THE AUSTRALIAN MUSEUM MAGAZINE

EDITED BY

C. ANDERSON, M.A., D.Sc.
DIRECTOR.

VOLUME I., 1921-1923

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THE AUSTRALIAN MUSEUM

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INDEX

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CONTENTS

The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.

Vol. I. No. 1. APRIL, 1921. PRICE ONE SHILLING.

THE AUSTRALIAN MUSEUM

COLLEGE STREET - - - SYDNEY

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TABLE OF CONTENTS

THE AUSTRALIAN MUSEUM.
Illuminated in honour of the visit to Sydney of H.R.H. The Prince of Wales in 1920.

Photo - Cecil Bostock

THE AUSTRALIAN MUSEUM
From Hyde Park.

Photo—Henry King

THE AUSTRALIAN MUSEUM MAGAZINE

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THE OBJECTS OF THE AUSTRALIAN MUSEUM MAGAZINE.

By THE EDITOR.

THE publications issued by the Australian Museum in the past have consisted of Reports, Memoirs, Records, and Catalogues, intended principally for scientific readers and specialists in various branches of natural science. Such publications form valuable contributions to knowledge, and are an essential feature in the life of an institution such as ours, but, since the Museum is supported by public funds for the instruction and enjoyment of the whole people, the Trustees have decided to make an increased effort to reach a wider public, so that every man and woman in the State, and even the children of tender years, may feel that the Museum has a message for them. It is with this object in view that the *Australian Museum Magazine* has been established.

As the *Magazine* is intended mainly for those who have no special knowledge of the technical details of natural history, the articles contained in it will be written, so far as possible, in non-technical language, and deal with subjects which are likely to be of interest to the average citizen. The haunts, habits and life-histories of the common animals of our bush, ponds, and seashore will be described; nor will the denizens of the ocean depths be forgotten. We shall endeavour to picture for our readers the everyday life of animals, their inter-relations, their struggles for existence, and their place in the whole scheme of nature. The form and structure of animals is an absorbing study, but animal architecture alone is apt to become dry bones in the figurative, as well as the literal sense, and surely an animal is more interesting when it is presented, not as a mere dead thing, but as a living, breathing creature. Fossils, too, which are merely animals and plants that have been dead a long time, have a fascinating tale to tell, and even the minerals found in our quarries and mines are more than the raw materials of industry and commerce. Like other primitive races, our aborigines are fast disappearing before the inroads of civilization, and we feel sure that every Australian will welcome popular articles on our predecessors in this continent, their quaint customs and ceremonials.

The collections in the Museum consist of animals, fossils, minerals and ethnological objects gathered from all quarters of the globe, though mainly

Australian, and one important function of the *Magazine* will be to make these collections better known to their owners, the public, and not merely to those who are able to visit the Museum in person, but also to those in distant parts of the State, who have not that privilege. From time to time new exhibits of more than usual interest are placed on view in the galleries; these will be described and illustrated in the pages of the *Magazine*.

Every child, and many grown-ups also, find much pleasure in collecting natural objects, and in future numbers we hope to assist them by a series of articles on the best methods of collecting and preserving animals, and recording observations on animal life.

Many of our readers may have opportunities of making interesting and valuable observations on wild life in Australia, and we shall willingly find room in our pages for such observations.

A lively curiosity is one of the best hand-maidens to knowledge, and fortunate is he who preserves in his manhood the enquiring mind of the child; we shall be pleased at all times to answer any queries addressed to us.

We propose, too, to describe for our readers the collecting trips which members of the Museum Staff make to various parts of Australia, and even to distant Pacific isles. If our collectors seldom encounter moving accidents by flood and field, yet their experiences on these expeditions are often interesting and entertaining.

NOTES

The first of the series of popular lectures arranged for this session will be delivered on April 14 by Mr. C. Hedley, F.L.S., his subject being "The Depths of the Sea." Succeeding lectures will be as follows:—May 12, "The Natural History of the Hawkesbury Valley," by C. T. Musson, F.L.S.; June 9, "A Seashore Ramble," F. L. Grutzmacher, F.C.S., F.L.S.; July 14, "Monotremes and Marsupials," L. Harrison, B.Sc., B.A.; August 11, "Lord Howe Island; a South Sea Tragedy," A. R. McCulloch; September 8, "Snakes and Their Venom," J. R. Kinghorn; October 13, "Ants and Ant Communities," A. Musgrave; November 10, "Primitive Man," L. Harrison, B.Sc., B.A.

Mr. Ernest Wunderlich, a member of the Board of Trustees, announces his intention to supply funds to defray the cost of preparing and installing an Australian Aboriginal group in the Museum. The thanks of the community are due to Mr. Wunderlich for his generous and patriotic gift, and it is to be hoped that this example will be followed by other public-spirited citizens.

Messrs. A. R. McCulloch and E. L. Troughton, of the Scientific Staff, have just returned from a holiday trip to Lord Howe Island, and have brought back with them a valuable zoological collection and many interesting notes on the natural history of this outlying dependency of New South Wales. They secured a fine series of photographs, some of which will be used to illustrate a future issue.

Two valuable gifts have recently been made to the Museum. Mr. G. A. Waterhouse, B.Sc., well known as a lepidopterist, has presented his collection of Australian butterflies, which represents the gatherings of many years and is recognized as the finest in the Commonwealth. The standard work, *The Butterflies of Australia*, written by Mr. Waterhouse, in collaboration with Mr. G. Lyell, was largely based on this collection. Professor A. Liversidge, a former Trustee, now resident in London, has presented his collection of crystals, the main part of which formerly belonged to General Cathcart. The collection is specially rich in Indian and Ceylonese minerals.

THE SCOPE AND WORK OF THE AUSTRALIAN MUSEUM.

By THE EDITOR.

A museum may be broadly defined as a repository for objects illustrating the works of man, past and present, the natural history of living things, and the structure and composition of the earth's crust; in short, it is a storehouse for the works of art and of nature. In practice, however, it is found convenient to sub-divide this vast field into various smaller domains, and, in Sydney, for example, we find these collections distributed between the Public and Municipal Libraries, the Art Gallery, and five Museums, each with its appropriate contents.

Omitting the historical and numismatical sections, which are more limited in extent, the collections stored in the Australian Museum fall into four main groups:—

1. Zoological Exhibits, illustrating the animal kingdom as it exists to-day.
2. Palæontological; the animals and plants of bygone ages (fossils).
3. Ethnological; the life and works of prehistoric and primitive races of man.
4. Mineralogical; the naturally occurring inorganic substances.

In each of these groups special prominence is given to Australian representatives.

The question may be asked: Why should we wish to assemble and preserve these objects? The answer is twofold. In the first place, they form the subject matter on which present knowledge is based, and the material by use of which future workers may still further extend the bounds of knowledge. Secondly, when properly displayed, they contribute to the wonder, pleasure, and instruction of the public. These two sentences epitomise the whole aim and object of museums and museum work; it now remains to show how our institution in particular tries to fulfil its mission.

If natural history objects are to be of any scientific service, they must be correctly named and classified. For this purpose the various branches included in the work of the museum are placed in charge of specialists, most of whom have had many years' training and experience in the museum itself. These experts form the scientific staff, on whose ability and industry the success of the museum as a scientific institution largely depends. Then comes the work of preserving the specimens for future reference, and cataloguing and storing them, so that they may be readily accessible for purposes of study. Most natural history specimens are perishable, and special materials and methods must be used if they are not to degenerate into useless rubbish. For it must be remembered that these collections are not for today only, but for posterity also, and that the museum holds them in trust for the whole scientific world.

I would emphasise the importance of museums as places for the acquisition and diffusion of knowledge, for, to the casual visitor, the exhibition galleries are the museum, and the uniformed attendants, performing their useful and necessary tasks as caretakers and cleaners, are the staff. It may surprise many to learn that the collections stored away are, perhaps, as extensive as those on exhibition. The needs of the student are different from those of the ordinary museum visitor, who would but be confused and dismayed by the display of row after row of specimens showing apparently little or no variation. To the student and the specialist, such series are invaluable; without them he would not be able to unravel the many intricate problems of evolution and variation, of geographical distribution, seasonal changes, and the relationship of species. When not employed in routine work, the members of our scientific staff are patiently engaged with microscope, dissecting knife, and test-tube, endeavouring to elucidate the structure, form and composition of the objects under their charge, and the results of their researches are issued in the Museum publications, or in the pages of scientific periodicals. Then, too, one will often find in our workrooms some kindred spirit, who is not a member of the staff, and may have come from some neighbouring State, or from overseas, to consult our collections and our library, which contains a fine assemblage of works and journals on natural history and ethnology, with special reference to Australia. A foreign *savant* journeys to our shores, and expects to find, and does find, the type specimens and records which he wishes to examine in connection with his special researches. The scientific workers in other institutions, such as the University, gladly avail themselves of the treasures stored in College Street, and the Museum authorities as gladly place these treasures at their disposal.

Scarcely a day passes which does not bring several callers, or letters, seeking information. Answering such enquiries is an important and essential branch of museum work, and, although the museum is, in the first instance, a purely scientific institution, many of the subjects on which information is sought touch on matters of economic importance, and may relate to insect pests, the habits and specific distinctions of fishes

* A more extended account of museum work in general, and of the scope and work of the Australian Museum in particular, will be found in an address by the President, Dr. T. Storie Dixson, delivered June 10, 1919 (printed by order of the Trustees, 1919).

and other marine animals, birds destructive to farm or orchard, or the occurrence and uses of minerals.

On suitable days, gallery demonstrations are given by members of the staff, who conduct small parties round the collections and explain the exhibits. This is a new feature, instituted by Mr. C. Hedley, and is much appreciated by our visitors.

Every year a course of free lectures is delivered in the Lecture Hall. These popular addresses, the initiation of which we owe chiefly to the enthusiasm and untiring efforts of two Trustees, Dr. T. Storie Dixson, now President of the Board, and Mr. John Vernon, formerly Auditor-General, are illustrated by museum specimens and lantern slides.

Much work has to be done behind the scenes in preparing specimens for display in the public rooms. An animal must be carefully skinned, the skin tanned or otherwise preserved, and then mounted in a natural posture, so that it may be a true representation of the living creature. This is the work of the taxidermist, who requires to be just as much an artist as does a painter or a sculptor. If the animal is to be shown with accessories of rock or foliage, these must be faithfully portrayed, so that they may look natural and unobtrusive, which demands a high degree of ingenuity and tasteful skill. Many animals are best represented by plaster models, carefully finished and coloured to resemble the originals; this, too, is work requiring no small amount of technical ability. If it is desired to display a skeleton, the bones must be thoroughly cleaned, bleached, and then articulated, so as to preserve their true relations to one another. This is the province of the articulator, who must have a knowledge of osteology. Next comes the work of the artificer, who, besides performing ordinary structural and repair work, has to exercise considerable manual dexterity in fashioning cases and supports for the exhibits. The last requisite is the label. The achievement of a satisfactory label is one of the most difficult tasks, and often the despair of the museum official, and is attained only after much discussion and searching of mind. The labels which accompany the gallery exhibits in the Australian Museum are printed on the premises, and are of two kinds, one, short and pointed, giving merely the name, locality, and a few essential facts concerning the specimen; the other, more lengthy and descriptive, to call attention to features of special interest and importance.

THE MANAGEMENT OF THE AUSTRALIAN MUSEUM

By THE EDITOR.

Until 1853, the affairs of the Museum were adminstered by a committee, but in that year it was incorporated by Act of Parliament under a Board, composed of twelve official Trustees and twelve elective Trustees. The twelve official Trustees consist of a Crown Trustee, nominated by the Governor, and the following public officers, namely, the Chief Justice, the Colonial Secretary, the Attorney-General, the Colonial Treasurer, the Auditor-General, the President of the New South Wales Medical Board, and such five other officers as the Governor names for the purpose. Vacancies which occur among the elective Trustees, by death, resignation, or otherwise, are filled up by the appointment of such other fit and proper persons as the remaining members of the Board may elect.

The Board meets for the transaction of business on the first Friday in each month, except January, when no meeting is held. There are three Standing Committees, namely, the House Committee, consisting of five members, the Scientific and Publication Committee, of five, and the Finance and Publicity Committee, of four. These Committees deal with the matters which fall within their province, and submit their recommendations to the Board, which alone has executive power. The President is Dr. T. Storie Dixson, President of the New South Wales Medical Board.

The Director superintends the staff and the general working of the institution, and is responsible to the Trustees.

The funds necessary for the upkeep and general expenditure of the Museum consist of a permanent endowment of £1,000 per annum, paid out of the general revenues of New South Wales, and an annual appropriation voted by Parliament. The Museum has, up to the present, received no private monetary endowment.

BLACKFELLOWS' PICTURES

By CHARLES HEDLEY.

The stories that we all want to hear are the stories of how things grow; no repetition has ever dulled the interest of those wonderful spring-time stories of the seed, the plant and the flower, or, of the nest, the egg and the chick.

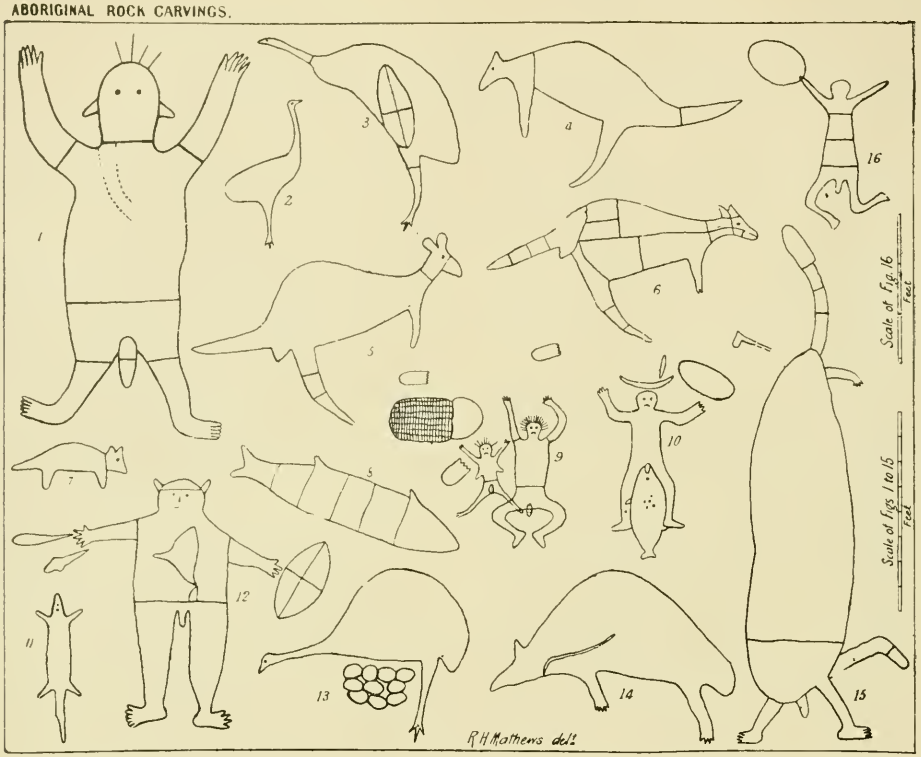
As plants or animals grew from small beginnings, so did Art. Masterpieces of painting and of sculpture are displayed in the modern Art Galleries, but for their beginnings we must look elsewhere. In France and England, many caves have been found in which the men of the stone age once lived. Buried in rubbish on the floor of such caverns are bits of horn and bone on which those ancient hunters have scratched, with surprising vigour, sketches of the animals, some of them now extinct, with which they lived. Such primitive folk had the minds of children in the bodies of grown men and women. Their love for art or music was no less sincere, because it was inarticulate. With hands as sure and eyes as keen as any, their pictures are crude, because the artist lacked perseverance and specialisation. The mind of a savage is simple, passionate and changeable, his brain soon wearies of continuous effort, and so he disappeared because he was pushed out of the world by others who were more purposeful and more persistent in toil.

A couple of hundred years ago the people who lived where Sydney now stands were just like those old cave dwellers of Northern Europe. The many sheltered inlets of Port Jackson provided a bounteous supply of fish, oysters, whelks and cockles, and so supported a numerous native population. In this twentieth century it is difficult to realise how recently and in what numbers the blacks once existed and how completely they have vanished.

Sacred grounds were set apart by these blacks, on which ceremonies were performed; these might not ever be seen by the uninitiated, which, of course, included women and children. Any luckless trespasser on these performances would have been speared to death at once. So that they could not be overlooked, the blacks chose the highest hill tops for their Bora grounds, as they called the spots reserved for their secret rites. Round Sydney on high ground there frequently occur level sheets of bare rock, a fine-grained sandstone. Here the native artist found scope for his talents by carving pictures on slabs of rock. Probably the tree trunks round about were decorated also, but, if so, the stone tablets have long outlasted both the timber and the men who wrought upon them.

The Ancient hunters of Britain and France observed form with a keen eye. This cast which is from the Australian Museum shows that the original piece of bone was deftly carved by a prehistoric French artist who had developed his draughtsmanship to a much more realistic pitch than the Australian aborigines who lived even in modern times.

ABORIGINAL ROCK CARVINGS.



Our blackfellows may have despised realism in art because their efforts to depict a scene serenely ignored details of form. What they did naturally, the cubists, futurists, and dadaists, strove to do unnaturally. The aboriginal makes his picture with a shorthand art of his own and with a quaint humor. This outline drawing was made by Mr. R. H. Mathews from aboriginal rock carvings, and the scale is roughly 8 feet to 1 inch.

These pictures cover a wide range; sometimes an ambitious spirit has tried to present a scene, such as a kangaroo hunt. A favourite subject, and one readily recognised, is a whale. Then, as now, a dead whale chanced at times to drift ashore. When this occurred it would have seemed to the blacks as if some kind providence had opened a butcher's shop gratis on the beach for their especial benefit. As a memento of its size and shape that whale would be drawn on the Bora ground. Such a tale lost nothing in the telling, and the marvellous meat was drawn "heroic size." Sixty feet in length was the testimony of one witness. Another group shows a whale attended by her calf, and alongside is a marine monster which appears to have been a sun fish. The throwing of a boomerang is an incident in some picture stories. What some of the figures stood for we cannot even guess. Some of the unintelligible ones may mean the tracks of game animals, naturally subjects of great importance to a hunter. A green turtle in another group stares at an emu standing beside a clutch of eggs. The turtle seems to be wrestling with the riddle of the egg.

Convention, absurd to say, had overtaken even the palæolithic artist and crushed his initiative with the right way to do things. For instance, their right and only way to draw a man was to spread his fingers and to extend his limbs apart as if crucified. Perhaps this was a dancing attitude of a corroboree.

It is said that the portrait of a man was sometimes made by outlining his shadow in the afternoon sunshine. Probably the sketch was first drawn with a burnt stick. Along the line to be engraved, holes were bored in the rock an inch, or half an inch, apart. Then the spaces between the holes was ground away or chipped out with a

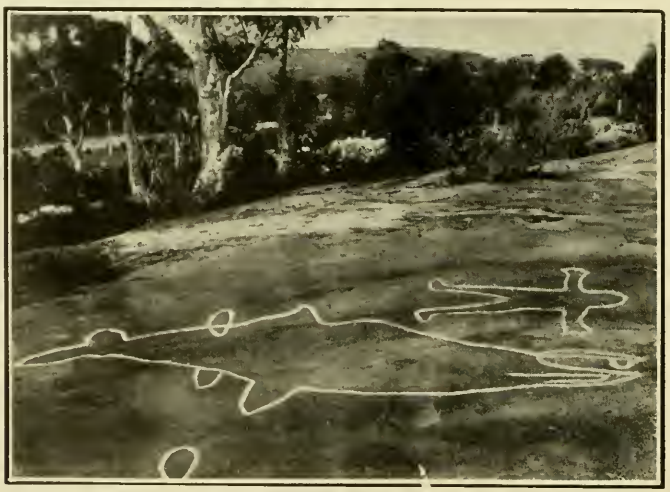
TREE CARVED BY AUSTRALIAN ABORIGINALS, DUBBO. *Photo—Harry Barnes.*

These carvings are generally found near the grave of a dead chieftain in whose memory the carving was made.

The outline of a Dolphin carved at Jibbon, Port Hacking by Aboriginals.

pick or chisel of hard rock. The older figures had broader and deeper furrows than the newer ones, and in some very ancient engravings the natural decay of the surface of the rock has almost obliterated the drawings.

Another style of illustration which the blacks practised was to make red hands in caves. White paint was made from burnt cockle shells mixed with wood ashes from the camp fire, made more durable by mixing it with blood. Red paint was got from iron clays, and black paint from charcoal mixed with fat. Having mixed his paint, the artist took a mouthful of it, then he placed his hand on the rock, the palm to the wall and the fingers outstretched. On this he squirted the paint from his mouth, and when his hand is removed, the print of it on the rock is seen blocked out by white. Finally its outline may be filled in with red paint. Sometimes the rock was first greased to make the paint adhere better.



A rock carving at Curl Curl, Manly showing an aboriginal Man, and a Strap-tooth Whale.

AUSTRALIAN INSECTS

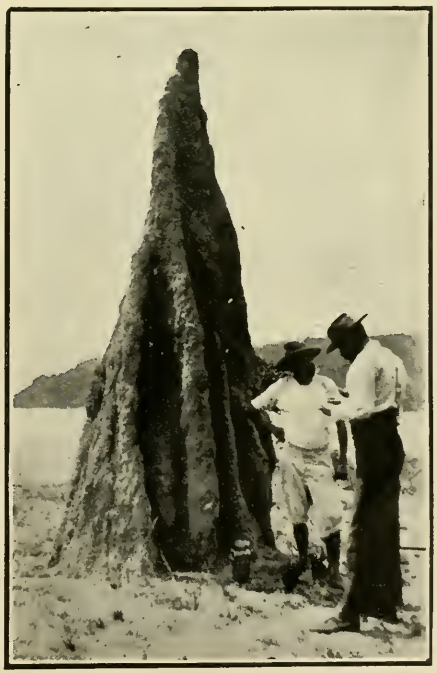
By A. MUSGRAVE.

I.—"WHITE ANT" COMMUNITIES

The lead was eaten through by "White Ants" so that they could attack the wood in the roof of the Museum. The nest shown on the left was removed from a beam in 1896.

Australia is very liberally endowed with representatives of the family Termitidae, which includes the termites, or as they are more popularly but wrongly named "white ants." This family is near the order which includes such familiar insects as cockroaches, grasshoppers, mantids, but apart from a very similar social life it has no affinities with the true ants.

"White ants" are chiefly found in tropical and sub-tropical countries, but three species are known to occur in Southern Europe and one in America, as far north as Manitoba, Canada. Australia is rich in species and their nests are common throughout the country. Thousands of pounds are annually spent in combating this insect pest, which is perhaps the worst against which we have to contend. The damage done to the roof of the Museum on the occasion of a visitation in 1896, was so extensive that the entire roof had to be replaced. A remarkable feature of this invasion was the perforation of sheet-lead by the persevering insects in their efforts to reach the wood.



Pyramidal Nest of Eutermes pyriformis at Cape York.

Photo A. R. McCulloch

The "white ant" responsible for the mischief was the Milk White Termite *Coptotermes lacteus,* as Mr. W. W. Froggatt, the Government Entomologist, calls it. This species is very plentiful around Sydney, where it constructs its nest in logs and stumps. In the South Coast District and northwards to Southern Queensland it makes a dome-shaped nest, which may measure six feet in height. This structure is formed of clay on the outside, and its base is usually embedded about a foot underground. When the outer clay covering is removed, the interior of the nest is seen to be composed of a clay-like material which was originally wood, but has been masticated by the termites and worked into its present form. Through it run the galleries of the colony. A round mass made of sheets of a special material placed one above the other, and riddled with galleries, is found in the centre of the nest. Mr. Froggatt has described it as the "nursery," on account of the numbers of young larvæ found in it.

The Meridional or Magnetic White Ant, *Termes meridionalis,* found in North Queensland and the Northern Territory, has the most interesting nest of all our Australian species. The termitarium resembles a wall in appearance, usually about 8 feet in height, and is so constructed that the ends of the wall point directly north and south, with the broad sides east and west.

The reason for so constructing the termitarium is that it may dry most rapidly. The sun shines on both sides, and each receives an equal amount of heat. This is necessary, as repairs and additions to the nest are made only during the wet season, when the building material is soft.

The nests found around Cooktown are often surmounted by turret and spire-like projections, which remind one of some European cathedral. A variation from the Cooktown form occurs near Port Darwin. In this case the nest has the eastern side convex and the western concave; the turrets, too, have given place to a serrated ridge.

One of the accompanying illustrations shows the Great Mound Nest of *Eutermes pyriformis,* which is common at Cape York and may be 18 feet high. The "nigger head" nests, so common in gum trees in the bush, are the work of members of the genus *Eutermes.* They are usually in communication with the ground by means of closed-in galleries. Other termites do not appear to make these arboreal habitations.

A "white ant" community is made up of a number of castes, each of which has its special duties to perform. The supreme being is the queen, the whole activities of the colony centering around her, since on her falls the duty of the reproduction of its life. She is much larger in size than any of the other termites in the nest owing to an enormous development of the egg tubes in the abdomen, which becomes distended with eggs. Her great rotundity makes her incapable of movement, and she depends on the workers for nourishment. Certain specialised pupæ, known as "supplementary queens," take the place of the queen in the event of her dying or any other such misfortune. The queen, as a rule, belongs to the caste which includes the winged males and females, but after pairing she settles down to a life of egg laying. The king is sometimes seen in the royal cell, but little seems to be known about him. The winged males and females are the only members of the termitarium which are usually seen outside the nest. The "white ant" swarms, which are such a nuisance in the summer months, are composed of myriads of these insects, which are forsaking the nest in order to set up house for themselves. A swarm usually makes its appearance about a quarter of an hour before sunset, after a hot, sultry day. The workers on such an occasion make a breach in the wall of the termitarium and the soldiers allow the winged forms to swarm out. These speedily

take flight and unless they are unfortunate enough to fall foul of some hungry bird, soon come to earth. Like moths, they are very commonly attracted by the glare of a light in an open window, and if one watches them as they settle around a lamp, it will be noticed that they readily cast off their wings without the slightest inconvenience, and crawl rapidly away to some dark corner. At the bases of the wings there is a definite cross line of weakness, and when the insect feels these members to be of no further service, it wriggles and twists its body with no uncertain effort, until a fracture occurs, and the whole four wings are left behind. Late on a hot evening, when we turn down the lamp, a cluster of gauzy iridescent wings on the table around it is often all that remains to remind one of the irritating attention of their owners during the few preceding hours.

To the second caste belong the workers, which are more numerous in individuals than any other. To them is entrusted all the work of the community; building and repairing the nest, feeding the young, and looking after the eggs and the queen. They are literally the "hewers of wood and drawers of water" of this termite kingdom. Like the next caste, the soldier, they are aborted males and females.

The soldier caste is generally easily distinguished by the large sickle-shaped jaws, which are used as weapons against invaders. They stand guard over the tunnels should any holes be made in them, and defend the workers, who quickly repair the damage.

The soldiers of the genus *Eutermes* are remarkable for having a sharp awl-like snout, in which fluid is stored as a means of defence against enemies.

As termites are such a general pest in Australia, a few notes on the methods adopted for their eradication may prove of use.

Arsenic is the poison generally used for their destruction, and as they feed on the bodies of their companions which have died from its effects, the poison is thus passed on. If the arsenic be mixed with treacle or sugar and placed in the wood where they are working, they will soon fall victims to it.

A method suggested by Mr. Froggatt for preventing their ingress into buildings is to paint the floor joists with arsenic mixed with wood preserving oil. A pound of arsenic should be boiled with a pound of washing soda and then mixed with four gallons of the oil.

In North Queensland and Papua many of the houses are built on piles, the tops of which are covered with tin caps to prevent the ants entering the house. The piles are also well coated with tar. All termites' nests in the vicinity of a building must be destroyed, as the insects often tunnel for long distances underground in search of the timber they desire. An established nest may be effectively disposed of by fire, since the internal woody pulp burns readily. A hole should be made on each side of the nest, and a fire lighted in one of them. The air passes freely through the galleries in the structure and so forms a draught, which soon carries the smoke into the innermost recesses and drives the flurried insects before it. A nest several feet in diameter will take several days to burn out, and the smoke from it gives off a peculiar pungent odour, which drives away all the mosquitoes in the vicinity—an item of no inconsiderable value in tropical regions. When the woody material of the nest is completely destroyed, together with the insects inhabiting it, the outer mound may remain intact for some considerable time. The cavity within forms an excellent oven in which bread can be baked, and they are not infrequently used for this purpose by the bushmen of Australia.

The methods for dealing with these noxious insects have been thoroughly treated by Mr. Froggatt in *Farmer's Bulletin*, No. 60, issued gratis by the Department of Agriculture.

II—THE WHITE BUTTERFLY MIGRATION

The White Caper Butterfly, *Anaphaeis java var. teutonia,* which, during November, 1920, passed over Sydney in swarms, has given rise to much speculation as to its ultimate goal and the reason for its migration. This butterfly is a member of the family Pieridæ, a group which includes those species popularly known as "The Whites." Many species of Pieridæ are noted for their migratory habits, and the great naturalist, Charles Darwin, in his "Naturalist's Voyage Round the World," records a flight of white butterflies which was seen from the deck of the "Beagle" when ten miles out at sea off the South American coast. In view of a theory put forward at a recent meeting of the Linnean Society of New South Wales, that the migration of the "Caper White" was probably due to the westerly winds carrying them from the West, it is of interest to read the conclusion arrived at by Darwin when he encountered the swarm of butterflies so far out at sea. "The day," he says, "had been fine and calm, and the one previous to it equally so with light and variable airs. Hence we cannot suppose that the insects were blown off the land, but we must conclude they voluntarily took flight." Another theory as to the cause of the migration was that the food plant of the butterflies, the Australian Caper Plant, had probably failed through drought conditions and the insects were forced to go further afield No satisfactory conclusion has yet been arrived at as to the motive for the butterflies always travelling in a certain direction. The 1920 swarm is not unique so far as New South Wales is concerned; we have records of swarms in 1894, 1903, 1906 and 1909.

During a migration, the insects often appear at irregular intervals. They may be conspicuous everywhere on certain days, hovering round the flowers of the garden or floating airily over the lantana blossoms, but suddenly they disappear, to be followed perhaps in a day or so by another body, which may linger a little longer before passing away on its unknown quest. Weak fliers, they make little headway against the buffetings of adverse winds, and a white flake on the green waters of the harbour too often bears testimony to an untimely end from the forces of nature.

The "Caper White" has for many years been known to frequent the Native Caper plant, *Capparis nobilis,* growing near the Herbarium in the Botanic Gardens, and the butterfly may be observed there in all stages of its development. During the recent migration, the butterflies descended in hundreds on this plant and were discovered laying their eggs on the leaves to such an alarming extent, that the tree had to be sprayed several times with arsenate of lead in order to destroy them.

Two White Caper Butterflies.
(Male above and Female below).

The spindle-shaped eggs of the butterfly are laid on the upper side of a leaf, sometimes as many as fifty being deposited on a single leaf. The

young caterpillar, when it emerges from the egg, is yellow in colour, and covered with long hairs. It is exceedingly voracious, and at once commences to eat the young shoots and leaves of the food-plant. Increasing rapidly in size, it changes its skin several times, until it attains a length of one and a quarter inches, which is its maximum size. At this stage the body is greenish in appearance with yellow tubercles on each segment forming transverse rows. The long hairs which were so conspicuous in the young larva have given place to very fine ones, the long ones having disappeared during a moult.

The caterpillar now develops into the pupa or chrysalis stage, which is attached to a leaf of the *Capparis*. The chrysalis is about an inch in length, and is greyish-white with yellow and black markings. The head bears a pointed process, and the second abdominal segment has two black spine-like structures.

The butterfly, on emerging from its chrysalis, has to wait some time until its wings are dried before it can join its companions in their migrations, or sport around the green leaves of the *Capparis*.

The "Caper White" has a very wide distribution. In addition to being found throughout Australia, it occurs in Malaysia, New Guinea, Friendly Islands, Solomon Islands, New Hebrides, and New Caledonia. So far, it has not extended its range into New Zealand.

The White Caper resting on Flowers.
Photo—A. Musgrave

The poet Swinburne has immortalised white butterflies in the following lines:—

"Fly, white butterflies, out to sea,
Frail, pale wings for the winds to try;
Small white wings that we scarce can see.
Here and there may a chance-caught eye
Note, in a score of you, twain or three,
Brighter or darker of tinge or dye;
Some fly light as a laugh of glee,
Some fly soft as a long, low sigh:
All to the haven where each would be—
Fly."

HOUSEHOLD PESTS.—From time to time the Museum is asked to supply information as to the most effective methods of ridding a house of such common insect pests as the house fly, the bed bug, fleas, and cockroaches.

Of these we shall deal first with the house fly, *Musca domestica*, also known as the typhoid fly on account of its being a carrier of the germs of this disease. Formalin has proved to be the best poison, and a few drops of five per cent. formalin placed in a saucer of sweetened milk will cause the death of all flies who partake of it. If proper care were taken in the first place to prevent flies breeding, by covering up receptacles for garbage and such places as manure heaps in stables, they would eventually disappear.

Fleas are encouraged through cats and dogs being kept on the premises or else through lack of proper cleanliness. Flea larvae feed upon dust in carpets and in the cracks and crevices of the floor. To dispose of fleas we must therefore get rid of all dust by thoroughly scrubbing out the room with hot water in which a small quantity of carbolic has been poured, and by beating all carpets.

The only effective method for getting rid of bugs is thorough fumigation by a competent person employing such means as hydrocyanic acid gas. This gas is very poisonous and fumigation should not be attempted by a novice.

Cockroaches are best destroyed by placing baits of borax and breadcrumbs, or equal parts of ground-up chocolate and borax, in the places where they lurk. Plaster of Paris sprinkled about will also be greedily consumed by the insects, and on being taken into their digestive system it hardens, and so causes death. Paris green blown into their hiding places has the effect of driving them out.—A. Musgrave.

THE LURE OF THE BIG NUGGET

By THE EDITOR.

Gold occurs in nature chiefly as specks, veins and masses in quartz, when it is called reef gold, or as grains, flakes and irregular lumps in the gravels, sand and débris of stream channels and flood plains, when it gets the name alluvial or detrital gold. Detrital or drift gold deposits result from the denudation of the surface layers of the earth, which were perhaps several thousand feet in thickness, and were traversed by auriferous quartz lodes, the gold, because of its relative insolubility and high specific gravity, becoming naturally concentrated by the action of running water.

Alluvial gold, especially when near the surface, is much more readily and more cheaply won than the gold which is locked up in the hard quartz of reefs; therefore it will be readily understood that in the early days of Australian gold mining, when small parties of diggers, or even solitary prospectors, were delving for the newly-discovered wealth, it was the drift deposits that received most attention. These were the palmy and adventurous days of mining, so well described in Charles Reade's fine novel, *It is Never Too Late to Mend*. The alluvial gold miner was a gambler, for the precious metal is erratic in its occurrence, and weeks or months of hard work would sometimes be spent in an unavailing search for "pay-dirt," while a more fortunate digger might "strike it rich" in a few days.

Any lump of gold found in the alluvium is called a nugget, whether its weight be a few pennyweights or a hundredweight or so. The word nugget, used in this sense, seems to be of Australian origin, for in the early convict days a lump of tobacco was called a nugget, and amongst farmers the same name was applied to "a small, compact beast or runt." Rolf Boldrewood, in *Robbery Under Arms*, writes: "We branded the little red heifer calf first—a fine fat six-months-old nugget."

The finding of a large nugget of gold was the occasion for great rejoicing on the part of the successful digger, and much excitement among the community. Valuable nuggets are occasionally turned up even now, but in the early days of our history as a gold-producing country, such an event was much commoner. Australia has produced more large masses of gold than any other continent, and this is responsible for the fact that many a "new chum" lands in Australia expecting to find nuggets of gold scattered in his path like pebbles.

The original nuggets have, practically without exception, long since found their way to the melting pot, to be converted into coin of the realm or, mayhap, to adorn some fair lady's finger or stop a hollow tooth to keep the ache away. But, fortunately, we have models of some of the most famous nuggets, which, when skilfully gilded, are to outward appearance almost as good as the originals and not so likely to be a temptation to some poor but dishonest man. In the mineral gallery of the Australian Museum a fine collection of nugget models will be found in a wall case near the entrance, and the stories of the discoveries of the originals are full of interest.

The visitor to the museum will be at once attracted by the huge "Welcome Stranger" and "Welcome" nuggets; the former weighed 2,520 ozs., and the latter 2,217 ozs., the respective values being about £9,534 and £9,323. The "Welcome Stranger" was the largest nugget ever discovered and the circumstances of its finding are somewhat romantic. It was found on Friday, February 3, 1869, in Bulldog Gully, near Dunolly, Victoria. Two miners, Richard Oates and John Deason, had been surfacing in the gully for about two years. They were Cornishmen and had come out to Australia in 1854 in the same ship, arriving at Dunolly in 1862. They were fairly lucky during their first two or three years there, but four very lean years followed, during which they scarcely made a living. At the beginning of 1869 their capital was completely exhausted and on the very morning of their great find, Deason was unable to get a bag of flour on credit at the nearest store. But the two men must have been made of good stuff, for they tightened their belts and worked on. Deason was fossicking round the roots of an old tree, where an obelisk now stands to commemorate the event, when his pick struck something hard. He was a profane man—many miners are—and "Damn it all," he said, "I wish it was a nugget, and had broken the pick." You can imagine the eager delight of the two when they realised that here in very truth was the very grandfather of nuggets, which, as they feverishly applied pick and shovel, revealed itself as being even larger than their fondest hopes had pictured it. Their sensations were much the same, no doubt, as those which thrill the treasure-seeker of romance, when at last he has traced to its hiding place, on some haunted isle of the Spanish main, the long-lost hoard of the old-time buccaneer. So the very welcome stranger was joyfully levered from its long resting place and, with great labour and much helpful language, trundled to the miners' tent. All through that Friday night Deason sat before the fire clean-

THE "WELCOME STRANGER" NUGGET.

From the Model in the Museum. *Photo C Clutton*

ing the nugget, and on Saturday morning it was loaded on a dray and taken into Dunolly. The finders had intended to cart the nugget to Melbourne and exhibit it there, but Deason did not like the look of the crowd that gathered round the dray in Dunolly. He decided to turn it into cash at once, so it was sold to the bank and melted after it had been solemnly christened in the presence of a large gathering of people, some of whom had travelled miles to assist at the ceremony. A few days later the two men were back at their claim, but no more nuggets rewarded them. They soon gave it up, and separated. Some years later the two mates again met at Dunolly. Meanwhile, Oates had made some fortunate investments and was richer than ever, but Deason's luck had forsaken him again and he was once more poor.

The "Welcome" nugget, but little smaller than its fellow, was found on June 15, 1858, in the Redhill Mining Company's claim, Bakery Hill, Ballarat, at a depth of 180 feet. The claim was being worked by a party of twenty-two Cornish miners, who, it is interesting to know, were the first to introduce steam-driven machinery at the Ballarat diggings. The nugget was first sold at Ballarat for £10,500, was exhibited at Melbourne for some weeks, and was sold there on March 18, 1859, for £9,325. It was melted in London, November, 1859.

These are the two most celebrated gold nuggets, but many others of considerable value have been found in Victoria, New South Wales and, more recently, in Western Australia. In the early days of shallow sinking, both in Victoria and New South Wales, the digger was ever cheered and spurred on by the hope that to-morrow his pick might encounter a lump of gold which would make him rich for life; to the sanguine every new rush was the promised land. Some miners had extraordinarily good fortune. A party of newcomers, just out from England, started to work an abandoned shaft 60 feet deep at Canadian Gully, Ballarat, and had deepened it only about four feet, when the man below drove his pick into a lump, too soft for stone, too hard for clay. Working round the obstacle, he prised it up and, examining it by the light of his candle, he was amazed and delighted to find that he had unearthed a nugget, which was found to weigh 1,117 ozs. Two days later the same party found another nugget of 1,011 ozs., and two of them, after but a few weeks in Australia, returned to England, rich men. What fine immigration agents they would have made!

But the finding of nuggets was not all romance; it had its tragic side. Sometimes the finder's mind became unhinged by the sudden accession of wealth, and he lived out his life babbling witlessly of gold. Then again the work was hard and often

THE "MAITLAND BAR" NUGGET
which is still in existence.

disagreeable, especially to men who had no previous experience of mining or any other kind of manual work. The surface deposits, particularly in Victoria, were exceedingly rich and in the early 'fifties of last century, a stream of goldseekers poured like a tide towards this El Dorado. The *Argus* of October 3, 1851, makes interesting reading:—

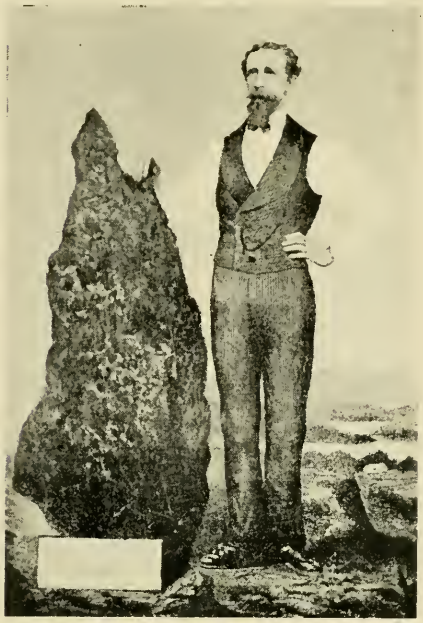
"The police force are handing in resignations daily; even the sergeants are deserting. The custom house hands are off to the diggings; seamen are deserting their vessels; tradesmen and apprentices are gone; the masters are following them; contractors' men have bolted and left large expensive jobs on their hands unfinished. What are the contractors to do? Why, follow their men, and off they go. Patients, on becoming convalescent, forget the attention of their doctor, and his kindness in bringing them round, and depart without even wishing him good-bye; the doctor must, of course, follow; and the lawyer, on the same principle, follows his clients."

The diggers suffered severely for want of provisions, which were both scarce and dear (a bag of flour cost £5), and an even more terrible menace haunted them. Masterless men and adventurers from all the colonies and from abroad hastened to Victoria in search of easy money. Ticket-of-leave men from Tasmania, then a penal colony, crossed the strait, determined to get their share of plunder, and many deeds of violence stain the annals of gold-mining in Australia. The digger who had accumulated a store of gold never went to sleep without the fear that he might be assailed by some savage robber before morning. Men went armed in the daytime and fortified themselves at night. One particularly brutal affair may be mentioned. Two miners were attacked and robbed, one being shot in the leg. As the marauders were tying the wounded man to a tree, one of them felt the bullet, which was embedded in the muscles of his thigh, and callously cut it out with his knife, saying he might want to use it again. Saving men, these bushrangers!

New South Wales has not produced so many large nuggets as Victoria, the largest being that found at Burrandong, near Orange, November 1, 1858. It weighed 1,286 ozs., valued at £4,389. It was melted at the Sydney mint, but no model of it seems to have been made. The "Maitland Bar," a nugget weighing 345 ozs., worth about £1,236, was found at Maitland Bar, in the Mudgee District, in 1887; it is one of the few large nuggets still extant, and is the property of the New South Wales Government.

Much discussion has taken place concerning the origin of gold nuggets. Mr. Evan Hopkins, in a pamphlet published in 1853, advanced the curious hypothesis that the roots of trees have the power of attracting gold from the earth and storing it in masses near the surface. Another view, which has been supported by such well-known Australian geologists as Selwyn, Daintree, Wilkinson, and Newbery, is that nuggets have been formed in the drifts by successive depositions of metallic gold from circulating waters carrying gold in solution. No doubt under favourable circumstances gold may have been deposited from solution by organic matter or metallic sulphides, and some nuggets may have been enlarged in this way, but the theory now generally accepted is that they come from gold-bearing quartz reefs which have been destroyed by denudation, and the gold masses thus set free have been carried perhaps many miles from the parent reef by the agency of running water. In the course of ages the adhering, brittle quartz would be largely removed, and the base metals originally alloyed with the gold would be leached out, which would account for the observed fact that nuggety and alluvial gold generally is purer than reef gold.

It has been argued by the upholders of the growth hypothesis that, if nuggets are derived from lodes, we should find large masses of gold in quartz reefs much more frequently than is the case; but it must be remembered that the reefs exploited by man are probably much smaller in extent, and perhaps poorer in gold content, than the long-vanished reefs from which came our alluvial gold deposits.



MR. HOLTERMANN
AND THE HOLTERMANN NUGGET.

