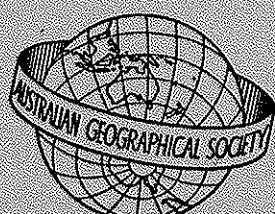


AUSTRALIAN GEOGRAPHICAL SOCIETY REPORTS

No. 1

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THE ARCHIPELAGO OF THE RECHERCHE

PART 1a

GENERAL HISTORY, By J. M. BÉCHERVAISE



PART 1b

PHYSIOGRAPHY, By R. W. FAIRBRIDGE and V. N. SERVENTY

PART 5

REPTILES AND FROGS, By L. GLAUERT

PART 6

SPIDERS and OPILIONES, By BARBARA YORK MAIN

PART 7

MOLLUSCS (SEA SHELLS and SNAILS), By J. HOPE
MACPHERSON

MELBOURNE, 1954

Price: Five Shillings

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The Australian Geographical Society's Expedition to the Archipelago of the Recherche, Western Australia ($33^{\circ}37'-34^{\circ}28'$ S. Lat.; $121^{\circ}30'-124^{\circ}10'$ E. Long.), took place during the month of November, 1950.

A map showing route and dates of landing on the various islands is appended to this paper. Periods of three or four days were spent on the larger islands.

The following islands and contiguous areas of the mainland were visited: Esperance, Figure of Eight (7.11.50), Boxer (9.11.50), Sandy Hook (10.11.50); Remark (11.11.50); Long (11.11.50); Pasco (12.11.50), Mondrain (12.11.50), Termination (18.11.50), Round (18.11.50); North Twin Peaks (19.11.50); South Twin Peaks (20.11.50), Cave (20.11.50), Wedge (21.11.50), Combe (21.11.50), Middle (21.11.50), Douglas (23.11.50), Goose (23.11.50), Salisbury (24.11.50), Israelite Bay (26.11.50), Christmas (28.11.50), Point Malcolm (28.11.50), Duke of Orleans Bay (29.11.50), Woody (30.11.50).

Expedition personnel was as follows:

John Béchervaise (Leader), J. H. Willis (Botanist), V. Serventy (Zoologist), R. Bean (Photographer), I. S. Wilson, M. Farrant. The expedition craft, a 35-ft. Diesel-powered fishing boat, schooner-rigged auxiliary sail, was in charge of Messrs. D. Mackenzie and A. Sanders.

It is planned that the complete report (Report No. 1) of the expedition will be published in several parts, containing: Introductory, General and Historical, Physiography, Birds, Plants, Mammals, Reptiles, Shells, Insects and Spiders.

This concluding section [Report No. 1, Parts 1, 5, 6 and 7—Archipelago of the Recherche: 1a. General History, by J. M. Béchervaise; 1b. Physiography, by R. W. Fairbridge and V. N. Serventy; 5. Reptiles and Frogs, by L. Glauert; 6. Spiders and Opiliones, by Barbara York Main; and 7. Molluscs (Sea Shells and Snails), by J. Hope Macpherson] is the third published (1st August, 1954).

Edited by J. H. Willis.

AUSTRALIAN GEOGRAPHICAL SOCIETY
MELBOURNE, 1954

Ia. GENERAL HISTORY

By J. M. BÉCHERVAISE*

The Archipelago of the Recherche, comprising innumerable rocks and shoals and about one hundred granite islands, ranging in size from less than an acre to slightly more than four square miles, occupies part of the Southern Ocean (Latitude 33° 37' - 34° 28' S., Longitude 121° 30' - 124° 10' E.) contiguous to the south coast of Western Australia, approximately between Esperance and Israelite Bay. Admiralty Charts of Australia—South Coast Nos. 2984, 1059 and 3189—provide completely adequate cartographic cover of the area.

All the islands of the Recherche Archipelago, with the exception of Middle Island, were gazetted on May 21, 1948, as "Reserve 22796, for the purpose of Flora and Fauna."

The Australian Geographical Society's expedition, in November 1950, was undertaken largely as a result of a suggestion from a member, Mr. T. C. Andrews, of Milson's Point, New South Wales, who as a youth in 1889/90 had lived on Middle Island for eight months and worked the salt deposits of the pink lake; he had revisited the islands in 1916. At Salisbury Island Mr. Andrews had taken an active part in the dramatic rescue, by the schooner *Grace Darling* under command of Captain Douglass, of 196 passengers from the *Rodondo*, a ship of 1,000 tons bound for Fremantle from Adelaide. This vessel had struck on Pollock's Reef in the early morning of October 6th, 1894. The rust-red hull of the *Penguin* still projects at a bizarre angle from shallow water near the beach on the north coast of Middle Island, where Captain F. Schroeder had purposely run his vessel ashore after she was caught in a severe blow while at anchor on June 27th, 1920.

The earliest history of the Archipelago is associated with the first recorded visit to the south coast of the continent in January 1627, when the Dutch vessel *Gulde Zeepaard*, under the command of Pieter Nuyts and navigated by Francois Thijssen, traversed the area. Matthew Flinders in his journal of voyages undertaken 1801-3 quotes the Dutch recital:

In the year 1627, the South Coast of the *Great South Land* was accidentally discovered by the ship *Gulde Zeepaard*, outward bound from the Fatherland, for the space of a thousand miles.

The exact date is unknown. "No historical fact," says Flinders, "seems to be less disputed. Whether 26th (i.e. of January) according to De Hondt or 16th as on Thevenot's chart is of little import." The chart of Genitsz (1628) further complicates the matter by the inscription: "t Land van P. Nuijts discovered 23rd January 1627." Nuyts's journal is now lost.

The next recorded visit to the area was made in October 1791 during the passage of Captain Vancouver in the ship *Discovery*; he named Termination Island as the last land seen east of King George's Sound and apparently, in spite of Nuyts's existing chart, supposed the islands to the north to be "much broken mainland".

A year later the French Rear-Admiral Bruny D'Entrecasteaux arrived in command of two vessels, *La Recherche* and *L'Espérance*, sent in search of Count de la Perouse, who had not been heard of since his departure from Botany Bay in January 1788. D'Entrecasteaux himself died during the voyage but his journal, edited by de Rossel (1808), is available. He reached the coast of New Holland on December 5th, 1792. Subsequently he explored the coast (as Flinders states) "with all the minuteness that the state of the weather could permit." However, a severe gale caused him to shelter (December 9th) at one of the western islands, generally stated to be Observatory, although Willis [*vide* Part 3a, Land Flora, pp. 3-4 of his Report] presents cogent reasons for considering this erroneous; subsequently he landed there twice. Vegetation then collected was described by Labillardiere, who also contributed notes on the geology of the islands, while Beautemps-Beaupré was responsible for the preparation of charts of the vicinity. D'Entrecasteaux, however, did not proceed through the islands but took a more southerly route.

Matthew Flinders expresses surprise that although D'Entrecasteaux praised the general accuracy of his predecessor Nuyts's charts, he named the islands *L'Archipel de la Recherche*. He then goes on to say:

Besides the solution of this important geographical problem (i.e. the flow of western rivers) something remained to be done on the points already seen. The mainland behind the first archipelago, as also the inner islands, were yet to be examined for harbours where refreshment for ships might be obtained; a comparison of the persons and usages of the inhabitants with those in other parts of this vast country was desirable; and,

*Australian Antarctic Division.

although little utility could be drawn from known productions at the two points visited, it might reasonably be hoped, that an investigation of a coast so extensive, would not fail to produce much useful information.

Further, Flinders states:

Many circumstances, indeed, united to render the south coast of 'Terra Australia' one of the most interesting parts of the globe, to which discovery could be directed at the beginning of the nineteenth century. Its investigation had formed part of the instructions to the unfortunate French navigator La Perouse, and afterwards of those to his countryman D'Entrecasteaux; and it was not without some reason attributed to England as a reproach that an imaginary line of more than two hundred and fifty leagues extent, in the vicinity of one of her colonies, should have been so long suffered to remain traced upon the charts, under the title of unknown coast. This compounded ill with her reputation as the first of maritime powers; and to do it away was accordingly already part in the instructions given to the *Investigator*.

Just before sunset on Friday, 8th January, 1802, Flinders sighted "the western-most isle of D'Entrecasteaux's Archipel de la Recherche". His adventurous spirit quickened to the challenge of the dangerous seas that lay ahead and that same night he writes in his journal: "The French Admiral had mostly skirted round the archipelago, a sufficient reason for me to attempt passing through the middle if the weather did not make the attempt too dangerous."

The 9th January was devoted to charting the western islands; azimuths, including those from the summit of Remark (*Ile de Remarque*, 722'), covering conspicuous objects over a wide area, in addition to observations of latitude and longitude. The evening found the *Investigator* off Mondrain Island with no suitable anchorage, but, with characteristic daring, Flinders sailed directly for the mainland coast and discovered the ideal sanctuary of Lucky Bay.

Until the morning of the 14th January, largely at the request of "the scientific gentlemen", Flinders remained in the immediate vicinity, recording several interesting finds which are elsewhere in these reports discussed in detail. It is not difficult to imagine how dangerous the archipelago appeared to mariners relying solely upon wind for power. Flinders writes:

In turning from the view of these complicated dangers (i.e. the islands and rocks of the archipelago) to that of the interior country, the prospect was but little improved. Sand and stone, with the slightest covering of vegetation, everywhere presented themselves on the lower lands and the many shining parts on the sides of the hills showed them to be still more bare. The vegetation, indeed, consisted of an abundant variety of shrubs and small plants, and yielded a delightful harvest to the botanists; but to the herdsman and cultivator it promised nothing: not a blade of grass, nor a square yard of soil from which seed delivered to it could be expected back, was perceivable by the eye in its course over these arid plains.

On Mondrain Island, Flinders notes "kangaroos" of an unfamiliar species; in the neighbourhood of Lucky Bay, he reports "lack of Indians". It may be thought curious that he appears so unconcerned when Mondrain is accidentally or intentionally fired to the extent "of a general blaze . . . all over the island."

The *Investigator* moved eastward on the 14th, Flinders naming the Twin Peaks Islands and finding an evening anchorage in a small northern bay of Middle Island (D'Entrecasteaux's *Ile du Milieu*), facing and sharing the name of Goose Island, which next day Flinders proceeded to explore whilst "the botanical gentlemen" visited the larger mass to the south. A quantity of "bernacle" (Cape Barren) geese were procured then and subsequently, and one wonders how strongly the memory of this gastronomic treat persisted in the subsequent coasting. At all events, Flinders revisited the archipelago in May 1803, after his circumnavigation of the continent.

On Middle Island, the now well-known lake of rose-coloured brine was discovered and Flinders climbed the high north-western granite hill which now bears his name. Mention is made of the characteristic dune limestone overlying the granite on the south side of the island and on Goose Island. The last islands of the Eastern Group were astern by the evening of 17th January, 1802.

For a few years, except for a brief anchorage off Middle Island, in January 1818, by Captain P. P. King in the *Mermaid*, the islands appear to have remained unvisited but, by 1825 certainly, the accounts of abundant seals had lured men through all the southern coastal waters. Many of these sealers were time-expired convicts victualled by Sydney merchants who it seems, however, were not always punctual with promised relief operations. Major Edmund Lockyer, whose papers are preserved in the Mitchell Library, Sydney (Ref. A 1497), landed from the *Amity* at King George's Sound on Christmas Day, 1826 (actually anticipating the foundation of the colony of Western Australia by two years), for the ostensible purpose of establishing a convict settlement there. In fact, however, his instructions were to intimidate any French who might be interested in the area or who might even have forestalled the occupation of "His Britannic Majesty's Government" in the western regions of New Holland.

At least three French vessels were known to have visited the western coasts in the two previous years. In October, 1826, the French explorer Dumont d'Urville on the *Astrolabe*, when at King George's Sound, recounted having met eight Englishmen who had been marooned on Middle Island by the Captain of a sealing vessel, the *Governor Brisbane*. As several of these refused to accept his offer of a safe passage to civilization he justifiably concluded that they had guilty consciences or feared punishment for crimes.

Lockyer's journals possess several references to lawless bands of sealers who had settled on Middle or Mondrain Islands. An entry for March 10th, 1827, gives details of the apprehension of a band of sealers, suspected of murder, who were to be sent to Sydney for trial; some were from Middle Island. According to Lockyer's statement:

They had come here (Albany) for the purpose of giving themselves up and also stated that they had been left there by their employers in a most shameful manner, having been eighteen months at the time with three months' provisions only.

. . . they have with them one hundred Fur Seal skins and have about seven hundred on an island near Mondrain Island, opposite the mainland by Thistle Cove and Lucky Bay. From these men's accounts of the coast from Middle Island down round Cape Leven to Rottenese Island . . . there are Boat harbours all the way at convenient distances.

Other interesting events are given in despatches from succeeding Government Residents at Albany. W. Charnley (*Walkabout*, July 1952) cites that of Sir Richard Spencer, dated August 10th, 1835, telling how two youths had arrived completely exhausted, having walked without provisions from the coast bordering the Archipelago. They had suffered great privations; first shipwreck, then a series of other misfortunes, not the least of which had been their forced associations with the Recherche sealing gangs. From Middle Island, the two boys, John Manning and James Newell, had been landed on the mainland by a notorious negro giant, "Black" Anderson, of Long Island. At the time he was virtually ruler of the Recherche Archipelago.

It was almost certainly concerning the same two youths that James Browne makes reference in a statement on the Natives of King George's Sound (now preserved in the Mitchell Library, Sydney: Ref. AK 34). He writes:

In the latter part of 1835 a small sealing cutter arrived at King George's Sound, and after remaining for some time, sailed for Van Diemen's Land, intending to touch at some of the Islands on her way down. She took from the Sound some labouring people who wished to leave the Colony. On their way down the Vessel was wrecked but the people on board managed to land on Middle Island, on which they found a party of Sealers. After remaining some time on the Island, two of the men (for some quarrel which took place) determined to walk up to King George's Sound, and got the Sealers to land them on the plain for that purpose. The distance from "Middle Island" to the Sound is between two and three hundred miles.

These men landed with little or no provisions and after the first two or three days found themselves in a state of starvation. However, after suffering the greatest misery, for want of food and water, being sometimes for days without either, they managed to get within fifty or sixty miles of the Sound . . .

James Browne goes on to tell how nobly the desperate men were ministered to by certain natives who arrived in the nick of time and conducted them to safety.

During the early 'forties several references to the sealing activities of the Archipelago and the exploration of the contiguous mainland are made in the Perth journals (*Perth Gazette* and *Western Australian Journal*: Sept. 3rd, 1842; Sept. 10th, 1842; Oct. 8th, 1842, etc.). The last cited, from the pen of N. W. Clarke, gives an interesting account of sealing on the south coast, ascribing the origin of the sealing gangs to the penal settlement of Van Diemen's Land. It describes how the sealers had many collisions with the blacks. "Even now," it relates, "in talking of these marauders, the natives describe them with symptoms of loathing and innate hatred." It had long been the practice of the sealers to steal the native women and as callously to abandon them.

Quoting in full part of the letter of October 8th, we find:

The great rendezvous of the sealers was the Archipelago of the Islands to the eastward of Doubtful Island Bay, where they chiefly subsisted on wild geese and seals' flesh, and occasionally made a run to King George's Sound to purchase flour and other necessities, and sell their seal skins. Another party of sealers was composed of the crew of the *Mountaineer*, a small craft from Van Diemen's Land, which was wrecked near the archipelago many years ago. In sealing expeditions, the sealers, instead of wages receive a share of the profits, and they are still on a footing of equality. The owner of the boat has one share for himself, and one for the use of the boat, and is generally the headman. One of the most daring of these people was a man of colour of the name of Anderson, and lawless as these men were, they looked up to him with a sort of dread. Anderson usually carried a brace of pistols about him, knowing that he held his life by a very precarious tenure. By persevering exertions he had amassed a considerable sum of money, and usually kept one or two black women to attend on him and minister to his wants, when not engaged in sealing. One of his crew met with an untimely end

near Doubtful Island Bay, and the body was to be seen some years ago, lying under a fall of water, with the throat cut from ear to ear

The favourite resort of Anderson was *Manduran Island*, one of the isles of the Archipelago. This is one of the finest islands off the main, and contains some natural salt pans, from which immense quantities of that commodity might be annually obtained. The soil of Manduran is likewise good, and is well adapted for agricultural purposes. The late Mr. Henty, when on that part of the coast, took away with him to Van Diemen's Land a considerable quantity of salt as a specimen. Strange to say, the salt of this island is of a reddish colour, formed probably by some vegetable substance [vide Willis, for statement on colour of the pink lake].

The account continues with gory details of the murder of Anderson, then concludes with further details of the sealers' lives:

The person who has been luckiest in sealing is one of the name of Williams, who is still resident at King George's Sound. From first to last he has made from £1,000 to £1,500 and his boat, the "Fanny", is well known as a remarkably fast-sailing, safe boat. She was built in Van Diemen's Land.

During the winter months, when not engaged in sealing, the sealers hunt kangaroo around the various bays, and supply the crews of American and French ships with fresh meat, for which they receive biscuit, flour, and salt pork in exchange

The *Perth Inquirer* (Jan. 5th, 1848) states that Middle Island "has been for some time the resort of a set of lawless desperadoes, composed of runaway convicts, sealers, etc."

Esperance Bay was first surveyed in detail by Commander T. W. Combe in the *Waterwitch* (1897), and further surveys within the archipelago were completed by him in the *Penguin* during 1897-1901. These are the basis of the present British Admiralty hydrographic charts.

I am indebted to Mr. V. Serventy and Dr. R. W. Fairbridge for the compilation of some notes on another aspect of the economic resources of the Archipelago of the Recherche. I quote their account:

During the mid-nineteenth century interest in all isolated islands with large bird population was attracted by the possibility of guano, and small schooner captains of various nations explored Australia's coasts with this object (vide Woodward, 1917); a specific case of a barque leaving for the Recherche (see *Inquirer*, June 16th, 1852). Little information is available about the early trafficking in guano, as much was collected secretly in order to avoid competition and State mineral licences (vide Fairbridge, 1948). Serious economic attention was drawn towards the archipelago about the turn of the present century by the growing demand for phosphate as agricultural fertilizer, and in 1904 Captain James Sale brought back samples of high-grade phosphate rock from Christmas Island, but later samples were not so good.

In 1907 a syndicate was formed by Mr. Chaplin, W.A. State Director of Agriculture at that time, with the object of prospecting the islands. He left the government service to superintend this work in person, which continued until their boat and plant was lost in a severe storm. Government assistance was then obtained and prospecting continued under L. G. Naylor, who, as manager of the Australian Phosphates Company, published a short report (1908) on the islands with estimates of the phosphatic limestone or guano available. The final selection was Christmas Island and, in 1908, the Government geologist, H. B. Woodward, was dispatched to prepare a geological map of the deposits there, and a fairly detailed description was provided (1909). Woodward published a short history and summary of the area later (1917); see also Maitland (1928) and Hutchinson (1950).

Woodward's report was quite favourable, but for some reason not at present clear the deposits were abandoned. With the renewed wartime scarcity of phosphate in World War II, the islands were re-investigated in February and March, 1943, by J. C. Duffer (for the British Phosphate Commissioners) accompanied by F. G. Forman, Government geologist for W.A. Their conclusions were that apart from a small occurrence of 1,000 tons on Christmas Island, there was nothing of economic value in this direction.

After World War I, several of the islands were visited by a party from the Australian Museum, and a few physiographic observations were made in the report on the birds by A. F. Bassett Hull (1922).

There have been several organized aerial reconnaissances, mainly in search of fish shoals and for photographs from the air, notably by G. P. Whitley (Jan. 1944) and S. Fowler (Sept. 1944). Other scientists, including D. L. Serventy (in 1944, 1947 and 1948), J. M. Thomson and B. Shipway (March 1947), have made short visits and recorded sundry notes.

Matthew Flinders' lack of optimism concerning the mainland country was not shared by several fine pioneers who commenced running sheep in the area round Esperance Bay in the 'sixties and gradually experimented with the grazing possibilities of some of the islands of the Archipelago. Andrew Dempster acquired a lease of 100,000 acres round Esperance Bay. The venture became a lonely but successful outpost, wool being shipped by the Dempster Brothers to Fremantle in their 20-ton cutter, *The Gypsy*.

So the end of the nineteenth century saw an interest in wool as the old sealing industry languished (although this continued sparsely until well into the present century), an interest in salt and guano, and, after the discovery of the major goldfields directly north of Esperance, a considerable increase in local mercantile and shipping affairs.

The several reports which the Australian Geographical Society have published, including the present, contain copious references to the biological work already performed earlier in the present century amongst the islands of the Archipelago of the Recherche.

A few salient points concerning our own recent expedition may serve to conclude this brief historical introduction to the papers which follow. The Archipelago was examined from west to east, commencing with Figure-of-Eight Island, 22 miles S.W. of Esperance, and concluding with Christmas Island, in the Eastern Group, 130 miles easterly from Esperance. A total of between 750 and 800 miles was covered. Every island in the Archipelago was sighted and landings were made on twenty representative islands, typical members, or those with special features of vegetation, contour or remoteness being selected. The actual landings and dates are listed within this report.

On the larger and more important islands, camps were established for periods ranging from two to four days. The principal camps were on Boxer, Mondrain, Sandy Hook, North Twin Peaks, Middle Island and on the mainland at Israelite Bay.

1b. PHYSIOGRAPHY

By R. W. FAIRBRIDGE* and V. N. SERVenty

I. INTRODUCTION

(N.B. Since most of the distances referred to will be across water, all important measurements in this report will be given in nautical miles (6,080 feet).)

The islands of the Recherche Archipelago all rise from the continental shelf, the Recherche Shelf, in varying depths under 50 fathoms. They extend as far as 35 nautical miles from the mainland and over 125 miles in an east-west direction, but the bulk are restricted to an area near the coast of some 1,500 square miles.

The islands are at present uninhabited and there is no regular transport service, but they may be reached by fishing boat from the port of Esperance. Landings are generally difficult and often hazardous, owing both to the heavy swell prevalent here and the sloping, rocky shores, sand beaches being rare.

II. GENERAL TOPOGRAPHY

In looking at the chart or from an aeroplane over the Archipelago of the Recherche, one of the most striking features is the small size of the individual islands in contrast to their great numbers. We shall describe no less than 76 islands, and there are many more rocky islets and reefs. Yet the largest islands are small—Middle (four miles across), Mondrain (four miles long), Salisbury (four miles long), North Twin Peak (three miles), Figure-of-Eight (two miles), Christmas (two miles). The bulk of the islands are much less than one mile long, and these are spread over an area of 1,500 square miles!

The shape of the islands is interesting. The smallest are round in plan and dome-shaped. Most of them rise straight out of the water to several hundred feet in height. The highest points exceed 700 feet (on Mondrain and Remark Islands). Beaches are almost unknown. The larger islands appear to be merely a collection of these dome-shaped units, thus there are several "figures of eight" (with two domes) or triangular islands (with three). Only the largest islands have anything approaching ranges of hills.

The surface of the islands is astonishingly uniform, corresponding to the uniformity of the granite-gneiss rocks which form the majority. These islands appear mainly smooth from a distance, but when climbing on them it is found that the surface of the rock exhibits two types of erosional features: runnels and caves. The first are a series of radial runnels or clefts, caused by rainwater running down off the dome-shaped hills and dissolving out little channels which run straight down the sides into the sea; these are in all sizes from a few inches deep to ten or twenty feet. In addition to the radial channels there are regular joint-clefts, similarly weathered out by solution waters, but following the structural pattern of the rocks.

Secondly are the caves and gnamma holes, which likewise range from tiny cavities and in places honeycomb (alveolar) structure, that is rather characteristic of granite weathering near the coast in Mediterranean and temperate climates. In horizontal places they tend to spread out into flat pans with undercut shoulders; often a solution runnel leads out of these and down the hillside. These are likewise probably due in part to dissolving powers of carbonic acid-rich rainwaters, especially under the influence of strong winds, but possibly in part also to salt-laden spray; in the latter case saltwater is driven into tiny cracks in the rock and, on drying, expands and breaks up the surface by a process of "fretting". These two processes may work hand in hand, so that the fretting and dissolving processes excavate cavities; and furthermore, since solution tends to alternate with precipitation there will be concentrated near the outer surface of the rock a hard crust (silicified), while in the cavities, gnamma holes and caves the rock surface is crumbling away.

In addition to these excavating processes, there is also the modelling process known as exfoliation, which is tremendously well developed in the islands. Huge curving slabs of rock hundreds of feet long and several feet thick are seen flaking off the steep flanks of the islands and sliding into the sea. On the most exposed sides of the islands, these are often broken up into cliffs and rocky shore of jumbled boulders.

* Geology Department, University of Western Australia, Nedlands.

Over the surface of some of the islands, especially capping prominent hills, are giant exfoliated boulders, from which these curved slabs have flaked off in all directions, giving a rounded appearance to the former angular blocks. For many years the phenomenon of exfoliation has been explained by insolation—the alternate heating and cooling in the desert sun, so commonly experienced in the inland, but it is now quite clear that it, too, is a chemical process, due to the solubility of certain minerals of granite (notably feldspars and mica) in acid rain-water (recently discussed and reviewed by Gentili, 1950).

On those islands where the granite-gneiss basement is overlain by younger rocks, notably the late Pleistocene calcareous eolianite ("Coastal Limestone"), a completely different topography is apparent. These islands have a flattish, undulating upper surface marked by a hard crust of travertine (chemically concentrated calcareous cap rock). The sides then drop away sharply in cliffs, which expose the softer sandy dune material beneath, often scoured out in part by wind to form shallow caves. Limestone (travertine-lined) solution pipes form massive pillars ("organ pipes", "chimneys", etc.) of the type illustrated and described at Point Peron (Fairbridge, 1950a).

In most parts of the islands where the eolianite occurs, it rests as a 50-100 ft. capping on a basement of granite-gneiss, but in a few places it comes right down to the shore, where we observe the unusual feature (for this Archipelago) of a flat "sandstone reef" at low tide level with undercut cliffs on the shore (again, as illustrated at Point Peron; compare this with the south coast of Goose I.). There is a badly weathered trace of a 10 ft. shore-platform also on Goose Island.

There is little trace of a true shore-platform on the "hard-rock" islands, granite-gneiss being singularly resistant to intertidal weathering. But a very slight indentation, a sort of embryo notch, may be noted on many of the otherwise uninterrupted smooth slopes that drop straight into the sea at about 25-30°. These embryo notches appear at about 10 feet above low water level and do not represent more than a slight shaving of 1-2 feet off sloping hillside for a vertical distance of 5-6 feet. However, they often afford a useful foothold in the otherwise very slippery and dangerous surface. These are interpreted as traces of the "10-foot" (Flandrian) shoreline of about 4,000 years ago, when the sea level was correspondingly higher than today.

On a few of the islands there are some traces of higher terraces (e.g. 400-500 ft., on Sandy Hook Island) which bear the old leached soils of the Pleistocene, but in such hard rocks it is difficult for such platforms to develop unless exposed to a constant erosive attack for many thousands of years.

In review, the topography of the islands may be described as characterized by tiny conical or dome-shaped hills rising from the continental shelf, and may be compared from the geomorphological point of view with those of the mainland that rise here and there from the coastal sandplains. The significance of this analogy will be discussed later (Section V).

The physiography and geomorphology of the Recherche has never been described before, but two valuable descriptions of the adjacent mainland will be found very helpful for purposes of comparison, for the two have certainly much in common (Jutson and Simpson, 1917; Clarke and Phillips, 1953).

III. SOILS

The Archipelago falls into the "Eyre Soil Region" of Teakle (1938), and is partly comparable to the adjacent mainland with its Esperance Plain (Teakle and Southern, 1936). The older and higher sandplains here (of 100 feet and more, see Clarke and Phillips, 1953) are characterized by a sand heath developing on a deeply leached siliceous sand, which passes down into a poor laterite gravel and yellow sand or sand clay. Most of these soils appear to be genetically related to the Tertiary sandstone, but locally to deeply weathered granite gneiss. These soils are acidic. Younger valley alluvium generally shows red-brown earths, where the old rocks have been more recently eroded. In places on the coast where the Quaternary eolianites (Coastal Limestone) occur, there are patches of more calcareous sand.

In the islands the granite-gneiss slopes are often swept clear of soil, especially near the shore, and only exceptional patches of red-brown earths occur. Isolated remnants of the old deeply leached sandplains are found on some of the islands (e.g. the "400-foot" plain on Sandy Hook and Long Islands). On a number there are the more calcareous sands which develop over the young eolianites (e.g. Boxer, ? Figure-of-Eight, Long, Middle, Goose, Pasley, Salisbury and Christmas Islands).

Fossil soils may be observed in places separating individual dune series in the Coastal Limestone; these are mostly leached red sands (terra rossa) and contain the fossil land-snail *Bothriembryon*. It is probable that fossil soils also occur in places at the base of the Tertiary sandstones where they rest on the weathered Pre-Cambrian. Traces of the late Tertiary (Pliocene) laterite, so widespread elsewhere in south-western Australia, are not common, and would appear to have been removed by Quaternary erosion; pebbles and grains of laterite may be observed in some of the beach sands.

IV. VEGETATION

A few notes, recapitulating the dominant features of the vegetation, may be helpful here. The usual sclerophyllous woodland of the mainland in the south-west, the jarrah forest (*Eucalyptus marginata*), is displaced in the Esperance region and not represented in the Archipelago. In its stead the country is mostly covered by the coastal sand-heath vegetation (of Gardner, 1944). This consists of patches of low scrub trees (dwarf *Eucalyptus*, *Melaleuca*, and *Acacia*) rising to about 6-10 feet, interspersed with broad areas of tufted grass and low shrubs 2-3 feet high. Gardner notes the extraordinary development of plagiotropic growth in this province, e.g. *Banksia* of the Prostratae series—"their subterranean stems radiate to a diameter of over four metres, the isolated inflorescences and floral leaves of some species appearing as isolated plants." No *Banksia*, however, has been observed in the Archipelago. In damp spots there are the usual paper-barks or tea-tree (*Melaleuca*), and yate (*Eucalyptus cornuta*), which may reach 15-20 feet. Many of the smaller islands have no trees at all.

Gardner (1944) describes the sand-heath formation as "the real home of the true autochthonous flora" which occurs in great variety, but this wealth was not noted in the Archipelago by Willis, who has dealt with the land flora in detail in another part of these reports (No. 3a, published 1953).

V. CLIMATE

The climatic type of the Recherche Archipelago is the "temperate, oceanic, with winter rain", symbol Csb according to Koeppen's system (Gentili, 1946). The relationship of climate to vegetation is discussed by Gardner (1944), who also gives very complete statistics. There are no permanent weather stations in the group, but the figures for Esperance and Israelite Bay may be taken as representing the western and eastern limits respectively, though both may be expected to indicate a slightly more "continental" climate than will be experienced in the islands, though the bulk are within 10 miles of the coast. The rainfall ranges from 20-30 inches, and may occur in any month of the year, but the bulk falls during the southern winter, in the months of June, July and August. Falls of more than 100 points within 24 hours are rarely experienced.

Climatic data for Esperance

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Mean max. temp. (°F.)	76.6	77.4	75.4	72.1	67.4	63.2	61.9	63.4	66.1	68.5	72.1	74.8	69.9
Mean temp. (°F.)	68.1	68.9	66.7	63.2	58.7	55.1	53.6	54.7	56.8	59.4	63.1	66.0	61.2
Mean Min. temp. (°F.)	59.5	60.4	58.1	54.2	50.0	47.0	45.2	45.9	47.6	50.2	54.1	57.2	52.5
Rel. humidity, 9 a.m.	62	63	66	70	75	78	78	74	69	65	62	61	69
Rel. humidity, 3 p.m.	63	64	64	65	64	65	65	62	63	64	64	63	64
Rainfall (pts.)	70	69	115	175	326	407	401	381	271	214	104	86	2,619
Evapo-transpir. (pts.)	435	383	354	270	185	143	137	158	188	256	333	399	3,206
Rainfall effectiveness	.7	1.0	1.6	2.6	5.6	7.7	8.0	7.5	5.0	3.7	1.5	1.4	46.3

(in "points", i.e. hundredths of an inch)

N.B.—To convert degrees Fahrenheit to centigrade, multiply by 5/9 after subtracting 32.

The islands lie in the latitudes of the westerlies for most of the year, especially during the winter months, and the weather is dominated by a succession of low pressure systems advancing from the south-west across the southern Indian Ocean, the centres of which generally pass farther to the south.

The summer season is short (January, February, March), and at this time the anti-cyclones of the tropical divergence belt partly replace the westerlies. Easterly winds are generally much lighter. The low pressure storm centres generally pass several hundred miles to the south of the continent, and the south-easterly may back to a south-westerly, which may blow for a few days till a depression is past. On rare occasions in summer, a tropical "low" may dip down

across the continent, leading to almost dead calm or erratic winds on the south coast. These "lows" are no longer hurricanes by the time they reach the area. In warm weather, during the summer, the coastal regions experience the normal land-breeze in the early morning and sea-breeze in the afternoon. The land-breeze is not generally felt more than a mile or two from the mainland shore.

A moderate ocean swell is experienced at almost all times along the south coast, and this becomes heavy during the south-west storms.

One of the dangerous features of these islands—and the south coast generally—is the occurrence of exceptionally big swells at very long intervals, perhaps three hours or more; fishermen standing on projecting rocks become confident over a long period of normal swells, but are sometimes carried away by the exceptional one. The cause of them is not clear; they may in part be very long distance swells from the Antarctic storms, gaining unusual amplitude on the steep-to continental shelf; in part they may be small tsunamis, set up by submarine landslides on the continental slope, which in places reaches an angle of 20° or even more.

VI. CURRENTS AND TIDES

The dominant current along the south coast has an easterly set and is most pronounced during the southern winter, when it coincides by the West-Wind Drift of the southern hemisphere. According to Schott (1936) and others, the main oceanic circulation south of Australia in summer is a westerly current, in part a counter-current to the easterly set of the "West-Wind Drift", which moves south of latitude 40° S. in this season. During the short summer season (January-March), the shallow water region of the Recherche Shelf becomes partially affected by the south-east trade winds and a westerly flow may be instituted for short periods (Admiralty Pilot, 1937). Nevertheless, Dr. D. Serventy (C.S.I.R.O., Fisheries Div.) has observed that drift bottles released at Albany when found were invariably farther east (in Clarke and Phillipps, 1953).

In the Recherche area, Admiralty tide measurements have only been made at Esperance and Goose Island Bay (Middle Island). It is the novel experience that offshore islands have slightly smaller tidal ranges than the adjacent mainland. The only continuous recording tide gauge on the Recherche continental shelf is at Albany, where the mean high water spring tide is 2:9 feet above datum, while the mean low water spring tide is 1:5 feet for the average fortnightly period. There is generally only one high and one low tide per day, the time of the latter corresponding to that of the maximum declination of the moon. However, there is also a marked annual range in mean sea level (of the order of 1:10 feet), which is low in summer and high in winter. In addition, there are "meteorological tides" which become prominent, as elsewhere along the southern and western coasts of the State, because the daily ranges are slight; thus when the barometric pressure is high, the sea level remains low, but when the air pressure drops, the sea level rises. Since these meteorological tides are independent of the astronomic tides, it is possible that at some times they tend almost to cancel one another out, so that the sea may remain relatively "high" or "low" all day. By the same token, the one may enhance the other.

The time of the tide (H.W.F. & C.) at Albany is XIh.3m. At Esperance the mean spring high water tide recorded was 3 feet datum, the time (H.W.F. & C.) being 0h.10m. At Goose Island the corresponding figure was also 3 feet, and time XIh.55m., according to the brief Admiralty observations ("Penguin", 1900-0'). However, it should be realized that unless carried out over a twelve-month period in these waters, such figures are of little value, and better reliance should be placed on the Albany records, which, experience has shown, have a very general application on the south coast.

From the physiographic point of view, it is important to realize that while a daily rise and fall rarely exceeds 3 feet, there is a range from summer minimum to winter maximum of over 6 feet. This figure will then be the effective range of intertidal marine erosion, before the swash zone is added. Owing to uninterrupted exposure to big swells and storms of the "Southern Ocean", the swash on the smoothly sloping granite shores, being almost frictionless, reaches astonishing heights.

On exposed shores of this sort, the granite slope is darkened by algae, etc., which live in the regular swash, to a mean height of 30 feet above datum, while at least 100 feet more are swept clear of soil and vegetation by the swash and spray of storm waves. (At Breaksea Island at the entrance to King George Sound, members of the crew of the Lighthouse Trader S.S. *Cape Orway* have reported that storm waves break over the low saddle near the centre of the island

over 200 feet above sea level, and a band almost devoid of vegetation runs across the island at this point.)

Mean temperature of the surface water on the Recherche Shelf in February (summer) is 19° C. (66° F.), while in May it is 17° C., in August 15° C., and in November 16° C. (Schott, 1935).

The question of nomenclature of the seas to the south of Australia is one of the vexed problems of oceanography. The general view accepted by geographers today is that there are only three major oceans, and that the *Indian Ocean* extends around the south of Australia to the meridian of South Cape, Tasmania (Schott, 1935). The hydrographic agencies, on the other hand, are more concerned with navigation, and prefer to divide the ocean surfaces into a series of convenient blocks, separated by rhumb lines; according to this scheme, to the south of Australia lies the *Southern Ocean*, with the Indian Ocean terminating along the line Cape Agulhas-Cape Leeuwin; the sector included within a line laid from West Cape Howe to Tasmania is designated the "Great Australian Bight" (International Hydrographic Bureau, 1928/37).

Practice amongst oceanographers today is reflected by Sverdrup *et al.* (1942), in adhering to the strictly geographical terminology, but for certain hydrologic and ecological purposes using the term "Southern Ocean", with quotation marks, for that body of water lying around the Antarctic continent and extending as far north as the sub-tropical convergence; under no circumstances does this water mass reach the southern shores of Western Australia, generally not passing north of 40° S. latitude.

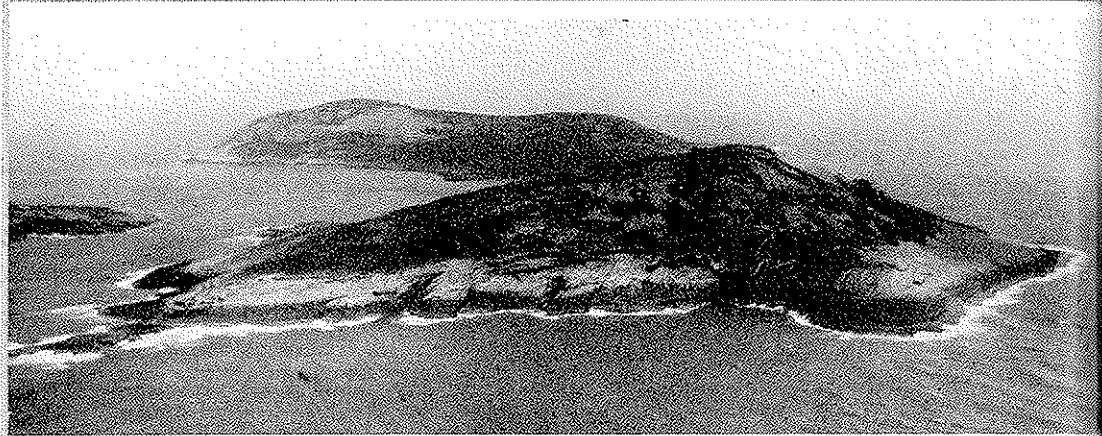
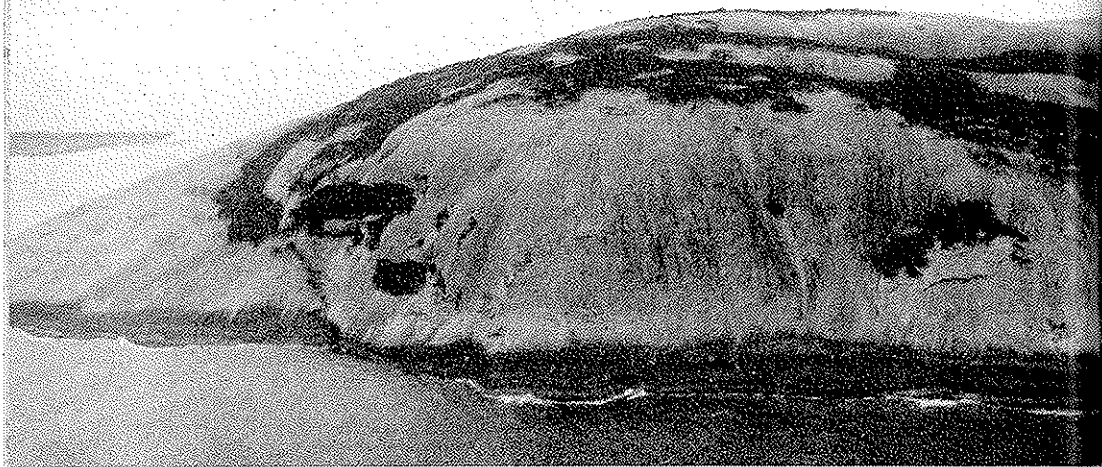
VII. PHYSIOGRAPHIC AND GEOLOGICAL NOTES ON 76 ISLANDS

1. The Western Group

The Western Group, named by d'Entrecasteaux, as its name implies, is the most westerly of the Recherche Archipelago, and consists essentially of three islands, Figure-of-Eight, Boxer and Capps, with smaller reefs and rocks offshore. They all rise from the 35-fathom shelf, being situated about 8 miles off the mainland and from 15 to 22 miles south-west of Esperance.

Figure-of-Eight [34° 02' S., 121° 37' E.] lies at the south-west end of the group, which is extended N.E.-S.W. It is 2 miles long and consists of twin hills, north and south, rising to 203 feet and 383 feet respectively, connected by a rocky neck. The island is gently contoured, with some bare rocky slopes on the southern hill and near the shore. The coast is rocky, sloping smoothly into deep water except on the east side, where there are low rocky cliffs and a short stretch of sandy beach. This is a good anchorage but only with a westerly wind and moderate swell. There appears to be a satisfactory anchorage on the west for use during the easterlies. The main rock-type is a granitic gneiss with basic lenses. Duffer (1943) reports a sandstone with ferruginous nodules (probably Tertiary) resting on it in the neck of land north of the southern hill; it contained 12.4% calcium phosphate. There may be some coastal limestone here. On the western side of the narrowest part of the neck there is a deposit of about 10 tons of sandy guano. The whole of the neck is covered by a sandy soil, at least 2 feet thick, and is riddled with mutton-bird burrows. There are no trees on the island, but 4-5 ft. shrubberies and some tussock grass on the slopes.

Boxer [34° 00' S., 121° 40' E.] lies 3 miles E.N.E. of Figure-of-Eight and is oriented N.W.-S.E. It is 1½ miles long, has a flattish summit, rising to 291 feet in the centre. The island is named after an aborigine, Boxer, who was marooned here as a punishment for misdeeds (Rintoul, 1946). The coast is rocky, smooth and rounded on the north side, blocky and cliffed on the south side. There are no true beaches, only small patches of sand at certain spots. There is no good anchorage, but a landing was made on the north side during a calm. The main rock is a granitic gneiss with strongly developed flow structure and basic lenses; one noted was recrystallized, 160 yards long and averaged 1 foot in width, and displaced here and there by cross-faults. The Pre-Cambrian is overlain by Coastal Limestone which forms a ridge down the centre of the island, and is mostly cliffed along the southern face. Three levels of caves occur in it facing the north at 100 feet, 130 feet and 170 feet above sea level; they appear to have been hollowed beneath travertine soil horizons by rain and wind erosion, and reach up to 5 feet in height and 30 feet on to the cliffs. One of the caves had been used as a fisherman's camp. There are several travertine springs on the south side of the island, issuing from the base of the Coastal Limestone at its contact with the granite-gneiss. The soil is sparse, but there is a patch of sand riddled with



Top: Flinders Peak (572 ft.), Middle Island, from west. (Note three levels of granite, interspersed with dark shrubbery, and black algal "swash zone" at base of cliffs.)
Centre: Christmas Island, from south (New Year Is. just showing on extreme left).
Lower: Limestone columns on Goose Island (S.E. corner).

—C.S.I.R.O. aerial photos. 88/19 and 87/6 (S. Fowler).
Lowermost photo. by A.G.S. Expedition, Nov. 1950.

mutton-bird burrows near the north-east point. There are also burrows in some of the caves. Patches of sandy guano occur, but no phosphate rock has been reported (Dulfer, 1943). Thickets of trees up to 20 feet high occur below the cliffs on the north side and western portion (mostly *Melaleuca*), but elsewhere there is only low scrub and tussocky grass.

Capps [33° 59' S., 121° 41' E.] is a rocky islet lying half a mile north of Boxer, and is about 1,600 yards long, rising to 87 feet. There is a small projection, Hector Rock, lying 1½ miles east of Boxer and 1 mile S.E. of Capps.

2. Islands of Esperance Bay

There are eight islands and numerous rocky islets distributed around Esperance Bay (named by d'Entrecasteaux), which is roughly 16 miles across and open to the south-west. The islands may be divided into those on the west, with Observatory, Charley, Cull and Cook Rocks, and those on the east with Lion, Black, Woody, Thomas and Gunton. They all lie within the 20 fathom contour.

Observatory [33° 56' S., 121° 48' E.] is 1 mile long and lies ¾ mile off the mainland, 6 miles S.W. of Esperance. It is marked "Île de l'Observatoire" on the chart of d'Entrecasteaux. It is very bare and rocky, and rises to 255 feet. The expedition did not visit it but passed close by, and Béchervaise (1951) mentions long granite slopes below dense and colourful vegetation. The only available description of a landing appears to be that by Labillardiere (1800), though Willis (1951) suspects that the island visited by Labillardiere was in fact Woody Island. The island is reported by graziers to be most satisfactory for fattening sheep and is provided with adequate springs of water. Labillardiere (1800) notes that the rocks were mainly granites, mentioning well-developed patches of quartz, feldspar, biotite and crystals, which suggests a good development of pegmatites; much of the surface was bare at that time, as today, but he mentioned thick scrub in the depressions. Also, he noted a flattish area of limestone in the high western part of the island, as well as small patches on the gentle north-east slope some distance from the beach; this sounds very much like the residual patches of Quarternary Coastal Limestone (colianite) found on several other islands in the Archipelago; but W. E. Dempster, who visited the island fairly frequently, cannot recall having seen any limestone capping there. Labillardiere mentioned a spring of fresh water coming from a joint in the granite on the south-west part of the island.

Charley [35° 56' S., 121° 53' E.] lies 3¼ miles due east of Observatory Island. It is more or less circular in plan, a rocky, granite dome, and rises to 353 feet. D. Serventy (1948) carried out a landing here, noting that there was no beach, only bare sloping rocky shores. Most of the island is bare rock, but there are patches of soil riddled with mutton-bird holes, and carrying a sparse vegetation of wattle scrub (*Acacia*) and "Pig Face" (*Carpobrotus*); there are no eucalypts. Formerly the island was heavily grazed by sheep, which may partly account for its excessive barrenness. It seems probable that the practice of burning-off and using these islands for pasture has considerably altered the initial vegetation. This island is also favoured for fattening sheep and has freshwater springs.

Cull [33° 56' S., 121° 55' E.]. This name on the Admiralty Chart may be a misprint for Gull (see *Pilot*), or it may be *vice versa*, since Cull may be derived from the graziers' practice of culling sheep. It lies ¾ mile east of Charley; it is rocky, rising to 319 feet, showing stunted trees on its flat summit, according to the Admiralty *Pilot*. The expedition did not land on the island, but passed nearby, and Béchervaise (1951) remarked that it appears to have been grazed bare. The same is true of Rabbit Island, which is a rocky islet, a few hundred yards long, lying ¼ mile N.N.W. of Cull Island; it is also the home of mutton-birds. A similar small islet, Button Island, lies ¾ mile north of Rabbit.

Lion [33° 52' S., 122° 01½' E.] lies 3 miles S.E. of Rossiter Head and 1½ miles offshore. It rises to 170 feet in height and is about 500 yards long. D. Serventy (1948) described it as a steep monolith of bare rocky gneissic granite. There are some patches of this soil with low scrub, but no thickets of *Acacia* or larger growth. Basset Hull (1922) noted that there was a huge cave weathered in the granite near the top. Every available patch of soil in the gullies is taken up with storm-petrel burrows. There is a steep cliff on the western side of the island.

Black [35° 56' S., 122° 00' E.] lies 6 miles S.W. of Esperance. It is ¾ mile long, rising to 349 feet, sparsely vegetated, with a rocky coastline. The name, according to the Admiralty *Pilot*, was bestowed on it for its black appearance in certain lights, though this is true of many of the islands.

Woody [33° 58' S., 122° 01' E.] lies 2 miles south of Black Island. It is 1½ miles long, with a rocky and rugged coastline, rising to a defined peak at 428 feet. There is a fairly well sheltered anchorage on the north side, and although there is no beach, a landing is easily effected into the rocky shore. The latter is partly cliffed. The rocks are exclusively granite-gneiss without superficial Tertiary sandstones or Quaternary Coastal Limestone. There is a fairly extensive cover of sandy soil.

As the name implies, the island was formerly vegetated with belts of yate (*Eucalyptus cornuta*) and other trees. As a result of continuous burning-off by man, culminating with a notable bush-fire which burnt for two full days in the summer before the expedition's visit, the indigenous vegetation has been decimated. Basset Hull (1922) remarks that even at that time there was only a small clump of mallice in a gully that had escaped the fires.

Thomas [33° 58½' S., 121° 59' E.] lies less than 1 mile south-west of Woody Island. It is ¾ mile long (E.-W.) and rises to 300 feet in height. A landing was made here by one of us (V.N.S.) and by Tarlton Phillips in 1951. It has rather steep slopes up to a flat summit; there are no beaches, the rocky shore sloping directly into the sea. The anchorage on the north side is fairly good. The rock-type is Pre-Cambrian granite-gneiss, and lacks any superficial sandstone or limestone. The surface is rather bare and rocky, with small patches of soil with mutton-bird burrows. The vegetation is scanty and there are no trees, only low shrubs.

Gunton [33° 59' S., 122° 00' E.] lies ½ mile south of Thomas, and is nearly 1 mile long. It is 381 feet high, and although not visited, appeared from inspection to be very similar to Thomas Island. It has patches of soil, with mutton-bird burrows, and carries a sparse vegetation over a rocky granite-gneiss core.

3. The Remark Group

Lying between 5 and 10 miles south-west of Cape le Grand, there is a group of islands—Sandy Hook, Long, Remark and Frederick—within the 20 fathom contour. For ease of reference, they have been grouped collectively under the name of the most conspicuous member, Remark. There is a broad belt of submerged rocks extending from Long Island to the south-west, culminating at Giant Rocks (34° 11' S., 121° 40' E.), which was appropriately named by d'Entrecasteaux "The Causeway" (Le Chaussée), as the waves constantly break here. Numerous submerged rocks rise from the 35 fathom platform to the south of here for another 5 miles.

Sandy Hook [34° 03' S., 122° 00' E.] lies 4½ miles W.S.W. of Cape le Grand, and rises to 460 feet. It is 1½ miles long, with bare rocky steep-to shores and slopes steeply up to a flat summit. There is a good anchorage on the south-eastern side, where there is a sandy beach about 50 yards long and a natural breakwater on the south side. These features apparently inspired the name of the island. The rocks are granite-gneiss throughout, devoid of any younger series. The sandy soil cover is only thin, except in a valley running down to the beach on the east side. In this valley there are numerous mutton-bird burrows and dense scrub and trees up to 20 feet high. There are a few acres of sand-plain country on the flat top of the island, with scattered termite mounds, and a flora recalling the sand-plain vegetation of the Esperance hinterland (Willis, 1953); this would appear to be an isolated relic of the early Pleistocene 400-500 ft. terrace.

An attempt was once made in the early days by a lessee, Mr. Connolly of Esperance, to clear Sandy Hook for pastoral purposes, but work was abandoned on account of its infestation by death-adders (letter to *West Australian* newspaper, 15 Nov. 1950: W. E. Dempster). They are still there.

Long [34° 03' S., 121° 58' E.] lies 1 mile south-west of Sandy Hook and, as the name implies, is long and narrow, elongated E.-W. for a distance of 1 mile. There is also a peculiar tongue extending ½ mile south from the western end of the island, where it rises to a maximum height of 340 feet.

The anchorage on the north side is moderate, but there is no good landing point, only smooth rocky slopes down to the shore, with some cliffs. The rocks are granite-gneiss for the most part, with some outstanding pegmatite dykes; there is a small outcrop of Coastal Limestone on the northern side, but the largest part of the island is covered with sandy soil, so the limestone may very well be more extensive. This soil is riddled with mutton-bird burrows—the largest colony observed in the Archipelago. There are dense glades of *McLalenuca* on the north side and on the higher parts (of rather low relief) there is a small patch of sand-plain-like flora interspersed with termite mounds.

Remark [34° 05' S., 122° 00' E.] lies 1 mile south of Sandy Hook Island and is 1 mile in length, being elongated E.-W., and continues to the east by Frederick Island (see next). It is marked "Île de Remarque" on the chart of d'Entrecasteaux. It has a very characteristic outline with a dome-shaped peak near the centre, rising to 722 feet. There is no anchorage or break, but a landing can be made on the north side opposite a heavily timbered short V-shaped valley. The island is entirely of granitic gneiss, without any appearance of limestone. The dome is deeply incised with radial solution runnels and honeycombed with gnamma holes. The upper rocky slopes are devoid of soil but in the above-mentioned valley on the north side there is a dense grove of yate (*Eucalyptus cornuta*) and the soil below it is riddled with mutton-bird burrows.

Frederick [34° 05' S., 122° 01' E.] lies directly east of Remark and is only separated from it by a rocky channel 250 yards wide. The island is 1½ miles long, the easterly part being a long narrow tongue. It is crowned by a rounded dome rising to 288 feet. There is a narrow rocky bay on the north side, where a landing may be made in suitable weather (see Admiralty *Pilot*). The rock is granite-gneiss, and there is only very sparse soil. The vegetation is of coarse grass and scrub on the northern side but the southern is practically bare.

(N.B.: On the W.A. Lands Dept. Litho. 4/300, this island is marked as "Goose Island".)

4. The Corbett Group

Named for convenience after its most prominent member, this group lies approximately 10 miles to the south-west of Cape le Grand, and consists of Corbett, Wilson, Davy, Howe, Hood and Round Islands, together with numerous smaller reefs and rocky islets. All lie within the 35 fathom platform.

Corbett [34° 08' S., 121° 59' E.] named after a lieutenant on the *Waterwitch* (1897), G. E. Corbett, lies 3 miles south of Remark Island. It is ¾ mile long and is rather square in shape, rising precipitously on the north side to 407 feet. It is mostly rocky, but in sparse patches of soil contains mutton-bird burrows. There are additional rocky islets offshore to the south-west. Davy Island (196 ft.) is another, lying 1½ miles to the south-west, and the Bishop Rock (104 ft.) extends this trend another ½ mile. Scattered pinnacles of rock rise precipitously out of the sea 2-3 miles west and south again from here.

Wilson [34° 08' S., 122° 00' E.], named after another lieutenant, W. T. P. Wilson, on the *Waterwitch* (1897), lies only 300 yards due east of Corbett and is 8 miles S.W. of Cape le Grand. It is 1½ miles long, oriented W.N.W.-E.S.E., rising in two peaks near the western end to 225 and 262 feet respectively. There is an open bay on the north-west side.

Howe [34° 09' S., 122° 02' E.] lies 2 miles south of Wilson Island and is ¾ mile long. It is roughly oval in shape and rises in a dome near the north end to 269 feet. There is an off-lying rocky islet 400 yards long on the east side, and two larger islets ½ to 1 mile respectively to the south.

Hood [34° 09' S., 122° 03' E.] lies 1 mile east of Howe Island and is 1 mile in length. It rises in a peak to 250 feet in the S.E. and to a lower point on a promontory on the west side.