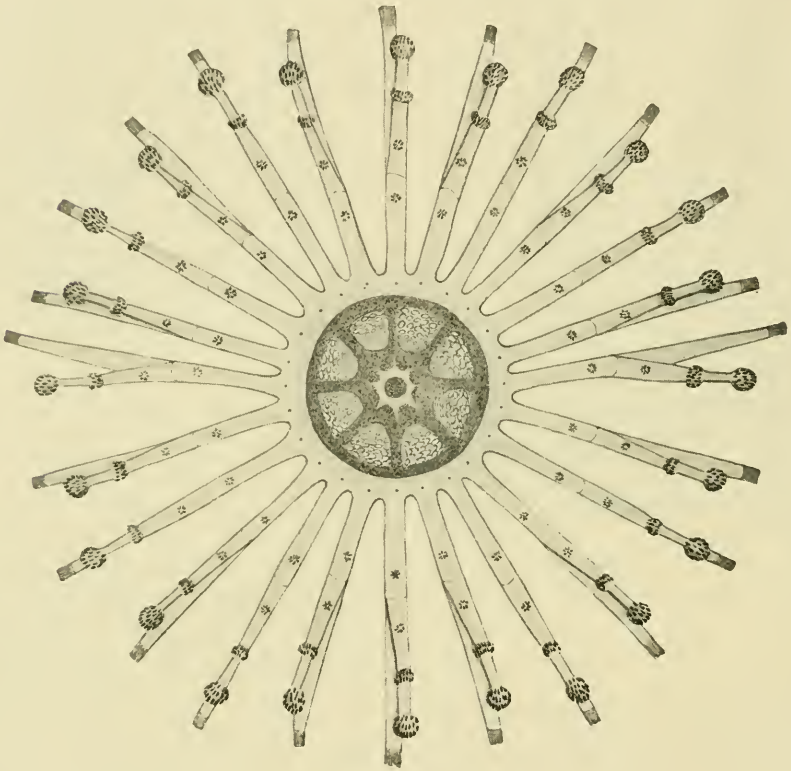
That quartz lodes are sometimes remarkably rich in patches is proved by Kerr's "Hundredweight" and Holtermann's "Nugget." The former was found at Hargraves, New South Wales, in July, 1851, by a Wellington black, a shepherd in the employ of Dr. W. J. Kerr, of Wallawa. He observed some glittering substance on the surface of a block of quartz, broke off a portion with his tomahawk, and found a mass of gold. He hastened home and communicated the glad tidings to his master, to whom he presented whatever gold might be contained in the block. Dr. Kerr lost no time in reaching the spot (is not Kerr a Scotch name?) and the gold, which was in three pieces and weighed 1,272 ozs., was soon lodged in a Bathurst bank. The grateful doctor presented the blackfellow and his brother with two flocks of sheep (about 1,500), two saddle horses, a team of bullocks and a quantity of rations. Regarding this valuable find, Sir C. A. Fitz Roy, in a dispatch to Earl Grey, dated August 15, 1851, naively states: "I am happy to say that although this excitement still continues, and has renewed the migration of adventurers to the goldfield, it has not unsettled the minds of those engaged in industrial pursuits so much as might have been expected; agricultural labours especially have not been suspended, and I believe from information that has reached me from various parts of the colony, and from my own observation, that a larger breadth of wheat has been sown this year than has ever been sown before."

Another huge lump of reef gold, probably the largest mass of the precious metal ever discovered in any part of the world, was found in November, 1872, in Beyers and Holtermann's claim at Hill End, New South Wales. This slab of gold and quartz, which has been called Holtermann's "Nugget," was four feet nine inches high, and over two feet wide. It was valued at £12,000, which, however, is probably an approximation only, as it was crushed along with a quantity of other stone. The late Mr. J. B. Holtermann, who was one of the principal shareholders in the mine, had himself photographed along with the mass of gold shortly after its discovery, and, later, had a woodcut prepared from the photograph, which he used in advertising some patent medicines in which he was interested. Holtermann built a large home at North Sydney, which was later owned by Sir Thomas Dibbs, and is now the North Sydney Grammar School. Both Holtermann and Beyers lost the money that they made from the nugget. Holtermann financed a number of unsuccessful schemes, and Beyers put his money into the Golden Grove Estate, Darlington, but lost most of it, his solicitor absconding with £60,000.

The usefulness of the Museum as a State institution for recreative instruction and research is greatly restricted by the lack of space for exhibition, for storage of specimens, and for extension of the library; more workrooms, too, are needed if the Museum is to pursue a forward policy such as will bring it into line with modern museums. As the President has said in his address of June 10, 1919, "the whole area of ground still available should be covered with suitable buildings"; in fact, the time is not far distant when more land should be acquired to provide for future needs.

A CRAWLING JELLY-FISH FROM PORT JACKSON

By E. A. BRIGGS, B.Sc., Lecturer in Zoology, University of Sydney.



THE NEWLY DISCOVERED JELLY-FISH IS ONE-EIGHT OF AN INCH IN DIAMETER.

To the rich and varied fauna of Port Jackson there has recently been added a new and interesting form belonging to the curious little group of animals known as crawling jelly-fishes.

The creeping or crawling jelly-fish from Port Jackson was first obtained in March, 1917, from a collection of sea-weeds, which had been scraped from the sides of a rock-hewn bathing pool at Point Piper, a sandstone headland on the southern shore of Port Jackson, about two and three-quarter miles from the entrance to the harbour.

Some two years later a further search for the crawling jelly-fish was conducted at Point Piper, from low water mark down to three to five feet below it. The material was obtained by scraping down the face of a weed-covered wall and collecting the dislodged masses of sea-weed and other marine growths in a small hand dredge. At the same time a net of fine silk attached to a wire ring on the end of a light pole was swept backwards and forwards through the water, in order to catch any specimens which might have been set free during the scraping of the wall.

Unfortunately, the animal is rather rare, but subsequent visits to the same locality yielded a number of specimens, thus affording an opportunity of observing its habits, which are little known.

Previous to the discovery of a crawling jelly-fish in Sydney Harbour, these animals were known only from the Falkland Islands, the Cape of Good Hope, Kerguelen Island and Antarctica, while two species had also been recorded from the Northern Hemisphere.

The crawling jelly-fish from Port Jackson is exceedingly small; its body is only the size of a pin's head, and is shaped like a miniature umbrella, with a short, thick handle, and a fringe of tentacles around the edge. Each tentacle consists of a main stem, which is divided at its extremity into an upper and a lower branch. On the upper branch are borne the batteries of stinging-capsules, by means of which the jelly-fish is able to ward off the attacks of

enemies or exert a numbing effect on the animals upon which it preys. The lower branch of the tentacle, which is used for crawling, ends in a sucker-like extremity. By means of these suckers and their secretion the animal is able to adhere so firmly to the smoothest surface that it is very difficult to detach it.

The most striking feature of the animal is its mode of progression. Ordinarily a jelly-fish floats in the sea with the tentacles hanging downwards, or it swims by contractions of the powerful muscles on its under surface, which drive out the water of the umbrella and send the animal forward in the opposite direction. In the case of the creeping or crawling jelly-fishes, the tentacles are modified into ambulatory organs, by means of which the animal moves actively over the surface of a seaweed or other marine growth. When the jelly-fish is lightly touched on one side, the crawling movement can be readily observed; the tentacles on the side opposite the source of irritation are released and applied at a point further from the body, which is then moved in this direction. Progression is also assisted by a reverse movement of the tentacles on the other side.

Another characteristic and almost constant movement is exhibited by the tentacles. This movement consists of a sudden jerking upwards, so that the upper branch of the tentacle, with its batteries of stinging-capsules, is thrown over the body, the lower or sucker-bearing branch at the same time loosening its hold on the substratum and sharing in the upward movement. It has been suggested that this action may have some protective function, since by it the clusters of stinging-capsules are thrown over the upper surface of the body. This movement is maintained almost constantly when the animal is stationary, and differs entirely from the slow and deliberate movement of crawling.

Crawling jelly-fishes are not known to swim, except the Falkland Island species, which is apparently able to do so. The species from Port Jackson was never observed to swim; neither could any swimming motion be induced by dropping the specimens into sea-water. They would fall straight to the bottom of the vessel and then move along the surface of the glass by slow crawling movements.

The small jelly-fishes or medusæ are really special bodies carrying the generative organs. They originate as members of a fixed, usually branched, plant-like animal or "Zoophyte," from which they are set free by breaking away as little umbrella-shaped bodies. These individuals differ widely from the fixed form, being, indeed, so unlike it that their origin would never have been guessed if the separation had not been seen to take place.

The discovery of a crawling jelly-fish in Port Jackson is, therefore, extremely interesting, but up to the present this one has not been traced to its fixed form.

DYING SLOWLY.—A Sea-egg or Heart Urchin, *Breynia*, which buries itself in the sand of the lagoon at Lord Howe Island, can withstand an amazing amount of injury and still live. If its shell or test be broken open, it is seen to be filled with little more than a membranous gut distended with mud, and a few reproductive organs. The removal of these inner works, however roughly, seems to cause the animal but little pain, since it merely waves its many spines around in feeble protest, and if given the opportunity, will dig itself into the sand again as effectively as though its vital organs were all in their proper places.

Several specimens which were being prepared for museum purposes had all of their soft parts removed except the extremely thin membrane which lines the test, yet they waggled their spines around freely for at least half an hour afterwards, the movement becoming quite frantic when they were finally immersed in fresh water. One wandered around a flat board upon the tips of its spines, apparently searching for its well beloved sand beneath the lagoon waters.

Heart Urchins, so lowly in organisation, are evidently but little affected by what we more sensitive beings recognise as pain, and consequently die very slowly from injuries which would instantly destroy more highly organised animals simply through the shock to their nervous systems. But though so lowly, they nevertheless construct amazingly intricate shells for the protection of their soft parts, their apparently simple membranes secreting wonderfully complex and ornate plates which interlock so accurately that an examination of them leaves us lost in admiration.—A. R. McCulloch.

SNAKES

THEIR FANGS AND VENOM APPARATUS. THE ACTION OF VENOM AND THE TREATMENT OF SNAKE-BITE

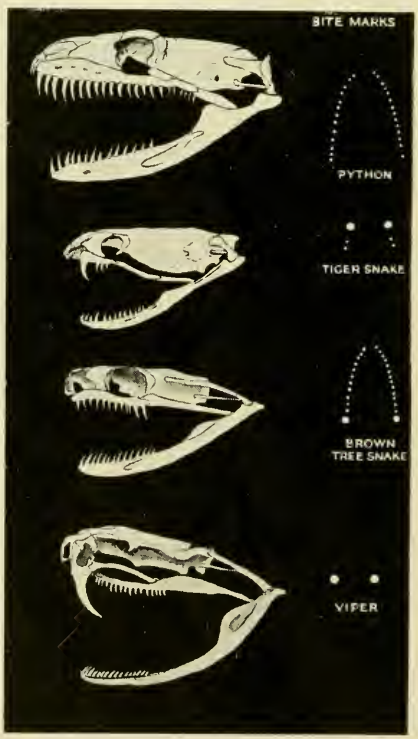
By J. ROY KINGHORN.

Venomous snakes are divided into two large groups: those having fangs situated in the front of the jaw, and others that carry them towards the rear of the jaw. The second group need not concern us very much, but I might say before passing that their fangs are never hollow, but are always grooved. A typical representative in Australia is the Brown Tree Snake, which is absolutely harmless to man or any of the larger animals.

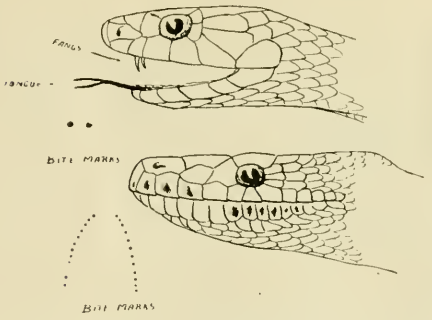
The first group concerns us most as the majority of our Australian venomous snakes belong to it, as do the Cobras and Krait of India, and the Rattle Snakes and Vipers. The poison fang is a pointed, very sharp, recurved tooth, bearing along its length either a groove or a canal, ending a short distance from the point.

Australian venomous snakes have either grooved or hollow fangs which are permanently erect. The Vipers and Rattle Snakes have enormously developed fangs attached to movable bones so that they may be automatically erected and depressed as the jaws open and shut; these fangs are almost perfect in structure, and may be likened to a hypodermic needle, as the edges of the groove are so flattened against each other that there is no trace of the join on the surface. As venomous snakes depend entirely upon their fangs in killing their prey, they would naturally suffer considerable inconvenience if they were without them for any length of time through loss, so Nature has made ample provision in the great majority of cases by arranging reinforcements in the form of series of successively paired fangs which grow in the gums, and are in various stages of development, the most advanced pair being in a socket beside those in use and becoming solidly fixed and attached to the venom apparatus as soon as the old ones are lost.

The venom of snakes, and the apparatus by which it is injected, are subjects which have been extensively investigated by scientists. The venom glands of snakes are situated under the eyes, and each gland is enclosed in a dense fibrous sheath which is surrounded by the main muscles of the jaw. From each gland there is a duct, or tube, which extends forward, terminating over the entrance to the canal or groove in the fang. The harder a snake bites the harder the



SKULLS OF SNAKES SHOWING BITE MARKS
At the top is a Python skull (such as Carpet or Diamond snake which are non-venomous, all the teeth being solid). Next is a Tiger or Black snake, and at the bottom a Viper, all of which are venomous. The Brown Tree Snake with fangs at the rear of the jaw is only slightly venomous.



Venomous snake above and Python (non-venomous) below.

tube is pressed against the canal in the fang, thus preventing any escape of venom other than through the canal or groove.

Venom can be ejected by some of the Cobras in another manner than that of biting, the process being known as spitting. Observation has shown that venom is evidently forced into the mouth and mixed with the saliva, then it is ejected through the lips to a distance of six or eight feet. Several people have been temporarily blinded through it entering their eyes and causing severe inflammation.

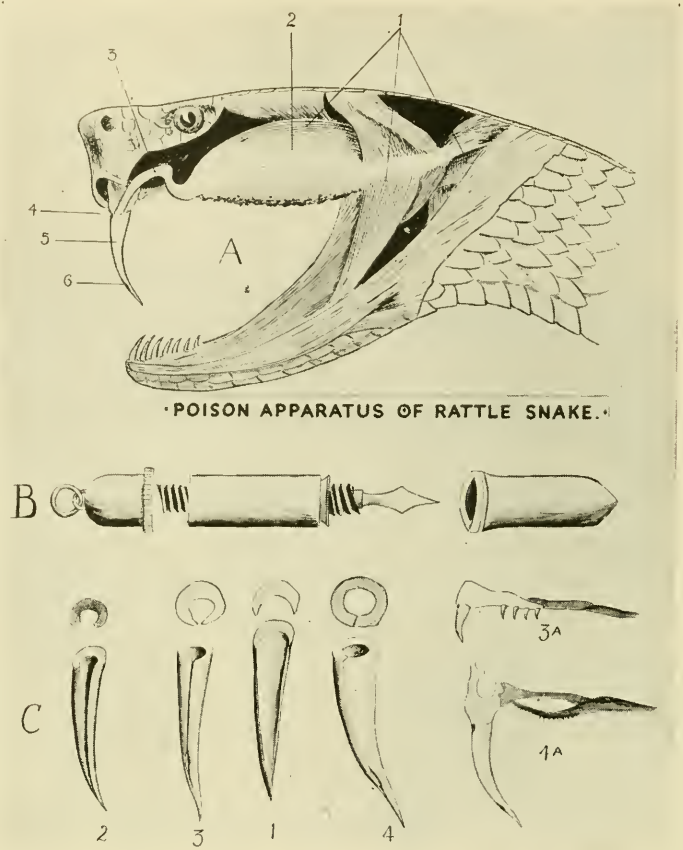
Study and investigation have shown that most snakes possess certain glands which supply their blood with substances antagonistic to venom to render them immune to their own poison and often to that of other snakes. Several animals and birds which are snake killers also have these glands developed, and are therefore immune to the effects of the poison.

Although the actions and symptoms which follow the bites of different snakes appear to be identical it has been found that a serum which brings about immunity against one species has proved a failure in cases of bites caused by other species. Serum prepared for use against the Cobra poison has proved futile against that of other species, and the same is perhaps the case between any two species of snakes throughout the world. Many instances, of which the following are several, might be given to prove this. A man who was well known around Sydney went to India, taking with him an antidote which he had used successfully against the venoms of Australian snakes. He was of the opinion that this same antidote would secure immunity from the poisons of the Indian species. He was bitten by a Krait, however, the venom of which acted upon his blood and nervous systems in a manner so different to what he had been used to in Australia, that the antidote failed to take effect, and he died. Another man, who had become immune to the poison of the Tiger Snake, was bitten by a Copperhead or Superb Snake, and the bite proved fatal. Others, who have become immune to the venom of Vipers have died when bitten by Cobras.

The immunity of the Indian snake-charmer is brought about by his having submitted himself to a graduated series of injections of the venom of the species of snake with which he intends to play; this process of innoculation takes a considerable time to mature before the man becomes quite immune, and it is not without its risks.

Recent investigation has shown that the venom of the Cobras, Sea Snakes, and our Australian species acts mainly upon the nerve centres which control the heart and respiration, eventually bringing about respiratory paralysis. At the same time, however, there may also be a clotting of the blood, but in the Vipers and Rattlesnakes this effect seems to be reversed, the main action being the clotting of the blood. Doctors Feyrer and Brunton, two famous workers on snake venoms, hold the opinion that no special law can be laid down relating to the effect of venom, as it is dependent upon the species, state, and size of the snake, the quality and quantity of its poison, and the circumstances under which it inflicts the bite; secondly, the species, size and vigour of the victim, and the circumstances under which it is bitten.

In India in 1911 there were over 24,000 lives lost through snake bite, but when the size of the population is taken into account, together with the fact that the majority of the people go about in the bush and jungle barefooted, it is a wonder that there are not many more deaths from bites than the number stated.



POISON APPARATUS OF RATTLE SNAKE.

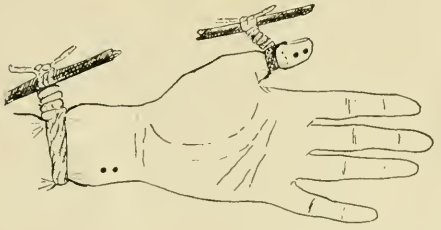
The venom apparatus of a snake consists of a pair of hollow or grooved fangs, situated one each side of the upper jaw, generally at the front of the maxillary bone. To each of the fangs is attached a tube and a venom gland, the latter lying along the upper jaw, just under or behind the eye. When a snake bites, the muscles which surround the gland squeeze out the venom, force it along the tube and into the hollow fang, through which it passes, eventually finding its way out through an opening near the point, which may be buried deep in the flesh of a victim.

On the diagram there will be seen the poison apparatus of a Rattle Snake, and for convenience this may be considered typical of Australian venomous snakes, except that the fangs of our species are very much smaller and are permanently erect. The illustration shows the apparatus of one side of the head only.

A. (1) Muscles which open and close the jaws, surround the venom gland and squeeze out the venom. (2) Venom gland, situated in a dense sheath of fibrous muscle. (3) Duct or tube, along which the venom is forced to the entrance of the canal in the fang. (4) Entrance to the canal in the fang. (5) Hollow fang. (6) Opening through which the venom leaves the fang.

B Brunton's first-aid instrument for snake bite, consisting of a lance, a screw cap cover, and a hollow handle which contains crystals of permanganate of potash.

C. (1) Ordinary grooved tooth possessed by many snakes in addition to the fangs. (2) Grooved fang as in the back-fanged snakes. (3) and (3a) Typical fang of Australian species, or the Cobras, etc., in which the groove is not quite closed: this type of fang is generally followed by one or more small teeth. (4) and (4a) Typical hollow fang possessed by Vipers and Rattle Snakes; the groove is completely closed; there are no other teeth on the maxillary bone, and it is erected or depressed as the jaws open and shut.



Ligatures tied to prevent snake poison spreading through the blood to the heart. The dots represent bite marks.

Throughout the world there are many medical men who are making investigations and experiments with venoms with the object of finding an absolute antidote, one that will act successfully against poisoning and death from snake bite, no matter what species of snake inflicts the bite. A vast amount of valuable information has been supplied during the last few years.

In Australia the most dreaded species of snake is the Death Adder, and rightly too, for over 50 per cent. of persons bitten by this snake succumb to the venom. The Tiger Snake comes next with a ratio of 45 per cent deaths to bites inflicted; while the Brown Snake is much less deadly, the percentage of deaths from its bites being about eighteen. The Black Snake has very few deaths recorded against it at all, although the majority of bites are from this species.

In this country a fair number of fatalities from "snake bite" occur every year; in many cases, lives which have been lost could have been saved if proper treatment had been given. Some of the improper treatments one hears of, however, such as chopping off a finger or a toe, cutting out lumps of flesh, knocking a patient about to keep him awake, and other equally harsh operations, are absolutely unnecessary, and often dangerous, and my effort here is to save all this as well as a few lives, by giving a safe and sure remedy, one that is within the reach of all, and if carried out quickly and correctly, should never fail in cases of bites from any of our Australian snakes.

Anyone who moves about where he is likely to come in contact with venomous snakes, or any home situated near where these reptiles abound, should have the following essentials: (1) crystals of permanganate of potash, (2) a small, sharp knife or lance, (3) and some string, elastic or rag that can be used as a ligature.

Following upon a bite from a venomous snake, and within a minute, if possible, a ligature must be applied close above the punctures, and on the side nearest the heart. Insert a stick into the loop of the ligature and twist it round until the latter is exceptionally tight; this is painful, but necessary. Then tie the stick higher up to prevent it unwinding. As soon as this is done wipe away any venom or saliva that may be on the surface of the skin, and make several longitudinal cuts over the fang punctures; they should be as deep as, or deeper than, the punctures inflicted by the snake. Into these cuts force some crystals of permanganate, and then squeeze the wound so as to get rid of as much of the poisoned blood as possible. If there are no cuts, cracks or abrasions on the lips or in the mouth, the wound may be safely sucked, either by the patient or by a friend; if any of the venom is accidentally swallowed, no harm will come of it so long as the stomach is healthy and free from ulcers or inflammation. If the bites are on any part of the body where a ligature cannot be applied, as much of the above treatment as possible must be faithfully adhered to. As soon as these operations have been carried out, a doctor should be sent for, but if they have been performed quickly and thoroughly, there need be very little anxiety as to the result, since permanganate of potash has been proved to be an absolute antidote to snake venom once it comes in contact with it. If a ligature be kept tight for more than half an hour there is danger of mortification setting in, so at the end of that time it should be loosened for an instant, and then tightened again This operation should be repeated every five minutes, and the doctor will

advise as to when the ligature may be finally removed.

Some writers have advised that if the bite is anywhere on the forearm or wrist, the ligature must be placed above the elbow, as there is only one bone there, and more pressure can be brought to bear upon the blood vessels, but, as venom spreads exceptionally quickly, it is advisable to have it tied close to the wound so that the poisoning will be localised, and the venom can be removed more easily than if it were allowed to spread throughout the muscles. A second ligature may be placed above the elbow if desired, but it is not absolutely essential.

Alcohol and ammonia have no curative effect whatever, either taken inwardly or applied to the wound. Venom has been mixed with both these chemicals and has retained all of its poisonous properties.

In some countries, especially where Cobras and Vipers exist, an antivenine serum is procurable. This is injected hypodermically near the site of a bite, and has proved to be most effective. It is prepared by treating an animal (usually a horse) with increasing doses of venom for a considerable time, until it becomes immune to almost any amount of venom that may be injected into it; then the serum is extracted. It is effective in cases of bites from the species of snakes used in its preparation, but not in those in which the victim has been bitten by some other species; for instance, Cobra antivenine is an antidote to Cobra poison only. Some years ago the Public Health Department of New South Wales made a number of experiments by treating a horse with the venom of a Tiger snake; eventually an antivenine serum was prepared and was effective, but only for bites inflicted by Tiger snakes. In 1906 the same Department issued a pamphlet on venoms, compiled by the doctor who made all the experiments, and I have no doubt that any reader who is interested may still be able to procure one on application to the authorities concerned. There are many other splendid papers on snake venoms, antidotes, treatment, etc., but they mostly deal with snakes which are foreign to Australia. The following is a summary of the treatment, in the order in which it is best to apply it:—

1. Ligature: to localise the effect of poisoning.
2. Cut the flesh: to drain away poisoned blood.
3. Apply permanganate crystals: to neutralise and kill the venom.
4. Suck or squeeze out as much blood as possible.
5. Send for a doctor.

I have placed the doctor last on the list for the reason that every second is valuable; and every second that treatment is delayed means that the venom is getting a better hold upon the system. If the patient shows signs of collapse, give stimulants such as small doses of brandy or whisky, etc., or strong tea and coffee; he must also have complete rest.

Unless one has made a close study of snakes, it would be almost impossible for him to determine at a glance a venomous from a non-venomous species, but the bite marks of the two types differ considerably from each other, as illustrated on page 22.

In Australia there are only two well-known non-venomous snakes, and they are the Diamond and Carpet snakes; so, for safety's sake, all other species had better be looked upon as deadly, or at least venomous.

Any Australian snake which is not thicker than your little finger is too small to inflict a fatal bite.

It is as well, however, to treat all bites as dangerous, because in some cases, where the bite is from a non-venomous type, blood poisoning may set in.

In cases where the large number of punctures leaves no doubt as to the bite being that of a non-venomous snake, it is not necessary to apply a ligature or to cut the flesh, but the wound should be washed in a weak solution of permanganate of potash; and hot fomentations would be of great value.

MUSEUM GROUPS.

By THE EDITOR.

Until comparatively recent times, the animals shown in museums were mounted in uniform rows, as single exhibits. Some daring innovator might go so far as to display a bird perched on a twig, or a mammal crouching on a bit of rock-work, but groups in the modern sense were scarcely thought of until about fifty years ago. Now museums vie with one another in their efforts to display, not only the animals themselves, but their environment also, in the most realistic manner.

The earliest attempt to realise the habitat group idea was made by Mr. E. T. Booth, of Brighton, England, who made a collection of British birds, and mounted them, with accessories, to reproduce more or less closely the surroundings in which they were obtained. The first bird group was installed in the British Museum through the instrumentality of Dr. R. Bowdler Sharpe, and a number of attractive exhibits of this kind, showing the birds in their native haunts, usually accompanied by their nest and eggs, now adorns the Bird Gallery of that great institution. These groups are comparatively small, but are constructed with great fidelity; the actual soil, stones, grass, shrubs, and even incidental dead animals, were transported bodily to the museum, and there assembled in the exact manner of their occurrence.

This painfully exact "restoration" method has been improved upon by Dr. Frank M. Chapman, of the American Museum of Natural History, New York, where the finest examples of group exhibits are to be

These animals and birds were all brought from the Antarctic by Sir Ernest Shackleton and Sir Douglas Mawson, and presented by those explorers to the museum. The small picture shows the group under construction. In nature the birds would not pose with such unconcern if they discovered a seal emerging from a "blow-hole," but would make hurried undignified departures.

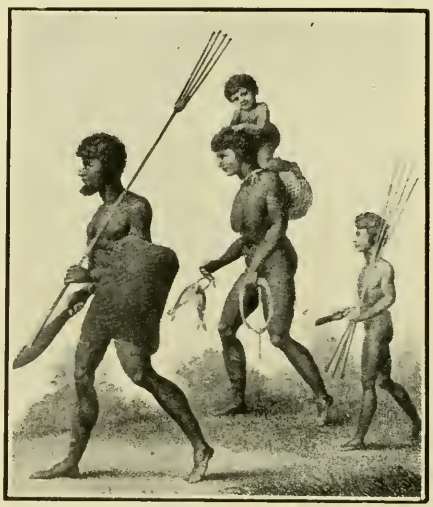
DWELLERS OF THE ANTARCTIC CONTINENT.

THE HAWAIIAN GROUP IN PREPARATION.

The figures are shown without wigs, and the properties which are displayed with the completed group are not yet added.

found. These, and similar up-to-date groups elsewhere, have a foreground which is not an exact copy of any particular spot, but is intended to give a good general idea of the sort of place where the animals live. The plants and shrubs, the rocks and soil, are imitated as closely as possible to harmonise with the actual conditions surrounding the living animal. This foreground merges into a painted, curved background, resembling the drop-scene of a theatre, which, by a clever use of perspective, conveys an illusion of expanse and distance, so that, when viewed from a darkened passage-way in front, the whole scene, which is illuminated from within the case, has an almost startling air of detachment.

In the Australian Museum, groups of nesting birds, and some of the smaller Australian mammals, such as the platypus and the native cat, were installed years ago. These small groups, which are comparable with the habitat bird groups in the British Museum, are skilfully and artistically arranged, and are life-like representations. More recently a large case, containing a group of four lions, each a fine example of the taxidermist's art, has been provided with a scenic background of forest, plain, and hill, with here and there small herds of zebras, antelopes, and giraffes. The foreground and the mounted lions are the work of Ward's Natural Science Establishment, Rochester, New York, "the godfather of all museums," which has played an important part in the development of modern taxidermy and animal groups; the background was painted by Mr. H. R. Gallop. Within the last twelve months an Antarctic group has been added. Here, the foreground represents a low, snow-covered shore, with the seals and birds characteristic of these inhospitable regions; and, extending away to the distance, is an ice-



A quaint old sketch of a family of Sydney Aboriginals made by Governor King when he governed New South Wales. The family are returning from a fishing expedition, the man carrying a curious fishing spear. It is such groups as this that the Museum hopes to erect.

THE HAWAIIAN GROUP COMPLETE.

The family is shown engaged in their ordinary work. The old woman beats out the bark of a tree to make native cloth; the girl assisting by pouring water on the material. Both men are mashing the roots of Taro into "poi" or native porridge.

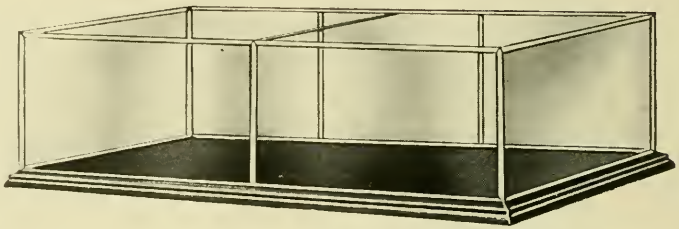
field, broken up by lanes of blue water. In the offing lies a ship, and a landing party is shown on the ice front. This Antarctic group reflects the greatest credit on the taxidermist, Mr. H. S. Grant, and his assistant, Mr. J. H. Wright, who mounted the animals and constructed the foreground, on Mr. Gallop, who painted the background, and on Mr. A. R. McCulloch, who superintended the installation. Any defects in the group are attributable to the fact that, as yet, there is no system of artificial lighting in the museum.

Groups such as these convey much more information to a visitor than serried ranks of single exhibits, and also create a livelier interest in the facts of natural history. With this object in view, the administration has projected additional groups—one representing a coral reef pool, the haunt of sponge and pearl-shell, tenanted by many-coloured fishes, and walled in by masses of gorgeous coral. In the Great Barrier Reef, Australia can boast of the greatest accumulation of living coral in the world; yet comparatively few Australians have any adequate conception of the transcendent beauty and brilliant colours of live coral, so unlike the specimens seen on mantelpieces or museum shelves. Another will show a tide-pool in Port Jackson, peopled with the marine organisms common in our harbour.

The group idea has been extended to include man as well as the lower animals, so that ethnological and historical exhibits are no longer confined to collections of weapons, utensils, and ornaments; for every progressive museum now endeavours, by means of carefully executed models, preferably life-size, and prepared from living subjects, accompanied by appropriate implements and effects, to portray for its visitors the actual appearance, dress, customs, and daily life of various races of men. If it is desired to show a tribal group in a natural, out-of-doors setting, a pictured background is added to harmonise with the foreground. The Hawaiian family group, recently installed in the Ethnological Gallery, is one of the most admired exhibits in the Australian Museum. This depicts a family of four, engaged in the preparation of "poi" from the root of the taro, and the manufacture of tapa cloth from the bark of the paper-mulberry tree. These figures, which were cast from nature by Mr. Allen Hutchinson, and have been skilfully coloured by Miss Phyllis Clarke, from living models, are instinct with life.

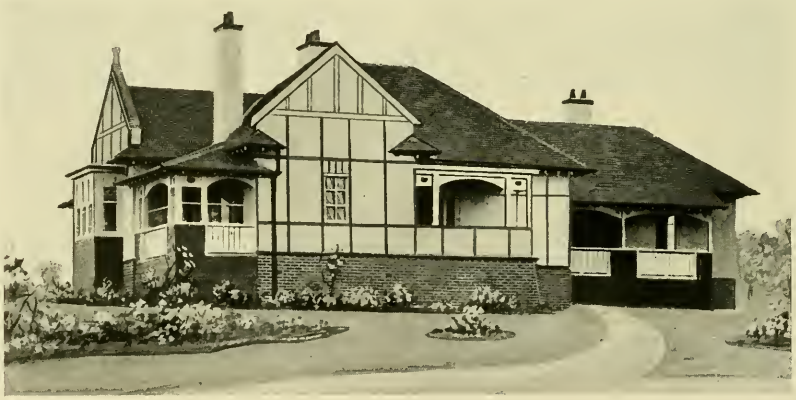
Our aborigines, like all primitive peoples who come into contact with civilisation, are rapidly dwindling in numbers; the Tasmanians are already extinct, and in the near future no full-blooded Australian black will be left. All the more, then, is it necessary for us to secure, while we may, and preserve for our descendants, faithful representations of the people themselves, their tribal customs, and their daily life. The Board of Trustees is fully alive to the importance of taking this work in hand, and a start will shortly be made with the first group of Australian natives.

Metal Showcases



While Wunderlich Metal Show Cases are essentially smart in appearance, yet their simple designs make them uncommonly efficient in displaying goods. Such cases can never distract attention from the objects they contain, and remain at all times solely a handsome accessory.

Asbestos Reinforced Cement—Durabestos



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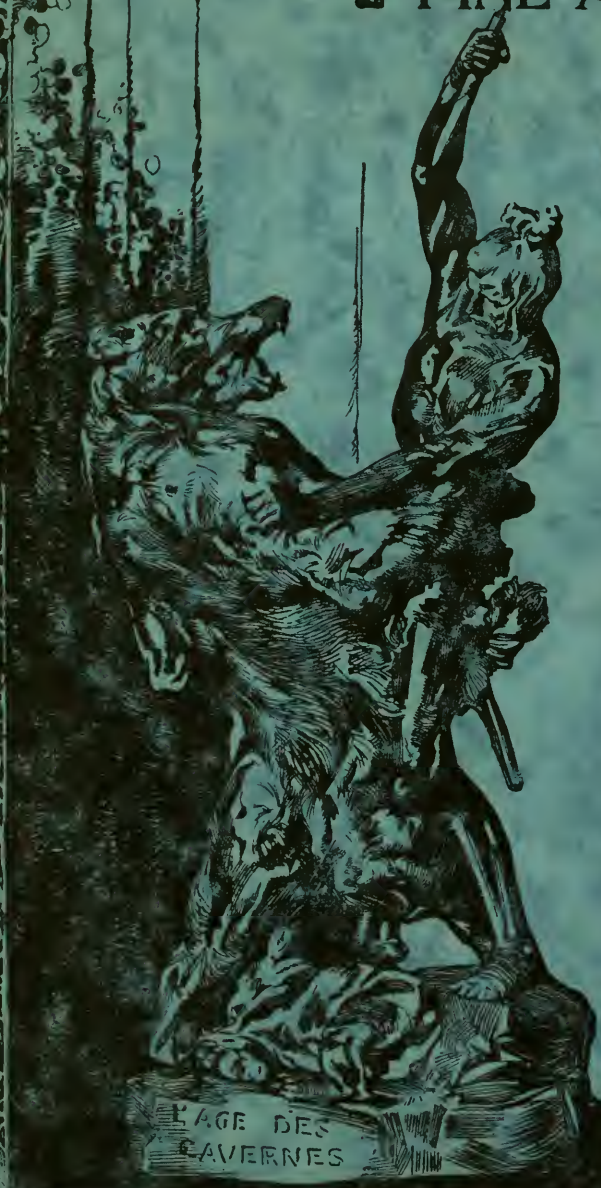

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Table of Contents.

The shady paths through the forest of Lord Howe Island often pass beneath the arching branches of banyans. They are walled in on each side with a dense mass of waving palm leaves which glitter in the sunlight filtered through the green canopy overhead.

Photo—A. R. McCulloch.

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VOL. I. No. 2. AUGUST, 1921.

Lord Howe Island—A Naturalist's Paradise.

By Allan R. McCulloch.

If you were to sail straight out eastward from Port Macquarie, New South Wales, for three hundred miles, you would come to two great hills rising out of the ocean depths, with just a little lower lying land around their bases. But should you be blown out of your course and pass either to the north or south of them, you might then double backward and forward over many thousands of miles in the Tasman Sea without encountering any other land. Lord Howe Island, only seven miles long, is just a tiny scrap in a huge ocean waste. But what a wonderful scrap! Covered with a luxuriant vegetation, which includes many remarkable plants found nowhere else in the world, its high and precipitous hills afford scenery as unique as it is beautiful. The presence of a coral reef and its enclosed lagoon provides additional features usually restricted to tropical climates.

"An Island of Dreams."

Dreams of sunlight, palms and open spaces, and also of freedom from the cares of this troublous world. And yet, for those whose tastes run to more substantial things, likewise an island of fascinating interest. There are delightful homes with gardens, and charming people, and all those things which go to make civilisation worth while. With all the enthralling freedom of unsullied nature one may combine the good things we demand of more populous places—an ideal, evanescent, and fast becoming submerged by the strenuous progress of the times.

Its hills rise high upon the horizon like two blue clouds as one approaches from the wide encircling ocean. The deep waters so completely isolate it from the rest of the world that even the sea-roaming natives of the Pacific islands, who wandered far and wide in their frail canoes, failed to discover it. It is true that a few bleached bones occasionally obtrude from the sands which have covered them, but these are of comparatively recent burial, and perhaps tell of some member of a whaler's crew or other seafaring man whose history has been forgotten.

When Lieutenant Lidgbird Ball discovered Lord Howe Island in 1788 he found it quite uninhabited by man, while its bird population was so ignorant of the murderous ways of humans that all its members, large and small, wandered up to observe what strange intruders had come to disturb their seclusion. They knew not what fear meant, having had no enemies other than of their own kind, for there were neither mammals nor reptiles to prey upon them, and their curiosity led them to approach within arm's length. There were lots of them, too, white birds with scarlet

bills (*Notornis alba*), about the size of a hen, being very plentiful. These could not fly, but wandered around fearlessly just as do the descendants of some others of their fellow inhabitants to this day. But, alas, their flesh seemed so good to those who followed in the Lieutenant's wake that within an incredibly short space of time this unique and trusting bird became extinct. Save for a single skin in the Vienna Museum and a few notes in journals recording orgies of killing, we know nothing of the existence of this remarkably interesting species. One can scarcely suppose, however, that man alone was responsible for its annihilation, since the island is so rugged that the bird must have had numerous strongholds to retire to where man has even yet never ventured. But if it was not man, it was the cats, pigs, or other animals which he liberated, and which running wild, spread themselves throughout the bush, playing havoc among the unsuspecting birds.

Lord Howe Island is a dependency of New South Wales, and was wisely proclaimed a reserve so long ago as 1879. It has rather over one hundred inhabitants who are mostly share-holders in a company controlled by the Government, the business of which is to collect the seeds of the so-called "Kentia" palms. These are peculiar to the island, and supply the world with one of its most decorative and familiar plants. A resident born on the island acquires so many shares upon attaining his majority, and thereafter receives his share of both the labours and profits of the company. The younger men have occasional work to do which is of a very arduous and dangerous nature, but they have long intervals in which to enjoy the many advantages of their island home.

"KENTIA" PALMS.

These are perhaps the most decorative of all plants, and their delicate greenery is in unceasing demand all the world over. Whether it be in the saloon of an ocean liner, the winter garden of a hotel, or even in some stuffy grill-room, there we find palms. These are almost always the Thatch Palm, *Howea fosteriana*, a species peculiar to Lord Howe Island, for this, better than any other, is able to withstand the unkind treatment such palms receive. Under natural conditions they flourish in a rather hungry soil, formed chiefly of coral sand which is often only a foot or two in depth. They commonly grow so thickly that they must compete with one another to secure a sufficiency of sunlight to enable them to bear seed. Those which survive are therefore very hardy and well adapted for artificial cultivation.

Thatch Palms, and sheds built of their stems and covered with their leaves.

Photo—A. R. McCulloch.

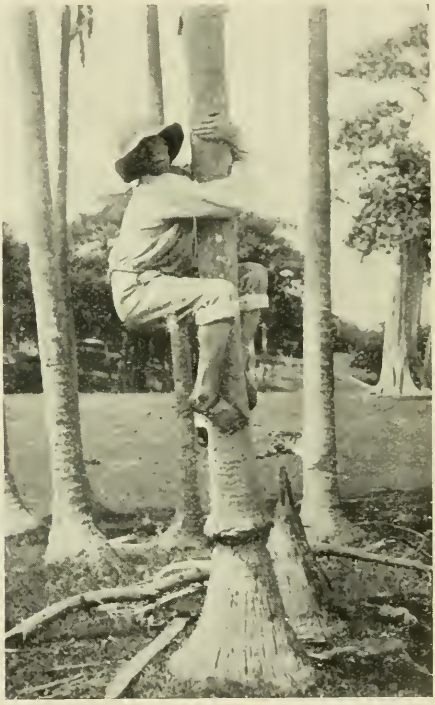
The world accordingly asks for their seeds, several thousand bushels of which are sent away each year, forming the principal export of the island. They have to be climbed for in the virgin forest, and perhaps

Thatch palm seeds.
Photo—E. A. Briggs.

fifty trees, each about forty feet high, have to be ascended during the day by each seeder to secure his quota. The seeds are stripped from the trees upon their stems, and shelled into sacks, each of which holds about two bushels. One, one and a half, or even two sacksful are then carried upon the collector's back over the roughest of rough tracks, and down the mountain sides to the water's edge, where they are boated to the seed-sheds for packing.

THE CORAL REEF.

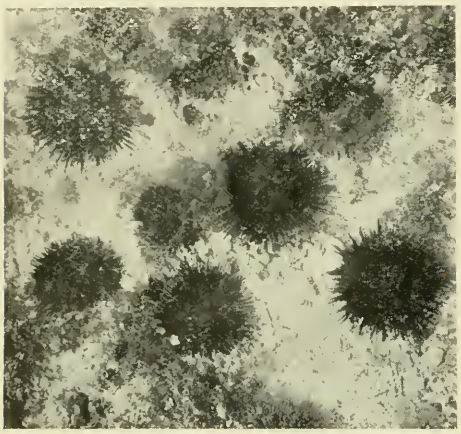
The coral reef on the eastern side of the island is the most southern in the world, and supports an abundance of animal life which one scarcely expects to find south of the tropics. Branching madrepores, coloured with delicate tints, spread their fronds luxuriantly in the deep pools which are sheltered from the battering effects of the surf, while the hardier brain corals flourish in more exposed zones. Fishes gaily ornamented with the brilliant colours and patterns characteristic of those of tropical seas are to be seen everywhere, darting in and out of the coral crevices. Sea-eggs, crabs, and shell-fish, together with their myriad other brethren of a coral-reef fauna, flaunt their splendour before the fascinated gaze of the observer as they carry on their allotted lives within the precincts of some sheltered pool.



Climbing for seeds with a strap around the insteps.
Photo—E. R. Waite.

A long arm, beset with waving spines and projecting from an unsuspected crevice, is the limb of a Brittle-star, with its myriad tube feet, extended to capture the food brought to it by the incoming tide. A shell, moving across the reef at a pace unusual for so sluggish an animal as a mollusc, is found to be inhabited by a gorgeous hermit-crab, painted with green, scarlet, and blue, and tells of a tragedy by which the former owner and builder of the shell was evicted and devoured to make room for the new tenant. Sea-eggs are there in

profusion, some digging channels for their seclusion in the coral-limestone, or even in the hard basalt, others lying hidden in sand with only the tips of their hair-like spines protruding, ready to penetrate the flesh of an incautious



Sea-eggs.
Photo—E. R. Waite.

enemy or an unwary wader. Still others gather unto themselves scraps of seaweed and other debris with which more or less inadequate covering they wander freely about the coral floor, secure rather by reason of their spiny armour than by the cover they affect. These and thousands more, all occurring within New South Wales, and six hundred miles southward of the Tropic of Capricorn.

THROUGH A WATER GLASS.

A water glass, or, as it is sometimes grandiloquently termed, a water telescope, is merely a bucket or a billy-can, the bottom of which is replaced by a sheet of glass. Its purpose is to break through the surface ripple and thus provide a window, so that through the clear water one has an uninterrupted view of the sea floor. With its aid, one is enabled to study the wealth of life in a coral pool, each member of which carries out its particular activities regardless of observation. The water itself acts as a sort of magnifying agent, and makes the bottom of a pool appear much closer than it really is.

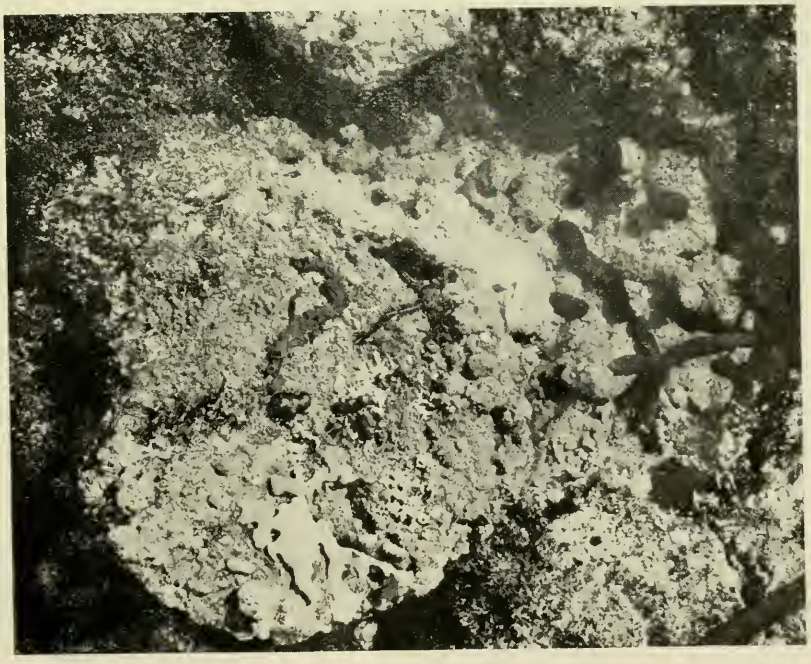
Covering the uneven sides of the pool is a colony of huge green anemones, each eight inches across and with a hundred waving tentacles. Every tentacle is armed with innumerable stinging cells to paralyse the small animals upon which the anemones feed. Associated with these lowly but beautiful polyps are certain small fishes, some of the Demoiselles of the genus *Amphiprion*, which have become so specialised in their mode of living that they are never found apart from their hosts. The anemones are sensitive creatures and will retract their tentacles at a touch, yet the movements of their small fish associates cause them no alarm. As one watches through the glass, one of the fishes may be observed to dart out from among them to snatch at some morsel of food and hastily retreat again to its shelter. The stings of its hosts do not affect it, even its naked eyes coming to no harm, yet they evidently afford it security from the attacks of its enemies. It is gaily ornamented with pearly bands across a

Collecting on the reef with a water glass.
Photo—A. R. McCulloch.

scarlet body, as though to advertise its presence to all the fish world. But it is singularly shy and dare not leave its tentacled friends, becoming so extraordinarily helpless when they are removed that it may be captured in one's hand.