Round [34° 12' S., 122° 06' E.] lies 3½ miles S.E. of Hood Island and about 12 miles south of Cape le Grand. It is little over ½ mile in diameter and, as the name implies, rather circular in plan. It is rather low, only reaching 91 feet. A landing was made on the north side. The expedition found that this island is composed of granitic gneiss with basic lenses. This is weathering into large residual boulders, which offer shelter to seals. There is very little soil, most of the surface being bare rock. The vegetation is accordingly scanty and restricted to a little low scrub and grass. There are a number of smaller rocky islets extending 3 miles to the south-west and another a similar distance to the south-east.

(N.B.: This "Round Island" should not be confused with a second islet of the same name 22 miles N.E. of Salisbury Island, in the eastern part of the Archipelago.)

5. The Termination Group

This is an isolated patch of islets lying far out on the shelf 28 miles S.S.W. of Cape le Grand, rising from the 45 fathom shelf, which is named for ease of reference after its principal member.

Termination [34° 28' S., 122° 00' E.] is about $\frac{1}{2}$ mile long, oriented V.N.W.-E.S.E., rising to 373 feet in a massive summit of bare rock of light appearance. It was named "Termination" in 1791 by Vancouver (1798), since it was at this point that they terminated their researches on the south coast. D'Entrecasteaux (see chart by Beautemps-Beaupré, 1807) called it "L'Avant-Garde" (The Advance Guard), but he would probably not have known of Vancouver's name at that time. There is a marked magnetic anomaly here (5° more on the west than on the east, according to Flinders, 1814). There is no good anchorage, no beach, and landings must be made directly on to the steep sloping rocks under somewhat risky conditions. The rock is entirely granitic gneiss with large basic lenses. It is almost devoid of soil, but carries a few meagre patches near the flattish crest of the island. On this grows a very restricted vegetation of native herbs and recumbent *Albizzia*, growing in rock crevices. There are no introduced weeds. Swarms of grasshoppers were noted and there is a large amount of lizard manure on sheltered ground (Willis, 1953).

Little Islet [34° 27' S., 122° 00' E.], lying $\frac{1}{2}$ mile north of Termination Island, is a rocky eminence rising 136 feet. Brown Reef lies another 2 miles to the north-east, but only dries 4 feet at low tide (according to the Admiralty *Pilot*).

6. The Cape Le Grand Group

This Group lies a few miles offshore, south and south-east of Cape le Grand, after which it has been named, and includes Ram, New, Cliff, Cloud, Pasco, Hastings, Hope, Rob, Roy, Tory and various smaller islets. Most lie within the 20 fathom countour, but Hope and Hastings may be a few fathoms deeper.

Ram [34° 02' S., 122° 09' E.] lies $1\frac{1}{2}$ miles S.E. of Cape le Grand and extends over $1\frac{1}{2}$ miles in an E.-W. direction, rising to 438 feet. There is a small cove on the north-east side, and the surface is covered with sparse scrub.

New [34° 01 $\frac{1}{2}$ ' S., 122° 09' E.] lies close inshore $\frac{1}{2}$ mile north of Ram I., and rises to 179 feet. D. Serventy (personal communication) remarked on the island being more covered in scrub than the others.

Cliff [34° 01' S., 122° 05' E.] lies 1 mile west of Cape le Grand and rises to 140 feet. It is rocky, and soil patches contain mutton-bird burrows.

Cloud [34° 03' S., 122° 05' E.] lies 2 miles S.W. of Cape le Grand, is $\frac{1}{2}$ mile long, and rises to 207 feet. The island is bare and only the upper part is covered with scrub. Otherwise it exposes granite-gneiss.

Pasco [34° 04' S., 122° 06' E.], named after Lieutenant F. C. C. Pasco, on the *Waterwitch* (1897), lies $2\frac{1}{2}$ miles south of Cape le Grand, extends $\frac{3}{4}$ mile long and rises to 223 feet. There is a fjord-like cove on the north-west side, where a hazardous landing can be made. It is a typical exfoliating dome of granite-gneiss, and the surface is characteristically pitted with shallow caves or gnamma holes. There are striking pegmatites and quartz veins, but no limestone, and very little soil. Mossy soaks occur along prominent joints and the vegetation is stunted; but Willis (1953) mentioned collecting 70 species of higher plants, which is surprising for so barren an islet.

Hastings [34° 06' S., 122° 07' E.] lies 5 miles south of Cape le Grand, is over $\frac{3}{4}$ miles long, and rises to 204 feet. Its slopes are smooth granite-gneiss, with scrub on the upper part. The expedition found difficulty in locating a landing spot here, and owing to deterioration of the weather the attempt was abandoned.

Hope [34° 05' S., 122° 10' E.] lies 5 miles south-east of Cape le Grand and extends over $\frac{3}{4}$ mile, but is very narrow, with a small bay on the east side, and rises to 147 feet. It is bare and rocky, with a well-defined summit (according to the *Pilot*).

Rob [34° 02' S., 122° 15' E.] lies 2 miles offshore and 6 miles east of Cape le Grand. It is a bare rocky island about 800 yards long, rising to 183 feet, with a rocky islet (Roy)—200 yards long and 140 feet high—lying 300 yards to the east.

Tory Islands [34° 01' S., 122° 18' E.] lie another 3 miles to the east and 2 miles S.E. of Mississippi Point. The main island is $\frac{1}{2}$ mile long, rising to 240 feet, and there are several smaller rocky islets offshore to the south-west, and others to the north in Mississippi Bay. They are all rocky with very little vegetation.

7. The Mondrain Group

This is an important group dominated by one of the largest islands in the Archipelago, but the other members are only small islets. They all rise from the shelf between 25 and 35 fathoms.

Mondrain [34° 08' S., 122° 15' E.] lies 8 miles S.E. of Cape le Grand and extends N.-S. over nearly 4 miles and is more than 1 mile across. It was named "Île du Mondrain" on the chart of d'Entrecasteaux. It rises in a number of peaks from north-south: 475, 548, 485, and 743 respectively. The latter is the highest point in the Archipelago. The *Pilot* notes that it is surmounted by a very large boulder and is thus visible from all directions; the A.G.S. Expedition suggests the name "Bird-skull Rock" (from its shape) for this eminence.

A good anchorage can generally be found on the north-east side, but there are no beaches at all, and landings must be made directly on to the rocks. With northerly winds, anchorage can be made in the south-east, where there is a fjord-like cove. The rocks are granite-gneiss throughout, with pegmatites but without limestone; a N.-S. dolerite dyke (about 4 ft. wide) was noted on the north-east side of the island. Flinders (1814) noted garnets in the gneiss. Exfoliation cracks form deep crevices and trenches, especially on the northern slopes of the island. There are many bare rocky areas, but in the depressions there are patches of quite rich soil with mutton-bird burrows, and there seems to be a relic of an ancient sand-plain with lateritic gravel near the summit of the island.

There are several good springs of fresh water on the island, and the only streams of fresh water noted in the Archipelago were found in valleys on the eastern side. The vegetation is sparse on the southern and western sides, but quite dense forest exists on the eastern side, with trees 30 feet high, including yate (*Eucalyptus cornuta*), etc. Bush-fires on the island were set alight accidentally by Flinders and by subsequent visitors; these fires have tended to make the undergrowth particularly dense.

Finger [34° 06' S., 122° 21' E.] lies 5 miles east of Mondrain, with two smaller islets extending N.-S. over 1 mile, rising to 146 feet. It has a rounded appearance, wooded near the top, and is steep-to on the north.

Pearson Islands [34° 12' S., 122° 21' E.] lie 6 miles south of Finger; both are small, bare and rocky, a few hundred yards long, rising to 293 and 140 feet.

Hugo Islet [34° 09' S., 122° 20' E.] lies $3\frac{1}{2}$ miles east of Mondrain and is simply a small rocky point reaching 53 feet.

8. The Marts Group

This Group lies south of Duke of Orleans Bay and Hammer Head, and most of its members, including Free, Passage, Station, Cornwall, York, the Marts Islands, Nares, Table, Forrest, Creak and Bens, occur within the 20 fathoms contour, but a few outlying members, Draper, Beaumont, Tizard and Wharton, rise near the outer limit of the 35 fathom shelf.

Free [33° 57' S., 122° 25' E.] lies 8 miles east of Mississippi Point, is about 700 yards long, and rises to 105 feet. It is bare and rocky.

Passage [33° 59' S., 122° 26' E.] lies 2 miles south-east of Free Island, is about 600 yards long, and rises to 85 feet. It is steep-to on the N.W. and S.E. and rocky in its N.E.-S.W. trend.

Station [33° 58' S., 122° 31' E.], named apparently by Flinders (1814), for it is marked for the first time on his chart. This island lies only $\frac{1}{2}$ mile offshore from Cheyne Point, is 1,000 yards long, and rises 182 feet high. There is a good anchorage for small vessels on the north side. It is connected to the mainland by a 10 fathom platform. The island is rocky and scrubby, with some soil and mutton-bird burrows.

Cornwall [34° 00' S., 122° 32' E.] lies 3 miles south of Station Island, is 1,200 yards long, trending N.-S., with a small cove on the north-west, and rising to 170 feet. It is rocky and quite bare, according to the *Pilot*.

York Islands [34° 00' S., 122° 35' E.], a group of five islets lying 2 miles east of Cornwall, the easternmost being 900 yards long and rising to 360 feet. It is steep-to on all sides and has dark patches of vegetation on its eastern face (Admiralty *Pilot*). The others are "low, dark and quite bare."

Marts Islands [34° 00' S., 122° 39' E.] are another group, lying 4 miles S.E. of Hammer Head, four in the east (highest 232 feet) and one large in the west (433 feet) with four smaller rocks. None are larger than 1,000 yards. The westerly (433 feet) is a high rocky dome. In the east, a landing was made with some difficulty by D. Serventy on the north side of the lowest one (107 feet); it is mostly bare rock with no thickets, but scrubby patches and soil on the top.

Nares Island [33° 56' S., 122° 36' E.] was named after J. D. Nares (later Admiral), who was a lieutenant on the *Penguin* (1900). It is situated on the south side of Duke of Orleans Bay, a rugged island, 86 feet high, about 400 yards long, lying just a few yards offshore. There is some low scrub, mostly Leeuwin Wattle, with shallow soil. The rock is granite-gneiss.

Table [33° 55' S., 122° 36' E.] lies on the north side of Duke of Orleans Bay, 500 yards long, rising to 212 feet, and is steep-sided with a partly flat top covered with low scrub.

Forrest [33° 55' S., 122° 43' E.] lies 6 miles east of Duke of Orleans Bay, is 600 yards long, rising from the 10 fathom shelf to 155 feet, and is covered with native grasses.

Creak [33° 56' S., 122° 43' E.] lies 2 miles south of Forrest Island, is 350 yards long, rising to 114 feet, and is bare and rocky.

Bens [33° 54' S., 122° 45' E.] lies in Alexander Bay, a few hundred yards offshore, and extends 600 yards in length, rising to 195 feet. It is rocky, but has a prominent sandy summit according to the *Pilot*.

Draper [34° 12' S., 122° 30' E.], named by Flinders (1814), lies on the outer edge of the 35 fathom shelf, being situated 13 miles south of Cheyne Point and 11 miles east of Mondrain. It is 400 yards long, 263 feet high, and is a circular, dome-shaped, bare and rocky island.

Beaumont [34° 05' S., 122° 32' E.] lies 8 miles south of Cheyne Point, again on the outer edge of the 35 fathom platform. It is 700 yards long, with two ill-defined summits, according to the *Pilot*, the western being 270 feet and the eastern one 50 feet. It is bare and granitic, with sparse vegetation on the upper slopes. Passed from a distance, there appeared to be a sandy beach on the north side, but this was not confirmed.

Tizard [34° 01' S., 122° 41' E.] lies 2 miles S.E. of the Marts Islands. It is flat and rocky, being only 300 yards long and 30 feet high, with scattered boulders on the top.

Wharton [33° 59½' S., 122° 43' E.], named after Admiral W. J. L. Wharton, who was Hydrographer at the time of the *Waterwitch* survey (1897), lies 2 miles east of the Marts Islands. It runs N.-S. and is 400 yards long, rising to 129 feet. It is steep-to on the east, and is a bare rocky dome.

9. The Twin Peaks Group

This Group embraces a cluster of a dozen islands and rocky islets, dominated by the North and South Twin Peaks Islands, and lying on the outer edge of the 20 fathom shelf and about 5 miles offshore from Alexander Point. Flinders (1814) named these two "The Twins" on account of their similarity. Later they became separated on the chart as "North" and "South". There are also a few islands within 1 mile of the mainland shore, including Inshore Island, Taylor Island, etc., and there are some isolated outer islands on the edge of the 35 fathom shelf about 10 miles offshore, including Slipper and Wedge.

Inshore Island [33° 55' S., 122° 50' E.] lies ½ mile offshore from Alexander Point, is roughly triangular in shape, extends over 800 yards long and rises to 157 feet. It is almost connected to the shore by a shallow sandbank. It is covered by coarse grass, according to the *Pilot*. There are also two smaller islands ¾ mile to the W.S.W. (71 feet high) and ½ mile N.W. (16 feet high) respectively.

Taylor [33° 55' S., 122° 52' E.] lies 1 mile offshore and 2 miles east of Inshore Island, is a more or less oval shape 800 yards long, and rises to 158 feet. It is grass-covered.

North Twin Peaks [33° 59' S., 122° 50' E.] is the largest of the group, lying 5 miles south of Alexander Point; it is nearly 3 miles long and consists of a series of dome-shaped hills rising to 242, 615, 223 and 94 feet respectively, in a line from N.E. to S.W. The island is rocky, with some dense scrub in patches, many extensive slabs of bare rock, and large crags near the highest peak. There

is an anchorage and landing place on the eastern end of the north side, where there is a small sandy beach on a narrow neck connecting the 242 ft. and 615 ft. hills. The rocks are mostly granite-gneiss, characteristically augen-gneiss, which is common also on South Twin Peak and another small island to the north, but not on other islands of the Archipelago. The surface of the gneiss is commonly eroded into gnamma holes and broad exfoliation surfaces were noted, especially on the southern side of the island. There is no limestone.

The soil is well developed on slopes and in the small valleys, and these are extensively burrowed by mutton-birds. The vegetation is quite thick in patches, notably of eucalypts (*Eucalyptus cornuta* and *E. lehmannii*), paper-barks (*Melaleuca*) and "jam" (*Acacia acuminata*). There was a severe bush-fire about 14 years before the expedition, but extensive regrowth had taken place (Willis, 1953).

South Twin Peaks [34° 00' S., 122° 48' E.] lies to the south-west of the North Twin, being separated only by a few hundred yards. The island is nearly 1 mile across, rising in a bare dome to 609 feet, being very steep on the north-east. It is almost circular in plan, save for a peculiar hook on the south. Its slopes are channelled with steep narrow clefts, some filled with soil and vegetation, but most of them are bare and smooth rock, sloping right down to the sea. In patches there is enough soil for mutton-bird burrows. There is no anchorage, landing place or beach. The rock is augen-gneiss and the vegetation is scanty scrub.

There are several smaller islands up to 600 yards in length and rising to 150 feet or so, lying within a mile or two of the North Twin Peaks. The Expedition landed on one ("Cave" Islet, which has a conspicuous grotto in the southern cliff face), but they are bare and rocky with little of interest to report. Most of them are unnamed, but the easternmost is called Cap Island (33° 58' S., 122° 56' E.).

Slipper [34° 03' S., 122° 46' E.] lies on the 35 fathom shelf, 3 miles S.W. of South Twin Peaks. It rises to 106 feet and is 300 yards long.

Wedge [34° 05' S., 122° 50' E.] lies 5 miles south of North Twin Peaks, extends over 1,200 yards and rises to 265 feet. As the name suggests, it has a wedge-like appearance from the sea, rising up steadily from the north-east to its highest point in the south-west. There is no anchorage or beach. At the summit there is a small rock pool filled with water; at the time of the Expedition's visit the pool was occupied by a bull seal. The rock-type is granite-gneiss and there is a restricted amount of soil in rocky crevices. These carry mutton-bird burrows and herbaceous vegetation.

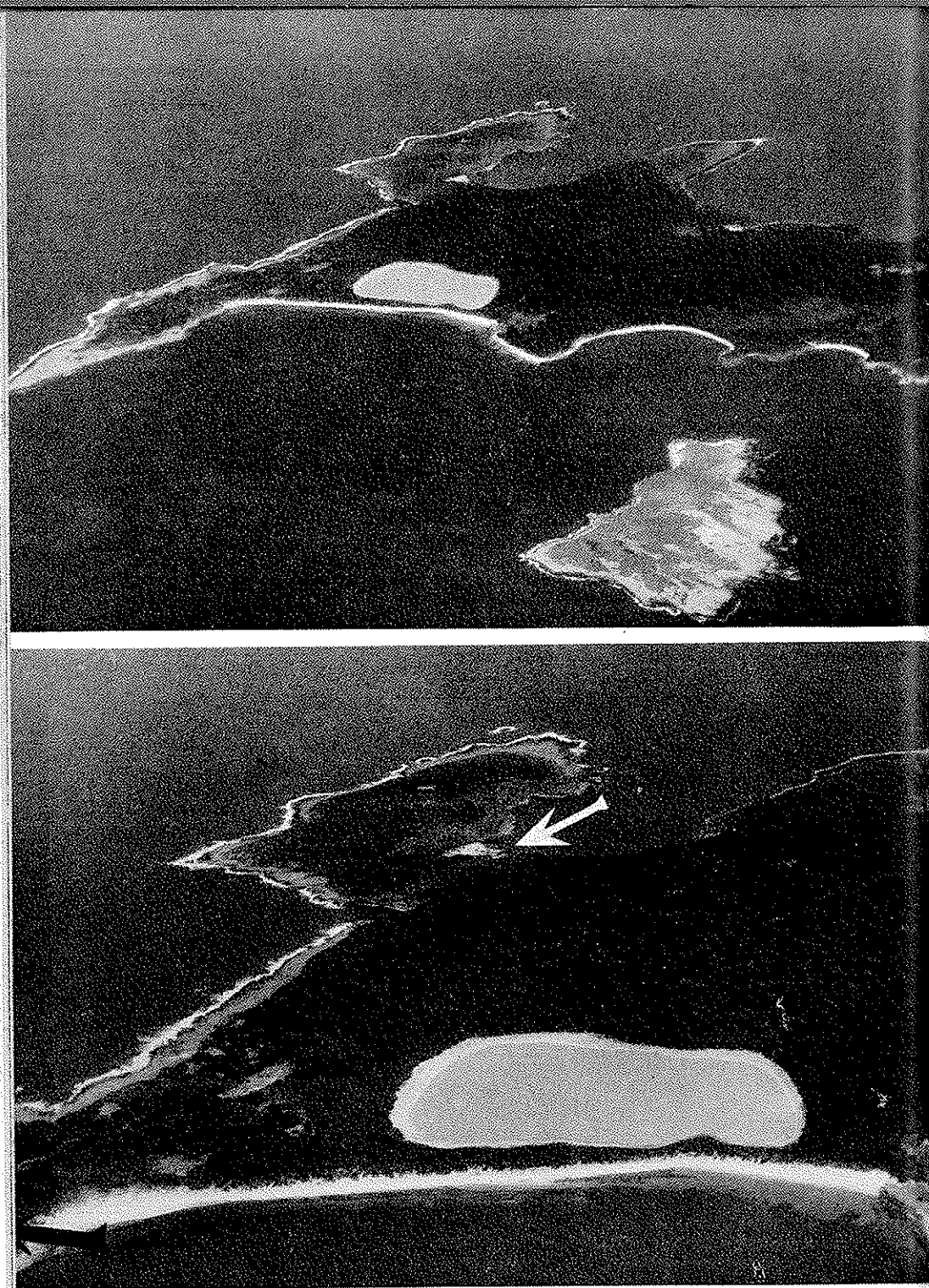
10. Combe Group

Combe Island [34° 05' S., 122° 58' E.] was named after T. W. Combe, who was commander first of the *Waterwitch* (1897) and later of the *Penguin* (1900) on surveys in these waters. It lies 8 miles S.E. of North Twin Peaks and is quite isolated. The island is 1 mile long (N.N.E.-S.S.W.), slightly pointed at each extremity, and rises very gently to a central elevation of 72 feet—abnormally low for the Archipelago. There is a partially protected anchorage near the northern point, but no sand beach. The shores are low, but rocky, and the western shore is distributed with residual granite boulders. The rock is granite-gneiss. The surface of the island is bare and sandy, and is riddled with burrows of the smaller mutton-bird. It is essentially a small salt-bush plain (*Atriplex cinerea*) with noon-flower or pig-face (*Carpobrotus*) and other succulents. It abounds with rock wallaby (*Petrogale lateralis*).

11. Cape Arid Group

This Group lies mostly within 6 miles of the mainland coast around Cape Arid, on the 20 fathom shelf, thus including Middle Island (the largest and most important of the whole Archipelago, but unfortunately excluded from the reserve for flora and fauna), Goose Island, Miles, Owen, Gulch, Stanley, Arid and Barrier; also some more isolated islands on the 35 fathom shelf, including Glennie, Helby, Douglas and Dome (the last rises from 40 fathoms).

Middle Island [34° 07' S., 123° 11' E.] lies 6 miles S.S.E. of Cape Arid, and extends 4 miles in length; it consists of a series of narrow ridges each about 2 miles long, extending N.N.E.-S.S.W. and joined in the middle, rising mostly from 200-400 feet, the highest point in the north-west being Flinders Peak, reaching 572 feet. Between the ridges are deeply indented bays along both north and south coasts. The island was originally named "Île de milieux" by d'Entrecasteaux, being roughly in the middle of the Archipelago.



Top: Eastern portion of Middle Island, from north (Goose Island in right foreground; eucalypt forest and pink brine lake in centre; Miles Is. Point at extreme left).

Lower: Close-up view of pink brine lake and sweep of beach along Goose Island Bay (camp site of A.G.S. Expedition indicated by black arrow at extreme left-hand corner, Limestone Bay by a white arrow at upper centre).

—C.S.I.R.O. aerial photos. 87/12 and 88/14 (S. Fowler).

A notable feature is a shallow salt lagoon half a mile across on the small flat coastal plain in the north-east. It is pink in colour, but not by reason of algae or organic matter. There are extensive salt deposits around the margin. A sample of the water collected by D. L. Serventy in the winter of 1948 showed a chlorinity of 128 grams per litre and a salinity of 230 grams per litre (this represents 65% saturation, assuming the salt present to be sodium chloride). Nitrates were absent.

There is a good anchorage on the north side in Goose Island Bay, but in the eastern part the sandy floor is loose, and in certain winds vessels are liable to drag their anchors. There are excellent sandy beaches along all the northern bays. There is a calcareous beach rock rising to 4 feet above low water mark on the east side of Goose Island Bay. It is here that the vessel *Penguin* was wrecked in 1906 after dragging its anchor in a westerly blow.

The rocks of the island are divided into a belt of granite-gneiss, trending N.N.E.-S.S.W. along the west coast, to the east of which there are parallel belts of meta-sediments, mainly schists, basic gneiss and quartzites. Also in places near the middle and south side the latter are unconformably overlain by Tertiary sandstones and Quaternary colianites (Coastal Limestone), with travertine capping. There are caves and cliffs several hundred feet high of Coastal Limestone on the south-east coast. Duffer (1943) reported finding no guano or phosphatic rock deposits. The granite-gneiss belt along the west coast contains two very striking dark bands which show up on the air photograph and from the sea; they appear to be due to dense vegetation growing on soft basic intercalations. On the north-eastern side of this same belt rich biotite bands were noted in the gneiss.

The soil on most of the lower part of the island is quite sandy, and there are extensive sand hills along the northern shore up to 30 feet high. In the north-east there is a chocolate sandy soil. There are extensive uncemented shell beaches along the eastern shores, nowhere above storm-wave level.

There is an old camp with a hut in moderate condition at the western end of the salt lagoon, and nearby is a lined well with a good supply of fresh water. There are also rock holes near the hut, and these carry fresh water during the wet season.

The vegetation is rather sparse on the western ridge of granite-gneiss, but on the south-eastern limestone and in the central valleys it is extremely dense. Four eucalypts (*E. cornuta*, *lehmannii*, *platypus*, and *incrassata* var. *angulosa*), paperbark (*Melaleuca globifera*) and moonah (*M. pubescens*) compose the chief forestal growth, with cypress-pine (*Callitris preissii*) on the landward slopes of Flinders Peak (Willis, 1953). There are tamar wallabies (*Macropus eugenii*), but no mutton-birds and no death adders (or any other snakes).

Goose [34° 05' S., 123° 11' E.] lies $\frac{1}{2}$ mile north of Middle Island. It was named by Flinders (1814), who shot a number of geese here. The island is 1 mile in length and rises to 154 feet. It is connected by a shallow sand-bank to the south-east with the mid-point of the north shore of Middle Island; the bank is covered by 2 $\frac{3}{4}$ fathoms of water, according to the *Pilot*. Anchorage may be made on the south or east side, and around the southern end there are sandy beaches. They are separated by sectors of limestone cliffs 30-40 feet high, which are fronted by flat water-level reefs that only uncover at low tides. The limestone cliffs are undercut with an intertidal notch 5 feet high, which reaches up to 20 feet deep into the cliffs to form small sea-caves. There are traces of a raised shore platform 10 feet above low tide level at several points.

The geology, according to Thomson and Shipway (1948) consists of a Pre-Cambrian granite-gneiss belt on the west side of the island, and this continues the belt noted on the west of Middle Island, with a N.N.E. trend. The granite-gneiss is paralleled in a restricted area on the south-east by a quartzite, representing again the zone of metasediments noted to the south on Middle Island. These Pre-Cambrian rocks are unconformably overlain in the south by a small patch of a conglomerate sandstone, containing fossil mollusca.

All these formations are unconformably overlapped by extensive Quaternary colianite (Coastal Limestone), which is consolidated on the surface into the usual travertine crust; and below the latter travertine-lined solution pipes (dating from the arid erosion of the late Pleistocene) have been weathered out to form "chimney" or "organ-pipe" structures. Bands of reddish fossil soil, averaging 1 foot in thickness, were noted in the colianite, and contain many specimens of the land-snail *Bothriembryon*. A few specimens occur in the colianite. These snails are commonly found living on the islands (Iredale, 1939), but are not definitely of the same species.

There is a moderate thickness of sandy soil on the Coastal Limestone, which is extensively riddled by mutton-bird burrows (*Pterodrome macoptera*). Duffer

(1943) examined the island and noted a limited quantity of sandy guano in shallow caves on the cliff faces where the birds nest. There are a few black rabbits on the island (introduced by fishermen). The western and northern parts of the island are almost bare of soil and the granite-gneiss surface is widely exposed. The vegetation is low and scrubby, with tussocky grass and recumbent shrubs.

Miles [34° 04' S., 123° 14' E.], named after I. B. Miles, a lieutenant on the *Penguin* (1900), lies 1 mile N.E. of the north-eastern point of Middle Island, is 1 mile long, and rises to 127 feet. It stands on a shallow platform under 10 fathoms, which extends 1 mile to the N.N.W. and supports several additional small rocky islets.

Owen [34° 02' S., 123° 14' E.] lies 1½ miles north of Miles, is very narrow, but extends 1 mile in length and rises to 60 feet at its northwest end. It is bare and rocky. However, the presence of some patches of soil is implied by a report of mutton-birds (Serventy and Whittell, 1951).

Gulch [34° 01½' S., 123° 15' E.] lies ½ mile N.E. of Owen and is 1 mile in length, rising to 67 feet. It has a small islet off the west side where there is a small bay with 4 fathoms of water in it. It is reported to be covered with long coarse grass and a few bushes, with patches of soil and mutton-bird burrows; G. Maxwell collected the native hollyhock (*Lavatera plebeja*) there in 1863.

Stanley [34° 01' S., 123° 18' E.] lies 1½ miles east of Gulch, is ¾ mile long and rises to 38 feet. It carries some vegetation and soil, and mutton-birds are reported.

Arid [34° 01½' S., 123° 10' E.] lies ¼ mile south of Cape Arid on the mainland; it is less than ½ mile long (E.-W.) and is very narrow, rising to only 18 feet. It is bare and rocky.

Barrier Islands [33° 59' S., 123° 09' E.] lie ½ mile offshore and 2 miles N.W. of Cape Arid. There are two islets, each ½ mile long, separated by ½ mile of rocky shoals, and rise respectively to 60 and 128 feet, the southern being the higher. There is a fairly well protected anchorage on the east side of these islands at the northern end of Arid Bay.

Glennie [34° 06' S., 123° 07' E.], named after R. W. Glennie, a lieutenant on the *Penguin* (1900), lies 2½ miles west of Middle Island on the outer edge of the 35 fathom shelf. Several smaller islets and reefs also occur in this area, including Brewis I. (16 ft.), Dailey I. (36 ft.), Palmer Reef, etc. Glennie is ¾ mile long and rises to 94 feet. It is high with a rounded summit, according to the *Pilot*.

Helby [34° 07' S., 123° 04' E.], named after H. W. H. Helby, another lieutenant on the *Penguin* (1900), lies 2 miles S.W. of Glennie, is ½ mile long, and rises to 34 feet. There is also a very narrow rocky islet, Hasley I. (30 ft.) ¼ mile to the north.

Douglas [34° 10' S., 123° 09' E.] lies 3 miles S.S.W. of Middle Island, is about ½ mile in length, and consists of two dome-shaped peaks (E.-W.) rising to 260 and 270 feet, joined by a narrow neck. Flinders (1814) named them as a monument to the memory of his bo'sun, Douglas, who died as they approached the island. The surface is barren and rocky with very spectacular cliffs on the precipitous south-west side, which drop 200 feet sheer into the sea. There are no beaches. Landing was made by the Expedition in calm weather on the north-east side against a sheer rock face. The rock is granitic gneiss, with lenses of more basic material, and some pegmatite dykes were noted. There are patches of soil with mutton-bird nests. There is scanty vegetation only around the westerly peak.

Dome Island [34° 10' S., 123° 21' E.] lies 7 miles E.S.E. of Middle Island, is ½ mile long and rises 295 feet. It rises sheer from the 40 fathom contour. It is bare, rocky and dome-shaped, hence the name.

12. Cape Pasley Group

About 15 miles east of the Cape Arid Promontory, and off Cape Pasley, there is Pasley Island and a number of smaller islets, also rising from near the 35 fathom line which here runs close in to the coast. A few miles farther to the north-east, the Bellinger Islands lie close in-shore.

Pasley [34° 01' S., 123° 34' E.], presumably named after Cape Pasley, lies at an approximate position 4 miles south of Cape Pasley and 15 miles E.N.E.

of Middle Island, rising from the 35 fathom shelf. It is not named on the Admiralty Chart or in the *Pilot*, but Naylor (1907) mentioned 900 tons of guano that might be shipped away. Dulfer (1943) mentioned a number of shallow caves in the limestone, but the guano deposits were very small.

Bellinger Islands [33° 54' S., 123° 36' E.] lie 5-6 miles N.E. of Cape Pasley and a mile or two from the shore. They are not well charted and not described in the *Pilot*. Dulfer (1943) visited them, but found no guano or phosphate.

13. The South-east Isles

This is hardly a group, but there are certain scattered islands and reefs rising from the shelf at about 45-50 fathoms, consisting of Salisbury I., Cooper I., Round I., Pollock Reefs, and various other reefs, marked collectively in the Admiralty Chart as the South-east Isles from the name given by d'Entrecasteaux.

Salisbury [34° 21' S., 123° 33' E.] lies 22 miles S.E. of Middle Island, rising abruptly from the shelf in 45 fathoms. The island is long and narrow, oriented N.E.-S.W., extending for 3 miles, but is only a quarter to half a mile across. The surface is rather flat but undulating. There are two high points near the centre, one rising to 390 feet, and an isolated rise on the south-west end reaching 330 feet. There is a rather flat terrace about 50 feet high forming the north-eastern tip of the island. There is no safe anchorage, no sand beaches, and landing on to the rocks is hazardous at all times except in abnormally calm weather.

The basement geology consists of rather dark-coloured granitic gneiss, which includes some garnet schist, and is striking N.-S. to N.E.-S.W. with the trend of the island. The gneiss rises to over 100 feet above sea level in the south, but in the centre not above 10-20 feet; along the coast the gneiss is exposed in a shore platform 10-15 feet above sea level from 50-250 feet wide. In places it is overlain unconformably by a rather massive hard brown sandstone, which is probably of Tertiary age; it is approximately flat-lying and is about 5-10 feet. Both Tertiary sandstone and the Pre-Cambrian are unconformably overlapped by the Quaternary eolianite (Coastal Limestone) which covers most of the island. In places the limestone comes right down to the shore, and is undercut with the usual intertidal notch, characteristic of these rocks. Sections of a 10-foot shore platform are also preserved in places. The limestone is well exposed in the coastal cliffs up to 200 feet or more, displaying numerous fossil soil horizons at undulating levels, marked by reddish colours, but on this island no fossils of the land snail *Bothriembryon* were found. In between the fossil soils, which partly show travertine crusts, there are the normal soft dune rocks with cross-bedding. Travertine-lined solution pipes and fossil root structures are common. The top of the island is an undulating plateau, formed of a very thick travertine crust with sandy brown soil. There are small patches of wind-blown sand here, according to Dulfer (1943), who also found "low grade phosphate rock in the eroded cliff face approximately 3,500 feet from the north-eastern point of the island, and situated between granite and sedimentary beds, where the calcareous sandstone cliffs were undercut for a depth of 4-6 feet." Detail of this section he gave as follows:

- "(a) Soft calcareous sandstone with a maximum thickness of 18 inches containing 7.24% of calcium phosphate and 7.2% of water.
- (b) White chalky material approximately 12 inches thick, containing 34.27% of calcium phosphate and 6.8% of water.
- (c) Hard brecciated rock about 12 inches thick and similar to Christmas Island rock phosphate. The analysis of a grab sample of this material showed it to contain 50.9% of calcium phosphate and 5.7% of water."

The vegetation is low and scrubby on the upper surface of the island, but is so extremely dense and difficult to traverse that it has drawn special comment from Willis (1953). He suggested that it might represent regrowth of an old vegetation partly destroyed in an extensive fire after the wreck of the *Rodondo* in October 1894. It is probably this dense vegetation that has discouraged the nesting of mutton-birds, which are completely absent. There are numerous rock wallaby (*Petrogale lateralis*).

Cooper [34° 14' S., 123° 37' E.] lies 21 miles E.S.E. of Middle Island and 6 miles N.N.E. of Salisbury. Its position and shape are only roughly marked on the chart, but it appears to be about 1 mile in length, rising to 120 feet high. It has "a light colour, with even outline, and has a rugged coast" according to

the *Pilot*, which suggests that, like Salisbury, it has a basement of granite-gneiss overlain by the light-yellow coloured Coastal Limestone.

Round [34° 05' S., 123° 53' E.] lies 33 miles east of Middle Island and 19 miles south-east of Cape Pasley. It is under 1 mile in diameter and according to the *Pilot* is "a prominent lump of rock". It was named "Round Island" by Flinders, but must not be confused with the other Round I. (12 miles south of Cape le Grand). There are some small offlying rocks.

14. The Eastern Group

As the name suggests, this group forms the most easterly of the Recherche, being named by d'Entrecasteaux, lying 10-20 miles east of Point Malcolm and south-east of Israelite Bay on the mainland coast. It consists of at least eight islands, some of which are named on the Admiralty Chart, but the largest, some two miles long, has been known for at least half a century as "Christmas Island"; however, the use of this name, coupled with the occurrence of phosphate there, has caused some confusion with the well-known Christmas Island in the north-eastern Indian Ocean. A short distance south-west of Christmas is another known as New Year Island.

There are no soundings on the chart hereabouts, but the regional pattern of the depths suggests that this group lies on the 35 fathom shelf.

There are two additional islands lying 6 miles east of Point Dempster, Israelite Bay, and these rise from about 20 fathoms and are each less than 1 mile in length. Nothing is known of them and they do not appear to have been named.

Christmas [33° 51' S., 124° 04' E.] lies at the south-eastern point of the group. It appears to be about 2 miles long and is in a figure-of-eight shape, with a very steep-sided peak in the north rising to 450 feet (measured by aneroid—V.N.S.) and in the south to 400 feet (also by aneroid). There is a narrow neck in the centre, rising to 100 feet and $\frac{1}{2}$ mile across and forming an abrupt granitic cliff on the east side, sloping down gently to the west. There is a good anchorage in 4 fathoms on the west side protected by New Year Island. There is a sand beach 300 yards long on this western shore, behind which in places there are limestone cliffs rising up to 30 feet, but generally the shore is low.

The geological features have been described in some detail in Woodward (1909), who discusses them as follows:

The granite rocks which form the foundation of this island are of a highly igneous character, thus differing considerably from many of those met with in the south-western district, which may possibly be of metamorphic origin. They present a bold bare polished surface upon which the foothold is very insecure, often having the appearance of colossal ruins or obelisks.

The inclined polished surfaces exhibit a complex structure of dark-coloured biotite granite and gneiss or schists, the foliation of which are much plicated, and appear to represent the primary rocks of this group, since fragments and masses of them are often met with, entangled in the magmas of porphyritic granite which appear to have been intruded at a subsequent period.

The porphyritic granites are of a pale flesh colour, the ground mass being composed of quartz, feldspar, and mica (muscovite), whilst scattered here and there throughout the whole are large crystals of orthoclase feldspars, which vary in size from one-half to one inch in length.

Radiating from these porphyritic masses are dyke-like extensions, in which the character of the rock changes rapidly into pegmatite, whilst further still from the primary magma these pass almost imperceptibly into quartz veins, which occasionally contain a little feldspar or mica in the form of large crystals, the latter being mostly biotite.

Intersecting the entire series are numerous narrow veins of highly basic fine-grained greenstones, which contain magnetite in such large proportions that even the thinnest microscopic sections are mostly opaque.

This Pre-Cambrian basement is overlain unconformably by grit or conglomerate with large granite boulders "cemented together by a dark-coloured shelly limestone". This matrix was found to be extensively phosphatized and selected samples gave very high figures of calcium phosphate. He believed that the enrichment took place in limestone caves. Duffer (1943) also described and sampled this rock, confirming in general Woodward's observations. The deposit, however, is limited to a few feet vertically and only extends along the western beach; Woodward estimated that there was in sight here 700 tons of rock phosphate averaging 51.6% $\text{Ca}_3(\text{P}_2\text{O}_4)_2$, with 8.07% CaCO_3 . He suspected that the deposit might extend back for some distance. Duffer put down test holes and trenches, and concluded that the deposit did extend back from the beach; he agreed to the estimate of only 1,000 tons here. The age of this marine conglomerate horizon is difficult to fix, but may well be Pleistocene, as there are similar

conglomerates elsewhere along the south-west coast (e.g. Cowaramup, Malamup, Knapp Head, etc.).

The conglomerate is overlain directly by a pale-yellow colianite (Coastal Limestone), 30-50 feet thick, which is interbedded with reddish and ferruginous quartz sands that are clearly fossil soils formed during short periods of still-stand in the Pleistocene dune-building.

The colianite is capped by a massive and nodular travertine crust which is locally rich in phosphate. Woodward (1909) mentioned 100,000 tons of phosphate reserves here, but Duffer (1943) noted that these superficial phosphatic crusts were of low concentration (less than 25%) and of no economic value.

The granite hills are bare, with small patches of soil. Overlying the colianite, the soil is sandy and brown, up to 2 feet thick, with a negligible coating of guano. It is extensively burrowed by mutton-birds. Hair seals were noted on the west beach.

No fresh water springs were found. There are no trees, but low scrub covers much of the island (Willis, 1953).

New Year [33° 51' S., 124° 03' E.] lies a few hundred yards off the southern end of the western beach of Christmas Island. It extends over $\frac{1}{2}$ mile in length and rises in a low bare hill to about 50 feet. Granite-gneiss is exposed over most of the island and there does not appear to be any limestone. There are patches of low scrub in the upper part.

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5. REPTILES AND FROGS

By L. GLAUERT*

Our knowledge of the reptile fauna of the Recherche Archipelago prior to the Expedition was extremely limited. The Perth Museum had a Death Adder from North Twin Peaks, a Marbled Gecko from Remark and a Gray's Skink from Middle Island. On the other hand, the material in the Australian Museum, Sydney, was more extensive, collecting having been undertaken by J. H. Wright and H. S. Grant in 1922. As a result of their efforts the White-lipped Snake, the Barking Lizard, the Netted Dragon, King's Skink, Peron's Sand Lizard and a tree frog were added to the faunal list.

The present collection made by Mr. V. N. Serventy from 22 islands includes four species of snakes, nine of lizards and one frog. With one or two exceptions they show no differentiation from individuals occurring on the adjacent mainland. One snake and four other lizard species are discussed in this paper; these were either observed, but not collected, on the islands or were noted on the contiguous mainland coast and may be anticipated in the Archipelago.

SNAKES

1. CARPET SNAKE, *Moralia variegata* (Gray)

Carpet Snakes were seen only on Mondrain Island—at the north-eastern shore. Here six, 5-6 feet in length, were found coiled together under a ledge of rock. One put into a pool of water sank to the bottom and crawled out. One handled did not attempt to bite.

2. DUGITE, *Demansia nuchalis affinis* (Guthrie)

This very variable snake was seen on Boxer and Figure-of-Eight Islands, where specimens were collected. On Boxer all the larger dugites looked very black, though on the other island "brown" and "black" specimens were seen, one of the former having scattered black scales towards the head. A "spotted dugite" 6 feet long and weighing 3½ lbs., caught at Esperance, had a young rabbit in its mouth.

On two young dugites found under a granite slab on Figure-of-Eight Island the dark on the head was separated from the cross-band on the nape; the back was dark but had a spotted appearance. The one had a light under-surface, the other light with a reddish tinge.

3. CROWNED SNAKE, *Denisonia coronata* (Schlegel)

This little snake, so common in the lower south-west of the State, was seen on Mondrain, Round and Christmas Islands, as well as on the mainland (Duke of Orleans Bay, etc.).

One caught on Mondrain, which bit its captor, apparently without serious results, had the black band on the nape very prominent, the head slightly darker than the body and the under-surface pink. A second specimen from the same island is rather smaller; its head is very dark but the black cross-band is still distinct. This spirit-preserved snake has the body above a paler and brighter green, the ventrals dark green at the base, their edges in places showing traces of pink. Both specimens have the dorsal scales smooth, not striated.

4. WHITE-LIPPED SNAKE, *Denisonia coronoides* (Guthrie)

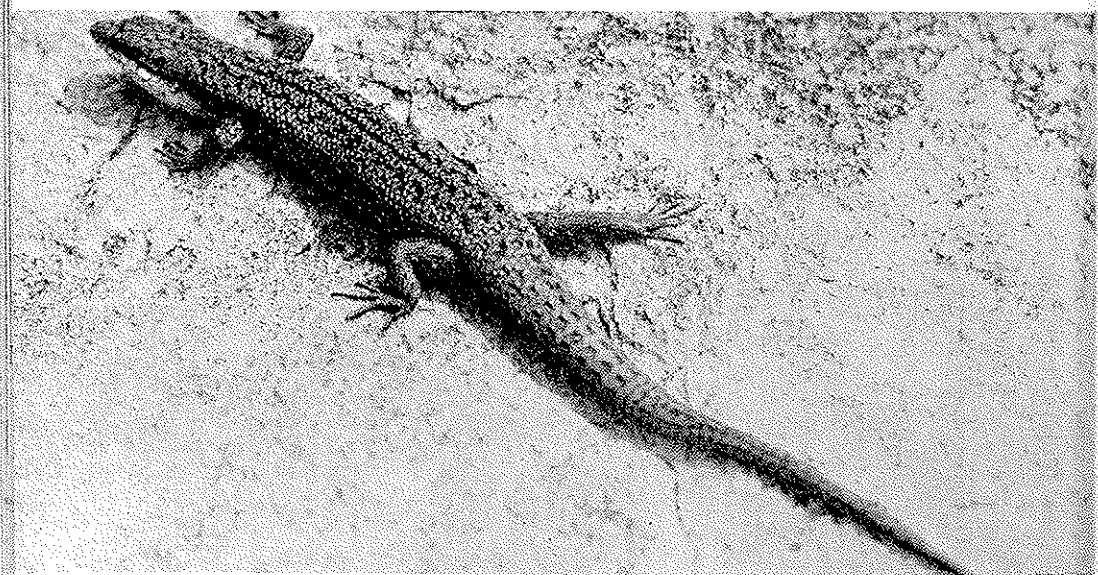
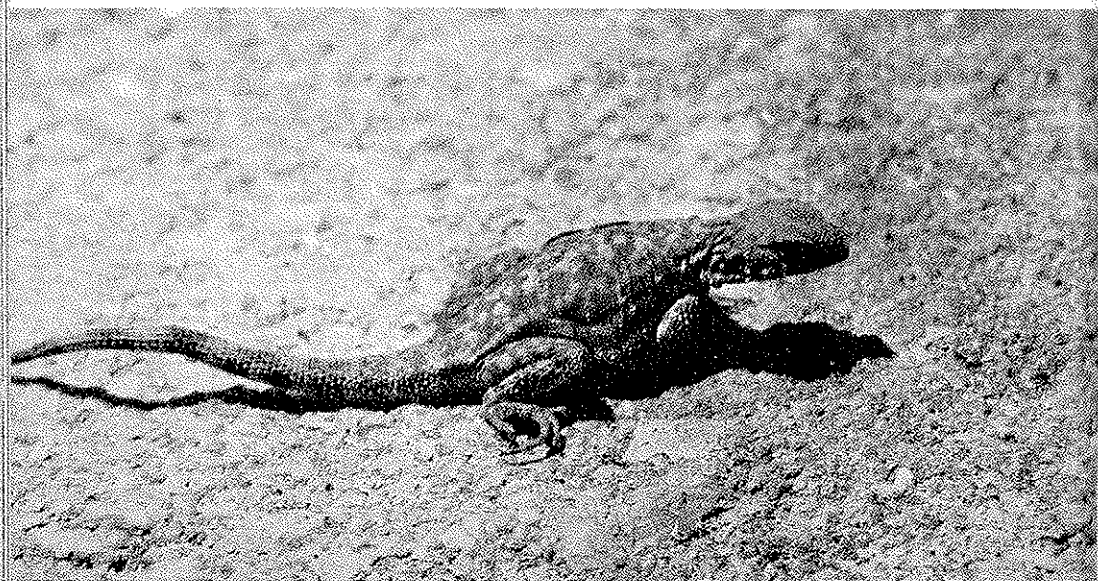
This snake, reported by Kinghorn as present on Mondrain Island, is not represented in the collection, nor is it mentioned by the collectors.

5. DEATH ADDER, *Acanthophis antarcticus* (Shaw)

Death adders were found to be very common on many of the islands visited. It has been stated that Sandy Hook Island was unsuitable as a grazing property owing to the abundance of the species. Mr. V. N. Serventy remarks:

It may be stated as a general rule that death adders are probably present on all islands of the group large enough to sustain them. However, they may be absent from Middle Island. Smaller islands such as Termination, Douglas and Wedge do not seem big enough to carry a large snake population. It is worth recording that on Figure-of-Eight Island one was seen moving across the top of the thick bush about a foot above the ground; this coiled into the striking position when approached. Another remained stationary until touched, when it took cover in the thick bush below.

*Curator, W.A. Museum, Perth.



Top: Barking Lizard, or Thick-tailed Gecko (*Gymnodactylus miliusii*).
Centre: Netted Dragon (*Amphibolurus reticulatus*).
Lower: Smith's Skink (*Egernia carinata*).

Photos: V. N. Serventy.

On Boxer Island a death adder was seen on the edge of a granite slab—a favourable position, where its colouration was an excellent camouflage. On bare rock these reptiles being short and stumpy, are unable to obtain purchase; they avoid such situations, which are favoured by the dugites.

An adder killed on North Twin Peaks Island was cooked and eaten; it was found to be tasty, rather like delicate chicken, but without much flesh.

LIZARDS

1. BARKING LIZARD (OR THICK-TAILED GECKO),

Gymnodactylus miliusii (Bory de St. V.) = *Phyllorhynchus miliusii*

This quaint and well-known lizard was collected on Sandy Hook, Mondrain, Termination and Thomas Islands, and was seen on Pasco, South Twin Peaks, Cave and Remark Islands. It was found to be very common in places. The Australian Museum has one from Charley Island. Mr. Serventy remarked upon the variety of tails seen, suggesting that several species were represented. However, this is not the case, for the Barking Lizard, like so many of the *Geckonidae*, can shed its tail with the greatest of ease, the replacing appendage often differing greatly from the original in shape, size and colouration.

2. MARBLED GECKO, *Phyllodactylus marmoratus* (Gray)

Apparently common everywhere, this little gecko was collected on Sandy Hook, Termination, North Twin Peaks, Figure-of-Eight and Thomas Islands, and seen on Remark, Long, Pasco, Mondrain, South Twin Peaks, Cave, Wedge, Middle, Nares and Woody Islands. In the Australian Museum are specimens from Gunton and Rabbit Islands.

3. SCALE-FOOTED LIZARD, *Pygopus lepidopodus* (Lacep)

The lizard is snake-like, with minute encased limbs, and ranges almost throughout Australia and Tasmania; it was reported from Israelite Bay and Point Malcolm, but not from any of the Recherche islands. A specimen collected at the former locality was typical in colouration, but the tip of the tail for a distance of two inches was a replacement and devoid of the usual ornamentation.

Another specimen seen at Israelite Bay held its head three or four inches above the ground, flattened the sides of the neck and protruded a small blunt black tongue when disturbed, the ear opening was prominent. V. N. Serventy's description was as follows:

The general body colour is blue-grey with three prominent dark stripes starting from the head, not continuous but interrupted by light brown, and with a light brown line along the centre of each stripe; on each side is a fainter line of dark spots. The under-surface is a faint pink.

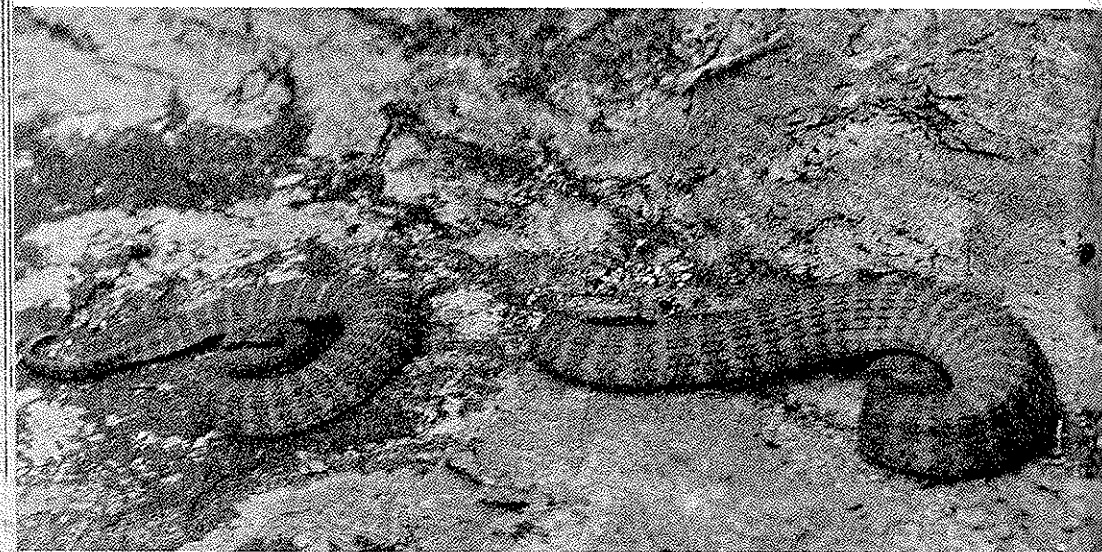
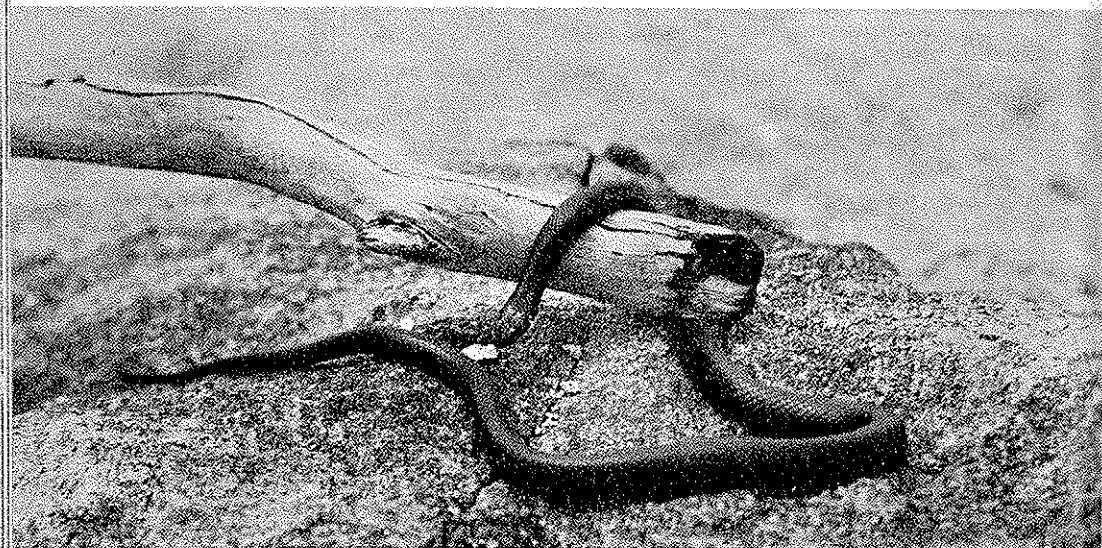
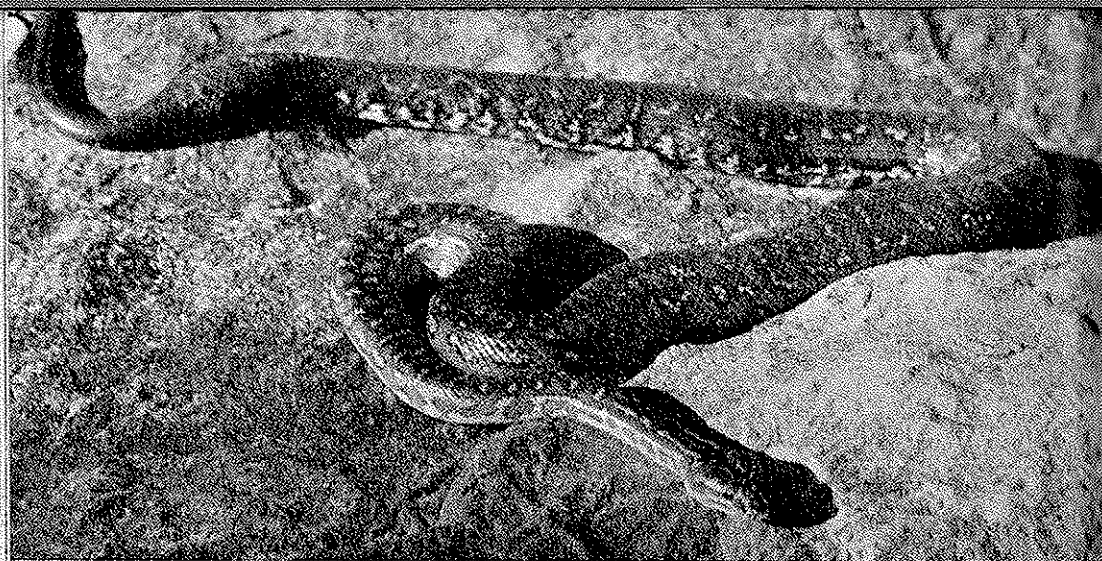
4. NETTED DRAGON, *Amphibolurus reticulatus* (Gray)

A common lizard of the interior, it was noticed on Pasco, Mondrain, Middle and Christmas Islands, a male and a female being collected from Mondrain. In general, specimens resemble the typical form, but there are minor differences—the tympanum is about as large as the orbit, the adpressed hind limb reaches beyond the tympanum but not to the eye, and the tail, which is more than once and one half as long as the head and body (145 to 80), is covered with uniform strongly keeled scales except basally below. There is a series of 50 pores extending the length of the thigh but interrupted in the preanal region. The female has shorter limbs and tail and lacks the pores, but resembles the male in colouration, which is more intense than on the mainland forms.