What is the reason for this strange association? Maybe the fish is just a burglarious intruder into the domain of the anemones, glad of their shelter, but robbing them of their food by stealing it from their mouths. The sedentary polyps being unable to resist their active and unwelcome boarders have, perhaps through long suffering, learnt to accept them with good grace.

Such queer associations of two widely differing animals are by no means rare. Near by the anemones is a bluish-white, soft coral, *Xenia,* which is a bunch of small flower-like polyps crowded upon one stem. No amount of watching will reveal the presence of a rare swimming crab *Caphyra* among the branches of the coral, but, if one combs the soft mass through the fingers, its hard carapace may often be detected. This crab is of a bluish-white tint, exactly corresponding with that of its host, but most wonderful is the delineation of several of the polyps of the *Xenia* upon its carapace. The drawing and the colour is exact, and their disposition is such that the crab may sit upright among the polyps with its eyes alert for the food particles they attract, and yet remain entirely unobserved by many prowling fishes which would readily devour it were its presence more obvious. What process of evolution has developed such perfect fraud? And what tribulation must the coral polyps suffer as each scrap of their hard earned food is confiscated by the ever watchful crabs, which they are most unwillingly forced to provide with board and lodging. This *Caphyra* is a swimming crab, its relatives having paddle-like limbs with which they can swim freely through the sea. But such legs are no longer of service to this parasite who needs only to secure a firm foothold upon its slippery host. Therefore its legs have become pointed with curious tufts of bristles which enable it to move with speed and precision upon a surface which would baffle any other less endowed crustacean.



An overturned coral boulder on the reef reveals a wealth of life. Its under surface is covered with brightly coloured sponges and sea-mosses, and a brittle-star is seen endeavouring to hide in a crevice. An orange starfish and two black slug-like Beche de Mer are left exposed on the right.

Photo—E. R. Waite.

BECHE DE MER.

At least one species of the Beche de Mer or Trepang, best known to most people as a delicacy in soup, is common on the Lord Howe Island reefs. Extended upon the sandy bottom of a pool, it appears as a black sluglike creature about twelve inches in length, with a disc of branching tentacles at one end. It engulfs sand, as fast as its imperfect constitution will allow it, with the object of sorting out some nutritive matter therefrom, just as do its relatives the sea-eggs and star-fishes. Not that it resembles either of these, being far less graceful, and it has the unpleasant habit of ejecting quantities of sticky white threads if it be lifted from its sandy environment. These threads attach themselves to anything they come in contact with, and serve as anchors to enable the beast to recover its equilibrium when overturned by untoward circumstances, such as an unduly large breaker.

The main road of the island. Carts are scarce, their place being taken by sleighs with smooth runners.

Photo—A. R. McCulloch.

CLAMS (*Tridacna*).

On those parts of the reef adjoining the volcanic rock at its southern and northern ends, one finds many small clams, eight inches in length, which are dwarf relatives of the giants whose valves are familiar objects in suburban gardens. They lie upon the flat surface of the reef just in front of the coral-breccia which is piled up by successive storms, where, apparently, they have been driven by the competition of a burrowing sea-egg. The latter disorganises their establishment by burrowing under their attachments, and, as the clams appear to be rendered quite helpless when once detached from their bases, they have perforce retired to this rather barren zone where the sea-eggs do not intrude.

The colours of the clams are endless in variety and, though all appear to belong to one species, no two individuals are ornamented quite alike. Some have mantles of plain chocolate, others are lighter in tint and pencilled with brown, while opalescent streaks and dashes of blue or green upon chocolate grounds are quite common. The reason for this variation is not apparent, the brilliant ornamentation having no obvious value, while the less ornate individuals do not appear to suffer in consequence of their homeliness.

These clams are wonderfully hardy, and able to withstand an amazing amount of ill-treatment. Though accustomed to the fresh sea-water brought to them by each successive tide, they enjoy the glare of the hot sun when left exposed; lying with their convoluted valves agape, they close up with a snap only when alarmed, and at the same time squirt a jet of water from their gill-chambers. Specimens torn from their bases lived at least fifteen hours in the air, and opened out freely again when placed in a tin of sea-water. Efforts to anaesthetise them by means of napthalene and formalin were unsuccessful, and some lived in foul water for over two days. Even forty hours out of their element was not fatal to them,

A garden clearing in the shelter afforded by a banyan.
Photo—E. A. Briggs.

though they were almost insensitive after their long drought.

ROADS THROUGH THE FOREST.

The shady paths winding over the island are wonderfully beautiful, and here and there present glimpses of the lagoon and the mountains which are rare pictures of delicate colour and charm. Sometimes they pass through forests of palms which wall them in on each side with a dense growth in every stage, from the fresh young shoots just appearing above the ground to the tall trees whose leaves form a canopy overhead, filtering the sunlight to gleam on the shining green undergrowth. Every now and again they pass under the arching limbs of a banyan, whose huge branches with their queer root-stems intertwine like mighty serpents, and are lost to sight in the scrub.

TRAVELLING TREES.

These Banyans grow downwards rather than upwards as do most trees, their life beginning in holes or forks of other trees whither the seeds have been carried by birds. From their elevated positions they send down their first roots—long trailing stems which feel their way earthwards along the trunk of their host. As the parasite thrives, it increases its stranglehold upon the supporting tree, which is gradually enveloped in a tangle of root-stems and dies. The wide-spreading branches of the now established banyan likewise give off adventitious roots, which unite to form flexible, rope-like stems fifty feet in length, and so strong that, when no thicker than a finger, they will bear one's weight. If these touch one another they coalesce and so vary greatly in thickness, while, once they have reached and become established in the ground, they increase so rapidly in girth as to become indistinguishable from the parent trunk.

By means of these root-stems, a banyan is enabled to spread itself over a considerable area, which may be a couple of acres in extent, and its trunks may be counted by the dozen. When its older parts decay and their connecting branches become severed, the original tree is divided into two or more younger portions, which continue to spread throughout the forest upon their stilt-like stems in such a way that one can imagine them gradually travelling over a considerable area in a space of many hundreds of years.

MOUNTAIN CLIMBING.

Two great hills rising abruptly from the sea to a height of nearly 3000 feet, present imposing precipices on every side, and fill the onlooker with admiration. Together they form the greater part of the island, and they are so difficult of access that they remain to-day just as when first seen by Lieutenant Ball 130 years ago. Mt. Lidgbird is a pyramid, rising by a succession of terraces to a razor-back, 2504 feet in height. We stood upon its summit with one foot upon its eastern face and the other upon the west, after a most exciting climb up its steep sides.

Leaving early in the morning to avoid the heat, and carrying only our tucker, we soon passed through the lower palm forest and forced our way through the tangle of dense undergrowth and over rocky boulders, until we attained the summit of the Round Face. This is a wonderful overhanging precipice, perhaps 1800 feet above sea-level, which faces the setting sun. Approaching its edge, we sat down and dangled our legs over the great space, and looked down between our feet upon the forest far below. All around were impressive cliffs and faces, some below us and already negotiated, and others above still to be climbed. Far down was the great vertical wall across the face of which runs the "Lower Road," itself 500 feet above sea-level, but now appearing as a green track raised but little above the white combers breaking upon the reef below. We look out to sea upon an unbroken horizon where not even the smoke of a steamer may be seen, so far are we out of the busy world. Almost below us is the southern end of the coral-reef enclosing a broad lagoon, every rock and shallow of which is laid out before us as on a map. Rose-white Tropic Birds, *Phaeton rubricauda*, with scarlet tail feathers, soar and wheel about their nests on the great cliffs, flying with incredible ease and rapidity in the high wind.

Ascending again, we struggle through an almost impenetrable forest of the Umbrella Palm, *Howea canterburyana*, many of which are in full flower while others bear great bunches of red-ripe seed. The rich black soil is in places so completely hidden by masses of the young palms that we tread dozens of them underfoot with every step, while canes and vines greatly impede our progress. Great fungi larger than dinner plates project from the tree trunks, and orchids and ferns cling to the rocky faces. Walls too steep to climb have to be skirted, and a rope thrown over projecting limbs assists us to scale some smaller cliffs. A small face, perhaps forty feet high, overhung its base so that one climbed on the rope alone, and looked down a slope so steep that a slip would have ended in a tumble seven hundred feet or more below. More clambering up steep slopes and further rocky faces, our bare arms becoming painfully scratched with the sharp sword-grass, and we arrive at last upon the summit, where the keen fresh breeze tempered the brilliant sunshine, and filled us with a sense of utmost exhilaration.

RARE BIRDS.

As we dispose of our lunch, which has perforce to be eaten dry, there being no water on the razor-back, we hear the shrill cries of the rare Big-hill Mutton Birds (*Œstrelata solandri*), which are now, towards the end of March, mating within their burrows. The sound is a high pitched chatter, somewhat resembling shrill laughter, and coming from out of the earth is suggestive of mountain sprites deriding the invaders of their solitude. We shout loudly, and they answer us in all directions, but we drag some of them from the burrows which are everywhere around us, and rudely dispel the fancy. The burrows are excavated anywhere on the steep slopes, and often extend several feet under a rock or a palm root. We found two birds in each of the burrows we investigated, but their sharp hooked beaks and their savage pecks did not encourage one to insert an arm into too many. The birds were also to be seen assembling around the mountain tops any afternoon as they came in from their fishing at sea to find their nests. If in the neighborhood one can call

The "Lower Road" overlooks the sea breaking on the reef 500 feet below it.
Photo—A. R. McCulloch.

them down by merely cooeeing to them. The sound attracts their attention, and they drop down to investigate, actually crawling over one while endeavouring to ascertain its origin. Though they are most plentiful near the mountain tops, they also nest on the Lower Road and in a large patch of sword-grass on the Little Slope, which is almost at sea-level. But they are restricted to the two mountain areas, leaving the remainder of the island to other species.

THE LOWER ROAD.

To reach Mt. Gower, one must go by way of a long and rough track around the eastern spurs of Mt. Lidgbird, or over a picturesque and somewhat hazardous one, known as the Lower Road, which crosses the face of a precipice about 500 feet above the water. Much has been written about the dangers of this so-called road, and those carrying heavy loads across it must needs pick their steps carefully lest they lose their balance, and, slipping on the narrow greasy slopes, fall headlong onto the rocks below. If but lightly laden, however, there is but little risk, save from occasional stones loosened by goats climbing on the cliff edge, a thousand feet above. The menace of loose stones is not inconsiderable on the steeper parts of the mountains, for they not only jeopardise one's safety by giving way beneath the feet, but, tumbling downwards, may injure another of the party below. We were fortunate in escaping any injuries from this cause,

but often watched small boulders loosened either intentionally or by accident, as they bounded downwards through the air hundreds of feet at a time, and crashed through the vegetation below.

From the time one leaves the sandstone of the lower-lying parts of the island, the whole journey to the hills and back lies over basalt boulders, which may be smooth and rounded as when worn by water, or rough with jagged points. Strong boots are all important, and if their soles be plentifully scattered with heavy nails, one is enabled to secure a grip upon the stones, which is surprising to those unused to such heavy footwear.

The site chosen for our camp between the Hills was near the bank of a "run" which either trickles or rages down the Erskine Valley, according to the state of the weather. It drops nearly a thousand feet during its short rocky course of about half a mile, and tumbles over faces some fifty feet high and so precipitous that we could not scale them; occasionally it runs underground out of sight. Yet every pool in its course is the home of numbers of a small shrimp (*Xiphocaris*), some tiny crabs (*Hymenosoma*), and small eels (*Anguilla*). How they ever reached the height of our camp, about 700 feet up, is a mystery. The eels perhaps utilised opportunities to skirt the faces afforded by extra wet weather, when water runs over most of the steeply sloping hill-sides. We had evidence of their powers of travelling over the land when collecting some on the lower levels; when thrown out onto the bank of a creek, they wriggled through the dry grass and fallen leaves as effectively as would any snake. But the shrimps and crabs could scarcely travel in this way, and they could not possibly have so reached the streams upon the top of Mount Gower where we found them.

FRESH-WATER CRAB (*Hymenosoma*).

This tiny crab is one of the most mysterious residents of the island. It lives under the stones in the several streams anywhere from sea-level, as in the Big Creek, to the mountain tops. It plays "possum" when disturbed, and as both the form and colour of its flat back cause it to closely resemble a small pebble, it is very easily overlooked. As *Hymenosoma lacustris*, it was first recognised from New Zealand, and was regarded as of interest chiefly because it was the only fresh-water representative of a common marine genus. Later it was recognised from land-locked lakes in Victoria, and afterwards from Lord Howe Island and Norfolk Island, together with its associate, the fresh-water shrimp *Xiphocaris*.

How come these two to appear in the fresh-waters of such widely separated localities? It might be supposed that they spend some of their earlier stages in the sea, as do the eels, and that odd individuals have occasionally drifted from one locality to another; but this suggestion is discounted by the fact that they occur in land-locked lakes and on the top of Mt. Gower, to which access from the sea is impossible. To suggest that the crab and the shrimp are survivors of an ancient fauna which passed from one place to another by means of old land-connections, long since disappeared, is equally unsatisfactory, for who can suppose that Norfolk Island and Victoria, for example, have ever been connected by even the most tortuous of land bridges? That the eggs have been transported upon the feet of wading-birds is open to the same objection as the proposition that they have been wind-borne, an objection based upon the belief that such eggs would become dry and wither during their passage. But this is mere conjecture, and whatever be the explanation of the occurrence of these two crustaceans in fresh-waters so widely separated, it will form a chapter of fascinating interest.

THE SUMMIT OF MOUNT GOWER.

The top of Mount Gower is very different from that of Mount Lidgbird, being a comparatively flat area several hundred acres in extent. Two "runs" converge and disappear over the sheer cliffs, falling perhaps a thousand feet into the Erskine Valley, the water trickling down them being supplied direct from the clouds which so commonly envelop the mountain tops. This area

From the summit of Mt. Gower, one looks across the Erskine Valley to the precipitous faces of Mt. Lidgbird, and then over the lower lying parts of the island. Nearly 3,000 feet below is the broad lagoon with its surf-capped reefs facing the west, while away to the north is the little group of islets known as the Admiralties.

Photo—A. R. McCulloch.

has been aptly described as covered with a "Moss Forest." Mosses, lichens, and climbing ferns of many kinds cover the trunks of almost all the trees, while the ground is completely hidden under a thick growth of sphagnum, except where it has been cleared by wild pigs. Looking downward over the sloping table-land from a central peak, one sees a forest of tree-ferns covering many acres, their feathery tops dominating all the other vegetation. The whole conjures up a mental picture of a forest of the coal ages, ferns, mosses, and palms, everywhere dripping with moisture direct from the clouds which commonly cover them.

From a tree-top, 2840 feet above the sea, one peers over a cliff to see the surf breaking upon Gower Islet, the southernmost portion of the island. The lower portion of this cliff, known as the Big Slope, supports an abundance of palms from which seed is collected in favourable weather, but its greater portion is inaccessible. Out in the ocean, eighteen miles to the southward, and brilliantly illuminated in the morning sun, is a rocky cathedral-like spire known as Ball's Pyramid—a pinnacle rising eighteen hundred feet into the sky, yet but sixty chains long at its base. Its upper slopes remain *terra incognita*, none but a few surveyors having ever landed upon the rocks around its base. It is of mysterious origin, its past history being difficult of comprehension, while mystery veils its present, none knowing what may live upon the higher levels of its wind-swept fastnesses. We saw it again later after leaving the island, its jagged profile being clearly silhouetted within the circle of a rising moon, and the sight left us pondering upon its obscurity.

MAGPIES.

While among the mountains we were charmed with the antics of a number of magpies (*Strepera crissalio*), which discovered us to be objects of great interest. First one and then another espied us clambering laboriously up the steep faces while they flew swiftly over the forest. Turning sharply on their course with wonderful volplanes and dives, they settled in trees close by, and, after eyeing us intently with their heads cocked to one side, soon called up two or three more from the neighbourhood. We were often surrounded by small parties of them, all absurdly curious

and often perched so close to us that we might have knocked them over with sticks.

Occasionally we made nooses out of the midribs of young palm leaves, fastening them to the ends of sticks a few feet in length. With these we snared magpies and other birds by simply passing the noose over their heads, while they pecked at it and expressed no alarm until it pulled them from their perches. We sometimes offered them a dead rat upon a stick. They accepted the gift with alacrity, perching upon the upheld stick and sagaciously pecking at, and loosening the strands of palm fibre we had tied around the body. First one and then another would take

Before they were destroyed by rats the birds were so tame that they could be snared with a palm leaf noose upon the end of a short stick.
Photo—A. R. McCulloch.

charge of it, each pursued by the rest; but its weight prevented them from carrying it far, which indicated that they will be inconsiderable as enemies of the rats which have recently become such a plague upon the island. The yapping of a small terrier hunting rats attracted magpies from all around, and they chattered melodiously among themselves, regardless of the noise caused by several enthusiasts, who with sticks and stones, assisted in dislodging the quarry.

About sundown the magpies around our camp became particularly garrulous as they settled down for the night. Each one appeared to have something to say, and said it with a remarkable variety of notes, so that the whole valley resounded with their melodious squawks and gurgles. This was in happy contrast to the pathetic silence prevailing over the remainder of the island, where the birds, once so numerous, are now practically extinct.

WOOD-HENS.

The rare and unique Rails, known on the island as Wood-hens (*Oeydromus sylvestris*), proved to be equally curious, and came hurrying out of the forest to investigate the cause of such noises as the tapping of two stones together, or the notes of a mouth-organ. Our first warning of their presence in the undergrowth was generally a startled cry, somewhat resembling that of the common Guinea-fowl, which was apparently intended as a warning to all in the neighbourhood of the presence of strange beings. Picking up pebbles and tapping them upon tree-trunks or rocks, we soon saw the birds hastening towards us. Espying us within thirty yards or so, they advanced more cautiously, but, if we remained still, approached sufficiently close to be snared with a palm-leaf noose. I tethered one by the leg to a stone in order to take its photograph, and its efforts to escape attracted the attention of another, which endeavoured to assist the captive by grasping its neck with its own long bill and pulling with all its strength. My presence with the camera within a few feet caused them no concern, and when the string slipped from the stone, they moved away without undue haste, perhaps discussing their strange adventure.

The woodhen's wings are so small that it cannot fly, but its strong legs have enabled it to ascend even the steep faces of Mount Lidgbird, on the summit of which we found it. Its plumage is of a brown colour tinged with green, which harmonises well with the dark brown earth and the green foliage of the palm scrub in which it wanders about, turning over leaves and

pebbles with its long grey bill in search of food.

We saw several of its nests which were placed in sheltered crevices among rocks or under trunks of fallen banyans. They were composed of palm fibre with a few leaves as lining, but none contained eggs. Woodhens once roamed plentifully over the whole island, but they have been steadily destroyed by cats and dogs, until they are now found only on the upper parts of the two mountains and in such inaccessible places as the Big and Little Slopes beneath the southern cliffs of Mount Gower. It is very probable that they will not last even there much longer owing to the ravages of the rats upon their eggs, and it would seem that they may well suffer the fate which has overtaken most of the other land birds of the island.

THE TRAGEDY.

But two years ago the forest of Lord Howe Island was joyous with the notes of myriads of birds, large and small and of many kinds. Doves wandered fearlessly around one's feet on the main roads, and the bush resounded with their cooing. Doctor Birds (*Aplornis fuscus*), made their appearance in the garden clearings in hundreds every evening, and with the fantails (*Rhipidura*), even wandered through the houses in search of insects and crumbs. Cuggermerucks (*Merula*), and Silver-eyes (*Zosterops*), played havoc in the fruit trees, while Thickheads (*Pachycephala*), and a dozen others added to the general chorus. They were unmolested save by each other, the residents of the island rarely disturbing their harmony. To-day, however, the ravages of rats, the worst enemy of mankind, which have been accidentally introduced, have made the note of a bird rare, and the sight of one, save the strong-billed Magpie and the Kingfisher (*Halcyon*), even rarer. Within two years this paradise of birds has become a wilderness, and the quiet of death reigns where all was melody. One cannot see how the happy conditions are to be restored. The very few birds remaining are unable to breed, being either destroyed upon their nests or driven from them by the rats, and their eggs eaten. One can scarcely imagine a greater calamity in the bird world than this tragedy which has overtaken the avifauna of Lord Howe Island.

The tangle of vegetation covering the greater part of the island has become the home of myriads of rats, which find in it an abundance of food and a safe retreat from man and dogs.

Photo—A. R. McCulloch.

With the birds gone, injurious insects have increased unchecked, and are destroying the produce of the island gardens. Fruit flies have ruined the peaches, and caterpillars of many kinds are stripping the leaves from shrubs and trees. The rats also eat the corn ere it ripens and extract the pulp from bananas, pomegranates, and other fruits while they are hanging on the trees. Nothing is safe from their rapacity, and dire distress threatens the residents unless some unsuspected cause brings about a reduction of the rats and an increase of the insectivorous birds.

THE ADMIRALTY ISLETS.

On the north-eastern side of the island is a group of rocky islets known as the Admiralties. These are rugged, difficult of approach except in very calm weather, and of curiously fantastic form, a great cavern penetrating the largest islet from side to side. The Admiralties are visited annually by countless myriads of seabirds, which find their isolation and inaccessibility excellent for the rearing of their young.

The Admiralty Islets, from Ned's Beach.

Photo—E. A. Briggs.

Visiting the islets in December, we saw circling and screeching about their nests innumerable birds, which became more numerous and more excited as we approached. Upon landing and climbing the low cliffs, we were greeted by a cloud of Wideawake Terns above our heads, all screaming and chattering with indignation at our intrusion, and ever dipping and snapping their sharp bills about our ears. At our feet their brown mottled eggs lay in profusion everywhere, while newly hatched chickens scuttled away in thousands into holes or under the stunted bushes, tumbling over themselves and each other in their excitement. They were so numerous that we found it difficult to walk without treading upon them, while the shrill cries of their parents in the air were almost deafening. Looking around, each member of the party could be located by the thousands of birds above him, which, so soon as he had passed, alighted again to seek out their eggs or young. This last would seem to present insuperable difficulties because the eggs are scattered indiscriminately everywhere, while the squeaking chickens had become hopelessly confused in the scramble to avoid us. Yet each of the parent birds appeared to find either its own or some equally satisfactory offspring, gradually sorting them out of the confusion, and settling down with them so soon as quiet was regained.

The eggs of the Wideawakes (*Sterna*) and the Mutton Birds (*Puffinus*), are gathered in great quantities by the residents of the island, being excellent for the table, without any of that strong flavour which commonly characterises seabirds' eggs. It is said that any bird

so deprived of its egg produces a second, and the fact that some birds are much later than others in rearing their young, is thus accounted for.

Conspicuous among the numerous birds are the Gannets (*Sula*), whose large white forms are to be descried

A Gannet and its young.
Photo—E. R. Waite.

everywhere. They exhibited but little concern at our presence, though if disturbed they readily showed fight with their powerful beaks. At such times they trod cruelly upon their poor half-fledged young, which also proved well capable of defending themselves. Sometimes the parent birds would surprise us by disgorging one or even two half-digested flying-fish or mackerel, which, as they were about a foot long, made us wonder where they had been stowed.

Graceful little Blue-billies nested on the cliffs, while such low shrubs and sticks as existed were seized upon by the Noddies for the support of their grassy nests. To seaward we observed a long black ribbon of Mutton Birds, spending the daylight hours collecting food for themselves and their hungry young—which set us wondering how many tons of fish and drift-life must be consumed daily to support the myriad inhabitants of the Admiralties and the main island.

MUTTON BIRDS.

In the seclusion of the dense palm forest on the eastern side of the main island are the "Mutton-bird Grounds," where the burrows of these birds are so numerous that one cannot walk among them without constantly sinking knee-deep through the loose sand into their excavations.

Year after year these strange birds return to these particular portions of the island, and dig out afresh the deep burrows in which to lay their eggs. We were assured by some residents of the island that the same burrows are excavated annually, even though all traces of them be removed between the breeding seasons. Should one be excavated in a position where it is not wanted, as for example, in the centre of a vegetable garden, it is said to be necessary to destroy the parent birds which excavate it to ensure its final elimination. Strange as this suggestion may seem, there is much evidence to support it. For example, the grounds are sharply defined, whether they be in the palm forest, in open grass, in the undergrowth of vines, or among sword-grass. There is no uniformity of conditions, yet the same sites are regularly inhabited by the birds as each breeding season approaches. They evidently return to nest in the localities with which they are familiar, and perhaps the young birds follow the older

Boatswain Birds and Blue-billies nest in thousands on the high cliffs of the North Ridge.
Photo—A. R. McCulloch.

ones when their breeding time approaches; and they are doubtless not averse to utilising an old burrow if they find it vacant, in preference to the labour of excavating new ones for themselves.

The burrows of the Mutton Birds riddle the sandy soil beneath a forest of palms and banyans so dense that it has been named the Valley of the Shadow of Death.

Photo—A. R. McCulloch.

We paid a visit to one of the Mutton-bird grounds one evening to watch the birds come in from the sea to feed their young. Arriving about an hour after sunset, we observed them wheeling and circling in hundreds over the palm forest. They were perhaps identifying the locations of their particular burrows, as we observed one to swoop downwards every few moments and disappear among the maze of branches. Though there was but little light, the birds could be clearly seen against the moonlit sky. They uttered no sound as they flew, but the swish of their motionless wings through the air when they swooped close over our heads, recalled the whir of aeroplanes. We had stationed ourselves at an open area where burrows were plentiful, and we observed that the birds often approached as though to alight, and then sneered off again as they observed us. As the light waned, however, they became less timid, and soon dropped down into the grass nearby. Upon first coming to earth, they squatted down as though their legs were too weak to support them, but soon turned in the direction of their burrows and floundered clumsily off towards them, fluttering their wings and waddling with their short legs. Through the dense sword-grass or along well beaten tracks they were intent only upon reaching their nests. We chanced to be in the way of several which waddled and fluttered up to us, squatting every few yards as though uncertain about such unusual obstacles in their path. We remained still, how-

ever, and they either floundered around us, or even tried to pass between us.

Soon they reached their burrows, and we heard out of the darkness the most heart-rending cries and wailings as though a hundred lost souls were bemoaning their fate. We were told that this is merely the mother bird's invitation to her offspring to come out of the burrow to be fed, and certainly the wailing was often rudely interrupted, as though the baby birds had forced their hungry bills deep down into their mothers' throats. But there was not light enough to see what was happening, and only the awful cries of the birds everywhere in the scrub indicated their presence all around us. On the seaward sides of these extensive breeding grounds we observed "runs" through the grass and undergrowth which led to slopes from which the birds take flight. As their long wings prevent them from rising from the ground, they have to spring from a sloping face into the air. All such slopes are therefore reached by well defined tracks formed by the constant passage of the birds from the forest to the sea. Such tracks may be trampled clear of all growths for a distance of twenty yards or more, and they end abruptly at the taking-off point.

How does a Mutton-bird find its own particular nest? Even when circling rapidly over the palm forest each must surely find some little difficulty in locating the particular area in which its burrow is situated, and after dropping down into the pitchy darkness, it must have trouble in distinguishing its own burrow from the others everywhere around. The observation of environment and sense of direction must be perfectly developed in these birds. When we remember that they spend the day in the glaring sunshine on the open ocean, feeding and collecting food for their young, and know that they find their way after dark through the thickest forest to their nests, we can only marvel at the greatly developed faculties which enable them to carry out both equally well.

Having fed their young, the parent birds are supposed to rest during the night and make off to sea again at dawn, the young being generally, if not always, left alone during the day. About April, the young birds are covered with a wealth of bluish-grey down, which is so plentiful as to make them appear larger than their parents. At this time they become very fat, and many are collected by the residents for table purposes.

Standing upon Malabar Head, one looks south ward over the greater part of Lord Howe Island.

Photo—A. R. McCulloch.

The Depths of the Sea.

By Charles Hedley.

To a man viewing the open ocean for the first time probably its most striking feature would be the level of its wide expanse. And when he thought of the land that lies under that water he might naturally imagine the bed of the sea as expanding in a plain like the surface.

But this would be a wrong conjecture, for, though there are plains at the bottom of the sea, plains indeed that are broader and more monotonous than any plains of the land, there are also valleys, uplands and volcanic cones. If they had not been already found and measured, their existence would have been assumed by geographers. For, as this globe aged, it grew through stages of gas or molten rock to coolness and solidity, and, after the crust had cooled and set hard, the core inside continued to cool and shrink. As the outer shell collapsed to fit this shrivelled core, wrinkles appeared on the surface; such wrinkles, which are valleys and mountain ranges, must occur indifferently on land or under the sea all over the world.

Under the sea the landscape is expressed in smoother lines than in terrestrial scenery. Here are no towering cliffs, ravines, or splintered crags, no waterfalls, forests, or glaciers. The features of alpine scenery have been carved out by rain, frost, and wind, but these agencies do not operate beneath the sea.

It happens that the highest height of the land and the deepest depth of the sea just balance one another. A depression in the North Pacific Ocean about a hundred miles south-east of the island of Guam is the match for Mt. Everest in the Himalaya.

An explorer examines the islands, mountains, or rivers, that he passes with compass and telescope; any peak or position that he can see, however distant or inaccessible, can be measured and placed on the map. But the mountains under the sea, that no human eye ever has seen or will ever see, must be studied in other ways. A blind man, who cannot see, must feel his way, so navigators feel their way to the depths of the sea with sounding line and thermometer.

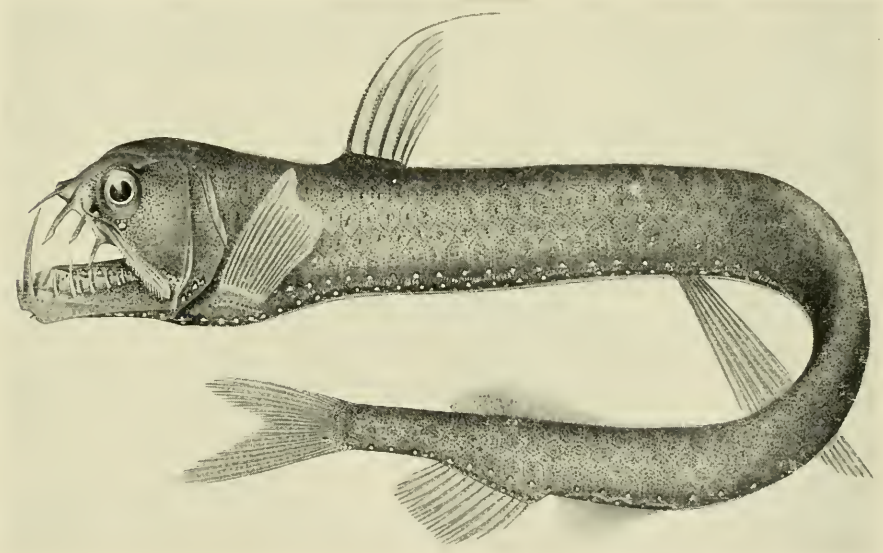
Before the impulse of the trade winds the surface of the sea is pushed away from the equator and is driven on to form great warm currents like the Gulf Stream. After long wanderings these rivers of the ocean sink out of sight in the cold polar seas. Movement in deeper water continues the circulation until at last great volumes well up to the surface to restore the level depleted by the trade winds and thus completes the cycle. So in deep water there is a constant trickle of icy water, a few degrees above freezing point, from polar to equatorial seas.

These currents maintain the life of the sea by spreading food and oxygen; they cool the torrid and they warm the frigid zones. Where the circulation is free, the temperature readings diminish gradually from the surface to the floor, but where the walls of a submarine basin obstruct the circulation, the temperature falls only to the level of that basin rim. Beneath this horizon the dead water maintains a uniform temperature.

These depths are not only cold but dark. Water that seems transparent for a few inches becomes opaque in a few fathoms, and no light can struggle down through miles of water. The myriad organisms that float in the sea would alone screen off the light. It has been suggested that different elements of the spectrum attain different depths; that, descending, we should reach a world of purple glow and pass a region where all shone red as if the light came through stained glass windows. But down beyond all this, there lies an abyss of blackest and eternal night, illumined only by the sheen and glitter of phosphorescence. As a consequence of the absence of light, vegetation disappears at about one hundred fathoms from the surface. In the gloomy depths beyond, all creatures are perforce carnivorous. Here many animals go

blind for want of light to see by, others have acquired great staring eyes to use the least glimmer of light. It follows that in the remotest ocean depths some kind of light exists for the use of the goggle-eyed fishes, and this is probably phosphorescent. When animals are drawn in a trawl from deep water to the surface, they glow brilliantly. It may be that their home on the sea floor is as brightly illuminated as a city street on a holiday night, that there the prawns twinkle like stars, great fish flame like torches and medusæ glow like arc lights.

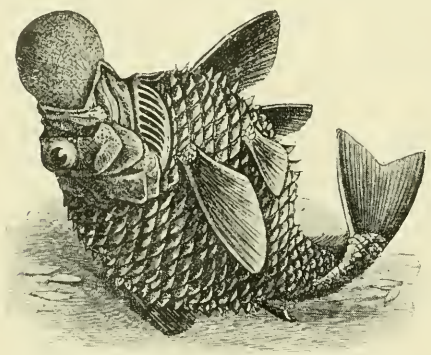
Three conditions in which the depths of the sea differ from the world of dry land are the cold, the darkness and the pressure. Both cold and darkness can be readily imagined from human experience, but pressure is a factor whose features cannot be so easily realised. It has been calculated that the pressure in ocean depths, from the weight of the water above, is more than two and a half tons to the square inch, a greater pressure than there is in the boiler of a steam engine. When the body of a sailor buried at sea reaches its final resting place in the ooze at the bottom, his corpse is probably crushed by the tremendous pressure to the size and semblance of a folded umbrella. A popular error supposes that the force of gravity is inert at the bottom of the sea, that ships, men, and guns can sink only to a certain depth, where they are suspended each at its particular stratum of density. But really everything that is dropped into the sea from a feather to an anchor sinks at last, some in a few minutes, others in a few days, to the bottom of the sea. Only by slow degrees, lasting over many generations, can any kind of animal migrate to or from the abyss. An individual that passed upwards would burst, and one that passed downward would be crushed. Still, when any species of animal has at last grown accustomed to the pressure, it is probably less inconvenienced by it than by the cold or by the darkness. A fish drawn in a net from the abyss to the surface is a sorry sight; by decompression it has been, as it were, exploded, the eyes are blown out of the head, the viscera burst from the mouth, and the body is inflated like an air cushion. Its flesh is loose and flabby,



As a dweller in the abyss this fish has acquired the following notable features; large staring eyes for peering into perpetual gloom; long needle teeth useless for biting or fighting but used to guide helpless prey down its throat; a small, weak tail that is deficent in propulsive power, though strong enough for the gentle life of the great depths.

Drawing—A. R. McCulloch.

but when it was alive, under the pressure from which it was so suddenly released, its tissues may have been as firm and dense as a piece of rope. These deep-water fishes are liable to a strange and paradoxical fate; they alone of all things in the world may come to their death by tumbling upwards. By expansion and contraction of their swim bladder, fish control their movements and balance. If an abyssal fish should chance to mount too high in pursuit of game, the swim bladder may expand beyond control of the muscles; then its fate is sealed, for the helpless creature, swollen to bursting, is carried higher and higher, even through miles of water, to the surface.



A Fish that has suffered "decompression." After being drawn suddenly from a great depth to the surface, the body was burst by release of pressure, so that the entrails protrude from the month, the eyes start out from the head, and the belly is much distended.
From Perrier's "Les Explorations sous marins."

The first of the deep-sea fauna seen by naturalists consisted of such decompressed fish found stranded on the beach or floating on the surface.

It is pressure that makes diving so dangerous an occupation. Some of the smartest of the South Sea Islanders are said to swim down for seventy or eighty feet, and diving in a dress with an air pump has with great care been successfully accomplished down to two hundred feet. But the divers who, tempted by great reward, venture much past a depth of 20 fathoms are liable to be pulled up in a paralysed condition. The danger lies not in the descent, as would be anticipated, but in the ascent. In the familiar soda-water siphon, the water has been charged by forcing gas into it under pressure; when the soda water is poured out, the gas, being suddenly released from pressure, effervesces violently. In a similar way when a diver descends, gases from the air he breathes, at a pressure corresponding to the depth reached, are forced into his blood. When he ascends, the pressure diminishes, and the released gases tend to effervesce as in the case of the soda-water discharged from the siphon; should a bubble thus burst from the blood into the brain or spinal cord, paralysis at once occurs. Practical divers treat paralysis by repacking the sufferer in his dress, lowering him to his former depth, hoping thus to reduce the bubbles, and drawing him up again very gradually. A prudent diver ascends from great depths slowly and rests at various stages.

It is considered, but this is a point not yet decided, that the animals of the sea live either about the surface, or on and near the bottom, and that the intermediate space, which may be miles deep, is almost barren of life. The pelagic fauna is that which floats at, or near the surface, and is totally different from either that which lives on the sea floor, or that which inhabits the beach. A glance over the ocean from the deck of a ship might convey the impression that the sea is indeed the "waste of waters" that it has been called, that, but for an occasional albatross or porpoise, it is a lifeless desert. But the presence of such voracious animals as porpoises and albatrosses are indications of an ample food supply. Though myriads of animals are always afloat on the surface of the sea, they fail to catch the eye of the traveller, for, either they are very small, or transparent, or disguised by their blue colour. In rain or hot sunshine some of the pelagic fauna may sink a little distance for shelter beneath the surface.

But after dark no one would make the mistake of calling the sea lifeless. An approach by night to a big city is marked by the appearance of a long array of lights; since each individual light is evidence of the care of a human hand, every sparkle in the dark represents a life. Had some pestilence sud-

denly destroyed the citizens no light would shine there. At sea there are few nights when phosphorescent lights do not glow and glimmer where the wave rolls back from the ship's stem, and in the city of the sea each light also counts for a life. Sometimes, though rarely, the whole sea may be seen ablaze with phosphorescence, and the waves rolling in a broad sheet of golden light.

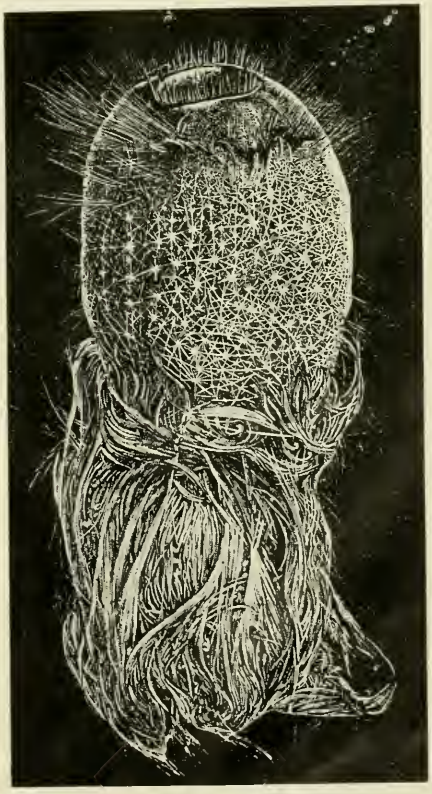
Most of the animals that shine thus by night are transparent creatures looking like little lumps of jelly. How and why this light is produced is not fully understood. Since fish avoid a net smeared with phosphorescence, it may be that the owner of a phosphorescent torch thus makes a sign threatening predatory animals that it can sting, or has some other disagreeable or unwholesome quality.

Even in daylight and at a distance the pelagic life sometimes may be seen plainly, in the form of long streaks of scum or discoloured water; such are known to sailors as "whale food." The Red Sea and the Yellow Sea were so named from the drifts of coloured scum seen there by early explorers. If some of the stuff be fished up with a bucket and magnified with a microscope, it is seen to consist largely of a sea weed called *Trichodesma*, looking like little bundles of chopped hay. A multitude of tiny creatures subsist upon this *Trichodesma* and similar plants, the growth of which is extremely rapid, and upon such animalculæ the larger animals feast in their turn.

Even the whale, that monster of the deep, comes to enjoy the bounteous spread. Whales are divided into two great groups, the toothed whales and the whale-bone whales; the toothed whales, the least of which are known as porpoises, tear their prey in their powerful jaws, as wolves or tigers do on land. But the whale-bone whales are not adapted for hunting, they feed more leisurely by gulping great mouthfuls of floating stuff, straining out the water through their whale-bone filter, and swallowing the solids left.

When Christopher Columbus sailed on his famous voyage of discovery to America, his ship became entangled among vast masses of floating seaweed in what is now known as the Sargasso Sea. Either Columbus exaggerated his adventure, or he was unlucky in encountering an unusual pack, for modern seamen have not found the weed to extend so continuously as he reported, or to constitute a real impediment to navigation. Each branch of this floating weed provides a home for a swarm of crabs, prawns, fish, and molluscs. At rest and clinging to the weed these can scarcely be detected; when disturbed they may make temporary mistakes in hurrying back to shelter, so that a white-chequered crab may crouch on a dark background. But after a few minutes' peace they sort themselves into their proper hiding places and again become invisible.

These surface animals have been noticed at some length because of their



An abyssal Sponge. Delicate meshes of glassy spicules constitute a skeleton supporting the soft tissues of the animal, and the mop of flowing fibres serves as a root to anchor it in the mud.
From Perrier's "Les Explorations sous marins."

importance to the fauna in the depths of the sea. On land, plants occur almost everywhere and support the animal population either directly or indirectly, for the vegetarians eat the plants and the carnivores eat the vegetarians. Now plants cannot exist without light, so that, where the sea is dark from depth, there vegetation fails completely. But for the surface fauna and flora the creatures on the sea floor would starve when they passed the limit of plant growth.

A Sea-Lily. These flower-animals of the ocean grow in dense fields on the floor of the deep sea; their roots are fixed in the ooze, above which the slender, jointed stalks rear for about two feet, and spread into graceful petals. These wave about seeking for victims to enfold and devour. In marble slabs are often seen the fossil stems of encrinites, similar creatures that lived in past geological ages.

From Perrier's "Les Explorations sous marins."

The abyssal fauna is, however, abundantly fed, as the wandering hosts of Israel were fed by a daily rain of manna. When the whales, the fish, the crabs, and tiny things innumerable have lived their lives in the sunshine above, their carcasses sink fast or slowly to the floor of the sea, and provide bounteous meals for the exiles in the dismal, freezing depths below. Food here literally drops into the mouths of the eaters, here are neither hunters nor hunted, here is abundance of space and sustenance for all. Life at the bottom of the sea if dreary is at any rate peaceful. The clash of war, the fierce struggle for existence is unheard, unfelt in these calm depths. In the abyss there is no need to hide nor are there any hiding places. Defenceless creatures could not here find any sheltering tufts of weed, any nooks or crannies in the rock. Nor in the darkness is there any need for those quaint disguises or mimicry by which surface animals escape their foes.

A "BROODY" RABBIT.—The best way to neutralise a pest is to utilise it, and a new way to turn our harmful, unnecessary rabbit to good account will be of interest to the man on the land. The strange behaviour of a rabbit described in *Nature*, of 1st March, 1900, may point the way to a new avenue of usefulness for the rabbit.

"Last year, in an aviary in one of the wards of the Caterham Asylum, a wild rabbit turned a dove off its nest and sat on two dove's eggs until they were hatched. This year the nurses are trying another hatching operation. They have placed two bantam's eggs in the same nest. The same rabbit has taken to these eggs, and only leaves the eggs to take its food, returning at once to the nest." Now all that is necessary is to carefully select a number of rabbits with the hatching habit well developed and segregate them; after a few rabbit generations have come and gone, a company could be formed to supply poultry farmers with rabbit incubators. The incident is curious, if true, and, as Mark Twain would say, it is curious anyway.

Some Large Non-Venomous Snakes and their Food.

J. Roy Kinghorn.

It is well known that snakes can swallow large animals, but a photograph of such an event is rare indeed, and it is through the kindness of the editor of the "North Queensland Register," and the "World's News," and the photographer, Mr. W. E. Stirling, that I am able to reproduce the accompanying illustration of a Queensland rock python which had just made a meal of a wallaby. Mr. Stirling informed me

North Queensland Python (Python amethystinus) after having swallowed a wallaby.
Photo—W. E. Stirling.

that while he was out shooting kangaroos in the rough country which forms portion of Ranger's Valley Station, Kymna, Queensland, he noticed the head and neck of a snake protruding from a hollow among some large boulders. He was using a powerful .44 Winchester at the time, and one shot through the reptile's neck quickly despatched it, after which he proceeded to drag it out into the open, where he found it to be distended to an enormous size as the result of a banquet. Mr. Stirling quickly decided that a photograph would be both interesting and necessary as a permanent record of his find, and, as his camera was at camp almost a mile away and the daylight fading, he had to make a swag of his prize and "take the mountain to Mahomet." Its weight was so much that he was compelled to leave his rifle, ammunition and several kangaroo skins under a bush until morning, but even then it was not without many rests that he at last reached his destination, where he placed the snake in position and took a photograph with the result shown in the illustration below. When cut open its stomach was found to contain a wallaby quite as large as a full grown sheep dog; it was squeezed into a very compact mass and was quite fresh, having evidently been eaten only a day or so previously. There were no gases present, and the bulge shown in the picture was entirely filled by the wallaby. When measured, the python was found to be a little over 12 feet in length, and I might add that, although large, its size is by no means out of the ordinary, as this species has been recorded up to a length of nearly 20 feet, while a cast in the Museum reptile gallery measures 17 feet 2 inches.

The question immediately arises as to how snakes manage to swallow such large animals, and the answer will be found in the following lines.

When a python catches its prey it kills it by strangulation or constriction.