Netted dragons are common on Mondrain, very actively running on all fours with the tail cocked in the air and bobbing the head several times when stopping, reminiscent of the head-bobbing in waders. The species is widespread in Western, South and Central Australia.

5. MONITOR, *Varanus* sp.

T. C. Andrews, who spent six months on Middle Island in 1889/90, mentions (*in lit.*) that monitors were common enough in the paperbark shrubberies. During the Expedition's camp there (22/11/1950) J. H. Willis saw a monitor on Miles Island Point; it would be about 3 ft. long, but ran under cover before a close inspection could be made. No specimens were collected, and the identity of this Recherche "goanna" remains in doubt. It is almost certainly referable either to *Varanus gouldii* or *V. varius* (Common or Lace Monitor).



Top: Carpet Snake (*Morelia variegata*). Centre: Dugite (*Demansia nuchalis affinis*).
Below: Death Adder (*Acanthophis antarcticus*).

Photos: V. N. Serventy.

6. KING'S SKINK, *Egernia kingii* (Gray)

The identity of certain skinks found in Western Australia has long been a matter of dispute. In December 1838,¹ descriptions of two new species by J. E. Gray were published under the names of *Tiliqua napoleonis* and *Tiliqua kingii*. The former was said to be "brown with three pale dorsal streaks; ear scales four, large; scales three toothed behind, three keeled." The latter was "dark brown with small pale spots at the tip of the scales, beneath pale, brown spotted, scales four or five ridged."

Seven years later² a third species, *Tropidolepisma nitida*, was described by Gray in the words: "Dark olive, varied with black; sides black and white spotted; tail elongate; scales smooth, shining, in 12 series on the back, each marked with three short smooth, close, rather converging keels; of the tail rather larger with rather larger but equally smooth and sharp keels; of the upper part of the limbs with three close distinct keels."

The forms *kingii* and *nitida* are figured by Gray in 1867,³ being represented by specimens about 15 inches in length. In 1887,⁴ G. A. Boulenger united the three forms under *Egernia kingii*, and there they remained until A. Loveridge again separated them,⁵ an arrangement confirmed by F. J. Mitchell in 1950.⁶

Egernia kingii may reach a length of 22 inches (561 mm.), as is shown by W.A. Museum specimen R.9347 from Jarrahdale, but the others are much smaller. Loveridge mentions that gravid females of his *E. nitida* measured less than 9 inches (228 mm.) and Mitchell found a female *E. napoleonis*, "with two young in an advanced stage of development"—R.6799 from Eclipse Island—of approximately the same size. It would seem evident that at least two species are indicated, one large, the other small.

To assist in the identification of the skinks collected by the A.G.S. Expedition, 74 specimens were examined. This material included many from the southern mainland as well as specimens from Wallabi Island in the Abrolhos group—the type locality of *E. kingii*,—from Rottnest, Carnac, and Penguin Islands off the west coast, Sandy Island near Point D'Entrecasteaux, Eclipse Island south of Albany and Goose Island in the Recherche Archipelago off the south coast.

Three forms are clearly indicated; one is dark with markings in the shape of spots or larger blotches as shown in Gray's plate 13 (or rather indistinctly visible as in plate 12), or the lizard may be dark on the upper surface with a small white dot on each of the lateral scales.

The scalation shows a certain amount of variation, but all had the 7th and 8th upper labial entering the eye, only a couple of cases showing the 6th and 7th in this position on one side only. Of the ten specimens from southern islands, four had 40 scales round the body, five had 42 and one specimen had 48.

In addition to its occurrence on so many of the Recherche islands, the species is known to occur on the mainland from Moora in the north to the Mammoth Cave and the mouth of the Pallinup River in the south. Inland it ranges to Kojonup and Tambellup.

7. CUVIER'S SKINK, *Egernia napoleonis* (Gray)

This smaller and paler species, with three well marked light dorsal stripes, is a southern form ranging from the vicinity of Brunswick Junction in the north to the south coast and inland to Ongerup and the Stirling Range. It has also been collected on Eclipse Island and so may be present on islands of the Archipelago. The largest specimen in the Museum measures about 12 inches (303 mm.).

8. SMITH'S SKINK, *Egernia carinata* Smith

The second smaller species is also paler than *E. kingii*, its ground colour bearing a number of irregular rectangular dark brown markings which may form longitudinal stripes. In some specimens all three are well defined, in others either the dorsolaterals or the vertebral are broken up. Others again have the markings scattered irregularly, although here and there traces of the longitudinal arrangement may be seen. Scales around the middle of the body vary from 30 to 38. The eyelids are never pale as in the preceding species.

The species has a wide range from the vicinity of Perth to the south coast and inland to Lake Grace and Norseman. It has also been collected on Rottnest

1. *Ann. Nat. Hist.*, 11: 290 (1838).
2. Catalogue of Specimens of Lizards in the collection of the British Museum, 1845: 106.
3. *Zoology of the Erebus and Terror. Reptiles*, T. 12 and 13 (1845), reprinted in *The Lizards of Australia and New Zealand* (1867).
4. *Catalogue of the Lizards in the British Museum (Nat. Hist.)*, 3: 138 (1887).
5. *Bulletin of the Museum of Comparative Zoology, Harvard*, 77, No. 6: 339, 340 (1934).
6. *Records of the South Australian Museum*, 9, No. 3: 281 etc. (1950).

and Eclipse Islands, as well as on Boxer and Mondrain in the Archipelago and was noticed on other islands of the group.

9. BOB-TAIL (OR STUMPY-TAILED LIZARD),

Trachysaurus rugosus (Gray) = *Teliqua rugosa*

The common and variable Bob-tail Lizard was seen on Mondrain, North Twin Peaks, Middle and Salisbury Islands, and was photographed but not collected. In notes supplied by Mr. Serventy the prevailing colouration was not recorded. It is interesting to recall that William Dampier published a lively description (probably the first) of this sluggish creature, after his voyage of 1699 along the north-west coast of Western Australia—see *A Voyage to New Holland &c.*, 3: 123 (1703).

10. GREY'S SKINK, *Lygosoma* (*Sphenomorphus*) *labillardieri* D. & B.

This lizard is represented in the collection by specimens from Figure-of-Eight and Thomas Islands. The Museum has a specimen from Middle Island, and in the Australian Museum are some from Mondrain and Charley Islands. It has not been seen elsewhere in the group.

The example from Thomas Island resembles the mainland forms in colouration and other particulars, but the other (from Figure-of-Eight) differs from the normal and has a colouration approaching that seen on a specimen from Eclipse Island near Albany, now in the W.A. Museum. The arrangement of the scales on the head also shows differences; the *frontonasal*, which is broader than long, is narrowly in contact with the *rostral* and the *frontal*; the latter is in contact with three *supraoculars*, and there are seven upper labials of which the fourth and fifth are under the eye. The ear opening is about as large as the eye; on the right are four lobules, on the left five. The adpressed limbs just touch.

The lizard is dark brown above each of the larger scales of the vertebral series, having a pale median stripe which extends along the body from the head to the tail, where they unite to form a pale median band extending to the broken tip. A white dorsolateral streak reaches from over the eye along the body to the end of the tail. Below this is another white streak which extends from the snout through the ear, over the limbs and along the tail; between these streaks the blackish sides are spotted with white. The limb markings are normal, the under-surface whitish with chin and throat "peppered".

11. FOUR-TOED SKINK, *Lygosoma* (*Leiolepisma*) *quadridigitatum* Werner

This variable little skink was seen on no less than ten of the islands visited and specimens were collected on Boxer and Termination Islands. That found on Termination was normal in colouration, but the one from Boxer Island had the dark markings more intense. On both specimens the frontal is longer than the interparietal, which is about as long as the frontoparietals; parietals longer than the frontal, in contact behind the interparietal. There are two or three pairs of enlarged nuchals and 24 or 26 rows of scales round the middle of the body, a feature found on many of our mainland specimens.

The length of the hind limb is variable in a specimen from Boxer—as long as the distance from the fore-limb to the nostril. In one from Termination Island it reaches slightly beyond the eye.

These differences from the typical form have no significance, since individuals from the mainland also show considerable variation in scalation and colouration.

12. ELEGANT SKINK, *Ablepharus elegans* (Gray)

A specimen of this small, widely ranging skink was caught on Mondrain Island and seen on Termination Island, where it was common. It is easily separated from the adjacent mainland species (with which it might on casual examination be confused) by its shorter limbs and by the numbers of digits, which are 4.4 instead of 5.5. The colours are typical.

13. FIVE-TOED SKINK, *Ablepharus lineocellatus* (Gray)

Two specimens were obtained at Esperance, none having been observed on any of the islands. Unlike the preceding, it has well developed legs and is an active species. The individuals are black spotted and lack the light black-edged ocelli.

FROGS

Hyla cyclorhynchus Blng.

This species, common on the adjacent mainland and farther west, was collected on Middle Island, where tadpoles were also present. There is a specimen in the Australian Museum from Mondrain Island.

Distribution of Reptile (and Frog) Species among islands of Recherche Archipelago and portions of Mainland Coast.
(Species are numbered in accordance with preceding annotated records; "A.M." denotes specimen in Australian Museum, Sydney; "W.A." signifies in Western Australian Museum, Perth.)

	Figure-of-Fight	Boxer Island	Charley Island	Thomas Island	Woody Island	Guntou Island	Sandy Hook Island	Long Island	Remark Island	Pasco Island	Round Island	Mondrain Island	Termination Island	N. Twin Peak Island	S. Twin Peak Island	"Cave Island"	Wedge Island	Combe Island	Goose Island	Middle Island	Douglas Island	Salisbury Island	Christmas Island	Long Island	Pt. Malcolm	Israeli Bay	Esperance
1. <i>M. variegata</i> ..	×	×					×					×	×	×									×			×	
2. <i>D. n. affinis</i> ..	×	×										×											×			×	
3. <i>D. coronata</i> ..	×																										
4. <i>D. coronoides</i> ..	×																										
5. <i>A. antarcticus</i> ..	×	×					×					×	×	×									×				×
LIZARDS																											
1. <i>G. miffusii</i> ..	×		AM	×			×					×	×	×	×	×										×	
2. <i>P. marmoratus</i> ..	×			×			×					×	×	×	×	×	×									×	
3. <i>P. lepidopodus</i> ..	×			×									×	×	×	×	×									×	
4. <i>A. reticulatus</i> ..	×													×	×	×	×									×	
5. <i>Varanus</i> sp. ..	×																									×	
6. <i>E. kingii</i> ..	×			×			×					×	×	×	×	×	×									×	
7. <i>E. carinata</i> ..	×											×	×	×	×	×	×									×	
8. <i>T. rugosus</i> ..	×																									×	
9. <i>L. labillardieri</i> ..	×		AM	×																						×	
10. <i>L. quadridigitatum</i> ..	×																									×	
11. <i>A. elegans</i> ..	×																									×	
12. <i>A. lineo-ocellatus</i> ..	×																									×	
FROGS																											
<i>H. cyclorhynchus</i> ..	×																									×	

6. SPIDERS AND OPILIONES

By BARBARA YORK MAIN*

I. INTRODUCTION

The present paper deals with a small collection of 16 species of spiders and opiliones made during the expedition of the Australian Geographical Society to the Recherche Archipelago in the late spring of 1950. Two new genera and seven new species were included, and descriptions of these novelties are now presented. Type specimens have been lodged in the Western Australian Museum, Perth, with the exception of the two new species of *Encyocrypta* and *Chenistonia*, types of which are in the author's collection at the Zoology Department, University of Western Australia.

Opiliones were collected from two of the islands and spiders from six; *Delena cancerides* was also observed, but not collected, on five other islands.

Except where otherwise mentioned, the classification used for the spiders is that of Petrunkevitch [Petrunkevitch, 1928 & 1933].

In the following specific descriptions, the leg index (given below the leg formula) is the length of the leg divided by the length of the carapace [Petrunkevitch, 1942]. The tibial index is the proximal width of the patella expressed as a percentage of the combined lengths of the tibia and patella [Petrunkevitch, 1929]. Species are numbered serially.

II. DESCRIPTION OF SPECIMENS

Order ARANEAE

Sub-order MYGALOMORPHAE; Branch *Sexostiatæ*

Family BARYCHELIDAE (Sub-family BARYCHELINAE)

Genus *Encyocrypta* Simon, 1888

1. *ENCYOCRYPTA PARIFUSCA* sp. nov.

Two female specimens (measurements given are those of the holotype).

♀ Cephalothorax 3.75 mm. long, 3.25 mm. wide; chelicerae project 2 mm. beyond carapace; abdomen 6.75 mm. long.

General appearance. Cephalothorax, sternum, chelicerae, labium and maxillae yellowish-brown; abdomen dorsally with mauve-brown mottlings on whitish background; spinners yellowish.

Cephalothorax oval, slightly longer than wide, sides elliptical, cephalic grooves distinct, convex, higher in front than posteriorly, sparsely clothed with delicate bristles.

Fovea deep, pit-like and procurved.

Clypeus vertical, membranous.

Eye group longer than wide, on a low inconspicuous eminence (but not a tubercle), in three rows of 2, 2, 4; AME directly behind ALE, ALE on edge of carapace half their diameter apart, the AME a little more than their diameter apart and are from the ALE a little more than the diameter of the latter; the posterior edges of the PLE are just over twice their long diameters apart; the PME are the distance of their short diameter from PLE. Ratio of eyes, ALE:AME:PLE:PME = 20:18:23:10. (These ratios are calculated from the long diameters of the eye.)

Chelicerae with apical bristles thickened and spine-like (but not a rastellum), inside edges of dorsal surface clothed with bristles, dorsal naked streaks; fang fairly short, curved, black and with a slight ventral groove having ridged margins; 6 to 8 large teeth on inner margin of fang groove, no teeth but a "beard" of long red hairs on outer ridge, intermediate basal group of 8 or 9 small teeth.

Maxillae with whole of ventral faces clothed with dark brown bristles; anterior edges with thick scopula except on upper angle; slight anterior processes on distal end of maxillae; excavated around labium; heel rounded; 11 to 15 cuspules on inner-anterior angle.

Labium free, convex, wider than long, indented anteriorly, with an anterior line of bristles and scattered posterior ones, no spines or cuspules.

Sternum. Length: width = 8:7 (width = distance between coxae III); oval, obtusely pointed posteriorly, posterior coxae not touching, uniformly clothed with

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long dark bristles; three pairs sigilla, close to margin, small, round and scarcely visible.

Palps long, scopula on tarsi; tibia with three ventral apical spines; entirely covered with stout bristles; dense claw-tufts; tarsal claw smooth.

<i>Legs.</i>	4	1	2	3
	2.53	1.93	1.87	1.67

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	2.00	1.75	1.75	1.00	0.75	7.25 mm.
II	2.00	1.75	1.50	1.00	0.75	7.00 mm.
III	1.50	1.25	1.25	1.25	1.00	6.25 mm.
IV	2.00	1.50	2.25	2.50	1.25	9.50 mm.
Palp	1.50	1.00	0.75	—	0.75	4.00 mm.

Width of patella I at "knee", 0.6 mm. Tibial index, 17.4. Width of patella IV at "knee", 0.65 mm. Tibial index, 17.33. All legs densely covered with bristles, no hairs, naked streaks obscured.

Spination (two anterior pairs of legs without spines): *Third leg*—Patella, *prolateral* = 1, *dorsal* = 1; Tibia, *ventral* = 1-3, *prolateral* = 1, *retrolateral* = 1; Metatarsus, *ventral* = 1-1-3, *prolateral* = 1, *dorsal* = 2-2; elsewhere none. *Fourth leg*—Tibia, *ventral* = 2-3-3, *dorsal* = 1-1; Metatarsus, *ventral* = 2-2-1-2-3, *prolateral* = 1, *retrolateral* = 1, *dorsal* = 2-2; elsewhere none.

Trichobothria on tarsi, metatarsi and tibia; dense scopula on all tarsi and four anterior metatarsi, thin partial scopula on metatarsi III and IV; dense claw-tufts; two tarsal claws, curved with a single tooth about half-way up, claws obscured by claw-tufts.

Abdomen ovate; dorsal mauve-brown mottlings on whitish background, ventrally greyish with faint mottlings, dorsum uniformly clothed with long delicate bristles.

Spinnerets yellowish; anterior pair minute, conical, about one and a half times their diameter apart; posterior pair stout, first segment longest, terminal segment rounded.

Locality of holotype: Mondrain Island.

Locality of paratype: Twin Peaks (probably the north island).

Taxonomic Note

The abdominal mottling of the Twin Peaks specimen is slightly different to the irregular reticulate pattern of the type specimen; the mottlings of the paratype are arranged in median indistinct chevrons, with the points towards the front. The reticulate pattern of the type somewhat resembles Koch's figure of *E. reticulata* [Koch, 1871-1883, T. xxxvi, figures 4 and 5] but the present species differs as it has a procurved fovea, only one tooth on each tarsal claw, a greater number of cuspules on the maxillae, the anterior median eyes more than their diameter from one another and a different number of teeth on the chelicerae. The measurements which Hogg [Hogg, 1901, p. 241] gives for *E. reticulata* are much larger than those found for the present species. To *E. fusca* Koch this species seems most nearly akin, but is readily distinguished, as the former has no cuspules on the maxillae [Koch, 1871-83, p. 479] and smooth tarsal claws [Koch, 1871-83, T. xxxvii, figure 1b]. The Isle of Pelew species, *E. ausseri* Koch, is differentiated by its bi-pectinate tarsal claws, absence of abdominal pattern and only slightly procurved fovea [Koch, 1871-83, p. 477-8 and T. xxxvi, figures 6, 6a] and also by the closer proximity of the anterior median eyes [Hogg, 1901, p. 240]. Hogg states also that the fovea of *E. ausseri* Koch is straight [Hogg, 1901, p. 240].

Sub-order MYGALOMORPHAE; Branch Octostriatae

Family DIPLURIDAE (Sub-family DIPLURINAE)

Genus *Cheniston* Hogg, 1901

2. *CHENISTONIA CUSPIDATA* sp. nov.

One adult female and three immature specimens (measurements given are those of the holotype).

♀ Cephalothorax 13.50 mm. long, 10.00 mm. wide; chelicerae project 5.00 beyond carapace; abdomen 13.00 mm. long. Cephalothorax light reddish-brown, glabrous, with a few scattered bristles, sides subparallel, slightly narrower behind (immature specimens much paler in colour than adult).

Fovea transverse, straight.

Clypeus horizontal, slightly wider than diameter of AME.

Eyes eight in a compact group on a low tubercle, anterior and posterior groups of bristles, heterogeneous, two rows of four, anterior row procurved, posterior row slightly recurved. Dimensions of eye group (tubercle), width: length ratio = 1.6:1.0. AME round, 0.6 of their diameter apart, about 0.5 their individual diameters from ALE; ALE elliptical and posited obliquely on tubercle; PME oval, smallest of the group, 3.6 times their individual short diameters apart, less than half their individual short diameters from PLE; PLE elliptical and posited obliquely on tubercle [Plate 1, fig. 7]. Ratio of eyes, ALE: AME: PLE: PME = 50:30:35:28.

Chelicerae dark reddish-brown, with thin scopula and eight strong teeth (seven teeth on immature specimens) on inner ridge of furrow; no teeth on outer ridge but a dense "beard" of long reddish-yellow hairs; an intermediate basal group of about twelve small teeth (8-12 in immature specimens) [Plate 1, fig. 6]. Longitudinal hairy bands and naked streaks on dorsal face of chelicerae, long stiff apical bristles but no rastellum.

Maxillae with thick scopula of reddish hairs on anterior margin, no maxillary lobes, excavated around labium, heel rounded, uniformly covered with bristles, no spines but numerous cuspules on anterior angle and on sides around labium (over 160 cuspules on each maxilla of adult specimen) [Plate 2, fig. 8].

Labium wider than long, not depressed but heels of maxillae overlap base, does not reach anterior margin of maxillae, indented anteriorly, stiff anterior bristles; suture line between labium and sternum is not visible in the mature specimen; no cuspules or spines [Plate 2, fig. 8].

Sternum. Length: width = 6:5 (width = distance between coxae II); roughly oval, obtusely pointed posteriorly, sparsely covered with dark bristles; heels of maxillae and first pair of coxae overlap sternum; pair of narrow, oval, transverse sigilla behind labium, three pairs opposite first three pairs of coxae, first two pairs round and close to margin (first pair obscured by overlapping coxae of first legs), posterior pair oval and away from margin [Plate 2, fig. 8].

Palp with ventral scopula on tarsus and tibia, claw with four blunt pectinations in a single row. *Spination*: Femur, *dorsal* = 1; Tibia, *ventral* = 2-2-3, *prolateral* = 1-1; Tarsus, *ventral* = 2 basal; elsewhere none.

<i>Legs.</i>	4	1	2	3
	2.55	2.41	2.28	1.94

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	9.00	6.00	7.00	6.75	3.75	32.50 mm.
II	9.00	5.25	6.00	7.00	3.50	30.75 mm.
III	7.00	4.75	5.00	6.25	3.25	26.25 mm.
IV	9.25	5.50	6.75	8.75	4.25	34.50 mm.
Palp	7.00	3.75	4.75	—	4.00	19.50 mm.

Width of patella I at "knee", 1.75 mm. Tibial index, 13.46. Width of patella IV at "knee", 1.85 mm. Tibial index, 15.00. Legs are tan-coloured, with dark brown hairs. Scopula and trichobothria as for genus.

Spination: *First leg*—Femur, *dorsal* = 1-1; Tibia, *ventral* = 1-1-2, *dorsal* = 1-1 (on prolateral edge); Metatarsus, *ventral* = 2-1-2; elsewhere none. *Second leg*—Femur, *dorsal* = 1-1-1; Patella, *dorsal* = 1; Tibia, *ventral* = 1-1-2, *dorsal* = 1-1; Metatarsus, *ventral* = 2-2-2, *dorsal* = 1-1; elsewhere none. *Third leg*—Femur, *dorsal* = 1-1-1-2; Patella, *dorsal* = 1 (retrolateral edge); Tibia, *ventral* = 2-2-2, *dorsal* = 2-1; Metatarsus, *ventral* = 2-2-3, *prolateral* = 1-1-1, *retrolateral* = 1, *dorsal* = 2-1-1-2; elsewhere none. *Fourth leg*—Femur, *dorsal* = 1-1-1-1; Patella, *dorsal* = 1; Tibia, *ventral* = 2-2-2, *dorsal* = 1-1-1 (retrolateral edge); Metatarsus, *ventral* = 2-1-2-3, *retrolateral* = 1-1, *dorsal* = 2-2-1-2; Tarsus, *prolateral* = 1-1-1-1; elsewhere none.

Three tarsal claws, median are small and smooth, upper claws with double row of 7-10 pectinations in each row.

Abdomen oval, greyish-brown and faintly mottled above, uniformly paler below; dorsally with scattered, long, delicate bristles, uniformly clothed with short, simple hairs.

Spinnerets four, yellowish; anterior pair close together, cylindrical, same diameter throughout length; posterior pair longer but less than half the length of abdomen, three segments, terminal segment as long as or longer than each of other two segments.

Locality of holotype: Termination Island.

Localities of immature specimens: Termination I. and Twin Peaks (probably the north island).

Field note. The specimens from Termination Island were obtained from lidless burrows situated beneath rocks.

Taxonomic Note

This species is readily distinguished from *C. major* Hogg [Hogg, 1901, p. 264], *C. hoggi* Rainbow and *C. giraulti* Rainbow [Rainbow, 1914, p. 240] as these species all possess spines on the labium; from *C. maculata* Hogg [Hogg, 1901, p. 262], *C. tepperi* Hogg [Hogg, 1902, p. 137] and *C. auropilosa* Rainbow and Pulleine [Rainbow and Pulleine, 1918, p. 160] by the different eye measurements; and from *C. villosa* Rainbow and Pulleine [Rainbow and Pulleine, 1918, p. 161] which has nine teeth on the inner margin of the cheliceral furrow.

Sub-order DIPNEUMONOMORPHAE

Family DYSDERIDAE (sub-family SEGESTRIINAE)

Genus *Ariadna* Audouin, 1825

3. *ARIADNA DECATETRACANTHA* sp. nov.

One female specimen, 7 mm. long.

♀ *Cephalothorax* reddish-brown, legs and sternum paler yellowish-brown.

Carapace much longer than wide, rather wider in mid region, slightly convex, no thoracic groove, no radial striae visible [Plate 2, fig. 2].

Eyes typical of genus, in three groups of two, median eyes between PLE; ALE and PLE contiguous [Plate 2, fig. 2]. Ratio of eyes, ALE:AME:PLE = 15:13:15.

Chelicerae conical, small fangs, furrow indistinct, three teeth on upper ridge, one tooth on lower ridge, concolorous carapace.

Maxillae same colour as legs and sternum; very long and narrow, scopula on anterior half of inner margin [Plate 2, fig. 1].

Labium broadest at base, narrowing anteriorly, front margin truncate, about two-thirds length of maxillae.

Sternum. Length: width = 7:4 (width = distance between coxae II); oval, very convex, obtusely pointed posteriorly, does not extend between posterior coxae, which are wide apart, glabrous, slightly procurved anteriorly.

Palps same colour as legs; with dorsal spines; tibia very hairy; tarsal claw.

Legs typical of genus, that is, with three anterior pairs turned towards the front, the fourth pair turned towards the posterior and with all legs set close to the body, an adaptation to living in narrow tubes. Legs covered with long, fine, dark hairs and bristles.

Spination: First leg—Femur, dorsal = 1-3 [Plate 2, fig. 4], ventral = 1 (apical on prolateral edge) [Plate 2, fig. 5]; Tibia, ventral = 2-2-2-2-2-2 (except left tibia = 8 spines in prolateral row); Metatarsus, ventral = 2-2-2-2-2-2. Second leg—Femur, dorsal = 1-3 (1 median on prolateral edge—absent on left femur, 3 apical); Tibia, ventral = 2-2-2-2-2-2; Metatarsus, ventral = 2-2-2-2-2-2 (except left M.T. = 8 spines in retrolateral row). Fourth leg—Metatarsus, ventral = 5 apical spines, 4 of which are welded together at the base, forming a "comb" [Plate 2, fig. 5].

All four pairs of legs possess other non-serial spines, which, not being specifically significant, are not here mentioned. Three tarsal claws, median claw small and smooth, upper claws with four unequal teeth in a single row [Plate 2, fig. 3].

Abdomen uniformly coloured greyish-brown above and below; no pattern or banding on dorsum; covered with long, fine, brown bristles. Spinnerets typical of genus.

Locality of holotype: Twin Peaks (probably the north island).

Taxonomic Note

The spination of the four anterior metatarsi and tibia of this specimen distinguishes it from the species *A. (Macedonia) octospinata* Lamb [Lamb, 1911, p. 170], *A. dysderina* Koch and *A. thyranthina* Simon [Simon, 1908, p. 380] and *A. montana* Rainbow [Rainbow, 1920, p. 233]. Absence of dorsal banding or any other abdominal pattern excludes it from the remaining Australian species, *A. segmentata* Simon [Simon, 1908, p. 380] and *A. (Macedonia) burcheli* Hogg [Hogg, 1900, p. 86].

Family LYCOSIDAE (Sub-family LYCOSINAE)

Genus *Lycosa* Latreille, 1804

4. *LYCOSA* species

A single specimen too immature to be accurately identified.

Locality: Twin Peaks (probably the north island).

Genus *Arctosa* Koch, 1848

5. *ARCTOSA* species

One immature male specimen too badly damaged to be adequately described and therefore unsuitable for a type specimen. This genus has not previously been recorded from Australia, but it might be mentioned here that the author recently obtained several specimens of *Arctosa* from Pemberton.

Locality: Twin Peaks (probably the north island).

Family EPEIRIDAE (Sub-family EPEIRINAE)*

Genus *Arachnura** Vinson, 1863

6. *ARACHNURA HIGGINSII* Koch

[*Epeira higginsii* Koch in *Die Arachniden Australiens* 1: 120, T. xi, fig. 1 (1873).]

Three female specimens.

Locality: Mondrain Island.

Note: Additional specimens observed but not collected.

Genus *Aranea* Linnaeus, 1758 [see Kaston, 1948, p. 247]

7. *ARANEA PUSTULOSA* Walckenaer

(For list of synonyms see Parrot, 1947, pp. 79-80.)

One male and one female specimen.

Locality: Boxer Island.

One female specimen (immature).

Locality: Mondrain Island.

One female specimen (immature).

Locality: Twin Peaks (probably the north island)

8. *ARANEA RECHERCHENSIS* sp. nov.

One adult female specimen.

♀ *Cephalothorax* dark brown.

Fovea transverse, slightly recurved, striae extend outward and posteriorly from the edges of furrow.

Eyes typical of the genus, with the median eyes only slightly raised.

Chelicerae brown.

Maxillae brown with yellow on anterior and labial faces, scopula on anterior-inside angles.

Labium with the base brown and apex yellow.

Sternum wide, anteriorly procurved, pointed posteriorly, indentations opposite coxae, posterior coxae close together.

Palps yellowish-brown.

Legs not uniformly coloured, various segments grade between yellow and greenish brown; posterior legs have faint annulations. As the precise colour of the legs is not consistent among members of the same species of this genus, details of the present specimen are not given. Spines few, weak and not arranged in definite series.

Abdomen roughly triangular from above. Humeral tubercles not obvious. Posterior tip, on which is situated a tubercle, is elevated vertically above spinnerets. Dorsally the abdomen is white with a wide dark longitudinal streak. Posteriorly the outline of the folium is faintly distinguishable as a black line. The sides of the abdomen are black and on the lower parts are streaked with irregular white patches. Venter has black patch between epigastric furrow and spinnerets; this is bounded laterally by two longitudinal white bands.

Epigynum from the side appears as a flat wedge projecting forwards. The atriolium is directed anteriorly and the spermathecal pores open near the free anterior end. No free scape; in its place is a depression bounded on each side by a horn-like process [Plate 3, fig. 8].

Locality of holotype: Figure-of-Eight Island.

*See Kaston, 1948, pp. 214 and 218.

Taxonomic Note

It is unfortunate that only one specimen of the above species was collected, as many species of *Aranea* are exceedingly variable and it is possible that this specimen may be only a variety of some already established species. In Rainbow's catalogue of Australian spiders [Rainbow, 1911, pp. 181-196] ninety-six species of *Aranea* are listed and of these only four are recorded from Western Australia. Since that date many more species have been described from both W.A. and other States. Probably if a careful revision of the genus were made many of these species would be transferred to the genus *Epeira* [See Kaston, 1948, p. 226] and at the same time some species reduced to synonyms.

It has long been known that Epeirid spiderlings, as well as spiders of some other families, can be carried by the wind very long distances, in some cases hundreds of miles, and still remain viable. Perhaps the earliest reference to this mode of distribution is that of Darwin, who recorded small spiderlings in the rigging of the ship which "was sixty miles distant from the land" [Darwin, 1890, p. 197]. An important factor associated with wind distribution is that widely spaced populations are continuously being intermixed. Rarely can sufficient time elapse for a species to become stable as each season the populations are re-shuffled and successively new varieties develop from year to year. A wide range of distribution is assured to each species and thus, in Australia, a small number of very variable species would be expected to occur. Several concrete examples of exceedingly variable, widespread and common species of *Epeiridae* do actually occur in Australia and New Zealand. In New Zealand, *Epeira viridulus* varies considerably in its dorsal colour pattern; *Aranea pustulosa* and *A. browni* both occur widely in Australia and New Zealand and, owing to colour and pattern variations, have appended to their names long lists of synonyms. These three species are now generally recognized by their characteristic epigynes, and additionally, the two *Aranea* species by characteristic abdominal tubercles. Many other less obvious species, and so-called "species", exhibit diffuse colour pattern variations, but the structure of the epigynum readily separates them into "species groups". It is very probable that each of these groups rightly constitutes one species and the diagnostic features other than the epigynum and male palp are merely transitory characters of a highly polymorphic entity. It would seem, therefore, that the structure of the epigynum and male palp would be a more consistent and reliable criterion of the species than the separation by means of colour pattern—a procedure which hitherto has been largely used for the Australian and New Zealand forms of *Aranea* and *Epeira*. Until such time as a thorough taxonomic review and distribution survey, together with speciation research, is made on the Australian forms of the genera, *Epeira* and *Aranea*, it will remain impossible to say to which species certain varieties belong. Thus, for taxonomic convenience, the seasonal varieties (or incipient species) will probably continue to be considered as species. However, whether the variants be called varieties or species, they must at all events be recognized as purely transitory and by no means stable as populations.

Family CTENIDAE (Sub-family CALOCTENINAE)

Genus *Horioctenoides* gen. nov.

HORIOCTENOIDES gen. nov.

♀ Cephalothorax longer than wide, depressed at sides in mid-region, height at thoracic groove and ocular area about the same, slight depression mid-way between eyes and fovea. Two longitudinal, lateral, dark bands with externally crenulated margins, extending from posterior eyes to posterior of cephalothorax. Thoracic groove longitudinal. Eyes in three rows of 4, 2, 2. Anterior eyes recurved, posterior eyes very strongly recurved. Clypeus subvertical. Chelicerae with two teeth on inferior margin of furrow. Labium wider than long, constricted at base, not reaching half-way up maxillae. Maxillae short, stout. Sternum cordiforme, truncate in front, obtusely pointed behind, emarginate. Legs rather stout, three pairs ventral spines on anterior tibia. All tarsi and metatarsi scopulate. Claw-tufts. Tarsal claws with about five pectinations. Abdomen elongate, pentagonal.

9. *HORIOCTENOIDES BIDENTATUS* sp. nov.

One female specimen.

♀ Cephalothorax 3.25 mm. long, 2.5 mm. wide (at widest part); caput 1.25 mm. wide; abdomen 5.25 mm. long.

Cephalothorax yellowish-brown, with two nigger-brown longitudinal bands, crenulated on the outside; dark smudges around the eyes and fovea [Plate 3,

fig. 7]. Cephalothorax slopes sharply downwards posteriorly from fovea, ocular area about same height as at fovea; a slight dip mid-way between ocular area and fovea. Cephalothorax covered with long, close-fitting white hairs, with a fringe of very long hairs around the edge of carapace.

Fovea longitudinal.

Clypeus sub-vertical, width about one and a half times the diameter of anterior median eyes.

Eyes in three rows of 4, 2, 2. Ratio of eyes, ALE:AME:PLE:PME = 10:13:25:20. Anterior row recurved, posterior eyes so strongly recurved that they appear as two rows [Plate 3, fig. 2]. The eye arrangement closely resembles that of the Lycosidae.

Sternum. Length: width = 11:10 (width = distance between third coxae); cordiforme, wide, slightly longer than broad, anteriorly almost straight, posteriorly projecting into blunt point; membranous margin; posterior coxae set wide apart [Plate 3, fig. 1]; colour nigger-brown with a median straw-coloured fleck; clothed thickly with white hairs and long brown bristles.

Chelicerae. Falces and fangs tan coloured; the furrow with three teeth on the superior and two teeth on the inferior margin [Plate 3, fig. 4].

Maxillae pale straw coloured, longer than broad, stout, anteriorly truncate, inside faces straight, rounded exteriorly, slightly convergent; coarse scopula on inside-anterior angle, bristles on outside margin [Plate 3, fig. 1].

Labium concolorous maxillae, slightly darker at base, broader than long, anteriorly rounded, constricted at base, group of dark-brown, stout, anterior bristles. Does not reach half-way up the maxillae [Plate 3, fig. 1].

Palpi yellowish with drak-brown smudges forming incomplete annulations; spinose; no claw-tufts on scopula; tarsal claw long, curved, with five minute teeth in single row.

Legs. 4 2 3
2.85 2.77 2.61 (Legs I absent in specimen.)

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	—	—	—	—	—	—
II	2.25	1.50	2.00	2.00	1.25	9.00 mm.
III	2.25	1.75	2.00	1.75	0.75	8.50 mm.
IV	2.50	1.00	2.50	2.00	1.25	9.25 mm.
Palp	1.10	0.40	0.75	—	1.00	3.25 mm.

Width of patella IV at knee, 0.5 mm. Tibial index, 14.28.

Ventrally legs dark nigger-brown like sternum, coxae straw-coloured. Dorsally and laterally legs yellowish-brown like carapace. Trochanters distinctly notched. Scopula of tenent hairs on all tarsi and metatarsi.

Spination: Second leg—Femur, dorsal = 2-2-2, prolateral = 1, retrolateral = 1-1-1; Tibia, retrolateral = 1, ventral = 2-2-2; Metatarsus, ventral = 2; elsewhere none. Third leg—Femur, dorsal = 1-2-3-3, retrolateral = 1-1; Tibia, dorsal = 1-1, prolateral = 1-1, retrolateral = 1-1, ventral = 2-1; elsewhere none. Fourth leg—Femur, dorsal = 1-2-2, prolateral = 1-1-1; Tibia, dorsal = 1, prolateral = 1, retrolateral = 1-1, ventral = 2-2-2; Metatarsus, dorsal = 1-1, prolateral = 1-1-1, retrolateral = 1-1, ventral = 2-2-1.

Dense claw-tufts of long tenent hairs. Two curved claws, each with five teeth in a single row [Plate 3, fig. 3].

Abdomen uniformly straw-coloured above and below. Dorsally a dark, median, longitudinal band extending from the anterior end and widening out posteriorly where it terminates with a straight transverse edge [Plate 3, fig. 7]. Abdomen covered with a uniform pile of short hairs and scattered, short, dark-brown spines.

Spinnerets straw-coloured, six, anterior and posterior pair conical and about the same length, median pair smaller and hidden.

Superficially the specimen resembles some of the smaller Lycosids but it is readily distinguished from this family by the presence of only two tarsal claws.

Locality of holotype: Figure-of-Eight Island.

Taxonomic Note

Although the lip of this specimen has basal lateral excavations, it is here included in the *Calocteninae* because the labium is wider than long and does not reach half-way up the maxillae [Petrunkevitch, 1928, p. 51]. The specimen is

excluded from the *Acantheninae* and *Cteninae* by the shape of the cephalothorax, and again from the *Acantheninae* by the smaller number of spines on the anterior legs [Petrunkévitch, 1928, p. 51].

This specimen has most structural affinity with *Horioctenus* Chamberlin from Peru [Chamberlin, 1916, p. 265]. Both forms have the posterior eyes strongly recurved, thus appearing as two rows, with the medians closer to one another than to the laterals; three pairs of ventral spines on the anterior tibia and one pair of ventral spines on the anterior metatarsi; basal notches on the labium; and a lycosid appearance. The present specimen differs principally from *Horioctenus* by the presence of two teeth (instead of one) on the inferior margin of the chelicera. It differs from the following exotic genera of the Calocteninae by: the number of teeth on the inferior margin of the chelicera and number of ventral spines on the anterior tibia and metatarsi of *Anahita* Karsh [Simon, 1897, p. 123]; the type of setae and claw-tufts and number of teeth on the inferior margin of the chelicerae of *Odo* Keyserling [Simon, 1897, p. 208]; leg ratio and number of inferior cheliceral teeth of *Apolonia* Simon [Simon, 1897, p. 208]; and number of inferior cheliceral teeth of *Caloctenus* Keyserling [Simon, 1897, p. 123]. From the Australian genus *Thasyrea* Koch the present form differs in the shape of the cephalothorax, the curvature of the anterior row of eyes and the number of teeth on the female palpal claw [Koch, 1878, p. 982]. It differs also from the West Australian genera: *Elassoctenus* Simon by the shape of the cephalothorax and the number of ventral spines on the anterior tibia and metatarsi [Simon, 1909, p. 164]; and *Hestimodema* Simon by the shape of the anterior lateral eyes, the tarsal scopula and type of claw-tufts [Simon, 1909, p. 165].

Family GNAPHOSIDAE* (Sub-family ANAGRAPHIDINAE)

Genus *Encoptarthria* gen. nov.

ENCOPTARTHRIA gen. nov.

♀ *Cephalothorax* longer than broad, convex, narrower anteriorly, anterior margin straight. *Fovea* longitudinal. *Eyes* eight, in two rows of four; both rows procurved, posterior row especially so, AME diurnal, PME oval, posited obliquely. *Chelicerae* with three teeth on the outer, one on the inner margin of furrow of each falx. *Maxillae* constricted in mid-region, dense anterior scopula. *Labium* attenuated anteriorly, margin truncate, constricted at base. *Sternum* longer than wide, truncate anteriorly, obtusely pointed posteriorly. Posterior coxae wide apart. Female *palp* with a pectinate claw, but no claw-tufts. *Legs* with all trochanters notched; all tarsi with claw-tufts and two similar pectinate claws. All tarsi and first two pairs of metatarsi with scopula. Abdomen elongate. No colulus. Six spinnerets, anterior pair terminating in a ring of ten long spinning tubes. Terminal segment of posterior spinners small and rounded.

10. *ENCOPTARTHRIA SERVentyi* sp. nov.

♀ Carapace 4.25 mm. long, 2.9 mm. wide; abdomen 6.5 mm. long (including anal tubercle).

Carapace dark, reddish-brown colour, longer than broad, convex, narrower in front, anterior margin truncate, long bristles on anterior and lateral margins.

Fovea distinct, longitudinal, lateral striae faint.

Clypeus horizontal, width about equal to twice the diameter of AME.

Eyes eight, in two rows of four, anterior row slightly and posterior row strongly recurved, PME oval, length of long axis about twice that of short axis, posited obliquely, AME diurnal. Ratio of eyes, ALE:AME:PLE:PME = 15:13:10:20.

Chelicerae concolorous carapace, cylindrical, long; fang curved; three teeth on superior margin of furrow, one tooth on inferior margin.

Maxillae broad, indented around labium, constricted in mid-region on external face, bristles all over, thicker on outer margin, dense scopula on inside half of anterior margin.

Labium about half as long as maxillae, almost as wide as long; narrower and truncated anteriorly and constricted at base; bristles on anterior margin.

Sternum. Length: width = 45:32 (width = distance between coxae II); yellowish, longer than wide, widest part opposite second coxae, anterior margin straight, obtusely pointed posteriorly, ends just in front of posterior coxae which are widely separated, uniformly covered with long fine brown bristles.

Palps without claw-tufts; single claw curved, and with about five teeth; thin scopula of simple hairs on ventral apical part of tarsus, on proximal part a dense brush of long, delicate bristles; spinose.

*See Kaston, 1948, p. 341.

Legs.	4	1	2	3
	2.59	2.2	1.82	1.79

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	2.75	1.70	2.25	1.40	1.25	9.35 mm.
II	2.50	1.25	2.00	1.50	1.00	8.25 mm.
III	2.00	0.75	1.75	1.85	1.25	7.60 mm.
IV	3.00	1.25	2.75	2.50	1.50	11.00 mm.
Palp	1.50	0.35	0.75	—	1.25	6.85 mm.

Width of patella I at "knee", 0.5; tibial index, 11.39. Width of patella IV at "knee", 0.45; tibial index, 12.50. All trochanters distinctly notched. All tarsi with a pair of claw-tufts of long tenent hairs. Two claws, each with six teeth in a single row. Tarsi and metatarsi I and II with dense divided ventral scopula, tarsus III and IV with a thin scopula. Trichobothria numerous.

Spination: First leg—Femur, dorsal = 1-1-1; Patella, dorsal = 2; Tibia, ventral = 1; Metatarsus, ventral = 2; elsewhere none. Second leg—Femur, dorsal = 1-1-1; Patella, dorsal = 2; Tibia, ventral = 1; Metatarsus, ventral = 2; elsewhere none. Third leg—Femur, dorsal = 1-3-3; Patella, dorsal = 2; Tibia, dorsal = 2, retrolateral = 1, ventral = 2-2-2; Metatarsus, dorsal = 2-2-2-2, ventral = 2-1-2; elsewhere none. Fourth leg—Femur, dorsal = 1-2-3; Patella, dorsal = 1-2; Tibia, dorsal = 1-1-1-1, ventral = 2-2-2 (except left tibia = 2-2-1); Metatarsus, dorsal = 2-2-2, prolateral = 1-1, retrolateral = 1-1, ventral = 2-2-2; elsewhere none.

Pedical with ventral scute with elongate pointed anterior process, bifurcate posteriorly.

Abdomen above and below uniformly greyish-brown; cylindrical, truncate anteriorly, pointed posteriorly, spinners and anal tubercle visible from above, uniform covering of short hairs and scattered short, thin bristles; anterior edge with thick cluster of long dark bristles.

Epigynum [See Plate 4, fig. 5].

Spinnerets, anterior pair wide apart, large, cylindrical, terminal part with circle of ten spigots or spinules; median pair small, posterior pair with terminal segment small, rounded and with tuft of hairs.

Locality of holotype: Sandy Hook Island.

Taxonomic Note

This species, by possessing notched trochanters, an exceptional feature of this family, shared by *Drassodes lapidosus* (Walckenaer) and *D. pubescens* (Thorell) [Locket and Millidge, 1950, p. 98], represents an aberrant Gnaphosid genus. Apart from this unusual character it obviously belongs to the *Gnaphosidae*, and the possession of spinning tubules on the anterior spinnerets includes it within the *Anagraphidinae* [Petrunkévitch, 1928, p. 52].

Of this sub-family there is no previous Australian record. By possessing notched trochanters this species is excluded from all exotic genera of the *Anagraphidinae* and such particular features as eye number and arrangement, scopula, claw-tufts and number of cheliceral teeth additionally exclude it from the genera *Lygromma* Simon [Simon, 1894, p. 353], *Theuma* Simon [Simon, 1894, p. 350], *Anagraphis* Simon [Simon, 1894, p. 352], *Theumella* Strand [Strand, 1906, p. 607].

Family SPARASSIDAE (Sub-family EUSPARASSINAE)

Genus *Delena* Walckenaer, 1837

11. *DELENA CANCERIDES* Walckenaer in *Hist. Nat. Ins. Apt.*, 1: 490 (1837)

Two female specimens.

Locality: Boxer and Figure-of-Eight Islands. (Specimens observed but not collected on other islands.)

The following field observations were made by Mr. V. N. Serventy:

Generally *Delena* was found under exfoliating flakes of granite rock.

Boxer Is., November 8th, 1950: One specimen crouching over a circular egg-sac.

Remark Is., November 11th, 1950: Specimen with young.

Long Is., November 11th, 1950: Under one slab of rock two specimens of *Delena*. It was observed that specimens without egg-sacs ran swiftly away upon being disturbed, whereas those with egg-sacs showed more hesitation.

Pasco Is., November 12th, 1950: One adult specimen with about 100 young spiderlings.

North Twin Peaks Is., November 19th, 1950: A *Delena* with spiderlings.

South Twin Peaks Is., November 20th, 1950: One adult specimen observed.

Salisbury Is., November 24th, 1950. One specimen observed.
Christmas Is.: No specimens observed.
Nares Is.: A specimen with young, well camouflaged beneath a rock.

Family SELENOPIDAE (Sub-family SELENOPINAE)

Genus *Selenops* Latreille, 1819

12. *SELENOPS AUSTRALIENSIS* L. Koch in *Die Arachn. Austr.*, 1: 615 (1871)

One immature female specimen.
Locality: Boxer Island.

Family CLUBIONIDAE (Sub-family CLUBIONINAE)

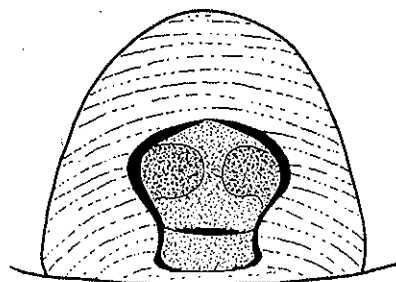
Genus *Chiracanthium* C. Koch, 1839

13. *CHIRACANTHIUM MONDRAINENSIS* sp. nov.

One female specimen, badly damaged (but the most reliable species criterion, i.e. the epigynum is preserved intact).

In general appearance this specimen is like most Australian species of *Chiracanthium*; it is of reddish-brown colour, with a longitudinal dark stripe, crenulated at the sides, on the dorsum of the abdomen.

Ratio of eyes. ALE:AME:PLE:PME = 1:1:1:1. The ocular area is smudged with black but there are no longitudinal dark stripes on the carapace; the posterior part of the carapace slopes steeply downwards from the fovea, which is longitudinal, short, and indistinct. The falces of the chelicerae are asymmetrical in the number of their teeth; the inner row of each falx has two teeth, but the outer row of one has one tooth, the other two. All tarsi are scopulate. The legs are uniformly coloured reddish-brown and have few spines. Length:width ratio of sternum = 6:5 (width = distance between coxae II).



Chiracanthium mondrainensis.

The epigynum [see text figure] agrees with none of the epigynes figured for Australian species. There is no figure of *C. nervosum* Simon, but it is described as being small, simple, anteriorly truncated, posteriorly attenuated and impressed [Simon, 1909, p. 161]. Such a description without a figure is inadequate for the identification of a specimen. Simon does mention that the epigynum is like that of *C. brevicaratum* Koch but simpler [Simon, 1909, p. 162]. A comparison of text figure 2 with Koch's figure of the epigynum of *C. brevicaratum* [Koch, 1871-1883, Abbildungen, T. xxxi, 7b] shows no similarity of structure.

Of species described from male specimens only, the present species differs in the following ways: (1) from *C. pennuliferum* Simon (W.A.) which has longitudinal dorsal bands on the carapace and slightly annulated femurs and tibia [Simon, 1909, p. 162]; (2) from *C. gracile* Koch (Queensland) which lacks the longitudinal dorsal band on the carapace [Koch, 1873, p. 402]; (3) from *C. tenue* Koch (Queensland) which has no scopula on the legs [Koch, 1873, p. 407].

Locality of holotype: Mondrain Island.

Family CLUBIONIDAE (Sub-family LIOCRANINAE)

Genus *Miturga* Thorell, 1870

14. *MITURGA SEVERA* Simon in *Die Fauna Süd-West Australiens*, 2: 174 (1909)

Two female specimens, one immature.
Locality: Boxer Island.

Family ATTIDAE (Sub-family PELLININAE)

Genus *Habrocestum* Simon, 1876

15. *HABROCESTUM PUNCTIVENTRIS* Keyserling in *Die Arachn. Austr.*, 11: 1412, T. cxix, figs. 6, 6a, 6b (1883).

One female specimen.
Locality: Mondrain Island.

Order PHALANGOIDEAE

Sub-order LANIATORES

Family TRIAENONYCHIDAE (Sub-family TRIAENONYCHINAE)

Genus *Nunciella* Roewer, 1929

- NUNCIELLA ASPERA* (Pocock), 1903

[*Triaenonyx aspera* Pocock, *Proc. Zool. Soc. London* Pt. 11: 404 (1903).

Triaenonyx aspera Loman, *Die Fauna Süd-West Australiens*, 3, pt. 4: 133 (1910).

Nuncia aspera Roewer, *Arch. Naturg.*, 80, fasc. 12: 80 (1914).

Nuncia aspera Roewer, *Die Weberknechte der Erde*: 592 (1923).

Nunciella aspera Roewer, *Roy. Soc. West Austr.*, 15: 95 (1929).]

Three specimens.

Locality: Boxer and Middle Islands.

III. SUMMARY OF SPECIES AND LOCALITIES

Number of specimens	Species	Island
2 (♀)	<i>Encyocrypta parifusca</i> sp. nov.	Mondrain and Twin Peaks
4 (1♀)	<i>Chenistonia cuspidata</i> sp. nov.	Twin Peaks & Termination
3 immature		
1 (♀)	<i>Ariadna decatetracantha</i> sp. nov.	Twin Peaks
1 (♀)	<i>Lycosa</i> sp.	Twin Peaks
1 (♂)	<i>Arctosa</i> sp.	Twin Peaks
(3♀)—more specimens observed but not collected	<i>Arachnura higginsii</i> Koch	Mondrain
4 (3♀, 1♂)	<i>Aranca pustulosa</i> Walckenaer	Twin Peaks, Mondrain and Boxer
1 (♀)	<i>Aranca reicherchensis</i> sp. nov.	Figure-of-Eight
1 (♀)	<i>Horioclenoides bidentatus</i> gen. and sp. nov.	Figure-of-Eight
1 (♀)	<i>Encoptarthria serentyi</i> gen. and sp. nov.	Sandy Hook
2 (♀)	<i>Delena cancerides</i> Walckenaer	Figure-of-Eight and Boxer (specimens also observed on Remark, Long, Pasco, North and South Twin Peaks, Nares and Salisbury.)
—more specimens observed but not collected		
1 (♀)	<i>Selenops australiensis</i> Koch	Boxer
1 (♀)	<i>Chiracanthium mondrainensis</i> sp. nov.	Mondrain
2 (♀)	<i>Miturga severa</i> Simon	Boxer
1 (♀)	<i>Habrocestum punctiventris</i> Keyserling	Mondrain
3	<i>Nunciella aspera</i> (Pocock)	Boxer and Middle

IV. DISCUSSION

No definite conclusions about the distribution of the species on the various islands can be made as the collection is not sufficiently representative. There are too few species and these, by their habits, are spiders which would be conspicuous. Less obvious forms probably exist on the islands but would not be noticed except by somebody familiar with the habits of spiders.

It would be expected that the spider fauna contains forms in common with southern Western Australia. Unfortunately, extensive collecting has not been done on the adjacent coastal area. The following spiders occur on various parts of the mainland:

Aranea pustulosa is common across the south of Australia, and in W.A. it is particularly common in the south-west coastal part of the State; it also occurs in New Zealand. *Arachnura higginsii* is common in the south-west of Western Australia, Tasmania and eastern Australia. *Delena cancerides* is one of the commonest and most widespread spiders in Australia. *Selenops australiensis* is also widespread in the south and east of Australia. *Miturga severa* occurs in Victoria, while *Habrocestum punctiventris* was recorded by Keyserling from Sydney. The Opilione, *Nunciella aspera*, is widely spread in the south-west of Western Australia, including Rottneest Island—often under logs [See Forster, 1952].

The existence of the new genera of *Ctenidae* and *Gnaphosidae* can be explained simply by the fact that extensive collections have never been made from either this isolated area or the adjacent mainland.

It is most unfortunate that so few specimens of the new species were collected. However, it is practical to describe them, attribute names and thus have them recorded. Their existence suggests that a further more thorough and systematic collection from the islands would be profitable.

All specimens recorded in the present paper, with the exception of the *Mygalomorphae*, have been deposited in the Western Australian Museum; the *Mygalomorph* specimens are in the collection of the author which is lodged in the Zoology Department of the University of Western Australia.

V. ACKNOWLEDGMENTS

My thanks are due to the Australian Geographical Society for the opportunity of examining the collection, and also to Mr. V. Serventy for the use of his field notes.

VI. DERIVATION OF NAMES OF NEW GENERA AND SPECIES

1. Lat.: *par, parvis* = equal (like in quality).
2. Lat.: *cuspidis, cuspidis* = point, spine or cusp—referring to the large number of maxillary cuspules.
3. Gk.: *dekatesares* = fourteen; *akantha* = spine or prickle—referring to the number of ventral spines on the four anterior metatarsi and tibiae.
4. Lat.: *recherchensis*—referring to the locality.
5. Gk. suffix: *oides* = likeness, resemblance—referring to affinities with the genus *Horiocetus*.
6. Lat.: *bidentatus* = 2-toothed—referring to the number of teeth on the inferior margin of the chelicerae.
7. Gk.: *enkepto* = to incise or notch; *arthron* = joint or limb—referring to the notched trochanters. Lat. genitive: *serventyi*—adopted as a tribute to V. N. Serventy, zoologist of the Australian Geographical Society's Expedition to the Recherche Islands in 1950.
8. Lat.: *mondraensis*—referring to Mondra Island, the type locality.

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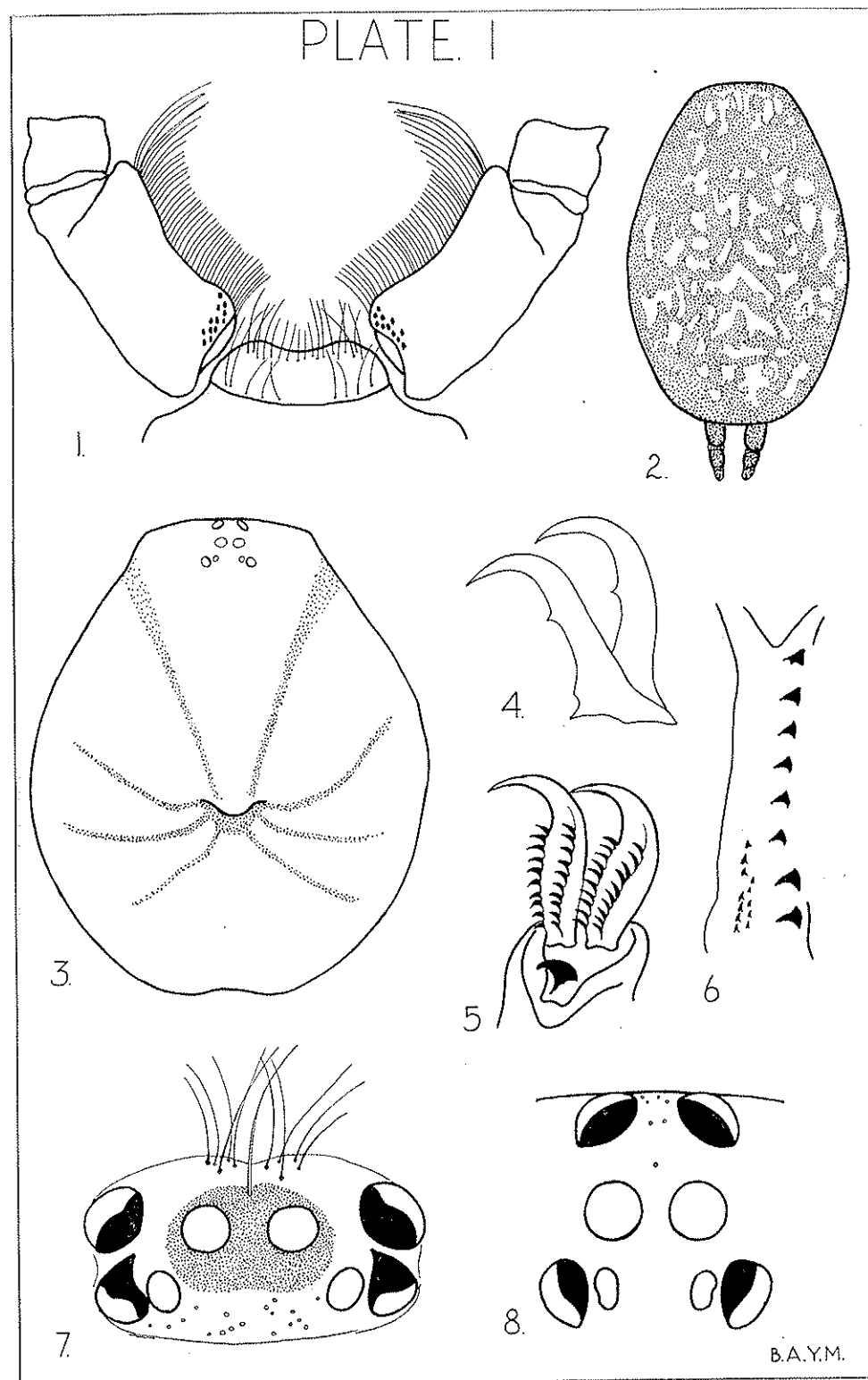


PLATE 2.

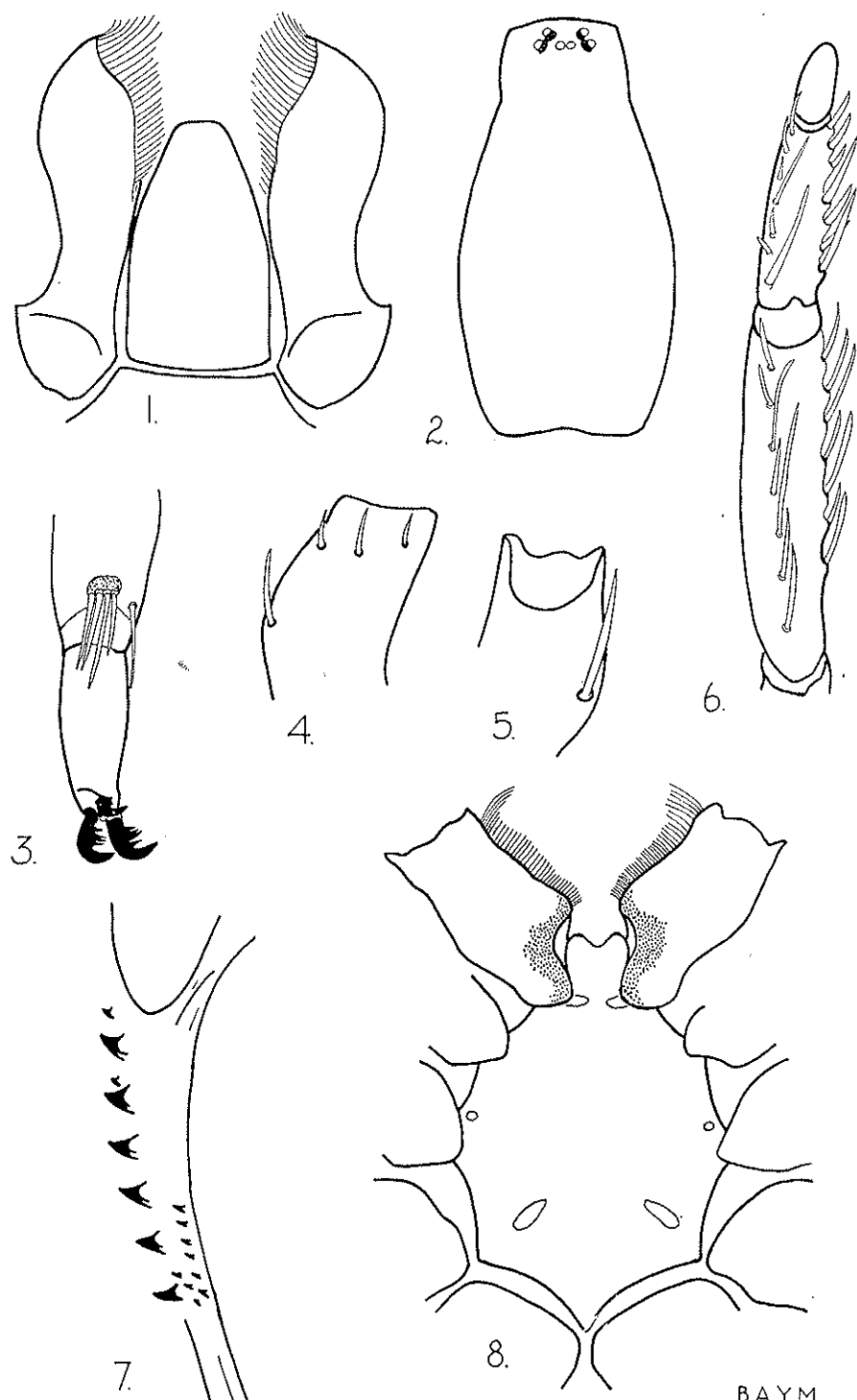


PLATE 3.

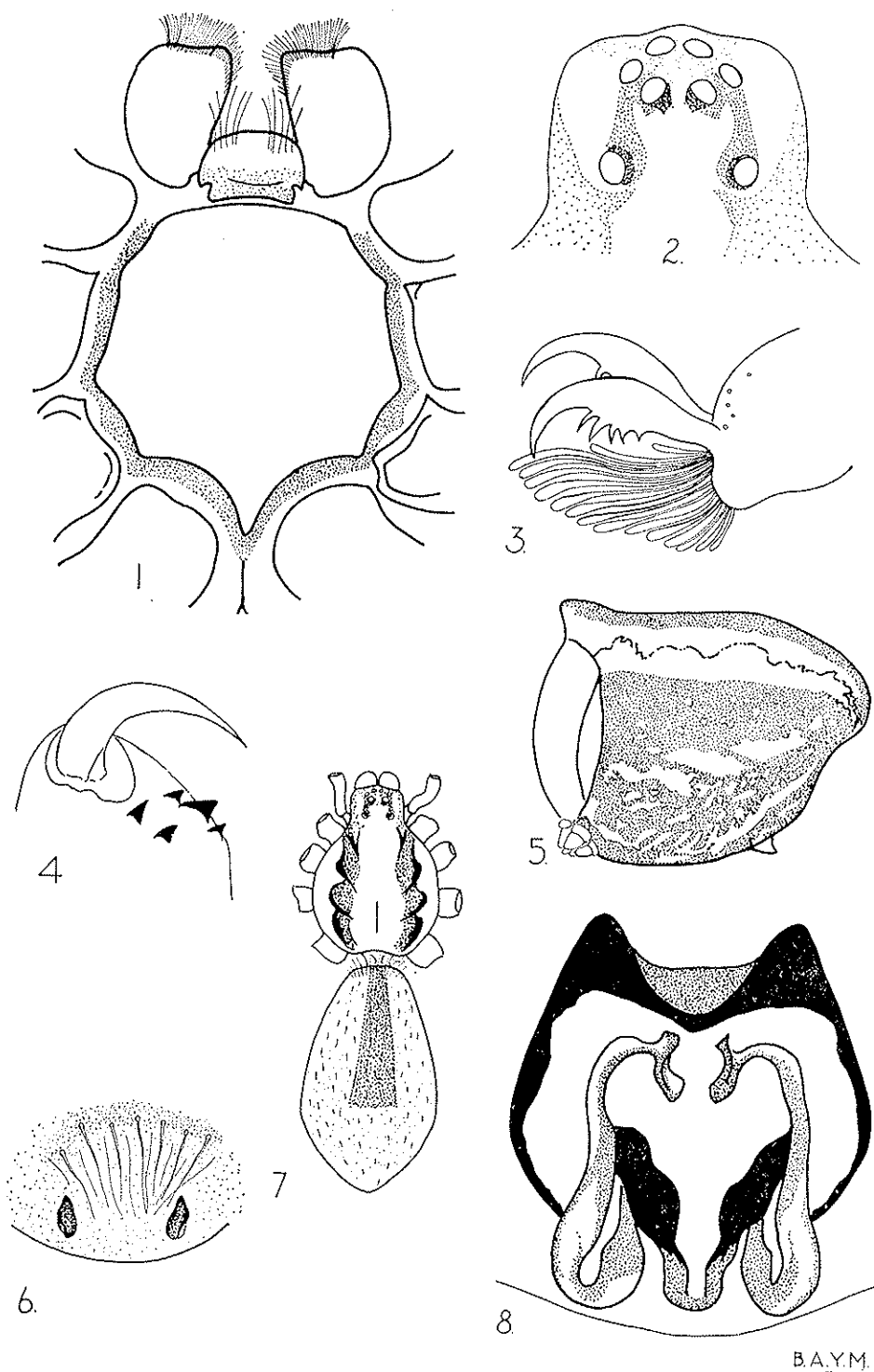
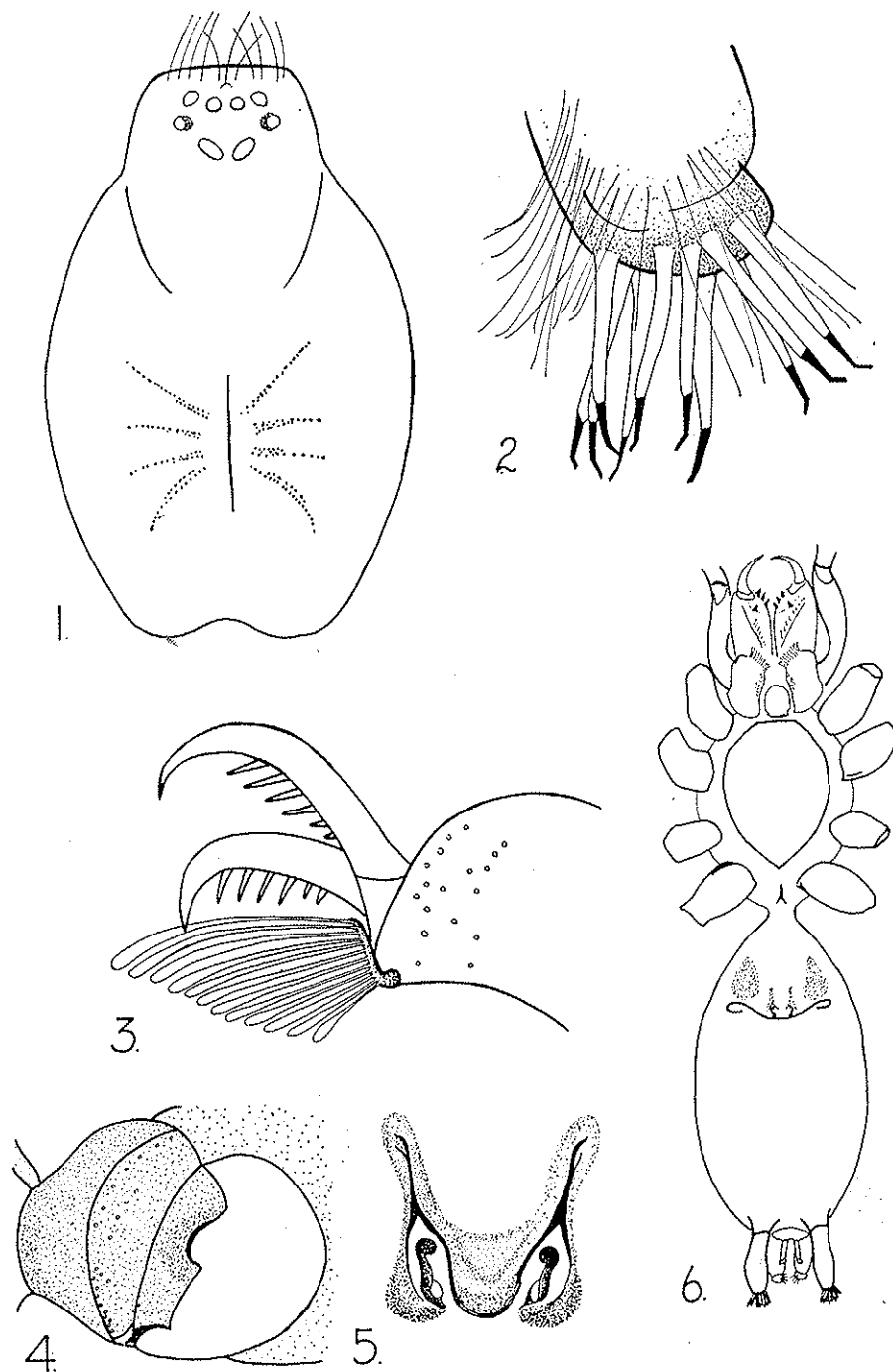


PLATE 4.



B.A.Y.M.

VIII. EXPLANATION OF PLATES

Except where otherwise mentioned, all drawings have been made from the holotypes. The drawings are done to various magnifications.

PLATE 1

Encyocrypta parifusca sp. nov.:
1. Labium and maxillae; 2. Dorsal view of abdomen (drawn from paratype); 3. Dorsal view of carapace; 4. Tarsal claws; 8. Eyes.
Chenistonia cuspidata sp. nov.:
5. Tarsal claws; 6. Right chelicera; 7. Eyes.

PLATE 2

Ariadna decatetracantha sp. nov.:
1. Maxillae and labium; 2. Dorsal view of carapace; 3. "Comb" of spines on metatarsus and tarsal claws of fourth right leg; 4. Dorsal view of apical part of first right femur; 5. Ventral view of apical part of first right femur; 6. Ventral view of tibia and metatarsus of first right leg.
Encyocrypta parifusca sp. nov.:
7. Left chelicera.
Chenistonia cuspidata sp. nov.:
8. Sternum, labium and maxillae.

PLATE 3

Horioctenoides bidentatus gen. and sp. nov.:
1. Maxillae, labium and sternum; 2. Eyes; 3. Tarsal claws (one of the claw-tufts has been removed to expose the claws); 4. Right chelicera; 6. Epigynum; 7. Dorsal view of carapace and abdomen.
Aranea reherchensis sp. nov.:
5. Profile of abdomen; 8. Epigynum (not cleared) as it appears looking directly down on ventral surface of abdomen.

PLATE 4

Encoptarthria serventyi gen. and sp. nov.:
1. Dorsal view of carapace; 2. Apical part of anterior spinneret showing spinning tubes; 3. Tarsal claws with one claw-tuft removed; 4. Trochanter, showing notch; 5. Epigynum; 6. Ventral view of spider.

7. MOLLUSCS (SEA SHELLS AND SNAILS)

By J. HOPE MACPHERSON*

I. INTRODUCTION

The following collection of molluscs was made by Messrs. J. H. Willis and V. N. Serventy during the Expedition of the Australian Geographical Society to the Recherche Archipelago, W.A., in November 1950. Apart from a few unlocalized live marine specimens and the land molluscs, all the material was collected as dead beach-worn specimens, the value of which as a basis for a survey is limited.

The area was first visited in December 1792 by Bruny D'Entrecasteaux's expedition, but to quote the naturalist J. J. H. de Labillardiere: "I was not able to discover any shells, by all the search I could make."

Between January 15 and 16, 1802, Matthew Flinders in the *Investigator* visited Goose Island Bay (Middle Island) and Robert Brown collected a few shells which were submitted to Gray of the British Museum. Circumstantial evidence would suggest that among them was the subsequent type of *Bothriembryon rhodostoma* (Gray).

Captain Rossiter (who rescued John Edward Eyre) was engaged in whaling operations among the Recherche Islands where he gathered many shells. They became part of his brother-in-law, John Brazier's, collection but this collection was never worked as a unit.

A. F. Bassett Hull (November 1921) collected some Recherche material, including a large suite of *Bothriembryon rhodostoma* from several islands (Charley, Rabbit, Gunton and Mondrain), and T. Iredale (1939) has given an account of the variations of the species on the various islands.

This is therefore the first record of a molluscan collection of any size being made in the Archipelago and it shows interesting affinities. The majority of the 159 species collected (including 130 gastropods and 27 pelecypods) belong to the temperate fauna of southern Australian coasts, but a few are a carry-over from the tropical fauna of the west coast of Western Australia.

These affinities are illustrated by the list of species which attempts to tabulate in brief form their zoogeographical relationships. However, the apparent absence of such cool-temperate-marking species as *Brachyodontes rostratus* and the presence of such genera as *Ninella* and *Nodilittorina* are pointers towards this area belonging to the warm temperate zone as defined by Bennett and Pope (1953).

Mr. J. H. Willis makes the following comments on some shell occurrences in the Archipelago:

The very small beach on the north-eastern coast of North Twin Peaks Island proved remarkably rich in molluscan species—at least 64 were collected during the A.G.S. camp there. Limestone Bay, a gulch surrounded by high calcareous cliffs at the S.E. corner of Middle Island, was also rich, and the deep shelly sand (among rocks) at its head yielded 60 different shells, of which 21 are new specific records for Western Australia. The long beach at Goose Island Bay on the north coast furnished a good assortment of shells (73 species) in the successive lines of drift deposited from tides. Remote Salisbury Island, without any beach, gave 28 shell species, five being new to the western State; best examples of the cowrie *Cypraea Reevei* were taken from crevices in the fretted shore platform of this island.

Very few complete specimens of such large, comparatively thin-walled shells as the Baler (*Melo miltonis*) and Jourdan's Turban (*Dinassovica jourdani*) were found, and these were securely wedged between rocks; but washed-up fragments were observed at many places. Broken pieces of the massive Giant Creeper (*Campanile symbolicum*) and other shells were often to be seen on rocks above high-tide level, and even on the summits of hills; presumably these had been carried up when alive and deliberately dropped by sea birds seeking to shatter them and so dislodge the soft-bodied molluscs within. Bivalves, as might be expected, were observed in variety *only* on those islands which had sandy bays with beaches.

Between Israelite Bay and Point Malcolm (visited by the A.G.S. party, but no shells were collected there) on the adjoining mainland coast is a muddy "lagoon" about five miles long, separated now from the ocean by fixed sand dunes. On this flat are many subfossil marine shells of species still living in the waters of the Archipelago, e.g. *Uber conicum*, *Cominella eburnea*, *C. lineolata*, *Niotoha pyrrhus* and *Cardium racketti* [See Cotton, 1952; Clarke and Phillips, 1953].

A list of the species collected has been arranged systematically with the authority for the species and the island localities cited. In order to tabulate

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distributions and show the affinities of each species the following prefixing symbols have been used:

† Species not previously recorded from Western Australia.

§ Species ranging as far east as Victoria.

* Species not recorded from the remainder of southern Australia.

Islands are arranged according to the order in which they were visited and, to save space, have been abbreviated as follows:

Box.	Boxer	Mid.	Middle
SHk.	Sandy Hook	Sby.	Salisbury
Mon.	Mondrain	Xms.	Christmas
NTP.	North Twin Peaks	Isr. Bay	Israelite Bay (mainland)

Goose Island Bay and Limestone Bay (on the north and south-east coasts, respectively, of Middle Island) have been abbreviated to "Gse. I. B." and "Limest. B."

Two new species are described hereunder and it is probable that there are other new forms which have been set aside until more material is available. All specimens recorded have been lodged in the National Museum of Victoria.

II. DESCRIPTIONS OF TWO NEW SPECIES

Members of the genus *Coxiella* occur in most of the salt-water lakes of southern Australia, so it is not surprising that there should be a representative species on Middle Island—presumably at the brine lake near Goose Island Bay.

COXIELLA MINIMA sp. nov. [Figs. 1a and 1b]

National Museum of Victoria—Type No. F13835, Paratypes F12636.

Shell small, 3.5 mm. high, truncate, smooth, dark horn coloured, imperforate, 2½-3 whorls which are very rounded with deep sutures. Mouth oval, reflected, the inner lip showing a slight white callous. Operculum concentric, with centre slightly to the lower end; completely filling the aperture.

Measurements of type: 3.5 mm. long, 2.0 mm. wide.

Type locality: Middle Island, Recherche Archipelago.

This shell, a true *Coxiella*, is quite distinct from the rest of the genus because of its small size and few whorls.

The following new species belongs to the family *Dipnelicidae*, erected by Iredale, 1937, for an unkeeled shell with a wide umbilicus from Hummock Island, South Australia. A second genus and species was erected by the same author for a similar but keeled shell with a narrow umbilicus from south-west of Western Australia in 1939. The present form, the third example of the family, has a keeled shell and wide umbilicus and so is intermediate between the two previous species. From the series it seems that the whole range might be included in the original genus and the present shell is placed in that genus.

DIPNELIX ALYCHNOPIS sp. nov. [Figs. 2a, b and c]

National Museum of Victoria—2 Cotypes No. F12635.

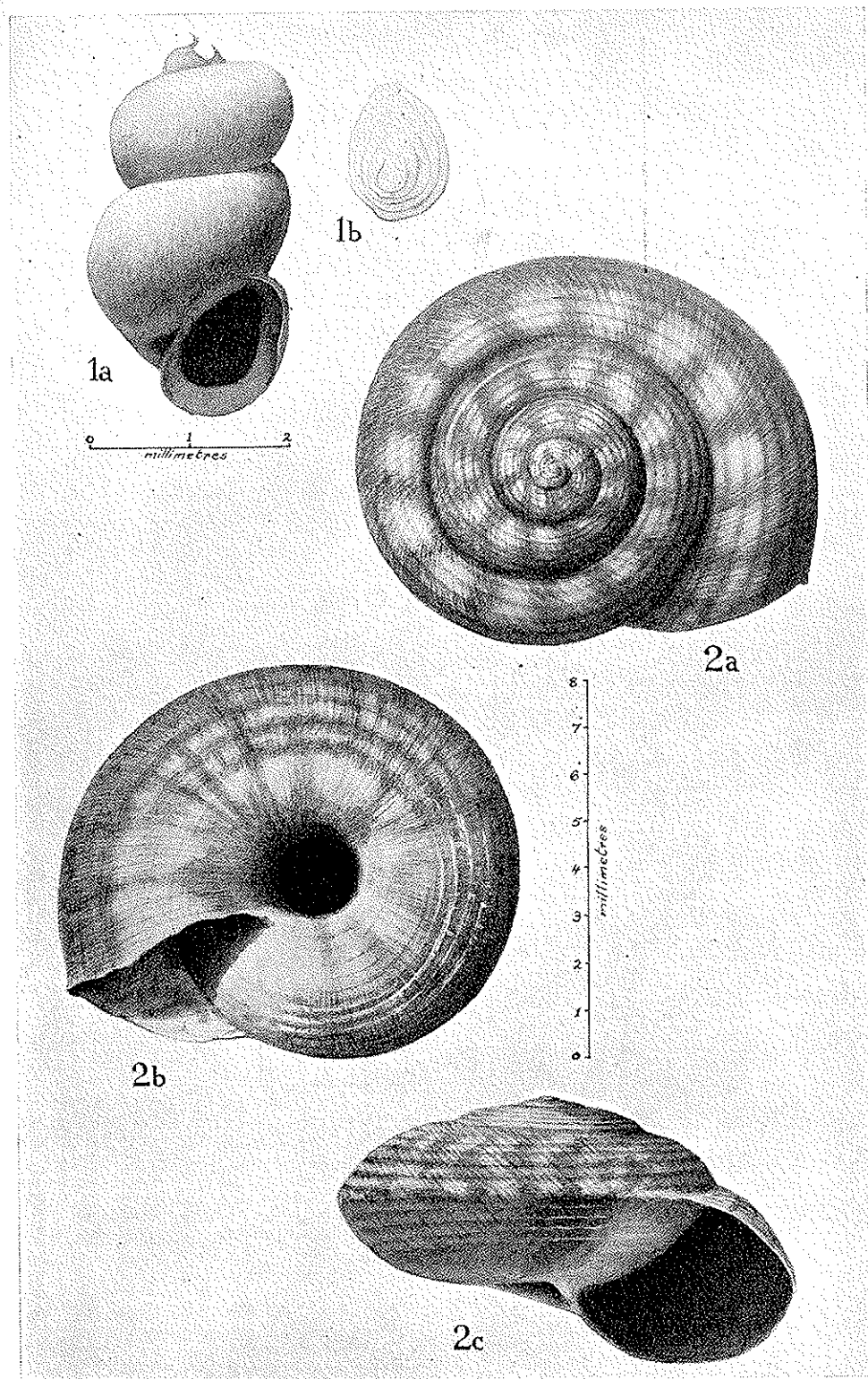
Shell small, 9 mm. in diameter, thin, spire a little elevated, whorls 4½, umbilicus open, about one-third diameter of the shell; mouth square, columella slightly reflected, a thin glaze connecting across the body whorl to the outer lip.

Colouration horn dull, not shiny, flamed with cream, the flames becoming more distinct when the shell is wet. Apical whorl smooth but very fine radial lines developing on the second whorl, giving a matt surface. Impressed upon the very fine radial sculpture are encircling concentric lines which are continuous from the mouth to the junction of the smooth apical whorl. The lines are stronger close to the keel on the body whorl and against the sutures. The sculpture of the under surface is similar to the upper surface.

Measurements of type: 9 mm. diameter, 4 mm. high.

Type locality: Mondrain Island, Recherche Archipelago.

Mr. J. H. Willis gives the following field note—"Collected on the north coast in a shaded gully amongst leaf mould."



Coxiella minima sp. nov. (1a, elevation; 1b, operculum).

Dipnelix alychnopis sp. nov. (2a, plan of dorsal surface; 2b, plan of ventral surface; 2c, elevation to show mouth).

—del. G. Browning, 1953.

III. LIST OF MOLLUSCS COLLECTED

Class CREPIPODA (Chitons or Coat of Mail Shells)

CHITONIDÆ

- Clavarizona*
hirtosa Blainville—NTP. (N.E. beach).

Class GASTROPODA (Univalves)

HALIOTIDÆ

- Haliotis*
§ *conicopora* Peron—NTP. (N.E. beach), Sby.
§ *laevigata* Donovan—Mid. (Gse. I. B.).
§ *roci* Gray—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby., Isr. Bay.
§ *rubra* Leach—Mid. (Gse. I. B. and Limest. B.).
§ *scalaris* Leach—Mid. (Gse. I. B.).
* *semiplicata* Menke—Mid. (Limest. B.).

FISSURELLIDÆ

- Scutus*
§ *amatinus* Donovan—NTP. (N.E. beach).
Montfortula
§ *rugosa* Quoy and Gaimard—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.).
Sophismalepas
§ *oblonga* Menke—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby., Isr. Bay.

PATELLIDÆ

- Patellanax*
†§ *chapmani* T. Woods—SHk., Mon., NTP. (N.E. beach).
†§ *laticostata* Blainville—Box., Mid. (Limest. B.), Isr. Bay.
§ *peroni* Blainville—Box., SHk., Mon., NTP., Mid., Sby.

ACMAEIDÆ

- Patelloida*
§ *alticostata* Angus—Box., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.).
Chiazacmea
§ *flammea* Quoy and Gaimard—Box., SHk., Mon., NTP. (N.E. beach), Sby. [W.A. shells have been separated as variety *conoidae* Q. and G. but these specimens have the typical flatter form of the Eastern shells].

TROCHIDÆ

- Clanculus*
§ *consobrinus* Tate—Mid. (Limest. B.).
§ *denticulatus* Gray—Mid. (Limest. B.).
†§ *flagellatus* Philippi—SHk., Mon.
†§ *limbatus* Quoy and Gaimard—SHk., Mid. (Limest. B.), Isr. B.
§ *maxillatus* Menke—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.), Sby.
†§ *ochroleucus* Philippi—Mid. (Limest. B.).
§ *piebejus* Philippi—Box., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.), Xms.
§ *ringens* Menke—Mid. (Limest. B.).
Cantharidus
§ *pulcherrimus* Wood—Box., SHk., NTP. (N.E. beach), Mid. (Gse. I. B.), Isr. Bay.
†§ *ramburi* Crosse—SHk., Mon., Mid. (Gse. I. B.), Isr. Bay.
Phasianotrochus
§ *apicinus* Menke—Mid. (Limest. B.).
†§ *bellulus* Dunker—Mid. (Gse. I. B. and Limest. B.), Isr. Bay.
†§ *eximius* Perry—Mid. (Limest. B.).
§ *irisodontes* Quoy and Gaimard—NTP. (N.E. beach).
Thalotia
§ *conica* Gray—NTP. (N.E. beach), Isr. Bay.
Cantharidella
†§ *tiberiana* Crosse—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.).
Austrocochlea
§ *adelaidea* Philippi—SHk.
†§ *concamerata* Wood—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.), Sby., Isr. Bay.
§ *rudis* Gray—Box.
Gibbula
§ *lehmani* Menke—Mid. (Gse. I. B.).
§ *preissiana* Philippi—SHk.
† *reedi* Verco—Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.).

CALLIOSTOMATIDÆ

- Calliostoma*
†§ *compta* A. Adams—Sby.
*† *duplicatum* A. Adams—Sby. [Adams gives no locality for his shell but the description and Pilsbry's figure (*Manual of Conch.*, vol. XI, p. 359, pl. 17, f. 26) corresponds very well to the single specimen in the collection].
†§ *legrandi* T. Woods—Isr. Bay [the single specimen is slightly broader in proportion to height than Victorian specimens].
Callistele
† *calliston* Verco—Sby.

STOMATELLIDÆ

- Stomatella*
§ *imbricata* Lamk.—SHk., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Isr. Bay.
Herpetopoma
§ *aspersa* Philippi—Box., SHk.
* *scaber* Fischer—Mon., NTP. (N.E. beach).

STOMATIDÆ

- Gena*
§ *auricula* Lamarch—Mid. (Gse. I. B. and Limest. B.).

LIOTIDÆ

- Pseudoliotia*
† *clathrata* Reeve—NTP. (N.E. beach).
Munditia
§ *australis* Kiener—Box., Mon.

TURBINIDÆ

- Subnivalia*
§ *undulata* Solander—SHk., Isr. Bay.
Nivalia
§ *whitleyi* Iredale—SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Isr. Bay.
Dinassovica
§ *jourdani* Kiener—Mon., NTP. (N.E. beach), Mid. (Limest. B.).
Micrastraca
§ *aurea* Jonas—NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby., Xms.

EUTROPIIDÆ

- Phasianella*
§ *angasi* Crosse—SHk., Mon., NTP. (N.E. beach), Mid. (Limest. B.).
* *australis* Gmelin—NTP. (N.E. beach), Sby.
§ *tomlini* Gatliff and Gabriel—Box., Mon., NTP. (N.E. beach), Xms.
§ *ventricosa* Swainson—SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Isr. Bay.

NERITIDÆ

- Nerita*
§ *melanotragus* Smith—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby., Xms., Isr. Bay.

LITTORINIDÆ

- Melaraphe*
§ *unifasciata* Gray—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby., Isr. Bay.

BEMBICIDÆ

- Bembicium*
§ *melanostoma* Gmelin—Sby.
Nodilittorina
* *rugosa* Menke—Box.

HYDROBIIDÆ

- Coxiella*
* *minima* Macp., sp. nov.—Mid.

RISSOINIDÆ

- Rissoina*
†§ *d'orbigni* A. Adams—Mon.

SOLARIIDÆ

- Philippia*
†§ *lutea* Lamarch—Box., Mon., Mid. (Gse. I. B. and Limest. B.).

VERMETIDÆ

- Serpulorbis*
§ *sipho* Lamarch—SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.).
Tenagodus
†§ *australis* Quoy and Gaimard—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B. and Limest. B.), Sby.
Pyxipoma
§ *weldii* T. Wood—Box., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.).

CERITHIIDÆ

- Eubittium*
§ *lawleyanum* Cross—Mon.
Cacozeliana
§ *granarium* Kiener—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gse. I. B.). [This West Australian species is recorded in Victorian lists, but this is in error. The Victorian shell should bear the name of the next species (*lacertinum*) and the two forms overlap in the Recherche material].
†§ *lacertinum* Gould—SHk., Mid. (Gse. I. B.), Xms.
Ataxocerithium
§ *serotinum* A. Adams—NTP. (N.E. beach), Mid. (Limest. B.), Isr. Bay.

Hypotrochus
 § *monachus Crosse and Fischer*—Mid. (Limest. B.).
 Campanile
 § *symbolicum Iredale*—Box., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B.) and Limest. B.), Sby.

SCALIDÆ
 Scala
 § *australis Lamk.*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Isr. Bay.

HIPPONICIDÆ
 Sabia
 § *conica Schumacher*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby., Xms.
 Antisabia
 * *barbatus Sowerby*—Box., SHk., Mon.

CAPULIDÆ
 Capulus
 †§ *devotus Hedley*—Mid. (Gsc. I. B.).

GALERIDÆ
 Sigapatella
 § *calyptraeformis Lamarck*—Isr. Bay.

NATICIDÆ
 Notocochlis
 †§ *sagittata Menke*—Mid. (Gsc. I. B.), Isr. Bay.
 Uber
 § *conicum Lamarck*—Isr. Bay.
 Ectosinum
 § *zonale Quoy and Gaimard*—Mid. (Gsc. I. B.).
 Propesinum
 †§ *umbilicatum Quoy and Gaimard*—SHk., NTP. (N.E. beach), Mid. (Gsc. I. B.), Isr. Bay.

CYPRÆIDÆ
 Notocypraea
 †§ *angustata Gmelin*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby., Xms., Isr. Bay.
 Cypraea
 † *reevei Sowerby*—NTP. (N.E. beach), Mid. (Gsc. I. B.), Sby.
 Zoila
 † *friendii Gray*. [No specimen was collected during the Expedition, but this large cowrie definitely occurs in Recherche waters—residents of Esperance have examples taken in the Bay, and a living specimen was found by D. H. A. Mackenzie attached to a pile of the Esperance pier.]

TRIVIIDÆ
 Ellatrivia
 †§ *merces Iredale*—Mid. (Limest. B.).

CYMATIIDÆ
 Cymatium
 § *exaratum Reeve*—Mid. (Limest. B.).
 Cymatilesta
 †§ *waterhousei Adams and Angus*—Mid. (Gsc. I. B. and Limest. B.).
 Mayena
 § *australasia Perry*—Mid. (Gsc. I. B.).
 Cymatiella
 †§ *gaimardi Iredale*—NTP. (N.E. beach), Mid. (Limest. B.).
 § *verrucosa Reeve*—Mid. (Gsc. I. B.).
 Maculotriton
 † *bicolor Quoy and Gaimard*—Sby.
 Ratifusus
 †§ *bednalli Brazier*—Sby.

MURICIDÆ
 Pterynotus
 †§ *angasi Crosse*—Box., Mon.
 Latirus
 † *walkeri Melville*—Mid. (Gsc. I. B.).

THAIDIDÆ
 Dicathais
 * *acgrota Reeve*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby., Isr. Bay.
 Mancinella
 * *bufo Lamarck*—Mid. (Limest. B.).
 Lepsiella
 †§ *reticulata Quoy and Gaimard*—SHk., Mon., Mid. (Gsc. I. B. and Limest. B.), Sby., Isr. Bay.

MAGILIDÆ
 Corallophila
 †§ *bulbiformis Conrad*—Mid. (Limest. B.).
 † *wilsoni Prit. and Gatliff*—Mid. (Limest. B.).

PYRENIDÆ
 Zemitrella
 †§ *lincolniensis Reeve*—NTP. (N.E. beach).
 †§ *menckana Reeve*—NTP. (N.E. beach), Mid. (Gsc. I. B.).
 †§ *pulla Gaskoin*—NTP. (N.E. beach).
 § *semiconvexa Lamarck*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby., Xms., Isr. Bay.

BUCCINIDÆ
 Cominella
 †§ *eburnea Reeve*—NTP. (N.E. beach), Mid. (Limest. B.).
 § *lincolata Lamarck*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Isr. Bay.
 Josepha
 § *tasmanica T. Woods*—SHk., Mid. (Gsc. I. B.).

NASSARIIDÆ
 Reticunassa
 †§ *paupera Gould*—NTP. (N.E. beach), Mid. (Gsc. I. B.), Xms.
 Niotha
 †§ *pyrrhus Menke*—Isr. Bay.

FASCIOLARIIDÆ
 Fasciolaria
 § *australasia Perry*—Mid. (Gsc. I. B.).

COLIDÆ
 Propofusus
 †§ *undulatus Perry*—SHk.
 Microcolus
 § *dunkeri Jonas*—Sby.
 † *lincolniensis Crosse*—Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby.
 Euthria
 * *species ?*—NTP. (N.E. beach), Mid. (Limest. B.).

OLIVIDÆ
 Oliva
 § *australis Duclos*—SHk., Mid. (Gsc. I. B.), Isr. Bay.

MITRIDÆ
 Mitra
 †§ *australis Swainson*—Box., NTP. (N.E. beach), Mon., Mid. (Gsc. I. B.).
 †§ *rhodia Reeve*—Box., NTP. (N.E. beach), Mid. (Limest. B.).
 † *species ?*—NTP. (N.E. beach), Mid. (Limest. B.).
 Austromitra
 † *lincolniensis Verco*—Mid. (Gsc. I. B.).
 § *schomburgkii Angus*—Box.

VASIDÆ
 Altivasum
 † *findersi Verco*—Box.

VOLUTIDÆ
 Melo
 † *miltonis Gray*—Mid. (Gsc. I. B.).
 Lyria
 †§ *mitraeformis Lamarck*—Mid. (Gsc. I. B. and Limest. B.).

CANCELLARIIDÆ
 Nevia
 † *spirata Lamarck*—Mid. (Gsc. I. B.), Isr. Bay.

MARGINELLIDÆ
 Marginella
 § *pulchella Kiener*—SHk., NTP. (N.E. beach), Mid. (Gsc. I. B.), Xms.

TURRIDÆ
 Splendrillia
 † *harpularia Des Moulins*—SHk., NTP. (N.E. beach).
 Euguraleus
 § *australis Ad. and Angus*—SHk., Mid. (Gsc. I. B.).
 Daphnella
 †§ *botanica Hedley*—Mid. (Gsc. I. B.).

CONIDÆ
 Floroconus
 § *anemone Lamarck*—Box., SHk., Mon., NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.), Sby., Isr. Bay.
 Parviconus
 § *rutilus Menke*—NTP. (N.E. beach), Mid. (Limest. B.), Xms.

BULLARIIDÆ
 Bullaria
 § *tenuissima Reeve*—Mid. (Limest. B.).

ELLOBIIDÆ

Marinula
§ *xanthostoma* A. Adams—Mid. (Limest. B.)

BOTHRIEMBRYONTIDÆ

Bothriembryon
* *rhodostomus* Gray—Box.

DIPNELICIDÆ

Dipnelix
†* *alychuopsis* Macp., sp. nov.—Mon.

Class PELECYPODA (Bivalves)

ARCIDÆ

Arca
†§ *squamosa* Lamarck—Box.

GLYCYMERIDÆ

Glycymeris
§ *radians* Lamarck—SHk., Mid. (Gsc. I. B.), Isr. Bay.

VULSELLIDÆ

Vulsella
§ *spongiarium* Lamarck—NTP. (N.E. beach), Mid. (Gsc. I. B. and Limest. B.).
Mallens
† *meridianus* Cotton—NTP. (N.E. beach), Mid. (Gsc. I. B. and S.E. coast).

PECTINIDÆ

Mimachlamys
§ *aspermus* Lamarck—Mid. (Limest. B.).

SPONDYLIDÆ

Spondylus
†§ *tenellus* Reeve—Mid. (Gsc. I. B. and Limest. B.).

LIMIDÆ

Austrolima
†§ *nimbifera* Iredale—Mon., Mid. (Limest. B.).

MYTILIDÆ

Mytilus
§ *planulatus* Lamarck—Mid. (Limest. B.).
Modiolus
§ *pulex* Lamarck—Isr. Bay.
Musculus
* *cunningianus* Reeve—Mid. (Gsc. I. B. and Limest. B.).

CARDITIDÆ

Cardita
§ *crassicosta* Lamarck—Mid. (Limest. B.).
Venericardia
†* *sowerbyi* Deshayes—NTP. (N.E. beach), Mid. (Gsc. I. B.). [This shell has more ribs (22) than typical *sowerbyi* from the Cuming collection.]

CHAMIDÆ

Chama
ruderalis Lamarck—Mid. (Gsc. I. B.).

LUCINIDÆ

Codakia
§ *lactecola* Tate—SHk., NTP. (N.E. beach), Mid. (Gsc. I. B.).

ERYCINIDÆ

Mytilia
§ *deshayesii* d'Orbigny and Reclus—Mon., NTP. (N.E. beach), Mid. (Gsc. I. B.), Xms.

CARDIIDÆ

Cardium
§ *cygnorum* Deshayes—Mid. (Gsc. I. B.).
§ *flavum* Linne—Isr. Bay.
§ *racketti* Donovan—Isr. Bay.

VENERIDÆ

Tawera
§ *lagopus* Lamarck—SHk.
Venerupis
§ *exotica* Lamarck—NTP. (N.E. beach), Mid. (Gsc. I. B.).
§ *galactites* Lamarck—NTP. (N.E. beach), Mid. (Gsc. I. B.).

TELLINIDÆ

Pseudarcopagia
* *piratica* Hedley—Box., Mid. (Gsc. I. B.).

PSAMMOBIIDÆ

Flavomala
§ *biradiata* Wood—Isr. Bay.

MACTRIDÆ

Mactra
§ *pura* Deshayes—SHk., NTP. (N.E. beach), Mid. (Gsc. I. B.).

AMPHIDESMATIDÆ

Amphidesma
†§ *angusta* Reeve—Isr. Bay.

ALOIDIDÆ

Aloidis
§ *iredalei* Cotton—SHk.

HIATELLIDÆ

Hiatella
§ *australis* Lamarck—Mid. (Limest. B.), Isr. Bay.

Class CEPHALOPODA (Octopus, Squid, etc.)

SPIRULIDÆ

Spirula
§ *spirula* Linne—Mid. (Gsc. I. B.).

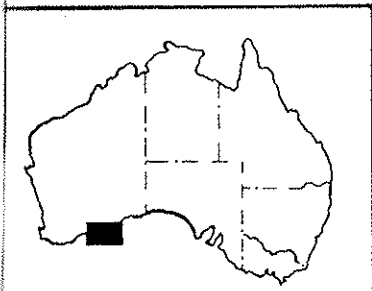
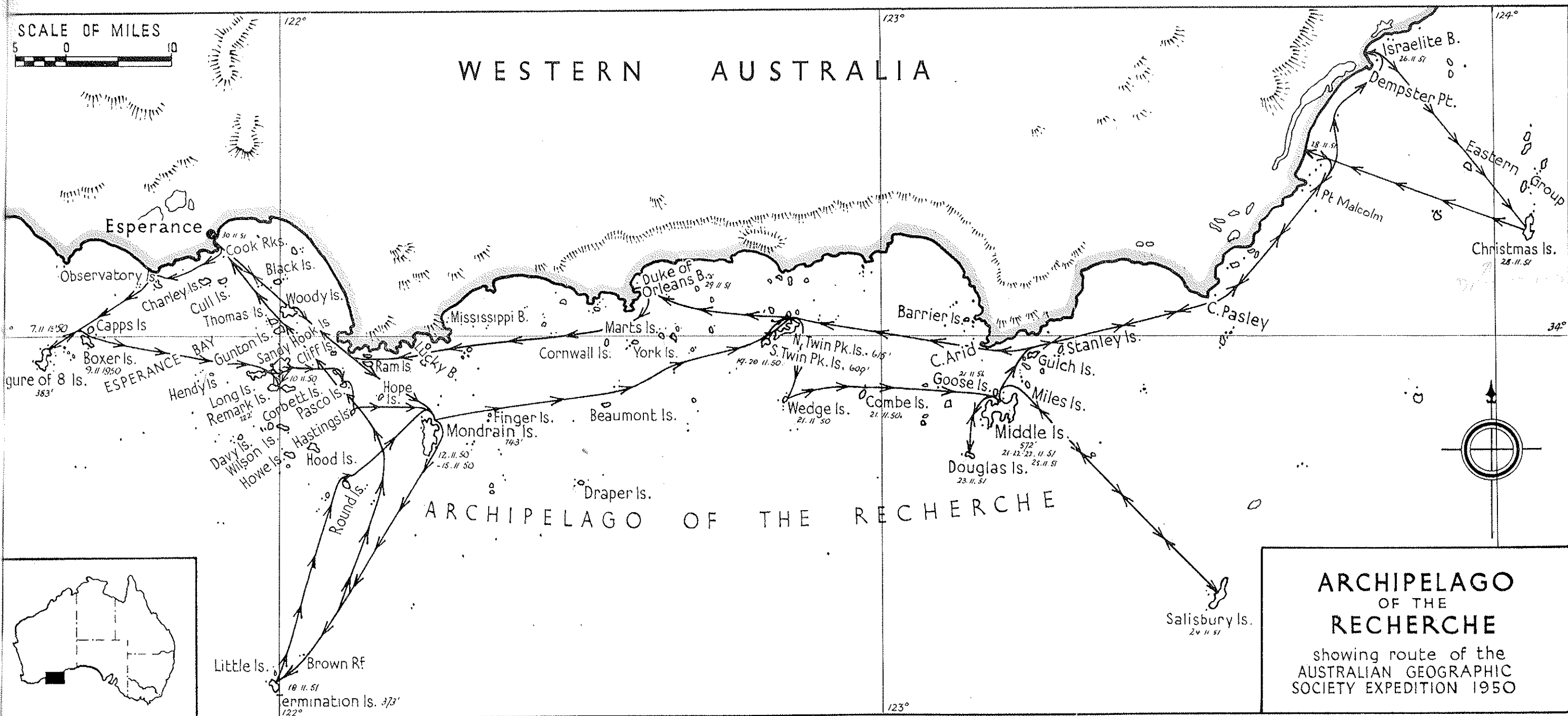
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SCALE OF MILES



WESTERN AUSTRALIA



ARCHIPELAGO OF THE RECHERCHE

showing route of the
AUSTRALIAN GEOGRAPHIC
SOCIETY EXPEDITION 1950

THE ARCHIPELAGO OF THE RECHERCHE
PART 2 — BIRDS

By

V. N. SERVENTY, B.Sc., B.Ed.

AUSTRALIAN GEOGRAPHICAL SOCIETY
MELBOURNE, 1952

THE ARCHIPELAGO OF THE RECHERCHE

The Australian Geographical Society's Expedition to the Archipelago of the Recherche, Western Australia ($33^{\circ}37'-34^{\circ}28'$ S. Lat.; $121^{\circ}30'-124^{\circ}10'$ E. Long.), took place during the month of November, 1950.

A map showing route and dates of landing on the various islands is appended to this paper. Periods of three or four days were spent on the larger islands.

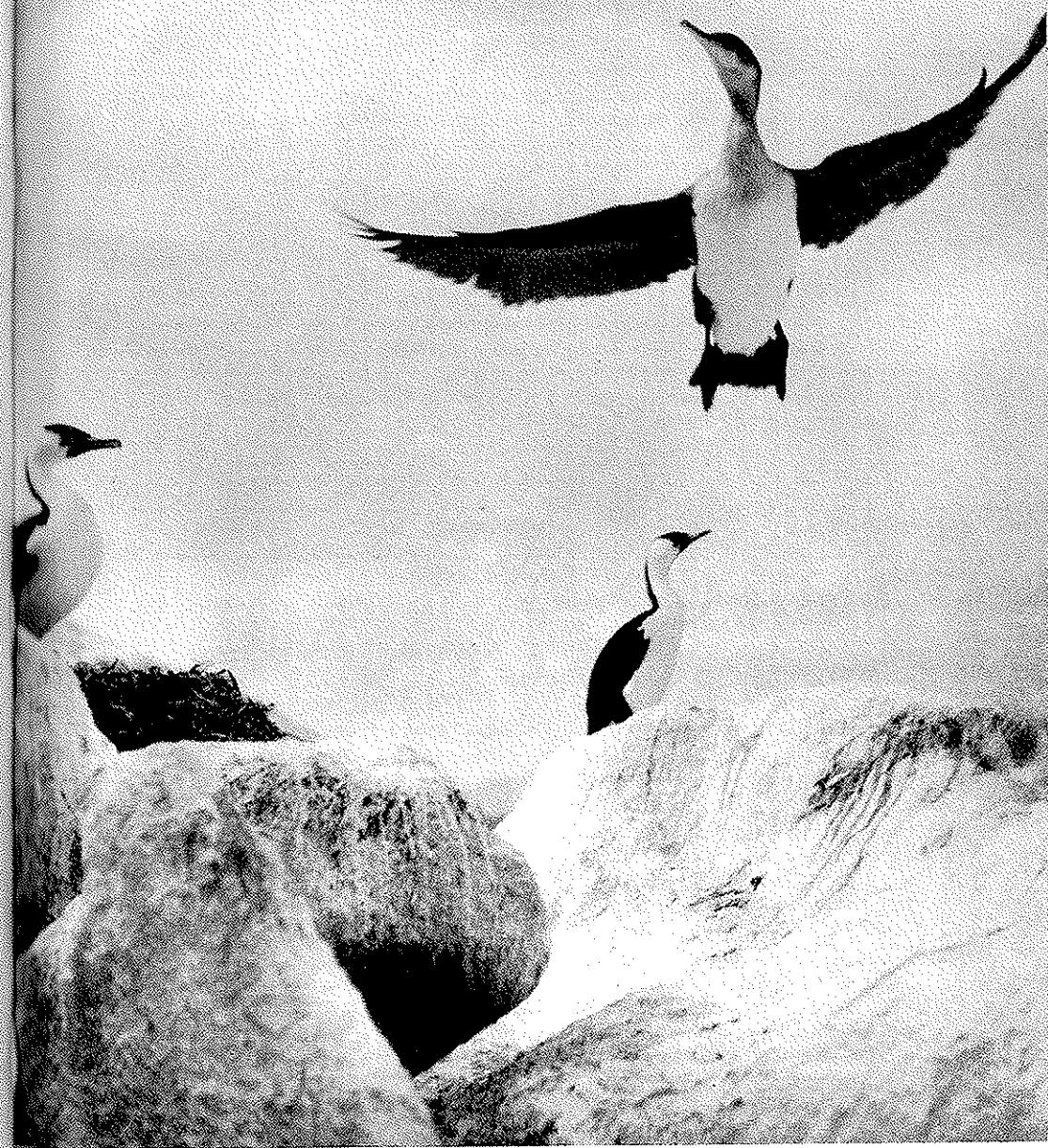
The following islands and contiguous areas of the mainland were visited: Esperance, Figure of Eight (7.11.50), Boxer (9.11.50), Sandy Hook (10.11.50); Remark (11.11.50); Long (11.11.50); Pasco (12.11.50), Mondrain (12.11.50), Termination (18.11.50), Round (18.11.50); North Twin Peaks (19.11.50); South Twin Peaks (20.11.50), Cave (20.11.50), Wedge (21.11.50), Combe (21.11.50), Middle (21.11.50), Douglas (23.11.50), Goose (23.11.50), Salisbury (24.11.50), Israelite Bay (26.11.50), Christmas (28.11.50), Point Malcolm (28.11.50), Duke of Orleans Bay (29.11.50).

Expedition personnel was as follows:

John Béchervaise (Leader), J. H. Willis (Botanist), V. Serventy (Zoologist), R. Bean (Photographer), I. S. Wilson, M. Farrant. The expedition craft, a 35-ft. Diesel-powered fishing boat, schooner-rigged auxiliary sail, was in charge of Messrs. D. Mackenzie and A. Sanders.

It is planned that the complete report (Report No. 1) of the expedition will be published in several parts, as follows: Introductory, General and Historical, Birds, Mammals, Plants, Reptiles, Shells, Insects and Spiders, Physiography.

This section (Report No. 1, Part 2—Archipelago of the Recherche: Birds, by V. N. Serventy) is first published (15th February, 1952).



Black-faced Cormorants at nesting site, Middle Island

BIRDS

As in the case of the mammals, no collections of birds were made at the islands, but as full field observations as possible were recorded.

The bird-life of the islands has received most attention from previous visitors. The first published accounts were given by the naturalists of the French expedition of 1792, under D'Entrecasteaux (Labillardiere, 1800, and Riche in de Rossell, 1808), and these were supplemented, but only briefly, by Flinders (1814) and King (1827).

In 1904 and 1906 J. T. Tunney, a collector engaged by the Western Australian Museum, visited some of the islands, but, unfortunately, no complete report appeared on his work. Several of his specimens, however, were studied by Gregory Mathews and became the types of new sub-species. Tunney collected on the following islands: Mondrain, Station, North Twin Peaks, a small island two miles south of North Twin Peaks, a small island near Duke of Orleans Bay, Boxer, Combe, Middle, Goose, Sandy Hook and Remark (*vide* Whittell, 1938, p. 325, and information from Mr L. Glauert).

The first modern naturalist to work the islands systematically was A. F. Basset Hull, of Sydney, who prepared a valuable account of a visit to the nearer islands in November and December, 1921 (1922, p. 277). He visited Charley, Rabbit, Lion, Woody, Gunton, Mondrain and Rob.

D. L. Serventy has published an account (1947, p. 44) of a visit in January, 1944, to Charley, Lion, Woody and Marts, and J. M. Thomson and B. Shipway of a visit to Goose in March, 1947 (1948, p. 349).

In the following report I have endeavoured to prepare a complete account of what is known of the birds of the Recherche Archipelago, including the essential information published by these earlier investigators. In connection therewith D. L. Serventy has kindly allowed me to use his unpublished records of visits during the winters of 1947 and 1948, including landings on Sandy Hook, Middle, Goose, Christmas and New Year. I have also utilized some information given by T. C. Andrews in an unpublished account of experiences at Middle Island in 1889.