This the snake accomplishes by throwing successive coils of its body round the victim and constricting its muscles; this action reduces the victim to a comparatively soft mass, which the snake commences to swallow, almost invariably commencing with the head, as, if swallowed tail foremost, the hair of a mammal, or the feathers of a bird would cause considerable impediment during the passage down the throat. The process of swallowing is necessarily slow, and would be much slower were it not for the great quantity of saliva that is excreted over the body of a victim, and for the fact that the teeth, which are sharp and numerous, are curved downwards and backwards, their points being directed down the throat. After a large meal such as the one shown in the accompanying illustration, a python remains in a state of semi-torpor for many days, not re-awakening again to active life until digestion has been completed. They can exist for periods of several months between meals, and this no doubt is a very valuable asset, especially in times of famine.

The London, Adelaide, and Melbourne Zoos can each boast of a python which swallowed its bed. In the latter, one winter a few years ago, a blanket was put into a large python's cage to keep it warm, but evidently the snake was ignorant of the method of domestic bed making, and, instead of wrapping itself up in the blanket, it reversed the process and wrapped itself round the blanket, and I believe that it is still living—although its digestion must have been ruined. I am not certain as to the fate of the other two snakes, but I believe that they died soon afterwards.

It may be interesting to note and compare the lengths of some of the best known snakes, and the following are authentic records of the measurements of the five largest species, together with the boa constrictor and the diamond and carpet snake.

Regal or Reticulated Python (*Python reticulatus*) .. ..30ft.
Indian Python (*Python molurus*) .. .. 25ft.
Anaconda (*Eunectes murinus*) .. 22ft.
African Python (*Python sebae*).. 18ft.
N. Australian Rock Python (*Python amethystinus*) .. .. 19ft.
Boa Constrictor (*Boa constrictor*) 13ft.
Carpet Snake (*Python spilotes var. variegata*) .. .. 11ft.
Diamond Snake (*Python spilotes*) 9ft.

Carpet Snake (Python spilotes var. variegatus).
Photo—J. A. Kinghorn.

The unofficial record of the length of an anaconda is 33 feet.

All these snakes are non-venomous, and kill their prey by strangulation; their food is variable, mammals, birds, or reptiles being included in the menu as the occasion offers.

The carpet snake and the diamond snake are very well known in Australia, more especially in the eastern portions of the continent, and they are both very closely allied to the Queensland species.

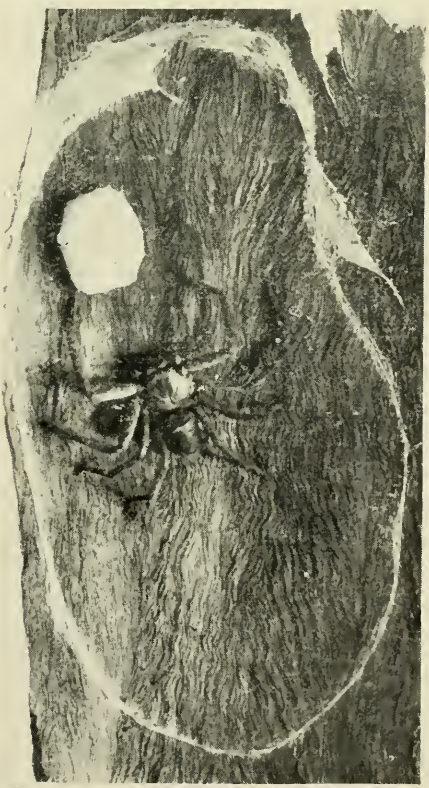
Notwithstanding the fact that most people look upon all snakes as enemies, the carpet and the diamond snakes are the friends of the farmer throughout the country as their food consists mainly of rabbits and rats, and it is for this reason that the writer would advocate protection for them. As a matter

of fact it is not very long since the farmers of a certain district on the North Coast of New South Wales applied for a period of protection to be proclaimed for these two snakes, as it was proved beyond doubt that they kept the rabbit pest well under. These snakes are seldom found doing damage around settled parts when wild game is available, but, when they do trespass, it is only natural that the poultry yard suffers. Poultry-eating snakes are luckily rare, and they generally pay the penalty. I know of one diamond snake which entered a poultry run near Sydney, and, after eating a plump fowl, found that its added proportions would not allow it to escape through the wire netting; in the morning it was found coiled up asleep, and the farmer made sure that it would never wake again.

Spiders, Poisonous and Otherwise.

By Anthony Musgrave.

The Huntsman Spider, *Isopeda villosa,* or, as it is more popularly called, the "triantelope," is a creature familiar to all Australians. Though usually found lurking under the bark of trees, where it may frequently be seen mounting guard over its white egg-sac, it sometimes invades houses on the approach of wet weather, and its giant and hairy form causes trepidation amongst the feminine occupants thereof. Certainly one can hardly help betraying an involuntary shudder at the thought of such a repulsive looking creature falling down the back of one's neck. With crab-like gait, it ascends the walls and explores the ceiling in search of flies, and, if unmolested, does good work in ridding the house of these noxious insects. Though the "triantelope," like all other spiders, is equipped with poison glands, there is little likelihood that the small amount of venom it secretes in order to kill its prey could seriously affect a human being.



Triantelope (Isopeda villosa) with egg sac on a piece of bark.

Photo—C. Clutton.

The similarity of the name "triantelope" to those of the well known animals tarantula and antelope suggests that this spider is a hybrid between the two, in which case, it is, like the majority of Australian vernacular names, grossly misleading. Nearly all large spiders are dignified with the name tarantula, and are credited with those poisonous qualities which have made the European species renowned in story and legend.

The true tarantula does not occur in Australia, however, nor does it belong to the same family as the triantelope, though its genus *Lycosa,* is well represented here. The south of Europe, particularly the area bordering the Mediterranean, is the home of the tarantula,

and it is from the town of Taranto in Southern Italy, where it commonly occurs, that the spider has derived its popular name. Like the trap door spiders it lives in an underground tunnel, to which, however, it does not attach a lid or trap door. The tunnel is lined with silk, and there the tarantula awaits the insects unfortunate enough to walk into its parlour. Its dwelling thus differs from that of the trianteIope, the home of which is usually beneath the bark of trees. The tarantula is certainly poisonous, though the toxic qualities of its poison have probably been exaggerated. It is, however, said to be capable of inflicting a severe bite, and among the superstitious Latin peasants it was regarded with dread. They believed that if a person was bitten by a tarantula, his nervous system was rendered abnormally sensitive by the poison, and he sank into a lethargy from which he could only be aroused by the playing of music. This caused him to execute a wild and frenzied dance, which had the effect of working the poison out of his system. This choreographic remedy gave rise to the dancing mania known as Tarantism, which spread like an epidemic over Europe during the Middle Ages, and finds its parallel in the jazz craze of the present day. The tarantella, a dance performed by the people of Southern Italy, is said to be a relic of that which gave relief to the victims of the tarantula's bite.

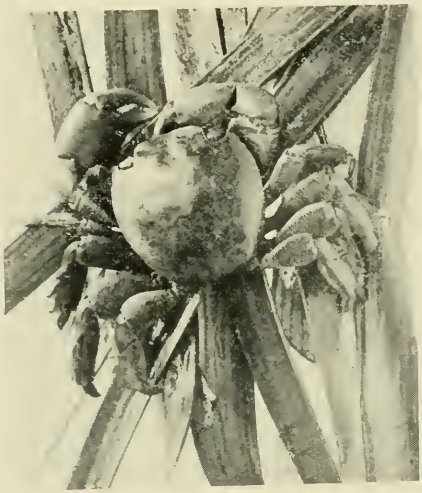
The widely distributed Red Backed Spider (*Latrodectus hasseltii*), though small in size, is certainly harmful, and we may regard it as our most poisonous species. The bite of this spider causes great suffering, and some weeks may elapse before the victim quite recovers from its toxic effects. Up to the present, no death has been recorded as a result of its bite, and Dr. Frank Tidswell, after a number of experiments conducted at the Board of Health, Sydney, writes "The results may . . . be taken as indicating the improbability of a fatal issue from poisoning by *Latrodectus hasseltii*."

Professor W. K. Gregory and Mr. H. C. Raven, of the American Museum of Natural History, New York, are at present in Australia with the object of studying our fauna and securing material for the projected Australian Hall in that great museum. They are making this museum their headquarters, and with characteristic energy have established a collecting camp near Ebor, in the New England district, where Mr. Raven will remain for about two months. Professor H. F. Osborn, President of the American Museum, who is deeply interested in questions of faunal conservation, instructed our visitors to impress upon the Australian public the great desirability of doing everything possible to save the unique animals of Australia from extinction, and during his short stay in Sydney, Professor Gregory found time to deliver in our Lecture Hall a delightful address on "The Australian marsupials, and why they are worth protecting," a subject on which he also addressed an influential audience in Brisbane, under the auspices of the Field Naturalists' Club. We hope to publish the substance of his lecture in our next number. Professor Gregory has now gone to Tasmania, and intends to pay short visits to Melbourne and Adelaide, returning to Sydney towards the end of August, prior to his departure for the States.

Quaint Crustaceans.

By F. A. McNeill.

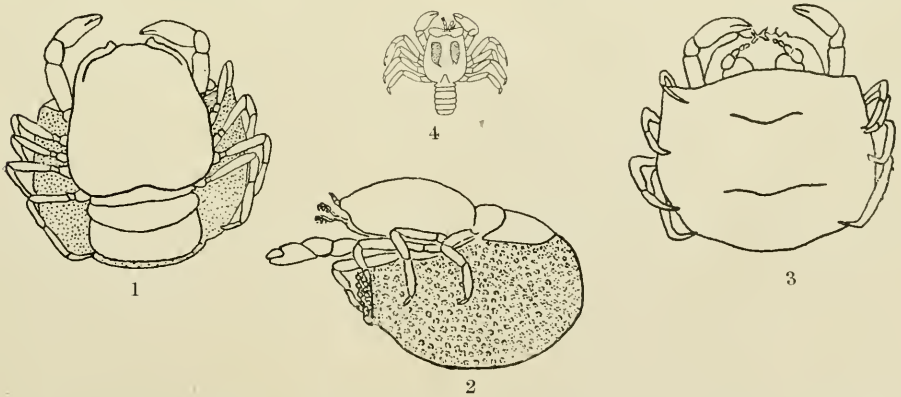
Among the less highly organised members of the various groups of animals we will often find curious and wonderful adaptations, whilst deeds of great perseverance are of no less frequent occurrence. Many of the crabs



Sargasso Crab on floating weed.
Photo—C. Clutton.

are highly specialised in these directions, and some cases are quoted below.

As an instance of how far some crabs travel, and to what extent they wander, we can take the distribution of the little Sargasso or Gulf-weed Crab and try to throw some light on this subject. As its name (*Planes*) implies, it is essentially a wanderer, being found in all warm and temperate seas, associating itself with floating inanimate objects, and is often found on the carapace or shell of large marine turtles. It never approaches land except as the result of misadventure, when it is often unfortunate enough to be cast ashore by heavy seas, and is not uncommonly found on the beaches near Sydney, together with the barnacle-covered beams or driftwood which it had selected as its ocean residence. At the mercy of the currents in the open ocean, one individual of this small species may, in all probability, circumnavigate the globe, rivalling any representative of its kind in the extent of its travels. It is recorded that the strictly pelagic habits of the Sargasso Crab deceived Columbus during the first voyage he made on the discovery of the West Indies, by convincing him that its presence on the Sargasso weed (*Sargasso bacciferum*) floating on the sea denoted the proximity of land. It is probable, however, that the great discoverer utilised the crab's presence as an argument to encourage his despairing sailors, and it was not quite so much to the point as the sailors appear to have thought it.



The Marsupial Crab; fig. 1, is a dorsal view of the female, 2½ times natural size; fig. 2 is a side view of the female, showing the pouch-like abdomen filled with eggs; fig. 3, ventral view of female to show the great lateral expansion of the abdomen; fig. 4, dorsal view of male, 4½ times natural size.

Drawing—F. A. McNeill.

Columbus had other and more satisfactory reasons for his own confidence. On account of its oceanic life, one might suppose this little creature to be one of the swimming crabs, which have specially adapted paddle-shaped limbs. This is not so; but the Sargasso Crab is

Gall on a coral colony; this is caused by the irritation set up by the female marsupial crab, which becomes enclosed in the gall.
Drawing— A. R. McCulloch.

nevertheless enabled to move freely through the water from one object to another by means of closely-packed rows of fine hairs or ciliae arranged along each border of the limbs. Another adaptation is seen in the structure of the terminal joint of each walking leg. This is triangular in shape, and is armed with hooked spines, giving the crab a foothold from which it is not easily dislodged.

MARSUPIAL CRAB.

One of the most curious adaptations and one of the strangest places of abode is seen in the case of the Marsupial Crab (*Hapalocarcinus marsupialis*), which derives its name from the likeness its abdomen bears to a pouch. This highly specialised crustacean occurs on the reefs off many parts of the tropical Queensland coast, associating itself with delicate-limbed corals. Its presence on the coral colonies is indicated by the occurrence of basket-like bulbous growths intermingled with the branches, inside of each of which may be found imprisoned a female crab. The males, on the other hand, are comparatively minute, but are active and free-living. They may often be seen clinging to the branches of the coral if this latter is withdrawn quickly from the water. In their younger stages the female Marsupial Crabs, like the males, are free-living; but they soon settle down upon some coral colony, and so irritate the living polyps that they grow abnormally, and produce the extraordinary structure which thenceforward forms the home of the crab. Its formation is largely controlled by means of certain complicated water currents set up by the breathing of the crab. By this means a safe retreat is provided for the crustacean, though the gall also becomes its prison, for the coral grows completely round it and leaves only small openings through which the water currents pass. These carry both food and oxygen to the imprisoned crab, which remains for the rest of its life within the gall. The males, however, on account of their small size, are enabled to gain access to the females by passing in and out of the openings of the galls. The young likewise escape through the same apertures.

SHELL-CASTING IN CRUSTACEANS.

Many people know that a crustacean casts its shell, but few are aware of the process by which this is accomplished. Further, it will be news to those who have not thought on the subject, that this so-called shell represents the animal's skeleton, which, unlike the skeletons of most other animals of our acquaintance, is mainly external, and encloses the soft body of the crustacean. This skeleton is composed of a hard substance called chitin, which resembles horn, and is deposited in the outer layer of the skin, where it forms a firm armour to protect the body, eyes, antennae and legs. With a little imagination, we can liken this covering to the jointed armour worn by the knights of olden times, consisting as it does of a number of plates moulded to the form of the wearer's body, and united with one another by flexible joints. But if

a knight had been placed in armour as a baby, he would have had to change his suit many times before he became a man. This applies equally to the case of the crustacean; each suit of its armour is of a definite size, and cannot be increased. As it becomes too small for the growing body of its occupant, it must be cast off and replaced by a new one, a procedure which happens many times throughout its life, when it has to undergo a highly complicated process of moulting in order to withdraw from its chitinous case.

It will be convenient to accept the moulting process of a prawn as typifying the same happening among all the other members of the Crustacean group. The young prawn periodically experiences a feeling of unrest and discomfort generally, owing to the tightening of his armour upon his growing tissues. He searches around for some secluded spot where he will be safe from the observation of his ever watchful enemies. Having found one, he secures a firm hold with his feet, and sways his body to and fro, so as to loosen the armour plating from the softer parts within. This motion causes a slit to appear between the shield covering his back and the plates of his abdomen. Through this he gradually draws his head and shoulders, bringing with them antennae and eye-stalks, legs and feet, as perfect as before, and having even their tiny spines and hairs upon them; then with a sudden jerk he pulls out his abdomen and leaves his clear transparent shell so perfect that even the coverings of the eyes, and the armoured lining of his stomach and digestive tract remain, and one might believe the real prawn stood upon the rock. The creature is now so weak that he rolls helplessly over, his soft body being so flaccid that he is scarcely able to support himself in position. At this stage he is so helpless, that if any animal were to seize upon him, he would be quite unable to defend himself. Knowing this, he strikes out as soon as he can, and feverishly works his swimmerets as they gradually stiffen and strengthen, and strives to swim or creep only in places of safety. There he stays until his new enlarged coat of armour, which has long been forming beneath the lately discarded one, hardens sufficiently to enable him to sally forth as a valiant prawn again. Such is the procedure of moulting or "ecdysis" in a prawn, which differs only in detail from that of the other members of the Crustacea.

HERMIT CRABS.

The name Hermit Crab is popularly applied to those well known crabs which have the strange habit of utilising the empty shells of Shell-fish or Molluscs for the protection of their soft abdomens. This member has no hard outer covering as in most other crabs, but the whole is quite fleshy, and would offer a tempting morsel to other hungry sea animals if left exposed to their gaze. The half-naked crab therefore hides itself within the cavity of a stolen shell, and it is so modified that it twists naturally into its spiral home. The anterior part of the body is well protected by a hard shelly armour. One of the claws is much bigger than the other, and closes the opening of the shell after the rest of the body is drawn in, barring the door against intruders. It is thus so effectually protected that it is rarely in danger, except when the crab is changing from an old shell, which has become too small for it, to a larger new one; this move is performed wonderfully quickly, the crab never leaving its old house till it has found a new one. Two formidable pairs of legs follow the large claws, and their strong, pointed, terminal joints are able to secure a firm hold of the ground when the crab is moving from place to place and dragging his weighty shell after him. The rest of the appendages are modified to accommodate the crab's body in his spiral shelly house.

Some hermit crabs are terrestrial, though they pass their earlier stages in salt water. These ordinarily, like their marine cousins, live in shells, but other hollow objects, such as a broken cocoanut, or even a cracked test tube discarded by a naturalist, have been adopted. These land hermits are often found great distances from the shore, which accounts for the presence of large marine shells high up in the hills of tropical islands.

The Welcome Stranger Nugget.

BY THE EDITOR.

The article entitled "The Lure of the Big Nugget," which appeared in the last issue of this magazine, attracted the attention of Mr. Alfred Argles, who was present when the nugget was unearthed, and in a most interesting letter he has favoured us with a detailed account of its finding. At that time he was a boy of ten, and for some time prior to the great event he had been employed "to drive the horse and turn the horse every time the bucket came up, until the horse would learn to turn himself." When lunch time came young Alfred was accustomed to take his "little porringer" and seat himself right on the spot where the great nugget was slumbering only four inches from the surface; for the top of the nugget was all quartz and showed no sign of the wealth underneath. He pathetically says in his letter: "Was it not a bit of bad luck to sit on 200 pounds of gold for a year and not know it was there"?

Before they found the nugget Deason and Oates ("big, able men") had had a "duffer" week, and there was no money in the camp to pay for the previous week's provisions. On Saturday night the storekeeper refused to supply them with any more rations, and the men were naturally depressed. But on Monday morning they went to work as usual, and presently encountered a big boulder, which raised their hopes as they made sure of finding a little gold round it. In endeavouring to turn the boulder over the miners "broke the handle of their fancy pick and swore some, for no man likes to break the handle of his fancy pick." Then they got a stringy-bark slab rail and that too broke under the strain; a long one-inch iron bar was next tried and that doubled up. But the miners' blood was up, and Deason procured a good tough pole of box, and with a mighty heave the boulder was turned over on its back and the astonished men saw that its under surface was a mass of gold. For some time Deason and Oates were so stunned that they were incapable of speech.

But their troubles were not yet over, for they had not pegged out the ground, and their miner's rights had lapsed and they had no money for renewal. In their dilemma they sought advice from Mrs. Argles, mother of Alfred, who kept a small chemist's shop in the nearby township of Mt. Moliagul, and was the local "medical man"; she happened to be on the spot on the eventful occasion, as Mrs. Deason had been taken ill on the previous Sunday. Mrs. Argles seems to have been a plucky and resourceful woman and a good general, for she quickly took command. First of all Alfred was sent to bring "the foreign photo-taker with his paraphernalia." He duly came and saw and photographed the nugget and the party. Next, Deason and Alfred Argles were instructed to go to old Ah Loo, the Chinese storekeeper, and ask him for the loan of ten shillings; Ah Loo was known to be a Chinaman of substance for he had made £2000 at the diggings. When Deason asked for the loan Ah Loo jumped up and said "Whaffor you ask me lendum money? You no deal o' me. Whaffor"? At that moment Alfred caught the Chinaman's eye, beckoned him into a little side room, and said, "Plenty big nugget, you lendum." That put a different complexion on the affair, and the now affable Ah Loo came out and said, "All li, me lendum; no care you no pay." With the ten shillings the fortunate diggers were able to provide themselves with the necessary miners' rights and so make good their title to the gold nugget.

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The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.

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THE AUSTRALIAN MUSEUM

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Table of Contents.

The Tasmanian Tiger or Wolf, as it is variously called, is the most powerful of the flesh-eating marsupials. It is restricted to Tasmania, though its fossil remains are found on the mainland. It has a dog-like form, and in its evolution it has closely parallelled the European wolf and other carnivores, its teeth in particular being similarly modified for rending flesh (see also figures of skulls in text).

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VOL. 1. No. 3. DECEMBER, 1921.

Editorial.

The Magazine.

The Australian Museum Magazine, of which this is the third number, has met with a flattering reception; the first number was sold out in a few weeks, and the second (of twice the number of copies) is at the moment of going to press almost exhausted. This shows that there is a considerable demand for a publication of this kind, and is very gratifying to the trustees. No effort will be spared to maintain, and, if possible, to raise the standard of the Magazine, which we hope will continue to obtain the public support which is essential to its continued success.

Museum Lectures.

These lectures are increasing in popularity, and are now a well established feature in the intellectual life of Sydney. From quite modest beginnings they have grown until the lecture theatre is all too small for our needs. At the regular lectures held this year the accommodation has been taxed to the utmost, and more than once we have had regretfully to close the doors and leave many would-be hearers outside. Mr. A. R. McCulloch's lecture, "Lord Howe Island; A South Sea Tragedy," was so popular that it had to be repeated.

This year we have been able to add some extra lectures to the ordinary course, and to place the Lecture Hall at the disposal of distinguished scientists from other States and countries. Dr. J. V. Danes, Consul-General for Czechoslovakia, lectured on "The Physiography of Czechoslovakia." Dr. W. K. Gregory, of the American Museum of Natural History, on "Australian Mammals and why they are worth protecting," and Captain A. S. White, of South Australia, on "The Economic Value of our Birds." It is hoped that this innovation will become a regular feature.

William Street Frontage.

Plans have been adopted for the improvement of the William Street frontage, which has been an eyesore ever since the City Council resumed part of the Museum premises for the purpose of widening the street, and the work will be proceeded with very shortly. It is proposed to erect a retaining wall along William Street, to level the ground on the northern front, and to terrace the eastern end, where also a roadway will be constructed to give access to the back of the Museum premises. When the work is completed it will enhance the appearance of the building, and also improve the lighting and ventilation of the basement rooms.

Electric Lighting.

The north wing is very badly lighted, particularly on the ground and first floors, where on a dull day the exhibits are seen to very poor advantage. It

is now proposed to instal electric lighting in these rooms, and also in the Lecture Hall, where its introduction will be a great boon. At the same time the lion group and the Antarctic tableau will be electrically lighted, with, it is hoped, a great increase in effectiveness.

Collecting.

Recognising that closer settlement is slowly but surely depleting our native fauna, and that our collections are still sadly deficient in material suitable for modern study, the trustees have wisely decided that the Museum should take a more active interest in field collecting. In furtherance of this policy Messrs. E. Le G. Troughton and J. H. Wright have been sent to South and Western Australia to obtain specimens of some of the rarer Australian mammals and birds, and Messrs. H. S. Grant and J. H. Wright will subsequently proceed to the Recherche Archipelago, south of Esperance, Western Australia, with an expedition led by Mr. A. F. Basset Hull, who is collecting and observing on behalf of Mr. H. L. White, of Belltrees, New South Wales. It is a pleasing duty to express our appreciation of the public-spirited action of Mr. Anthony Hordern, who has kindly made available part of the Hordern and Le Souef Research Fund to help in defraying the expenses of our officers while collecting in Central Australia, and of Mr. White, who generously invited the trustees to send two collectors to accompany the Recherche Expedition.

Nearer home some field work has also been done within the last few months. Mr. A. Musgrave spent some days at Upper Chichester, near Dungog, collecting mammals and insects, and Messrs. C. Hedley and J. R. Kinghorn joined the Royal Australasian Ornithologists' Union in their annual "camp out" at Wallis Lake, near Tuncurry.

By the kindness of Mr. E. B. Harkness, Under-Secretary Chief Secretary's Department, and Mr. A. P. Summergreene, manager of the State Trawling Industry, Messrs. F. McNeill, A. Livingstone, and H. O. Fletcher, have at different times accompanied one of the State trawlers on its cruise, and have thus been able to secure valuable material for our collections.

Museum Groups.

The Museum staff have been busily engaged for some time past in preparing groups for exhibition. A flying fox group is nearing completion; a large number of these bats will be shown clinging in characteristic attitudes to the branches of a tree.

Another interesting exhibit will be a pool showing the celebrated lung fish (*Neoceratodus*) of Central Queensland; a number of casts of this interesting fish have already been prepared by Mr. C. Clutton, and these will be coloured from studies made on living specimens.

Early in January some members of the staff will proceed to Lord Howe Island to obtain the materials and make the necessary sketches for a coral reef group, and a cliff scene with nesting boatswain birds and wide-a-wake terns. Mr. A. E. Phillips has generously promised a donation of £20 towards the expenses of this expedition, if four others will present a like amount; Sir James Burns, trustee, has, with characteristic generosity, agreed to make one of the four.

Need of Funds.

It is with peculiar pleasure that I have referred to the generosity of these various donors, for, though we are indebted to many kind friends for valuable donations of specimens, notably the Hargraves collection of shells presented by Mr. Thomas Walker in 1877, never before have we received any private benefactions for collecting, which is the very life of a museum. In America, where they do these things much better, the expenses of collecting expeditions are almost invariably borne by private benefactors, and at the present time two American museums have experienced collectors in Australia, who are doing remarkably good work. The Australian Museum is embarking on new enterprises, of which this magazine is one, and increased activity in collecting is another; for these purposes funds are required, and we confidently look to Australian citizens of means for help.

Australian Mammals and why they should be protected.

By Dr. W. K. Gregory.

[Dr. Gregory, who is Curator of Comparative Anatomy in the American Museum of Natural History, and Associate Professor of Palaeontology in Columbia University, New York, came to Australia this year, accompanied by Mr. H. C. Raven, in order to obtain by exchange and field collecting a typical series of Australian mammals, to be displayed in the projected Australian Hall of the American Museum. Acting on instructions from President H. F. Osborn, Dr. Gregory lost no opportunity of impressing upon Australians the necessity for protecting their unique and fast disappearing mammalian fauna, and, with this object in view, he delivered a lecture at the Australian Museum, the substance of which is reproduced in this article.]

The preservation of animals may be urged because of their beauty, their scientific interest, or their utility, and there are few indeed which have not some claim to protection on one or other of these counts. I shall not deal with Australian mammals as regards their economic importance, although a plea might well be advanced for their protection on that ground. An enormous number of marsupial skins are marketed every year in Europe and America; at one sale in St. Louis, the great fur mart of the United States, half a million skins of Australian 'possums were offered, and the Queensland Minister for Agriculture has said that in 1919-1920 no fewer than five and a quarter million 'possums and a million native bears were slaughtered in Queensland. If this slaughter continues these poor animals will be exterminated. Of course, there are other factors which are partly responsible for the depletion of the indigenous fauna of Australia, for foxes, bush fires, and poisoned baits are all doing their deadly work. This appalling waste is neither necessary nor inevitable if proper means are taken to prevent it. There is a saying that "You cannot eat your cake and have it too," but, in the case of a timber forest or a country full of fur-bearing animals, you can in a sense do both; you can draw your annual tribute of timber or of furs and yet preserve the trees and animals for future generations. The annual value of the furs procured from the wild animals of Australia is very considerable, but, if the animals are reduced in numbers almost to the vanishing point, no more income can be derived from that source.

But my main object is to show why these animals are worthy of protection from a scientific point of view, and to do this it is necessary to discuss some of the outstanding characteristics of the Australian mammalian fauna.

Mammals, in general, that is the four-footed animals which are covered with hair and suckle their young, are divided into three groups, the Monotremes, the Marsupials and the Placentals; the placentals, such as the dog, horse, and ape, form the largest group of existing mammals, and everyone is familiar with their principal features. They are the characteristic mammals of extra-Australian lands, but, with the exception of stragglers like the dingo, a few bats, rats and mice, no placental mammals are native to Australia.

THE MONOTREMES.

These are entirely confined to Australia and New Guinea, where they are represented by the duck-billed platypus or *Ornithorhynchus* and spiny anteaters or echidnas. These are the only mammals

The Echidna or Native Porcupine is able to burrow rapidly and so hide from its enemies. With the Platypus it forms the most primitive group of mammals extant.

Photo.—G. C. Clutton.

which still lay eggs, a very ancient method of bringing forth young, which was probably at one time characteristic of all back-boned animals. In spite of this old-fashioned custom of theirs the monotremes suckle their young and are therefore true mammals. The fur of the platypus is very valuable, but, as it is an aquatic animal, and very alert, and is, moreover, stringently protected, it is probably in no immediate danger of extinction; nor is the echidna, which is well defended by its sharp spines, and is not useful in any way, although to the blackfellow it is an article of diet. Were these two animals to become extinct the whole scientific world would be filled with keen regret, but, as Grant Allen says in his sprightly verse:—

Although in unanimous chorus
We mourn that, from ages before us,
No single *Enaliosaurus* to day should survive,
Yet joyfully may we bethink us,
With the earliest mammal to link us,
We still have the *Ornithorhynchus*,
Extant and alive.

MARSUPIALS.

These, exemplified by the kangaroo, wombat, bandicoot and many others, form the second great group, and, as their name implies, they are provided in the female with a pouch or *marsupium* in which the young are carried. Marsupials are the distinctive Australian mammals, and, except for the American opossums and the highly interesting *Caenolestes* of South America, they have no surviving relatives. In past geological ages the members of this primitive order were more widely distributed, but, with the rise of a more modern mammalian type, better equipped for the battle of life, they gradually dwindled. They crossed into Australia while that continent was united to, or at any rate less widely separated from, the rest of the world than it is now, and, as the bridge by which they came was submerged before the higher types could follow, they have found sanctuary in Australia and its adjacent islands from the fierce competition which all but exterminated their kind in other countries. Thus Australia became a marsupial preserve.

BIRTH OF THE MARSUPIAL.

One striking difference between marsupials and the higher mammals lies in the fact that the young marsupial is born in a very helpless immature condition. A full-grown kangaroo may be six feet in height, yet its new-born young is no larger than one's thumb. As soon as it is born the tiny creature becomes transferred to its mother's pouch, where it becomes firmly attached to a teat and remains there perhaps for months. The manner in which this transference is effected is still under discussion. It has been observed that the young of the Virginian opossum are born with abnormally long fore-legs, armed with sharp claws, by means of which they crawl up their mother's body and enter the pouch. The same thing is probably true of the kangaroo, for its young also has elongated fore-limbs armed with claws which are absent on the toes of the hind feet.

A newly-born Great Grey Kangaroo, attached to a teat in its mother's pouch. Its fore limbs are abnormally long and provided with claws which are wanting on the weaker hind limbs.

Photo.—G. C. Clutton.

ADAPTIVE RADIATION.

In nature there are a number of niches or particular conditions of life which are suitable for such animals and plants as have become adapted for them. Every

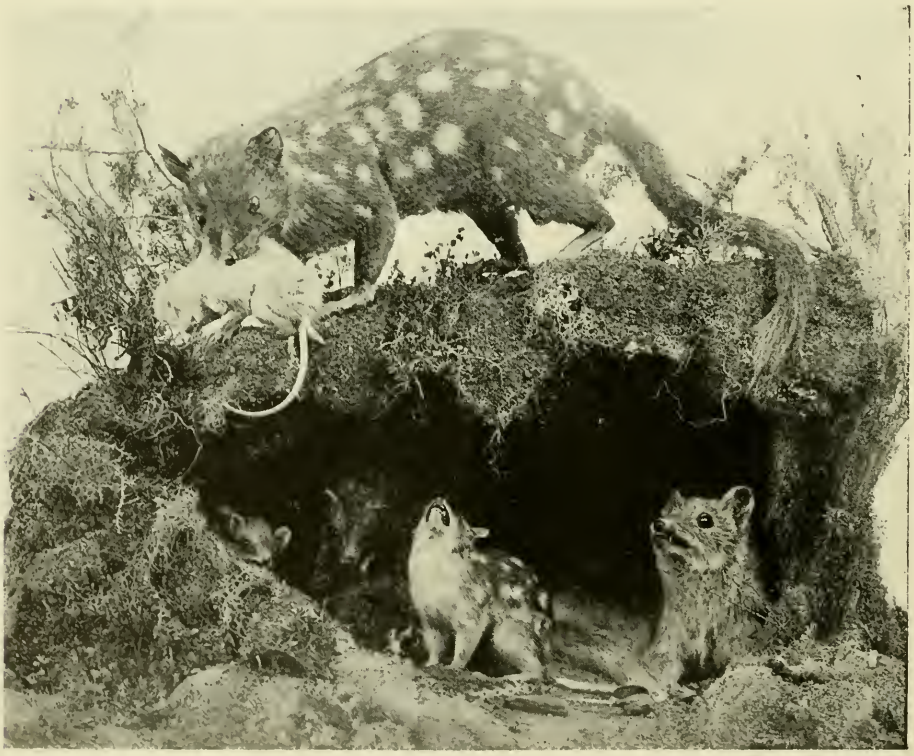
Young Native Bear or Koala; an expert tree climber, though rather slow of movement.
Photo.—G. C. Clutton.

animal class has its modest beginning, mostly in the distant geological past. Thus the earliest mammals were probably insect-eaters, and were provided with sharp needle-like teeth, adapted for piercing the integument of insects and the bodies of worms. But as time went on these primitive mammals branched out in various directions and occupied different "spheres of influence," each group becoming adapted for a specialised mode of life. Thus some took to the water and became modified for an aquatic existence, others got the habit of climbing trees and became arboreal like the squirrels or the native bear, still others became burrowers. Others again acquired long legs and became swift runners, like the northern wolf or the Tasmanian tiger. With these changes in the mode of progression were associated changes in the teeth and the digestive system. Animals which live on grass have the grinding type of teeth with broad crowns, like those of the horse and the cow, while the flesh-eating animals, carnivores like the wolf and the lion, have long, sharp teeth with which to grasp their prey, and cutting teeth to tear the flesh from the bones of their victims. Before mammals had become the dominant race, the reptiles, which were then the lords of creation, had developed in just the same manner, and in just the same directions as the mammals of to-day. There were grass-eating reptiles, which occupied the place of the herbivorous mammals, there were carnivorous reptiles, the lions and tigers of their day, huge reptiles wallowed in primeval rivers like the present-day hippopotamus, and still others roamed the ocean like our whales and dolphins. In this connection one may say with truth that nature abhors a vacuum and fills it with such material as is available. This modification of one class of animals to fit into various environments is what is meant by adaptive radiation, and it is because the marsupials illustrate this great principle in such a wonderful manner that they are so interesting, and important to the zoologist and student of evolution.

Banded Ant-Eaters are primitive animals of great zoological interest, which are rapidly nearing extinction.
Photo—A. Musgrave.

The Tasmanian Devil is a most ferocious animal; it is a flesh-eater and is restricted to Tasmania.

Photo.—G. C. Clutton.



The ravages of Native Cats are well-known to breeders of poultry. This picture shows a mother bringing home a native rat to her half-grown young.

Photo.—G. C. Clutton.

MARSUPIAL TYPES.

The primitive insectivorous type is represented by the marsupial mole (*Notoryctes*) and the banded anteater (*Myrmecobius*). The native cat, the Tasmanian devil and Tasmanian tiger are carnivorous. If we examine the skull and teeth of the latter we find that they are perfectly adapted for a flesh diet. The teeth at the side of the mouth have a shearing blade and the canines are long and sharp. The 'possum represents another line of development, having molar teeth with conical cusps suited for the mastication of leaves and fruit. The kangaroo again is a typical grass eater, the upper teeth having sharp ridges which alternate with corresponding ridges in the teeth of the lower jaw. Then we have forms like the wombat in which the teeth are adapted for cutting up tough stalks of grass and woody tissues.

The Marsupial Mole closely resembles the European Mole in its general form and in the modification of its limbs, which are adapted for burrowing. It is confined to the desert regions of Central Australia.

Photo.—G. C. Clutton.

In their locomotor apparatus the marsupials exhibit similar adaptive radiation. We have the little running forms such as the marsupial mice, from which we pass upwards to the native cats and the Tasmanian wolf. Then there are the hopping types, like the kangaroo rats and the kangaroo, which presents the extreme example of an animal that progresses by leaps and bounds. Burrowing forms are represented by the bandicoot, the wombat, and, best of all, by the pouched mole found in the desert regions of Central Australia; it has a conical body, a sharp nose, very small eyes, and limbs admirably adapted for progress underground. There are many tree-climbing types like the 'possums and so-called squirrels, culminating in forms which take long leaps from branch to branch, and have developed folds of skin on the sides of the body which enable them to skim through the air like kites.

Being a placental mammal the European Mole is not even a distant relative of the Australian Marsupial Mole.

Photo.—G. C. Clutton.

The 'Possum, slaughtered in millions for its valuable fur, is representative of the tree-climbing types.
Photo from Life—G. C. Clutton.

PARALLELISM IN DEVELOPMENT.

In other lands the various life spheres are occupied by distinct orders of mammals; thus the grass-eating mammals form one order, the flesh-eaters another. But in Australia the single marsupial order has been adapted in the most marvellous manner for the most diverse roles, so that the distinct orders of the old world are parelleled in Australia by various modifications of the one order available. Thus the kangaroos and wallabies may be regarded as the Australian representatives of grass-eaters such as the hoofed mammals, while the native cats, Tasmanian devil, and Tasmanian wolf parallel the cats, dogs, and bears of other countries.

Animals which have similar modes of life develop a similarity in form; no better example of this can be instanced than the striking resemblance in *outward form* between a whale and a fish. Now when we compare marsupials with parallel forms among placental mammals we find some very remarkable resemblances, as is clearly indicated by the names given to the native fauna of Australia by the early settlers, who were so struck by their similarity to the animals with which they had been familiar at home. The marsupial mouse so strongly resembles the common house mouse in outward appearance that it seemed perfectly natural to regard the two as close relatives. Yet the common mouse is a placental, and is more closely related to the giraffe than to the marsupial mouse, which, on the other hand, is a near relative of the kangaroo and the native bear, as is clearly seen from its skeletal and anatomical features. So the Tasmanian wolf presents a strong similarity to the northern wolf, because its mode of life and method of procuring and dealing with food is the same, yet in its internal structure it is closely allied, not to the common wolf, but to the pouched mouse, the marsupial mole and

The Ring-tailed 'Possum builds a nest or drey of twigs and ferns.
Photo.—G. C. Clutton.

other marsupials, although externally it may resemble them very little. Again the wombat might on outward appear-

Flying Squirrels, marsupial and placental. Both have membranes between their limbs to enable them to take long flying leaps from tree to tree. But though so similar in appearance the Australian form (left) has no affinity with the American (right).
Photo.—G. C. Clutton.

ance be classed with the beaver; it has the same stocky build and both are good gnawers and diggers. Comparing their skulls we find that in both the front teeth are reduced to two in each jaw, one on each side; these teeth are chisel-like, grooved, and placed so that they form an arc with the lower jaw. Moreover, in both these teeth lack roots, so that they grow continuously throughout the life of the animals, and no amount of grinding reduces them. Then in both we find a wide space between the front teeth and the succeeding teeth on each side of the jaws, an arrangement which is probably useful in allowing the animal to manipulate its food, turn it over with its tongue, and pass it back to the cheek teeth. But in spite of these striking similarities in their dental apparatus there is no difficulty in distinguishing the skull of the wombat from the skull of any placental. For example, the roof of the mouth, the hard palate of placen-

Marsupial mice are insect-eaters and do not gnaw as does the house mouse. It is supposed that the earliest marsupials which found their way into Australia were of this type.
Photo.—G. C. Clutton.

tals is entire, but in marsupials it is pierced by two openings. And the lower jaw in practically all marsupials (*Tarsipes* is the only exception) has a pronounced inward bend to the lower border. There are many other anatomical differences which distinguish marsupials from placentals; thus in marsupials the brain is simpler than, and not so wrinkled as that of higher mammals, and there are marked differences in the reproductive systems of the two groups.

Again, if we examine the spiny anteater of New Guinea, we find that it has a long slender snout, a feeble lower jaw and no teeth; it has a long protusible tongue which it uses to lap up the ants which form its staple diet. In these particulars it strongly resembles the great anteater or ant bear of South America, but in internal structure it is wholly unlike that animal, and reveals its close relationship to the other monotreme, namely the platypus.

The Wombat has much in common with the Beaver. Both gnaw and dig and have evolved the same general form, but they are nevertheless descended from quite different ancestors. Photo.—G. C. Clutton.

HABITUS AND HERITAGE.

When two animals belonging to different groups have acquired a similar appearance because of their adaptation to similar modes of life we say they have the same *habitus*. And when we find that they differ fundamentally in structure, that their class characters are unlike, and that the sum total of their features necessitates their being placed in different groups, we say that they differ in *heritage*. Thus the marsupial heritage is revealed by the presence of a pouch, by the perforated palate, by the other characters common to marsupials and not found in other mammals. These are the features which indicate the true relationships of animals, while the habitus characters tend to obscure the true relationships. Thus when Australian mammals were first made known to the world by Captain Cook's voyages, the naturalists of the time were misled by their superficial resemblance to well-known animals, and the kangaroo, for

The Beaver, being a water dweller has developed a large paddle-like tail. Photo.—G. C. Clutton.

Skull of a Wombat (upper figure) and a Beaver (lower figure) showing similar structure and arrangement of their teeth.
Photo.—G. C. Clutton.

example, was classed with the jerboa, the wombat with the beaver, for that seemed to them to be a natural classification. Closer examination revealed, however, that, in spite of the great diversity displayed by the marsupials, they all belong to a single great group with identical heritage characters, and that this great group is sharply marked off from the placentals. That is, the Australian marsupials are the diversified descendants of a common ancestral type, which is believed to be represented by the small mouse-like forms.

Skull of a Tasmanian wolf (left) and a European wolf (right) showing general similarity in their teeth; the former can be recognised as marsupial by the two perforations in the palate.
Photo.—G. C. Clutton.

Lower jaw of a Wombat, showing the inward bend (marked with a cross) which is a distinctive mark of marsupial heritage.
Photo.—G. C. Clutton.

In conclusion I would impress upon my readers that the mammalian fauna of Australia is the most uncommon, and perhaps the most interesting in the world. It is a link with the past, and shows affinities with the primitive mammals of the remote times when the lordly reptile was monarch of all he surveyed. Because of this, and because of the wonderful manner in which they illustrate the great principles of adaptive radiation and parallelism in development, surely it is our duty to save the

Cape Jumping Hare, a placental hopping mammal resembling the Rat Kangaroo in outward form and limbs.
Photo.—G. C. Clutton.

The Rufous Rat Kangaroo is a representative of the hopping type of marsupial; this species builds a nest of grass.
Photo.—G. C. Clutton.

Australian mammals from extinction and preserve them for the scientific men and students of future generations. Who would not rather see one kangaroo bounding tremendously over the plain than a hundred kangaroo skeletons or skins in a museum?

[The photographs in this article, when not taken from life, are from specimens in the Australian Museum].

Numismatic Exhibit.—Two cases containing a comprehensive collection of medals, seals, and medallions, have recently been placed on exhibition in the entrance hall. The contents include war medals and war-time badges, exhibition award and commemorative medals.

Visit of an Archaeologist.—Captain H. W. Murray, F.S.A., of Surrey, England, who was recently on a visit to Sydney, spent some time in the Museum examining the ethnological collections, in which he is keenly interested. He has now left for England, but hopes to return to Australia.

Osteological Students.—Dr. A. N. Burkitt, Lecturer in Anatomy at the University of Sydney, has been studying the dentition of man and other animals, and has made extensive use of our osteological collection. Miss H. T. Stephens and Miss E. Thomas, students in Science and Medicine at the University, have also found the Museum collection of skeletons very helpful in their studies.

War Canoe.—The Solomon Islands War Canoe presented to the Museum by Mr. Harry Wickham, of Roviana, has now been placed on view in the Melanesian gallery, where, slung from the roof, it forms an imposing exhibit. The canoe, which is a magnificent example of native boat-building skill, is forty-six feet in length, with a beam of three feet seven inches, and is seated for twenty-two rowers. It is inlaid with pearl and nautilus shell, and highly ornamented with shells and feathers. It was necessary to pass the vessel in through a window on the first floor, a task which involved much ingenuity and hard work. Mr. J. H. Wright, assistant Taxidermist, formerly of the Royal Navy, planned and supervised the carrying out of this work with great skill and success.

Solomon Island Exhibit.—A table case has recently been installed in the Melanesian room to accommodate some of the smaller objects from the Solomon Islands, such as personal ornaments, lime boxes, and examples of shell currency.

Some Famous Diamonds and their Story.

By the Editor.

Probably few of our readers have ever seen a diamond weighing more than a few carats; large diamonds are either the property of monarchs or are jealously guarded among the treasures of the world's millionaires. But all of us may inspect glass models, which, though they lack the fire of the originals, faithfully represent them in size and shape, and, approximately at least, in colour. A collection of such models is exhibited in the Museum, and in this article an attempt is made to sketch the stirring history of some of the more famous diamonds counterfeited in the collection. Truth is stranger than fiction, we say, and even the writers of *fiction,* sadly lacking in a sense of humour, often use this trite phrase in relating the imaginary events of their romances. Certainly the tragic happenings narrated by Wilkie Collins in *The Moonstone,* or by Arthur Morrison in *The Green Eye of Goonah* are not more strange than the real adventures which make up the history of such diamonds as the Kohinoor or the Hope Blue. The beginning of the story is usually shrouded in mystery. We know not where, or when, or by whom, the diamonds were found; they appeared like meteors and flamed across the pages of history leaving a trail of blood and ruin in their wake. Most of them, like the sun, took their rise in the east, for, up to the beginning of the eighteenth century, India was the only known source of diamonds.

THE MOUNTAIN OF LIGHT.

Perhaps the best known of all diamonds is the Kohinoor, which we first hear of in the fourteenth century. It had been held as an heirloom in the family of the Rajahs of Malwa from time immemorial, and when, in 1304, the reigning Rajah was defeated by the Sultan, Alaeddin, it became the spoil of the conqueror. In 1526 it is found in the possession of Sultan Baber, a direct descendant of the warlike Tamerlane, and the founder of the Mogul Empire. It remained the property of the Mogul dynasty until the invasion of India by the Persian conqueror, Nadir Shah, in 1739. The terrible Aurungzeb was the most powerful of the Mogul emperors, and it is related that the Kohinoor, which, however, was not yet known by that name, formed one of the eyes of the peacock in his famous peacock throne at Delhi, which was the capital. Delhi was sacked by the Persian invader during the reign of Mohammed Shah, the last of the Moguls. The conqueror was very anxious to possess himself of the famous gem, but the luckless Mohammed was just as anxious to retain it, and Nadir's efforts to secure it were baffled for a long time, until one of the faithless ladies of the harem revealed its hiding place in the folds of Mohammed's turban. It is said that Nadir, on first seeing the splendid stone, exclaimed, "Koh-i-nur," that is, ("Mountain of light"), and the diamond has been known by this name ever since.

At Nadir's death the Kohinoor became the property of Shah Rokh, to whom it brought nothing but misfortune. However, he clung desperately to his treasure, enduring the most fiendish tortures, even blinding, rather than part with it. In 1751 he concluded a treaty with Ahmed Shah, founder of the Durani Afghan dynasty, and made the fatal gem over to him. Its possession proved disastrous to the Durani line, and it subsequently became the property of Runjit-Singh, the "Lion of the Punjab," who removed it to Lahore. There it remained till the Punjab was annexed by Britain in 1840, when it was confiscated by the East India Company and presented to Queen Victoria the following year, since when it has remained one of the British crown jewels. The story is told that Lord Dalhousie, the then Governor-General of India, who took charge of the diamond for trans-

*A carat is now fixed at 200 milligrams and 1 oz. avoirdupois is equal to 141¾ carats about.

mission to England, was so absent-minded that he carried it in his waistcoat pocket for six weeks, and then discovered it only by accident.

When it came into the possession of Queen Victoria the Kohinoor weighed 186 carats, and was unsymmetrical in shape, with one or two flaws. It was recut, some judges say very injudiciously, and now weighs 106 carats.

THE PITT DIAMOND.

The Regent or Pitt diamond has a story as romantic as that of the Kohinoor. It is believed to have been discovered by a slave in the Parteal mines on the Kistnah River in 1701. According to one account the finder cut a hole in the calf of his leg, concealed the gem in the wound, and so escaped with it to the coast. There he met an English skipper, who bought it from him and promised to carry him to a free country. But the faithless sailor, having secured the diamond, threw the slave into the sea and that was an end of him. The skipper afterwards sold the stone to a diamond merchant named Jamchund for £1000, squandered the money and then hanged himself, a victim of remorse and *delirium tremens*. Jamchund disposed of the diamond, for £20,000 to Thomas Pitt, Governor of Fort St. George, an ancestor of the famous Earl of Chatham. Pitt brought the stone to England and had it cut into a brilliant weighing 136¾ carats, but, while it was in his possession, he was a miserable man. He was openly accused of having obtained it by foul means, and was obsessed by a morbid fear of being murdered and robbed of the diamond. He skulked about, often in disguise, and never slept twice under the same roof. In 1717 he sold it to the Duke of Orleans, Regent of France, for £135,000, and it thus became one of the French Crown jewels. At the revolution the French regalia, including the Pitt diamond, now known as the Regent, were placed in the Garde-meuble, whence they were stolen in 1792. An anonymous letter was afterwards received by the Commune, describing the place where some of the purloined treasures would be found. A search was made at the spot in the Champs-Elysees and there the Regent and other valuables were discovered. Napoleon wore the Regent in the pommel of his sword of state, and, it is asserted, at one time pledged it to the Dutch Government as security for a loan. It was subsequently exhibited in the Louvre, but in 1903 it was offered for sale at an upset price of £480,000.

THE HOPE BLUE.

Perhaps of all diamonds that now known as the Hope Blue has the strangest and most tragic history. Practically all who have owned this gem have suffered; some lost life itself, others reason, fortune, or happiness. Why should the mere possession of this stone bring misfortune? Or is it all coincidence? We know nothing of the early history of the Hope, but it was probably brought from India by Tavernier, a celebrated French traveller and gem collector, who made several journeys to the east and had a keen eye for valuable diamonds. It is said that Tavernier stole the gem from a Burmese temple, where, as usual, it formed one of the eyes of an idol. In 1688 he sold it to Louis XIV., King of France. It was then pear-shaped, and weighed 67½ carats. It was occasionally worn by ladies of the French court, and always brought them ill-luck. Marie Antoinette, who afterwards perished by the guillotine, wore it to a grand ball at the Tuileries. The Princess de Lamballe, who sometimes borrowed it, was killed by a Paris mob. It was stolen along with the Regent and the rest of the regalia in 1792, but, unlike the Regent, it was not recovered. We hear then of a splendid blue diamond, evidently Tavernier's Blue, in the hands of an Amsterdam cutter, Nicholas Fals, from whom it was stolen by his son. Fals was ruined, and his son committed suicide, after giving the stone to Francis Beaulieu. Beaulieu took it to London, and, when in the last stages of destitution, sold it to Daniel Eliason, dying of starvation next day. In 1830 Eliason sold it for £18,000 to Henry Thomas Hope, of Deepdene; it thus became the entailed property of the Hope family, and has since been called the Hope Blue. Its present weight is 44½ carats, and

current opinion regards it as the larger half of Tavernier's Blue, which had been cut, perhaps by Fals. What became of the rest of the original stone is uncertain.

It descended to Lord Francis Hope, who in 1894 married the well-known actress, May Yohe. Their union was not a happy one, for Lady Francis deserted her husband, who divorced her in 1902. In 1901 Lord Francis sold the Hope to Lord Sholto Douglas, a member of the ill-fated Queensberry family, who wanted it for his pretty wife, the dancer, Loretta Mooney, whom he met at a Texan mining camp. But the new owner did not have it long, for, ruined by his wife's extravagance, he was forced to sell the gem. It is not easy to disentangle the threads of this fateful diamond's history during the next few years; it comes to the surface now and then as the temporary property of some unfortunate, only to disappear again in a cloud of rumour. It was owned for a time by Jacques Colot, a Paris broker, who became insane and shot himself. The next owner seems to have been Prince Kanitovsky, who lent it to Lorens Ladne, a beautiful actress of the Folies Bergères—and shot her from a box the first night she wore it. Then it was owned by a Greek, Simon Montharides, and he, we are told, was thrown over a precipice with his wife and children and killed. It then came into the possession of Abdul Hamid, Sultan of Turkey, and continued its baleful career. The Sultan's favourite, Salma Tubayba, was wearing it on her breast when the Young Turks broke into the palace, and she was shot dead by her master, the bullet narrowly missing the diamond. Abdul was deposed in April, 1909, and the diamond apparently passed into the possession of a dealer named Habib. He sold it in Paris for £16,000 in June, 1909, and, in November of the same year, he was drowned in the wreck of the French liner *La Seyne*. The ship's safe was recovered by a diver, as it was wrongly believed that the Hope diamond was still in Habib's possession. In November, 1910, it was in America at the New York branch of the French firm of Cartier, who sold it to Mr. Edward B. Maclean, of Washington, and it is apparently still in his possession. The new owner has not escaped the evil influence of the gem, for, shortly after it came into his possession, his five-year-old child, the "billion dollar baby," was knocked down by a motor car and killed.

THE SANCY.

The history of this diamond is so confused that it is difficult to separate fact from legend. It was probably first brought from the Orient by Nicholas Harlai, Seigneur de Sancy, Ambassador at the Ottoman Court, where he purchased it about 1570. It is described as originally almond shaped, facetted on both sides, and its weight is given as 53½ carats. From de Sancy the diamond was borrowed by Henry IV of France, to enable him to raise money for the hire of a body of Swiss mercenaries. But the messenger carrying the gem to the King disappeared, and, after some time, it was discovered that he had been waylaid and assassinated. De Sancy, who had great confidence in the honesty and resourcefulness of his emissary, proceeded to the scene of the crime, discovered and disinterred the body, and found the diamond in the stomach of his faithful servitor, who had swallowed it to prevent its falling into the hands of the robbers. It was then sold to Queen Elizabeth, somewhere between 1590 and 1600, and thus became for a time one of the English Crown jewels. James II sold it for £25,000 to Louis XIV of France, about the year 1695. Louis XV. wore it as a hat ornament at his coronation. It was stolen in 1792, but turned up again in 1828, when it was sold by a French merchant to Prince Demidoff, of Russia. In 1865 it was purchased from the Demidoff family by a London firm acting for Sir Jamsetjee Jeejeebhoy, of Bombay, and once more returned to the land of its origin. It was again offered for sale in Paris in 1867, and was bought by the Maharaja of Patiala. On his death it resumed its wanderings, and in 1906 it was reported that William Waldorf Astor presented it to Mrs. Langhorne Shaw on the occasion of her marriage to his son, Waldorf.

THE ORLOFF.

The Orloff is first heard of in the beginning of the eighteenth century, when a grenadier, a deserter from the Indian Army of France, stole it from a temple in Mysore. He fled with his spoil to Madras, and there sold it for £2,000 to an English sea captain. The purchaser carried it to London, and disposed of it for £12,000. It was subsequently bought by Prince Orloff, and presented by him to Catherine II of Russia, in the hope that he might be restored to her favour. It remained among the Russian crown jewels until recently. Where is it now? It weighs 193 carats, and has the shape, and is about the size of half a pigeon's egg.

THE GREAT MOGUL.

This stone was described by Tavernier, who saw it at the Court of Aurungzeb, in 1665. He puts its weight at 280 carats, but states that it had been cut from a rough stone weighing 787½ carats. It had the shape of an egg cut in half, thus resembling the smaller Orloff diamond. Its subsequent history is entirely unknown, though attempts have been made to identify it with the Kohinoor and the Orloff. It has either been wholly lost or cut into several smaller stones.

THE LARGEST DIAMOND.

The Cullinan, though its history has, so far, been prosaic enough, has the distinction of being the largest diamond known; in its rough state it weighed 3,025¾ carats, about 20 ounces troy. It was found in January, 1905, in the Premier Mine, Transvaal. The mine manager, Frederick Wells, was, late one evening, descending a jagged slope in an open working when he saw a corner of the huge diamond projecting from the surface. He dug it out with his pocket knife, and, entering the office of the company, he handed the diamond to the general manager, McHardy, who was sitting with the president, Mr. T. M. Cullinan, inspecting the day's yield of diamonds. We can imagine their astonishment. The stone was taken to Pretoria, where it was exhibited to the public for several days, subsequently being sent to the London office. For two years it lay in the London and Westminster Bank, its enormous size making a sale impossible. Finally, at the instance of President Louis Botha, it was purchased by the Transvaal Government for £200,000, and presented to King Edward, as a recognition of his Majesty's grant of a constitution to the Colony. The Cullinan was cut by the Amsterdam firm of Joseph Asscher and Company, the process taking nine months. It was cut into a drop brilliant weighing 516½ carats, another of 92 carats, square brilliants of 309 and 62 carats, and about one hundred smaller stones, all without flaw and of the finest quality. The united weight of the gems cut from this marvellous diamond is 1,050 carats. Experts value them at a million pounds.

In October, 1919, another large diamond weighing 1,500 carats (about half the weight of the Cullinan) was unearthed at the Premier Mine; it is thought that this once formed part of the Cullinan, which was not a complete crystal, one side showing a cleavage surface.

Artists at the Museum.—Artists and art classes are frequent and welcome visitors to the Museum. Miss Dora Olfsen, the well-known sculptress, worked for some weeks in our shops, preparing models of typical Australian animals which will be reproduced as statuettes. An art class from the Technical College under the leadership of Miss R. Blakemore makes weekly visits during the session for the purpose of painting Australian birds, and the devotees of commercial art find in our collections material which can be used in their work. The students of the Sydney Art School have made extensive use of the skeletons exhibited in the Osteological Gallery.

A Naturalist on the Great Barrier Reef.

By E. A. Briggs, B.Sc.

Lecturer in Zoology, University of Sydney.

My trip to the Great Barrier Reef of Australia was undertaken for the purpose of studying the marine life of this fascinating area of reefs and shallows, of islands and lagoons. Among these interesting places I spent a considerable time examining and noting the habits of the many curious animals which comprise the heterogeneous life of these reefs.

The Great Barrier Reef is one of the most interesting areas of recent land growth in the world. The gradual subsidence of the Queensland coast, and the gradual spreading of the coral rock over the sinking continental shelf has led to the formation of a huge deposit of limestone which extends from the neighbourhood of Torres Strait along the north-east coast of Australia for a distance of 1,250 miles. This immense barrier, built up by the activities of countless myriads of coral polyps, is not an uninterrupted wall, but is deeply scored in many places by channels and passages, which, in some cases, are wide outlets to the vast expanse of the Pacific.

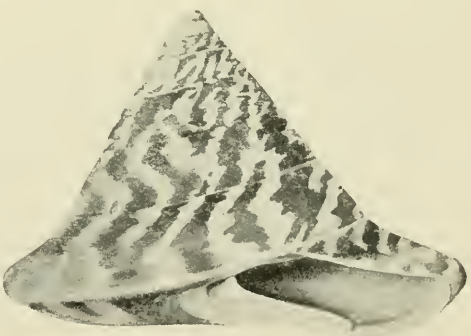
The distance from the mainland to the outer edge of this great chain of reefs varies from ten to thirty miles near its northern extremity. As we follow the reefs to the southward we find the outer edge of the barrier gradually creeps away from the Queensland coast until south of Cairns it is 40 to 60 miles from the mainland. Still further south the barrier extends rapidly to the east, and finally breaks up into a series of isolated reefs and small islands, the outermost of which are some 150 miles distant from the Queensland coast. The area within the barrier is thickly studded with islets, reefs and sand-banks, all of which offer a happy hunting ground to the naturalist.

This great accumulation of coral does not form a high barrier above the surface of the sea, but produces a series of detached reefs, which are perched on the huge bulk of the coral rock, and in many cases appear only at low tide. Here is a shallow, warm-water sea, where many important industries have arisen, such as pearl-shelling, bêche-de-mer gathering, and turtle-fishing, only to languish again owing to the unrestricted conditions under which they were allowed to be carried on. As a result of over-fishing the animal life on the reefs very soon became so depleted that it was impossible for the various industries to be conducted at a profit.

At present the reefs from Torres Strait southward to Port Mackay are being extensively fished over for Trochus shell, and, unless legislation is introduced to prevent the gathering of the smaller shells, we shall soon see the tragedy which befell the pearling industry and the bêche-de-mer fishery enacted all over again.

SHELLS AND BUTTONS.

The trochus shell (*Trochus niloticus*) which is like a gigantic snail's shell, is



The trochus shell, from which rows of buttons are cut, attains a diameter of 5½ inches. It is remarkable for its colouration, flame-like markings standing out against the white ground of the shell.
Miss P. F. Clarke, del.

gathered by hand on the coral reefs between tide marks. The catch is then cleaned by spreading the shells, still containing the animal, on the beach for the blow-flies to dispose of the flesh. The putrid contents are afterwards re-

moved by washing the shells in the sea. The demand by button makers for trochus shell has been created within the last ten years. The catches after being prepared for market, are shipped to Japan where rows of buttons are cut from each shell.

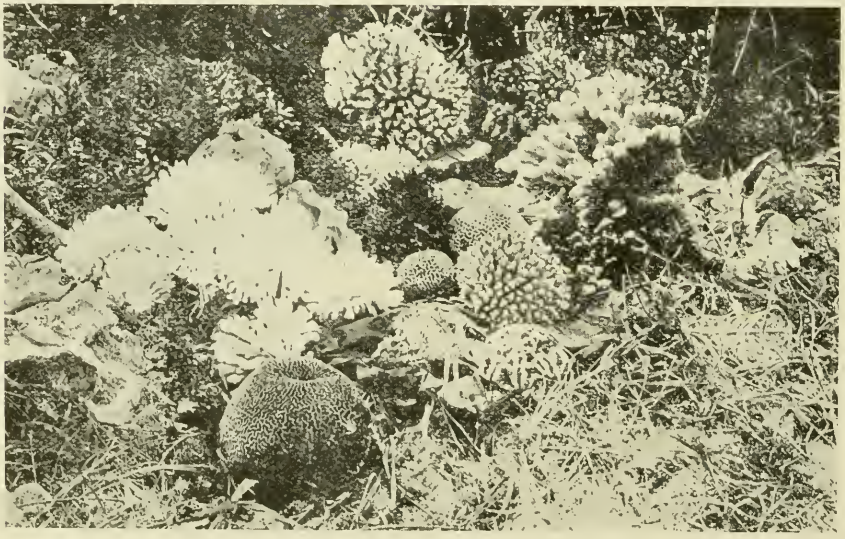
A CORAL REEF.

At first sight a coral reef is very disappointing; the surface is composed of dead and broken coral presenting a long vista of heaps of discoloured fragments which have been piled up by the action of the waves. As the coral grows nearer to the surface of the sea portions become exposed to the direct heat of the sun when the reef is uncovered at low tide and under these circumstances the coral soon dies. The branched forms ("stag-horn coral") die first, and their broken limy skeletons compose the main bulk of the reef. In the deeper pools left by the receding tide, and on the outer edge of the reef flourish the living corals which are of extreme beauty and of the utmost interest. As these continue to grow all around the edges in the deeper water they are continually adding to and thus enlarging the size of the reef. There are many different kinds, from the branching "stag-horn coral" to the great rounded masses of the "brain corals," which may be three feet or more in diameter.

The colours of the living corals are brilliant and diverse, one branching variety being a beautiful light green with the end of each branch terminating in a bright yellow tip. Some are various shades of pink, while others again are a brilliant blue. In and out between the coral branches of these submerged gardens dart many bizarre and highly-coloured flamboyant fishes, which harmonise to an extraordinary degree with their florid surroundings. In the deeper channels between the reefs large spanish mackerel, exceeding five feet in length, were often caught on lines baited with red flannel, and trailed from the stern of our boat as we sailed through the narrow tortuous passages.

Attached to the sides and keel of our boat were the strange sucker fishes, which cling on by means of a large oval sucker on the upper surface of the head. The fish are thus carried from place to place, and only loose their hold when they temporarily leave the ship to go in search of food.

As one wades through the shallow water of the reefs large black cucumber-shaped animals may be seen protruding



Bleached corals from the Great Barrier Reef

from the crevices in the rock, or slowly crawling over the fine white sand. These are the bêche-de-mer, and at one time they were extensively collected and largely exported to China. Although called by the fishers "sea slugs" or "teat-fish," they are neither slugs nor fish, but are closely related to the star-fishes.

GIANT SEA ANEMONES.

The familiar crimson-coloured sea anemones from Port Jackson and our adjacent coastal beaches are veritable pygmies compared to some of their tropical allies. The Great Barrier Reef

Clam shells and large blue-coloured Starfishes standing out in bold relief against the glistening white of the coral sand.

produces giant specimens which may measure no less than from 18 inches to 2 feet across their expanded discs. These giant anemones are further interesting on account of the circumstance that they are self-constituted "harbours of refuge" to sundry fishes and crabs. The anemones are themselves bright in colour, but the associated fishes are even more so. In addition a small crab shares the sheltering hospitality of the anemone. Some of these tropical coral-reef-frequenting anemones, which have their tentacles beautifully branched, must be cautiously handled in consequence of their notable stinging properties.

From the side of our boat we were able to look down into the clear depths of the sea and admire the wonders of the ocean bed. Whole stretches of the sea floor are covered over by the so-called soft corals with here and there collections of clam shells and large blue-coloured starfishes, which stand out in bold relief against the glistening white of the coral sand.

EAGLE ISLAND.

At Eagle Island a pair of beautiful sea eagles were seen hovering overhead, and we found their nest, which stood about ten feet in height, on the windward side of the island. The nest contained one egg and a young bird measuring about two feet from tip to tip of the outstretched wings. We removed the bird from the nest for the purpose of obtaining a photograph, but our eaglet proved to be in a pugnacious mood, and it was only after considerable difficulty that I succeeded in making an exposure.

Large mottled eels proved to be very common on the reefs, usually lying with their bodies closely pressed along narrow grooves in the coral rock. When disturbed they would make off through the shallow water to other grooves, into which their bodies fitted so perfectly that they merged with the surrounding rock and were almost immediately lost sight of. A small species of shark with a bulls-eye pattern on the side of the body appeared to haunt the same locality as the reef eels.

Turtles were sometimes met with either in the rock pools or swimming in the open sea, while we frequently passed coiled sea-snakes basking in the warmth of the sun as they floated passively on the surface of the water.

DUGONGS AND THEIR OIL.

The dugongs form a highly characteristic and interesting group of reef-frequenting marine mammals which are the object of a regular fishery chiefly on account of their valuable oil. Dugongs are essentially social in their habits and assemble in herds, the females being always much more numerous than the males. The adult animal reaches a length of eight to ten feet, and has a distinctly rounded muzzle, while the mouth of the male is armed with a pair of large projecting tusk-like teeth. Dugongs are herbivorous, and their food consists almost exclusively of the marine grass, which grows in great abundance over the reef-flats.

Dugongs on a northern beach.

The chief value of the dugong is the oil yielded by the liver. The quantity varies very considerably, sometimes as much as eight to ten gallons being taken from a single individual captured during the winter months, but on an average only four or five gallons are obtained. The oil is peculiarly clear, limpid, and free from disagreeable smell, and is largely in demand for medicinal purposes.

DENIZENS OF THE MANGROVES.

Although the coral reefs, with their kaleidoscopic array of life, fascinate the observer, nevertheless the mainland can lay claim to some very curious forms such as the goggle-eyed mangrove fish, the calling or fiddler crab, and the ant-house plants. Where the shore is not exposed to strong surf it is usually invaded by certain kinds of trees forming a net-work so dense that it is often very difficult to make a landing. The mangrove is the most important tree of this kind. It grows freely in the shallow sea water on low and muddy shores, and protects the land from the waves. The roots grow in a loop-like fashion, the upper portion being out of the ground at varying distances from a couple of feet downwards, and thus form a network around the tree. The roots of these trees are often heavily encrusted with oysters and barnacles. Muddy sediments accumulate in the quiet water among the trees, and thus the land gains on the sea.

The jumping mangrove fish (*Periopthalmus koelreuteri*) are found in great abundance on the mud flats and among the network of roots of the mangrove trees left bare by the retreating tide. These small fish skip about by means of the muscular, scaly base of

The loop-like roots of the Mangroves where muddy sediments accumulate, and thus the land gains on the sea.
Photo—A. R. McCulloch.

their front fins, with the head raised, bearing a pair of goggle eyes, which seem to protrude from their orbits. The front fins, which are bent at an angle like an elbow-joint, are used for hopping over the mud flats or for climbing about on the roots of the mangroves. Since the fish spends a considerable amount of time out of water, its gills are probably of very little use to it, and the tail then acts as a breathing organ. The mangrove fish rests with its tail in the water with the head and trunk exposed; under these circumstances the fish is able to breathe through its tail, the oxygen dissolved in the sea water passing through the thin skin into the minute blood vessels with which the tail fin is plentifully supplied.

The ground around the roots of the mangrove trees is generally well riddled with crab holes, which serve as retreats for the calling or fiddler crabs. These crabs are remarkable for the enormous size of one of the hands, generally the right, in the male, which may actually exceed in size the rest of the body. It is not known what purpose this organ serves, but it is supposed that the male stops up the mouth of the burrow with it when he and the female are safely inside. It is also used as a weapon in combats with other

The goggle-eyed mangrove fish (Periopthalmus Koelreuteri rests with its tail in the water and the head and trunk exposed.

Photo—A. R. McCulloch.

males. The males probably use it for exciting the admiration of the females in courtship, since they may be seen at the mouths of their burrows with the large hand, which is very brilliantly coloured, in constant motion as though beckoning to attract the attention of the females. When feeding they always hold the hand ready for use the long-stalked eyes keeping a sharp lookout over the top. If alarmed they scurry off sideways, holding the large hand forwards in a fighting attitude.

The Ant-house plant, which serves as the home of a numerous colony of small black ants.
Photo—A. R. McCulloch.

ANTS AND TERMITES.

In the low-lying country near the coast the ant-house plant is found. Besides the "white ants" (termites), which construct a great mound nest sometimes 18 feet in height, there are true ants which make their home in the curious button orchids. These ant-house plants are usually to be found growing on the paper-bark trees. One part of the orchid is enlarged to form an irregular mass about four inches in diameter. It has one or two entrances, and is honeycombed throughout by a series of tunnels, which serve as the home of a numerous colony of small black ants.

Green ants are also exceedingly plentiful in the dense coastal scrub. They build their nests of varying sizes in the trees by fastening together bunches of leaves, and as the colony grows more leaves are added to the structure. The building of the nest is a most interesting spectacle; a great many of the ants assemble along the edges of two green leaves which are close together, and reaching from one to the other, gradually bring their edges into contact. Other ants now bring some pupae from another nest, and pass them backwards and forwards from one edge of the held leaf to the other, at the same time pressing the pupae against each leaf. A white secretion oozes from the pupae, and this quickly dries, and holds the leaves together.

Almost all the animals referred to in this brief description of the Great Barrier Reef of Australia are exhibited in the museum galleries, and are accompanied by explanatory labels, giving full details concerning their curious habits and other features of special interest and importance.

The Spider-eating Insects of Australia.

By G. H. Hardy.

Spiders belong to the most abundant class of the invertebrates, other than insects, to be seen in the Australian bush. There are species that hunt their game, some that weave an entangling net to snare their prey, others that sink a shaft in the ground and at the entrance wait for other creatures to come within reach, and still another that seeks its food under water.

Spiders themselves form a staple food for other creatures, such as birds, and hence many secure special cavities to retire into on the least suspicion of

danger. They roll a leaf, find a crack or crevice, or construct a hole to protect themselves from the larger predatory animals. They also fall a prey to various insects, but usually only one species is preyed upon by any spider-eating insect.

A certain large yellow wasp which belongs to the family *Pompilidae* hunts for one of those species that makes a hole in the ground. These wasps can be seen entering hole after hole until a spider is found. The wasp boldly enters, but the spider, by far the more active of the two, slips past, and, with the wasp close behind, an exciting chase begins. As quick as a stroke of lightning will the spider seek and find shelter, behind a stone, under a leaf, or anywhere that affords cover. The wasp is usually left far behind, but, with the persistance that is typical of its kind, it will visit stone, stick, leaf, or hole, along the line the spider took, and, routing the refugee out of its hiding place, will continue the chase.

These lightning darts of the spider, whose usual habit is to sit motionless hour after hour, require such excessive energy that the harassed creature finally becomes exhausted and is overtaken. Should the spider enter a hole wherein another spider is at home, the intruder immediately makes a further lightning dart, perhaps towards its pursuer, in an endeavour to escape falling a victim to cannibalism. It is usual for the wasp to win the chase, but the quarry may escape, if, as sometimes happens, the wasp seeks it in another occupied hole. In this case the wasp will pursue the new spider with the same fervour and insistance, whilst the original one is left to its own devices. The captured spider forms the food of the new generation of wasps, as an egg is destined to be buried with it.

These observations, which differ in several respects from those recorded of other species of the family in various parts of the world, were carried out at Lindisfarne, near Hobart, Tasmania, where these spiders with sapper-ways are very plentiful. Doubtless similar habits will be found under similar circumstances on the mainland of Australia.

There are at least two species of ichneumon flies that prey upon spiders in the form of external parasites. The larvae lie along the upper side of the abdomen of their prey, attached near the base, and with the head lying away from the head of the spider. A larva of the ichneumon has not been found in a stage prior to this, where it remains one or two days; within a night it feeds, becoming more and more bloated, till finally nothing is left of the spider but skin. The larva then spins a cocoon while hanging in the spider's web, and, in a fortnight, there emerges the winged form of the ichneumon. One species occurs in Tasmania, a second in New South Wales, and a third in Queensland, so probably other ichneumons with this habit will be found distributed over Australia.

The author who wrote "'Come into my parlour' said the spider to the fly" could scarcely have been aware that some flies enter the "parlour" of the spider with impunity; sometimes the host and not the guest is the victim. In Western Australia it is not an uncommon sight to see a robber-fly dart at a spider in the centre of a web, and, seizing it in a most dexterous manner, carry it away to feed upon at leisure. The habit is apparently limited to one species of robber-fly, which is rather common in the vicinity of Perth. In this case it is the fly itself and not the larva that feeds upon the spider, and it appears to form the only diet this particular fly partakes of in the matu stage of its existence.

A family of flies that also plays havoc in the spider world contains species of rather sluggish habits. They are known as "bladder-flies" on account of the blown out, bladder-like shape of many of the species. The larvae of these flies are internal parasites on spiders.

The eggs of spiders also contribute to the commissariat of the insect world as witnessed in case of the mantispids (not to be confused with "mantids" to which family they bear a close resemblance in form as well as name). The larvae of these creatures feed upon either the eggs or the newly-emerged spiders before they leave the egg-sac. Recently in Queensland a small moth has been found to feed upon the egg-sac of spiders.

The R.A.O.U. Conference

And Museum v. Private Collections.

By J. R. Kinghorn.

The Museum has lately been the meeting place for the annual conference of the Royal Australasian Ornithologists' Union. Here ornithologists from all parts of the Commonwealth gathered to discuss matters dealing with Australian birds, and the meeting this year was of special importance because of the work done in revising and compiling a complete new check list of names of birds (both scientific and vernacular), together with references to habitat and geographical distribution. This list, when published, should be of the greatest importance and use to ornithologists and laymen throughout the Commonwealth and other parts of the world.

When the question of correctly naming some of our birds came before the meeting, several of the best known species such as the laughing jackass and the lyre bird underwent a severe test and cross examination as to whether their scientific names were wrong or not, the rule in science being to abide by the earliest correct name, unless that name be very misleading. The finding was that the lyre bird, known for a long time past as *Menura superba*, had been living under a false name, while the jackass, *Dacelo gigas*, had been laughing at us for many years because it alone knew that its earliest name was *D. novae-guiniae*, misleading surely, as the bird is not known from New Guinea. The check list committee decided that the lyre bird shall henceforth be known as *Menura novae-hollandiae*, this being its earliest correct name. No doubt the great shyness of this bird in the past was due to its being aware that it lived under an "alias;" however, it stands corrected, and so, in its embarrassment, should most likely continue to be shy and perhaps even more evasive than ever. The name of the jackass is to remain as *Dacelo gigas*, and the bird will continue to laugh at the ways of man, perhaps even more heartily and mockingly, especially if it gets to hear of the heated discussions concerning it that we indulged in, in the Museum lecture hall.

When the R.A.O.U. finished its meetings in Sydney, a ten days' camp was held at the head of Wallis Lake, Tuncurry, N.S.W., where much useful observation work, listing species and photography was carried out.

The evenings were spent in holding meetings either for lantern lectures or discussions on ornithological matters. Important questions relating to official Museum collections and private collections were raised. It was suggested that no unauthorized member of the Union be allowed to form a collection. In my opinion, if this is carried out it will be a very fine move and a step towards checking the indiscriminate killing of birds, likewise the robbing of their nests to satisfy personal vanity.

It was also suggested that certain private collections or small local museums be established throughout the country for the convenience of the people, the plea being that the larger museums, such as the Australian Museum, or any other State museum, being government institutions, may at some time or other be so bound up in red tape, or staffed with such unapproachable officials that a request to examine certain birds in the reference collection may be refused. With the exception of a few very fine, already established, private collections, belonging to well-known and competent ornithologists, all attempts to form collections by other persons should be strongly discouraged. A collection of birds is one of the most difficult to keep free from the ravages of insects and other destroyers, and I know of several small collections in New South Wales country towns which have been allowed to deteriorate beyond all reason. In a museum such as the Australian Museum there are two collections of everything, a gallery or public exhibition collection, and a duplicate or reference collection, which is stored away in specially dust- and insect-proof cabinets, and is avail-

able for the use of students and other workers. The condition of the Museum collections is excellent, this being due to the vigilance of a specially trained staff. In the past the birds were scattered throughout many different cabinets, but they are now undergoing a complete re-arrangement and cataloguing, and the final result will be that any individual specimen of any species can be found within a few seconds. Any species specially asked for is available for inspection, and students and workers will always receive such facilities for study, and as much of our time as can be placed at their disposal.

Primitive Magic and Sorcery.

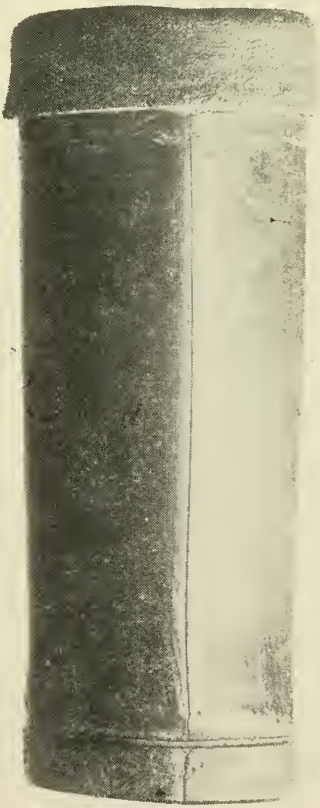
By William W. Thorpe.

Amongst the many curious articles in the Museum ethnographical collections is a small cylindrical bamboo box from the east end District of Papua partly filled with vegetable mould, and capped by a rind lid.

It is used, by a process of make-believe, to obtain certain possessions from another native. The owner of the box dips his finger in cocoanut "milk," then into the box, and smears the mould around his lips, meanwhile asking for what he requires. It is used more especially for obtaining possession of the wife or a pig belonging to another tribesman, and, owing to the belief of the latter in the potency of the box and its contents, he dare not refuse.

Sorcery or magic enters largely into the life and experience of all native peoples. In fact one sees its survival in many of the fears and superstitions current amongst civilised communities. It may be defined as an attempt to produce a result by some extraneous agency, superhuman or occult. As a rule those who practice it claim to have special contact with spirits, but, as in this case, a material agency is commonly used, for the profession has its own properties and implements of trade. These practices are only possible because of the psychological condition of the natives. The well-balanced mind knows there is nothing magical about the box or its contents, but the Papuan thinks otherwise; and this, taken in conjunction with the personality and reputation of the operator, brings about the desired result. A special class of individuals seems to be set apart to practise as sorcerers, who often have to qualify by rigid preparation before setting up in the business.

Unless one is associated with native people it is difficult to realise how inseparable magic or sorcery is from their daily life. If the rain does not fall, it is attributed to sorcery, and the local practitioner is requisitioned to



Papuan Sorcery tube.
Photo.—G. C. Clutton.

counteract it for the benefit of the growing crops. When a man has bodily pains, or is attacked by an illness, the malady is often removed by the native sorcerer, who pretends that he has extracted the offending cause. Magic can only be overcome by counter-magic, and so the time of the savage is largely employed in bringing evil on his enemies, or counter-charming against their machinations.

The mentality of the native does not permit him to put things and events to the test of natural laws or common sense. This is a stage to which he has not attained. He is taught certain things and he adopts them as the articles of his creed, and never dreams of doubting the wisdom of his forbears. Should he show signs of disbelief he would be subject to the ridicule of his tribal companions. Repeated successes of the sorcerer tend also to establish the beliefs inculcated. On the other hand, most of his efforts are brought to a successful conclusion by the readiness of his fellow tribesmen to believe that he can do what he professes. Moreover, the untutored mind generally likes, or is prone to be deceived, and even many civilised people prefer the experience which makes them stare and wonder, rather than to develop the critical faculty which enables them to ascertain the truth and eliminate such things as mysteries from their creed.

Peculiar Agencies of Animal Distribution.

By F. A. McNeill.

Under the striking heading "Shrimps from the Sky," there appeared in the pages of the *Sydney Morning Herald* of August 1st, 1918, a notice from Singleton, N. S. Wales, reporting the fact that large quantities of shrimps fell with rain during a prolonged shower, and continued to descend for some time. As was then suggested, a whirlwind could well be the responsible agency in bringing about such an apparently strange happening. Winds of this nature develop under unstable atmospheric conditions, and, while travelling along, could lift portions of a water surface much in the same way as they carry up dust. Small freshwater fishes still alive have not uncommonly been conveyed in this manner. The shrimp in question afterwards proved to be a common freshwater species (*Paratya australiensis*), and not a marine form, as was thought at the time, blown inland from the sea 40 miles distant. It occurs throughout the greater portion of the interlacing river systems of N.S. Wales, and in other parts of the continent. Apart from this wide distribution, however, the species is found in isolated water holes and lakes, as well as in small water courses. Many of the latter are situated on very high ground, and this leaves one at a loss to explain offhand the manner in which the creature gained access to these disconnected and out of the way places. The record from Singleton provides one definite solution to account for the peculiar distribution of this species of shrimp. In other parts of the world, however, the occasional transportation of small animals by whirlwinds, which has been referred to by Charles Darwin as "what may be called accidental means," probably does not provide the main means of distribution along the peculiar lines exhibited in the case of the Australian *Paratya*. It is probable that this latter has been distributed mainly by the agency of migrating wading birds, which must carry the eggs or young on their legs and feet, entangled with the mud and slime that congregates on those parts, much in the same manner as pond snails adhere to these appendages in the case of ducks. Another instance of peculiar distribution is exemplified in the case of the "Yabbie" (*Parachaeraps bicarinatus*), a freshwater crayfish well known for its depredations in artificially constructed dams in Western N.S. Wales and other parts of the eastern and sou-

thern regions of Australia. It riddles the banks with its burrows, causing them to collapse, and is a source of continual trouble to the man on the land. No sooner is a new dam constructed than the presence of this pest is noticed. Perhaps, as has been suggested by some, the creature traverses wide tracts of land in the night time from one water hole to another, or its distribution may very well have been brought about in the manner outlined for the case of *Paratya*. Mr. Charles Hedley, of the Australian Museum, has satisfied himself that the wide dispersion in the South Pacific of certain small invertebrate animals is due to the agency of wind-blown leaves. He writes as follows:—"Every one who has crossed a woodland track in windy weather has seen handfuls of dead leaves whirled up by eddying gusts. Let such a gust pick up such leaves from a Pacific atoll, during the height of a violent cyclone; they travel softly, without jarring off what has adhered to them, and may easily be dropped on an atoll a hundred miles distant after a few hours. To all collectors it is well known what numbers of small invertebrates attach, either as ova, larva or adult, to fallen leaves. So a shower of a few dead leaves might throw at once a dozen species of insects, spiders and snails on an island where no life was before."

Electric Rays.

By A. R. McCulloch.

Is there any fisherman, professional or amateur, on our coast, who is not acquainted with Electric Rays, or Numbies as they are sometimes called? Their extraordinary powers of giving off electric discharges has brought them under the attention of almost every fisherman —sometimes more forcibly than can be remembered with comfort.

A party of biology students from the University on their annual excursion to Port Stephens, recently discovered a medium-sized example of the common species, *Hypnarce subnigra*, in shallow water. It burrowed beneath the sand with extraordinary rapidity when it observed their presence, doubtless realising the peculiar inquisitiveness of such people. But all to no avail. One member of the party seized a water-logged stick and commenced to dig it out, while another, unaware of the identity of the prey, simultaneously stabbed it with a ferocious looking bowie-knife. Both jumped several feet in the air as they received a violent shock, and very nearly allowed the fish to escape. It was characteristically clumsy in its movements, however, and considered its greatest safety lay in seclusion beneath the sand. But the students were not to be denied the experience of testing its electric properties, so it was soon scooped out onto the beach, where it was prevailed upon to deliver about fifty successive shocks in a space of ten minutes or so. These were quite intense at first, but gradually weakened, and were felt from all parts of the fish, including even the ventral fins and the rim of the snout. An effort to kill the fish by stabbing it suddenly through the brain produced a pronounced discharge which resembled a blow on the biceps of the stabber, due to the sudden contraction of that muscle. Another investigator, with extra good control of his nerves, retained his hold of a knife while inserting it into the electric organ on the sides of the body, and felt the shock completely through his body from his arm to his feet. When one placed a foot upon the fish a shock was felt in the lower muscles of the calf of both legs.

The electric properties of the numbfish would appear to be merely for protective purposes, since the mouth is so small, and the teeth so feeble, that none but small fishes and crabs are devoured. Were a shark or other large enemy to seize a numbie, it would doubtless liberate it after the first shock. One could hardly imagine the predicament

of any animal bold enough to swallow one alive—it would completely outclass that of the foolish monk who swallowed the dried peas. The insulating principles of the fish are evidently very well arranged, since the discharge loses none of its intensity even when the fish is lying on wet sand, and, as was proved, can be transmitted along a wet stick from the water, which is not a little remarkable.

Near the eyes of the specimen referred to above, were three leeches of a kind peculiar to fish, which aroused some comment as to their circumstances during a discharge. Do they too receive a shock or are they insulated, or have they evolved some modification which reduces the shock to a merely pleasant tickling sensation?

The electric organs of European numbfishes have been studied in detail, and most interesting data concerning them have been gathered together. The organ consists of a series of hexagonal cells arranged vertically between the upper and lower surfaces, and filled with a jelly-like substance. The discharge has all the properties of electricity, and will both cause a spark and magnetise the needle.

There are three different kinds of numbfishes so far recorded from the waters of this State, but two of these are restricted to deeper water, and are taken only by the trawlers. A fine example over two feet in length, well worth seeing if one is interested in these things, is on exhibition in the Australian Museum.

Notes and News.

Lectures to the Blind.—To serve the people is first and last the aim of the Australian Museum. The old-fashioned museums did not trouble about people who could not help themselves, but, while those who are clever and strong need little help, those of our fellow citizens who are weak and helpless require our consideration. A better way in this direction as in many others has been pointed out by the newer of the museums in America. Mr. C. Hedley, a member of our staff, who was studying the improvements in museum administration practised in New York, became interested in their treatment of blind visitors. On his return to Sydney he introduced their method of lecturing to the blind. Some article from the Museum collection, such as a mounted animal or a native weapon, is chosen by the speaker. In simple language he

Blind students from the New South Wales Institution for the Deaf and Dumb, and the Blind, in the Australian Museum Lecture The atre. After the various animals have been described by the senior demonstrator they are handled by the students who, aided by his assistants, are thus enabled to form some idea of the size, shape and texture of the specimens. Photo.—G. C. Clutton.

describes the appearance, use, and structure of the article to the blind folk, and finally the article is taken round to be handled by each visitor in turn. By passing his hands over it the student gains by touch a complete knowledge of its texture, weight, and size. Meanwhile he is reminded of the particular points noted by the lecturer. Perhaps three or four such articles will be studied by the party during their visit. In the end the blind boy or girl probably carries away a better knowledge of the things studied than those who have seen them, but seen them with a hasty glance. The blind students, so their teacher says, look forward to their visit to the Museum rather as a treat than as a lesson.

The Young of the Platypus.—Acting-Professor L. Harrison had a novel exhibit at the October meeting of the Linnean Society of New South Wales, in the shape of two young platypuses in their nest. The funny little things were about three weeks old, and looked like pink sausages. In the dark nest they were quiescent, but, when placed on the table, they displayed extraordinary energy, tumbling about incessantly, turning somersaults and twisting themselves into the most comical positions. Mr. Harry Burrell, an enthusiastic student of the monotremes, who has done splendid work in elucidating the life history of the platypus, and who secured these specimens on the Namoi River, says that the young of both the platypus and the echidna may almost be said to afford an instance of perpetual motion.

By the kindness of Acting-Professor Harrison and Mr. Burrell we have been enabled to make colour sketches of these babies, which will be subsequently cast and exhibited with their nest in the Museum.

Travels of a Geologist.—Professor Sir Edgeworth David, trustee, has recently returned from an extended geological tour, during which he visited Victoria, South Australia, and Western Australia, in order to obtain materials and information for his forthcoming work on the geology of Australia. Amongst other places of interest, he visited the curious mound springs of Central Australia, and examined the gypsum deposits and salt lakes of Cape Yorke Peninsula. In Western Australia Professor David travelled as far north as Nullagine, where he inspected the remarkable auriferous and diamond-bearing conglomerates which are found there. He also examined the Collie and Irwin River coal measures of Western Australia, and was able to establish important correlations with the coal beds of Eastern Australia. Sir Edgeworth travelled extensively over the great Nullarbor Plains in the south east corner of Western Australia; these form a nearly level and almost treeless expanse, stretching for 400 miles east and west, and almost as far north and south. The distinguished scientist pays a warm tribute to the many friends who assisted him in his geological and geographical researches, and speaks in the highest terms of the intelligence and fine qualities of many of the aborigines whom he encountered on his journeys.

A Zealous Collector.—Mr. E. H. Rainford, of Bowen, Queensland, has been engaged for some time collecting for the Museum on the Queensland coast. His efforts are quite voluntary, and have already resulted in much valuable material and interesting notes on the habits of the animals which have come under his notice. Writing of the carnivorous habits of the marine worm *Nereis* he says: "One day at low water my attention was drawn by the activity of some green *Nereis* pursuing a pink worm of the same shape and size as themselves—apparently they differed only in colour. As soon as the *Nereis* discovered the pink one it raced after it, endeavouring to head it off; when level with the fugitive it suddenly protruded from its mouth a white bladder [its stomach—Ed.] which fastened on to the head of its prey (sometimes three or four attempts were necessary); through this protuberance the *Nereis* absorbed the whole of its victim fairly quickly. Sometimes two Nereids would attack the same worm, one the head, the other the tail, and continue swallowing until they met in the middle, when each would go its way peacefully."