The present expedition was able to visit a greater number of islands than had been possible for any previous naturalist. As a result we now have a very fair coverage of the avifauna of the archipelago, at least from the point of view of distribution. Though we were not able to confirm the sanguine hopes of Hull as to the interesting species that might be found breeding on the outer islands, the new information brought back by the expedition does not lack interest. Perhaps the most noteworthy results concern the additional data on breeding stations of the various petrels, particularly that of the Great-winged Petrel (*Pterodroma macroptera*), which is now known to nest on many of the Recherche Islands. Hull hinted that it might be a local breeder, but the first proof that it did so was only forthcoming in 1947.

It seems unlikely that any notably new breeding records will be made for the archipelago, as the islands which we inspected are a representative sample. Any hope that the larger sea-birds, such as albatrosses and gannets, may nest on some of the outer, inaccessible islands and reefs has been dispelled by the aerial surveys of Mr Stanley Fowler, formerly of the Commonwealth Scientific and Industrial Research

Organization. He has closely examined from the air the whole of the archipelago and failed to find any evidence of such nesting activity.

Hull's list of Recherche birds contained twenty-four species. In the present report fifty-seven species are included, of which forty-one were met with during the Australian Geographical Society's expedition.

The islands carry limited and low-grade deposits of rock phosphate, prospecting for which was commenced by the late Captain James J. Sale in the early years of the present century, and surveys have been made by the Geological Survey of Western Australia (Woodward, 1909, p. 6) and the British Phosphate Commissioners.

There is no evidence of present regeneration of guano deposits on any of the islands, and there are no great aggregations of surface-nesting sea-birds, such as are known to be replenishing guano deposits at present on some of the Abrolhos Islands and in Shark Bay. In fact, as in the case of the seal population, one is impressed by the comparative sparseness of the sea-birds which nest on the Recherche. There are, it is true, colonies of petrels of some magnitude, but a more detailed survey is needed to gain any worthwhile evidence of the abundance of these unobtrusive burrowing species. Superficial impressions suggest, however, that their numbers are inferior to those in the well-known rookeries of *Puffinus tenuirostris* of south-eastern Australia. In any case petrels have been proved to forage many hundreds of miles from their nesting stations, and so they are not such good indices of the productivity of the immediate local waters as are species of more littoral habit.

One cannot resist the conclusion that the dearth of such species as Cormorants and Terns, combined with the absence of the Gannet as a breeding species, suggests that the waters immediately in the neighborhood of the Recherche Archipelago are not highly productive and that they were richer in the sub-recent past, when it was possible for guano deposits to be accumulated.

1. LITTLE PENGUIN, *Eudyptula minor* (Forster, 1781).

The habit of nesting and sheltering in rock crevices, combined with their nocturnal behaviour, made the search for Penguins a difficult task. In our opinion the birds occur on practically every island of appreciable size in the archipelago. For example, Nares is little more than a rock and yet Penguins have been recorded on it. Tracks of the birds were seen on many occasions.

Weight of adult bird: 650 gm.

Dimensions of eggs: wt. 40 gm.: 53.0 x 37.5 mm.

NOTES FROM VARIOUS ISLANDS:

BOXER: One bird examined.

MONDRAIN: A nest found with two eggs on November 13 (dimensions given above).

TERMINATION: A dead Penguin found on a Sea-Eagle's nest.

ROUND: Dead young Penguins, still in down, were found.

NORTH TWIN PEAKS: One young bird in down. Several hundred feet above sea-level a nest with two eggs was discovered in a rock crevice. There was no brooding bird and the eggs were cold.

WEDGE: A nest with two eggs.

COMBE: One nest with two eggs and one with a large young.

GOOSE: Several Penguins found among the rocks. One had one egg and another a large young.

Hull (1922, p. 288) found birds and eggs on Rob and Rabbit on December 10th during his visit and noted a bird on Charley. D. L. Serventy (1947, p. 48) recorded a bird with a half-grown chick on Marts in mid-January. Serventy and Whittell (1951, p. 66) list the

following nesting islands, in addition to those just mentioned: Cull, Sandy Hook, Station and Christmas.

A specimen collected by Tunney from Sandy Hook was made by Mathews the type of a new sub-species, *E. m. woodwardi*, differing from the eastern States form in its grey-blue coloration (1912, p. 199). It was figured in colour in his *Birds of Australia* (1911, vol. 1, pl. 66).

2. BROWN QUAIL, *Synoicus ypsilophorus* (Bosc, 1792).

As no specimens were collected, positive identification could not be made, but birds attributed to this species were flushed on Figure of Eight, Round, Thomas (five birds) and Christmas. At Figure of Eight an abandoned egg was found.

Hull collected a female of the species, and observed several others at Woody, where also D. L. Serventy reported flushing them in small numbers and coveys in 1944, as well as two birds at Sandy Hook in 1947. T. C. Andrews (ms.) mentions quail as among the birds occurring on Middle; and Tunney listed, but did not collect, the Painted Quail (*Turnix varia*) on Mondrain.

3. BRUSH BRONZEWING, *Phaps elegans* (Temminck, 1810).

Individuals were seen on Sandy Hook, Middle and Round, but they were not abundant. The birds were more plentiful on the mainland at Esperance than on the islands. It is clear that predators cannot be a factor in their relative abundance in this general region, as the islands are free of introduced ground carnivores like foxes and feral cats.

Labillardiere was the first to record this bird at Recherche (perhaps at Observatory); Hull collected them at Woody, finding them fairly plentiful, and D. L. Serventy recorded them from Woody and New.

4. BANDED LANDRAIL, *Hypotaenidia philippensis* (Linn., 1766).

Béchervaise drew my attention to one of these birds on Christmas. It rose from a point near the beach and settled again some fifty yards up the hillside.

This is the first record of the species for the Archipelago, but is not unexpected as Rails are inveterate wanderers and may appear on islands distant from the mainland. This species has been reported from Pelsart and Rat Islands in the Abrolhos.

5. HOARY-HEADED GREBE, *Podiceps poliocephalus* (Jardine and Selby, 1827).

Mackenzie saw a "dabchick" on the Pink Lake on Middle, where long ago Andrews also listed the birds. In view of the habitat, the likelihood is that it was this species and not the two others which also occur in the State.

6. WHITE-FACED STORM-PETREL, *Petagodroma marina* (Latham, 1790).

Several hitherto unrecorded nesting islands for this species were discovered and are additional to the list given by Serventy and Whittell (1951, p. 92). These are Douglas, Christmas and Nares, and the species possibly nests also on Boxer and Mondrain as well.

Weight of bird: 55 gm.

Dimensions of eggs: (a) wt. 12.5 gm.; 37.6 x 26.4 mm.

(b) wt. 15.0 gm.; 36.7 x 27.5 mm.

NOTES FROM VARIOUS ISLANDS:

BOXER: A bird was found in a tent at 5 p.m. It was not there earlier in the day, so possibly an overcast sky may have tempted it out of a burrow before dusk. No burrows were actually found.

MONDRAIN: A small hole about two inches in diameter was commenced in the floor of one of the tents after an absence of several days.

MIDDLE: A number of small abandoned burrows. However, it is possible that these were the work of lizards rather than birds.

DOUGLAS: The Storm-Petrels were found breeding for the first time on our trip. The tunnels were often three or four feet in length, but of very shallow depth. As a rule the end would be a few inches below the surface. Some tunnels were straight, but where an obstacle occurred the direction changed. Roots and rocks are probably the causes of most of the windings in tortuous petrel burrows, so common on these islands in contrast to the straighter burrows on the more sandy and vegetation free west coast islands, with which I am more familiar. The birds were always quiet when handled. The burrows, although requiring opening up at the entrances, would just permit of the entry of an arm. On this island the Noon-flower (*Disphyma australe*) formed an excellent covering to the ground, and its matted structure made a solid roof to the burrows.

CHRISTMAS: Many burrows found, in all cases containing eggs.

NARES: This island was separated from the mainland only by a narrow channel about twelve feet wide. There were four nesting burrows, but one was empty.

No birds were observed at sea.

Hull (l. c., p. 281) was the first to record this bird as a breeding species on the Recherche and he found a strong breeding colony on Lion (birds on eggs) on November 26th, and an abandoned colony on Rob. D. L. Serventy found burrows on Woody (unused), Lion and Marts, the estimated breeding population on a rookery in the last-named being 5,000 pairs.

7. LITTLE SHEARWATER, *Puffinus assimilis* (Gould, 1838).

Tunney discovered this species as a local breeder on Boxer, and Mathews described his specimens as constituting a new race, *P. a. tunneyi* (1912, vol. 2, p. 71). Fleming and Serventy (1943, p. 115) refer to *tunneyi* all the Western Australian nesting populations of this species.

Hull did not meet with the species on his survey, but D. L. Serventy (1947, p. 48) recorded it from Lion.

We found two additional nesting islands. Burrows which seemed to be made by this species were found on Wedge, but as the bird is a winter breeder the absence of birds is understandable.

On Combe there was a huge rookery. Here a live bird was found being attacked by a Pacific Gull just near the beach. The whole of the surface of this low, flat island, except the small rocky fringes, is riddled with burrows. Although no estimate of numbers was made, their total would run into tens of thousands. Despite considerable search no other live birds could be found though several dead ones were noticed.

8. FLESHY-FOOTED SHEARWATER, *Puffinus carneipes* (Gould, 1844).

These Shearwaters were seen on practically every sea trip we made, and burrows were found on many of the islands inspected. Our visit was made just prior to the egg-laying season and hence the birds were not fully in residence.

Weight of birds: 570 gm. 680 gm.
600 gm. 740 gm.

NOTES FROM VARIOUS ISLANDS:

FIGURE OF EIGHT: Although a number of burrows showing fresh marks of digging were searched, no birds could be found. However, the whole of the central portion of the island is a rookery. Actually, wherever there is soil there are burrows and this applies to most of the islands in this archipelago.

BOXER: There were a number of burrows, but the ground generally is unsuitable. There seemed to be more burrows on the south end of the island, where ten burrows to about 100 square yards seemed to be a fair average for the area. No adults were found.

SANDY HOOK: Here a fertile valley rising from the beach divided the island into two parts, and it was only in the valley that burrows were found. The adults were seen flying in around seven p.m. on November 10th. Although it was not yet dark the birds would circle for some time and apparently landed farther up the valley. A few were caught and banded, most being very vicious when handled.

REMARK: In a Yate forest burrows were plentiful, all very deep, exceeding six feet in length and winding around root systems, proving very difficult to dig out. Much of the island is rocky and the Shearwaters were confined to this valley.

LONG: One huge rookery. Many birds were calling on November 11th. One bird was dug up and when disturbed did not try to fly. It fluttered over the ground in the shade of the *Melaleuca*, and was left still resting on the ground. Two birds, but no eggs, were found together in one burrow.

MONDRAIN: A huge and noisy rookery. At night the whole island was vocal, but as the hours drew on the calls subsided to a soft murmuring, the bulk of the calls being associated, probably, with the arrival of birds, either mates or intruders. The incoming birds landed through gaps in the tree canopies where the burrows were among timber. Occasionally they were caught in the branches. A few days later the birds became noisier, the calls continuing until 4 a.m., when most of them left. Before dark in the evenings small rafts of birds could be seen waiting on the water.

NORTH TWIN PEAKS: A number of burrows where the soil were suitable.

SOUTH TWIN PEAKS: A fairly rocky island and a few burrows present. They were freshly scratched, but there were no occupants.

DOUGLAS: A few burrows.

CHRISTMAS: A few burrows. This island is the furthest east nesting station of the species in Western Australia.

WOODY: Only a few burrows. With the heavy grazing and the firing of the island, a tall crop of introduced grasses has developed. It was found, throughout, that burrows were rarely excavated in such places. The matting of the dead grass apparently prevents the Shearwaters from digging. The most favoured places seem to be in forested areas, though ground covered by shrubs also provides a suitable nesting site.

THOMAS: This island was visited subsequently on March 25th, 1951, and a few burrows were found. They were occupied by large young still in down, but with some of the primaries beginning to show.

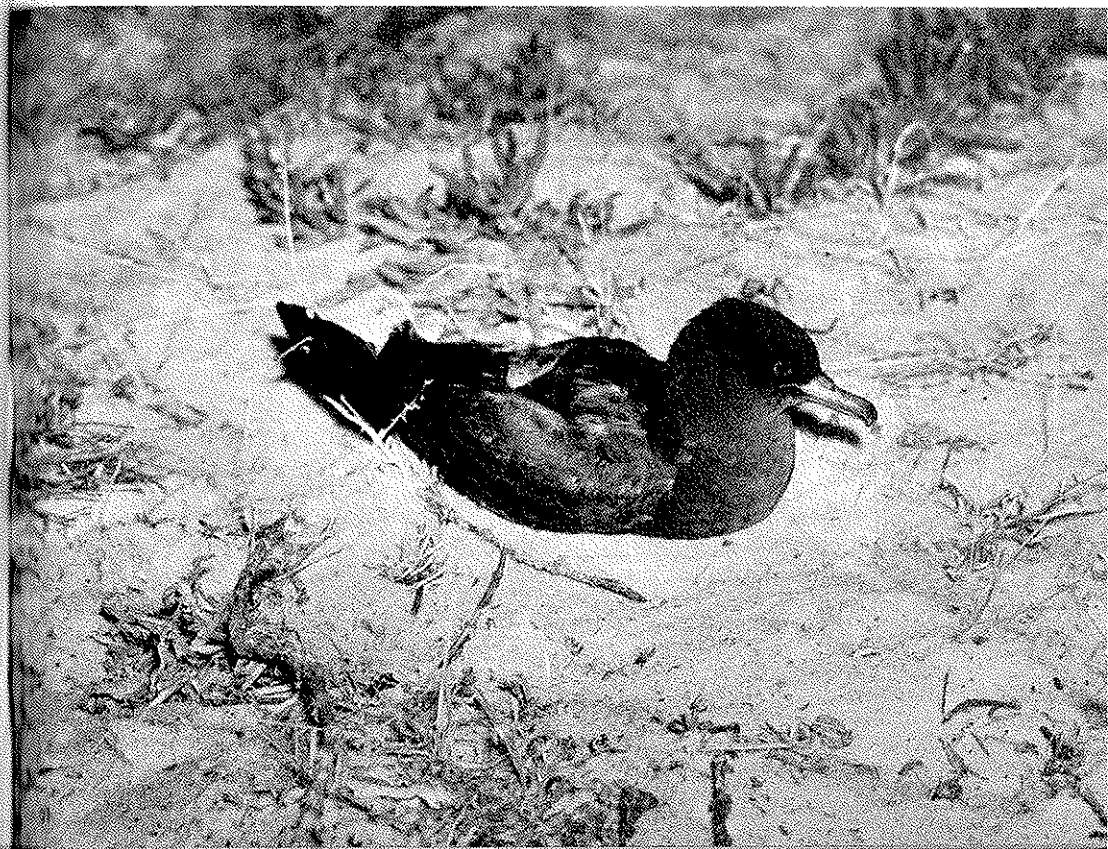
The nesting islands in the above list which have not previously been recorded as such (*vide* Serventy and Whittell, 1951, p. 97) are Remark, Long, North Twin Peaks, South Twin Peaks and Douglas. Additional islands recorded by Serventy and Whittell are Charley, Rabbit, Gunton, Cliff, Station, Owen, Stanley, George, Gulch and Corbett; thus twenty-two islands of the Recherche are now known as breeding places of this species.

A specimen collected on Sandy Hook by Tunney was used as the model for the coloured figure of the species in Mathews's *Birds of Australia* (1912, vol. 2, p. 76).



Black-faced Cormorants on "Parents' Rock" at Middle Island

(Below) Fleshy-footed Shearwater at night, Sandy Hook Island



9. SHORT-TAILED SHEARWATER, *Puffinus tenuirostris* (Temminck, 1835).

Three beach-drifted specimens of this south-eastern Australian breeding species were found by D. L. Serventy at Esperance in April, 1948, and one, farther west near Hopetoun, in November, 1946 (1948, p. 131). The nearest nesting island is St Francis Island, at the eastern end of the Great Australian Bight, and these records indicate that the species forages at least as far west as the Recherche, the feeding range overlapping widely that of *P. carneipes*, which is commonly reported in South Australia.

10. GREAT-WINGED PETREL, *Pterodroma macroptera* (Smith, 1840).

Thomson and Shipway (1948, p. 349) were the first to discover this winter-breeding species as nesting in the Recherche, at Goose Island. We found their excellent account of the normal breeding sites to be fairly typical of the conditions on the five additional islands where we discovered it.

However, with regard to the burrows, which are normally shallow, some individuality is shown. Possibly the species may take over the burrows of the summer-nesting Fleshy-footed Shearwater. Certainly many of the burrows on Goose were four to five feet deep, and though immature birds of the present species were found on our visit, and no Fleshy-footed Shearwaters were seen, it is possible that both species may occur here.*

Serventy and Whittell state that the bird is quieter and more docile than species of the genus *Puffinus*, but the younger birds in down we found to be quite aggressive. The beak would normally strike hard enough to draw blood unless the birds were handled with gloves.

We found the birds nesting on Boxer, Figure of Eight, Termination, Goose, Christmas and possibly Douglas, where some burrows were found which appeared to be of this species. Termination had the most birds at the time of our visit, several dozen immatures being present. Most of the birds here were in quite exposed situations under rock ledges. One immature was weighed and found to be 540 gm. It gave a piping cry when handled and also disgorged food.

Birds were found in burrows on Figure of Eight and in caves on Boxer. Here a dead bird was found, while the whole of the cave floor was patterned with tracks. A few birds called softly from burrows under the rock, but attempts to dig them out were unsuccessful.

It is probable that a more patient search during the breeding season will considerably extend the number of islands on which this species breeds.

Before closing these notes on the nesting petrels it might be of interest to refer to their reactions to moonlight. Our visit coincided with a *waxing* moon between November 10th (new) and November 25th (full). At Mondrain (November 12-18) we were able to note the effect between the new moon and its first quarter, while at Middle Island (November 23-25) the moon was full.

We found that as the moonlight increased the petrels avoided coming in to land. This applied to the Fleshy-footed Shearwater particularly, since it was approaching its egg-laying period. Before the

* Tunney, in his manuscript diary, listed *Puffinus pacificus* as occurring on Goose. This species does not breed on the south coast, and he obviously made an error in identifying either *P. carneipes* or *Pterodroma macroptera*.

moon had risen to maximum brightness rafts of birds could be seen in the early afternoon, waiting for dusk. After that period birds were often seen far out at sea fishing, but none was waiting to land and the nights were quiet. For the remainder of our trip, during bright moonlight, our camp-sites were silent places compared with those of the first ten days of the voyage.

However, this disinclination to land during moonlight may have been only apparent and a pure coincidence. If this migratory Shearwater behaves in a parallel manner with the Tasmanian *Puffinus tenuirostris* it would observe a rigid nesting time-table. Though the *tenuirostris* rookeries are clamorous during the courtship period they are entirely deserted for about a fortnight or so immediately prior to the egg-laying (Campbell, 1901, p. 885).

The White-faced Storm-Petrels, which were already incubating eggs, appeared to be unaffected by the variations in moonlight.

Another point of interest is that even in dark caves Great-winged Petrels still burrowed. Desire for darkness is apparently not the only stimulus to burrowing.

11. CAPE PETREL, *Daption capensis* (Linn., 1758).

D. L. Serventy observed one bird east of Cape Pasley in June, 1948.

12. YELLOW-NOSED ALBATROSS, *Diomedea chlororhyncha* (Gmelin, 1789).

One bird was seen flying between Termination and Mondrain on both trips. Three individuals were seen together, resting on the water, near Israelite Bay.

D. L. Serventy found the species plentiful in the waters about the Recherche in cruises during June and July.

13. BLACK-BROWED ALBATROSS, *Diomedea melanophris* (Temminck, 1828).

In June, 1948, D. L. Serventy saw an adult bird on two occasions east of Middle Island.

14. WHITE-CAPPED ALBATROSS, *Diomedea cauta* (Gould, 1841).

D. L. Serventy saw one individual in July, 1947, off Christmas Island. It had a grey head and mantle. The movements of this species in southern Australia are not yet clearly understood nor the significance of the colour phase with grey head and mantle which occurs, in addition to the more frequent white-headed birds, in both east and west.

15. BLACK-FACED CORMORANT, *Phalacrocorax fuscescens* (Vieillot, 1817).

Of sparse occurrence on the islands. We met with the birds at the following localities, numbers of individuals being given in brackets: Burton's Rock (3), Cloud (2), Mondrain (1), North Twin Peaks (3), Israelite Bay (1), Nares (3) and Middle—the last-named providing the only nesting rookery found on the trip.

It is interesting that Andrews in 1889 recorded a rookery in exactly the same spot as it exists today. The site is at the foot of Flinders' Peak on the north side of the island. The rock here is covered with excreta. On being approached by boat the birds did not take off, even though approached within thirty feet. Sticks and stones thrown near

them made no difference. An inspection by land showed many old nests on rocks, right at the sea edge. The large young had a front of brown feathers and the neck was also brown though merging into black. They lacked the clean-cut appearance of the adult birds.

As already suggested, a striking feature of the rookery was the tameness of the birds. The large young would allow of an approach to within five or six feet. Brooding birds would not move until intruders came within about twelve feet. An adult landed on our boat while we were having lunch.

The rookery comprised occupied nests, of which the following is an inventory on November 23rd. One nest contained eggs, a clutch of two. Each weighed 40 gm., one measuring 56.6 x 37.2 mm., and the other 53.5 x 36.9; they were light blue with a white coating, one being so heavily coated as to conceal all the blue. Three nests had small young, one in each, and all appeared to have only been hatched a few days. The fifth nest contained two large young still in down. In addition, there were thirty-one young birds still unable to fly any distance.

In feeding the adult would fly in, black feet pushed forward and webs well spread, the wings beating rapidly and gular pouch distended. Any young bird in the vicinity would begin to beg for food, but the first might be pushed aside by another. Apparently both adults and young at this stage were able to recognize one another, since the nest sites were no longer used, all the large young clustering together in groups on the seaward rocks. In the begging attitude the young bird spread out its wings, bent the tail upwards and distended its gular pouch, which from the front looked remarkably large and yellowish pink. With its beak it pecked at the parent's neck. After a short interval, of possibly ten to twenty seconds, the adult bent down with mouth open. The youngster plunged its beak inside and food was seen passing between them. This process took about ten seconds, occasionally repeated, and was a very active one, almost aggressive in character. The parent, still besieged by the youngster, eventually flew away, sometimes pecking savagely at other young birds which attempted to beg food. After a wide circle out to sea the bird returned to an isolated rock nearby. About a dozen adults were perched here, so doubtless this was a "parents' rock", inaccessible to importunate youngsters.

On one occasion an adult was flushed off a nest containing a just-hatched chick. A large young bird began to peck at the moving chick. The parent immediately flew in from a rock nearby and drove off the attacker, then commenced to brood the youngster.

Altogether the situation provided a nesting site pleasant in the extreme. There was practically none of the objectionable smell common to cormorant rookeries. Possibly winter storms would wash the area clean each year, and thus enable the birds to use it for long periods. With other species the rookery site varies from year to year, probably to rest the area and allow fresh shrubs to grow.

No cormorants were seen at the Eastern Group (Christmas and adjacent islands), nor did D. L. Serventy record them on his several visits. Captain Pedersen has suggested that their absence is due to there being no shallows; all the shore lines are steep-to. This may explain the absence of the birds from the outer islands as well.

A specimen collected by Tunney at a small island two miles from North Twin Peak was made the type of a new sub-species, *P. f. tunneyi*, described by Mathews (1912, p. 88). A coloured figure is given in his *Birds of Australia* (1914; vol. 4, pl. 221).

16. BLACK CORMORANT, *Phalacrocorax carbo* (Linn., 1758).

One bird was seen at Combe and three on the mainland at Israelite Bay.

17. AUSTRALIAN GANNET, *Sula serrator* (Gray, 1843).

This species is only a winter visitor to Western Australia from Bass Strait and Tasmania. Three birds were seen during our visit, probably laggards. Willis saw one at Boxer on November 8th. A bird was seen on the way to Mondrain, and the third when approaching North Twin Peaks on November 19th.

18. CASPIAN TERN, *Hydroprogne caspia* (Pallas, 1770).

This species was fairly widely distributed over the archipelago. The following observations were made, with the numbers seen in brackets.

Boxer (2), Round (1), North Twin Peaks (2), Cave (2), Middle (2), Douglas (2, and one nestling still in down), Goose (nest with two eggs), Christmas (1), Nares (1) and Israelite Bay (nest with two eggs).

The chick had an orange beak with black tip, both inside and externally and the tongue also was orange. The legs were pale yellow. Feathers light grey. The eggs (from Goose Island) weighed 60 gm. each and measured 66.0 x 44.3 and 67.9 x 43.4 mm.

19. CRESTED TERN, *Sterna bergii* (Lichtenstein, 1823).

The following birds were noted during the voyage: Near Dempster's Head, Esperance (21), Boxer (3), Remark (1), Long (several), Cloud (several), Mondrain (2), Finger (20-30), North Twin Peak (3), Wedge (20), Combe (1), Goose (1) and Christmas. On this last-named island 200-300 birds were met with in the screaming flock which is a prelude to nesting. Possibly the small number of birds met with elsewhere was due to this concentration.

20. FAIRY TERN, *Sterna nereis* (Gould, 1842).

Noted only at Boxer (4 birds) and Israelite Bay (1).

21. SOUTHERN SKUA, *Stercorarius skua* (Brünn., 1764).

Sanders reported one bird at sea on the return from Salisbury. D. L. Serventy found the species fairly plentiful in the winter months.

22. ARCTIC SKUA, *Stercorarius parasiticus* (Linn., 1758).

D. L. Serventy reported two birds on separate occasions in January, 1944, which were attributed to this species (1947, p. 49). On July 16, 1947, he definitely identified a bird in the dark phase, with pointed middle tail feathers, off Christmas Island—a rare observation of a wintering bird in Australian seas.

23. SILVER GULL, *Larus novae-hollandiae* (Stephens, 1826).

These birds were not plentiful on the islands during our visit, possibly due to the withdrawal of breeding colonies back to the mainland. Just under 100 birds were counted on Esperance beach prior to our departure. The following numbers were encountered at the islands: Figure of Eight (10, which appeared about to begin nesting), Boxer (c. 6), Sandy Hook (1), Remark (1), Long (1), Hastings (1), Mondrain (1), Termination (1), North Twin Peak (1), Cave (2), Combe (1), Douglas (1), Goose (6 and some old nests), Middle (several at the cormorant rookery, two being young and apparently the gulls had



Young Great-winged Petrel



Nest of Pacific Gull, with newly-hatched chicks

nested there), Christmas (1), Nares (1), Woody (1), Thomas (1) and Israelite Bay (several).

24. PACIFIC GULL, *Gabianus pacificus* (Latham, 1801).

Well distributed throughout the archipelago and found nesting. We saw their shell-cracking platforms on all of the islands visited, most of the remains being fairly fresh.

Dimensions of eggs: Weight,

- (a) 105 gm.; 80.4 x 51.1 mm.
- (b) 95 gm.; 81.4 x 51.2 mm. (Just chipping.)
- (c) 70 gm.; 73.5 x 47.5 mm. (Just chipping.)
- (d) 85 gm.; 75.5 x 49.5 mm. (Just chipping.)
- (e) — 72.3 x 54.5 mm. (Just chipping.)
- (f) — 74.6 x 53.7 mm. (Just chipping.)
- (g) 95 gm.; 76.2 x 51.2 mm. (Just chipping.)

NOTES FROM VARIOUS ISLANDS:

FIGURE OF EIGHT: Two adults nesting; two eggs in a nest built in the beach shingle.

BOXER: One adult came to our camp.

SANDY Hook: One bird.

REMARK: One bird in immature plumage.

LONG: One adult.

CLOUD: Two adults.

MONDRAIN: Three pairs were seen. In one case two young were found, both on *Carpobrotus*, some yards from the nest. The strong black beak had a yellow tip and the legs were a greyish-black. When replaced on the nest for the purpose of a photograph, both nestlings kept heading for the original hiding place and eventually sheltered in my shadow. Apparently after a certain age the young forsake the actual nest and hide in nearby shrubs. On another rocky headland a nest with two eggs was found. Again the nest was in the open, but there were bushes nearby. The behaviour pattern of the adults was somewhat similar in each case. A few hundred yards from the nest the adults, either both or more usually only one, began to call. This note sounds something like "Ow-Ow", a somewhat long note. As the nest was reached the call came in a shorter and sharper fashion, but still sounding like "Ow-Ow-Ow".

ROUND: A nest with two young chicks.

NORTH TWIN PEAKS: Four adults, of which one pair was almost certainly nesting, though time did not permit the finding of the nest.

CAVE: One nest with a large chick.

WEDGE: Two adults showing nesting behaviour.

COMBE: One adult killing a Little Shearwater; one large young also found.

MIDDLE: Nest with two young.

DOUGLAS: One adult.

GOOSE: One nest with two eggs. Another old nest was within a foot of this, and both were largely composed of a grass, *Poa sp.*

SALISBURY: Nest with two just-hatched chicks was found on a large rock near the sea.

CHRISTMAS: Two nests found within fifty yards of each other, the first with two eggs (in which the chicks could be heard cheeping) and the second with one.

NARES: An empty nest, the two adults calling overhead.

WOODY: One adult.

THOMAS: In March, 1951, there were two adults and one large young flying.

On the beach at Esperance on our return were counted eight mature Pacific Gulls, sixteen in almost mature plumage and nineteen in the all-brown stage. At Israelite Bay and Duke of Orleans Bay there were single birds.

A specimen collected by Tunney on Mondrain was used by Mathews to illustrate the species in colour for his *Birds of Australia* (1913, vol. 2, pl. 121).

25. TURNSTONE, *Arenaria interpres* (Linn., 1758).

A group of 30-40 birds was seen on Termination and 6 on Combe.

26. SOOTY OYSTER-CATCHER, *Haematopus fuliginosus* (Gould, 1845).

This species wholly replaced the Pied Oyster-catcher on the islands, and it was met with throughout. The following numbers were recorded: Figure of Eight (2), Boxer (at least three pairs), Sandy Hook (2), Remark (2), Pasco (2), Hastings (1), Mondrain (1), Termination (3), Round (2), North Twin Peaks (3), Cave (2), Wedge (2), Combe (4), Middle (1), Douglas (1), Goose (1), Salisbury (1 pair), Christmas (2), Israelite Bay (2), Point Malcolm (3), Nares (2), Woody (1) and Thomas (2).

At Boxer a chick was found by Mackenzie, the young bird being in fresh water up to its belly, with the beak submerged and only the nostrils projecting. Two adults were calling continuously nearby.

A nest at Salisbury was found under a rock ledge just above high water mark and three feet under the overhanging ledge. It was a depression in the ground with no lining. The ground colour of the eggs was a dull bluish-grey, plentifully streaked with dark brown over the whole of the surface, and with dull brown flecks. Dimensions:—

(a) Weight, 58 gm.; 63.0 x 41.6 mm.

(b) Weight, 40 gm.; 65.9 x 42.7 mm.

A nest probably belonging to this species was found under a rock ledge at Mondrain and another among shingle at Cave.

The Pied Oyster-catcher (*Haematopus ostralegus*), characteristic of sand beaches, was not seen at all on the islands. At Esperance parties of up to six individuals were noted. At Israelite Bay there was a group of two adults and two young and another of two adults and one young.

27. BANDED PLOVER, *Zonifer tricolor* (Vieillot, 1818).

D. L. Serventy saw two birds at the Pink Lake, Middle Island, in July, 1947.

28. RED-CAPPED DOTTEREL, *Charadrius alexandrinus* (Linn., 1758).

Two birds were present at the Pink Lake, Middle Island.

It might be mentioned that T. C. Andrews (ms.) recorded that "snipe, plover and curlew make their homes" on the shores of Pink Lake, indicating that various waders visit the locality in the season.

29. LITTLE STINT, *Erolia ruficollis* (Pallas, 1776).

Noted at Observatory (29 birds), Boxer (20), Cave (2), Wedge (20-30), Israelite Bay (200-300), and Esperance (12).

30. WHITE-FACED HERON, *Notophöyx novae-hollandiae* (Latham 1790).

D. L. Serventy saw one individual on Christmas Island in July, 1947, the bird being at a small fresh water pool in the granite.



White-faced Storm-Petrel, with egg, removed from nesting burrow at Douglas Island



Cape Barren Goose, swimming in the sea near Boxer Island

31. REEF-HERON, *Demigretta sacra* (Gmelin, 1789).

One individual was seen on Middle and another on Goose—both of the dark grey phase.

32. NANKEEN NIGHT-HERON, *Nycticorax caledonicus* (Gmelin, 1789).

We saw no birds on the whole trip. Hull, however, reported a colony of at least forty pairs breeding on Lion in 1921, but they were not there when D. L. Serventy visited the island in 1944.

33. CAPE BARREN GOOSE, *Cereopsis novae-hollandiae* (Latham 1801).

The Cape Barren Goose has featured in most of the natural history references to the Recherche, from Labillardiere on.

Labillardiere recognised it as a new species and considered it a kind of swan. In the official account of this cruise (de Rossel, 1807-08) it is stated that Riche, the zoologist of the expedition, proposed to name it *Anas Terrae Leeuwin*.

NOTES FROM VARIOUS ISLANDS:

FIGURE OF EIGHT: Three birds. Two of these allowed me to approach within about ten feet. Both flew for a short distance, then ran into the water. They did not seem to be able to swim very well and drifted towards Boxer. Later they worked their way to the shore and came out. It may be mentioned that Figure of Eight is unusual among the Recherche Islands in possessing a sandy beach with a good landing. The day was very calm. Serventy and Whittell (1951, p. 188) state: "It can swim, but rarely does so except before it is fully fledged and when wounded". Apparently individuals are variable in this respect. Normally ability to swim, or perhaps better, a tendency to land in the water, would be fatal, since most of the islands have sloping sides as landing places and these would not be easily negotiated by a goose. At Termination, for instance, we found a waterlogged goose almost drowned. It was much lower in the water than in the normal swimming position, with only part of the back and the head and beak out of the water. It was rescued and released at the next island we came to (Round). The bird had apparently fallen into the sea from Termination, which is extremely difficult to land on, and certainly impossible for a swimming goose. However, on other islands birds may have learned that swimming is one method of avoiding danger. The Figure of Eight birds took to the water without hesitation, and on other islands we saw birds sliding down rocks into the sea, in preference to flying. These all appeared adult birds.

BOXER: Seven birds seen. One large young bird was caught and banded. Another six birds were seen in one flock, which, from a distance appeared to be like young emus. There was a strong wind at the time and the birds made no attempt to fly. Although they ran quite swiftly we had little difficulty in capturing one. It appears that the method of escape is modified by local conditions.

Sandy Hook (1 bird), Long (12), Hastings (6), Cliff (3), Termination (12), Round (2), Wedge (4), Combe (6), Douglas (1), Christmas (12) and Thomas (6).

Although the species has been on the totally protected list since 1938 hunting still continues. Fresh cartridges were picked up on Thomas Island on the visit on March 25th, 1951. Also since many geese are openly kept in local fowlyards it is obvious that the law is being flouted with impunity. As practically all parties visiting the islands start from Esperance, it would be a simple matter to inspect returning boats and prosecute offenders. Informational notices should also be posted

on the main jetties to warn those who may at present be sinning in ignorance.

The number of individuals recorded in the above survey definitely indicates that even on the outer islands, where shooting cannot be a factor, the birds are far from plentiful. Indeed it appears likely that the local environment never harboured a really numerous population. Flinders (1814, vol. 1, p. 87; vol. 2, p. 266) killed sixty-five at Goose Island and its vicinity in January, 1802, and complained he was only able to take twelve in May, 1803. Mr W. E. Dempster informed us that Cape Barren geese were appreciated as table birds in the old days at Esperance. On one occasion he brought home 18 fat geese and stated that when caught young they were easily domesticated. He blamed the survey vessel, H.M.S. *Waterwitch*, 1897, for a serious diminution in numbers.

Mr N. E. Stewart (personal communication) states: "Cape Barren geese in my opinion are scarcer than they were, say, ten years ago. On our last trip we never counted more than fifty on any island. Ten years ago I have seen over eighty in one flock, and that not on an isolated island. Mr Glauert mentioned the *Kybra* and the excursions made to catch geese and bring them back for Christmas. The islands where they used to go were renowned for geese, but now one is lucky to see half a dozen in these same islands. I refer to Owen, Stanley, George, Miles, Gulch and Goose Islands".

A specimen collected by Tunney at North Twin Peaks was described by Mathews as the type of a new sub-species, *C. n. georgi*, larger and darker than Bass Straits birds (1912, vol. 4, pl. 204). However, if this sub-species is valid, the name published by de Rossel (*terrae-leeuwin*) would have priority.

34. AUSTRALIAN GOSHAWK, *Accipiter fasciatus* (V. and H., 1827).

None seen by our party. D. L. Serventy recorded a bird on Charley in 1944.

35. WEDGE-TAILED EAGLE, *Uroaetus audax* (Latham, 1801).

Individuals seen at Mondrain and Middle. Andrews (ms.) reported nesting at the latter island.

36. WHITE-BREASTED SEA-EAGLE, *Haliaetus leucogaster* (Gmelin, 1788).

An immature individual was seen at Combe.

An old nest was found at Boxer. This was at ground level, but built in the butt of a tree, about half-way up the hillside.

At Remark a pair of birds came under notice and an occupied nest found. This contained one egg and one dead young bird, the body being still warm. Leaves of *Agonis marginata* were on top of the nest.

One bird on Mondrain.

At Termination an eagle flew off a nest on our landing. This proved a remarkable structure. A number of nests had joined together, probably under the influence of the wind. The total effect was of an extremely large nest sprawling over the rocks. Five other nests were also close by. Two dead Great-winged Petrels and one Fairy Penguin were found in the large nest, where also fresh sprays of *Lobelia anteps* had been placed by the birds.

Willis reported an eagle's nest from North Twin Peaks.

An adult bird was seen circling Flinders' Peak at Middle.

On Goose four nests were discovered, two of them being in rock crevices, or in other words possessing a roof. However, it is possible that some of these may have belonged to an Osprey.

Béchervaise reported a nest at Douglas.

On Christmas was an old nest on the top of the northern peak, and a large young occupied a nest half-way down the peak.

37. PEREGRINE FALCON, *Falco peregrinus* (Tunstall, 1771).

None observed by our party. In 1921 Hull found two pairs nesting on Lion, and D. L. Serventy saw one on the same island in 1944.

38. (?) GREY FALCON, *Falco hypoleucus* (Gould, 1840).

Hull reported a White Goshawk (*Accipiter novae-hollandiae*) at Woody, but as this species does not occur in Western Australia, south of the Kimberley Division, it was probably the Grey Falcon which was concerned. Béchervaise reported a bird, which seemed to be the Grey Falcon, at Israelite Bay.

39. NANKEEN KESTREL, *Falco cenchroides* (V. and H., 1827).

One bird at Boxer and a pair at Christmas. Hull saw one at Gunton.

40. BROWN HAWK, *Falco berigora* (V. and H., 1827).

Hull found a pair breeding on Charley.

41. OSPREY, *Pandion haliaetus* (Linn., 1758).

One bird seen at Goose and another at Salisbury.

42. (?) BARN OWL, *Tyto alba* (Scopoli, 1769).

Béchervaise observed a white owl on Sandy Hook and Hull mentioned that owls had been reported from Lion. Probably this would be the most likely species.

43. PURPLE-CROWNED LORIKEET, *Glossopsitta porphyrophala* (Dietrichsen, 1837).

D. L. Serventy observed one bird flying over Marts.

44. ROCK PARROT, *Neophema petrophila* (Gould, 1840).

We made the following records:

Figure of Eight (6 birds), Boxer (5), Remark (1), Sandy Hook (several), Pasco (1), Mondrain (2), Round (4), North Twin Peaks (4), South Twin Peaks (several), Wedge (12), Combe (over 12), Middle (1), Goose (a few), Christmas (5), Woody (20) and Thomas (20).

Hull and D. L. Serventy found the birds also on Lion and Charley. At New Year (near Christmas) the latter observer estimated a population of at least 100 birds in June, 1948.

45. SACRED KINGFISHER, *Halcyon sancta* (V. and H., 1827).

D. L. Serventy saw one bird at Middle Island, in the eucalypt forest, in June, 1948. Though most of the birds of this species leave the southern parts of the State for the north during the winter months, a small percentage of individuals remain.

46. PALLID CUCKOO, *Cuculus pallidus* (Latham, 1801).

On June 15, 1951, N. E. Stewart heard, from F.R.V. *Warreen*, which was anchored at the island, a bird calling on Sandy Hook.

47. WELCOME SWALLOW, *Hirundo neoxena* (Gould, 1842).

These birds were seen on most of the islands visited.

No accurate counts were attempted, but the following are the actual locality records:

Observatory, Boxer, Sandy Hook, Remark, Long, Pasco, Mondrain, Termination, Round, North Twin Peak, South Twin Peak, Cave, Wedge, Combe, Middle, Douglas, Goose, Salisbury and Thomas. D. L. Serventy also noted the species at Charley, Woody, Lion, Marts and Christmas (including adjoining islets).

A nest with two eggs was found in a high cave on Boxer, while another empty nest with a pair of birds in attendance was also found.

48. AUSTRALIAN TREE-MARTIN, *Hylochelidon nigricans* (Vieillot, 1817).

One bird was seen at North Twin Peaks.

49. GOLDEN WHISTLER, *Pachycephala pectoralis* (Latham, 1801).

It would appear that this species is confined to the larger islands, where trees form good thickets. We found it on the following islands:

Sandy Hook (two individuals observed), Remark (6), Long, Mondrain (common), North Twin Peaks and Middle. Hull collected a male on Woody.

50. SPOTTED SCRUB-WREN, *Sericornis maculatus* (Gould, 1847).

We found this species at Mondrain, Middle and Salisbury. The birds were fairly plentiful, but very shy. At Mondrain, where we were camped for some time, they began to venture closer to the camp area after a few days. In the early morning they started singing about four o'clock.

Mathews (1943, p. 78) described specimens from Mondrain, collected by Tunney, as a separate sub-species, *S. m. mondraiini*, on the basis of its larger size than mainland birds.

51. SILVEREYE, *Zosterops australasiae* (Vieillot, 1817).

We noted the birds on Boxer, Sandy Hook, Remark, Long, Mondrain, North Twin Peaks, Middle, Salisbury, Christmas and Thomas. Hull and D. L. Serventy recorded them on Woody.

52. SINGING HONEYEATER, *Meliphaga virescens* (Vieillot, 1817).

The species was noted on the following islands:

Figure of Eight (probably 20-30 pairs), Boxer, Sandy Hook, Remark, Long, Pascoe (4 pairs), Mondrain, Round, North Twin Peaks, South Twin Peaks, Wedge, Combe, Middle, Douglas, Goose, Nares (6), Woody and Thomas.

D. L. Serventy recorded it also on Lion, Marts, Station and Charley.

53. NEW HOLLAND HONEYEATER, *Meliornis novae-hollandiae* (Latham, 1790).

The species was recorded from the following islands:

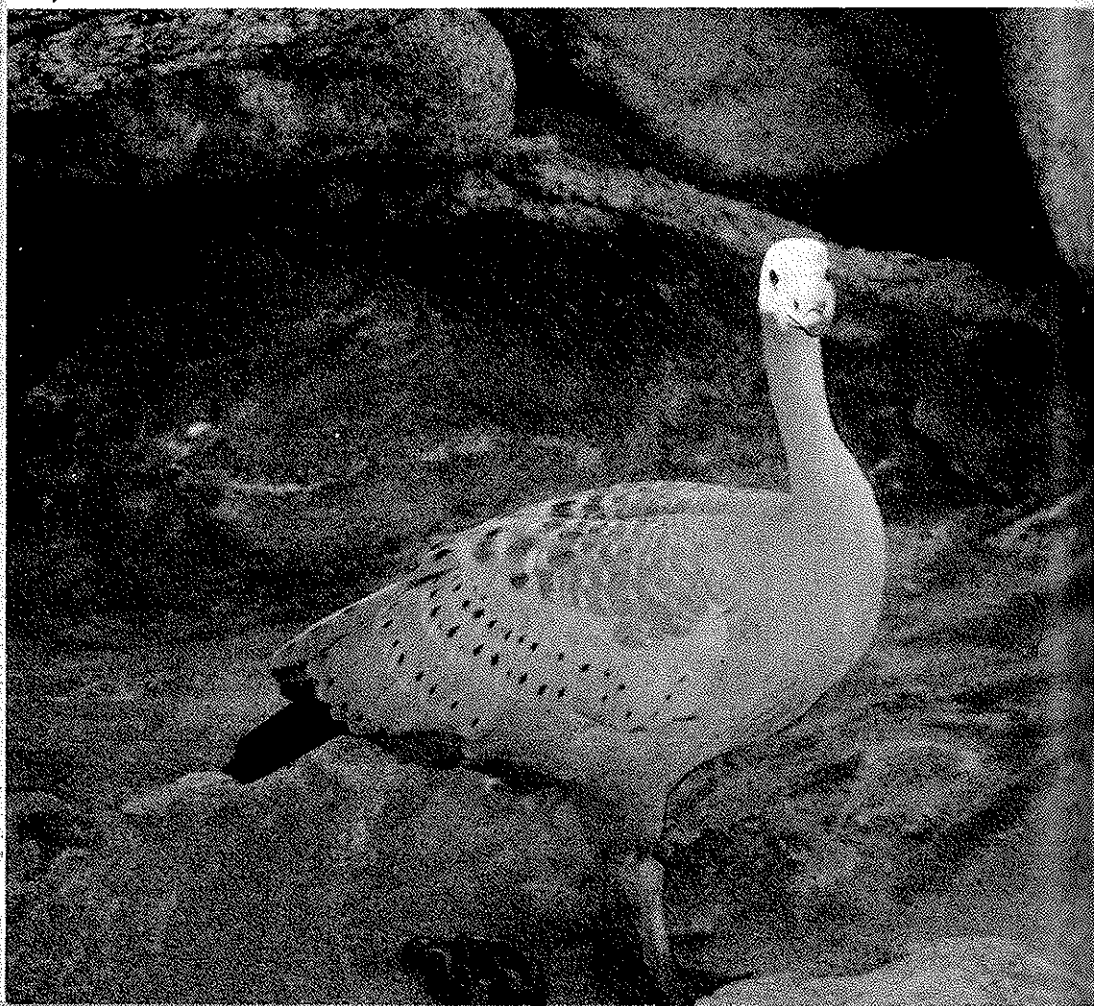
Sandy Hook, Mondrain (feeding on the yate flowers), Middle (family parties with young on the wing) and Thomas. Hull and D. L. Serventy also found it on Woody.

Serventy and Whittell (*l.c.*, p. 344) state that the species is common on those islands which have eucalypt thickets. However, we found a party of six on Thomas, which has no such thickets, though they may have been a party passing through.



Nest of White-breasted Sea-eagle in Melaleuca at Boxer Island

Below: Cape Barren Goose, Combe Island



54. RED WATTLE-BIRD, *Anthochaera carunculata* (Shaw, 1790).

One bird was heard calling by D. L. Serventy in the eucalypt forest at Middle Island in June, 1948.

55. AUSTRALIAN PIPIT, *Anthus novae-seelandiae* (Gmelin, 1789).

Three birds seen on Christmas and two on Thomas. Hull collected a specimen on Woody.

56. (?) RED-EARED FIRETAIL, *Zonaegithus oculatus* (Q. and G., 1830).

Andrews (ms.) referred to "finches and diamond sparrows. There were many young birds among them and the trees were heavily stocked with nests. The ground beneath was strewn with empty egg shells". This was on Middle Island. The nature of the habitat would suggest the Red-eared Firetail as the most likely species to have occurred. The dry country Zebra Finch (*Poephila castanotis*)—the only other alternative—does not normally extend to the coast in this region.

57. RAVEN, *Corvus coronoides* (V. and H., 1827).

We noted the species on the following islands:

Figure of Eight (2 birds), Boxer (1), Mondrain (2), Round (2), South Twin Peaks (2), Combe (4), Goose (2), Middle (2), Christmas (6) and Woody (a nest found).

D. L. Serventy reported a dead bird on Marts. Andrews (ms.) referred to "black clouds" of these birds during his residence on Middle.

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Albatross, Black-browed	11	<i>Meliphaga virescens</i>	21
Albatross, White-capped	11	<i>Neophema petrophila</i>	20
Albatross, Yellow-nosed	11	<i>Notophöyx novae-hollandiae</i>	18
<i>Anthochaera carunculata</i>	23	<i>Nycticorax caledonicus</i>	18
<i>Anthus novae-seelandiae</i>	23	Osprey	20
<i>Arenaria interpres</i>	16	Oyster-catcher, Sooty	16
Bronzewing, Brush	6	Owl, Barn	20
<i>Cereopsis novae-hollandiae</i>	18	<i>Pachycephala pectoralis</i>	21
<i>Charadrius alexandrinus</i>	16	<i>Pandion haliaetus</i>	20
Cormorant, Black	13	Parrot, Rock	20
Cormorant, Black-faced	11	<i>Pelagodroma marina</i>	6
<i>Corvus coronoides</i>	23	Penguin, Little	5
Cuckoo, Pallid	21	Petrel, Cape	11
<i>Cuculus pallidus</i>	21	Petrel, Great-winged	10
<i>Daption capensis</i>	11	<i>Phalacrocorax carbo</i>	13
<i>Demigretta sacra</i>	18	<i>Phalacrocorax fuscescens</i>	11
<i>Diomedea cauta</i>	11	<i>Phaps elegans</i>	6
<i>Diomedea chlororhyncha</i>	11	Pipit, Australian	23
<i>Diomedea melanophris</i>	11	Plover, Banded	16
Dotterel, Red-capped	16	<i>Podiceps poliocephalus</i>	6
Eagle, Wedge-tailed	19	<i>Pterodroma macroptera</i>	10
<i>Erolia ruficollis</i>	18	<i>Puffinus assimilis</i>	7
<i>Eudiptula minor</i>	5	<i>Puffinus carneipes</i>	7
<i>Falco berigora</i>	20	<i>Puffinus tenuirostris</i>	10
<i>Falco cenchroides</i>	20	Quail, Brown	6
<i>Falco hypoleucus</i>	20	Raven	23
Falcon, Grey	20	Scrub-Wren, Spotted	21
Falcon, Peregrine	20	Sea-Eagle, White-breasted	19
<i>Falco peregrinus</i>	20	<i>Sericornis maculatus</i>	21
Firetail, Red-eared	23	Shearwater, Fleishy-footed	7
<i>Cabianus pacificus</i>	15	Shearwater, Little	7
Gannet, Australian	13	Shearwater, Short-tailed	10
<i>Glossopsitta porphyrocephala</i>	20	Silvereye	21
Goose, Cape Barren	18	Skua, Arctic	13
Goshawk, Australian	19	Skua, Southern	13
Grebe, Hoary-headed	6	<i>Stercorarius parasiticus</i>	13
Gull, Pacific	15	<i>Stercorarius skua</i>	13
Gull, Silver	15	<i>Sterna bergii</i>	13
<i>Haematopus fuliginosus</i>	16	<i>Sterna nereis</i>	13
<i>Halcyon sancta</i>	20	Stint, Little	18
<i>Haliaetus leucogaster</i>	19	Storm-Petrel, White-faced	6
Hawk, Brown	20	<i>Sula serrator</i>	13
Heron, Nankeen Night-	18	Swallow, Welcome	21
Heron, Reef-	18	<i>Synoiicus ypsilophorus</i>	6
Heron, White-faced	18	Tern, Caspian	13
<i>Hirundo neoxena</i>	21	Tern, Crested	13
Honeyeater, New Holland	23	Tern, Fairy	13
Honeyeater, Singing	21	Tree-Martin, Australian	21
<i>Hydroprogne caspia</i>	13	Turnstone	16
<i>Hylochelidon nigricans</i>	21	<i>Tyto alba</i>	20
<i>Hypotaenidia philippensis</i>	6	<i>Uroaetus audax</i>	19
Kestrel, Nankeen	20	Wattle-Bird, Red	23
Kingfisher, Sacred	20	Whistler, Golden	21
Landrail, Banded	6	Wren, Spotted Scrub-	21
<i>Larus novae-hollandiae</i>	15	<i>Zonaegithus oculatus</i>	23
Lorikeet, Purple-crowned	20	<i>Zonifer tricolor</i>	16
		<i>Zosterops australasiae</i>	21

THE ARCHIPELAGO OF THE RECHERCHE

Part 3a—LAND FLORA, By J. H. WILLIS

Part 3b—MARINE ALGAE, By H. B. S. WOMERSLEY

Part 4—MAMMALS, By V. N. SERVENTY

The Australian Geographical Society's Expedition to the Archipelago of the Recherche, Western Australia ($33^{\circ}37'-34^{\circ}28'$ S. Lat.; $121^{\circ}30'-124^{\circ}10'$ E. Long.), took place during the month of November, 1950.

A map showing route and dates of landing on the various islands is appended to this paper. Periods of three or four days were spent on the larger islands.

The following islands and contiguous areas of the mainland were visited: Esperance, Figure of Eight (7.11.50), Boxer (9.11.50), Sandy Hook (10.11.50); Remark (11.11.50); Long (11.11.50); Pasco (12.11.50), Mondrain (12.11.50), Termination (18.11.50), Round (18.11.50); North Twin Peaks (19.11.50); South Twin Peaks (20.11.50), Cave (20.11.50), Wedge (21.11.50), Combe (21.11.50), Middle (21.11.50), Douglas (23.11.50), Goose (23.11.50), Salisbury (24.11.50), Israelite Bay (26.11.50), Christmas (28.11.50), Point Malcolm (28.11.50), Duke of Orleans Bay (29.11.50), Woody (30.11.50).

Expedition personnel was as follows:

John Béchervaise (Leader), J. H. Willis (Botanist), V. Serventy (Zoologist), R. Bean (Photographer), I. S. Wilson, M. Farrant. The expedition craft, a 35-ft. Diesel-powered fishing boat, schooner-rigged auxiliary sail, was in charge of Messrs. D. Mackenzie and A. Sanders.

It is planned that the complete report (Report No. 1) of the expedition will be published in several parts, containing: Introductory, General and Historical, Physiography, Birds, Plants, Mammals, Reptiles, Shells, Insects and Spiders.

This section (Report No. 1, Parts 3 and 4—Archipelago of the Recherche: 3a. Land Flora, by J. H. Willis; 3b. Marine Algae, by H. B. S. Womersley, and 4. Mammals, by V. Serventy) is the second published (28th February, 1953). The few needful references to literature in 3a are interpolated for convenience within the text—not at the end of the paper, as is customary.

AUSTRALIAN GEOGRAPHICAL SOCIETY

MELBOURNE, 1953



Clematis microphylla (Goose Island)

3a. LAND FLORA

(including marine flowering plants)

By J. H. WILLIS*

I. HISTORY OF BOTANICAL INVESTIGATION

Initial Work of Labillardiere (1792)

At the Oxford University are preserved original samples of 17 species of plants† brought by William Dampier from the north-west Australian coast in 1699. They constitute the earliest known botanical collection made in Western Australia (or in the Commonwealth) and drawings of several species—including *Diplolana dampieri* and *Clanthus formosus* (Sturt's Desert Pea)—appeared in Dampier's *A Voyage to New Holland etc.*, Vol. 3 (1703); but none of these pre-Linnean specimens were scientifically named or described until 1810. It was the Recherche Archipelago that provided material for the first published descriptions (1799) of any Western Australian plants, including the Yate (*Eucalyptus cornuta*). A peculiar interest therefore attaches to this island region, to the itinerary of the botanist, Jacques Julien Houton de Labillardiere (with the French expedition under Bruny D'Entrecasteaux), who collected these types at the close of 1792, and to the accurate fixation of his collecting sites.

Careful perusal of Labillardiere's journal, *Relation du Voyage à la Recherche de La Perouse*, 1799 (English translation, 1800), discloses that landings were made and plants collected *only on one* westerly island, in the vicinity of Esperance Bay. His *Atlas*, not published until 1811, shows a route that skirts the Recherche Archipelago to the south, passing up then between Middle and Salisbury Islands, nearly touching the western side of Christmas Island and reaching almost to the Nuyts Archipelago (South Australia), before the expedition sailed south and easterly for Tasmania; but the chart is quite inadequate for distinguishing small individual islands.