Fijian Exhibit.—By removing a number of Buka ceremonial paddles space was found in the wall cases of the Melanesian room for displaying the collection of Fijian ethnography. Among the objects placed on view are some fine examples of glazed pottery, ponderous clubs, tapa cloth, and domestic implements and ornaments. Special attention may be called to the exhibits illustrating the kava-drinking custom and the cannibalistic habits of old Fiji.

Fossil Whale.—Last year Professor T. Thomson Flynn, of the University of Tasmania, had the good fortune to find the skull and part of the skeleton of a squalodont whale in the Miocene beds near Table Cape, Tasmania, where its remains have been embedded for at least two million years. These whales were voracious creatures, with sharp cusped teeth something like those of the shark, and are now quite extinct, nor have they left any direct descendants, for existing whales followed another line of descent. They show distinct evidence that whales have descended from carnivorous animals. The remarkable specimen found by Professor Flynn must have reached a length of about sixteen feet when alive. The difficult task of preparing casts of this valuable skull for distribution to scientific institutions was entrusted by Professor Flynn to this Museum, and Mr. G. C. Clutton and his assistant, Mr. J. Kingsley, have carried out the work very successfully. Professor Flynn writes: "It is a pleasure to be able to express myself in the highest terms of admiration of the fine work which your Mr. Clutton has performed in the execution of these casts. They are, I firmly believe, worthy of any scientific institution in the world."

Snakes' Fangs.—Mr. R. Fulton, of the Public School, Upper Colo, writes that he has recently examined a black snake which had three fangs in its jaws, two being together on one side, while there was only one on the opposite side. Before and since that enquiry similar letters have reached the Museum, all of which have been answered, but, for the enlightenment of others, it might be as well to give here a brief explanation of the occurrence of such peculiarities. All venomous snakes have a reserve stock of fangs growing in the gums and they are in various stages of development; the smallest is so small that it would take a lens to detect it, while the most advanced pair (one on each side) are well developed and quite ready to take an active part as soon as the fangs in use are lost either through accident or cast aside through the natural shedding of the teeth. The maxillary bone, to which the fangs are attached, has two sockets, one containing the fang in use, and another along side it for the reception of the reserve fang. Very often when the reserve one develops too quickly it takes its place beside the one in use, but it does not become firmly attached to the bone or venom apparatus until the old one is out of the way. Snakes with three fangs are not rare, and there are several in the Museum collection.

Victorian Visitor.—Mr. A. S. Kenyon, of the Rivers and Water Supply Commission of Victoria, recently paid a visit to the Museum, primarily to arrange exchanges of aboriginal stone implements, by which our collection of Victorian stone axes and flaked material has been considerably increased.

Record Attendance.—On Eight-hour Day, 3rd October of this year, 5,600 people passed in through the Museum turnstile. This is the highest number of visitors ever recorded for one day since the Museum was founded.

The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.

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THE AUSTRALIAN MUSEUM

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Table of Contents.

Making rope on the Island of Mailu, Papua. The women are engaged removing knots and excrescences from a tough bush vine, which makes excellent canoe lashings and halyards.

Copyright photo.—Captain Frank Hurley.

THE AUSTRALIAN MUSEUM MAGAZINE

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Editorial.

A museum must either go forward or retrograde; there is no standing still, for, as the late G. Brown Goode, of the Smithsonian Institution, Washington, said in an oft-quoted passage, "One thing should be kept in mind by any organisation which intends to found and maintain a museum, that the work will never be finished, that when the collections cease to grow they begin to decay. A finished museum is a dead museum, and a dead museum is a useless museum."

The Australian Museum has a distinguished past, thanks to the able administrators who preceded us, but it behoves us to look now to the future, to keep our institution abreast of the times scientifically, to advance in step with similar institutions in other States and countries, to use our utmost endeavours to see that the museum gives the best possible service to the people at whose expense it is maintained.

In the first number of this Magazine we have briefly set forth the purpose and work of museums in general, and the Australian Museum in particular, and we shall not now enlarge on these, but we would again emphasize the fact that museums have two main objects, namely, to serve as storehouses for collections which have formed or will form the subject matter of scientific investigation, and, secondly, to interest and instruct the general public. It will be obvious that to fulfil these functions there must be ever increasing accommodation, for collections never decrease in size, but, on the contrary, are always being augmented. Thus, in the matter of space, museums, like the daughters of the horse-leech, are ever crying "give, give," and we propose to set forth some of the reasons why this question is an urgent one in the case of our own museum.

The museum buildings are overcrowded. The exhibition galleries are of course filled to repletion, and new exhibits can be introduced only by removal of others. This may not be entirely a misfortune, for few exhibits are so fine that they cannot be replaced by better, but the most attractive and instructive exhibits are ethnological and faunal groups, and these require much more space for their effective display than do series of mere specimens. We hope to instal a number of such groups in the near future, but we are sadly handicapped by lack of space and other facilities.

A "type" room, in which a carefully selected series of specimens and preparations illustrates the divisions of the animal kingdom and the basis of zoological classification, is of immense service to students, but at present there is no gallery suitable for this purpose

in the Australian Museum; it should be self-contained, separate from the main galleries, yet easily accessible .

Again, many museums have a section specially devoted to children, the exhibits carefully chosen to awaken the interest and expand the minds of the little ones; we might well establish such a room in the Australian Museum if space were available.

Our library is seriously congested, and we are under the painful necessity of housing the overflow in cellars and other unsuitable places. We have no reading room, where visitors can sit in comfort when consulting books of reference. It must be kept in mind that a scientific library is to be regarded as a tool, and every workman likes his tools to be handy and in good order.

Our storage capacity is very inadequate for the needs of our reserve collections, which are just as important as the exhibited series. Moreover, what accommodation there is consists mostly of ugly, galvanized iron buildings, which are a continual source of annoyance. They leak periodically, the insidious white ant attacks the woodwork, and in the heat of summer these buildings are the reverse of comfortable.

The building as it stands is incomplete. May we not hope that at no distant date an effort will be made to finish at least one wing according to the plan already in existence?

We conclude with another quotation from G. Brown Goode: "The degree of civilization to which any nation, city or province has attained is best shown in the character of its public museums and the liberality with which they are maintained."

Notes and News.

Mr. Ernest Wunderlich, a highly esteemed member of the Board of Trustees, who was closely associated with the foundation of this Magazine, left in the end of December on an extended trip to Europe. During his absence he will visit museums and kindred institutions, and gather information regarding their management.

Dr. Arnold Heim, of Zurich, Switzerland, during his recent stay in Sydney, paid several visits to the Museum. He was particularly interested in the ethnological collection, and has arranged for an exchange of implements from the Swiss lake dwellings in return for Australian aboriginal objects.

Mr. A. F. Grimble, M.A., Lands Commissioner, Gilbert and Ellice Island Colony, while on a visit to Sydney in December last, called at the Museum seeking information on the fauna of that island group. He is keenly interested in the fishes, and was supplied with collecting gear, and will send back his takings for identification.

The Museum field parties, consisting of Messrs. A. F. Basset Hull, E. L. Troughton, H. S. Grant, and J. H. Wright, who were collecting in South and Western Australia, have now returned, bringing a large series of mammals, birds, and other specimens. On the Recherche Archipelago a number of seals were secured, besides skins and eggs of sea birds.

Messrs. A. R. McCulloch, E. L. Troughton, G. C. Clutton, W. Barnes, and Miss P. F. Clarke returned from Lord Howe Island about the middle of March. They have been successful in securing a large series of birds, and materials and sketches which will be utilised in preparing various scenic groups for exhibition in the museum. The cost of the expedition has been largely defrayed by donations from Messrs. A. E. and O. Phillips, Sir James Burns, Sir Hugh and Mr. William Dixson, to all of whom our best thanks are due for their liberality.

Native Races of The Mid-Pacific.

By W. W. Thorpe.

An exhibit recently installed in the Melanesian Room, is a series of plaster facial masks of the natives of the Pacific, taken and coloured from life.

The three main groups of these peoples are the Polynesians, Micronesians and Papuasians, the latter, for convenience, being separated into three subdivisions, namely: The Melanesians proper, The Papuo-Melanesians, and the Papuans.

THE POLYNESIANS.

These people have often been referred to as "The White Race of the Pacific," because of Caucasic traits in their personal appearance and conduct. Formerly they were scattered over a very wide area, but are now considerably reduced in numbers, and in some islands almost extinct. They ranged over a very huge triangular region, apex at the Hawaiian Islands in the north-east, and New Zealand forming the south-west corner, while their most easterly limit has been fixed at Rapanui or Easter Island. Within this triangle lie the Ellice, Phoenix, Navigator, Cook, Austral, and Marquesas Islands, and other smaller archipelagos. Some islands coming more within the geographical area of Melanesia are Polynesian in population, *i.e.,* Ongtong Java (Lord Howe's Group), and Rennell Island in the Solomon Group.

The Polynesians entered the Pacific at some time subsequent to the Melanesians. In all probability they came down from the Malay Peninsula, through Java and the East Indies, to the Solomons and adjacent groups, but finding them already occupied by the Melanesians, and unable to settle there, they passed on until islands were discovered either to be uninhabited, or with a limited population, which they either destroyed or with whom they mingled. Their point of contact with the fixed Melanesian population seems to have been the Fijian Group.

The Polynesians are heavily built and well-proportioned. Their height fully equalling that of the European. Apart from the nose being artificially flattened, the features in the main are attractive. The skin is dark brown with an olive tinge. These tints are faithfully portrayed in the Hawaiian Group already set out in the Museum. The hair is also very dark brown, sometimes black, and wavy, but not in any way resembling the texture of the Papuan or Melanesian, or the straight hair of the Malay. The head is of peculiar shape in that it is broad, sloping high from the forehead, and flattened at the back.

The typical Polynesian is open and candid, unsuspicious, and devoid of treachery, cheerful and good-natured. He is a good fighter and an undaunted navigator. Cleanliness and a taste for neatness are characteristic of these people. The language is euphonious, and they possess an abundance of songs and traditions which have been handed down through many generations.

The Polynesian constructs a wooden dwelling of a very substantial nature, and the detail of structure is often remarkable. The women excel in the manufacture of a cloth commonly known as *tapa,* a fabric prepared from beaten bark and tastefully decorated with native dyes and stains. This material is often beaten to a delicate thinness and several pieces are joined together, forming huge rolls up to one hundred feet in length. *Tapa* in course of manufacture forms part of the Hawaiian tableau, while a large sheet may be seen as a background to the Fijian exhibits in the wall cases.

It is in wood carving that one sees Polynesian art at its best. We have only to point to the productions of the Maories and Marquesans in support of this statement. On the other hand these people made no pottery, and, in its absence, wooden vessels and gourds were used as receptacles. Being a seafaring people, special efforts were expended in canoe-building. These were often of great size, and it took years to construct one vessel.

Taiwhaio, Maori chief, New Zealand, Polynesian man, adorned with kiwi-feather cloak and holding staff of office.

Cooking is done by steaming or baking in ground ovens, the men taking their share in the preparation of food. A pit was made and filled with wood, upon which stones were piled. This was set alight, and, as the fire burned down, the heated stones sank to the bottom. The food to be cooked was then wrapped in large green leaves, and placed in the hole upon the stones, covered with leaves and earth, and left for some time. When removed it was invariably found to be completely cooked, and in a juicy condition.

The women folk spent most of their time making bark cloth and baskets, in other domestic duties, and fishing.

Tattooing of either the face, trunk or limbs was a fairly common custom. In some islands the men only were tattooed, while in others the women alone bore this decoration. Clothing was limited, the men as a rule wearing the T bandage of native cloth, and the women a loin cloak of the same material, or a leaf dress. The Maories and Hawaiians often had more elaborate garments of flax and feather-work for those of rank or to be donned on festival occasions. On these days the garments were more voluminous, and flowers were added as garlands.

The Polynesians brought with them into the Pacific the betel-nut chewing habit, and adopted the intoxicant *Kava* wherever the plant was found to be indigenous. Their weapons were few, and the almost entire absence of the bow and arrow may be mentioned.

An important part was played by the custom of *tabu,* a system of prohibition, forbidding contact with persons or

Men of Yap, Carolines. Tyes of fair Micronesians, showing clothing and palm-leaf baskets.
Photo—A. Matsumura

things for the time being or permanently. For example, a king of Polynesia must not touch the ground for fear of serious consequences to his people. The marking of gardens with *tabu* symbols was sufficient to safeguard them. *Tabu* could also be utilised in the conservation of food over lean seasons, as when game or fish were scarce.

Hereditary chieftainship was the form of government usually recognised, and the state religion was controlled by a priestly caste, who served numerous gods.

THE MICRONESIANS.

The Pacific Ocean north of the Equatorial Line is studded with innumerable islands, and, because of their limited size, the area is collectively known as Micronesia. The islands included under this name are the Gilbert, Marshall, Caroline, and Ladrone Archipelagos. The latter group are at present inhabited by a race derived from the Philippine Islands. This archipelago was discovered by Magellan in 1521, and, because of his inability to trust the then inhabitants (Chamorros), owing to their habit of pilfering at every opportunity, he called the group the Ladrone (Thieves) Islands. This name was changed to Mariana Islands in 1668. The inhabitants of the remaining archipelagos are of a very mixed type, the dominant elements being probably a combination of pre-Malay (Indonesian) and Polynesian. Some ethnologists consider the Micronesians to be a branch of the Polynesian race, but the slightly mongoloid caste of feature differentiates them from the true Polynesian.

Warriors, Gilbert Group. Dark Micronesians, wearing coir armour, fish-skin helmets and armed with shark-teeth weapons.

The Caroline Group, now named after Charles II., of Spain, was discovered by Portuguese navigators in 1527, and called Sequeira, but in 1686 they were annexed by the Spanish, who renamed them in honour of their own reigning king. The natives here exhibit a remarkable variety of complexion, being dark in the west and a lighter brown towards the east. In the east also the Polynesian element is more pronounced, and the custom of tattooing is very prevalent; on the other hand Papuan influence is likewise apparent.

The Caroline Islanders are exceptionally good seamen, and in common with Marshall Islanders possess direction-charts to guide them in their inter-insular voyages.

Special attention may be directed to the currency of the Carolines. Shell money changes hands for commodities, and, in the island of Yap, immense rings of limestone, up to three tons in weight, are used as money. These masses have a communal proprietorship, and belong, not to the individual, but to the village. A peculiar interest attaches to the Carolines also on account of the ruins of large stone buildings set up at some remote period by a prehistoric race. The primitive use of the hand loom is also practiced in this island group.

The Gilbert or Kingsmill Group consist of about a score of atolls or low coral islands enclosing lagoons. The inhabitants are very dark, and of fine physique. They are for the most part a fishing community. For protection against a two-handed sword of shark's teeth the warriors wear a complete set of armour composed of closely interlaced cocoanut fibre.

THE PAPUASIANS.
(MELANASIAN DIVISION.)

These are shorter than the true Papuan, the nose more depressed, and the hair less frizzy. These people have been described as the earliest race to populate the islands of the South Pacific. Their range includes the south-east of New Guinea, and the islands eastward as far as Fiji, where the mingling with the Polynesians, already mentioned, has taken place. This intermixture is slightly less apparent in New Caledonia. The following groups are considered to be more or less pure Melanesian:—Admiralty, New Britain, New Ireland, Solomon, and New Hebridean Groups.

As a race the Melanesians are closely allied to the negroes, but differ considerably from the aborigines of Australia. As the name implies they are normally dark-complexioned, although not all of uniform tint.

The Admiralty folk for many years bore the unenviable reputation of being a treacherous and cannibalistic race. Their weapons consist of spears and daggers, bearing points or blades of obsidian, a volcanic glass occurring in the group. These weapons are also made with the barb or armature of the stingray. The Admiralty islanders are adept at constructing large bowls cut from solid logs and provided with elaborate fretwork handles. The crocodile is frequently represented in their carvings, and shell-bladed adzes are peculiar to the Admiralty Group. Huge cylindrical drums are also to be found in the villages.

The New Britain people make enormous fish traps and use shell-money. Their weapons are varied; the most striking, in more senses than one, is the heavy stone-headed club. New Britain seems to be the home of secret societies *par excellence* in the Pacific.

The New Irelanders are very adept at woodcarving. On view in the Museum one may see an extensive series of what were once solid logs intricately carved with all manner of devices mostly of a zoological nature.

The Solomon Islanders are noted for their beautiful shell inlay work. Sections of the pearl oyster and Nautilus are largely used, being set in the resin of the *Parinarium* fruit. Canoes, figures, weapons, ornaments, all partake in some measure of this form of decoration.

The New Hebrideans are of smaller stature than the average Melanesian. Among the features which distinguish the inhabitants of the New Hebrides may be mentioned the custom of deforming the human head in infancy, the absence of pottery except in Espiritu Santo, the use of feathered arrows, and government by chiefs, who claim to have

Woman, New Hebrides. Diminutive Melanesians, wearing Hibiscus bark dresses.

Photo—Dr. G. Brown.

inherited the right from a spiritual source.

The New Caledonians, in common with the Fijians, but not to such a marked extent, show signs of the Polynesian infusion. They are largely on the decrease, and the time is not far

Fijian Man.—Melanesian with slight Polynesian infusion, wearing old style of tapa head dress and beating drum.

distant when the New Caledonian will become extinct. The special features of these people include currency made from the fur of the flying fox, a crude form of pottery; adze blades and ornaments of greenstone, and a plaited device for throwing spears.

A short account of the Fijians not elsewhere included may complete this brief description of the Melanesians. They are a fine race, though formerly much addicted to cannibalism. Their weapons are massive clubs and spears, and a Melanesian type of bow and arrows. Pottery with a vegetable glaze, and *tapa* cloth are made by the women folk, but the output of both is considerably reduced, while the former is almost an abandoned art due to the introduction of European utensils. The drinking of kava, or *yagona,* introduced by the Polynesians may also be mentioned.

PAPUASIANS

(PAPUANS AND PAPUA-MELANESIANS)

The great island of New Guinea lies immediately to the north of Cape York, Queensland, and is separated from Australia by the shallow waters of Torres Strait. The western half is Netherlands (Dutch) territory, while the eastern part was, till recently divided longitudinally into German and British New Guinea, the latter or southern portion being officially designated Papua.

Many islands lie off the south-eastern extremity, and those in Torres Strait form, as it were, stepping stones between Australia, and the land of the Papuan. The true Papuan, a taller race than the Papuo-Melanesian, inhabits the north, north-western and south-western portion of the island, including also the Torres Strait, whilst the latter mixed

Man, Dutch New Guinea. True Papuan, showing clothing, and woolly nature of the hair.

Photo—R. G. Niall.

and shorter race is to be found in the eastern archipelagos and the contiguous parts of the British territory. There seems to have been two distinct migrations into these Papuo-Melanesian areas. Compared with the Polynesians the New Guinea folk are indifferent seamen, and may be more correctly described as an agricultural race. Pottery is made in many parts, and a large quantity is produced in the Fort Moresby district, and traded regularly by water to the west, where sago is given in exchange. Bows and arrows are the chief weapon of the Papuans, but are everywhere absent amongst the Melanesian types. These are replaced by stone headed clubs, and palmwood spears, though these latter weapons are not unknown amongst the bow-using people. An immense variety of stone clubs are made, some indicating great skill and patience in their production.

The houses of New Guinea vary considerably. They are usually erected on piles, and in the east many of the villages are set up on the sea shore, where the tidal waters advance and recede below their dwellings. Communal houses to hold more than one family are common. Special club-houses, restricted to the use of the men, are built in many places. In wood carving the Papuan depicts motives of man and animals, while the Papuo-Melanesian in his art favours bird and fish designs. The betel-nut habit is general throughout New Guinea, but kava indulgence is practically unknown. Great attention is paid to the coiffure, and various styles of hair-dressing are adopted.

A great deal has yet to be learned regarding the inhabitants of New Guinea. Much has been ascertained, but the major portion of this large island is still a *terra incognita*.

A Seaside Ramble.

By F. L. Grutzmacher, F.C.S., F.G.S.

(A lecture delivered at the Australian Museum, 9th June, 1921.)

Sydney residents are particularly favoured with regard to seashore work. Little work may be done on a shingle beach, for the grinding of the stones in the wash of the waves is not favourable to life, and Sydney beaches are not overwhelmingly prolific. But a rocky shore such as we have all along our coast is ideal, and all the creatures mentioned afterwards may be found at our front door.

JELLY-FISHES.

One of the things, however, which we often find on the sand is a jelly-fish, and, although on the shore it is rather repulsive, in the water it becomes a most graceful thing. There is little that is solid about it, for it is mostly water contained by a delicate network, but nevertheless its organisation is more complicated than its first appearance would indicate.

Around the circular edge of the top or "umbrella" you may find, as a rule, small dents at equal distances apart; these contain peculiar organs which seem to give the animal a sense of direc-

Jellyfish; its stinging tentacles are used to paralyse its prey and also afford protection to the animal itself, and to other creatures such as small fishes, which live in close association with it.
Photo.—A. R. McCulloch.

tion when swimming. This swimming is done by undulatory motion of the "umbrella." The mouth of the jelly-fish is a four-sided opening at the end of a

short stem hanging from the centre; the food is taken in and digested in a large stomach which extends into four pouches, and from these, canals convey the digested food over the body. The canals run into a circular canal going around the edge of the "umbrella," and all these are usually quite visible through the transparent animal.

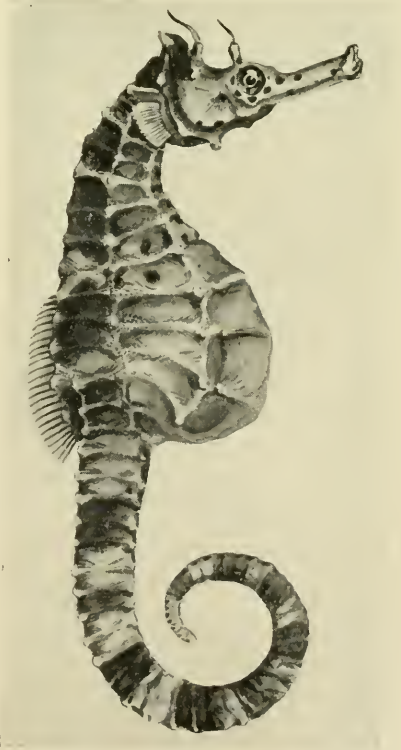
Looking down on the top of a jelly-fish we may often see four reddish purple bodies inside the jelly, in shape something like a Maltese cross. These are reproductive organs, and the development of the young jelly-fish is very curious. The egg when discharged develops into a little free-swimming creature, but this soon attaches itself to some projection, loses its swimming powers, and becomes fixed. Then it proceeds to grow a number of buds, which look something like a pile of tiny soup plates one above the other. These buds eventually break off from one another and each separate bud becomes a new jelly-fish. Thus each jelly-fish is really the grandchild of the jelly-fish which produced it, the parent being the intermediate creature which developed the bud.

THE PORTUGUESE MAN-OF-WAR.

Another creature often washed up on the sand is the blue-bottle or Portuguese Man-of-war. This also is in the same class as the jelly-fish, though in a different order. They are very pretty, but, as bathers know, very dangerous, for their sting is truly dreadful. The deep blue air bladder, rounded at one end and slightly pointed at the other is, in some species, surmounted by a small crest, and has a tiny opening at each end, controlled by a set of muscles. The blue-bottle is not really one animal, but is a whole colony of animals. Under the floating bladder which is filled with air are the long tentacles, armed with terrible poison darts, which float out far around the blue-bottle; but besides these there is a whole host of shorter structures, the individuals of the colony. These, strange to say, are not all alike. The blue-bottle colony has only one stomach common to all the members, and some of these individuals are engaged only in supplying that stomach. They have mouths and absorb food for the benefit of the whole colony, but they do nothing else. Others are gifted with powers of reproduction, and provide new colonies, but they do not feed themselves; they simply make use of the common food absorbed into the whole system by their brothers.

SEA-HORSES.

Washed up on the beach after a heavy gale we may often find the curious sea-horse. There can be no doubt as to why it is called "sea-horse," for its head bears a most ridiculous resemblance to a horse's head. A curious feature of its body is that the latter is composed of a series of rings, something after the manner of a caterpillar. These rings extend right down to the tail, and this organ is extremely prehensile. The fish



Seahorse—Hippocampus abdominalis.
A species occurring in shallow water off the coast of New South Wales.

swims in a vertical position, using its back fin as a propeller, but its tail is always on the alert to seize the stem of any plant which it may meet in the water. Using the weed as an anchor to prevent itself from being carried along by moving water, the fish awaits any food which may happen to come along. A curious thing happens when two sea-horses swim against each other; their prehensile tails involuntarily interlace, each grips the other, and it is only with the greatest difficulty that they are able to free themselves again. They have to catch hold of some weed with the under part of the chin and then struggle and pull until the two tails part.

The sea-horse shares with the kangaroo the honour of having an abdominal pouch, and uses it for the same purpose. But whereas the young of the kangaroo are not born in the pouch but are placed there afterwards, the sea-horse places the eggs in the pouch and leaves them there to be hatched. The pouch then serves as a shelter for the young. Strange to say, it is only the male fish which possesses a pouch, and he relieves the mother of all responsibility concerning the upbringing of her offspring.

Another curious thing about this fish is that it has the power of moving its two eyes quite independently of each other.

PHOSPHORESCENT ANIMALS.

If you happen to be at the beach in the darkness of the evening, particularly where the waves break over rocks, you will often see the water lit up by lines and flashes of greenish-white light of intense brilliancy. The phenomenon is known of course as phosphorescence. Now on account of this name quite a large number of people believe that this light is caused by the presence of phosphorus in the water. Actually there is no phosphorus in the sea at all. The illumination is caused by myriads of living animals called Noctilucae. They are very tiny creatures, almost circular in section, and have a diameter of from 1-20th to 1-100th of an inch. Their appearance may be compared to that of a microscopic peach made of jelly. On one part of the body, like a projecting stalk, is a kind of tail, with which the little Noctiluca whips the water and drives itself along. If one of the living animals is touched with a needle point a flash of light is immediately visible, and any irritation makes it reappear. This accounts for the lighting up of the sea near the rocks or as the waves hit the sand; the breaking wave dashes the little creatures against the rough barrier and they flash out their indignation and give us the phosphorescence. This lighting up may be a kind of self de-

Sea urchin (Toxocidaris erythrogrammus). The commonest species in and around Port Jackson, sheltering in the crevices of rock-pools in the mid-tidal zone. In the foreground may be seen a few striped periwinkles (Monodonta obtusa).

Photo.—A. Musgrave.

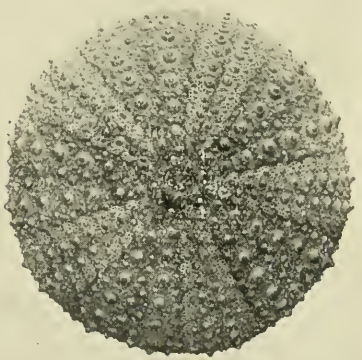
fence with the idea that the bigger creatures would hesitate to swallow fire. The light becomes particularly brilliant in the little animal just before it dies, but with death it ceases altogether.

There is something very queer about this phosphorescence of the Noctilucae. The light is so strong that the illumination from an ordinary tumbler filled with sea water containing the animals is sufficiently powerful to enable a person to

read a book. But the light gives out no heat, and the most delicate temperature recorders are unaffected by it. Nor is it produced by any kind of combustion, for oxygen gas, the greatest of all supporters of combustion, has no effect on it.

SEA-URCHINS.

Sea-urchins will be found in hollows on the undersides of the rocks at dead low tide. They are curious animals, living in a shell case or test, which, when thrown up on the shore denuded of spines, is often called a sea-egg. This shell is composed of limestone and is not all in one piece; several hundreds of pieces go to the making of even the



Corona of sea urchin (Toxocidaris erythrogrammus).

The corona or shell with the spines removed. The bands of tubercles mark the points of attachment of the spines, and the perforations intermingled with the smaller of these form the openings through which the feet protrude.

Photo.—A. Musgrave.

smallest. The shell is quite thin, and its growth is really marvellous. When quite young, the animal is less than the size of a marble, and it has to grow. Its case has to hold it and must therefore be made larger, but the animal is inside it; how can it make its case larger from the inside? The secret lies in the fact that the case is not all in one piece. All the pieces fit most accurately, but each is covered with a layer of living tissue which passes between the joints and which can secrete lime from the sea water. In this way the various pieces are extended at the edges, all still fitting tightly, and so the case is enlarged though the builder inside never sees what he is doing.

The spines of a sea-urchin are all movable and present a dangerous opposition to an attacker. They are often very numerous; in a large purple urchin common on our coast I once calculated the number to be about 1,100.

The sea-urchin is also well provided with feet. They do not always project, but are pushed out when required. They consist of little, white, hollow tubes with a sucking disc at the end, and are provided with fine muscles. When the animal wishes to walk, it forces the tubes through holes in its case by filling them with water from the inside as if from a force pump, and when they are full the muscles take control and the animal walks.

The mouth of the sea-urchin consists of five jaw-like parts each bearing a powerful tooth. The teeth project through the central opening under the shell, and can exert enormous strength. It is largely with these teeth that the urchin cuts out the hollow in the rock where it lives.

STARFISHES.

The general design of all starfishes is based on the same foundation, that of rays projecting from a central disc. They are remarkably "leggy" creatures, as you will see if you turn one over smartly on its back. The little white legs will be seen waving wildly in the air. In construction they are much the same as the tube feet of the sea urchin.

Each ray of a starfish has a small primitive eye spot at the end of it, and just above it is a small projection like a tentacle which is used as an organ of smell, so that the starfish is well provided with noses. A very beautiful starfish is found on the rocks exposed to the battering of the ocean, and I am sure that the colouring on its back must have inspired the first artist in Satsuma ware.

A starfish is a very remarkable animal in its method of feeding. It fre-

Mosaic starfish (Plectaster decanus).

Usually an inhabitant of deep water, but not uncommonly found on rock faces in sheltered water below the limit of the low tide. In life this is an extremely brilliant object, the upper surface consisting of red patches ornamented with a network of white calcareous ridges.

Photo.—A. Musgrave.

quently attacks a morsel far larger than its own mouth (which is in the middle of the underside of the central disc.) This does not distress the starfish, because it can perform a most extraordinary feat with its inside. When it cannot get its food to its stomach, it does the opposite, and takes its stomach to the food. It projects its stomach out through its mouth, folds it around the victim, and keeps it there until all the food is digested. When that is done the stomach is drawn back again to its proper place. The walls of the stomach are very loose and crinkled inside the body, and this allows for the necessary stretching.

The starfish has the property of absolute indifference to mutilation. If divided into halves each half grows another, and we have two animals instead of one.

The life history of the starfish is also very extraordinary. It comes from an egg which gives forth a tiny free-swimming creature something like a microscopic worm. This animal grows and grows, but it is not the future starfish. For, after a time, from a small rudiment inside it another animal grows, and as it progresses it steals the stomach and digestive organs of the original animal and takes them for its own use, though it grows a separate mouth of its own. The poor foster-mother dies and actually becomes part of the food of the new animal, which has grown from a part of the foster-parent's body. The sea-urchin, which is also a close cousin of the starfish, has a development somewhat similar.

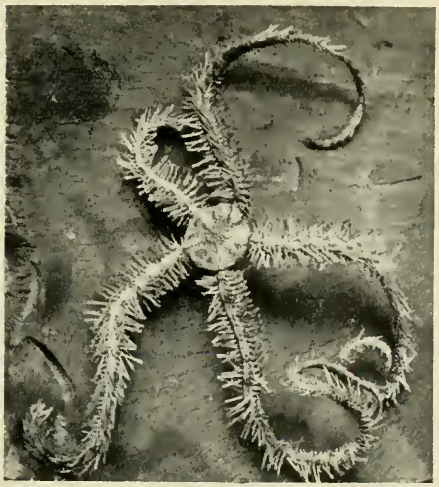
BRITTLE-STARS.

Very curious are the brittle-stars, common on the rocky shores at low tide. Like a starfish in appearance, they are quite unlike it in movement, for their arms are long and very flexible, and, unlike the starfish, which creeps slowly

The eight-rayed starfish (Asterina calcar), and the five-rayed starfish (Asterina exigua), are our two commonest forms, and, occur abundantly in pools left by the receding tide.

Photo.—A. Musgrave.

along, they travel at a rapid rate. They move by a succession of snake-like undulations of their arms, and these long arms are attached to a central disc which is quite small. In the starfish the rays



Brittle starfish (Ophiothrix fumaria). Common under loose stones in pools, and in crevices between tide marks.

Photo.—A. Musgrave.

seem to be part of the body, but in these creatures they seem like mere appendages.

The name "Brittle-star" given to these curious animals refers to the extraordinary way in which they break themselves to pieces when captured. A lizard will snap off its own tail if held by it, but the brittle-star, when angry or terrified, deliberately breaks all its arms into fragments to show its annoyance. But this does not mean that the creature is committing suicide, for after a short interval all the broken parts will be renewed and the animal will be literally as good as new.

SEA-SQUIRTS OR ASCIDIANS.

At dead low tide you may find the Cunjevoi or sea-squirt, which has the scientific name of *Cynthia*. You may easily know it by the fine jets of water which it squirts up as you approach. Despite the pretty name of Cynthia it is about as ugly a thing as is made; it is like an irregular, very warty, and somewhat hairy bag, with two openings like mouths at the top of its body. These mouths gape open when the tide is coming in and are then seen to be red in colour.

This animal is one of the greatest curiosities of the shore, inasmuch as it belongs to the same sub-kingdom of animal life as ourselves—that is, it is one of the vertebrated animals or animals with backbones. I am not saying that the sea-squirt has a backbone, but I mean that the young sea-squirt has the beginnings of one, which, however, it loses as it grows up. The fact is that Cynthia is a shocking degenerate. The young animal is something like a very small tadpole in shape and is able to swim quite freely; it has a well developed nervous system, a good eye, and other sense organs. But after a very short time it fixes itself to a rock and begins a retrograde movement and ends by becoming the immovable degenerate adult which has lost all visible connection with the higher types of life. There is of course a reason for this. Cynthia is an awful example of the effects of having plenty of food without having to work for it. Long ages ago it was probably an active creature, but food was plentiful and the animal just had

Cunjevoi (Cynthia praeputialis).

The cunjevoi overlap the extreme edge of the low tide mark, exposed to the full wash of the surf on the coast.

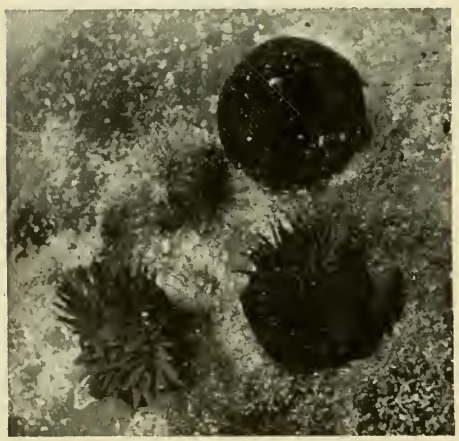
Photo.—A. Musgrave.

to open its mouth as it went along and the food went in. This made it lazy, so it tried the effect of just sitting down with its mouth open, and found that it got its food just the same. The result was that finally it just anchored itself

to a rock and remained there, too lazy to move. Another result was, of course, that its own sense organs degenerated through disuse and finally disappeared, and so through the ages it gradually changed to the dull senseless thing it now is. Cynthia always reminds me of the story of the very old-age pensioner who, when asked by a kind lady how he passed his time said, "Zumtimes I zits and thinks, and other times I just zits." Cynthia "just zits."

The two openings of which I spoke as showing red when gaping are connected with the food supplies, which consist of the minute life of the sea. As the tide rises the animal is covered and the water is drawn in through one opening and expelled through the other, and the food is extracted meanwhile.

A remarkable thing about the adult sea-squirt is its heart, or rather its blood circulation. The heart is something like a bag bounded by strong muscles, and its pulsations, which send the blood around the animal's body, are simply muscular contractions which begin at one end of the bag and slowly travel until they reach the other end. But here is the remarkable thing—the blood does not always flow the same way. After the pulsations have reached the end of the bag there is a short pause; then they begin again in the opposite direction, so that the blood is driven round the body also in the opposite direction.



The Sea Waratah Anemone (Paractis papaver). Under rocks in dark corners this blood-red sea anemone expands its tentacles. The contracted animal at the top shows the condition of the anemone when not submerged.

Photo.—A. Musgrave.

SEA-ANEMONES.

The sea-anemones, some of the most beautiful creatures of the animal world, may be found in cracks and hollows on the rocky shore. It is rather difficult sometimes to believe that they really are animals, as they look so much like flowers. The cylindrical body has a strong muscular disc underneath, by which the animal clings to its support, and at the top there is an upper disc bearing circles of tentacles, usually beautifully coloured. The tentacles, which are quite flexible, each contain a little dart, which is injected into the victim when the anemone seizes its prey. If you touch them with your fingers you can feel them cling. Although this will cause no discomfort to you, it is otherwise with small shell-fish, etc., which are paralysed by the grip. In the centre of the rim of tentacles is a large mouth, which communicates with a wide stomach occupying nearly half of the interior of the body. The anemones are extremely voracious, and even creatures with hard unappetising shells are just swallowed whole and the shell is thrown out again after the soft body has been absorbed. The finest anemone on our coast is the sea dahlia (*Oulactis muscosa*), which is found in exposed places such as near the mouth of Middle Harbour and on the coast. Its tentacles are pale bluish purple in colour and the centre is often a rich velvety brown. It has a curious habit of plastering its body with sand grains and sea shells, which quite disguise it when the tentacles are closed. In the more sheltered spots, we find the sea waratah, (*Paractus papaver*) smaller than the other, with a smooth, dark brown body and coral red tentacles. It is often called the "blood sucker," which gives it a reputation entirely undeserved.

CRABS.

Plenty of little shore crabs will be found on the rocks and may often be noticed feeding. It is a quaint sight to

see the crab standing up on the tips of all its legs and looking like some self-satisfied old person, as it deliberately raises each "hand" alternately to its mouth. Talking of feeding reminds me that the stomach of the crab is remarkable in having a set of working teeth inside it. The lining of the organ is thickened and hardened with lime, so as to make a sort of framework, and on this there are three hard calcareous teeth which work into each other and project into the stomach cavity. Very powerful muscles work these teeth and cause them to grind up the food. It is to be hoped that the crab does not suffer too often from toothache!

A young crab is very unlike a crab. When it first comes out of the egg it is a free swimming little creature with a thin, loose, transparent skin all about it. As it grows it casts its skin from time to time, develops legs, loses its long tail and gradually becomes the adult crab which often cannot swim at all.

Rock Crab (Leptograpsus variegatus). The commonest crab on the coast of New South Wales. To be seen everywhere along the rocky foreshores, swiftly retreating into a safe hiding as an onlooker approaches.

Photo.—A. Musgrave.

BARNACLES.

Acorn barnacles are found all round the rocks, more often exposed to the air than not. They have made fair progress towards becoming land creatures, but are prevented from further progression by their fixed habit. Yet when young, the larva is a quite active creature. But after a while the young barnacle attaches itself to a rock, grows a hard armour casing around itself and loses all powers of locomotion. It is fixed to the rock head downwards and passes all the rest of its life in this upside-down condition.

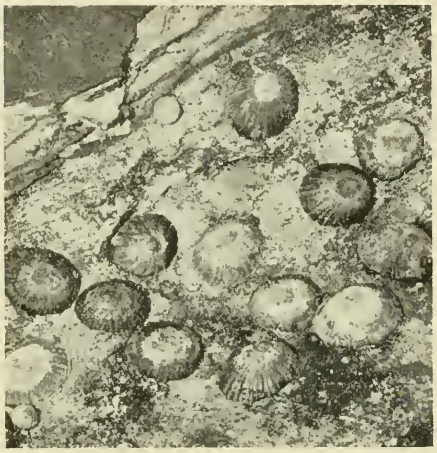
When the tide rises, a central door in the shell of the barnacle opens, and the animal searches for food by thrusting plume-like feet in and out with a sweeping motion, which draws to them the minute life on which the creature feeds. Along a stretch of barnacle-covered shore quite a distinct swishing, grinding sound may be heard as the acorn shells get busy in the rising tide.

SHELLS.

The whelks of our beaches (which are not the same as the European whelks) all have very strong shells, usually with some notable device on them to resist battering or crushing, for mostly they are fond of the rocky shores where the waves have full play. The small rock-whelk, for example, dark brown in colour and about an inch long, has a shell studded with girdles of small hard knobs, while the "belted whelk"

has a series of ridges arranged in rings around the shell. This whelk prefers places where it can get the full force of the sea's battering.

The mouth of the shell of a whelk is broken at the end furthest from the apex of the shell by a deep notch, through which an organ called the siphon acts. This is a spout-like projection which enables the animal to receive the aerated water for breathing.



Limpets (Cellana variegata).
To be found high and dry on the rock flats when the tide is out.
Photo.—A. Musgrave.

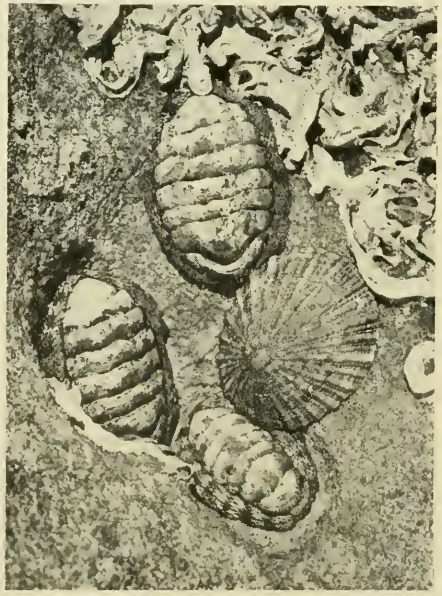
The opening of the shell can be entirely closed by a tightly fitting door called the operculum, which the creature draws into it. This operculum is a characteristic feature of those Gastropoda (snail-like shell-fish with only one shell). In the case of the land snail, the opening is closed in winter by a hard layer of mucous matter called the epiphragm.

PERIWINKLES.

Periwinkles may always be found crawling about in the rock pools. In the periwinkles, or sea snails, there is no notch in the margin of the shell such as is possessed by the whelks. The presence or absence of this notch is a fairly sure guide to the feeding habits of these creatures, for if the notch be present the animal is almost certain to be carnivorous, while, if it is absent, the animal is a vegetarian.

Some of the periwinkles have almost deserted the sea as a home, and especially is this the case with a very small bluish-grey periwinkle (*Melaraphe mauritiana*), which is found in clusters in hollows well up on the rocks. It is only covered by the highest tides and sometimes only by the spray of them. It is well on the way to becoming a land animal; the land snail is a periwinkle which has completed the change.

The general internal structure of the whelks and periwinkles is much the same, the internal organs being gathered together in a twisted hump which is covered by the shell. The tongue is a long ribbon working to and fro behind the mouth opening. It is covered like a file with rows of teeth—an enormous number of them; some species of sea snails have over 500,000 teeth. The foot on which the animal glides is just a flat creeping disc, and the creatures move by a series of wave-like undulations which flow along it.



Chitons (Sypharochiton pellis-serpentis).
In company with limpets and tubes of Galeolaria occur these quaint "mailed" molluscs. They are everywhere to be found clustering together in small depressions on the rocks, from about the mid to the upper tidal zones.
Photo.—A. Musgrave.

LIMPETS.

The limpets are proverbial for sticking to the rocks, and, as a matter of fact, no amount of ordinary pulling in a straight line will remove one from its holding. The central part of the foot is raised from the rock by muscular action, forming a kind of sucker with a partial vacuum between the foot and the rock, and, since the edges of the foot fit the support perfectly, the external atmospheric pressure helps the animal to resist being detached. The limpets are always easily known by their dome-shaped or tent-shaped shells, a shape on which the battering waves can get no purchase to dislodge them.

The limpet, which also has a ribbon tongue, is a vegetarian and feeds on the green sea growths on the rocks. A remarkable thing about these animals is their homing instinct. A limpet hollows out a depression in a rock to accommodate itself nicely, and, though it leaves this at feeding time in search of food, it will return again and again to its old home, and never seems to settle in the wrong hollow by mistake.

CHITONS.

Occasionally gliding over the rock, but more often as still as the stone itself, may be seen those curious molluscs, the chitons, often called mail-shells. Instead of one solid shell like a limpet, these animals have developed a hard calcareous armour composed of eight separate transverse pieces, which fit one over the other something after the manner of tiles on a roof. You can see this well if you detach a chiton from its rock and place it on its back, when it will proceed to roll itself up into a ball with the shell on the outside. A leathery band or girdle runs around the outside of the eight plates. The chitons have no eyes or tentacles, whereas the periwinkles and their kind, have two tentacles and also eyes on very short stalks, at the base of the tentacles.

The chitons are vegetable feeders, living on minute seaweeds and those very tiny marine plants called diatoms. If you place one of these molluscs on a piece of glass wet with sea water and watch its movements from the underside, you will see that its foot extends nearly the whole length of its body, while the mouth is plainly visible just above the foot. Behind the mouth is a long, toothed, ribbon tongue like that of the periwinkle.

In spite of its very simple appearance the chiton has a well developed three-

Mussels (Brachyodontes hirsutus).

Portion of a colony fitted together into a mass of epidermis and byssus (hairy filaments). This species is to be found clustering on wharf-piles or in rock crevices in sheltered waters. The top of the picture shows a number of barnacles.

Photo.—A. Musgrave

chambered heart and a very fair nervous system. It has no brain, though; the centre of the nervous system is a thick nerve ring in the region of the gullet. The larvae of the chiton are free swimming creatures, though the adult animal cannot, of course, swim at all.

MUSSELS.

We now come to a bivalve or two-shelled mollusc, the mussel, which you will find on the lower rocks or around the piles of wharves. The mussel is a very near relation of the oyster, but it is superior to the oyster in that the adult animal has powers of locomotion; the larval forms of both are free swimming. The foot of the mussel, by which it walks, is a most remarkable organ. It is a continuation of the front part of the body and is not unlike a tongue in shape. It is thrust forward out of the slightly open shell, and near the base of the foot there is a gland which gives out a sticky, silky secretion, which hardens into a kind of thread when produced. The animal gets along by projecting its foot forward, fastening the end of the thread produced from the gland to some suitable spot, and then, bringing back its foot suddenly, it pulls on the thread and hauls itself along through a fraction of an inch. Each time it repeats this motion it fixes an extra thread, and, when it has moved sufficiently, this bundle of threads, known as the byssus, serves to anchor it most securely to its support. The byssus can be cast off if the mussel wishes to move on at some future time.

THE OCTOPUS.

It seems rather curious to call the octopus a shellfish, yet it really is a mollusc and is related to the whelks, periwinkles, and snails. But it has carried its development so far that the shell is a mere apology for a shell, a rudiment only. It serves merely to con-

Reef-building annelid worm (Galeolaria caespitosa).

White masses of annelid worm tubes cover the rocks from about the mid-tide zone to the limit of the neap tides. In the quieter waters they thickly encrust the rocks and wharf piles, presenting the appearance of coral, but are less abundant on the open coast where adverse conditions apparently restrict their growth.

Photo.—A. Musgrave.

nect up various muscles, for it is internal, not external like a periwinkle's shell. It is like the beginning of an internal skeleton, whereas the shells of the animals I have described are external skeletons, not merely houses. The shell of a cuttlefish, a first cousin of the octopus, is more pronounced; it is often found washed up on the shore—a white, leaf-shaped body with a hard projecting guard on one side and soft laminae on the other.

The octopus is a hideous brute, and you can always find him at dead low tide crawling or lurking about in the shadow of the rocks, particularly towards evening, for he does not love the strong light. His staring, deep golden eyes are quickly seen, and they are most wicked looking things. The octopus has the power of flooding his skin with blushes of different colours to correspond with his surroundings. His eight long arms are covered on the underside with a double row of suckers, no less than 240 to an arm, which give him tremendous power when he grips a victim. The arms are also used for creeping and slow swimming. Rapid swimming is done backward by forcible ejection of water from a tube in the body which points forward.

In the centre of the circle of arms is a pair of thick fleshy lips which hide a powerful pair of jaws shaped like a parrot's beak. Behind the beak is an extraordinary tongue, part of it soft and fleshy and capable of appreciating the flavour of its food, the remainder covered with strong file teeth to tear the food up.

The head is connected with the bag-like body by a kind of waist, and it is just behind this waist that the funnel tube lies which the octopus uses in rapid swimming. From this tube he can also, if attacked, eject a quantity of black inky fluid, which completely hides him, but he is not so prone to doing this as is the cuttlefish.

The female octopus makes an excellent mother. She lays about 600 eggs at a time on the walls of the cave where she lives or on the seaweeds around, and during the 7 weeks of hatching she guards them most faithfully. The young ones are sociable, and swim about on the surface together, but as they grow older they become solitary in habit.

The octopus is hunted fiercely by the sharks and porpoises, and should one escape it is usually with the loss of several of its arms. In this case the disabled victim retires to a cave for a few months and grows new members to replace those which have been lost.

Mr. O. W. Tiegs, M.Sc., Lecturer in Zoology, Adelaide University, recently spent some ten days in our library consulting works on the metamorphoses of insects.

Mr. A. C. Mackay, F.R.G.S., of the Austral Guano Company, which holds a lease of Walpole Island, about 150 miles south of Noumea, New Caledonia, has presented to the Museum some interesting specimens found on the island. These comprise clam shell ornaments, left behind by the former inhabitants, and remains of the extinct horned turtle *Miolania*, which was previously known only from Australia, Lord Howe Island, and Patagonia. This extension of its known range is of considerable scientific importance, and Mr. Mackay is to be congratulated on his find.

Some members of our flora and fauna which are not appreciated in Australia are in great demand in other parts of the world. Mr. C. E. Pemberton, of the Hawaiian Sugar Planters' Association, has spent some time here collecting seeds of the Moreton Bay fig, which is highly esteemed in Hawaii for afforestation purposes. Mr. Pemberton has also been very successful in procuring a series of beneficial insects, including the wasp, which is essential for the fertilization of the figs. Mr. E. W. Rust, of the Californian Department of Agriculture, who, like Mr. Pemberton, has come to Australia in quest of beneficial insects, recently visited the museum and inspected the entomological collection.

Rats and Fleas in Their Relation to Plague.

By E. W. Ferguson, M.B., Ch.M.

Principal Microbiologist, Department of Public Health.

It is a truism that has been demonstrated on many occasions that we often know little about the creatures that are our closest associates, and it has needed the discovery of their character as disease carriers to stimulate the study of their life histories. The discovery of the rôle of the mosquito in malaria, of the house fly as carrier of typhoid and dysentery, has resulted in a flood of light being thrown on these insects and their allies. In a similar way our information in regard to rats and fleas has followed on the discovery of their connection with human plague.

Plague is a febrile disease caused by a minute germ or bacillus. In man the disease may occur in one of three forms —Bubonic, Septicaemic or Pneumonic. The bubonic form follows on the inoculation of the virus and depends for its character upon the arrest of the plague bacilli in the nearest lymph glands. The swollen and inflamed glands constitute the "bubo." If the bacilli succeed in passing this barrier they may proceed to multiply in the blood stream, this constituting septicaemic plague. This form is a terminal one in fatal bubonic cases, but a case may become septicaemic from the first. In the pneumonic form the disease is located in the lungs, and causes death in hundred per cent. of cases. This form of plague is highly infectious.

The full knowledge of the manner in which bubonic plague is transmitted and the part played therein by the rat and rat flea is a quite recent acquisition. The association of the rat with plague was however at least suspected by the ancients, as is shown by the Biblical account of the outbreak of plague amongst the Philistines on the removal of the ark of the covenant. It was for Dr. Ashburton Thompson of Sydney to demonstrate that on epidemiological grounds the disease could only spread from rat to man through the agency of infected fleas, though previously it had been shown that fleas were capable of conveying the plague bacilli. The Indian Commissioners on Plague were finally able to set the matter at rest by direct experimental evidence.

The main facts are simple and are now a matter of common knowledge. In a new locality plague is introduced by infected rats who spread the disease among the shore rats. In these animals plague takes the form of a septicaemia, that is to say the bacilli or germs are present and actively multiplying in the blood; as many as 100,000,000 bacilli may be present in 1 cubic centimetre of rat blood, and it is not a matter for any wonder that bloodsucking insects like fleas soon become themselves infected. In turn the fleas infect other rats and, given the chance, are capable of infecting human beings.

In human bubonic plague there is no evidence that one person is infected from another, in each case the source of infection is traceable back to the flea and from the flea to the rat.

RATS.

There are many kinds of rats in the world, but practically only two species are of importance in relation to plague. These two, in common with the mouse, are close associates of man, and with him have travelled throughout the world. The two kinds are commonly known as the brown or sewer rat (*Rattus norvegicus*) and the black rat (*Rattus rattus*), though the latter is more often grey or brown or even rufous in colour, and various subspecies have been described. The two species differ in structure and in habits. The brown rat is the larger and heavier species with coarser hair, shorter head, and smaller ears and shorter tail, whilst the black rat is a more slenderly built animal with very long tail and long ears. The brown rat, as its alternative name implies, is a denizen

of the underworld, it is the rat of sewers and basements. The black rat on the other hand prefers the upper stories and roofs, and has even in places taken on a more or less arboreal existence. It is also the ship rat, though both species may be so carried.

The rat is a voracious eater and catholic in its tastes; nothing that is in the remotest sense eatable comes amiss to a rat, though probably by nature they are grain feeding. The life history of the two species is similar. In Sydney both species probably breed all the year round, though there are no data available to calculate the number of litters a rat may have in one year. It is known, however, that these animals breed at an early stage, and litters follow one another at intervals of weeks. The number per litter varies, but in Sydney the average per litter for *R. norvegicus* is 8.05 and for *R. rattus* 6.66.

It has been said that both species are spread all over the world. Though in the main correct, this statement requires qualification, as the two species are at the present day not equally distributed; in general it may be stated that the brown rat is the rat of the temperate zones and the black rat that of the tropics. Probably both species originated somewhere in central Asia and became habituated to their present mode of life in and around the tents of the nomadic Tartar tribes with whom they lived. This is in the main pure speculation, but there is definite historical evidence of the time of their invasion into Western Europe. The black rat came first, arriving in England somewhere about the twelfth century, and is said to have been brought back by the Crusaders. The advent of the brown rat into England is comparatively recent, these rodents making their appearance during the time of George I. They are supposed to have come to England in ships. In England, as elsewhere on the continent, they rapidly displaced the black rat, which, however, at the present time is re-appearing in the big seaport towns. In the tropics the black rat has held its own, while in subtropical centres as at Sydney, both species are represented in approximately equal numbers.

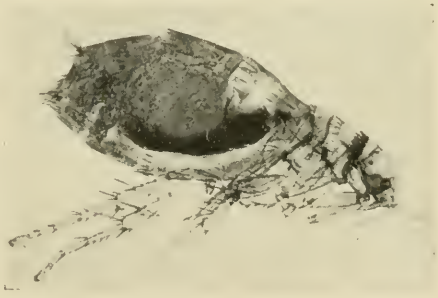
Both species suffer from plague, but in most of the tropical countries where plague is endemic to-day, the black rat is the reservoir. Other animals also

Indian Red Flea (Xenopsylla cheopis).
Photo.—R. Grant.

suffer from plague, for example, the Californian ground squirrel and the Tarbagan or Mongolian marmot ((*Arctomys bobac*), which was held to be primarily responsible for the calamitous Manchurian pneumonic outbreak in 1910.

FLEAS.

Eleven different species of fleas have been shown to be capable of carrying plague. Most of these, however, are only of local interest or else do not readily bite man. Two are, however, especially inculpated; these are the Indian Red Flea (*Xenopsylla cheopis*) which is the rat flea of the tropics, and



European Rat Flea (Ceratophyllus fasciatus).
Photo.—R. Grant.

the European Rat Flea (*Ceratophyllus fasciatus*), the former being by far the more important. In Sydney three species of fleas occur commonly on rats—*Xenopsylla cheopis*, *Ceratophyllus fasciatus* and *Ctenopsylla musculi*; the latter is the mouse flea, but is equally common on rats.

Mouse Flea (Ctenopsylla musculi).
Photo.—R. Grant.

In our knowledge of the bionomics of fleas we are principally indebted to the Indian Plague Commission and to the work of Mr. Bacot of the Lister Institute.

All fleas are dependent upon blood for their existence; most are connected with some particular host, but there is considerable variation in the degree of restriction to their host, and in the absence of the special host many species will undoubtedly attack other animals, including man.

Fleas pass through four distinct stages—egg, larva, pupa and adult. The eggs are deposited by the female while still on the host, and roll off mostly into the bedding material, where they hatch in two to twelve days. The larvae are white, legless, segmented maggots, and live in the dust of floors, crevices, or in the open, sandy localities being preferred. The larval stage varies in duration according to circumstances, lasting under favourable conditions from one to three weeks. When full grown the larva spins its cocoon, in which pupation takes place. The pupal existence varies tremendously, and fully formed fleas may remain for long periods in their cocoon before emerging. As a rule, however, the life cycle is completed in under four weeks.

The adult life under favourable circumstances is a long one. Bacot found that the human flea (*P. irritans*) was capable of living to 125 days without feeding, but kept under cool, moist conditions. Under similar circumstances the European rat flea (*C. fasciatus*) lived 95 days, the dog flea (*Ctenocephalus canis*) 58 days and the Indian rat flea (*X. cheopis*) 38 days. This period was greatly increased when the fleas were fed daily, the maximum life being for the various species as follows:—

Human flea	513 days.
European rat flea ..	106 days.
Dog flea	234 days.
Indian rat flea .. .	100 days.

Conditions of moisture and coolness are, however, indispensable, as in hot weather the duration of life without food is but a few days.

Dog Flea (Ctenocephalus canis).
Photo.—R. Grant.

The question of how the flea conveys infection to man has been the subject of a large amount of investigation. The Indian Plague Commission came to the conclusion that infection took place through the rubbing into the wound of the infected faeces of the flea. Bacot and Martin showed that infection could also take place directly into the wound. These authors showed that the proventricular valve at the entrance to the flea's stomach became blocked by a clot containing millions of the plague germs, and that after a time the clot softened in the centre and, while inter-

fering with the valvular action, allowed regurgitation of the contents of the stomach laden with plague germs into the puncture. It is stated that fleas may remain infected for as long as 20 days.

The occurrence of Bubonic plague in man is thus directly consequent on the presence of infected fleas and rats. If there are no infected rats the fleas are harmless, if there were no fleas, infected rats would be harmless. The flea is the direct medium of communication from rat to man.

Plague is distinctly a seasonal visitation and the season of maximum incidence in both rat and man corresponds with the season when rat fleas are most abundant. In Sydney this falls in February and March. Weekly counts of the different species of fleas taken on rats have been made at the Department of Public Health since 1909 and these show a marked increase in the numbers of the Indian rat flea caught in February and March.

I do not propose to discuss here the various methods of rat and flea destruction, but it may not be out of place to stress the necessity for every individual in the community doing his or her share in the campaign for the control of these pests.

The Health authorities can deal with areas in which plague is known to be existent, but they cannot undertake the task of destroying the whole rat population. The duty of rat destruction on any premises must fall upon the owner or occupier. If premises are rat-free and rat-proof no anxiety need be felt, but it is well to remember that any faulty construction will be found out by rats and full advantage taken of it.

Cases of human bubonic plague are preceded by rat plague, but too often it happens that the first notification of the existence of plague in a locality is revealed only by the discovery of a human case. Here the public can aid the authorities by reporting the fact as soon as any mortality is noticed among the rats.

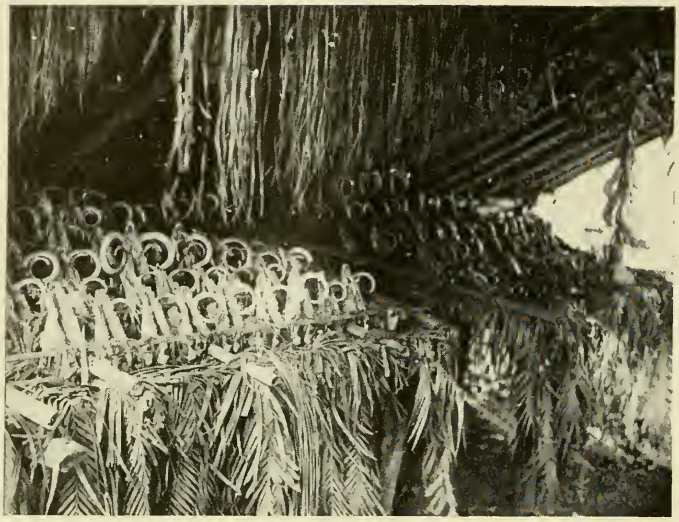
Pigs' Tusks and Armlets.

A. R. McCulloch.

Societies for the Prevention of Cruelty to Animals are strictly modern outcomes of civilisation, and have no counterpart among savage peoples. Primitive man cares nothing at all for the feelings of the lower animals, and not infrequently even binds and tortures his fellow man when he feels in need of some extra entertainment. Such agonies as he inflicts upon his pigs in order to secure their malformed tusks for his personal adornment therefore cause him no qualms of conscience, his only concern being lest they damage their offending teeth before they have reached their full and painful development.

A boar's skull is provided with a pair of tusks in each jaw, which normally meet in opposition, and by grinding one against the other, are kept short and serviceable. In order to keep them efficient, and to counteract their wearing, Nature has caused them to grow continuously throughout the life of the pig. It follows, that, if, through any cause, any one of the four tusks be not duly ground away by its opposing fellow, it will become abnormally long; and since

Lower jaw of a pig, with circular tusks. The opposing upper tusks have been removed so that the lower tusks grow without hinderance, curve round and re-enter the jaw. The point of the left tusk has encountered a molar tooth and unable to grow forward has pushed the root out through the side of the jawbone.
Photo.—H. Barnes, Junr



Pigs' tusk house in "Sing Sing," or ceremony, ground, Wala, New Hebrides.
Photo.—A. R. McCulloch.

its basal portion is strongly curved within its socket, that curve is maintained in the overgrown portion.

Our native friends of the South Sea islands take advantage of this peculiarity by extracting the tusks from the upper jaw, which leaves those of the lower free to grow unobstructed. And they keep the unfortunate pig in an enclosure either in or near their houses, and feed it and otherwise take every precaution that it shall not break its tusks in any way. As a result the tusk grows into a complete circle, and its hard ivory point recurves upon the jaw and forces its way through the living bone. Even worse! Often it strikes the hard molar teeth, which, being unable to give way as does the softer bone, press upon the tusk so sorely that its very growing root is forced backwards and outwards through the side of the lower jaw. The accompanying illustration shows just such a mandible, in which the curled tusk of one side has penetrated completely through the jawbone, while that of the other, being partly obstructed by the molar teeth, has driven its base through the outer side of the mandible. Such tooth-aches as must have been suffered by the unfortunate boar which was forced to provide this specimen must surely be unequalled.

But tooth-ache or any other agony the pigs may suffer is of no moment to our native brother so long as he procures the circular tusks to wear upon his arms, his chest, or even suspended from his ear-lobes. Such tusks form an important part of his life, being significant of his status and manhood, and a dozen

Houses surrounded by a "pig-fence," Aitchin, New Hebrides.
Photo.—A. R. McCulloch.

Headman on pig-killing altar, Dip Point, Ambrym, New Hebrides; he is wearing two pig's tusks as breast ornaments.
Photo.—A. R. McCulloch.

other things associated with ceremonial rites which appeal to his nebulous mind as of greater or less distinction.

Thus chieftainship is not hereditary in Espiritu Santo as in the south of the New Hebrides group, but if a man kills eleven pigs with circular tusks, he becomes a high chief, and takes his rank accordingly into the next world. Moreover, it is customary to kill pigs in honour of the dead, either to raise the rank of the deceased or to commemorate his recent death. In Malekula, New Hebrides, a special instrument called *ndete* is used in this ceremonial killing. A tusker is dragged forward and dispatched by a blow on the forehead with the blunt end of the instrument.

Wooden pig-killing implement, 'ndete; Malekula, New Hebrides. The pig is despatched by a blow on the forehead with the mallet head.
Photo.—A. Musgrave.

Toilet Articles from Ancient Egypt.

By William W. Thorpe.

In Egypt, the custom of discolouring the eyelids and brows dates back to the very earliest times. A moistened powder composed of either antimony, malachite, preparations of lead, or manganese oxide, was used. Some Egyptians preferred the charcoal derived from burnt almonds, but each medium had for its objects the emphasising of the eyes, and the production of a supposed stimulus that the darkened or tinted area added to these organs. The moistened substance was applied with a reed or pin before a polished copper hand-mirror, or painted on by another person. The general term for these eye-paints was *kohl*, and various vessels were used to hold them.

A series of four receptacles are herewith pictured, made of alabaster, a translucent mineral composed of sulphate of lime. These were used for holding *kohl* and other cosmetics; three are from the period of the First Dynasty, and according to the accepted ancient chronology were in use about 5,000 B.C. The fourth and smallest pot, still containing powdered lead carbonate and a piece of malachite, dates only to the Twelfth Dynasty, 3,400 B.C.

It stirs the imagination to reflect that these articles were perhaps the cherished possessions of some Egyptian belle who had her little day some thousands of years ago, and that they may have contained the war paint which served to enthral some gallant of old Nile, "sighing like furnace, with a woeful ballad made to his mistress' eyebrow."

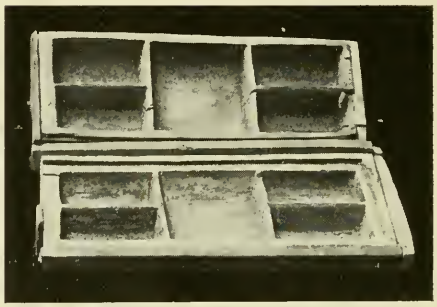
All the specimens were found, along

with other tomb furniture, in the cemeteries of Lahun and Sedment, between sixty and seventy miles south of Cairo.

Other boudoir adjuncts, found in great variety, are caskets and boxes used for jewellery and cosmetics. Their construction often shows great ingenuity and intricate workmanship. Hinged receptacles are unknown, but curious are the substitutes employed to make opening and shutting possible.

Four alabaster cosmetic pots used to hold eyepaint or "kohl." Two of these contain malachite and other pigments, and some are about 7000 years old.
Photo.—A. Musgrave.

The wooden casket, or trinket box figured, closes by the sliding of the two parts together, much after the principle of a modern school pencil case. The lid portion forms nearly half of the casket and the whole, when closed, is almost circular in section except for the margin of added wood to strengthen the region of the slide grooves. Each part contains five cells or recesses, these openings being in apposition when the casket is closed. The reason for this added



"Vanity box" from ancient Egypt, over 3000 years old, used for holding trinkets and ornaments.
Photo.—A. Musgrave.

space in the lid is not apparent, for, if the objects in either half project, the lid would not slide. It may be, that the articles placed in the upper half, were such as would stay in place undisturbed.

The body of the receptacle and its divisions have been cut from the solid. The ends of the lower half, likewise the lateral margin, have been attached to the body with wooden dowels. A small knob forms the handle for sliding the two component parts together.

This casket dates back to the period of the Eighteenth Dynasty, about 1600 B.C., and is from Sedment.

We are indebted to the public spirit shown both by Mr. Ernest Wunderlich (Trustee), and his brother, Mr. Alfred Wunderlich, for these interesting objects lately added to our collections. The joint gift from which these articles were chosen, contained over one hundred specimens, and was unearthed by the British School of Archaeology in Egypt during the season 1920-1921.

Migratory Locusts.

By G. H. Hardy.

The short-horned grasshoppers which are so destructive to vegetation in various parts of the world are known as migratory or plague locusts. In Australia we are, to our sorrow, familiar with these swarms, which are at times so extensive that trains are held up, the numerous crushed bodies of the insects rendering the rails greasy. Just recently the grasshopper pest has been particularly bad in the Singleton district in this State, and at Gawler in South Australia.

The migratory locusts breed prolifically only within restricted areas and it is from these areas that they swarm, covering vast tracts of land, destroying vegetation and laying eggs anywhere in

soft ground whether it be suitable for the development of their off-spring or not.

The newly hatched larvae from each egg-mass move in a group; when two groups meet they join together into a larger one and they build up numbers in this way till larval swarms are formed. At night the larvae climb plants and pass the time in a state of semi-coma. Next morning, when the temperature is sufficiently high, the larvae are restored to normal activity, and, having partaken of breakfast, they again come to earth, and soon a general movement in one direction is in operation; they do not usually feed during these rambles. With the cool of the afternoon the larvae retire to some place of rest on vegetation, and, before passing to a state of repose for the night, they indulge in a full meal.

If the day remains sufficiently cool, the larvae will content themselves with feeding and spending the following night in the same spot. If the weather is moderately warm, the swarm will proceed with its wanderings, but, should the sun be hidden behind a cloud sufficiently long to allow the necessary drop of temperature, it will rest once more and possibly feed again; when the cloud has passed and the sun returns the larvae start on their march afresh. On very hot days the swarm will often cease travelling during midday and the larvae will cluster close together, hiding from the scorching sun.

This nomad life goes on until after the final moult, when the locusts become adult and the tribe ceases to wander on foot; for a few days the newly winged insects are incapable of long flights. During this period the locusts devour vast quantities of food and a fatty substance is built up in their bodies.

When they are fit for flight, one here and there begins to take wing for short distances, and one such disturbance, affecting other locusts, causes still further movement until at last the whole swarm is flying in the same direction. When two flying swarms meet they repeat the taeties of the larvae by mixing together; gradually a vast multitude is formed and longer flights are undertaken until at last a definite direction evolves and the locusts desert their breeding region, leaving a few scattered remnants where once they were in countless numbers. The emigration from the breeding ground is often so complete that only single ones from many groups are left behind, and these are nearly all weaklings or parasitised.

The migrating adult locust has its body cavity largely occupied by air sacs, which are only temporary organs and reach their highest development at the first period of migration, disappearing towards the last when the developing reproductive organs take their place. Whilst these air sacs are large the insects are incapable of taking food in any quantity but subsist on the fatty substance referred to above, and the damage they may do to crops is brought about by their cutting the stems. Later they devour all before them.

This break in the feeding leaves no trace in the line from their source of dispersal to the site of the damaged crops. Before their breeding localities and habits were known the locusts appeared to have come from out of the nowhere and ravished the country in one direction.

It has been a difficult task to track the locusts to their breeding ground, but this has been accomplished and their destruction in the larval form has met with success; the migratory locusts are now so well under control in several countries, more particularly the United States of America and South Africa, that millions of pounds are saved annually.

Mr. George Milburn, of Nottingham Downs, Queensland, has presented a number of bones, mainly vertebrae, of the extinct, carnivorous, marine reptile *Cimoliosaurus*. Remains of a smaller species of the same genus have previously been found in an opalized condition in the opal deposits of White Cliffs, New South Wales, but the fossil is known mainly from the Cretaceous of Queensland.

Useful (protected birds), exhibited during Country Production Week. Many of these are insectivorous and are regarded by the man on the land as his best friends.

Photo.—E. A. Bradford.

During Country Production Week, held under the auspices of the Country Promotion League, from February 20th to 25th, the Museum exhibited in the windows of Farmers', Limited, a large series of birds, comprising the species which are useful to farmers, and also those which are destructive to stock, crops, and fruits. The exhibit was a prominent feature of the Week, and attracted a considerable amount of attention.

Mr. C. Hedley, Principal Keeper of Collections, left Sydney by the R.M.S. Makura on March 16th for an extended trip to North America. Mr. Hedley proposes to do some exploring in the Rocky Mountains region, and, if conditions are favourable, will visit Alaska.

Our lecture session opened this month, when Dr. J. S. Purdy, Metropolitan Officer of Health, discoursed on the "Extermination of Vermin and the Prevention of Plague and other Insect-borne diseases." On April 13th, Dr. W. A. Sawyer, of the Rockefeller Foundation, who has been in Australia for some time conducting the Hookworm Campaign, will lecture on "The Story of the Hookworm." We are very fortunate in being able to secure the service of such eminent specialists as lecturers on subjects of such vital interest to the community.

Destructive (unprotected birds), exhibited by the Museum during Country Production Week. These birds are in many instances destructive to crops and useful animal life, although one cannot say that any bird is harmful all the time everywhere.

Photo.—E. A. Bradford.

EXTENSION LECTURES.

In 1905 the Trustees of this Museum inaugurated a series of popular science lectures. These early gallery demonstrations, as they were termed, proved so attractive and were so well patronised, that when additions were made to the building in 1910 a lecture theatre was provided. Though the seating capacity of this theatre is 250 the audience is invariably in excess, and additional seating accommodation has to be provided, on occasions it has even been necessary to repeat the lecture.

With a desire to render a still greater public service it has been decided to extend these lectures to suburban and country centres. It is realised that many of our citizens are prevented by distance from sharing in the good things provided for the metropolitan resident, and it is to remedy this that this innovation has been introduced. The services of the lecturer are free, the Museum will provide them, but it is expected that local residents will make arrangements for the hall, lantern, and generally do their part to make the scheme a success.

Secretaries of Schools of Arts, Literary Institutes, Parents' and Citizens' Associations, and kindred bodies are invited to apply to the Director for further information which will be gladly supplied.

Dog-tooth ornament worn by native chief in the New Hebrides. Over 130 dogs have contributed their canine teeth to the formation of this striking object.
Photo.—G. C. Clutton.

Breast Ornament.

By William W. Thorpe.

When the H.M.A.S. *Brisbane* called at Rabaul, New Britain, during September of last year, Mr. Linacre, in charge of Native Affairs, presented to the commander and officers of the ship, an elaborate breast ornament.

This example of local handiwork has been loaned to the Museum, and has been placed on exhibition in the Melanesian Room. The general shape is triangular, length 22½ inches by 7¾ inches across the top; and the ornamentation consists, for the major part, of canine teeth of the island dog. In constructing this ornament the teeth have been perforated, and attached in rows to a plaited fibre string base. At the angles and upper centre of the breast plate are small pendants with similar teeth and shell sections. On the breast portion there are twenty-nine rows, and the number of teeth altogether used total five hundred and twenty. As only four canine teeth occur in an individual, at least one hundred and thirty dogs have been accounted for. When worn by the chief, it is suspended from his neck by the attached finely plaited cord. It was considered of great value, and no doubt formed an heirloom of much importance.

The principal items in our next issue will be:—

"A Museum Group in the Making." A. R. McCulloch.
"The Islands of New South Wales and their Birds." A. F. Basset Hull.
"Ocean Island." T. J. McMahon, F.R.G.S.
"Bird Notes." J. R. Kinghorn.

These will be profusely illustrated by a fine series of photographs.

The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON M.A., D.Sc.

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THE AUSTRALIAN MUSEUM

College Street, Sydney.

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1/3

BABBLERS

Top Left—Chestnut-crowned Babbler. *Top Right*—White-browed Babbler.
Centre—Red-breasted Babbler *Lower*—Grey-crowned Babbler.

Table of Contents.

Part of the Montague Island Gullery.

Photo—A. F. Basset Hull.

Silver Gulls on Montague Island.

Photo—A. F. Basset Hull.

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Editorial.

THE MAGAZINE.

The Australian Museum Magazine has now passed its first anniversary, and it is possible to make an estimate of the success or otherwise of the publication. It is gratifying to report that, judging from sales and from the enquiries which have reached us from all parts of New South Wales, and even from other States, the Magazine is widely appreciated and is assured of sufficient support to warrant its continuance. We hope for a further increase in circulation as time goes on, and the publication becomes better known to the Australian public.

OUR FRONTISPIECE.

The fine coloured plate by Mr. Neville W. Cayley which forms the frontispiece of this number is the generous gift of Messrs. Angus & Robertson, Ltd., Sydney. It is a reduced reproduction of an illustration which will appear in a forthcoming work, "The Birds of Australia and Tasmania with their Nests and Eggs," to be known as

CAYLEY'S BIRDS OF AUSTRALIA.

This magnificent publication, which will probably remain the standard work on our birds for many years, will shortly be issued by Messrs. Angus & Robertson, who are deserving of the highest praise for their enterprise and patriotic spirit. The letterpress will be the work of Mr. A. S. Le Souef, Director of the Taronga Zoological Park, Sydney, and Mr. Charles Barrett, author of "In Australian Wilds," with special contributions by Mr. A. J. Campbell, author of "Nests and Eggs of Australian Birds," and field observations by leading Australian ornithologists. Every Australian bird will be illustrated in colour by Mr. Cayley, whose name is a guarantee of fine work. A special feature will be the splendid plates illustrating the eggs of all birds which breed in, or visit Australia. In these plates the artist and the engravers, Messrs. Bacon & Co., Ltd., Sydney, have, by some necromancy, succeeded in making the eggs stand out in relief with a quite startling stereoscopic effect. The work will also contain a very fine series of photographs from life, showing the birds in their native haunts, their nests and nesting sites, their young, and something of their daily life. The completed work will contain over two thousand of these photographs, each taken by an accomplished nature photographer.

This and other Australian museums have a special interest in "Cayley's Birds of Australia," for we have been privileged to help in its production, which has entailed continual reference to the various national collections, including our own, and frequent consultations with the officers in charge of the ornithological sections.

LIGHTING OF THE MUSEUM.

It is our misfortune that the oldest portion of the building was erected in the days when museums were considered more from an architectural point of view than as receptacles for the storage and display of natural history objects, consequently this museum, while a fine example of Italian Renaissance style, is very badly lighted in parts. To overcome this defect electric light is being installed, and already the wall cases in the palaeontological room have been illuminated, so that the interesting collection of vertebrate fossils can now be seen to advantage. At the same time electric light has been supplied to the lecture hall, the board room and front offices, and the lion and Antarctic groups, the attractiveness of which has thus been greatly enhanced.

GROUPS.

The Boatswain Bird group, the making of which is described by Mr. A. R. McCulloch in this issue, is almost completed, and will, we feel sure, form a most interesting and attractive exhibit. The preparation of the Admiralty Islets bird group and the coral pool is now proceeding, and, when these three exhibits are on view, Lord Howe Island will have an added interest for our visitors.

Notes and News.

His Excellency the Governor General and Lady Forster, accompanied by Captain C. J. Traill, M.C., A.D.C., paid a visit of inspection to the Museum on 22nd May. Their Excellencies were much interested in the collections, and the activities of the institution.

Two members of the Board of Trustees, Sir James Burns and Dr. J. R. M. Robertson, have recently departed on an extended trip to Europe. We wish them both a prosperous and enjoyable journey.

The Museum possesses a large collection of coins, ancient and modern, but these, through lack of suitable space, have not previously been exhibited. A show case has now been set apart for the display of a portion of the collection, and, by periodically changing its contents, an opportunity will be given for the public to inspect the more interesting coins contained in the Museum.

Among recent visitors were Mr. S. A. Greenland, Department of Native Affairs, and Mr. A. P. Lyons, Resident Magistrate of the Eastern Division, Papua. Two students of anthropology, Mr. F. E. Williams, of Balliol College, Oxford, and Mr. Gullberg, of the Smithsonian Institution, Washington, both on their way to make investigations in New Guinea, called at the Museum and examined our anthropological collections. Another recent visitor was Dr. Herbert Basedow, who is proceeding to the Northern Territory to lead an exploring party on an oil quest.

In our last issue it was mentioned that "some members of our flora and fauna which are not appreciated in Australia are in great demand in other parts of the world," and the case of the Moreton Bay fig was instanced. Since then the fine fig trees bordering the central avenue in Hyde Park, Sydney, have been condemned to death, and most of them are already gone to provide an outlet for passenger traffic by the projected underground railway. There may be good and sufficient reasons why these trees could not be spared, but their passing will be deplored by many. As Henry Ward Beecher said, "Of all man's works of art, a cathedral is greatest. A vast and majestic tree is greater than that."

Notes on the Babblers*.

By Neville W. Cayley.

GREY-CROWNED BABBLER.

(*Pomatostomus temporalis*).

These well-known birds are found over the greater portion of eastern and south-eastern Australia. They frequent open forest country, and are commonly seen playing and hunting for food near habitations and along the roadside; their strange cries and calls have been responsible for a number of their "bush" names, such as Dog-bird, Cat-bird, Barking-bird and Chatterer. They are very interesting to watch, being always on the go and playing all sorts of games from "chasings" to a fine exhibition of "catch-as-catch-can" wrestling. At first sight one would believe them very quarrelsome—but not so; they are friendly, happy creatures, so much so in fact that "Happy Family" is the name they are mostly known by. Another name, which they share with the Grey Jumper (*Struthidea cinerea*), is "Twelve Apostles," because they usually go about in flocks of twelve. They do a huge amount of good, destroying large numbers of noxious insects—especially the larvae of the codlin moth—and should therefore be encouraged in one's orchard and garden. All hands help with the making of the huge dome-shaped nests; these are usually built in small saplings, constructed of sticks, and lined with grass, bark, wool, etc., with a side entrance that is hooded over. Many nests are built—often two or more in the same tree—but only a very few are used for laying, the others being occupied as roosting-places. Four eggs constitute the usual clutch; they are elongate-oval in shape, and the ground colour varies from pale brown to purplish brown or buff, marked or veined all over with hair-like lines of dark brown or black. The strange thing about these markings is that they can be removed by rubbing with a damp cloth. The breeding season is August to December. Outside measurements of nest: 14 inches long by 13 inches wide, 14 inches in depth. Measurement of egg, 27 mm. by 19 mm. This species is known throughout Queensland, N.S. Wales, Victoria, and South Australia.

WHITE-BROWED BABBLER.

(*Pomatostomus superciliosus*).

This bird is smaller than the Grey-crowned Babbler, but has a wider distribution, being found in both eastern and western Australia. Captain S. A. White, of South Australia, says: "This bird is found practically all over the State, and is a most useful bird, destroying large numbers of noxious insects, especially ridding orchards of codlin-moth grubs. Very sociable, even in nesting time they seem to live in families, and at other times more in parties of five to twenty. Like the other species, they build a great many nests and lay in very few of them. It is a common sight to see four or five birds come out of a nest, which they seem to occupy as roosting places."

The nests are similar to those of the Grey-crowned Babbler. Three is the usual clutch of eggs, but they vary in number from one to five; the shape is oval, the ground-colour a pale greyish brown, varying to light or buff-brown, and slightly marked or veined with dark brown hair-like lines or indistinct mottlings of a darker shade of the ground-colour. From the middle of May to the end of the year constitutes the usual breeding season. Outside measurements of nest: 10 inches by 12 inches. Measurements of egg: 23 mm. by 17 mm.

CHESTNUT-CROWNED BABBLER.

(*Pomatostomus ruficeps.*)

This species of Babbler, found mostly in the interiors of N.S. Wales, Victoria and S. Australia, resembles the

* See coloured frontispiece.

other babblers in habit except that it spends most of its time on the ground.

Mr. Robert Grant procured specimens for the Trustees of the Australian Museum on Buckiinguy Station in western N.S. Wales. He says: "Although resembling the other species in habits, they are remarkably active on the ground and difficult to procure. They run with great rapidity, and manage as a rule to keep a bush or other object between themselves and anyone following."

They are usually met with in flocks numbering from six to twenty, frequenting the level timbered country; they are rather shy, and not so garrulous as the other Babblers. Their nests and nesting habits are much the same as those previously described. The usual clutch of eggs is four (sometimes five), varying in shape from oval or elongate-oval to swollen oval; the ground colour varies from a light purplish brown to olive-grey; some eggs are marked or veined with hair-like lines of blackish brown, others indistinctly mottled with a darker shade of the ground-colour, mostly at the larger end. They are most useful, as their food consists of insects, and they destroy large numbers of grasshoppers. Breeding season, July to December. Outside measurements of nest: 12 inches by 8 inches. Measurement of egg: 25 mm. by 17 mm.

RED-BREASTED BABBLER.

(*Pomatostomus rubeculus.*)

This species of Babbler closely resembles (it is, in fact, the northern form of) the Grey-crowned Babbler, differing only in its smaller size and the reddish coloration of its breast. It is very sociable in its habits, being generally met with in flocks numbering from six to twelve. The nests and the nesting habits do not differ from those of allied species. Three is the usual clutch of eggs, which are oval in shape, the ground-colour varying from a purplish grey to brownish or buff-grey, marked or veined all over with hair-like lines of dark brown. The food consists of insects of all kinds. Breeding season, May to December.

It ranges over Western and North-western Australia, Northern Territory, Queensland, and Central Australia.

The Extension Lectures were inaugurated on April 11th by Mr. A. R. McCulloch, lecturing on "Lord Howe Island, a Naturalsists' Paradise," under the auspices of the Railway and Tramway Institute, Mr. Fraser, C.M.G., being in the chair. Dr. T. Storie Dixson, in his opening remarks, explained the scheme, and the policy of the museum in its endeavour to reach every citizen of the State.

On July 3rd, Dr. Anderson, under this scheme, lectured at Goulburn, his subject being "Life in Past Ages." This was under the auspices of the Goulburn Mechanics' Institute.

Mr. T. Hodge Smith, on July 19th, will lecture at the Newtown School of Arts, his topic being "The Geological History of the Sydney District."

On May 27th fifty members of the 1st Dulwich Hill Company of Girl Guides, under the leadership of Lieutenant Nellie Carmichael, paid a visit to the Museum, seeking information on Australian animals, particularly birds. Mr. J. R. Kinghorn gave the party a lecture on birds and reptiles, and subsequently conducted them round the galleries.

The Making of a Museum Group.

By Allan R. McCulloch.

[Owing to the generosity of Messrs. A. E. and O. Phillips, Sir James Burns, Sir Hugh and Mr. William Dixson, the Trustees were able to despatch a party from the Museum to Lord Howe Island to collect material for the construction of three gallery exhibits. Mr. McCulloch was in charge, and was assisted by Mr. E. L. Troughton. The taxidermy and casting, &c., were carried out by Messrs. G. C. Clutton and W. Barnes, while Miss P. F. Clarke accompanied the party as artist. The first exhibit, a nesting group of Boatswain Birds, has been constructed by Messrs. H. S. Grant and J. H. Wright, and is now almost ready for exhibition. The following article gives an account of the field work entailed in its preparation, together with some notes on the habits of the birds themselves.—Editor.]

In days gone by, those good old days we so often hear about but which were really so bad in many things, a museum consisted largely of rows upon rows of stuffed animals, and whole shelves of specimens in bottles of spirit. People wandered in and looked them over in a more or less aimless fashion, and most of them went away again carrying nothing with them but a recollection of many dead things. In novels one reads of fusty old gentlemen in frayed coats whose interest in the musty things of museum galleries precluded them from the society of their fellow men. That was the spirit of the museum of days gone by.

But the modern museum must be a place of entertainment and education, the latter presented in such a form that it is unwittingly assimilated by everybody. The vagaries of nature, the relationship of everything around us, changing momentarily and all the time, are what make up the interests of our lives, and, whether we know it or not, we are all deeply concerned with everything nature has to show us. And it is the business of a museum to draw attention to, and so make us appreciate these interests. So we no longer arrange specimens in endless rows, but endeavour to present them as they are in nature, very imperfectly it is true, but far more effectively than has been done in the past.

To bring a Boatswain Bird or two into a museum is quite a simple matter. A gun and a knowledge of taxidermy are all that is required for that. And there would be no difficulty in arranging some artificial rocks, decorating them with ferns and bushes, and after stuffing the birds and mounting them in pretty positions, preparing a group that would look quite effective. But would it be correct? Would it teach people something of nature's ways, or would it mislead them with false ideas, which is precisely what we must not do? In order to represent those same birds with all their vitality and the air around them so as to show people how they are in life, it is necessary that we go into the field. Instead of merely bringing them down with a gun, we must climb up to their nests, to watch their flight from above as well as from below, to make friends with their babies, and to study their ways of living. And we must not only have a taxidermist with us to mount the birds in life-like attitudes, but an artist also who can see and paint the background, and so reproduce the atmosphere in which they live. The nature of the cliffs on which they nest, and the kind of bushes occurring thereon must be carefully noted if the reconstruction is to be really instructive, and just what the birds do or don't do is to be carefully observed so that the specimens may be properly associated in the group.

It was with all these things in mind that we set out early in the year for Lord Howe Island. We selected Boatswain Birds as the subject of our group for several reasons, one of which was that they are of such striking beauty that they could be mounted into an effective group, while they are also characteristic of a large group of sea birds which build their nests upon more or less inaccessible cliffs.

We found the birds in plenty nesting on all the seaward cliffs at anything from fifty to a thousand feet above sea-level.

The almost finished group, as it will appear in the Museum. One parent bird has been feeding the speckled chicken in the nest, and resents the intrusion of the other, which is likewise intent upon contributing its quota to the family food supply.
Photo—G. C. Clutton.

Some had eggs, others were feeding white fluffy young, just hatched, while others tended to the wants of fully fledged chickens as large as themselves. These were almost always sheltered securely from the weather in crevices or holes formed by lava bubbles in the basaltic cliffs. The cavities were sometimes almost hidden from view by a luxuriant growth of grass which made them quite cosy, notwithstanding the lack of anything in the way of a nest to keep the chicken or the egg off the hard bare rock. The parent birds were greatly disturbed at our approach, and squawked at us harshly, while ruffling up their beautiful plumage so that their black-tipped feathers showed strikingly amongst their dress of palest pink satin. They did not attempt to leave the nest, however, even when robbed of their single brown or speckled egg, and though provided with sharp pointed bills with serrated edges, they used them so ineffectively that we had no difficulty in grasping and holding them while investigating the nests.

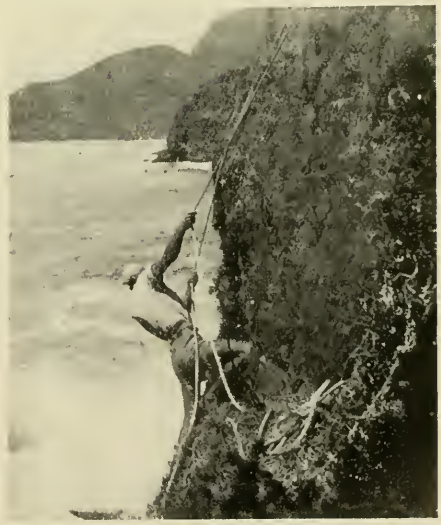
Often as we climbed the cliffs, the noise of our approach to a nest was so smothered in the roar of the surf on the rocks below that we found the parent bird or the young fast asleep. The brooding birds slept with their heads a little tilted backward, not tucked under a wing, as might be supposed, but the young lay sprawled out in any old position. Their necks were generally stretched out upon the ground, doubtless because of the large amount of food contained within the gullet, for the young Boatswain Bird grows apace, and requires much food to build up its rapidly increasing frame. One we disturbed had two half digested squid placed end on end in its throat which were so large that we wondered how it had managed to stow them away so successfully. On one occasion, while watching a young bird in its nest, we saw its mother alight and proceed to feed it, regardless of our presence. She allowed it to insert

The use of ropes enables the climber to descend vertical faces of rock to positions otherwise inaccessible.
Photo—A. R. McCulloch.

its large bill far down her throat, and then regurgitated the food she had swallowed into its hungry maw, a proceeding which seemed to entail much energy and discomfort for them both. So soon as it had obtained all she had to give it, the large chicken, which is pictured with its mother in an accompanying figure, proceeded to peck at its parent in a most unfilial manner, and drove it out to sea again to search for further dainties to appease its apparently insatiable appetite.

Boatswain Birds wander far and wide over all temperate and tropical parts of the Indian and Pacific Oceans, flying with incredible ease in all weathers. They are apparently assisted by one or two long slender feathers which project from the tail, and are known as "steers." These swing from side to side like the rudder of a ship as the bird turns in the wind, and it is said that individuals which have lost them fly less effectively than those in which they are present. Just how far this is correct is doubtful, but certain it is that the flight of even the steerless Boatswain Bird is a thing to be marvelled at.