Identification of the particular island, upon which Labillardiere landed and collected, is still uncertain. John Rintoul (*History of Esperance*, 1946) gives the anchorage of the ship *Recherche* as near Observatory Island, at the western extremity of the Archipelago. However, there are several strong objections to such a decision, and these will now be discussed.

Early on December 10th, 1792, the *Recherche* was (apparently) approaching Butty's Head; then she kept south of an island "connected to the mainland by chains of reefs" [Observatory?]. By late afternoon another island and reefs were passed [Charley or Cull?]. Next day the two ships advanced eastward before a freshening south-westerly wind "towards the centre of a group of little islands, about 5,100 toises [i.e. 6 miles] from the coast"—that would describe the Woody, Thomas and Gunton cluster. Here they threshed about all night in a tempest among dangerous reefs, and near here they doubtless rode at anchor on the 12th. On the 13th, Labillardiere writes the first account of vegetation in this Archipelago:

... The vegetable mould, collected in the least precipitous situations, was covered with shrubs, sometimes so close together as not to be easily penetrated. I plucked a magnificent species of *Leptospermum*, remarkable for its silvery leaves and bright red flowers ... [i.e. *Kunzea sericea* (Labill.) Turcz.]

He had landed at a "little island on the south-west of us ... mountainous, and not more than 2,050 toises in length" [i.e. less than 2½ miles]. He paid a second visit to this island on December 15th and explored its south-western portion, finding that "the summit of one of the highest mountains ... was formed of calcareous stone disposed in strata almost horizontal." Near the highest point he was elated to discover "a little rill of fresh water issuing from a fissure in a granite rock"; also nearby was a grove of *Eucalyptus cornuta*, its "most elevated twigs not above thirteen feet in height."

Thus, the significant features of Labillardiere's "little island" were its mountainous terrain, size (about 2 miles in length), limestone capping and eucalypt forest. Unfortunately, the Australian Geographical Society's expedition of 1950 was not able to land on Observatory; but this island does *not* fulfil the specifications of Labillardiere—it is clearly much less than a mile long, is not at all mountainous,

* National Herbarium, South Yarra, Victoria.

† See T. G. B. Osborn and C. A. Gardner, in *Proc. Linn. Soc. Session 151* (1938/39), pt. 2, pp. 44-50.

and (according to information supplied by Mr. W. E. Dempster of Argyle, W.A.) has had neither calcareous rock nor, at any time, eucalyptus trees.

We can reject Observatory Island* as the landing place described by the French botanist. Does any other island satisfy all the conditions? The longitudes given throughout Labillardiere's journal do not help; they are computed as east of a Paris datum, but are unreliable and valueless for fixing island positions on a modern nautical map. There seems no doubt that, before any landings were made, the French vessels were well within the Archipelago and not merely on its western fringe. Of those islands visited by the A.G.S. expedition in 1950, Woody conforms most closely to the description quoted above. It is hilly and fairly large (at least 1½ miles long), is well-watered and carries groves of *Eucalyptus cornuta*. Moreover, I found on the north coast there all but two of Labillardiere's six island plants, viz. *Muehlenbeckia adpressa*, *Platysace compressa*, *Kunzea sericea* and the eucalypt already mentioned; I failed to locate *Chorizema ilicifolium* and *Lobelia heterophylla* (either here or anywhere else in the Archipelago), but the southern parts were not examined and Woody Island had been burnt during the two previous summers.

The only obstacle to identification of Labillardiere's island with Woody seems to be the absence of limestone from the latter. W. E. Dempster (in letter, 17.7.1951) writes: "I do not think there is any limestone on either Woody or Observatory Islands, both of which I used to visit fairly frequently."

More extensive collections were made by Labillardiere on the adjoining mainland coast (including the sand-plains around Esperance Bay) and there is no record that his island collectings exceeded six species. Consultation of his herbarium and numerous field notes in the botanical institute at Florence University (Italy) by Dr R. Pichi-Sermolli (23/9/1952) has failed to throw further light on the subject.

Visit of Robert Brown (1802)

Nine years after the French expedition, Matthew Flinders cruised for a week along this rugged coast, and big collections (embracing many types) were made then by the illustrious botanist Robert Brown at Lucky Bay on the Cape Le Grand Promontory. Again, only one island was examined botanically, viz. Middle (Ile du Milieu)—largest of the Archipelago and situated in the eastern part, off Cape Arid. Fresh from a surfeit of spectacular and exciting discoveries around Lucky Bay, Brown was not impressed by the less colourful insular vegetation, for Flinders wrote (16.1.1802): "The botanical gentlemen employed the day in going round Middle Island, but they found very little to reward their labour." Nevertheless, the "very little" embraced no fewer than 29 species (attributed to "Goose Island Bay" in Bentham's *Flora Australiensis*, 1863-'78) and 12 of these were novelties later to be described by Brown in his *Prodromus* of the New Holland flora (1810).

From May 18th, 1803, Flinders spent three more days at Middle Island—"cutting wood, boiling down seal oil and killing geese." He had come around the west coast from Timor and wanted a supply of salt from the brine lake discovered 16 months previously, but heavy rains had dissolved it. Brown was lame (from scurvy?) and apparently unable to collect again on Middle Island, had he wished to do so. Peter Good (a plant collector) was very sick and died immediately upon arrival in Sydney on June 10.

Also in 1802, Nicholas Baudin's expedition concentrated on King George's Sound, L. Freycinet working up the botanical collections made during a month's sojourn there (February/March). Baudin perhaps deliberately avoided sailing near the Recherche Archipelago, having in mind the unfavourable report on that region and the work already accomplished by his fellow countryman, D'Entrecasteaux.

Other Collectors

It is possible that Allan Cunningham (Jan. 1818) and William Baxter (between April and August 1829) both collected at Middle Island, but I lack conclusive evidence. George Maxwell of Albany was an assiduous field botanist who, for some 20 years before 1880, collected plant specimens and seeds along 500 miles of southern coast (from Brookes Inlet to the Bight). During the winter of 1863 he assisted Dempster Brothers' exploration party on the mainland coast between Points Malcolm and Culver. He seized this opportunity to botanize much of the coastline beyond Esperance Bay, and while in the vicinity of Cape Arid he certainly collected a little on Middle and Gulch Islands. Maxwell returned to these parts in 1875 and may have visited Middle Island again. His numerous, well preserved specimens fill many sheets at the National Herbarium, Melbourne, samples of at least 13 species being from Middle and nearby islands.

* D'Entrecasteaux's detailed chart of the Recherche (in the Fisher Library, Sydney) definitely indicates a landing on Observatory Island. If this be correct, then Labillardiere's narrative is hopelessly inaccurate.

Botanical investigations within the Archipelago had been virtually at a standstill since Maxwell's time. Dr. F. Stoward procured Bushy Vale (*Eucalyptus lehmannii*) from Middle Island, and G. Simmonds *E. incrassata*, var. *angulosa*, from the same area—both sometime before 1909. G. P. Whitley brought back specimens of two common mosses in 1944, viz., *Campylopus introflexus* from Charley and *Bryum campylothecium* from Remark Island, while Dr. D. L. Serventy gathered about a dozen different flowering plants on Middle and Christmas Islands during the winter of 1948.

Many collectors, however, have operated on the contiguous mainland and records for the Eyre district coastline are very numerous. Maxwell continued his excursions until 1879. Miss S. J. Brooke worked the hinterland of Israelite Bay (back to the Russell Range) very thoroughly during the 1880's, forwarding all her material to Baron von Mueller who described several new species therefrom. Esperance became the centre of much botanical activity and was visited in turn by: Andrew Dempster (its founder, who collected extensively for Mueller between 1870 and 1880), J. Forrest (1870), H. S. Carey (1877), W. Webb (1881), D. Lindsay (Elder Expedition, 1891), L. Diels (1900), L. L. Cowan (1902), C. R. P. Andrews (1903), J. H. Maiden (1909), C. A. Gardner (1931), G. P. Whitley (1944) and J. H. Willis (1947).

At the time of the Australian Geographical Society's expedition (November 1950), only the most meagre data existed concerning the flora of the Recherche islands, and I was unable to list more than 51 species from all previous sources of information—apparently no seaweeds, fungi or lichens had ever been collected, and the record of only a single moss was available. Nothing was known concerning the ecological aspects or regional distribution of plants among the various islands, for the older collectors (Labillardiere, Brown and Maxwell) had examined only a very small fraction of the Archipelago, and their visits coincided either with the summer or winter seasons when little vegetation would be in flower.

It is now possible to give a list of 240 indigenous flowering plants and ferns, 35 naturalized weeds, 22 bryophytes, 36 fungi, 22 lichens and 48 algae, indicating their occurrences among the 20 representative islands encompassed by the A.G.S. team. Of all these species, 46 (including 17 fungi, 14 lichens and 8 algae) are new records for Western Australia.

II. PHYTOGRAPHICAL NOTES ON 20 REPRESENTATIVE ISLANDS

Before discussing the flora of the Archipelago as a whole, I shall briefly describe the major vegetational features of every island on which the A.G.S. party landed. No two were identical floristically, each having an individuality attributable to the composition of the plant communities present, and most islands yielding some species not shared by any others.

It is convenient to consider the islands in groups, from west to east. After the name of each (in heavy type) there is inserted, between square brackets, the maximum elevation in feet, the approximate area (to one-tenth of a square mile), and the number of indigenous vascular plant species now known to occur; where this figure is believed to be still far from complete, it is followed by a + sign.

In this and succeeding sections, most vernacular names (where used) are those appearing in A. J. Ewart's *Flora of Victoria* (1930).

The Western Group

Figure-of-Eight, Boxer, Capps and a few seal rocks constitute the westernmost cluster of Recherche islands.

Figure-of-Eight [383', 0.9 sq. ml., 56 spp.] is a dumbbell-shaped outlier, eight and a half miles off Butty's Head. Wholly granitic and treeless, it conveys an impression of monotony from the sea. The largest shrubs (but more stunted than usual) are *Acacia cyclops*, *Albizzia lophantha* (Cape Leeuwin Wattle) and *Myoporum insulare*, which form limited thickets on the south-eastern slopes. Lower shrubberies of *Pimelea ferruginea* (rosy-headed and very attractive), *Eutaxia obovata*, *Leucopogon obovatus* and *Calocephalus brownii* (white Cushion-bush) occur on the northern and central portions, with much *Frankenia tetrapetala* forming thyme-like mats near the shore. The sandy south-westerly uplands comprise an extensive shearwater rookery; this is overgrown with succulent *Carpobrotus aquilatus* (Angular Noon-flower) which replaces the smaller Rounded Noon-flower, *Disphyma australe*, so abundant on lower slopes and carpeting rocks that are frequently drenched with salt spray. On the eastern side of the very narrow central part is a small sandy beach where a few typical strand plants occur, e.g. *Nitraria schobertii* (Nitre Bush) and *Cakile maritima* (Sea Rocket), but no *Spinifex hirsutus*. Grazing was practised many years ago and is doubtless to blame for the introduction

of eight alien grass species and several other established weeds, none of which has proved aggressive.

Boxer [291', 0.5 sq. ml., 87 spp.], although smaller and 90 feet lower than Figure-of-Eight, has a much more diversified flora. Two days were spent ashore and more intensive exploration was possible than on any other island. There is a large capping of dune limestone which, in the western part, carries a dense thicket of shrubs and a circumscribed forest of *Melaleuca pubescens* (Moonah)—the only myrtaceous plant, attaining 15 feet in height. The eastern portion has only low semisucculent scrub, patches of grass and considerable areas of bare granite rock. A sheltered limestone gully at the north-west extremity carries some very old bulky Moonah trees, a few tall specimens of *Albizzia*, long vines of *Clematis microphylla* and *Tetragonia implexicoma* (Bower Spinach) and a ground cover of tender herbs (*Parietaria*, *Dichondra* and *Galium* spp.).

Toward the centre of the southern coast on Boxer is a large declivity of bare smooth granite, where seepage from the calcareous strata above it affords a suitable habitat for communities of pygmy plants; here grow admixtures of *Hydrocotyle medicaginoides*, *Crassula natans*, very depauperate states of *Juncus bufonius*, *Triglochin trichophora*, *Scirpus* and *Centrolepis* species in moss-like masses. Of outstanding interest is the occurrence on these seepages of the tiny *Centrolepis murrayi*—known previously from the single type collection (Pearson Island in the Investigator Group, South Australia, where Professor T. G. B. Osborn discovered it in January 1923). Another South Australian plant, which proved to be a new record for the Western State, was *Haloragis acutangula*; it grew plentifully on southern limestone slopes, and was later noted also on Middle Island. Vigorous examples of *Spinifex hirsutus* ("silver grass") crept with immense rhizomes at the base of one limestone talus heap on the south coast.

Boxer has also been grazed and parts of it burnt at various times. An old fire area in the west now supports healthy *Melaleuca* regrowth about eight feet tall. More recently burnt areas (e.g. the north-east) are covered with introduced grasses and the ubiquitous Melilot (*Melilotus indica*) which, with *Medicago hispida* and *Bromus gussonii*, has taken possession of open places in several parts of the island.

Esperance Bay Group

Esperance Bay is encircled by ten islands, Charley, Cull, Rabbit and Button forming a cluster off Dempster's Head, while Woody, Thomas and Gunton are the more remote ones—ten miles south-east of Esperance toward Cape Le Grand.

Woody [428', 0.9 sq. ml., 58 spp. +], largest of this group, was the only island on which we made a landing (at the north-east corner). With a good water supply and black fertile soil that will grow excellent clover, Woody has been used for grazing since the 1870's. Mr. W. E. Dempster observes (in letter, 17.7.1951) that until 1879 the island carried a fine eucalypt forest; in that year his father commenced cutting the larger poles, and later most of the remaining timber was used up in fences on the island to keep stock away from the Heartleaf Poison-bush (*Gastrolobium bilobum*) which infested many parts. Some Yate (*Eucalyptus cornuta*) and small Moort trees (*E. platypus*, var.) still grow in the north-east.

Probably small fires occurred there from time to time; but, in the summers of 1949 and early 1950, the whole island was burnt out. Our cursory inspection embraced only a part of the northern coast, which presented a very desolate appearance—sole survivals would seem to be a few shrubs and small trees, mostly hugging the cliff faces. Of the 27 introduced weeds found on Woody 14 were grasses, the dense crops of Wild Oat (*Avena fatua*) being astounding—in favourable places they often exceeded six feet in height, impeding progress over acres of country. The grasses *Aira præcox* and *Vulpia membranacea*, which was noted also on seven other islands, had never before been collected in Western Australia. Already copious seedlings of *Albizzia*, *Rulingia* and *Melaleuca pubescens* were springing up on the burnt earth, and doubtless much other native growth would reappear in the absence of further holocausts. The degeneration in indigenous plant-life as a result of grazing and successive fires on Woody Island is all the more deplorable when one realizes that this is most probably the site of Labillardiere's first collecting in 1792.

Remark Group

Sandy Hook, Long, Remark and Frederick are a compact group, from 5 to 10 miles south-west of Cape Le Grand and 4 to 7 miles south of Woody Island. Landings were made on all but Frederick—a low mass of uninviting aspect (botanically).

Sandy Hook [460', 1.1 sq. ml., 100 spp. +] is probably the most floriferous island of the whole Archipelago, and doubtless many species of plants escaped observation during the hurried excursions made on two consecutive evenings. Nine species,

including the very rare *Boronia scabra*, Fox-tail Mulga Grass (*Neurachne alopecuroides*), two orchids (*Thelymitra fusco-lutea* and *Microtis alba*), *Labichea lanceolata*, *Eucalyptus conglobata* and the *Stylidium pilosum*, were not recorded on any other island. No calcareous collanite was noted on Sandy Hook. A dense eucalypt shrubbery (*Eucalyptus lehmannii* and *E. incrassata* var. *angulosa*), with many smaller shrub associates, extends over the high plateau-like interior—on shallow sand-gravel formation overlying the granite rock which outcrops frequently.

Among these colourful and often ericoid flowering shrubs are: six *Acacia* species, *Gastrolobium bilobum*, *Bossia dentata*, *Templetonia retusa*, *Boronia albiflora* (pink and white), *Hibbertia* sp. (resembling *H. acerosa*), *Kunzea sericea*, *Calothamnus quadrifidus*, *Dampiera lavandulacea*, *D. prostrata* and *Anthocercis viscosa* with large white and waxy fragrant blooms. Cypress-pine (*Callitris preissii*, granite form), a she-oak with large prickly cones clustered on the old wood (*Casuarina trichodon*) and grass-tree (*Xanthorrhoea preissii*) occur only near the summit at the wider southern end. Nearby, at the head of a long timbered gully which descends eastward to the sandy cove, a community of cushion growths (*Borya nitida*, *Andersonia sprengeloides* and *Stylidium pubigerum*) is associated with extensive seepage over sheets of rock. Conspicuous in the gully scrub is an unusually robust, glaucous form of the mallee *Eucalyptus conglobata* having quadrangular branchlets. The present cover density is probably attributable to former bush fires, of which there was ample evidence.

A few strand plants (*Spinifex hirsutus*, *Cakile maritima* and *Sonchus megalocephalus*) and several clumps of introduced Box-thorn (*Lycium ferocissimum*) are restricted to beach sand along the sheltered south-eastern cove; broad-leaved Island Paperbarks (*Melaleuca globifera*) encircle this beach on the landward side, forming a dense thicket.

Long Island [340', 0.5 sq. ml., 71 spp.] is rather uniformly flat, except in the western extreme, and is heavily wooded with Moonah (*Melaleuca pubescens*) where sand and humus overlie the granite. There are signs of burning long ago (perhaps from the days of sealing, when "Black" Anderson lived there in the 1830's); but the Moonah has re-established, and high growths of Wild Oat (*Avena fatua*) now occupy sandy clearings among the trees. A grove of large umbrageous *Melaleuca globifera* and Bushy Yate (*Eucalyptus lehmannii*) at the north-eastern end affords canopy to an almost mesophytic ground flora, e.g. *Parietaria debilis*, *Sida hookeriana*, *Oxycarpus hispidula*, *Pinelea clavata* (Banjine) and a lush lax form of *Poa caespitosa* (Tussock Grass). Cushions of moss, and such moisture-loving ephemerals as *Angianthus tenellus*, pink-flowered *Stylidium calcaratum* (not found elsewhere), *Scirpus antarcticus* and *Centrolepis* species, accompany shallow pools and soakages around slabs of granite rock. A curious short-awned form of the Long-hair Plumegrass (*Dichelachne crinita*) was detected only on Long Island.

Remark [722', 0.4 sq. ml., 60 spp.], with a steep dome visible for 50 miles around, is largely precipitous and there is much bare rock without vegetation. Exposed to every wind, cushion plants crown the summit where shallow pools provide for several minute ephemerals (e.g. *Angianthus tenellus*). Some fine Yate poles (regeneration after an old fire which killed eucalypts up to 2 feet in diameter) grow thickly in a small sheltered gully on the eastern side, while on the south-west face of the peak is a hollow of *Melaleuca globifera* bordered by very large shrubs of *Kunzea sericea*. As on Sandy Hook, two *Hakea* species occur here—*H. suaveolens* in protected places and the grotesque *H. clavata* in open rocky situations. Unyielding clumps of the extremely tough-leaved *Lomandra rigida* are abundant on Remark—it occurs also at Dempster Head, Esperance.

Cape Le Grand Group

Pasco [223', 0.3 sq. ml., 70 spp.] is typical of the scattered steep islets around Cape Le Grand (about 3 miles to the north). Precipitous on all sides and appearing bald from the sea, it was found to support a surprisingly rich flora. *Scaevola drummondii*, *Diuris longifolia* and *Angianthus preissianus* were not observed elsewhere. Large shrubs are practically confined to a defile at the head of an impressive west-coast fjord (which almost divides the island in two) and to a small hollow surmounting the southern sector; *Kunzea sericea* is the dominant and tallest species (to 10 feet). Low spiky masses of *Lomandra rigida* and *Hakea clavata* are frequent, while at the northerly summit flourish extensive cushiony growths aligned by the effects of wind—*Borya nitida*, *Andersonia sprengeloides* and *Stylidium pubigerum*, as on Sandy Hook. The uncommon *Verticordia minutiflora* is also present, in low dense rounded bushes.

Corbett Group

Round Island [91', 0.2 sq. ml., 48 spp.], of low graceful contour is about 13 miles south from Cape Le Grand and the most easterly of this scattered group. It was a matter for regret that our itinerary could not include visits to any of the more impressive members—Corbett, Wilson, Howe and Hood. Neither weed nor any sign of fire was visible on Round Island, upon which the vegetation must have remained unaltered for many centuries. About 10 different woody shrubs, of which *Astartea fascicularis* is the tallest, grow on the higher central part. Six indigenous grasses form swards and tussocks in the north-eastern sector. Coast Twin-leaf (*Zygophyllum billardieri*) was not noted anywhere west of this island.

Termination

Termination Island [373', 0.3 sq. ml., 12 spp.] on the 122nd E. longitude, and about 33 miles southerly from Cape Le Grand, is completely isolated. A wind-swept precipitous rock near the edge of the Continental Shelf, it is often washed by mountainous seas and one questions whether any previous landings had been made there. It is certainly not the "Termination Rock" mentioned on several of George Maxwell's labels in the Melbourne Herbarium; doubtless that refers to the ultimate granite outcrop along the mainland coast—near Wattle Camp and about 33 miles north-east of Israelite Bay.

All of the dozen species of higher plants are hardy annual herbs or low succulent perennials, except for the Cape Leeuwin Wattle, *Albizzia lophantha*. This legume is entirely prostrate here, sprawling from the shelter of rock crevices; copious *Albizzia* seedlings appear, but very few survive the rigours of exposure and shallow salty soil. It is interesting to record that seedlings raised in Adelaide Botanic Gardens from Termination Island pods have retained the prostrate habit under cultivation—seemingly an acquired character. *Disphyma australe*, *Lepidium foliosum* and *Lobelia anceps* are the principal species, and no weeds could be found. The *Lepidium* provided food for innumerable grasshoppers which, in turn, were probably eaten by lizards—King's Skink abounds on Termination. A large part of the soil (where present) consists of lizard manure, accumulated over a long period on this most remote of all the islands.

Mondrain

Mondrain [743', 3.6 sq. ml., 135 spp. +] is the most elevated and second largest island in the Recherche seas, comparatively isolated at 7 to 10 miles south of Lucky Bay (Mainland coast). It lacks limestone and is forested for the greater part. On 23rd January, 1944, a very severe fire (apparently the first since January 1802) devastated three-fifths of the island, and it was interesting to see how far the vegetation had recovered in six years (to November 1950). In the northern gullies, Yate saplings had attained heights of 10 feet and more. With them several tall legumes now grow thickly, laced together with impenetrable tangles of the parasitic dodder-laurel, *Cassytha pomiformis*. Climbing Lignum (*Muehlenbeckia adpressa*) here justifies its name, ascending in spirals to the tops of gully trees after the manner of true lianas; the Bluebell Creeper (*Sollya heterophylla*) is also a frequent climber.

On elevated north-western slopes a dense regrowth forest of *Eucalyptus lehmannii*, *E. incrassata* var. *angulosa* and *E. platypus* var. *heterophylla* has arisen. Purple and white-flowered forms of *Hibiscus huegelii* (seedlings after the fire) are conspicuous and beautiful on two northerly slopes. At the extreme northern point a spinney of old she-oaks, *Casuarina huegeliana* (to 15 feet high) escaped burning. Rock pools, with seasonal pygmy plants on mud around the margins, and cushiony communities (as on Pasco) are to be found at both the northern and higher southern summits. An ericoid shrubby trigger-flower (*Stylidium glandulosum*) and spectacular Kunzea resembling a bottle-brush (*K. baxteri*) are noteworthy species on the northern peak, both being rare plants on the mainland and poorly represented in herbaria. *Lomandra rigida*, so common on pinnacles of the Remark group, Pasco and South Twin Peaks (to the east) seems to have missed Mondrain.

Floristically rich are two patches of heathland which occupy sandy cappings to the north and south of a central eminence. In composition, these colourful shrubberies are similar to those on the plateau of Sandy Hook and more closely approach a mainland sand-plain than any other association in the Archipelago. Here were 14 flowers not seen on other islands, e.g. the rare *Patersonia inaequalis*, *Acacia crassiuscula*, *Gompholobium knightianum*, *Dampiera fasciculata* and *Scavola linearis* (hitherto known only from South Australia), with a fair development of sedges and *Liliaceae* but no *Amaryllidaceae* (*Conostylis*, *Anigozanthos*, etc.). In the south-eastern sector a semi-permanent stream empties into a majestic fjord; large Yate

trees grow in this deep valley (which was severely burnt), but there are only occasional patches of fern (*Cheilanthes tenuifolia*) and very few of the mosses one would expect to find there.

Twin Peaks Group

North and South Twin Peaks islands (separated by a narrow channel) lie between 5 and 7 miles south of Point Alexander; they are surrounded by a number of much smaller scattered islets.

North Twin Peaks [615', 1.1 sq. ml., 90 spp.] is narrow with many indentations and exceeds 2 miles in length, the high peak situated in the north-eastern third. There is no limestone and, apart from considerable areas of bare granite, this attractive island is thickly forested. Tallest trees are Yates, high up on the southern side of the main peak; in their shade ferns (*Cheilanthes*) are abundant and mosses (*Campylopus*, *Sematophyllum*, etc.) carpet the damp rock ledges and boulders. Bushy Yate (*Eucalyptus lehmannii*) covers much of the northern slopes, ascending to the summit in dense and stunted thickets. Deep humus lies in many places. Island Paperbark (*Melaleuca globifera*) and a wide-leaved form of "Jam-wood" (*Acacia acuminata* var. *latifolia*) are important arboreal species, while the vigorous liana, *Kennedya nigricans* ("Black Cockatoo-flower"), and a tall broad-leaved Beard-heath (*Leucopogon interruptus*) were noted by the author for the first time in forests here. *Kunzea baxteri* (with spikes of large, purplish, almost herbaceous capsules) occurs plentifully on the higher rocky parts, but *Callitris preissii* was not seen. *Bulbine semibarbata* and what seems to be a form of *Lobelia rhombifolia* (but with much smaller flowers than usual and globose capsules) are present on the peaks; neither species has been found on other islands.

North Twin Peaks has recovered well from a burning that would seem to have occurred about 1936—we ascertained the approximate date by ring counts on several moribund regrowth saplings of Bushy Yate which were felled for the purpose.

South Twin Peaks [609', 0.4 sq. ml., 53 spp. +], although so closely contiguous and of similar elevation and form to the preceding island, affords an astonishing contrast botanically. There is little humus and much more bare rock, while the cover plants are mostly herbaceous. Only on the sheer, almost inaccessible eastern face is there an approach to forestal growth, but apparently without any eucalypts. *Lomandra rigida*, *Platysace compressa*, *Opercularia hispidula* and the introduced Hawkweed *Picris* (*P. hieracioides*) are frequent, yet none of them were seen on the much larger northern Twin Peaks island. Several very old spreading shrubs of the handsome scarlet-flowered *Melaleuca elliptica* were found half-way up the northern slope of South Twin Peaks; it is a rarity in the Archipelago, and the only other occurrence we noted was on Woody Island (also an aged specimen).

Cave Islet [74', ± 5 acs., 18 spp.], a little north of South Twin Peaks, was the smallest island visited by the A.G.S. party. Its vascular vegetation is mostly concentrated near a pile of boulders to the south, with Cushion-bush (*Calocephalus brownei*) as the principal shrub. No weeds were seen. Interest centres in a remarkable grotto which pierces the southern cliff face to a distance of about 80 feet. Rock ledges give access to the end of this cavern and at its mouth shallow rock pools are resplendent with brightly coloured algae and sponges.

Wedge [265', 0.1 sq. ml., 28 spp.] is aptly named from its shape—very precipitous, grading evenly from a lofty southern point to the low northern tip which affords the only safe landing. There is little soil and a sparse vegetation. One small shrubbery of *Leucopogon obovatus*, *Astartea fascicularis* and *Hakea clavata* clings to the south-western declivity, while on the south-eastern side of the narrow central ridge we find a small area dominated by tufted grasses (*Stipa tenuiglumis*, *Agropyron scabrum*, etc.), but not the usual tussock-former, *Poa caespitosa*. Round-leaved Noon-flower (*Disphyma australe*) trails in festoons of rosy-magenta bloom over rock ledges at the northern end, and the annual maritime form of Austral Hollyhock, *Lavatera plebeja* (silver-leaved and velutinate, with palest mauve petals) is more abundant here than at other islands.

Combe

Combe [72', 0.4 sq. ml., 23 spp.] is rather isolated, about half-way between the Twin Peaks and Middle Island. Physiographically and floristically it is unique among the Recherche islands, for the whole 250 (±) acres comprises a treeless saltbush plain of sage-grey aspect. Depths of calcareous (and probably phosphatic) sand cover the granite, except at the shore-line, but there is no actual limestone. Coast Saltbush, *Atriplex cinerea* (variable in foliage) predominates and is the

tallest shrub present; sometimes it occurs alone, but often in varying mixture with *Rhagodia baccata*, *R. crassifolia*, *Enchylena tomentosa*, *Olearia axillaris* and *Carpobrotus equilateralis* which become severally dominant in places. Glassworts (*Salicornia australis* and *Arthrocnemum halocnemoides*) are restricted to a few low-lying portions of the plain which collect moisture. *Sporobolus virginicus*, *Frankenia tetrapetala* and *Lobelia anceps* grow only among rocks along the shore where they are closely cropped by rock wallabies. Ten species of Combe's very limited flora belong to the succulent families *Chenopodiaceae* and *Aizoaceae*, embracing every member of these groups that we recorded in the Archipelago; *Arthrocnemum halocnemoides* apparently exists nowhere else, but it is common on saline flats of the mainland coast. Leguminous and myrtaceous plants are entirely lacking, there is only one grass (*Sporobolus virginicus*) and *Sonchus asper* (Rough Sow-thistle) is apparently the only naturalized alien.

Cape Arid Group

The chain of islands off Cape Arid (Barrier, Stanley, Gulch, Miles, Goose, Middle, Douglas, Dome, etc.) is circumscribed, except for Dome which is rather isolated at about 13 miles south-east.

Middle [572', 4.2 sq. ml., 136 spp. +], between 5 and 8 miles to the south of Cape Arid, is at once the largest and most diversified island off the southern coast of Western Australia. Briefly, the highest land is a 2-mile granite ridge bordering the west coast where it falls to the sea in three precipitous escarpments resembling superimposed lava flows. At its northern extremity, this ridge culminates in the bold mass of Flinders Peak (summit of the island). The south-eastern quarter is an immense capping of dune limestone, with 200-foot cliffs along the very indented south coast. Between these elevated portions the intervening country slopes gently northward toward the wide sandy sweep of Goose Island Bay, which is bounded on the north-east by Miles Island Point—a long low tongue of timbered granite. A shallow rounded pinkish brine lake, lying just within the coastal dune ring of this bay, completes the major landscape features of Middle Island.

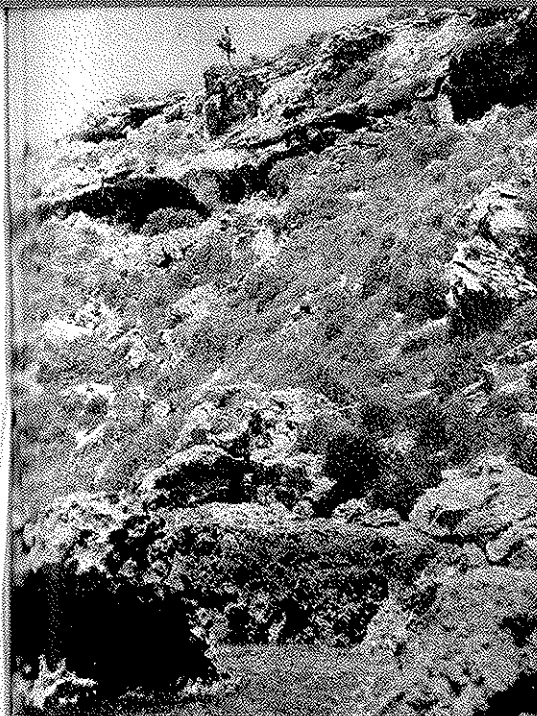
Characteristic sand-dune vegetation (e.g. *Spinifex hirsutus*, *Lepidosperma gladiatum*, *Scaevola crassifolia*, etc.) and a halophytic flora (*Juncus maritimus*, *Salicornia australis*, *Samolus repens*, etc.) affect the blown sea sand and brine lake margins respectively. Elsewhere, except for expanses of bare rock, the island is practically covered with forest (on the granitic and sandy interior slopes) or with exceedingly dense and almost impenetrable scrub growth of various genera (on the limestone tracts).

Four eucalypts are present (*Eucalyptus cornuta*, *E. lehmannii*, *E. platypus* var. *heterophylla* and *E. incrassata* var. *angulosa*), sometimes forming pure stands of a single species, but more often in mixture with each other or with arboreal *Melaleuca* and *Acacia* species; no eucalypts grow on the calcareous formation. Near the centre of the island are extensive glades of Moonah (often mossy beneath), which may occur as an understorey to *Eucalyptus platypus* (Moort). The only mistletoe species of the Archipelago, *Ameyma miraculosa* var. *melaleuca*, not infrequently parasitizes Moonah trees on Middle Island to which it is apparently confined. High on the eastern slopes of Flinders Peak is a thick shrubbery of cypress-pine (*Callitris preissii*)—regrowth from one of the fires which have occurred; evidence is lacking that any outbreak here was as damaging as those upon Woody or Mondrain.

Twenty species of the shrubs apparently do not range to other islands, and include such large plants as *Acacia anceps* (large golden and fragrant blossoms), *A. nitidula*, *Dillwynia pungens*, *Phebalium rude* and *P. euphemia* (much smaller summit species), *Pomaderris oraria*, *Melaleuca brevifolia*, *M. pentagona*, *Calytrix tetragona* and *Scaevola crassifolia* (of dunes); the *Acacia anceps*, *Pomaderris* and two *Melaleuca* species are restricted to south-eastern limestone. *Pomaderris oraria* has not been recorded previously for the Western State; but there is also an old unrecorded specimen of it in Melbourne Herbarium from Gale's Brook on Mississippi Bay, collected by G. Maxwell. Fruits of *Acacia nitidula* (formerly unknown) were collected by us at Flinders Peak.

Seepages are frequent along the coastal junction of granite bedrock and high limestone deposits, with many brackish pools of red and green freshwater algae and fringing growths of Brookweed (*Samolus repens*). *Isotoma scapigera* is a charming rosette plant in fretted recesses of the calcareous cliffs, also in a depauperate form at the brine lake; the long-peduncled mauve flowers are bluebell-like.

* It had been anticipated that microscopic examination of the lake water would reveal concentrations of unicellular algae with red pigmentation (e.g. *Dunaliella*)—thereby explaining its bright rose colour. However, Mr. A. D. Hardy of Melbourne, an experienced algologist to whom a sample was submitted, found the water devoid of organic material; one must therefore ascribe the colouration to some inorganic substance in solution (perhaps a salt of manganese).



Upper (left): Lime-stone cliff-face community (Goose Island).
(right): *Lavatera plebeja* (Wedge Island).
Lower (left): Moort forest (*E. platypus*) with understorey of Moonah
(*M. pubescens*) on Middle Island.
(right): *Stylidium adnatum* in rock crevice (Figure-of-Eight Island).



Borya nitida in "cushion" formation (Middle Island).



Astartea fascicularis, planed by constant winds (Middle Island).

Cushions of *Borya* and stunted *Stylidium glandulosum*, aligned in concentric "waves", grow upon Flinders Peak as on several other bleak island summits, where the effects of high wind are manifest also in dwarfing, planation and regular inclination of shrubby growth. Shallow pools of rainwater at the summit carry seasonal growths of *Centrolepis glabra*, *Glossostigma drummondii*, *Isoetes drummondii* (a fern ally) and other small semi-aquatics.

Goose Island [154', 0.3 sq. ml., 56 spp.], in close proximity to the north coast of Middle, is largely granitic; but there are picturesquely fretted limestone cliffs in the eastern part where succulent plants (commonly *Disphyma* and *Tetragonia*) assume a long-pendulous habit of growth, swinging like festoons above the sea. Very even low shrubbery covers most of the surface, and the only approach to arboreal growth (now) is a clump of stunted paperbarks in the north-central region. Burrows of shearwaters and black rabbits abound. These introduced rodents have lived harmoniously with the native bird population since before 1889, and they do not seem to have adversely affected the vegetation. Several weeds are frequent, notably pimpernel (*Anagallis arvensis*) and a sow-thistle (*Sonchus asper*), while there are many evidences of fire. The burr-fruited annual *Trachymene pilosa*, although so widespread on Middle Island, was unaccountably absent. Muddy pools at the summit are populated with several minute ephemeral plants, e.g. *Triglochin*, *Scirpus*, *Centrolepis*, *Glossostigma* and *Limosella* species, also *Calandrinia pygmaea* which was found only here.

Douglas [270', 0.1 sq. ml., 25 spp.], 3 miles beyond the south-west tip of Middle, consists of two high narrow granite ridges meeting at an angle of lower elevation where they are almost cleft by the sea. Vegetation is practically confined to the south-western extremity of the western half (as on Wedge), where dwarfed *Leucopogon obovatus*, decumbent *Albizzia*, much Hollyhock (*Lavatera plebeja*), *Senecio laetus* and four grass species occur. Carpets of succulent Noon-flower (*Disphyma australe*), sloping toward the brink of high escarpments, are treacherous to walk upon. The rugged eastern half of Douglas, with its remarkable "bell-rock" summit, is quite bare except for low interrupted herbage in a few crevices.

South-east Group

Salisbury [390', 1.3 sq. ml., 26 spp. +], some 27 miles south of Cape Pasley and almost as far from Middle Island, has no near neighbours and is only less remote than Termination; but it is a long, narrow, much larger mass. Except for the southern granite headland, it consists of a tremendous thickness of stratified coralline, rising nearly 400 feet above the granitic base and wave platform. There are only two plant associations on this limestone: a halophytic flora of the friable cliff faces (Noon-flower, Bower Spinach, Twin-leaf, saltbushes, etc.), and a uniform plateau shrubbery of great extent which is dominated by *Leucopogon parviflorus*, *Spyridium globulosum*, *Acacia cyclops*, *Boronia alata* and *Pimelea clavata* in that order of frequency. The shrubs are intergrown, forming dense, nearly impenetrable thickets to about 5 feet in height; they probably represent old regrowth from a fire which is reputed to have swept over Salisbury at the time of the *Rodondo* wreck there in October 1894. The large Coast Sword-sedge (*Lepidosperma gladiatum*) and Tussock-grass (*Poa caespitosa*) occur in small breaks throughout the plateau scrub, while *Clematis pubescens* is an occasional vine; no *C. microphylla* was noted, although it is a frequent component of limestone shrubberies on Middle and Goose Islands. The small number of species (26) recorded is consistent with the general principle that richness of an insular flora varies inversely with distance from the mainland, but the granitic southern part of Salisbury may yield further species.

Eastern Group

Christmas Island [$\pm 450'$, ± 1.3 sq. ml., 46 spp.] is by far the largest of a subsidiary archipelago about 21 miles from both Pt. Malcolm and Pt. Dempster (at Israelite Bay). The lofty northern and slightly lower southern granitic mount are separated by a depressed limestone-guano saddle which carries a few shrubs not occurring on the granite, e.g. *Atriplex*, *Threlkeldia* and *Calocephalus*. A sandy beach on the western side of the saddle is hedged around by tall Nitre Bushes (*Nitraria schoberi*) and carries the strand grass *Spinifex hirsutus*. On the whole, the island has much bare rock and is rather sparsely vegetated. *Albizzia* appears to be the only leguminous plant, occurring as pure shrubbery in a sheltered hollow at the south-eastern foot of the higher hill. *Casuarina huegeliana* is the largest woody species, but is confined to the north-eastern crest of the island. *Knizea baxteri* (sole myrtaceous plant) is present at the northern summit. No pools or cushion plants were observed. Five weeds grow on the calcareous saddle where there were also signs of a previous fire.

III. PLANT FORMATIONS AND COMMUNITIES

It was impossible during the A.G.S. expedition to undertake any serious work of an ecological nature—such as soil analyses and profile examinations, quadrat surveys, evidences of succession, zonation of algæ, meteorological readings, etc. There was barely time to take stock (and collect specimens) of all the plant species occurring on the various islands, some of which were visited for only a few hours. Whatever observations are now recorded on the gross ecology of the islands must therefore be qualitative and purely descriptive, and no explanations are advanced concerning certain phenomena.

Effects of Wind

On small steep islands, e.g. Wedge and Douglas, vegetation is noticeably concentrated in the south-west portions, while other parts may be quite bare (certainly of shrub growth). Most probably this grouping results from a more reliable precipitation of moisture where prevailing south-westerly wind strikes the cliffs. The effects of wind are also graphically apparent in the dwarfing, planation and often steep inclination of shrub growth, e.g. *Astartea fascicularis* [see p. 12].

Soil Types

Soils of the Archipelago may be conveniently grouped under three broad headings:

1. GRANITIC (from solid rock, through talus and rubble to coarse sands).
2. DUNE LIMESTONE (from rock and rubble to fine calcareous sand).
3. BLOWN SAND (both littoral and as depositions over granite).

The soils derived from granite support climax associations either of woody shrubs or trees (sometimes tall enough to be designated forest), with pygmy annual communities, where water seepages or pools occur, and chasmodiphytes in crevices. Limestone soils carry mixed shrubberies (often dwarfed or semi-succulent), rarely an approach to woodland. Blown sand is associated with strand and dune vegetation (often succulent), open woodland with ground herbs, or patches of grass.

Major Communities

Much more information would be needed to define accurately and discuss the vegetation on a basis of *plant associations*, with subsidiary categories; but certain communities are recognizable, and the following is an attempt at classifying them:

1. **Eucalypt Forest.** Eucalypts are undoubtedly the climax plants on larger islands, where granitic sand and humus can accumulate in valleys or along hillsides. They are present on at least seven islands and the five species are distributed as follows: MIDDLE (*Eucalyptus cornuta*, *E. lehmannii*, *E. platypus* var. *heterophylla*, *E. incrassata* var. *angulosa*); MONDRAIN (the same four species); NORTH TWIN PEAKS (*E. cornuta*, *E. lehmannii*, *E. incrassata* var. *angulosa*); SANDY HOOK (*E. lehmannii*, *E. incrassata* var. *angulosa*, *E. conglobata* var.); WOODY (*E. cornuta*, *E. platypus* var. *heterophylla*); REMARK (*E. cornuta*); LONG (*E. lehmannii*). Individual widely branching specimens of Yate (*E. cornuta*), to 40 ft. high and up to 7 ft. in girth, on Middle Island are the largest trees to be found in the Archipelago. Comparable examples (burnt) exist in the deep south-eastern gully of Mondrain. *E. lehmannii* (Bushy Yate), *E. platypus* var. (Moort) and *E. incrassata* var. (Yellow Mallee) sometimes encroach onto areas of loose blown sand where *Melaleuca pubescens* (Moonah) and *M. globifera* (Island Paperbark) usually predominate; the latter may then continue as an understorey to the eucalypts. Near the centre of Middle Island straight clean boles of *E. platypus* are brown and lustrous as in the mainland Salmon Gum (*E. salmonophloia*); groves of small slender Moonah are associated. Eucalypts occur either as stands of a single species (e.g. the large straight examples of *E. lehmannii* on lower eastern slopes of Flinders Peak, Middle Island) or in varying mixture with each other. Dwarfing occurs with exposure and shallow soil, especially where dense regrowth has followed a fire (as at the summit of North Twin Peaks).

Associate trees or tall shrubs in eucalypt forest are *Acacia acuminata* var. *latifolia*, *Albizia lophantha*, *Hakea suaveolens*, *Bossia dentata*, *Pimelea clavata*, and sometimes *Haloragis racemosa* or *Templetonia retusa*. *Agonis marginata* and, less commonly, *Callitris preissii* occur on a few rocky declivities. *Clematis pubescens*, *Sollya heterophylla*, *Kennedy nigricans* and *Muehlenbeckia adpressa* are occasional lianas, with parasitic *Cassytha pomiformis* sometimes abundant after a fire.

2. **Melaleuca Woodland.** The two species *M. pubescens* (Moonah) and *M. globifera* (Island Paperbark) may occur singly or in mixture on blown sand

which is probably rich in lime. As indicated above, they commonly mingle with eucalypts and lose their identity as dominants in an association. Moonah is the more calciphilous kind, sometimes growing on limestone (as at Boxer); the Paperbark favours granitic sand or (much reduced in size) grows even in rock crevices. Considerable areas are dominated by these small umbrageous trees—e.g. at Long, portions of Mondrain and Goose Island Bay (Middle Island) where they cover rather level ground that may be extensively tunnelled by shearwaters. With the exception of *Myoporum insulare*, other woody species are usually deficient; but *Phebalium rude* occurs under *Melaleuca* species at Miles Island Point and other parts of Middle Island where *M. pubescens* is sometimes infested by the small-flowered and -leaved mistletoe, *Amyma miraculosa* var. *melaleuca*.

Grasses often occupy clearings among the trees, and such annuals as *Trachymene pilosa*, *Daucus glochidiatus*, *Sida hookeriana*, *Solanum nigrum*, *Waitzia citrina*, *Lxioleuca viscosa* and *Senecio latus* are noteworthy amongst the ground flora.

Exceptionally large Paperbarks, on a sandy depression at the western side of Middle Island brine lake, have attained heights of nearly 30 ft. with basal girths of 4 to 5 ft. The timber is notoriously brittle, unlike that of Moonah. *Melaleuca* (?) *brevifolia* occurs in pure formation on a small seasonally damp depression above limestone cliffs at Middle Island (south coast); larger trees of the same species occupy saline flats between Dempster Point and the jetty at Israelite Bay, also at Point Malcolm.

3. **Woody Mixed-shrub Thicket.** The climax community on small steep islands, e.g. Pasco, is a shrubbery (often dominated by *Myrtaceæ*). Spacing is usually very close and branches of the individual plants may be so interlocked that progress through the formation is difficult. Such density is sometimes the result of heavy seedling growth after bushfires. On larger islands, shrubberies of the coastal rocks merge into woodland toward the interior where depth of soil and shelter increase.

Prominent species on granite are: *Astartea fascicularis* (abundant and very dense on many islands), *Kunzea sericea*, *Leucopogon obovatus* (ubiquitous), *Spyridium globulosum*, *Dodonaea oblongifolia*, *Hakea clavata*, *Eutaxia obovata* and *Pimelea ferruginea*. These occur separately or, more frequently, in varying mixture. The lower semi-herbaceous perennials *Platysace compressa* ("Tapeworm Bush") and *Lomandra rigida* are common associates in this formation, while dwarfed cypress-pine (*Callitris preissii*) is sometimes present on peaks, e.g. at Sandy Hook, Mondrain and Middle. *Agonis marginata* is also a shrub of rocky declivities, attaining almost the stature of a tree near the summits of Middle and the Twin Peaks islands. Cushion-bush (*Calocephalus brownii*) is an extreme state of the woody shrubbery on granite.

On limestone, the shrubberies are often exceedingly dense, with intergrown prickly branchwood, and the composition differs appreciably from that of thickets on granite. *Spyridium globulosum*, *Acacia cyclopis* and *Leucopogon parviflorus* are frequent components; but *Boronia alata* (with large, square, greenish flowers and coarsely pinnate foliage having a rank pungent aroma) and stunted *Pimelea clavata* may also occur. *Melaleuca pentagona* is conspicuous on the south coast of Middle Island, but was not found on any other calcareous capping; it occurs on sand over granite, however, at Dempster Head, Esperance. [See also notes under **Salisbury** on p. 13].

Following is a list of 10 shrubs which are restricted (among the islands) to limestone, sometimes on escarpments:

Clematis microphylla (a liana), *Pultenaea obcordata*, *Acacia anceps*, *Pomaderris myrtilloides*, *P. oraria* (very rare), *Lasiopetalum discolor*, *Melaleuca pentagona*, *M. (?) brevifolia*, *Acrotriche cordata* and *Alyxia buxifolia* (rare).

4. **Ericoid Shrubbery.** On Mondrain and Sandy Hook are high plateau-like areas where shallow sand and gravel (derived from the underlying granite) are kept rather moist by percolating rain water and seepages. Pulviniform mosses (*Campylopus* spp.) are present in the damper parts, there is much organic matter and the soils may prove to be acidic—exceptional in the Archipelago. These limited areas are full of interest botanically, being rich in brightly coloured flowers of many genera (*Thysanotus*, *Drosera*, *Acacia*, *Boronia*, *Goodenia*, *Dampiera*, *Stylidium*, etc.); they may be relics of an early Pleistocene land surface.

Although many of the constituent shrubs bear xerophilous, ericoid foliage, this formation can hardly be termed "heathland", because epacrids are not at all conspicuous; neither can it be classed as "sand-plain", for the *Proteaceæ*, dwarf *Myrtaceæ* and *Amaryllidaceæ* of the mainland are all but completely lacking—nevertheless, it does evince features of the latter formation and shares certain

groups, e.g. *Neurachne*, *Loxocarya*, *Lepidosperma*, *Xanthorrhoea*, *Thysanotus*, *Styphandra*, *Patersonia*, *Exocarpos spartea*, *Acacia* spp., *Gompholobium*, *Chorizema*, *Boronia*, *Goodeniaceae* and *Stylidiaceae*. [See also notes under **Mondrain** on p. 8].

The ericoid shrubbery passes insensibly into mixed-shrub thicket on granite rock, and into eucalypt forest (yellow Mallee scrub or taller stands of Yate toward the gullies).

5. Semi-succulent (Chenopodiaceae) Shrubbery. On many islands are friable patches of blown sand over granite (or weathered eolianite) which are honeycombed with shearwater burrows and covered with sprawling juicy-leaved semi-shrubs. The family *Chenopodiaceae* is conspicuous, often dominant, with such members as *Rhagodia baccata*, *R. crassifolia*, *Atriplex cinerea* and *Enchylana tomentosa*. Prostrate *Carpobrotus aquilaterus* (Angular Noon-flower or Karkalla) predominates in places, e.g. at the southern end of Figure-of-Eight, and *Tetragonia implexicoma* (Bower Spinach, of the same family *Aizoaceae*) is usually present as a scrambler over other vegetation; occasionally (as at Goose Island) *Clematis microphylla* also appears—a liana. Two frequent associates in the community are *Olearia axillaris* and a stunted form of *Myoporum insulare*.

This formation is poor in species, and most of them have small insignificant flowers (*Carpobrotus* is exceptional). All are salt-tolerant and can exist within the influence of ocean spray. Largest single development of the chenopodiaceous shrubbery is at Combe, where the whole island consists of a monotonous saltbush plain reminiscent of Houtman's Abrolhos; *Atriplex cinerea* is dominant. [See also notes under **Combe** on p. 9]. Areas of low semi-succulent shrubs are usually circumscribed, but they may pass into true woody shrubberies of mixed composition or into *Melaleuca* woodland (with suppression of the succulent types, and appearance of grasses and annuals). The interrelations between vegetation and the activities of burrowing birds, especially in this community, would make a fascinating research.

6. Mat Plants (chiefly succulent). The pioneer community on cliff-tops, bare sloping granite pavements and boulder heaps against the sea is almost invariably a carpeting growth of *Disphyma australe* (Rounded Noon-flower) which can exist under constant wettings by salt water. Mats of thyme-like *Frankenia tetrapetala* (Sea-heath) are often associated with it, and sometime also prostrate forms of *Threlkeldia diffusa* and *Enchylana tomentosa*, or of *Samolus repens*. This simple halophytic community passes into low woody shrubbery (*Olearia-Leucopogon-Pimelea*), grass, or semi-succulent shrubbery on blown sand.

7. Grass Patches. The term "Grassland" is hardly applicable to the very limited areas of pure grassy cover occurring naturally on many islands—even small ones, like Wedge and Round, where smooth- and fine-leaved Tussock-grass (*Poa caespitosa*), Spear-grass (*Stipa tenuiglumis*), Wheat-grass (*Agropyron scabrum*) and annual Sand Brome (*Serrafalcus arenarius*) are the principal species. Grass also occupies open tracts in the *Melaleuca* woodlands; but introduced species have taken possession of most sandy clearings on islands once subject to grazing, and it is now difficult to visualize the original populace. Introduced *Aira praecox* and *Vulpia membranacea* (the former only at Woody, the latter on many islands) had not been collected previously in Western Australia and my specimens were forwarded to Perth Herbarium just in time to be recorded in *Flora of Western Australia* 1, pt. 1: 399 (Mar. 1952), by C. A. Gardner. Probably Sand Brome was once more frequent on the islands, but has suffered from competition with more aggressive aliens.

Coast Rat-tail Grass (*Sporobolus virginicus*) is decumbent and halophytic, sometimes associating with mats of *Disphyma* and *Frankenia* in the pioneer community against salt water; it is the only member of *Gramineae* on Termination and Combe Islands.

8. Annual Herbs. A large part of the vegetation on small remote islands consists of annuals which grow during winter and spring in small pockets of moist soil, completing their life cycles during the hot dry summer period. The most widespread of these seasonal herbs are *Lepidium foliosum*, *Apium prostratum*, *Crassula miriamae* (analogous to *C. sieberiana* of eastern Australia), *Calandrinia calyptrata*, *Scirpus antarcticus*, *Lavatera plebeja* (velutinate coastal form), *Senecio laevis* (annual form) and *Brachycome pusilla* (undescribed variety). Other herbs, e.g. *Lobelia anceps* (large-flowered) and *Stylidium adnatum*, often accompany the annual species, perennating in rock crevices.

A rather different community of small ephemeral herbs exists around temporary pools and seepages, as on mountain peaks. [See under No. 11—**Minute Ephemerals**].

Minor Communities

9. Cliff-face Community. Limestone escarpments (exemplified by the south-eastern coasts of Goose and Middle Islands) afford a complex of halophytic succulent perennials, a few woody shrubs and small annuals which are not associated elsewhere. The succulents predominate and frequently assume a long-pendulous habit, dangling like festoons from rock ledges, e.g. *Tetragonia implexicoma* and *Disphyma australe*; *Threlkeldia diffusa* or *Zygophyllum* spp. are also occasionally present. Dune Thistle (*Sonchus megalocarpus*) more rarely occurs as a tufted succulent perennial (e.g. on Boxer). *Hymenolobus procumbens* and *Hydrocotyle medicaginoides* are weak annuals peculiar to seepages from limestone cliffs. At Middle Island, *Isotoma scapigera* (annual rosette herb) grows on fretted eolianite above the sea (southern coast). Woody shrubs are infrequent on the cliff-face, although they may occur in great variety above it; *Alyxia buxifolia* and *Pomaderris oraria* are two very rare species in the Archipelago, both having been noted only at Middle Island (in depauperate form) near the *Isotoma* occurrence mentioned above.

10. Dwarf Cushion-shrubbery. A most interesting and attractive, if uncommon, community is that of the condensed ericoid semi-shrubs which grow in cushion-like formation, exposed on the higher granite peaks with no soil; but these are structurally dissimilar to the true cushion-forming plants of cold Tasmanian mountain plateaux. *Borya nitida* (Liliaceae), *Andersonia sprengelioides* (Epacridaceae) and *Stylidium pubigerum* (Stylidiaceae) are the only three contributing species in this Archipelago, occurring together at the summits of Sandy Hook and Pasco where seeping moisture collects in temporary pools. *Borya* alone extends to Mondrain and Middle Island peaks, where it is accompanied by *Stylidium glandulosum*—an ericoid semi-shrub (resembling *Calectasia*) which does not form distinctive "cushions". *Lomandra rigida* is almost pulviniform, in enormous clumps on exposed granite, but the habit is hardly shrubby and the long, thick, rigid leaves are certainly not ericoid.

No island showed a better development of cushiony growths than Pasco, where these often attained a foot in height and extended in irregular hummocks for many yards. On Flinders Peak (Middle Id.) the mounds of *Borya* are disposed in concentric "waves" aligned at right angles to the prevailing westerly winds, giving a very curious effect [see p. 12].

11. Minute Ephemerals. Springs on the granite and sizeable pools of rain water (as at mountain tops) encourage little marginal colonies of minute seasonal plants on the shallow drying mud. These midgets include: *Isoetes drummondii* (only on Flinders Peak among the islands, but also on Mt. Belches, Duke of Orleans Bay), *Centrolepis* and *Scirpus* spp., *Triglochin trichophora*, *Calandrinia pygmaea* (Goose Id. only), *Crassula bonariensis*, *Hydrocotyle alata*, *Mitrasacme paradoxa*, *Glossostigma drummondii*, *Limosella aquatica*, *Stylidium* and *Angianthus* spp. Flowering and fruiting are complete by the end of the year, and the actual area occupied by this type of vegetation is infinitesimal.

12. Salt-marsh Community. Only at small depressions on the plain surface of Combe (where water occasionally lies) and around the edges of Middle Island brine lake is there any approximation to saline marsh. Two glassworts (*Salicornia australis* and *Arthrocnemum halocnemoides*) occur in the former locality; at the brine lake *Juncus maritimus* and *Gahnia trifida* form a zone of tall sedgy growth on drier ground, with depauperate *Salicornia*, *Samolus* and *Isotoma* approaching the water's edge (in November)—this was probably where Brown collected *Suaeda maritima* in 1802, but it is not there now.

13. Littoral Sand Community. Beach sand, infrequent in the Archipelago as a whole, appears at Figure-of-Eight, Sandy Hook, North Twin Peaks (very small occurrence), Christmas, and Middle Island where the shore of Goose Island Bay has far more sand than all other occurrences combined. Composition of the beach vegetation is extremely simple. The long-trailing, salt-tolerant, pioneer grass, *Spinifex hirsutus*, is almost universal—with or without succulent *Cakile maritima* and *Sonchus megalocarpus* on the seaward side of dunes. Two sedges, *Scirpus nodosus* and (less commonly) *Lepidosperma gladiatum*, help to stabilize small dunes which, on their landward side, carry various shrubs, e.g. *Olearia axillaris* and *Spyridium globulosum*. *Scaevola crassifolia* is restricted to the dunes along Goose Island Bay, while *Nitraria schoberi* is practically limited to Christmas Island beach—only occasional individual plants occur on Goose, North Twin Peaks and Figure-of-Eight.

14. Sub-marine Community. Only two species of flowering plants, which naturally grow submerged in the sea, were noted in Recherche waters. Detached

branches of both *Cymodocea antarctica* and *Posidonia australis* are frequent amongst the algal drift washed up on most shores. *Cymodocea* was seen actually alive in many rock pools at low tide; but, although plants of it were not observed *in situ*, *Posidonia* most probably grows on the sandy sea-floors of Goose Island Bay, at Christmas Island and Sandy Hook—extensive beds of growing plants were seen in the shallow waters of Israelite Bay and off Point Malcolm beach. (At Esperance, fruiting branchlets of *Posidonia* were being washed ashore during the last week in November). Apparently neither *Zostera* nor *Halophila* occurs anywhere in this region; the former genus is not recorded for Western Australia, though exceedingly common in sandy shallows along eastern Australian coasts.

Affinities with a South Australian Archipelago of Similar Structure and Latitude

The only ecological accounts of any southern Australian islands, comparable with those of the Recherche Archipelago, were published by Professor T. G. B. Osborn in *Trans. & Proc. Royal Soc. S. Aust.* 47: 97-118, T. 4-9 (1923) and 49: 276-289, T. 21-23 (1925), the former summarizing his investigations into the flora of Pearson Island and the latter dealing with Flinders Island—both part of the Investigator Group, off the west coast of Eyre's Peninsula, S.A. R. H. Hayman and E. E. Henty [*Proc. Royal Soc. Vic.* n.s. 51: 149-152 (Jan. 1939)] described a "Survey of the Vegetation Community on Reevesby Island" (Sir Joseph Banks Group) which has certain affinities with the Recherche.

In size, elevation, soil and general zoology, Pearson Island, S.A., has many features in common with parts of the Recherche. Following are some comparisons of the Pearson environment with that of Mondrain:

PEARSON Id., S.A.

Distance from Coast	Size	Height	Structure	Rainfall	Vascular Plants	Animals
40 miles	± 2.5 sq. ml.	780 ft.	Granitic, some travertine, little blown sand.	± 15 in.	(exc. weeds) 52 spp.—no eucalypt, and no legume.	Rock Wal-laby and R. Parrot; no snakes.
MONDRAIN Id., W.A.						
7 miles	± 3.6 sq. ml.	743 ft.	Nearly all granitic, no limestone, little sand.	?	(exc. weeds) 135 spp. +, incl. 4 eucalypts, 12 legumes.	Rock Wal-laby and R. Parrot; 3 snakes.

The much more diversified plant and reptilian life on Mondrain can probably be attributed to its better rainfall (as suggested by rock pools and seepages) and proximity to a coast with exceedingly rich flora; Pearson Island, on the other hand, is small and remote from a more arid mainland. Whereas the climax communities on granite (or granitic sand) at Pearson Id. are *Casuarina stricta* woodland and *Melaleuca pubescens* scrub, those on Mondrain are *Eucalyptus cornuta*-*E. lehmannii* forest and either woody or ericoid shrubbery, with little *Melaleuca pubescens*. The *Atriplex cinerea* littoral association and annual communities on travertine of Pearson Id. have a similar facies to the saltbush plain covering Combe Island (where *A. cinerea* predominates). Pioneering communities are essentially the same in both regions.

There is a dearth, or absence, of such Recherche families as *Cyperaceae*, *Orchidaceae*, *Papilionaceae*, *Epacridaceae*, *Goodeniaceae* and *Stylidiaceae* in the two Investigator islands, and the travertine limestone (rising no higher than 200 feet) is probably of a different age and origin from the Western eolianites. The proportion of *Chenopodiaceae* to the total indigenous flora on this South Australian archipelago is relatively much higher than in the Recherche, viz. 16 spp. (16.5%) as against 8 spp. (only 3.3% of the vasculares)—a reflection of the more arid South Australian environment. Total number of indigenous vascular plants recorded for the Investigator Group is 97 species, of which 83 occur on the much larger Flinders Id. and 14 are locally restricted to Pearson. Of the 97, 42 have not been found in the Recherche Archipelago, e.g. *Crassula sieberiana*, *Beyeria leschenaultii*, *Dodonaea viscosa*, *Frankenia pauciflora*, *Pimelea serpyllifolia* and *Ixiolana supina*; but these and several others are represented there by closely related and analogous forms.

IV. COMPOSITION AND DISTRIBUTION OF VASCULAR FLORA Statistical Analysis (Indigenous Plants)

Total number of species now recorded for Archipelago: 240.

Genera: 157 (average no. species per genus: 1.5).

Families: 66 (average no. species per family: 3.6).

Families represented by a single species: 23 (35%).

Principal families, in order of species representation:

Compositae (20 spp.), *Papilionaceae* (10), *Epacridaceae* (8),
Myrtaceae (17), *Liliaceae* (10), *Goodeniaceae* (8),
Gramineae (11), *Cyperaceae* (9), *Stylidiaceae* (8),
Mimosaceae (10), *Chenopodiaceae* (8), *Orchidaceae* (7).

Species occurring on every island visited: 6,

viz. *Carpobrotus aquilatus*, *Disphyma australe*, *Crassula miriamae*, *Apium prostratum*, *Lobelia anceps* and *Senecio laetus*.

[If Termination were omitted, this list would be increased by *Tetragonia implexicoma*, *Leucopogon obovatus* and *Olearia axillaris*].

Species still in flower during November 1950: 158

(i.e. almost two-thirds of all the angiosperms).

Species common to Victoria: 116 (i.e. 48%).

Species common to islands of Bass Strait: 60 (at least).

Alien Plants

Number of species represented: 35 (incl. 16 grasses).

Each restricted to a single island: 12 spp.

Found on two islands: 4 spp.

Found on three islands: 4 spp.

Found on more than three islands: 15 spp.

Rare Species

Collected by Labillardiere (1792), but not located since:

Chorizema ilicifolium (TYPE), *Lobelia heterophylla* (TYPE).

Collected by R. Brown (1802), but not located since:

Suaeda maritima, *Villarsia parnassifolia* (TYPE),

Anthocercis littorea, *Myoporum parvifolium*.

[The six species mentioned above all still occur on the contiguous mainland coast].

Record based on a single plant in the following six species:

Diuris longifolia (S. summit, PASCO), *Pomaderris oraria* (Limestone Bay, S.E. corner MIDDLE), *Anthocercis genistoides* (Miles Id. Point, MIDDLE), *Myoporum tetrandrum* (Yate grove near centre, MIDDLE), *Leschenaultia formosa* (S. summit, MONDRAIN), *Vittadinia trilobu* (N.W. gully head, BOXER).

Record based on single colonies in the following eleven species:

Isoetes drummondii (Flinders Peak in summit pool, MIDDLE), *Schannus drummondii* (N. summit, PASCO), *Centrolepis murrayi* (S. declivities near centre, BOXER), *Drosera glanduligera* (N. point in gully, MONDRAIN), *Phebalium euphemiae* (Flinders Peak summit, MIDDLE), *Eucalyptus globata* (Main gully, S.E. SANDY HOOK), *Calytrix tetragona* (Miles Id. Point, MIDDLE), *Hydrocotyle alata* (S. summit pools, MONDRAIN), *Stylidium calcaratum* (centre, LONG), *Angianthus humifusus* (S. slopes of peak, near sea, NORTH TWIN PEAKS), *Angianthus preissianus* (N. summit, PASCO).

Comparisons with Mainland Flora

Approximately 600 species are known to occur along the mainland coast opposing the Archipelago of the Recherche (G. Maxwell collected 311 of them, including 32 TYPES,—now in Melbourne Herbarium) and this figure is far from complete. Thus, at least 360 vascular plants do not extend across to the islands which are, in effect, residual mountain tops with nothing of the florally rich sand-plain country ("quowcken" of Eyre district aborigines). If sand-plains ever did exist between present islands, they were dismembered perhaps during the general eustatic upward movement of sea level after the end of the Pleistocene period [C. Teichert, *Proc. Royal Soc. Vic.* n.s. 59: 75 (1950)]. Such peaks as Mt. Belches (Duke of Orleans Bay) are botanically almost identical with the highest island summits (North Twin Peak, Flinders Peak, etc.); but sand-plains, with their wealth of spectacular flowers, surround the bases of and connect these mainland eminences.

There is a surprising dearth of *Proteaceae* among the islands (only 3 species) and a comparatively poor representation of *Cyperaceae*, *Restionaceae*, *Orchidaceae*, *Papilionaceae*, *Myrtaceae* and *Goodeniaceae*—by contrast with the numerous mainland species in these groups. The colourful genera *Conostylis*, *Petrophila*, *Isopogon*, *Adenanthos*, *Grevillea*, *Banksia*, *Daviesia*, *Backea*, *Chamaelancium* and *Astroloma*, which are so conspicuous between Esperance and Israelite Bays, are absent from the Archipelago. Neither is there any insular occurrence of the cycad, *Macrozamia reidii*, nor of Christmas-tree, *Nuytsia floribunda*. The *Macrozamia* ranges, in this region, from about 30 miles west of Esperance to an eastern limit in the hills north of Cape Pasley, while *Nuytsia* ends at Rubicon Creek in the Cape Arid hills (according to J. P. Brooke, "Natural Features of Israelite Bay" in *Report, Sixth Meeting Australasian Assoc. Adv. Science*, pp. 561 & 564, 1895); we found both at Duke of Orleans Bay.

Only two pteridophytes frequent the islands—Rock Fern, *Cheilanthes tenuifolia* (found in granite country almost throughout southern Australia) is widespread between Figure-of-Eight and Christmas but not very plentiful; Quillwort, *Isoetes drummondii* (also of wide distribution in southern Australia) was noted only in a drying pool at the summit of Flinders Peak, Middle Id. Shore Spleenwort (*Asplenium obtusatum*), which is reputed to occur on Eclipse Island, 11 miles south of Albany, was sought diligently but unsuccessfully in the Recherche, nor was its more widespread congener *A. flabellifolium* (Necklace Fern) to be found. Paucity of fern growth is consistent with conditions prevailing over the whole southern and south-western portion of the State.

Members of the carnivorous *Lentibulariaceae* (so common in swamplands of south-western West Australia) seem to be absent entirely from both the Archipelago and adjoining mainland terrain.

Discontinuities in Distribution

As with mammals and reptiles, the distributions of plants (between extremes of the Archipelago) exhibit some curious phenomena which admit of no easy explanation. Some of the more striking instances are as follows:

Sixty-four (64) species have been found only on single islands. The ubiquitous grasses *Poa caespitosa* and *Stipa tenuiglumis* appear to be absent from Wedge and Christmas Islands respectively. There is abundant *Lomandra rigida* on South Twin Peaks, but (apparently) none on the mass of North Twin Peaks which almost touches it; nor does this hardy plant extend any farther east. Other startling contrasts are afforded by this pair of islands. [See p. 9]. The *Hibbertia racemosa* was detected only on Figure-of-Eight and Middle Islands, 90 miles apart. *Hibiscus huegelii* is restricted to Woody, Mondrain and Middle, with gaps between of 17 and 53 miles respectively. *Melaleuca elliptica* occurs at Woody and South Twin Peaks (45 miles apart), but was not located on large islands between or anywhere else. More surprising still is the occurrence of *Casuarina huegeliana* on northern headlands of Mondrain and Christmas, but nowhere in the intervening 105 miles (where the Twin Peaks and Middle Id. would afford admirable habitats).

The species instanced above are all plants of granitic soil, and the range of some might be extended when intensive exploration of the Archipelago is possible.

Occurrence of Distinct Entities

One enticing objective of the A.G.S. expedition was to ascertain, if possible, whether any undescribed forms of plant life existed among the islands. Nothing was discovered which could be pronounced unhesitatingly as a species new to science, but several island populations were found to diverge appreciably from mainland forms of apparently the same species. When further investigated, two entities may possibly warrant recognition as distinct species; the available dried material of them, however, is rather limited. These variants will now be discussed:

Wherever *Lobelia anceps* grows (always on granite), it assumes a remarkably broad-leaved, large-flowered, robust and almost succulent form that is hardly to be recognized as conspecific with the tenuous, very small-flowered, narrow-leaved and sparsely foliose plant of marshy places in the eastern States.

On the other hand, North Twin Peaks yielded a *Lobelia* which I can only refer at present to a form of *L. rhombifolia*; but there are significant differences—solitary shoots with distant narrow-linear stem leaves, much smaller flowers and, above all, an evenly globular, non-gibbous ovary.

High on Sandy Hook, Remark, Pasco, Mondrain and North Twin Peaks is an ericoid *Hibbertia* with affinities to *H. acerosa* of the mainland, but differing in its coarser, denser, more rigidly ascending foliage and larger flowers on manifestly shorter pedicels; it may prove to be undescribed. Young flower buds are often

transformed into large brown spherical galls, about half an inch in diameter; these convey the impression of fruits on some prickly *Persoonia*.

Abundant on many islands, from Figure-of-Eight to Goose (but not seen on the larger masses of Mondrain and Middle) is a noteworthy variant of *Brachycome pusilla*. This decumbent annual has rather foliose branches, broad strongly dissected leaves and short white or pale bluish rays. In the typical form of *B. pusilla* plants are smaller, less branched, with entire linear leaves (practically confined to the base) and much longer ligules to the ray florets; but the achenes exhibit no essential differences. "*Dissecta*" would be an appropriate varietal epithet for the island plant, which has been noted also at Dempster Head, Esperance, and near Israelite Bay.

The cypress-pine of the Recherche was collected by Brown at Middle Island (1802) and designated, but not published, as a distinct species "*Callitris tuberculata*". It also occurs at several points on the mainland coast (always on granite) and extends at least as far west as Doubtful Island. Baker and Smith (1910) took up Brown's manuscript name and published *Callitris tuberculata*, but with a most inadequate diagnosis in their *Pines of Australia*, p. 99. Some botanists consider that the plant is specifically different from the calciphilous Rottnest Island Pine (*C. preissii*, syn. *robusta*) which has usually larger cones. However, despite the habit and habitat differences, I am unconvinced and prefer to treat the Recherche tree as a form of *C. preissii* developed on granite—variations exist even on one island, and the cones of some examples are practically indistinguishable (as are the seeds and columellae) from specimens growing naturally near Perth, e.g. at Point Resolution.

New Records for Western Australia

Records of the following six indigenous species seem never to have been made previously for the Western State:

Centrolepis murrayi (S. declivities, BOXER)—nearest record Pearson Id., South Australia (where hitherto believed endemic).

Pomaderris oraria (S.E. limestone cliff, MIDDLE; also Gale's Brook, Mississippi Bay on mainland, and at the Ravensthorpe Range (q.v. Perth Herb.))—nearest record Flinders Id., S. Aust. (under "*P. racemosa*").

Haloragis acutangula (BOXER and MIDDLE, on limestone)—nearest record Eyre Peninsula, S. Aust.

Scævola linearis (Central plateau shrubbery, MONDRAIN)—nearest record Eyre Peninsula, S. Aust.

Stuartina muelleri (On 6 islands, FIGURE-OF-EIGHT to WEDGE)—nearest record Eyre Peninsula, S. Aust.

Sonchus megalocarpus (S. cliffs, BOXER; beach, SANDY HOOK; also many mainland stations, e.g. Esperance, Duke of Orleans Bay, Point Malcolm, Israelite Bay—on beach dunes)—nearest record Flinders Id., S. Aust. (under "*S. asper*, var. *littoralis*").

Spergularia rubra and *Gnaphalium indutum* were listed for Western Australia in F. Mueller's 1889 *Census of the Australian flora*, but both were omitted by C. A. Gardner in his *Enumeratio Plantarum Australiae Occidentalis* of 1930. They are each present in several parts of the Recherche Archipelago. *Picris hieracioides* (found only at South Twin Peaks) is an alien weed which does not appear in Gardner's *Enumeratio*, although it is recorded by Bentham (*Flora Australiensis*, 1866) on the basis of several collections from Preiss (1839) onwards.

Euphorbia paralias is an interesting new record of a littoral, alien species which I found only at one place, viz. the extreme eastern part of the beach on Goose Island Bay (Middle Id.) where it was well established amongst driftwood and clumps of *Scirpus nodosus*. The only other Australian location of this European Sea Spurge would seem to be on the west coast of Yorke Peninsula, S. Aust., opposite Wardang Island—perhaps the two widely separated occurrences are linked by the visit of some ship?

V. HUMAN INTERFERENCE

(fires, grazing, weeds)

There is no evidence that aborigines ever visited the Recherche islands before the advent of white men; but disturbance of the natural flora (and its equilibria) has occurred since, in all places which have been inhabited for months at a time or used for the depasturing of sheep. Changes have been profound on several much-grazed islands near to Esperance (notably Woody), and each of the larger ones has also suffered more or less deterioration as a result of human activity.

Destruction of scrub and forest land by fire (either accidental or deliberate) has had greater effects on the vegetation than all other disturbances attributable

to human agency—timber-felling for various purposes, browsing of herbage by stock with the concomitant introduction of alien grasses and weeds; clovers have been deliberately sown in places. Indigenous plants are usually less aggressive than the intruders which compete for space and nutriment; attention has already been drawn [p. 6] to the Wild Oat which may take complete possession of burnt-over clearings. It is singular that Middle Island, which has been inhabited to a greater extent than any other, should appear to-day well-wooded and natural, with so few indications of detrimental "man-handling".

The earliest record of any fire in the Archipelago concerns a conflagration caused by some of Flinders' men on Mondrain (13th January, 1802); Flinders described it as "a general blaze all over the island." Extent of the damage then is not known, but apparently recovery of the vegetation was complete within a century. Mondrain was ignited again and severely burned on 23rd January, 1944, about three-fifths of the island being devastated [notes from S. Fowler who made an aerial inspection of Mondrain, 27.9.1944]. A. F. Basset Hull (*The Emu* 21: 284, 1922), referring to his visit to Mondrain in November 1921, stated that "many times have fires been put through the scrub." But the contention is hardly supported by a statement from G. P. Whitley's skipper, Arthur Douglas (*The Emu* 44: 6, 1944): "All attempts at burning off Mondrain had previously failed, and not even kerosene could help to ignite the accumulated undergrowth there." It seems incredible that anyone should *desire* to burn out this mountainous island, which could offer nothing in the way of grazing land. Heavy regrowth certainly now covers most of the 1944 fire area [see p. 8].

Except for the more recent disastrous fires on Woody Island (1949 and 1950), information on the burning of other islands, e.g. Boxer, Sandy Hook, Long, Remark, Twin Peak, Goose and Middle, appears to be lacking. [See reference to ignition of Salisbury, p. 13]. It is most likely that occupancy during the sealing days witnessed occasional firing of scrub and forests—North Twin Peaks and Sandy Hook have both had fires of some magnitude. It is questionable whether very occasional fires (if not severe) may not benefit the vegetation by destroying old, stagnant, over-mature growth and encouraging crops of healthy seedlings; the danger lies in successive fires which burn out young regeneration and prevent the re-establishment of humus in the soil, while any fire is inimical to nesting birds.

Fortunately for the Recherche Archipelago, the pestiferous mainland strain of rabbit has not been introduced, and the only island upon which we found rabbits at all was Goose, where a black strain has existed at least since the 1880's. Presumably these rodents were introduced by sealers, but they have caused no appreciable damage to the soil or indigenous vegetation. Very few other alien animals exist and their effects on plant equilibria are negligible.

Besides ornamental shrubs, a few stands of pole timber, and very limited patches of grass, the Recherche is devoid of plants which might be of direct utility to man; edible fruits are virtually absent.

VI. LIST OF VASCULAR PLANTS (with their island occurrences)

Species in this enumeration are arranged systematically (according to the Engler and Prantl scheme, with slight modifications) and authorities for names are cited.

Three prefixing signs have been used, as follows:

f Species observed in flower during November 1950.

* Naturalized alien plants (weeds).

† Species not previously recorded for Western Australia.

Islands are arranged according to the order in which they were visited and, for economy of space, the following abbreviations have been adopted:

Fig. (Figure-of-Eight)	Rnd. (Round)	Mid. (Middle)
Box. (Boxer)	NTP. (North Twin)	Gse. (Goose)
SHk. (Sandy Hook)	Peaks	Dgs. (Douglas)
Rmk. (Remark)	STP. (South Twin)	Sby. (Salisbury)
Lng. (Long)	Peaks	Xms. (Christmas)
Pco. (Pasco)	Cve. (Cave)	Wdy. (Woody)
Mon. (Mondrain)	Wge. (Wedge)	
Tmn. (Termination)	Cbe. (Combe)	

Collections (including several types) made by Labillardiere, Brown and Maxwell are indicated, and exact localities are given for rare and localized species.

New combinations of two varietal epithets are made under *Anyema miraculosa* and *Athrixia nivea*.

PTERIDOPHYTA (Ferns and fern allies)

ADIANTACEÆ

Cheilanthes tenuifolia (Burm.) Sw., 1806—Fig., Box., SHk., Rmk., Lng., Mon., NTP., STP., Mid., Gse., Xms., Wdy.—also *leg. Maxwell*.

ISOETACEÆ (Quillworts)

Isoetes drummondii A. Br., 1863 [form with indusiate sporangia = ? *I. humilior* F. Muell.] —Mid. (rare—summit pool on Flinders Peak), also on Mt. Belches, Orleans Bay.

GYMNOSPERMÆ (Conifers)

CUPRESSACEÆ

Callitris preissii Miq. in Lehm., 1845 [syn. *C. robusta* (Mirb. ex Endl., 1847) F. M. Bailey, 1886; incl. *C. tuberculata* R. Br. ex Baker & Smith, 1910]—SHk., Lng. (rare), Mon., Mid. (summit)—also *leg. R. Brown* (TYPE *C. tuberculata*).

ANGIOSPERMÆ (Flowering Plants)

MONOCOTYLEDONEÆ

POTAMOGETONACEÆ

Cymodocea antarctica (Labill.) Endl., 1836 [marine plant]—Fig., SHk., Pco., Mon., NTP., Cve., Mid., Gse., Xms.

Posidonia australis Hook. f., 1857 [marine plant]—Box., SHk., Mon., NTP., Mid., Gse., Xms.

JUNCAGINACEÆ

Triglochin trichophora Nees in Lehm., 1846—Fig., Box., NTP., Cbe., Mid., Gse. (pools).

GRAMINEÆ (Grasses)

Neurachne falopecuroides R. Br., 1810—SHk.

Spinifex hirsutus Labill., 1806—Box., SHk., Mid., Xms. (beaches).

* *Ehrharta longiflora* Sm., 1789—SHk., Xms., Wdy.

Sporobolus virginicus (L.) Kunth, 1832—Box., SHk., Pco., Tmn., Rnd., NTP., Cve., Cbe., Mid., Dgs., Xms.

Agrostis avenacea Gmel., 1791—Fig., Box., Lng., Mon., NTP., STP., Mid., Gse., Xms., Wdy.

Dichelachne crinita (L.f.) Hk.f., 1853—Lng. (short-awned form).

Stipa tenuiglumis, Hughes, 1921 [very close to *S. elatior* Hughes]—Fig., Box., SHk., Rmk., Lng., Pco., Mon., Rnd., NTP., STP., Wge., Mid., Gse., Dgs., Wdy.

* *Polypogon monspeliensis* Desf., 1798—Box., Rmk., Pco., Mon., Wdy. (very tall).

* *Lagurus ovatus* L., 1753—Wdy.

* *Koeleria phleoides* Pers., 1805—Fig., Box., Lng., STP., Wdy.

* *Vulpia bromoides* (L.) S. F. Gray, 1821—Fig., Box., Lng., Mon., NTP., STP., Gse., Xms., Wdy.

* *Membranacea* (L.) Dum., 1821—Box., Rnd., NTP., STP., Wge., Gse., Xms., Wdy.

* *Scleropoa rigida* (L.) Griseb., 1844—Box.

Serrafalcus arenarius (Labill.) C. A. Gardner, 1952—Box., SHk., Rmk., Lng., Pco., Mon., Rnd., NTP., STP., Wge., Dgs., Xms., Wdy.

* *Bromus mollis* L., 1762—Box., Wdy.

* *Gussonii* Parl., 1842—Fig., Box., SHk., Wdy.

* *Briza minor* L., 1753—Fig., Box., Mon., Wdy.

Poa caespitosa Forst., 1786 [fine and smooth-leaved form]—Fig., Box., SHk., Rmk., Lng., Pco., Mon., Rnd., NTP., STP., Cve., Mid., Gse., Dgs., Sby., Xms., Wdy.

* *Aira caryophyllea* L., 1753—Fig., Rmk., Lng., Wdy.

* *præcox* L., 1753—Wdy.

Danthonia caespitosa Gaudich., 1826—Pco., Mon., Mid., Xms.

* *Avena fatua* L., 1753—Fig., SHk., Rmk., Lng., NTP., Wdy. (very tall, to 8 ft.).

Cynodon dactylon Rich. in Pers. 1805—Wdy.

* *Lolium loliaeum* (Bory & Chaub.) Hand. Mazz., 1914—Fig., Box.

* *Parapholis incurva* (L.) Hubbard, 1946—Fig., Box., Wdy.

- Agropyron
f scabrum (Labill.) Beauv., 1812 [robust, pubescent form]—Box., SHk., Rmk., Lng.,
Pco., Rnd., NTP., STP., Wge.
* Hordeum
f murinum L., 1753—Fig., Box., Lng., Wdy.

CYPERACEÆ

- Scirpus
f antarcticus L., 1771—SHk., Rmk., Lng., Pco., Mon., NTP., STP., Wge., Wdy.
f cernuus Vahl, 1806—Fig., Box., Mon., Tmn., Rnd., NTP., STP., Mid., Gse.
f nodosus Rottb., 1773—Fig., Box., SHk., Rmk., Mon., Rnd., NTP., STP., Cve.,
Mid., Gse., Dgs., Sby., Xms.
Schenus
f drummondii (Steud.) Benth., 1878—Pco. (summit).
Lepidosperma
gladiatum Labill., 1804—Box. (rare), Pco., NTP., Mid., Sby.
f viscidum R. Br., 1810—SHk., Pco., Mon.
f angustatum R. Br., 1810—SHk., Rmk., Pco., Mon., Mid. (summit).
f leptostachyum Benth., 1878—SHk., Mon.
Gahnia
f trifida Labill., 1804—SHk., Pco., Mon., Mid. (salt lake, & S.E. limestone cliffs).

RESTIONACEÆ

- Loxocarya
f flexuosa (R. Br.) Benth., 1878—Mon. (rare—central part).

CENTROLEPIDACEÆ

- Centrolepis
f murrayi J. M. Black, 1923—Box. (mixed with minute Triglochin Juncus and
Crassula spp. on seepages over southern granite faces; only other collection known
is that of TYPE, from Pearson Id., Sth. Aust.—T. G. B. Osborn, Jan. 1923).
f glabra (F. Muell.) Hieron., 1873—Mid. (summit pool).
f strigosa (R. Br.) Rcm. & Schult., 1817—Fig., Box., Rmk., Lng., Pco., Mon., NTP.,
STP., Mid., Gse., Xms., Wdy.—also leg. Brown.
f polygyna (R. Br.) Hieron., 1873—Box., Lng., Pco., Mon., NTP., Mid., Gse., Xms.,
Wdy.

JUNCACEÆ

- Juncus
f bufonius L., 1753—Box. (reduced cushion form, with Centrolepis spp.), Gse., Wdy.
f plebeius R. Br., 1810—Wdy. (? introduced).
f maritimus Lam., 1789—Mid. (salt lake).

LILIACEÆ

- Xanthorrhoea
preissii Endl. in Lehm., 1846—SHk. (centre), Mon. (centre).
Lomandra
f rigida Labill., 1804—Rmk., Lng., Pco., STP. (common).
Borya
f nitida Labill., 1804—SHk., Pco., Mon., Mid.—chiefly exposed granite of peaks.
Dianella
f revoluta R. Br., 1810—Fig., Box., Mon., NTP., Mid., Gse., Xms.
Anguillaria
dioica R. Br., 1810—SHk., Pco., Mon., Mid. (west ridge).
Agrostocrinum
f scabrum (R. Br.) Baill., 1893—SHk., Mon. (centre).
Thysanotus
pateronii R. Br., 1810—Mon. (centre).
f dichotomus (Labill.) R. Br., 1810—SHk., Mon. (centre).
Bulbine
f semibarbata (R. Br.) Haw., 1821—NTP.
Stypandra
f imbricata R. Br., 1810—SHk., Lng., Wdy.

IRIDACEÆ

- Patersonia
inaequalis Benth., 1873—Mon. (centre).

ORCHIDACEÆ

- Pterostylis
nana R. Br., 1810—Lng. (Moonah grove), NTP. (Yate forest), Mid. (Flinders Peak).
Thelymitra
aristata Lindl., 1840—Rmk., Pco.
fusco-lutea R. Br., 1810—SHk. (mossy springs).
Microtis
f alba R. Br., 1810—SHk. (mossy spring in gully head).
f unifolia (Forst.) Reichb. f., 1871—Fig., Box., SHk., Rmk., Lng., Mon., NTP.,
STP., Mid.
Diuris
longifolia R. Br., 1810 [very dwarfed]—Pco.
Caladenia
latifolia R. Br., 1810—Fig., Box., Lng., Mon., NTP., STP.

DICOTYLEDONEÆ

CASUARINACEÆ

- Casuarina
huegeliana Miq. in Lehm., 1845—Mon. (N. peak, to 15 ft.), Xms. (N. peak).
trichodon Miq. in Lehm., 1845—SHk., Mon. (centre), Mid. (Flinders peak).

URTICACEÆ

- Parietaria
f debilis Forst. f., 1786—Fig., Box., SHk., Lng., Rmk., Mon., NTP., STP., Mid.,
Gse., Sby., Wdy.

PROTEACEÆ

- Hakea
clavata Labill., 1804—SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Wge., Mid.
suaveolens R. Br., 1811—SHk., Rmk., Pco., Mon., NTP., Mid.—also leg. Brown
(TYPE).
Dryandra
sp. [leaves only]—Mon. (N. peak and summit).

SANTALACEÆ

- Exocarpus
sparteus R. Br., 1810—SHk., Mon. (centre and N.).
Leptomeria
f cunninghamii Miq. in Lehm., 1845—Mon. (centre).

LORANTHACEÆ

- Amyema
miraculosa (Miq.) van Tiegh., 1895, var. melaleuca (Tate) comb. nov. [syn. Loranthus
miraculosus, var. melaleuca Tate, 1880]—Mid. (frequent on Moonah).

POLYGONACEÆ

- Muehlenbeckia
f adpressa (Labill.) Meisn., 1843—Fig., Box., SHk., Lng., Rmk., Mon. (forming
lanes), Rnd., NTP., STP., Wge., Mid., Gse., Dgs., Sby., Xms., Wdy.—also leg.
Labillardiere (TYPE).

CHENOPODIACEÆ

- Atriplex
f cinerea Poir., 1810 [incl. A. isatidea Moq.]—Fig., Box. (S. side), Tmn. (S., rare),
Rnd., NTP., Cbe. (common), Mid., Gse., Sby., Xms. (saddle).
Rhabodia
f haccata (Labill.) Moq., 1849—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Rnd.,
NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Sby., Xms., Wdy.—also leg.
Brown.
+ var. linearis (Benth.) J. M. Black, 1948—Mid. (tall scrambler at E. base of
Flinders Peak).
f crassifolia R. Br., 1810—Box., Cbe., Mid., Gse.
Suaeda
maritima (L.) Dum., 1827 [incl. S. australis (R. Br.) Moq.]—Mid.—leg. R. Brown,
1802.
Enchylana
f tomentosa R. Br., 1810—Fig., Box., SHk., Mon., Tmn., Rnd., NTP., STP., Wge.,
Cbe., Mid., Gse., Dgs., Xms.
Threlkeldia
f diffusa R. Br., 1810—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., STP.,
Cve., Cbe., Mid., Gse., Dgs., Sby., Xms. (saddle).
Salicornia
australis Banks & Sol. in Forst., 1786—Cbe., Mid. (salt lake, also E. & S.), Sby.
Arthrocnemum
halocnemoides Nees in Lehm., 1845—Cbe. (variable).

AIZOACEÆ

- Carpobrotus
aquilatus (Haw.) N.E. Br., 1928—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Tmn.,
Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Sby., Xms., Wdy.
Disphyma
f australe (Soland. & Forst.) J. M. Black, 1932—Fig., Box., Lng., Pco., Mon., Tmn.,
Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Xms., Wdy.
Tetragonia
f implexicoma (Miq.) Hook. f., 1854—Fig., Box., SHk., Lng., Rmk., Pco., Mon.,
Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Sby., Xms., Wdy.

PORTULACACEÆ

- Calandrinia
calyptata Hook. f., 1840—Fig., Box., Pco., Mon., Tmn., Rnd., NTP., STP., Wge.,
Cbe., Mid., Gse., Dgs., Xms.
pygmaea F. Muell., 1859—Gse.

CARYOPHYLLACEÆ

- Stellaria
f media Cyrill., 1784—Box., Mon.
* Cerastium
f viscosum L., 1753—Fig., Box., Rmk., NTP., Wdy.
Spergularia
f rubra (L.) J. & C. Presl, 1819—Box., Lng., Pco., Mon., Gse., Wdy.
* Polycarpon
f tetraphyllum Lef. in L., 1759—Fig., Box., Wdy.
* Silene
f gallica L., 1753—Wdy.

RANUNCULACEÆ

- Clematis
microphylla DC., 1818—Box., Mid., Gse.
pubescens Hueg., 1837—Mon. (in gullies, rare), NTP., Mid., Sby.

LAURACEÆ

- Cassytha*
f. pomiformis Nees in Lehm., 1845—SHk., Mon. (common after 1944 fire), Mid.

CRUCIFERÆ

- Lepidium*
f. foliosum Desv., 1814—Fig., Box., Lng., Rmk., Mon., Tmn., Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Xms.
Hymenolobus
procumbens (L.) Nutt., 1838—Box. (southern limestone ledges).
Cakile
f. maritima Scop., 1760—Fig. (rare), SHk. (beach).

DROSERACEÆ

- Drosera*
glanduligera Lehm., 1844—Mon. (gully at N. point).
f. macrantha Endl., 1837—SHk., Mon. (centre).

CRASSULACEÆ

- Crassula*
mirianae Ostenf., 1918—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Tmn., Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Sby., Xms. (saddle).
f. bonariensis (DC.) Cambess. in St. Hil., 1825—Fig., Box., Mon.
f. natans Thunb., 1794—Box., Gse. (sunkages from limestone).

PITTOPOREACEÆ

- Sollya*
f. heterophylla Lindl., 1832—Rmk., Mon., NTP., Mid.

MIMOSACEÆ

- Acacia*
f. anceps DC., 1825—Mid. (limestone above S. coast).
cyclopsis A. Cunn. in G. Don, 1832—Fig. (rare), Box., SHk., Lng., Rmk., Mid., Sby., (common).
subcærulea Lindl., 1827—SHk., Mon., Wdy.
myrtifolia Willd., 1805—SHk., Rmk., Pco., Mon.
crassiuscula Wendl., 1820—Mon.
nitidula Benth., 1864—Mid. (E. foot of Flinders Peak)—also *leg. Brown* (TYPE in part).
f. heteroclita Meisn. in Lehm., 1845—SHk., NTP., Mid., Gse.
acuminata Benth. in Hook., 1842.
var. latifolia Benth., 1864—SHk., Lng., Rmk., Mon., NTP., STP., Mid., Wdy.—also *leg. Maxwell* (TYPE of variety).
obscura DC., 1829—SHk., Mon. (centre), Mid. (peak)—also *leg. Brown*.
Albizia
lophantha Benth., 1844 [syn. *A. distachya* (Vent.) Macbride]—Fig., Box., SHk., Lng., Rmk., Pco., Mon. (very tall in gullies), Tmn. (prostrate form), Rnd., NTP., STP., Wge., Mid., Dgs., Xms., Wdy. (copious seedlings after 1950 fire)—also *leg. Brown*.

CÆSALPINIACEÆ

- Labichea*
f. lanceolata Benth., 1837—SHk.

PAPILIONACEÆ

- Chorizema*
f. aciculare (DC.) Gardner, 1931—Mon. (centre).
ilicifolium Labill., 1799—[? Wdy.—*leg. Labillardiere*, 1792 (TYPE)].
Gastrolobium
f. bilobum R. Br. in Ait., 1811—SHk., Pco., Mon., NTP., Mid., Wdy.
Gompholobium
f. knightianum Lindl., 1837—Mon. (centre).
Pultenaea
f. obcordata (R. Br.) Benth., 1864—Box., Mid. (on limestone).
Dillwynia
f. pungens (Sweet) Mackay, 1838—Mid. (E. foot of Flinders Peak).
Eutaxia
f. obovata (Labill.) Gardner, 1931—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Wge., Mid.
** Trifolium*
** glomeratum* L., 1753—Wdy.
** Medicago*
** hispida* Gaertn., 1791—Box., Wdy.
** Melilotus*
** indica* Albion, 1785—Box. (very common), Wdy.
Bossiaea
dentata (R. Br.) Benth., 1864—SHk., Lng., Pco., Mon., Rnd., NTP. (summit), Mid. (peak)—also *leg. Brown* (TYPE in part).
Templetonia
retusa (Vent.) R. Br., 1812—SHk., Lng., Pco., Mon., Wdy.
Kennedya
f. nigricans Lindl., 1835—NTP. (E. slopes of peak), Mid.

GERANIACEÆ

- Pelargonium*
f. australe Willd., 1800—Box., SHk. (very large), Lng. (2 forms), Rmk., Pco., Mon., Rnd., NTP., STP., Cve., Wge., Mid., Wdy. (small form).
Geranium
f. pilosum Forst. ex Willd., 1800—Box.

OXALIDACEÆ

- Oxalis*
f. corniculata L., 1753—Box., Lng., Mon., Mid.

RUTACEÆ

- Boronia*
f. alata Sm., 1807—Box., NTP., Mid. (to 5 ft. under moonah), Sby. (common).
f. albiflora (R. Br.) Benth., 1863—SHk., Mon. (centre—about 9 leaflets), Mid., (white and pink).
f. scabra Lindl., 1839—SHk. (species rare and little known).
Phebalium
f. rude Bartl. in Lehm., 1844—Mid. (N. coast, on granite).
f. euphemiae (F. Muell.) Gardner, 1931—Mid. (summit of Flinders Peak, rare).

ZYGOPHYLLACEÆ

- Nitraria*
schoberi L., 1759—Fig. (small N. beach), NTP. (1 bush), Gse. (1 bush), Xms. (bordering whole W. beach).
Zygophyllum
f. billardieri DC., 1824—Rnd., Mid., Gse., Sby., Xms. (saddle).
? glaucescens F. Muell., 1862—Mid. (rare—S. limestone cliffs; also at Israelite Bay).

POLYGALACEÆ

- Comesperma*
f. volubile Labill., 1806—Box. (common at limestone summit), Mon. (centre).
f. confertum Labill., 1806—Mon. (centre).

EUPHORBIACEÆ

- Euphorbia*
** parviflora* L., 1753—Mid. (E. extremity of long beach at N.E. point).
Poranthera
f. microphylla Brongn., 1829—NTP. (summit), Mid. (S. limestone).
Phyllanthus
f. calycinus Labill., 1806—Box. (rare), NTP. (rare—summit), Mid. (N.E.).
f. scaber Klotzsch in Lehm., 1844—Box., SHk., Lng., Pco., Mon., Rnd., NTP., STP., Wge., Mid., Gse., Wdy.
Beyeria
f. viscosa (Labill.) Miq., 1844—SHk., Lng., Rmk., Pco., Rnd., Mid., Wdy.

STACKHOUSIACEÆ

- Stackhousia*
f. huegelii Endl., 1837—Mid., Xms. (N. peak).

SAPINDACEÆ

- Dodonaea*
oblongifolia Link., 1821 [syn. *D. ceratocarpa* Endl., 1837]—Box., SHk., Lng., Pco., Mon., Rnd., NTP., Mid., Gse.—also *leg. Brown*.

RHAMNACEÆ

- Pomaderris*
** oraria* [as "P. ovaria"] F. Muell. ex Reiss., 1857—Mid. (rare—S. coast limestone; also at Gale's Brook on Mississippi Bay, *leg. Maxwell*).
myrtilloides Fenzl.—Box., Mid. (on limestone)—also *leg. Brown*.
Spyridium
f. globulosum (Labill.) Benth., 1863—SHk., Lng., Rmk., NTP., Mid., Sby. (common).
f. spadicum (Fenzl.) Benth., 1863—SHk., Mon., Mid. (*leg. Maxwell*).

MALVACEÆ

- Lavatera*
f. plebeja Sims, 1821—Box. (S. coast), Rnd., Wge. (common), Gse. (rare), Dgs., Gulch I. (*leg. Maxwell*).
** Malva*
** parviflora* L., 1753—Wdy.
Sida
f. hookeriana Miq. in Lehm., 1844—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Wdy.
Hibiscus
f. huegelii Endl., 1837 [white and rich purple forms]—Mon. (N. coast), Mid. (*leg. R. Brown*, 1802), Wdy. (N. coast).

STERCULIACEÆ

- Rulingia*
f. grandiflora Endl., 1837—Mon. (rare—gully above S.E. fjord). Wdy. (abundant after 1950 fire).
Lasiopetalum
f. discolor Hook., 1835—Box., Mid. (rare—on limestone).
f. quinquenervium Turcz., 1852—SHk.

DILLENIACEÆ

- Hibbertia*
f. racemosa (Endl.) Gilg. in Engl & Prantl., 1893—Fig., Mid.—also *leg. Maxwell*.
f. sp. lafi. H. acerosa (R. Br.) Benth.—SHk., Rmk., Pco., Mon., NTP. (summit).

FRANKENIACEÆ

- Frankenia*
f. tetrapetala Labill., 1804—Fig., Box., Rnd., NTP., Cbe., Mid., Gse., Dgs., Sby., Xms., Wdy. (shores).

THYMELÆACEÆ

- Pimelea*
f. ferruginea Labill., 1804—Fig., Box., SHk., Lng., Pco., Mon., Rnd., NTP., STP., Mid.
argentea R. Br., 1810—Box. (rare, after fire), Mon., Mid.—also *leg. Brown* (TYPE).
f. clavata Labill., 1804—SHk., Lng., Rmk., Mon. (to 10 ft.), NTP., Mid., Sby. (stunted), Xms. (saddle)—also *leg. Maxwell*.

MYRTACEÆ

- Eucalyptus*
lehmannii (Schauer in Lehm.) Benth., 1866—SHk., Lng., Mon., NTP., Mid.—also *leg. Dr. Stoward*.
cornuta Labill., 1799—Rmk., Mon., NTP. (S. of summit), Mid., Wdy.—also *leg. Labillardiere* (TYPE).
f. conglobata (R. Br.) Maiden, 1922—SHk. (main gully, large and coarse-leaved form).
incrassata Labill., 1806,
f. var. angulosa (Schau. in Walp.) Benth., 1866—SHk., Mon., NTP., Mid. (to 30 ft.)—also *leg. G. Simmonds*.
platypus Hook., 1852,
var. heterophylla Blakely, 1934—Mon. (N. peak), Mid., Wdy. (form approaching *E. spathulata*)—also *leg. Brown*.
Agonis
f. marginata (Labill.) Schau. in Lehm., 1844—SHk., Rmk., Mon., NTP. (large trees S. of summit), STP., Mid. (peak).
Kunzea
f. baxteri (Klotzsch) Schau. in Lehm., 1844—Mon., NTP., Mid. (W. ridge), Xms. (N. peak).
sericea (Labill.) Turcz., 1847—SHk., Lng., Rmk., Pco., Mon., Wdy.—also *leg. Labillardiere* (TYPE).
Melaleuca
f. elliptica Labill., 1806—STP. (several old bushes on NW. slope of summit), Wdy. (N. slopes, fire damaged).
? brevifolia Turcz., 1852—Mid. (limestone depressions above S. cliffs; also at Israelite Bay, common).
pubescens Schau. in Walp., 1843—Box. (climax community), SHk., Lng., Rmk., Mon., NTP., Mid. (extensive groves), Wdy. (heavy seedling growth after 1950 fire)—also *leg. Brown*.
f. globifera R. Br. in Ait., 1812—SHk., Lng., Rmk., Mon., NTP., STP. (to 30 ft.), Mid., Gse. (N. central)—also *leg. Maxwell*.
pentagona Labill., 1806—Mid. (S. coast limestone).
Calothamnus
f. quadrifidus R. Br. in Ait., 1812—SHk., Mon., Mid. (peak).
Astartea
f. fascicularis (Labill.) DC., 1828—SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Wge. (summit), Mid., Wdy.
Calytrix
tetragona Labill., 1806—Mid. (N.E. point, rare).
Verticordia
f. minutiflora F. Muell., 1864—Pco., Mon. (centre).

HALORAGIDACEÆ

- Haloragis*
f. racemosa Labill., 1804—Fig., Rmk., Mon. (to 15 ft. in gully above S.E. fjord), Mid., Xms.—also *leg. Maxwell*.
f. acutangula F. Muell., 1855—Box., Mid. (on limestone).
f. scordiodoides Benth., 1864—Box., SHk., Lng., Rmk., Pco., Rnd., NTP., STP., Wge., Cbe., Mid., Dgs., Wdy.

UMBELLIFERÆ

- Hydrocotyle*
f. alata R. Br., 1820—Mon. (summit pool).
f. medicaginoides Turcz., 1849—Box. (southern limestone ledges), Mid. (S. coast limestone).
Trachymene
pilosa Sm. in Rees, 1819—Fig., Box., SHk., Lng., Rmk., Pco., Mon., NTP., STP., Mid., Xms., Wdy.
Platysace
f. compressa (Labill.) Norman, 1939—SHk., Lng., Rmk., Pco., Mon., STP. (common), Wdy.—also *leg. Labillardiere* (TYPE).
Daucus
glochidiatus (Labill.) Fisch. Mey. & Avt-Lall., Ca. 1840? [syn. *D. brachiatus* DC., 1830]—Fig., Box., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Wdy.
Apium
prostratum Labill., ex Vent., 1804—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Tmn., Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gse., Dgs., Sby., Xms., Wdy.

EPACRIDACEÆ

- Andersonia*
f. sprengelioides R. Br., 1810—SHk., Lng., Rmk., Pco. (cushion plants), Mon.
Acrotriche
f. cordata (Labill.) R. Br., 1810—Mid. (S. limestone cliffs).
Leucopogon
interruptus R. Br., 1810—NTP., Mid. (Flinders Peak)—also *leg. Brown* (TYPE).
parviflorus (Andrews) Lindl., 1833—Fig., Box., Mid., Gse. (rare), Sby. (common).
rotundifolius R. Br., 1810 [hyaline leaf margins]—SHk., Mon. (centre), Mid. (Flinders Peak)—also *leg. Brown* (TYPE in part).
f. gnaphalioides Stschegl., 1859 [broad, hairy leaves]—SHk., Pco., Mon. (centre).
f. obovatus (Labill.) R. Br., 1810 [incl. *L. revolutus* R. Br.]—Fig., Box., Lng., Rmk., Pco., Mon., Rnd., NTP., STP., Cve., Wge., Mid., Gse., Dgs., Xms., Wdy.
f. apiculatus R. Br., 1810—Mid. (Flinders Peak)—also *leg. Brown* (TYPE).

PRIMULACEÆ

- * *Anagallis*
f. arvensis L., 1753—Box., Rmk. (blue form), Gse. (common), Wdy.
Samolus
f. repens (Forst.) Pers., 1805 [forma]—Box. (on limestone), Rnd., Mid. (salt lake, E. coast limestone), Dgs. (eastern peak)—also *leg. Brown*.

LOGANIACEÆ

- Mitrasacme*
paradoxa R. Br., 1810—Box. (mossy humus), Mon., NTP.
Logania
f. vaginalis (Labill.) F. Muell., 1868—SHk., Mon. (in forest).

GENTIANACEÆ

- Sebea*
f. ovata (Labill.) R. Br., 1810—SHk., Mon.
Erythraea
f. centaurium Pers., 1805—Fig., Box., Rmk., Pco., Mon., Rnd., NTP., Mid., Gse., Wdy.
Villarsia
parnassifolia (Labill.) R. Br., 1810—[Mid.—*leg. R. Brown*, 1802] (TYPE).

APOCYNACEÆ

- Alyxia*
buxifolia R. Br., 1810—Mid. (rare—S. coast limestone)—also *leg. Brown* (TYPE in part).

CONVOLVULACEÆ

- Dichondra*
repens R. & G. Forst., 1776—Box., Mon., Gse.

LABIATÆ

- Westringia*
f. dampieri R. Br., 1810—Box., Pco., Mon., Mid. (common), Gse. (rare).

SOLANACEÆ

- Solanum*
f. simile F. Muell., 1854—Box. (rare—after fire), NTP., Mid. [*leg. R. Brown*, 1802], Sby. (rare, W. coast).
f. nigrum L., 1753—Fig., Box., SHk., Rmk., Mon., Wdy.
** Lycium*
f. ferocissimum Miers, 1854—Box. (rare), SHk. (beach), Wdy. (north).
Anthoecris
f. viscosa R. Br., 1810—SHk., Lng., Mon., NTP. (rare—summit), Mid. (W. ridge), Wdy.
littorea Labill., 1806—[Mid.—*leg. R. Brown*, 1802].
genistoides Miers, 1857—Mid. (very rare—1 bush only, on N.E. point).

SCROPHULARIACEÆ

- Glossostigma*
f. drummondii Benth. in DC., 1846—Mid. (pool at summit), Gse. (summit pools).
Limosella
f. aquatica L., 1753—Box. (N. soaks), Mon. (pools near summit), Mid., Gse. (summit pools).
** Dischisma*
f. arenarium E. Meyer, 1837—Box. (N. coast).

MYOPORACEÆ

- Myoporum*
parvifolium R. Br., 1810—[Mid.—*leg. R. Brown*, 1802].
f. insulare R. Br., 1810—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Rnd., NTP., Cve., Cbe. (dwarfed), Mid., Gse., Sby., Xms. (saddle), Wdy.
tetrandrum (Labill.) Domin, 1923 [syn. *M. serratum*, R. Br., 1810]—Mid. (rare—in Yate grove, near centre).

RUBIACEÆ

- Opercularia*
f. hispidula Endl., 1837—SHk., Lng., Rmk., Mon., STP. (broad-leaved form).
Galium
f. aparine L., 1753—Box. (N.W.—in shade of moonah).
f. australe DC., 1830—Box., Rmk., Mon., NTP., STP.

PLANTAGINACEÆ

- Plantago*
f. varia R. Br., 1810—Box. (soakages, S. coast), NTP. (small E. peak), Wdy.

CAMPANULACEÆ

- Wahlenbergia*
f. gracilentia Lothian, 1947—Fig., Box., Lng., Mon., NTP. (summit).

LOBELIACEÆ

- Lobelia*
heterophylla Labill., 1804—[? Wdy.—*leg. Labillardiere*, 1792 (TYPE)].
f. anceps Thunb., 1794 [large-flowered form]—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Tmn. (common), Rnd., NTP., Cve., Wge., Cbe., Mid., Gse., Dgs., Xms., Wdy.—also *leg. Maxwell*.
f. rhombifolia De Vr. in Lehm., 1845—NTP. (near summits of main and small E. peaks).

LOBELIACEAE (contd.)

- Isotoma*
f. scapigera (R. Br.) G. Don, 1834—Mid. (salt lake, S. and E. coast limestones)—also *leg. Brown, Maxwell*.

GOODENIACEAE

- Goodenia*
f. scapigera R. Br., 1810—SHk., Mon. (centre).
Leschenaultia
f. formosa R. Br., 1810—Mon. (rare—near summit).
Scaevola
f. crassifolia Labill., 1804—Mid. (N. beach, and S.E. limestone).
emula R. Br., 1810—Mid. [*leg. R. Brown*, 1802 (TYPE in part)], Wdy.
f. linearis R. Br., 1810—Mon. (centre). (Only previous records from S. Aust.).
Dampiera
f. fasciculata R. Br., 1810—Mon. (centre).
f. lavandulacea Lindl., 1839—SHk., Mon. (centre).
f. prostrata De Vry., 1854—SHk. (common in deep S.E. gully).

STYLIDIACEAE

- Stylidium*
f. glandulosum Salisb., 1806—Mon. (centre and N. point), Mid. (W. ridge).
f. pilosum Labill., 1806 [syn. *S. reduplicatum* R. Br., 1810]—SHk.
f. pubigerum Sond. in *Lehm.*, 1845—SHk., Pco. (cushion form).
f. adnatum R. Br., 1810—Fig., Box., Mon., NTP., Mid., Gsc., Xms.—also *leg. Brown* (TYPE in part), *Maxwell*.
f. calcaratum R. Br., 1810—Lug. (damp granite slabs near centre).
f. perpusillum Hk. f. in *Hk.*, 1847—Mon. (gully at N. point), NTP. (mossy ledge—S. of summit), Mid. (*leg. G. Maxwell*, 1863).
f. despectum R. Br., 1810—Mon. (N. point gully and summit), NTP.
Levenhookia
pusilla R. Br., 1810—SHk. (in moss), Mon., NTP.

COMPOSITAE

- Brachycome*
f. pusilla Steetz in *Lehm.*, 1845, var. nov. [dissected foliage, short ray florets]—Fig., Box., Lug., Rnd., NTP., STP., Cbe., Gsc.
Vittadinia
f. triloba (Gaud.) DC., 1836—Box. (rare—1 plant on N.W. limestone).
Olearia
axillaris (DC.) F. Muell., 1865—Fig., Box., SHk., Lug., Rmk., Pco., Mon., Rnd., NTP., STP., Wge., Cbe., Mid., Gsc., Sby., Xms., Wdy.—also *leg. Brown*.
Stuartina
f. Muelleri Sond. ex *Schlechtendal*, 1852—Fig., Box., Lug., STP. (summit), Wge., Wdy.
Gnaphalium
f. involucreatum Forst., 1786—Fig., Box., SHk., Lug., Rmk., Pco., Mon., Rnd., NTP., STP., Mid., Gsc., Xms., Wdy.
f. indutum Hk. f., 1847—Box. (mossy humus), Gsc. (soakages).
f. luteo-album L., 1753—Fig., Box., Lug., Pco., Mon., Rnd., NTP., STP., Cve., Mid., Gsc., Xms., Wdy.
Podosperma
angustifolium Labill., 1806—Box. (rare), Mid. (S. limestone).
Ixiolena
f. viscosa Benth. in *Endl.*, 1837—Box. (head of N.W. gully), Lug., Wdy.
Waitzia
citrina (Benth.) Steetz in *Lehm.*, 1845—Lug., Mon. (centre in moonah), Mid. (S. limestone)—also *leg. Maxwell*.
Athrixia
f. nivea (Steetz) Druce, 1917
var. *suffruticosa* (Benth.) comb. nov.
[syn. *A. stricta*, var. *suffruticosa* Benth., 1866]—SHk., Lug., Rmk., Pco., Mon., Rnd., STP., Wge., Xms., Wdy.
Angianthus
f. tenellus (F. Muell.) Benth., 1866—Rmk. (summit), Lug., Pco., Mon.
f. preissianus (Steetz) Benth., 1866—Pco. (summit).
f. humifusus (Labill.) Benth., 1866—NTP. (S. slopes near sea).
Calocephalus
f. brownii (Cass.) F. Muell., 1859—Fig., Box., Lug., Mon. (E. coast), Rnd., NTP. (rare), Cve. (common), Mid., Gsc., Dgs., Sby., Xms. (saddle)—also *leg. Brown*.
Cotula
f. cotuloides (Steetz) Druce, 1917—Fig., Box., Rmk., Pco., Mon., Rnd., NTP., STP., Wdy.
f. coronopifolia L., 1753 (dwarf form)—Mon. (rare), NTP. (spring S. of summit).
f. australis (Less.) Hk. f., 1853—Mon. (N. coast).
Senecio
f. lantus Soland. in *G. Forst.*, 1786—Fig., Box., SHk., Lug., Rmk., Pco., Mon., Tnn., Rnd., NTP., STP., Cve., Wge., Cbe., Mid., Gsc., Dgs., Sby., Xms., Wdy.
** Arctotheca*
** calendula* (L.) *Levy*, ? 1950 [syn. *Cryptostemma calendulaceum* (L.) R. Br.]—Wdy.
** Hypochaeris*
** f. glabra* L., 1753—Fig., Box., Rmk., Mon., NTP., STP., Xms., Wdy.
** Picris*
** f. hieracioides* L., 1753—STP. (N. side).
Sonchus
f. megalocarpus (Hk. f.) J. M. Black, 1929—Box. (rare—S.W. cliffs), SHk. (beach).
f. oleraceus L., 1753—Fig., Box., Lug., Rmk., Pco., Mon., NTP., STP., Cve., Wge., Mid., Xms., Wdy.
f. asper Hill, 1769—Box., NTP., STP., Cbe., Gsc. (common).

VII. CRYPTOGRAMIC FLORA

(excluding pteridophytes)

Opportunity was taken to collect specimens of any moss, higher fungus or lichen occurring on the islands—the only cryptogam ever recorded previously (E. B. Bartram, *Trans. British Bryological Soc.* 1, pt. 5: 469, Aug. 1951) was a moss collected by G. P. Whitley at Remark in 1944. Through lack of time, no attempt was made to obtain material of terrestrial and freshwater algae. In the following lists 82 species of cryptogamous plants appear, the identities of 10 being either uncertain or unknown, except for genus (these are prefixed by a query); 35 species are, apparently, new records for Western Australia and are indicated by the prefixing sign †. Systematic arrangements follow current procedure in the several groups, and the abbreviation of island names is the same as that adopted on the list of vascular plants; habitat notes are given for most species. Points of interest in these three major groups will now be discussed briefly:

Mosses and Hepatics

The bryophyte flora of the islands is limited (careful searching disclosed only 22 species), but it embraces about one-fifth of the total species known from Western Australia. *Fissidens pungens* (Boxer Id.) does not appear to have been recorded previously, although I found this minute moss also in Karri forest along the Shannon River in 1947. The *Chiloscyphus*, found at a permanent and shaded rock spring on southern cliffs of Figure-of-Eight, is certainly an unrecorded hepatic for the West and is closely allied to *C. polyanthus*; but, in the absence of fruiting material, its precise identity can not be determined.

Tortella cirrhata was first published in 1844 under the genus *Trichostomum* (from Swan River specimens), and the present West Australian record would seem to be the only other one made since then. The discovery of *Fabronia leptura* (a lustrous, myosuroid and matted species occurring on rock surfaces at the highest elevations of Mondrain and North Twin Peaks) is an interesting link in the chain of about 10 known occurrences between Swan River, W.A., and the Whangarei County, New Zealand; this beautiful moss is still unknown in the fruiting condition. In a drying pool at the summit of Flinders Peak (Middle Id.) small barren shoots of a tenuous water moss were found; *Drepanocladus* seems the most likely genus.

Fungi

Although the season was so far advanced, rainy weather just prior to the A.G.S. visit made conditions for fungal fruiting more propitious than might be expected in November. Of the 36 species collected, almost half (17) were new records for the Western State. Six fleshy toadstools were found, including the widespread and well-known luminous agaric *Pleurotus nidiformis* (type from Toodyay, W.A.) and the delicate ephemeral *Mycena leptoccephala* which exhales a curious nitric odour. These and many other species came from a moist shaded gully on the north coast of Mondrain; but an autumn visit to this Archipelago would greatly enlarge the present inadequate list of evanescent fleshy fungi. The summit of North Twin Peaks yielded two fungi of more than ordinary interest—a large "earth-star" puffball from leaf mould and a crustaceous black pyrenomycete from dead *Hakea* twigs.

The puffball answers well to descriptions and figures of *Geastrum rufescens*, notable for its large size and indefinite torn mouth. Once reputed to occur in Australia, this species had been dropped by recent writers on our fungi (e.g. Cleland 1935, Cunningham 1944) because of confusion with the similar but peristomate *G. limbatum*. This Recherche occurrence seems to be the first undoubted record for Australasia.

The pyrenomycete, *Nummularia pusilla*, occurred as irregularly rounded, biscuit-like and tessellated crusts on dead twigs of *Hakea suaveolens*. No other collection of this species had been made since that of the type (taken on *Bursaria* twigs at Callington, South Australia, in 1887).

Lichens

As with Recherche fungi, a large proportion of the lichen species (14 out of 22) have proved to be new records for Western Australia. The majority are growths of wide distribution in southern Australia and very few (e.g. *Buellia subalbula*) are to be found in arid country, as on the Nullarbor Plain. There was a surprising lack of *Cladonia* species, and no examples of the ubiquitous beard

lichens (*Usnea barbata* and *U. florida*) were seen. The lichens may be conveniently grouped under four habitat categories:

granite rock surfaces, limestone, wood and bark, and soil (including leaf mould).

Two of the new Western records were interesting species in the *Collema*, both growing over leafy litter and mosses on ground shaded by Moonah trees: a *Leptogium* (Boxer Id.) with brown apothecia is probably referable to *L. menziesii*, while a *Collema* (bluish-green and thinly foliose, on Middle Id.) can not be identified in the absence of any fructification.

For the checking of all lichen identities, I am indebted to Mr. P. N. S. Bibby, my colleague at the National Herbarium of Victoria.

VIII. LIST OF NON-VASCULAR CRYPTOGRAMS

BRYOPHYTA (Mosses and liverworts)

MUSCI (Mosses)

FISSIDENTACEÆ

Fissidens

† *pungens* C. M. & Hpc., 1853—Box. (damp limestone in shaded N.W. gully), Mon. (gully on N. coast).

DICRANACEÆ

Campylopus

bicolor (Hornsch.) Hook. f., 1867—SHk., Pco., Mon. (cushions around pools, etc.), NTP., STP. (damp granite ledges), Xms.
† *introflexus* (Hedw.) Mitt., 1869—Fig., Charley I. (leg. G. P. Whitley, 1944).

POTTIACEÆ

Tortella

calycina (Schwgr.) Dixon, 1923—Fig., Box., Mon., NTP., Mid., Gse., Shy., Wdy.
cirrhatta (Hpc.) Broth., 1902—Box., SHk.

Triquetrella

papillata (Hk. f. & W.) Broth., 1902—Box. (N.W. moonah grove), Mon., Mid. (moonah groves).

Barbula

australasie (Hk. & Grev.) Brid., 1826—Box. (limestone), Pco., Mid. (limestone), Gse., Shy. (limestone).

Desmatodon

convolutus (Brid.) Grout, 1939—SHk.

Tortula

princeps De Not., 1838—Fig., Box., SHk., Mon., Mid. (small form on moonah bark), Gse., Shy.

FUNARIACEÆ

Funaria

hygrometrica Hedw., 1801—Box. (S. cliff soakages), Mon.

BRYACEÆ

Brachymenium

preissianum (Hpc.) Jaeg., 1875—Box. (limestone under moonah).

Bryum

billardieri Schwgr., 1816—Fig., Box., SHk., Lng., Pco., Mon., Rnd., NTP., Mid., Xms.
campylotheceum Tayl., 1846 [incl. *B. pallenticoma* C.M.]—Rmk. (leg. G. P. Whitley, 1944); almost co-extensive with *B. billardieri*.
suberythrocarpum C.M., 1856—Box. (limestone), Tmn., Gse. (soakages E. coast).

FABRONIACEÆ

Fabronia

leptura (Tayl.) Broth., 1907—Mon. (granite slabs on N.E. promontory and main S. peak), NTP. (peak).

RHACOPIACEÆ

Rhacopilum

strumiferum C.M., 1851—Box. (woody debris in shade of N.W. moonah grove).

HEDWIGIACEÆ

Hedwigia

ciliata (Hedw.) P. Beauv., 1822—Mon. (N. point), NTP., STP. (granite slabs).

THUIDIACEÆ

Thuidium

furfurosum (Hk. f. & W.) Jaeg., 1878—Box. (N.W. limestone), Mon., Mid. (moonah groves).

AMBLYSTEGIACEÆ

? *Drepanocladus* sp.—Mid. (pool on Flinders Peak).

SEMATOPHYLLACEÆ

Sematophyllum

homomallum (Hpc.) Broth., 1925—Box. (moonah trunks), SHk., Lng. (common), Rmk., Mon., NTP. (Yate trunks, etc.), STP., Mid.

HEPATICÆ (Liverworts)

HARPANTHACEÆ

Chiloscyphus

† sp. [aff. *C. polyanthus* (L.) Corda, 1829]—Fig. (permanent shaded spring on southern cliffs).

Lophocolea

? *heterophylloides* Nees, 1845—SHk., Mon. (rock soaks), NTP. (soakages), STP. (summit).

FRULLANIACEÆ

Frullania

cranialis (Hk. f. & Tayl.) Tayl., 1845—NTP. (on shaded bark of *Agonis marginata*, near summit).

FUNGI (larger species only)

BASIDIOMYCETÆ

HYMENOMYCETES

AGARICACEÆ (Gilled fungi)

Mycena

† *subgalericulata* Clel., 1931—Box. (damp moonah log).

† *leptoccephala* Fr., 1874—Mon. (humus in gully, N. coast; odour strongly nitric).

Pleurotus

nidiformis Berk., 1844 [syn. *P. lampas* Berk., 1845]—Mon. (base of old paperbark, in N. coast gully—a luminous toadstool).

Crepidotus

† *subhaustellaris* Clel., 1924—Mon. (on sticks).

Russula

† *lepidota* Fr., 1838 [white form]—Mon. (N. coast gully).

Coprinus

† *plicatilis* Fr., 1838—Mon. (on rock wallaby dung).

Schizophyllum

commune Fr., 1821—Box. (moonah logs), Rmk. (on dead *Hakea suaveolens*).

Xerotus

† *archeri* Berk., 1858—Lng. (bark of *Anthocercis viscosa*), Mon. (paperbarks), Mid.

POLYPORACEÆ (Pore fungi)

Fomes

rimosus (Berk.) Cooke, 1885—NTP. (on *Acacia acuminata*).

setulosus Lloyd, 1915—Lng. (bushy yate), Mon., Mid. (yate).

scruposus (Fr.) G. H. Cunn., 1948—Rmk., Mon. (paperbark and moonah).

Polyporus

† *dichrous* Fr., 1821—Mon. (dead yate in S.E. fjord gully).

Fomitopsis

ochroleuca (Berk.) G. H. Cunn., 1948—Lng., Mon., Mid. (dead wood).

Trametes

drummondii G. H. Cunn., 1950 [syn. *Hexagona decipiens* Berk., 1845]—Mon. (she-oaks on central high point; also at Pearson Id., Sth. Aust.).

Coriolus

sanguineus (Fr.) G. H. Cunn., 1950 [syn. *Polystictus cinabarinus* (Fr.) Cooke, 1886]—SHk., Mon., NTP., Mid. (fallen timber).

Poria

† *medulla-panis* (Fr.) Cooke, 1886—Box. (resupinate on dead moonah butts).

HYDNACEÆ

? *Grandinia* sp.—Mon. (rotting logs, N. coast gully).

Odontia

† *arguta* (Fr.) Quel., 1886—Cbc. (butts of old *Atriplex cinerea*).

THELEPHORACEÆ

Stereum

hirsutum (Fr.) Fr., 1838—Mon. (rotting logs, N. coast gully).

hispidulum (Berk.) G. H. Cunn., 1953 [syn. *Phlebia reflexa* Berk., 1851, non *S. reflexum* Lloyd, 1922]—Mon. (burnt logs in N. coast gully).

Corticium

† *calceum* Fr., 1838 [chalky white, thinly effused]—Mon. (fallen branches and sticks).

Vararia

† *portentosa* (Berk. & Curt., as *Corticium*, 1873) G. H. Cunn., 1953 [effused and pale chamomise-coloured]—Box. (moonah logs), SHk.

Peniophora

vinosa (Berk.) Mass., 1889 [syn. *Stereum umbrinum* Berk. & Curt., 1873]—Box., Mon., NTP., Mid. (bark of *Albizia*, *Melaleuca* and *Myoporum*).

GASTEROMYCETES

SCLERODERMATACEÆ

Scleroderma

flavidum Ellis & Everhart, 1885—Mon., Mid. (in forests).

LYCOPERDACEÆ (Puffballs)

- Mycenastrum*
corium (Guesert) Desv., 1842—Xms. (calcareous sandy ground on saddle).
Lycoperdon
† *polymorphum* Vitt., 1842—Mid. (peak; also on Pearson Id., Sth. Aust.).
† *asperum* (Leveille) de Toni, 1888 [syn. *L. australe* Berk., 1858]—Mid., Gsc., Xms. (also Pearson Id., Sth. Aust.).
Geastrum
† *minimum* Schweinitz, 1822—Mon., Rnd. (also on Pearson Id., Sth. Aust.).
† *rufescens* Pers., 1801—NTP. (leaf mould at summit—the first undoubted occurrence in Australia).

TULOSTOMATACEÆ

- Tulostoma*
† *australianum* Lloyd, 1906, emend. G. H. Cunn., 1925—Box. (leaf mould).

ASCOMYCETÆ

DISCOMYCETES

PEZIZACEÆ

- †? *Otidea* sp. [white, irregularly convoluted cups, ca. 1 inch wide, odour seminal]—Box. (damp shaded earth under granite ledge, N.W.).
Lachnea
† *scutellata* Gill., 1879—Box. (rotting moonah log in shaded N.W. gully).

PYRENOAMYCETES

XYLARIACEÆ

- Nummularia*
† *pusilla* Sacc., 1889—NTP. (twigs of dead *Hakea suaveolens*; other collection known is that of TYPE, from Callington, Sth. Aust., on *Bursaria* twigs—J. C. O. Pepper, Nov. 1887).
Daldinia
† *concentrica* Ces. & De Not., 1870—Mon. (burnt trunks of *Hakea suaveolens*).
Hypoxylon
† *annulatum* (Schweinitz) Mont., 1856—Mon. (rotting logs, N. coast gully).

FUNGI IMPERFECTI

STILBELLACEÆ

- Isaria*
†? *suffruticosa* Cooke & Massee, 1890, emend. Petch, 1937—Mon. (on chrysalids amongst humus, N. coast gully).

LICHENES (Lichens)

COLLEMACEÆ

- Synechoblastis*
† *nigrescens* (Huds.) Trev., 1853—Box. (moonah trunks), Lng., Mon., Mid. (moonah groves).
† *leucocarpus* (Hk. f. & Tayl.) Müll. Arg., 1882—Co-extensive with *S. nigrescens*.
Leptogium
†? *menziesii* (Ach.) Mont., 1852—Box. (with brown apothecia, on leafy litter and amongst moss).
† *Collema* sp. [blue-green and thinly foliose, growing over humus, mosses, etc., on the ground]—Mid. (moonah groves).

PANNARIACEÆ

- Psoroma*
† *sphinctrinum* (Mont.) Nyl., 1859—Mon. (greyish, red-fruited crusts on moonah trunks).

STICTACEÆ

- Sticta*
† *aurata* Ach., 1803—Mon. (moist granite rocks near summit).

LECIDEACEÆ

- Rhizocarpon*
† *geographicum* (L.) Lam. & DC., 1815—Widespread on granite rock surfaces.

CLADONIACEÆ

- Cladonia*
† *aggregata* (SW.) Ach., 1795—Lng. (charred wood), Pco., Mon. (soakages), NTP. (summit).
Thysanothecium
† *hookeri* Tayl., 1846—Lng. (on charred wood).

LECANORACEÆ

- Lecanora*
† *sphaerospora* Müll. Arg., 1892—Box. (limestone).
sp. [large black discs, on sticks]—Lng., NTP.
sp. [minute orange disks, on limestone]—Box.

PARMELIACEÆ

- Parmelia*
† *conspersa* (Ehrh.) Ach., 1803—Fig., Box., SHk., Rmk., Pco., Mon., Rnd., NTP., Xms. (on granite).
† *rutidota* Hk. f. & Tayl., 1844—Box., Lng., Mon., NTP., Xms. (dead sticks and bark).
† *perforata* (Wulf.) Ach., 1803—Lng., Mon. (dead wood).
† *physodes* (L.) Ach., 1803—Lng., Mon. (dead wood).

USNEACEÆ

- Ramalina*
† *calicaris* (L.) Röhling, 1813—Lng. (moonah trunks).
† *ecklonii* Mont., 1852—Lng., NTP. (moonah trunks).

CALOPLACACEÆ

- Caloplaca*
† *murorum* (Hoffm.) T. Fries, 1871—granite rock and black mica veins throughout Archipelago.

TELOSCHISTACEÆ

- Teloschistes*
† *parietinus* (L.) Norm., 1853—Fig., Box., SHk., Lng., Rmk., Pco., Mon., Xms. (bark, etc.).
† *chrysophthalmus* (L.) Beltr., 1858—Box., Lng., Rmk., Mon., Xms. (dead wood).

BUELLIACEÆ

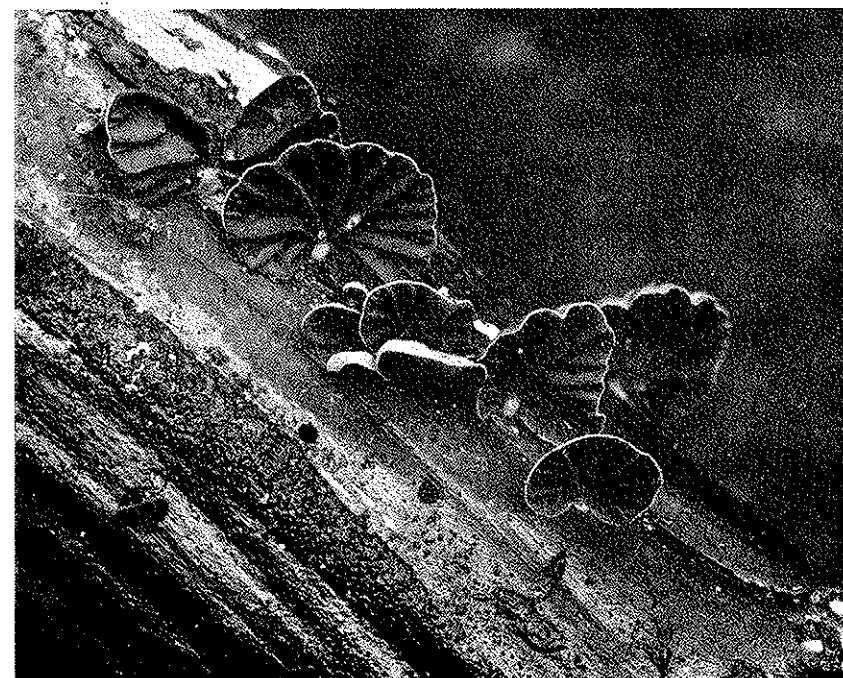
- Buellia*
† *subalbula* Müll. Arg., 1880—widespread on granite surfaces (white crusts).
† *spuria* (Schær.) Anzi, 1860—co-extensive with *B. subalbula*, but grey.

PHYSICIACEÆ

- Anaptychia*
† *speciosa* (Wulf.) Mass., 1853—Box. (moonah trunks), Rmk., Mon. [+ var. *sorediosa* Müll. Arg.]

INDETERMINATE MATERIAL:

- sp.—chalk-white patches on limestone; fruits black and ill-defined.
sp.—minute livid discs on green algal film covering moonah bark.



Xerotus archeri Berk.—a new fungal record for Western Australia.

Photo: R. D. Lee

3b. MARINE ALGAE

By H. B. S. WOMERSLEY*

The collection of marine algae listed below was made by Mr. J. H. Willis, Botanist on the 1950 Australian Geographical Society expedition to the Recherche Archipelago, during November 1950. Apart from a few specimens from rock pools, all were collected from the drift. A small collection from near Israelite Bay, on the mainland, is also included.

This list, as far as I am aware, provides the first records of marine algae from the Recherche Archipelago, and although the collection is a small one it does widen our knowledge of the distribution of several southern Australian species. The following species were previously known only from the eastern half of the southern Australian region: *Sphacelaria biradiata*, *Polycerea nigrescens*, *Sargassum cristatum*, *Corallina pilifera*, *Jania natalensis*, *Melobesia cymodoceae*, *Neomonospora elongata* and *Polysiphonia dasyoides*. These are listed with prefixing sign †.

The following species, *Carpoglossum quercifolium*, *Cystophora brownii*, *Cystophora pectinata*, *Carpopeltis elata* and *Laurencia cruciata* are of Western Australian affinities, while the remainder are either generally distributed around southern Australia or are cosmopolitan.

Specimens of all species have been deposited in the Algal Herbarium of the Department of Botany, University of Adelaide. Some duplicates have been deposited in the National Herbarium, Melbourne.

The classification below is that used by Womersley 1950, where additional references will also be found. To avoid redundancy, the word "Island" has been deleted from all citations of Figure-of-Eight and North Twin Peaks Islands.

CHLOROPHYTA

ULVALES

ULVACEÆ

- Ulva lactuca* L. Setchell & Gardner 1920, 265. Smith 1944, 45-265—Figure-of-Eight. A few small specimens of *forma rigida*.
Blidingia minima (Kütz.) Kylin 1949, 30. *Enteromorpha minima* Kütz. Bliding 1938, 84—Shallow pools, Combe Island. Larger specimen than normal (to 4 or 5 cm. high), with a very few branches, and agreeing well in cell structure with this species.

CLADOPHORALES

CLADOPHORACEÆ

- Cladophora valonioides* Sonder. Harvey 1859, pl. 78—Pt. Malcolm, south-west of Israelite Bay.

SIPHONOCLEDALES

VALONIACEÆ

- Dictyosphaeria sericea* Harvey 1860b, 339, pl. 196A—Limestone Bay, Middle Island (south-eastern sector).

SIPHONALES

CODIACEÆ

- Codium mamillosum* Harvey 1858, pl. 41—North Twin Peaks.
Codium muelleri Kütz. 1856, 34, t. 95, f. 2. Womersley 1950, 145—Israelite Bay.

PHAEOPHYTA

SPHACELARIALES

SPHACELARIACEÆ

- † *Sphacelaria biradiata* Askenasy 1894, 15, pl. 2, f. 12. Sauvageau 1914, 163-166—Figure-of-Eight, on *Cystophora*.

DICTYOTALES

DICTYOTACEÆ

- Dictyota furcellata* Agardh. J. Agardh 1848, 90. De Toni 1895, 280. Womersley 1950, 150—Goose Island.

* Department of Botany, University of Adelaide.

- Pachydietyon furcellatum* (Harvey) J. Agardh 1894a, 83. *Dictyota furcellata* Harvey 1858, pl. 38. Womersley 1950, 151—North Twin Peaks.
Pachydietyon paniculatum J. Agardh 1894a, 84. De Toni 1895, 283—Figure-of-Eight.
Lobospora bicuspidata Areschoug. Harvey 1858, pl. 34—Goose Island.
Pocockiella nigrescens (Sonder) Papenfuss 1943, 467, f. 15—Goose Island. I am very doubtful whether this species is specifically distinct from *P. variegata*. The differences lie in the darker colour (usually black when dried) and more erect, branched fronds of *P. nigrescens*, but both these characters are rather variable.
Pocockiella variegata (Lamx.) Papenfuss 1943, 467, f. 1-14—Combe Island.
Zonaria spiralis (J. Agardh) Papenfuss 1944, 341. *Homoeostrichus spiralis* J. Agardh 1894b, 89—Figure-of-Eight.

CHORDARIALES

CHORDARIACEÆ

- † *Polycerea nigrescens* (Harvey) Kylin 1940, 36, f. 20 A-B; t. 7, f. 16—Goose Island and North Twin Peaks.

DICTYOSIPHONALES

PUNCTARIACEÆ

- Asperococcus bullosus* Lamx. Newton 1931, 172, f. 107—North Twin Peaks, on *Posidonia*.
Hydroclathrus clathratus Bory. Setchell & Gardner 1925, 543. *H. cancellatus*, Harvey 1859, pl. 98—North Twin Peaks.

LAMINARIALES

ALARIACEÆ

- Ecklonia radiata* (Ag.) J. Agardh. Lucas 1936, 95, f. 52. Womersley 1950, 157—Figure-of-Eight and North Twin Peaks.

FUCALES

NOTHEIACEÆ

- Hormosira banksii* (Turn.) Dcne. Harvey 1860a, pl. 135—Figure-of-Eight and North Twin Peaks.

FUCACEÆ

- Scytothalia dorycarpa* (Turn.) Greville. Harvey 1858, pl. 9—Figure-of-Eight.
Carpoglossum quercifolium (R. Br.) J. Agardh. Harvey 1858, pl. 43—Figure-of-Eight and Cave Islet (in rock pool).
Cystophora brownii (Turn.) J. Agardh. Harvey 1860a, pl. 169—Figure-of-Eight.
Cystophora grevillei (Ag.) J. Agardh. Harvey 1862, pl. 183—Pt. Malcolm, south-west of Israelite Bay.
Cystophora monilifera J. Agardh. Harvey 1863, pl. 245—Figure-of-Eight.
Cystophora pectinata (Grev. & Ag.) J. Agardh. Lucas 1936, 71. Kütz. 1860, t. 74, f. 2—Figure-of-Eight.
Cystophora retorta (Mert.) J. Agardh 1848, 243. Lucas 1936, 72—Goose Island.
Cystophora subfarcinata (Mert.) J. Agardh 1848, 240. Lucas 1936, 74—North Twin Peaks.
Cystophyllum muricatum (Turn.) J. Agardh? De Toni 1895, 154. Lucas 1936, 74—Cave Islet (in rock pool). A stunted, sterile specimen, lacking vesicles.
Sargassum biforme Sonder? J. Agardh 1889, 75, pl. 23, f. 3. Lucas 1936, 67—Figure-of-Eight.
† *Sargassum cristatum* J. Agardh 1889, 84, pl. 25, f. 5. Lucas 1936, 67—Pt. Malcolm, south-west of Israelite Bay.
Sargassum merrifieldii J. Agardh 1889, 115, pl. 30, f. 4. Lucas 1936, 68—Figure-of-Eight. Insufficient material for a firm determination.
Sargassum varians Sonder. J. Agardh 1889, 49, pl. 16, f. 1-8. Lucas 1936, 64—Figure-of-Eight.
Sargassum verruculosum (Mert.) Agardh. J. Agardh 1889, 53, pl. 18. *Sargassum raoulii*, Harvey 1859, pl. 110—Figure-of-Eight.
Scaberia agardhii Greville. Harvey 1860a, pl. 164. Lucas 1936, 76—Figure-of-Eight and North Twin Peaks.

RHODOPHYTA

CRYPTONEMIALES

CORALLINACEÆ

- Corallina cuvieri* Lamx., var. *crispata* (Lamx.) Areschoug. Harvey 1847, 106. Lucas & Perrin 1947, 399. Womersley 1950, 166—Limestone Bay, Middle Island (south-eastern sector) and Goose Island.
† *Corallina pilifera* Lamx. Kütz. 1858, t. 74, c.d. Lucas & Perrin 1947, 400—Figure-of-Eight and North Twin Peaks.
Jania micrarthrodia Lamx. Lucas & Perrin 1947, 397—North Twin Peaks and Goose Island.
† *Jania natalensis* Harvey 1847, 107. Kütz. 1858, t. 79, II—Figure-of-Eight.

CORALLINACEÆ (contd.)

- Metagoniolithon charoides* (Lamx.) W. V. Bosse. *Amphiroa charoides*, Harvey 1847, 26, pl. 39—Figure-of-Eight, Goose and Middle Islands (at Limestone Bay).
Metagoniolithon stelligera (Lamx.) W. V. Bosse. *Amphiroa stelligera*, Harvey 1862, pl. 230—Figure-of-Eight, North Twin Peaks and Goose Island.
Metamastophora flabellata (Sonder) Setchell. *Womersley* 1950, 167. *Mastophora flabellata* Harvey 1847, 108—Figure-of-Eight and Goose Island.
† *Melobesia cynodocce* Foslie. *De Toni* 1905, 1767—On *Cynodocce antarctica*. Figure-of-Eight, North Twin Peaks and Goose Island.

GRATELOUPIACEÆ

- Carpopeltis elata* (Harvey) Schmitz. *Acropeltis elata* Harvey 1860a, pl. 122—Figure-of-Eight and North Twin Peaks.

GIGARTINALES

PLOCAMIACEÆ

- Plocamium nidificum* (Harvey) J. Agardh 1876, 346. *Lucas & Perrin* 1947, 213—Figure-of-Eight.

SOLIERIACEÆ

- Solieria robusta* (Grev.) Kylin 1932, 18. *Solieria australis* Harvey 1860a, pl. 149—Pt. Malcolm, south-west of Israelite Bay.

RHABDONIACEÆ

- Rhabdonia coccinea* Harvey 1858, pl. 54. *Lucas & Perrin* 1947, 171, f. 42—Pt. Malcolm, south-west of Israelite Bay.

HYPNEACEÆ

- Hypnea seticulosa* J. Agardh 1851, 446. *De Toni* 1900, 476—Pt. Malcolm, south-west of Israelite Bay.
Hypnea episcopalis H. & H. Harvey 1858, pl. 23. *Lucas & Perrin* 1947, 191, f. 58—Figure-of-Eight.

DICRANEMACEÆ

- Dicranema grevillei* Sonder. Harvey 1859, pl. 120. *Lucas & Perrin* 1947, 157, f. 29—North Twin Peaks.

RHODYMENIALES

RHODYMENIACEÆ

- Botryocladia obovata* (Sonder) Kylin. *Chryssymenia obovata*, Harvey 1858, pl. 10. *Lucas & Perrin* 1947, 203, f. 67—Goose Island.

CERAMIALES

CERAMIACEÆ

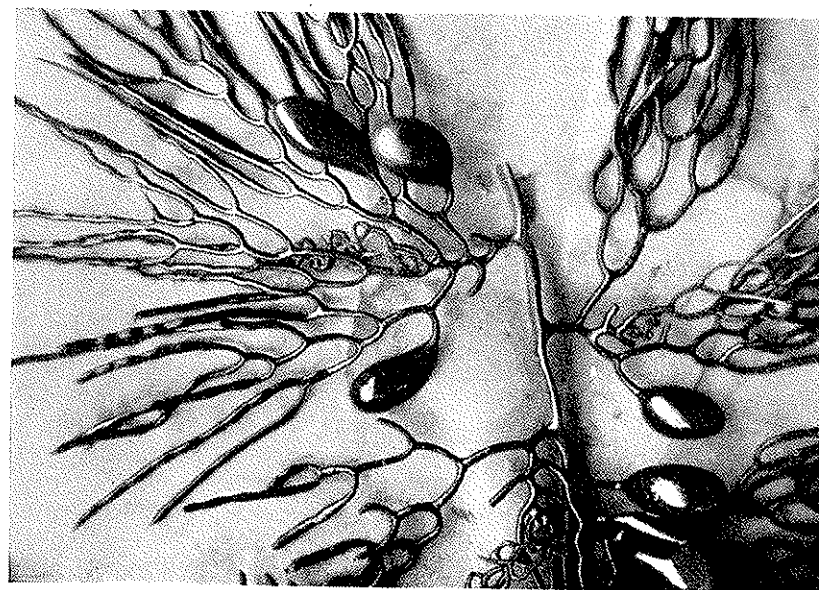
- † *Neomonospora elongata* (Harvey) Womersley 1950, 177—Cave Islet, on *Cystophyllum*.
Wrangelia myriophylloides Harvey 1862, pl. 224—North Twin Peaks.

RHODOMELACEÆ

- † *Polysiphonia dasyoides* Zanardini. *Lucas & Perrin* 1947, 266. *Womersley* 1950, 184—Figure-of-Eight (on *Hormosira*) and Cave Islet.
Laurencia cruciata Harvey 1854, 544. *Yamada* 1931, 198, pl. 5a, f. E.—Goose Island. A single specimen, of the Palisade group, which agrees reasonably well with Yamada's figure of this species.
Laurencia forsteri (Mert.) Greville? Kützinger 1865, t. 47, d, c. *Yamada* 1931, 213, pl. 13a—Figure-of-Eight. Two specimens which seem to be a slender form of *L. forsteri*, although lenticular thickenings are very few, if any, in the cells.

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Cystophora retorta (Mert.) J. Ag.—a brown seaweed, seldom bearing vesicles.

Photo: R. D. Lee (material from Sorrento, Vic.)

4. MAMMALS

By V. N. SERVENTY

The study of the mammals of the Recherche Archipelago was confined to field observations, no collecting being done on these island reserves. Useful data on distribution, etc., were gathered, but no outstanding discoveries were made.

Both marsupials recorded by previous visitors were met with, but a native rodent was not seen, understandably enough in the absence of attempts at collecting. The sparsity in numbers of the seal population, in view of the lavishness of island habitats and the inaccessibility of most of them to human intruders, was an outstanding impression.

Besides the occurrences enumerated in the systematic section which follows, we came across animals which it was not possible to identify. On Figure of Eight Island two small mice were seen running slowly over the grass tussocks and were, probably, introduced house mice (*Mus musculus*). Christmas Island possessed a mammal resembling a large rat in appearance, but with a somewhat longer body. In the opinion of two observers it was not a ship rat.

Introduced mammals were, fortunately, not conspicuous. Rabbits occur on only one island. No evidence was obtained of the feral cat.

Sheep and other domestic stock have been pastured on some of the inner islands for many years by the Dempster brothers, pastoral pioneers of the Esperance district. Mr. W. E. Dempster, writing in the *West Australian* of November 15, 1950, stated that:

For nearly 40 years Dempster brothers had tested their pastoral possibilities and found that no two islands gave the same results. On Figure of Eight Island the feed was abundant. . . . Here the sheep fattened rapidly for about three months, then, unfortunately, became coastly and had to be removed. The same conditions obtained on Thomas Island. Many of the islands were too densely scrubbed to be of any practical use. The east end of Woody Island had good quality grass, but most of the island was scrub, with heart-leaf poison. . . . We found the most satisfactory of the group were Observatory Island, Charles Island and Cull Island, on which sheep fattened and had abundant water. . . . Mondrain Island had little pastoral value, though it made an excellent home for some of the outlaw aborigines of those early days.

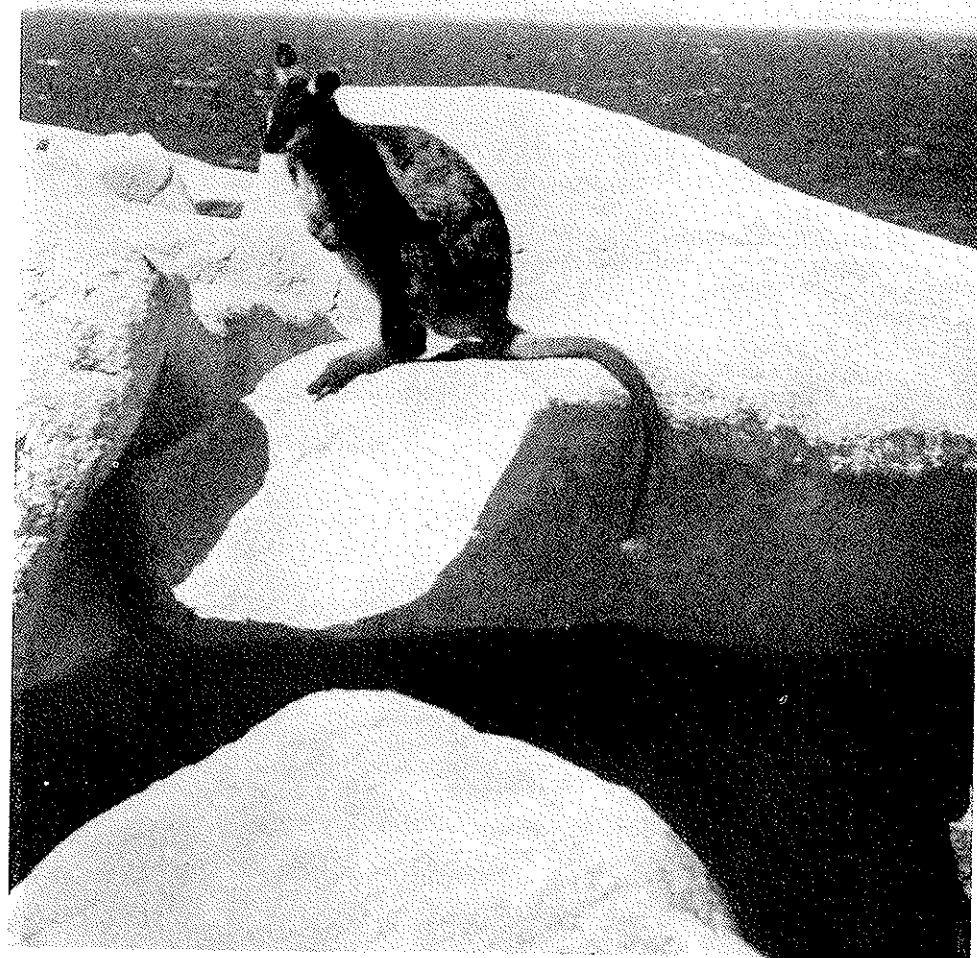
Rintoul (1946, p. 43) adds Woody and Boxer as islands on which natives were occasionally exiled.

Goats and pigs had also been placed on some of the islands, but apparently only to a limited extent. No feral stock of domestic origin now survives on any island.

It was very evident from our experience that opening the islands to grazing meant the regular burning of the vegetation, with consequent inimical effects on the native fauna. Woody Island is a case in point, as here the native vegetation is almost entirely gone, whereas as recently as 1944 a C.S.I.R.O. party found it densely wooded in parts with wattle scrub and other plants and belts of yate (*Eucalyptus cornuta*) up to about 20 feet high.

1. RECHERCHE ROCK-WALLABY, *Petrogale lateralis hacketti* (Thomas, 1905).

The Rock-Wallaby was described and named by Oldfield Thomas (1905, p. 425) from specimens collected on Mondrain Island by J. T. Tunney, but the animal had been reported from the islands over a century before.



Recherche Rock Wallaby (*Petrogale lateralis hacketti*).

In January 1802, Matthew Flinders, in the *Investigator*, examined Mondrain Island and his party "brought back a few small kangaroos of a species different from any I had before seen" (1814, p. 83). The next printed reference to the animal was contained in the newspaper, *The West Australian*, October 9, 1894, in its account of the wreck of the *Rodondo*. It was mentioned that the survivors, after landing on Salisbury Island, caught wallabies for their subsistence. This reference has been overlooked by later writers, and Salisbury Island as a locality for the species has been omitted from the records.

Tunney's expeditions for the Western Australian Museum in 1904 and 1906 (Whittell, 1938, p. 325) resulted in the collection of a number of specimens from Mondrain and Combe Islands, from which the first positive identifications was made. Thomas, who worked up the material at the British Museum (Natural History), described the Rock-Wallaby as a new sub-species, *hacketti*, of *P. lateralis* of the mainland, and differing from it in its larger size and stronger teeth. Mondrain was named as the type locality, 14 specimens from there being examined. Subsequently, when describing another Rock-Wallaby, *Petrogale pearsoni*, from Pearson Island, at the eastern end of the Great Australian Bight, Thomas (1922, p. 682) elevated *hacketti* as a full species, with *pearsoni* as a nearly related but smaller species. This arrangement was followed by Wood Jones (1924, p. 225) and Troughton (1946, p. 179). The differences between the forms *lateralis*, *hacketti* and *pearsoni* are, however, clearly of a sub-specific nature and the various forms can be considered only as well-marked geographical races. Indeed it is questionable whether these western forms warrant specific separation from *P. penicillata* (Griffith, Smith and Pidgeon, 1827) from the eastern States. On modern taxonomic concepts it would be reasonable to consider them all members of one allopatric species.

The present expedition found the Rock-Wallaby fairly plentiful on the two islands from which Tunney collected it, Mondrain and Combe, and also rediscovered it on Salisbury. D. McKenzie, of Esperance, a member of our party, informed us that it also occurs on Wilson Island, on which we did not land, but he had the impression that there it was a much smaller animal than the one occurring on the other three islands. N. E. Stewart, formerly of Esperance, informs me that he has also seen this wallaby on Wilson as well as on the adjacent Corbett Island. These clues are worthy of being followed up by future investigators, and collections should be made, as it is possible that more than one race may have differentiated in the archipelago and the giant form *hacketti* might not be the universal one.

Although the animal was shy we found that it would allow of an approach to within about ten yards. It did not seem to be entirely nocturnal, as many were seen throughout the day, apparently unconcerned about possible predators such as the Sea-Eagle. It was largely confined to rocky areas, whether near the shore or inland. Because of extensive jointing and weathering in the gneiss, the Rock-Wallabies were able to travel long distances without becoming visible on the surface. These wide cracks offered adequate shelter.

Some of the islands have suffered severely from fire. Flinders (1814, p. 83) refers to a general blaze started by his crew on Mondrain, and Whitley (1944, p. 6) and Fowler (1945, p. 334) describe a more recent devastating fire on the same island. Since Rock-Wallabies are still plentiful on Mondrain it would appear that the rock-haunting habit offers a reasonable security to the species from this danger. Given protection from human interference, both direct and indirect, such as has

contributed to its severe decline on the mainland, the species should survive and flourish on these island sanctuaries.

2. TAMMAR, *Macropus eugenii* (Desmarest, 1917).

Like the Rock-Wallaby, this wallaby has almost vanished from the mainland and now survives on islands around the coast, including the Abrolhos (North and South Wallaby Islands), Garden Island, the Recherche Archipelago, and islands at the eastern end of the Great Australian Bight, including Kangaroo Island.

On the Recherche it is known only from Middle and North Twin Peak Islands.

Flinders (l.c., p. 88) mentions that on Middle Island "a small species of kangaroo seemed to be numerous, though none were caught". Tunney collected specimens from there and also on North Twin Peaks, which enabled the species to be identified.

T. C. Andrews, in his unpublished account of personal experiences on the south coast, gives the following description of his observations on the species at Middle Island, where he spent some time as a youth in 1889:

We are startled to hear a strange noise similar to the surface of the ground being struck with a blunt instrument. We recognize it as the danger signal of the Tamar Wallaby when alarmed. Here, beneath a canopy of leaves the quaint little marsupials seek shelter from the sun in summer and the winterwind in winter. They can be seen in the early dawn leaving the thicket for the feeding grounds. When leaving their shelters they follow the pads, never leaving them until they reach the vicinity of the wallaby tree from which they feed. After feeding they return to the shelter of the thicket, where they sleep during the heat of the day and come out to feed again in the late afternoon.

He also mentions that he and his brother snared "no less than seventy-two dozen in 240 days".

The animals were still fairly plentiful on both Middle and North Twin Peaks, judging by their tracks. However, the Tamar is shyer than the Rock-Wallaby and very few were actually seen during the day. The species did not occur on any of the other islands visited by our party, nor did McKenzie know of its presence on any additional islands of the Recherche.

The presence of Rock Wallabies and Tammars on adjacent islands, but not together on the one island, raises an interesting problem. Obviously both must have occurred together when these islands were part of the mainland, and, in general, the environments are much the same on the five islands on which they occur, with the possible exceptions of Combe and Salisbury. These two may favour a rock-haunting species as against a woodland or brush type.

A somewhat similar distribution problem arises on the west coast—where the Tamar occurs on Garden Island, while the Quokka (*Setonix brachyurus*) is found on Rottnest—and for which Clarke (1948, p. 141) offers the following explanation:

It is suggested that at the time when Garden Island and Rottnest Island formed part of the mainland, the physically inferior forms, such as *M. eugenii* and *S. brachyurus*, were driven by larger macropods from the richer land round the Swan River estuary to the poorer coastal sandhills. If so, the two forms would co-exist on the north-directed promontory formed of the co-joined Cape Peron, Garden and Rottnest Islands. *Setonix*, being physically inferior to *M. eugenii*, would migrate towards the end of the promontory (the present Rottnest), leaving *M. eugenii* in the Garden Island-Cape Peron region. Subsequently the promontory was separated from the mainland and divided in two, Rottnest, inhabited by *Setonix*, being the remains of its northern tip, and Garden Island, inhabited by *M. eugenii*, being its base.



White-capped Hair-Seal (*Neophoca cinerea*).

This theory rests on a number of doubtful assumptions, and a more likely explanation of the distribution pattern, which is exhibited in varying degree by other animal groups on islands around the Western Australian coast, has been put forward by D. L. Serventy (1951, p. 59). This is based on Gause's law (Gause, 1934) that two animals with similar ecology cannot co-exist in the same habitat and one will, by competition, supplant the other.

In a normal mainland environment a diversity of similar animal species can occur, each characteristic of a particular ecological niche or else differing in food preferences. A small island, however, cannot maintain a variety of habitats of sufficient effective area, and there must come a point in the reduction of an island, varying for different species, where distinction between ecological niches is no longer a real factor. The formerly non-competing forms are no longer so, and Gause's Law comes into operation. Which species survives may depend on fine differences in the reactions of each to the particular insular environment, or perhaps, be entirely fortuitous.

In the case of the Tammar and Rock-Wallaby in the Recherche Archipelago, Dr. R. W. Fairbridge has pointed out to me another factor which might have been concerned in their origin. From a consideration of the depths recorded in the Admiralty Charts it would appear that Mondrain, Salisbury, Combe and Wilson were separated from the mainland prior to Middle and North Twin Peaks. Since the eustatic changes in sea level were in the nature of a damped oscillation, the outer islands may have been separated a considerable period before the inner islands. It is possible that there may have been fluctuations in the relative abundance of the Tammar and the Rock-Wallaby due to environmental factors favouring one habitat, woodland or rock, when the respective series of islands were isolated. This would "load the dice" as to which survived in the various islands.

3. WESTERN SWAMP-RAT, *Rattus fuscipes* (Waterhouse, 1839).

Tunney collected specimens at Mondrain which were described as a new species, *Rattus mondraineus*, by Thomas (1921, p. 428) on the basis of slight colour and cranial differences from *R. fuscipes* of the mainland, but Troughton ranks it only as an insular race.

We had no opportunity of making observations on it.

4. SHIP RAT, *Rattus rattus alexandrinus* (Geoffroy, 1803).

An individual of this introduced species was dug out of a burrow on Woody Island when digging for petrels, two lizards being found in the same burrow. It was identified by Mr. L. Glauert.

N. E. Stewart informs me that Ship Rats were very troublesome on Woody Island when he visited it in 1939. He killed twenty-three with a stick around the campfire.

Dead specimens were found on Boxer and North Twin Peak.

5. RABBIT, *Oryctolagus cuniculus* (Linn., 1758).

Rabbits were introduced at an early period on Goose Island, north of Middle Island, whether by the sealers or passing ships is not known. As early as 1889 Andrews (ms.) remarked on the rabbits occurring on this island, and apparently all of the population now consists of the black colour phase.

The Australia Pilot, vol. I, 1937, states that at the time of the Penguin survey in 1901, rabbits were plentiful on the island.

We saw one very shy black specimen, and Thomson and Shipway (1948, p. 351) observed two black ones in 1947.

6. AUSTRALIAN FUR-SEAL, *Gypsophoca dorifera* (Wood Jones, 1925).

Only one party of Fur-Seals was met with during the expedition. This was on Salisbury Island, where a group of about 50 adults took to the water on our approach. With them were a few Hair-Seals. There was no sign of breeding activity.

The low population strength of the Fur-Seal in the Recherche, even after many years' cessation of hunting, is remarkable. The animals have not built up to the numbers which might have been expected. Other colonies have been reported in recent years by various visitors, but the aggregate numbers must be quite inconsiderable. The F.R.V. *Warreen* encountered a rookery of about 100 Fur-Seals at Christmas Island (opposite New Year Island) in June, 1948, but met with no others during its fishery survey cruises through the archipelago. Andrews (ms.) mentions the Fur-Seal as most abundant on Cooper's Reef near Christmas Island.

Unfortunately only the most meagre records exist of the activities of the early sealers, but they must have reduced the Fur-Seal population to a remnant so small that a quick recovery has been impossible, a situation which has been paralleled in many other Southern Hemisphere Fur-Seal colonies. This devastation must have been rendered the easier in the Recherche area by the probability, suggested by all the records, that the original population strength was not large.

The French Expedition under D'Entrecasteaux (Labillardiere, 1800, p. 447) was the first to report the presence of seal at the Recherche, but the account does not differentiate between the species, and no reference to abundance is made. Flinders (1814, p. 91), however, was definitely pessimistic as to the sealing possibilities. "All the islands", he wrote, "seem to be more or less frequented by seals; but I think not in numbers sufficient to make a speculation from Europe advisable on their account; certainly not for the China market, the seals being mostly of the hair kind, and the fur of such other as were seen was red and coarse".

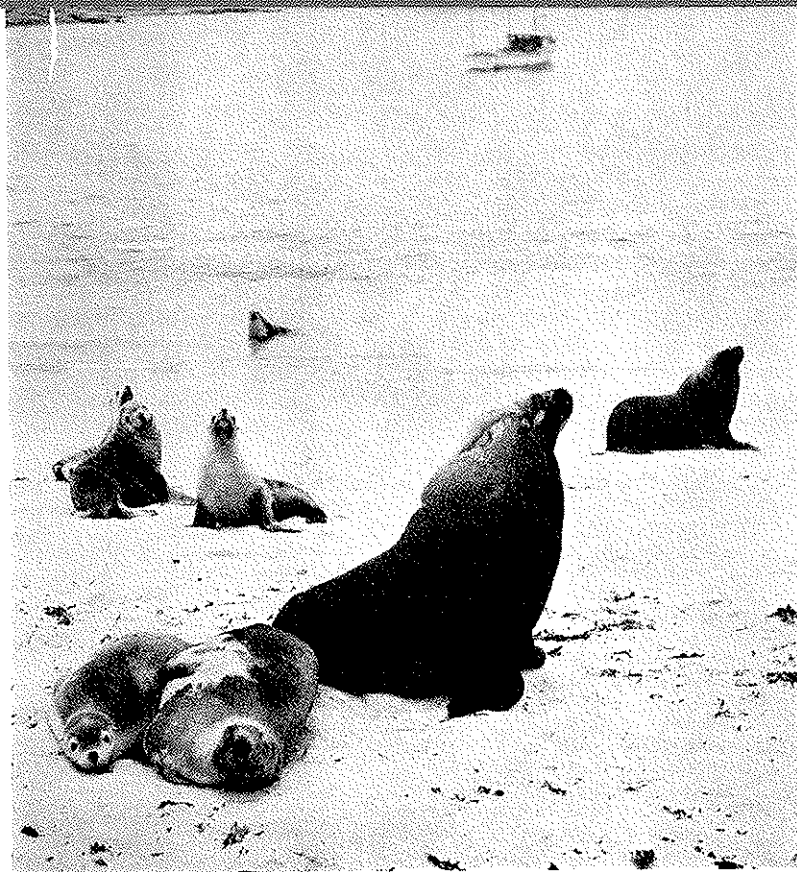
Seals have been legally protected in Western Australia since 1892, but at least one open season has been permitted since then, in 1920, in which year a sealing party took 494 Fur-Seals and 327 Hair-Seals at the Recherche.

Even after the disappearance of the old-time sealers, who appeared to have had their headquarters at Middle Island, some sealing of a minor nature was continued after the establishment of Dempster's sheep station at Esperance in 1863. Mr. W. E. Dempster (in a personal communication) states that on one occasion his uncle, James Dempster, brought back a boat load of Fur-Seal skins worth 30/- each. The Hair-Seals supplied the station with oil and hides.

7. WHITE-CAPPED HAIR-SEAL, *Neophoca cinerea* (Peron and Lesueur, 1816).

The expedition met with this seal on several of the islands. Our general experiences with it confirmed published accounts, such as the summary given by Troughton (1946, p. 255), except in some minor points.

Individual behaviour was quite variable. In general the most savage were the mothers. These would make short rushes at human intruders and then return immediately to the baby. On one occasion, when the intruder failed to retire, being safely quartered on a high rock, the baffled mother turned on the bull and bit him savagely. The bull roared once or twice and began to doze again. However, on another occasion a bull cuffed the mother soundly when one of our party intruded



Bull and cows, *Neophoca cinerea* (Christmas Island).



Young Hair-Seal (Wedge Island).

on the harem. All these would be apparently displacement activities in the sense that strong excitement produces a reaction which is out of place or useless under the circumstances, the appropriate or useful response being prevented by the peculiar situation. In both the cases mentioned the intruders were beyond the reach of the seals.

In general the old bulls ignored our presence unless we came very close. Apparently it is only other bulls which produce strong anger reactions. There was not sufficient time to investigate some rather puzzling individual reactions observed. It may be mentioned that all bulls showed pronounced scarring on the shoulders. Also mother seals apparently leave quite young babies under rocks while they go to sea, either for food or recreation.

The following are detailed notes on the various islands.

FIGURE OF EIGHT: Two seals bathing. On a rock near this island were about 20 seals.

BOXER: One young seal asleep in the grass and about 30 feet above sea-level. On being wakened it roared, bared its teeth and hurried to the water.

MONDRAIN: Five seals.

TERMINATION: About 20 seals. This island had the first harem we met with.

ROUND: About 20 seals and at least three harems.

WEDGE: About 40 seals and a number of harems.

It was on this island that a solitary bull challenged our advance on the summit. This point must have been about 200 feet above sea-level and near the top was a pool in which the bull was bathing. He pursued us for 20 or 30 yards down the hill.

COMBE: About 10 seals resting.

GOOSE: A dead seal was found in a limestone cave.

DOUGLAS: About 10 seals, including a harem.

SALISBURY: 20 seals, with 50 Fur-Seals.

CHRISTMAS: 65 seals on a sand beach and a number of harems. These were among nitre bushes rather than on rocks.

THOMAS: One seal.

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