We watched them wheeling and circling, either singly or in groups of two to four, and so perfectly at ease in mid air that they could stretch a leg forward to scratch behind the ear or bend the head backward to peck at some irritating parasite among their feathers. Every now and again one would pause in its flight and remain fluttering its wings before its fellows as though showing off its skill. Sometimes we saw one attempt to alight in some crevice in the face of a cliff, fluttering near the rocks with every feather in the wings



Troughton examines a well-secluded nest, while the photographer clings to one of the killmoak bushes shown in the upper picture.
Photo—A. R. McCulloch.

A fully fledged chicken and its mother in a crevice formed by a lava bubble in the basalt cliff. Before leaving the nest, the young reaches a size equal to that of its parent.

Photo—A. R. McCulloch.

and tail outstretched, the latter bent upward, and then sheer off again as though warned off by a sitting mate.

The adult bird is covered with a satin-like plumage which is principally white in colour, but which in the male is suffused with a wonderful delicate pink over the whole body, leaving the head white. A black eyebrow and some black-tipped feathers near the tail, a large scarlet bill and bluish legs add to the beauty of this aerial dandy. The steers are scarlet, and their curious form and rarity cause them to be somewhat sought after for millinery purposes. "Tailing" therefore provides both thrills and profit for some of the better climbers among the island boys who annually scour the more accessible cliffs in search of the nesting birds. As these usually sit with their heads in the dark and their tails projecting from the cavities, the steers can be plucked out almost without disturbing their owners. They are then carried in the climber's hatband until he returns to safer levels.

The young Boatswain Bird, as in many other sea birds, differs considerably in appearance from its parents. Each feather of the upper surfaces is marked with one to three broad bars of black, which offer a striking contrast to the pure white of the rest of the plumage. The bill is slaty-blue, and the long tail feathers are undeveloped. During the earlier part of our stay on the island, we found all the nests tenanted by birds with only eggs or newly hatched young, and as we wanted a young but fully fledged specimen to show the speckled plumage, we had to pay them periodical visits to ensure securing one with just these characters. A violent gale churned up the seas to such a height that several chickens we had hoped to collect were washed out of their nests, but others were found after some little search, which we visited regularly, and watched the de-

Our artist is assisted up a rocky face.
Photo—A. R. McCulloch.

velopment of the black and white feathers among the white down until the latter had almost disappeared. They grew in their nests from the size of chickens of an ordinary fowl to that at which they equalled the bulk of their parents, and, though never friendly, they gradually became more or less accustomed to our periodical intrusions. With a very genuine dislike of destroying any living thing unnecessarily, we found the final task of taking their short-lived lives to be much against the grain, and made sure that their demise was both painless and instantaneous.

Climbing the cliffs to the nests provides many thrills, as the accompanying illustrations show. The volcanic rock is often very rotten, and crumbles away under one's feet, so that every projection affording a hold for either hands or feet must be carefully tested before reliance can be placed upon it. Further, as one can often easily ascend to places from which it is difficult or impossible to descend again, it is advisable that two climbers should work together so that one may help the other if necessary. A rope was usually scorned, but we were occasionally able to reach positions, otherwise wholly inaccessible, by means of long lengths of manilla. By fastening the ends to two bushes some distance apart and allowing them to hang down to the part to which we wished to descend, we were able to climb down even smooth rocky faces, while moving to the right or left as required by using the corresponding rope.

Steady nerves and a sense of balance are all-important in cliff-climbing, and one must be ever on the alert for unsuspected dangers. On one occasion, my climbing mate Troughton, while in a particularly dangerous position, brought his whole weight to bear upon a projecting ledge of rock which broke away from under him, and he slipped several feet on the rope before he could grasp it sufficiently firmly to save himself from a sheer drop of a hundred feet onto the rocks below. Further, the killmoak bushes which cling to the rocky faces, or small projecting rocks, often appear to the most careful climber to afford a secure hold, but tear away when one's full weight falls upon them. At such times, thought and action must be instantaneous, and we more than once found ourselves with nothing but a meagre support for one foot to save us until we could regain our balance. It is upon occasions like these that one glances downward to the white surf, roaring and boiling against the foot of the cliff far below, and regrets that Nature has not seen fit to provide us with wings so that we might leap off into space, as do the birds we disturb in our ascent.

As already stated, we had not only to secure the specimens required for our group, but it was also necessary that our artist should see and make paintings of the view from the nesting site selected for reconstruction, to be used in the final painted background of our case. Likewise, the various positions of the nesting birds had to be studied by the taxidermists of our party. With the ever ready help of our friend Stan Fenton, we selected a suitable nest about fifty feet above sea-level, which was fairly accessible to all of the party, and made a careful study of its form and environment. Photographs were taken from various points of view, colour sketches prepared,

Painting the Background.

Photo—A. Musgrave.

and samples of the rock and grasses preserved for later reference.

On returning to Sydney, this nest was reproduced as accurately as possible for exhibition in the Museum gallery. With the photographs as a guide, a wooden framework was built, over which fine wire gauze was stretched, its folds and angles corresponding with those of the rock surrounding the real nest. This gauze was then covered with a mixture of papier-maché, cinders, and plaster, which produced the texture of the volcanic cliff, and the whole coloured from the rock samples. The flying bird and the chick, which had been mounted on the island, in carefully studied positions, were supplemented by a third, and their faded bills and feet recoloured from sketches made from the fresh specimens. Grasses were added, and the whole completed so far as possible in the workshop, after which the rather massive framework was brought up in sections and finally arranged in the case. Concealed electric lights illuminate the finished group, and so produce the effect of realism as nearly as may be.

There have been two Boatswain Birds in the Museum for a considerable number of years, and they have been exhibited in a very conspicuous place. Yet it is probable that scarcely a dozen of the thousands of visitors who have passed through the galleries each year have remembered them, or perhaps even seen them. But we hope that this new group will attract so much attention that it will be carried away in the memory of many hundreds each year, just as is the lion group or the case of Hawaiians in their life-like poses.

"Check-List of the Fishes and Fish-Like Animals of New South Wales," by Allan R. McCulloch, is a welcome addition to the natural history literature of our State. By the use of a simple "key," one is enabled readily to determine any fish. The list is profusely illustrated, and is complete with a generous index and glossary. Credit is due to the Royal Zoological Society for having issued this handbook, and to its patrons for having made possible its publication at a cost greatly below that of publication.

The Islands of New South Wales and their Birds*.

By A. F. Basset Hull, Honorary Ornithologist.

In the days of my boyhood in Tasmania, a brigantine was making periodical trips to some islands in the Pacific for guano, and the skipper would bring home numbers of handsomely marked eggs of the Sooty Tern and Noddy. From this source our small collections were enriched, and our eager imaginations were stirred by tales of tropical sandbanks littered with eggs; of stretches of sand swept clear of eggs and revisited next morning in order to gather "new-laids" for consumption, and our acquisitive souls grieved at the wanton destruction of the beautiful specimens to gratify the coarse appetites of the greedy sailors! How we longed to visit those distant isles and gather the eggs streaked and blotched with great "gouts" of red, brown, and purple; to tenderly drill them and extract the useless contents so that magnificent series could grace our collections. It has fallen to my lot to realise those youthful dreams, and the reality even transcended my boyish imagination, but I have also found that it is not necessary to travel to the far tropics to see vast numbers of seabirds breeding and brooding their beautiful eggs.

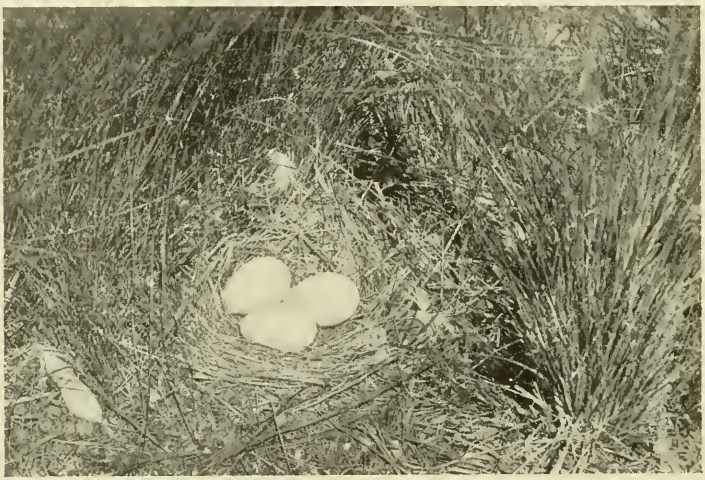
A glance at the map of New South Wales does not reveal any clusters of islands such as occur along the coast of Queensland, but nevertheless there are many islands and islets to be found at intervals from Montague Island in the south to the Solitaries beyond Coff's Harbour. At various times during the past fifteen years I have organised expeditions to the majority of these islands and discovered that they are all inhabited by numerous interesting species of birds, in some cases in vast numbers.

My first visit was to Montague Island, a little to the north of Bermagui. A preliminary correspondence with the lighthouse keeper, Mr. A. P. Bailey, led to my accepting his invitation to inspect the "Gullery." Permission to land having been obtained from the Department of Navigation, my son and I went by the s.s. *Bega* (which subsequently foundered off Tilba Tilba), and after sixteen hours of pleasant steaming along the coast we reached the island about 8 a.m. The Admiralty chart gives the name of this island as Barunguba. It is 110 chains in length and 40 chains in width at its widest part, the superficial area being about 310 acres. It is formed of two islets, connected by a narrow neck, through which the sea breaks in heavy weather. The southern and larger portion is of granite, with huge rounded boulders cropping up above the scanty vegetation, and on top of an immense rock in the centre stands the lighthouse, constructed of the grey granite itself. The northern portion is of black basalt, the cliffs on the seaward side being about 200 feet in height, descending precipitously into the ocean. The landing place is on the southern part, and the track up to the lighthouse passes through low scrub and tussocks of grass, with masses of the creeper *Kennedya rubicunda*. Under this scrub the runs and burrows of the Little Penguin (*Eudyptula minor*) extend in every direction. Numbers of these peculiar birds were sitting on pairs of whitish eggs, more or less nest stained. In the evening those birds which have been out all day obtaining food come home to their expectant families. Standing on the granite rocks near the boat harbour, and looking over towards the mainland five miles distant, I could see numerous patches of broken water, darkened as if by a passing squall or a shoal of fish. These patches moved

*See page 128.

steadily in the direction of the island, and as they came closer I could see the black heads of the Penguins and hear their barking cries. The swimming groups made for several different landing places, but the one immediately below me was the favourite spot. As each group of perhaps twenty to thirty birds reached the rocks they waited, "backpedalling" until the surge ran up a sloping rock, when they shot forward, rolling over and over in the white foam like currants in flour, and as the surge receded they were left clutching the rock or running forward to get clear of the next oncoming wave. Once out of reach of the water, they gravely shook themselves, and chatted in a rippling undertone to each other, huddling together until about a hundred birds had collected on the rock. Then, amidst a chorus of vibratory cries, they started up the slope, following a well-defined track until they reached the rushes and tussocks, where they branched off along smaller tracks to their respective nests. All night long, as I lay on the verandah of the keeper's house, I heard their cries of welcome and endearment, mingled with unmistakable cries of anger and annoyance when some neighbour intruded on the privacy of a nest, resounding from the thick vegetation below the lighthouse quarters.

Interesting as the Penguins were, the northern islet presented a much more animated and brilliant spectacle, for here the Silver Gulls (*Larus novae-hollandiae*) had their great breeding ground. After negotiating the stiff climb up the slippery side of the neck between the two islets we came upon the first group of nesting birds in the "Gullery." There, amongst the tussocks, in the sandy ravines, on the stony ridges, and scattered about the shingle on the slopes of the landward side of the island, were hundreds of nests, from which the birds rose at our approach, filling the air with scolding or plaintive cries. The nests, although sometimes rather close together, were mostly deep, and surrounded with quite a framework of interlaced grass. In fact, some of the nests were quite elaborate structures, although out on the shingly slopes they were merely deep indentations, with a ridge of pebbles and a few straws or fragments of dry seaweed round the eggs. On some of the rocky headlands the eggs were deposited in natural hollows in the rocks, but nowhere did I see any nest so placed that the eggs could roll from one nest to another. The majority of the



Nest of a Silver Gull, containing eggs of the rare red mutation. (Montague Island.)
Photo—A. F. Basset Hull.

nests contained three eggs, but quite a large number contained four, a few contained five, and four nests were loaded up with no less than six eggs each. It was indeed a delightful experience, viewing those thousands of eggs with all their wonderful variations in colour, markings, and size. Ordinarily the eggs vary from a pale olive-green ground sparsely to thickly covered with sepia and black markings, blotches, spots or hair-lines, to deep rich brown ground with similar markings, but some remarkable variations were seen; one with very deep green ground, having a broad ring of black round the thick end, and another with umber ground capped with black, gradually merging into the brown, but without other markings. Two distinct "mutations" were found, one being a beautiful pale blue absolutely devoid of markings, and the other having *white* ground, sparsely streaked and spotted with pale *red* and purplish red suffused markings. On the occasion of a second visit a few years later another clutch of this white and red mutation was found and photographed.

Although Mr. Bailey had noted the Crested Tern (*Sterna bergii*) nesting on the island, there were none on the occasion of my first visit. On the second visit I found a few of these graceful birds breeding on a shingly patch on the eastern side of the north islet, about 30 eggs having been laid amongst the loose stones, without any attempt at making a nest. In one case there were two eggs, apparently laid by the same bird. The accompanying illustration shows how casually the eggs were deposited amongst the stones.

On my second visit to Montague Island I found that the Wedge-tailed Shearwaters (*Puffinus pacificus*) had commenced to construct their burrows preparatory to laying. This species is gradually extending its range southward, while the Penguin is extending its range northward, as will be seen later in this narrative.

The first visit to Montague had a rather unpleasant ending. As we were proceeding to Narooma on the mainland to catch a Sydney-bound steamer, our boat was capsized on the bar, and my camera and plates were lost, together with all our personal luggage. We were rescued by

Nests and eggs of the Crested Tern. (Montague Island.)
Photo—A. F. Basset Hull.

The Pierced Rock, South Tollgate Island.

Photo—A. F. Basset Hull.

the Narooma lifeboat after half an hour of perching on the upturned boat in the surf.

About 40 miles north of Montague Island the Tollgate Islands lie off Bateman's Bay. There are two islets, high and steep, separated by a narrow strait. Each islet presents an almost sheer rocky face to the sea, and slopes rather abruptly to the landward side, where the beach renders landing easy in calm weather. On the southern islet there is a pierced rock jutting out from a sandspit. On these two islets I found Little Penguins, Wedge-tailed Shearwaters, and White-faced Storm Petrels (*Pelagodroma marina*) breeding, the last named species in small numbers only. The Penguins had eggs, fresh and heavily incubated, or young birds in varying stages of growth. The Shearwaters had been working on their burrows, but had not started laying. There were large numbers of these burrows in the sandy soil on top of the islets; probably some thousands of birds breed there annually. There were traces of another burrowing bird, the burrows being short and untenanted. There is possibly a colony of Prions breeding late in the year.

Northward again from the Tollgates for a distance of 15 miles brings one to Brush Island. This island I visited by way of Nowra, Milton, and Ulladulla, taking a launch from the latter port for the 15 mile trip south. On the way down I met with the Fluttering Petrel (*Puffinus gavia*) in fairly large numbers. The birds secured were of such a different colour to the illustrations and descriptions of this species that I gave a new name to the Ulladulla bird (*Emu*, vol. xv., p. 206). The bright colour, however, faded somewhat, and intermediate shades from blue to brown having been recorded, my new name sinks into a synonym.

Brush or Murramurang Island lies barely half a mile off Murramurang Head, an old-time camping ground of the aborigines, with one of the most extensive kitchen middens on the coast. It is long and narrow, about 80 acres in extent, slightly elevated in the centre, and thickly covered with sheoaks, honeysuckles, small gums, and scrubby undergrowth. The Penguins occupied many burrows along the shore and in crevices of the rocks almost within reach of the surf. The nests contained either fresh eggs or young birds, incubated eggs or big, pot-bellied chickens, with a mere collar of down left to distinguish them from their parents. Above the line occupied by the Penguins were hundreds of burrows of the Wedge-tailed Shearwater, each containing a bird sitting on a fresh egg of pure white. Both on the beach at Ulladulla and in the water on the way down I had noted numerous dead Short-tailed Shearwaters (*Puffinus tenuirostris*), better known as the "Mutton Birds" of Tasmania and southern Victoria. On Brush Island I found many of these birds, some partly eaten by Hawks or Crows, some which had been dead several days, and others quite recently dead. Just above the thick scrub, on a patch of sand, I found an egg, quite fresh, but perforated by a pebble, as if

it had been dropped from a height of a few inches rather than laid on the ground. This egg measured 71 x 45 mm., and was, I believe, dropped by one of the Mutton Birds. The eggs of the Wedge-tailed Shearwater are much smaller, averaging about 60 x 40 mm. This was only one of many instances which have come under my observation of dead Shearwaters coming ashore in large numbers. The mortality occurs generally in the latter end of October or early November, and many hypotheses have been advanced to account for the phenomenon. Starvation, disease, sudden storms, and conflicts with the Wedge-tailed birds have all been suggested to account for the untimely death of the Mutton birds. Recent reference has been made by a New Zealand writer to similar occurrences on that coast. There is room here for careful observation and investigation.

No trace of the breeding place of the Fluttering Petrel could be found on Brush Island, although a very thorough search was made.

North of Brush Island there are a few islets close to the mainland, and at the entrance to Jervis Bay there is Bowen Island, formerly a haunt of the Wedge-tailed Shearwater. I visited this island, but discovered nothing worth recording.

Off Port Kembla there is a fairly large island, called Rabbit Island. Here I found both the Penguins and Wedge-tailed Shearwaters breeding. A little further north, and about three miles out to sea from Wollongong, there are two islets, one called Pig Island. The group, including Rabbit Island, which is in three divisions, is known as The Five Islands. On Pig Island I found the White-faced Storm Petrel breeding in numbers, their burrows being driven in the shallow sandy soil under the thick growth of mesembrianthemum and convolvulus which covers the higher part of the island. This was the most northern record of the breeding of this species at the date of my first visit, October, 1909. Penguins and Wedge-tailed Shearwaters were also breeding on this island

When Dr. Danysz was experimenting with the rabbits on Broughton Island, one of his staff informed me that a Storm Petrel was breeding on that island. This information, and Gould's description of the White-winged Petrel (*Aestrelata leucoptera*), which he was informed bred on Cabbage Tree Island, at the mouth of Port Stephens, led me to organise an expedition to the Port and adjacent islands. Mr. C. Hedley, Assistant Curator of the Australian Museum, Dr. Hamlyn Harris, and several other friends made up the party. We went by steamer to Nelson's

Young White-winged Petrel in nest. (Cabbage Tree Island.)
Photo—A. F. Basset Hull.

Bay on the 15th October, 1910, and chartered a motor launch to take us to Broughton Island, twelve miles north of the Port, where we arrived about 9 a.m., and landed on a sandy beach. Climbing the steep sandhills and walking a quarter of a mile to the centre of the island, I found a number of small burrows in a sandy hillock with a north-easterly aspect. Investigation proved these to be the burrows of the White-faced Storm Petrel, the birds sitting on their single eggs, most of which were quite fresh. Numerous fragments or skeletons of dead Petrels were lying about, the victims of Hawks and some domestic cats left by the Danysz experiment staff. Thus the northern record of this Petrel was extended by about 150 miles.

Broughton Island is nearly two miles in length, hilly, and with a steep cliff at the eastern end, descending to a nar-

Black-browed Albatross rising from sea outside Sydney Heads.
Photo—F. Degotardi.*

row neck between the main island and Little Broughton Island. The latter is difficult of access, but on a later occasion I managed to effect a landing and carried out an investigation of the numberless burrows, which proved to be those of the Wedge-tailed Shearwater. This bird also breeds on the extreme western end of the main island and on two small outlying islets. A most interesting discovery on Broughton Island was a burrow containing a Sombre Petrel (*Puffinus griseus*), not previously recorded as breeding in Australia, the bird being a New Zealand species. My discovery was evidently preparing its burrow for the egg, and another investigator subsequently found the same species in this "rookery" with an egg, thus rounding off my record.

But the great objective of this first expedition to Port Stephens was the White-winged Petrel. In his "Handbook to the Birds of Australia," published in 1865, John Gould said that his specimen was obtained while breeding on Cabbage Tree Island, at the mouth of Port Stephens, and he was informed that the bird bred there in abundance. He added: "The Australian Seas abound with Petrels, the investigation of the various species of which, their habits and economy, as well as their places of abode, will serve to occupy the attention of ornithologists for years to come." All the years that elapsed from the time Gould wrote those words the White-winged Petrel had remained unsought for, and its nest and egg were undescribed. It may therefore be imagined with what interest I scanned Cabbage Tree Island on the way out from the Port to Broughton Island, and how eagerly I landed on the historic spot after returning from the scene of the Danysz experiments.

Cabbage Tree Island lies barely a mile from the entrance to Port Stephens; it is about half a mile in length, sloping rather steeply up from the western shore to a height of 500ft. The eastern shore faces the ocean, presenting an almost sheer cliff to the rollers. The greater part of the island is densely clothed with trees, principally the native plum (*Sideroxylon australe*) and the beautiful Palm (*Livistona australis*), to which the island owes its name. The first discovery of note on the island was our old friend the Penguin, occupying shallow burrows or ensconsed in crevices under the rocks on the shore. These birds were sitting on fresh or partly incubated eggs, or had one or two young ones in varying stages of growth. This constituted another "farthest north" record of a breeding place of

Black-browed Albatross rising from Sydney Harbour.
Photo—F. Degotardi.*

View from Cabbage Tree Island. Yacaaba Head (Port Stephens) in the distance.
Photo—A. F. Basset Hull.

this species. Above, and closely approaching the Penguins' zone, were numerous burrows of the Wedge-tailed Shearwater, some inhabited by birds, although it was still too early in the season to expect eggs. Ascending further and entering a steep gully, evidently forming a watercourse in wet weather, and with numbers of great palms growing amidst loose boulders, I stumbled over the accumulations of dead fronds. Under my feet a shrill cry sounded, and a small bluish-grey bird fluttered from under the fronds, and partly waddling, partly flying, it tried to make its way down the gully towards the shore. The vines retarded its progress and I soon captured it, and realised that I held Gould's White-winged Petrel. Further search revealed several more birds, all of which uttered their shrill cry on being uncovered where they had hidden themselves in crevices of the rocks under the dead fronds. There were no signs of eggs, their laying date being evidently a future one. Ascending the gully to the top I had a magnificent view of Yacaaba Head, the northern headland of Port Stephens, and amongst the boulders discovered another lot of the Wedge-tailed Shearwaters.

On 30th October, I again visited the Island, but the Petrels had not laid. Again on the 4th December I made another attempt to obtain the egg of this bird, and this time was successful. Immediately upon entering the shade of the palm gully I found a White-winged Petrel sitting in full view amongst some vines trailing over the ground, and, on removing her, discovered her egg reposing on a bed of dead cabbage palm fronds, broken into short pieces and piled for a few inches in depth in a hollow amongst the stones. The egg was pure white, chalky in texture, and elongated oval in shape. The gully was evidently the favourite spot, for many more nests were found, each containing a single egg, individual eggs showing considerable variation in shape and size. The average dimensions of a number measured were 1.96 x 1.46 inch.

On this last occasion the Wedge-tailed Shearwaters were all sitting on eggs. This species, like its Tasmanian cousin, has

a fixed date for laying, namely, the 27th November. A few eggs may be found on the 26th, and a late bird may lay on the 28th, but by the 4th of December every burrow contains an egg. By the way, this egg is very palatable, the albumen being rather like that of a duck-egg, and the yolk very pale yellow; there is no trace of a fishy flavour. The Penguins also had more fresh eggs, and from observations taken over the last fifteen years I have come to the conclusion that this bird breeds practically all the year round.

Near Cabbage Tree Island there is a high islet called Boondeldah or Big Island. It required several attempts before I was able to effect a landing on this islet, the cliff being steep all round except at one point where a basalt dyke through the porphyry has weathered away, leaving a narrow gully into which we ran our dinghy, dragging it up out of reach of the surf. The climb up this gully was somewhat strenuous, but on reaching the top we were rewarded by seeing the most densely crowded "rookery" of the Wedge-tailed Shearwaters on the coast. Many of the birds had been unable to secure sufficient soil to burrow in, and had laid their eggs on the bare rock or under the shelter of a little bush. These birds sat quite unmoved as we passed by.

On this memorable December trip I also visited Shark Island, near the Port Stephens lighthouse, and several islands inside the Port. On Schnapper Island I found a huge Nankeen Night Heronry, hundreds of birds having nested in the native plum trees. I was later informed that a party of sportsmen (?) from Nelson's Bay had paid a visit to this island and brought away a boatload of dead birds, which it may be added are useless for food or ornament.

My furthest north trip was to Coff's Harbour, and here the Wedge-tailed Shearwaters were the only seabirds found breeding on Coff's or Mutton Bird Island. As this island is to be joined up to the mainland to form a harbour, the birds will not long remain unmolested.

Full accounts of these trips were published by me in the pages of the "Emu," the organ of the Royal Australasian Ornithologists' Union, to the file of which I would refer any reader desiring a more detailed narrative.

A specimen of the curious Ribbon Fish (*Trachypterus jacksonensis*) was recently caught at Middle Harbour, Port Jackson, and secured for the collection; a fine cast has been prepared for exhibition in the gallery. Its body is a bright silvery colour, the skin studded with numerous bony tubercles, and the fins a pale pink. It is six feet three inches long, thirteen inches deep, and only two inches in thickness, this curious shape suggesting its vernacular name. Only two specimens definitely identified as *Trachypterus jacksonensis* have been previously recorded, one the type, from Manly, the other from Milton, N.S. Wales, which unfortunately was not preserved. Ribbon Fishes undergo remarkable changes with growth, the young being quite unlike the adults. They are probably inhabitants of deep water where their broad fragile bodies and fins are less liable to injury than in the perturbed waters of lesser depths. When first observed this latest specimen was swimming with an undulating motion.

Mr. J. J. Fletcher, M.A., B.Sc., Trustee, has presented a valuable collection of over four hundred specimens of amphibians, including co-types and other specimens described by him some years ago in the *Proceedings of the Linnean Society of New South Wales.*

The June excursion of the Naturalists' Society of New South Wales was held in the Museum. About thirty members attended, and spent an instructive and enjoyable afternoon inspecting the various collections under the guidance of Messrs. W. W. Thorpe and F. A. McNeill.

The Story of the Hookworm.

By Dr. Wilbur A. Sawyer,

Senior State Director International Health Board of the Rockefeller Foundation, and Director of the Australian Hookworm Campaign.

[Abstract of a lecture delivered at the Australian Museum, April 13, 1922.]

The hookworm is one of the nematodes, which on account of their shape are commonly called thread worms or round worms. Their early ancestors doubtless lived in earth or water as the more primitive nematodes do to-day, but, with the lapse of time, this class of worms became diversified and adapted to various environments. Some made their home in decaying vegetation, others learned to penetrate living plants, and still others acquired the power to live on the highly nutritious tissues of living animals, or on the partly digested contents of their intestines.

Among the nematodes which are thus parasitic on animals are the hookworms, comprising a number of genera and species. Each species is parasitic in a special host; the dog, the cat, the sheep, the cow, the seal, the elephant, man, and doubtless many other animals, each have their particular species of hookworm parasite. Two species are parasitic in man, *Necator americanus,* the common hookworm of the tropical belt, the Southern Hemisphere, and North America, and *Ancylostoma duodenale,* which predominates in northern Africa, northern India, China, and Europe. In Australia, *Necator americanus* is the commoner form, but there is a small admixture of the other, probably introduced from Europe, and both varieties may be found in the same

Hookworm demonstration at a country public school. Part of the campaign is an effort to interest the children, who in turn become missionaries in the cause, and thus carry the propaganda from home to home. Much good work has been done in this direction.

A Papuan village on piles, over salt water. Settlements like this are practically free from the Hookworm scourge.

individual. Hundreds of hookworms are sometimes found in one person, and from five to eight hundred were removed from each of several children in the Tweed River region.

Unfortunately hookworms damage their human hosts. They cling to the intestinal wall by their mouths, armed with hooklets or cutting plates, and feed on the lining of the bowel and its juices. This causes little ulcers and destroys the body tissue, and the worms also produce a poison, which is probably injected into their hosts through structures in their mouths.

The effects of the hookworms on man are gradual in onset, and so much like those of other chronic diseases that the condition is often not recognised, and the sufferer loses his opportunity of a rapid and early cure through the removal of the worm. The outstanding effect of the presence of the hookworm is pallor, due to a reduction in the amount of red colouring matter in the blood, and with this anaemia we find in children a retardation of growth both physical and mental. Sometimes severely infested persons develop an abnormal appetite for earth or clay, and are known as earth eaters, but this is not common in Australia. The anaemia is apt to be accompanied by lack of ambition, weakness, and increased susceptibility to infectious diseases, and in severe cases death may occur.

To find their way into living animals parasitic nematodes have to overcome the defences of the body against invasion, such as the digestive juices of the alimentary tract and the outside covering of skin. Some enter through being swallowed as eggs, and depend for protection on envelopes that resist digestion. The larvae of others, for example filaria, are injected beneath the skin of their host by mosquitos. Others, including the hookworm larvae, have developed the ability to wriggle through the outside skin and take a devious course to their destination in the intestines.

It is a fortunate circumstance that in the case of the hookworm, part of its life cycle must still be spent outside the body of its animal host in the habitat of the early nematodes, moist earth. The eggs cannot hatch in the digestive tract, and infestation can take place only if the eggs hatch in the ground and the developed larva gains access to the body through the skin, the usual way, or through the rare accident of being swallowed at the proper stage of development. Thus if no hookworm eggs reach the ground there will be no hookworms, and *man can protect himself from infection by proper treatment and disposal of sewage.* Discharge of

Native Lecturer. When the Campaign reaches a village, an intelligent native is selected to carry out the work amongst his fellows. This depicts one in his uniform.

sewage into the sea gives complete protection, for the salt in the water absolutely prevents the development of the larvae. In infected areas, parents can largely protect their children from infection by seeing that they never go barefoot on polluted ground.

The hookworm larvae can develop only in warm, moist earth. Except in certain parts of Australia, in the far north and near the eastern seaboard, the soil is too dry for the larvae, or the climate is too cold at the times when there is sufficient moisture. In the regions where surface conditions are unfavorable for the larvae, it is only in a few of the deepest mines that temperature, moisture, soil pollution, and other circumstances, provide a suitable environment and permit hookworm disease to spread, but even there it can be controlled by proper sanitation.

To study and control this disease in Australia, so that it may not interfere with the development of the north and the mines, the Australian Hookworm Campaign is being carried on jointly by the Commonwealth Department of Health, the International Health Board of the Rockefeller Foundation, and the States. Two hundred and ten thousand people have been examined for hookworm eggs, and forty-eight thousand have been found to be infected. Thirty-three thousand sufferers have already been cured by the hookworm campaign. But the most important part of the work is prevention by stopping soil pollution. Thousands of latrines have been rendered safe, and much educational work has been done through the press, through illustrated lectures, and by means of pamphlets. The object of the Campaign is to prevent the spread of the disease, and to establish permanent measures of control. To do this *it must have the help of citizens who understand.*

The common hookworm of Australia and the Pacific Islands, Necator americanus, female. The full-grown hookworm is half to two-thirds of an inch in length. One female may deposit as many as a thousand eggs a day.

A Horse's Hardship.

By E. le G. Troughton.

An important feature of museum work consists in identifying and supplying information concerning specimens sent from all parts of the State or brought in personally. These specimens are sometimes of great interest, not only to the enquirer but also from a scientific point of view, and there is always a chance that the bringing in of some unusual type of animal may lead to an important discovery.

Occasionally a specimen is abnormal in some way, perhaps a monstrosity like a two-headed calf or, as a specimen does not necessarily represent an entire creature, it may be a single vertebra of an extinct gigantic lizard or the small tooth of some native animal; again it may be a bone deformed owing to an accident, as is the object described in this note.

The accompanying illustration shows the metatarsal or "cannon bone" of the hind-limb of a horse from Graham's Valley, near Glen Innes, New South Wales, brought in recently by Mr. C. E. Watson. Round the bone is looped a piece of ordinary strong fencing wire, the ends of which are twisted firmly together. The movement of this loop has worn a groove in the bone which is accentuated by a high ridge of callus on either side of it. Such an irritation of living bone would excite a prolific flow of constructive matter from the cells, and in this way are deposited new layers, emanating from the bone itself, which would soon cover an immovable body of limited size. Indeed, it has been proved that if the surface of a bone is removed and a close-fitting silver ring placed round it, living bone will surround and cover the ring. In one operation a silver ring, placed round a bone denuded of its outer membrane, had in three months been completely enveloped in newly formed bone an eighth of an inch thick.

In this case the limiting membrane, or periosteum, which controls the growth has been worn through and, as the groove became deeper, the growing shaft of bone has thrown out new layers in an effort to bridge the interspace. The painful movement of the wire, however, has kept the limiting membrane incomplete, and, without its controlling influence, an overflow of growing tissue has banked up on either side of the groove. Unfortunately, though

"Cannon," or Metatarsal bone of horse.
Photo—G. C. Clutton.

these ridges must have served to check any movement up or down, the wire must have rotated freely in the wound, often catching in obstacles and causing the animal intense pain.

How the wire became so firmly fastened around the limb must remain a secret of the animal's painful life story, for the owner tells us that it was wild and unbroken, and was only seen about once a month. Perhaps the unfortunate creature became entangled in a length of wire, and, in frantic efforts to break loose, twisted the ends firmly before doing so and thus it carried the incubus to an early equine grave. Another possibility is that the wire loop was lying on the ground and the young horse stepped through it, whereupon it either worked up with the action of walking or the animal, in trying to rub it off, only succeeded in more firmly establishing the unwelcome leglet.

Bird Notes.

By J. R. Kinghorn.

THE SACRED KINGFISHER AND ITS YOUNG.

About the middle of last December a bird lover at Hunter's Hill wrote to the Museum to the effect that several pairs of kingfishers were nesting in two bird's-nest ferns (a species of staghorn), and stated that last year, when the kingfishers were sitting, a gale, accompanied by torrential rains, flooded the birds out, drowning one of the parents. He had observed that one pair took it in turns to fly to a staghorn (the brown under part) and peck away at the fibre in an endeavour to make a burrow. The writer visited the locality to examine the nest and site and found that the staghorn was growing on an old sawn-off tree stump about twelve feet from the ground, and on the under side, sheltered by over-hanging leaves, was a hole or burrow (the nest) extending inwards for six or eight inches, the far end being slightly enlarged, but there were no eggs. The birds were very shy, sitting 30 or 40 yards away high up in the trees, apparently watching very closely to see that no damage was done.

I again visited the locality on January 14th and found that the new nest had not been occupied. I peered inside with a light and noticed that the floor was very damp as if the rain had flooded it out, and perhaps it was on this account that the birds had decided not to make their home there after all, but had gone to another staghorn which was growing about six feet from the ground

Nest of the sacred kingfisher, Halcyon sanctus, in a staghorn, Hunter's Hill.
Photo.—J. R. Kinghorn.

on the trunk of a very large tree; here they had made their home in an old nest, perhaps their nest of last year. The tunnel is a little over two inches in diameter, and extends inwards for about 8 inches. On flashing an electric torch I was enabled to see three young birds; they were very crowded and one seemed to be living on top of the other two. Their eyes were mere slits, but their mouths were cavernous, and, when I imitated the call of the parent bird, they would open their beaks as if to swallow me and would squeak with all their might in an endeavour to tell the mother that they were very hungry and wanted more. The bluish-green quills were just beginning to show through large patches of bare skin. Again, as on the previous occasion, the parent birds kept a very long way off and watched me from the top of a tree.

The nest of the Sacred Kingfisher is often made in a "nigger's head" white ant's nest in gum trees, or else a hole is drilled in an old decayed stump. The eggs may be four or five in number and are laid in cavities in the side of the tunnel: they are almost round and are pure white.

This bird is a very well known species and its colour is greenish blue on the back and wings and upper part of the tail feathers. The head is greenish on the fore part, but becomes more of a blue colour on the nape. There is a white or cream collar round the neck, bordered by black. The under parts are whitish, the breast feathers being tipped with light brown, while the sides of the abdomen are buff. The under side of the tail feathers are grey.

The food of the kingfisher consists mainly of grubs, small lizards, moths and other insects, and it very seldom does any fishing. I have seen it sitting on the branches of trees overhanging the water, but, when it darted downwards, as I thought in search of a small fish, it almost invariably returned to its vantage point with an insect in its beak. One of the best fisherman of this tribe is the little Azure Kingfisher (*Halcyon azurea*), but, as this species is very blue above and bright buff coloured underneath, with a tiny stump of a tail, it could never be mistaken by anyone for the Sacred Kingfisher.

THE RED-WHISKERED BULBUL.

Otocompsa emeria.

The above name belongs to an Indian bird which was introduced to Australia a few years ago, and which is now firmly established in and around the Sydney district. There have been many enquiries at the Museum during the last few months concerning the name and previous home of this new bird. On several occasions notes have appeared in the *"Emu,"* the official organ of the Royal Australasian Ornithologists' Union, under the heading of *Otocompsa jocosa,* a scientific name synonymous with the oldest and correct one *O. emeria.*

The figure accompanying this article will give readers a very good idea as to what the bird is like. In size it is almost as large as the crested bell bird and the coach-whip bird, and, as all three birds possess a crest, the bulbul, at a casual glance, might easily be mistaken for either of these, but its colour is as follows. Forehead, crown, head, crest, front of cheeks and bill, black. A narrow black line joins the corner of the mouth and extends to just above the shoulder. The hinder parts of the cheeks and the ear coverts are white, and there is a small tuft of crimson feathers immediately behind and joining the lower part of the eye. Sides of neck brownish black, as is also a crescentic band which passes over the shoulders, but does not continue across the chest, which is white; the abdomen is white but washed with brown. Upper parts and wings brown, edge of wing especially near the shoulder, pale pink.

HOW IT CAME TO SYDNEY.

Through making enquiries I understand that a pair of these birds escaped from the Sydney Botanic Gardens about eight years ago, and the great progress the species has made in establishing itself firmly in this country is surprising indeed. Many reports as to its presence have been sent in to the Museum from various localities round

Sydney, but the majority are from the Lane Cove River and the Northern Suburbs. My first acquaintanoe with the Bulbul was early in December, 1921, when I was walking down the Northwood Road; hearing a strange whistle above me, I looked up and saw this unique and very trim looking bird perched on a telephone wire. I have since seen several of them in the same locality. In fact I saw a flock of three pairs on 12th January, 1922, quite close to my home at Northwood.

NEST, EGGS, AND YOUNG.

The Bulbul has been found nesting at Gladesville, and the nest, which is small and cup shaped, but rough, and composed of small twigs and leaves, is generally built in small shrubs rather than in trees. The eggs are usually three in number and are pinkish white, marked with shades of red.

The young do not develop the distinctive red tufts until about three months old.

DISTRIBUTION.

The range of this bird, previous to its coming to Australia was mainly Asiatic, from India, through the Himalayas to Bengal, Assam, and Burma to the extreme southern part of Tenasserim. It extends to China, Siam and the Malay Archipelago, but was introduced to the Nicobars, and Mauritius.

IS IT FRIEND OR FOE?

The question immediately arises as to its habits; so many of our introduced birds have made a nuisance of themselves that it would be both interesting and useful to gather as much information as possible about the habits of the bulbul in this country, and I would ask all who come in contact with it to note carefully any of its peculiarities, and especially what its food consists of. This bird, which is well known in and around Indian gardens and farms, feeds mainly upon insects, but occasionally takes to fruit, thus opening up a field for thought and observation.

The bird seems to be increasing very rapidly in numbers, and now is the time

The redwhiskered bulbul, Otocompsa cineria, an Indian bird accidentally introduced into Australia. It is becoming very numerous in and around Sydney, and should be watched very carefully as to its feeding habits.

Photo.—J. R. Kinghorn.

for us to decide whether it is going to be friend or foe. As far as we know, in other countries it seems to be harmless in some localities, but a pest in others, and it has come to us with rather mixed references. If it turns out to be a pest the necessary steps to check its progress can be taken in good time, and, if it proves to be a friend, we can have it placed on the protected list under the *Birds and Animals Protection Act.*

As I stated before, reports have come in from many of the Sydney suburbs as to its presence, but all reports say that it is very shy and nervous, so that observation is thereby rendered very difficult. This seems to be a great point in its favour, because circumstantial evidence, amongst the smaller birds at least,

shows that most if not all of our pests are bold and barefaced in their acts of destruction.

DISQUIETING EVIDENCE.

In the *Avicultural Magazine* there are statements to the effect that, when reared in aviaries, the bulbul feeds mainly on mealworms and other insects such as house flies, varying this occasionally with a little soft food such as banana, and reports such as this seem rather reassuring, but in the *Ibis*, another magazine of ornithology, all reports are very much against it. In 1901 an ornithologist noted that the bulbul discovered that strawberries were very good to eat, and it was not long before it became a great nuisance to gardeners. It was also found to be partial to mulberries.

In 1892 it was introduced into Mauritius and increased its numbers at a terrific rate, rearing several broods in a year, so that by 1911 it was widely distributed through the island and was a scourge and pest to gardeners and fruit growers. It was found to live entirely on insects and fruit, the latter being the main diet. The great decrease in the numbers of *Zosterops* (Silver Eyes) was put down to the bulbul living on the same food, thereby forcing the smaller bird to either get out of the way or perish.

As this subject promises some very interesting observations which should result in valuable information, I can assure readers that the bird will be kept well under observation, and I will be very glad to receive the fullest information possible from those who are interested, so that, as soon as sufficient data are available, they can be published. The most satisfactory way to observe is with the aid of strong field glasses.

Be sure of your bird and do not mistake it for either of the other two mentioned; look for the tell-tale red feathers behind the eye and below the tail feathers. The note of the bulbul is very pleasant, and it seems to be a very proud bird, evidently because of its crest, as it generally perches well in view.

BIRD PROTECTION.

A study of wild life shows that our useful birds are rapidly becoming exterminated, despite the fact that there is a *Birds and Animals Protection Act*, under which all our birds, with the exception of about thirty species, are protected, and the boundaries of declared sanctuaries are laid down. At the present rate of destruction, we may find that in a few years not many useful birds will remain, while the country will be overrun with pests. It would appear that declared pests, with the exception of crows, are the only birds which escape destruction, while useful ones, often, perhaps, because of their attractive colours, are those most sought after either for personal adornment or for aviarine purposes. In view of these facts, some New South Wales members of the Royal Australasian Ornithologists' Union are now engaged upon a special enquiry into the economic value of our birds and the best method of protecting them. The fact that New South Wales has many declared sanctuaries is not to say that the law in respect to protection is being observed. Far from it, often there is more destruction and shooting in sanctuaries than elsewhere, and this is mainly because proper supervision is impossible, due to an insufficiency of rangers. The R.A.O.U. is making an effort to have additional sanctuaries proclaimed, and to have a number of honorary rangers appointed from its ranks to help the already overworked police and special rangers in the enforcing of the *Birds and Animals Protection Act.* They hope that they will have the just sympathy and help of all.

Ocean Island.

THE PHOSPHATE INDUSTRY.

By Thos. J. McMahon, F.R.G.S.

A mere dot on the map, a tiny speck of land, barely five miles in circumference, is Ocean Island, also known by its native name of "Banaba." It lies in the loneliest space of the Central Pacific, 50 miles south of the Equator, and 2800 miles from Sydney.

One of the many thousand pinnacles to be seen in the worked-out phosphate fields.

Photo—T. J. McMahon.

For very many years this island was known to Pacific traders, and American whalers, but none ever guessed its wonderful value. Beachcombers, mostly escaped convicts from Australia, lived upon the island, but none realised the millions of money that lay in the vast, deep deposits of phosphate-of-lime that lay under their feet.

The island was so small, apparently so valueless, that no nation bothered about it. It was subject to long and terrible droughts, when the scanty native population had to fly to adjoining islands for food. After the droughts would come copious downpours of rain, and then the island was a veritable garden. To-day, Ocean Island is a great commercial asset; it is termed the richest island in the world.

The island rises at its highest point about 250 feet above water. Swept by beneficent trade breezes, the island is exceedingly healthy, and always remarkably cool. No malaria exists, nor tropical diseases, discomforts, or pests of any kind. In the bloom of a good rain season it is a picturesque island, the innumerable, ghost-like, phosphate-rock pinnacles, in a wonderful variety of shape and size, of the worked-out phosphate fields, are intensely effective and interesting.

Ocean Island forms the circular top of a submarine mountain. It is plain that at one period this summit must have been submerged, as the framework of the island is composed of coral. According to scientists, the island appears to be slowly rising, as seems by a very curious system of terraces. It is not solid, but is pierced by countless galleries and caves of un-

A native of Ocean Island in festival dress.
Photo—T. J. McMahon.

known extent, and, in places, of great depth. Six hundred feet of line have been lowered into one cavity without touching bottom. The network of subterranean caves has led scientists to declare that the island is built up tier upon tier of coral arches. The caves under the island have wonderful shapes, many have wells plentifully supplied with water, useful in drought periods. The native men refuse under all circumstances to enter the caves, and consequently the women have become the keepers, and they enter fearlessly. In drought times the caves supplied water to the natives, and it is said the women—who are masterful in manner, and not at all subservient to the men—gained their power by doling out the water only as they felt inclined, realising that the men, fearing evil spirits, were afraid to enter the caves. The women take care to feed the fear of the men, and declare the caves are full of evil spirits with a decided objection to men.

Ocean Island is the seat of the British administration of the Gilbert and Ellice Crown Colony. The British took possession of the Island in the year 1901. Prior to that the "Pacific Islands Company" was engaged in collecting the phosphate of the island. In 1902 this company was bought out and a British company formed a remarkable industry for the mining and distribution of the phosphate, now recognised as a magic soil fertiliser. Since the war this company has given way to the British Commission, consisting of England, Australia, and New Zealand, in administering the affairs of the islands of Ocean and Nauru, and managing the phosphate industries of the two islands, 160 miles apart.

The phosphate industry is perhaps one of the most interesting in the world. The bounteousness of Nature is shown in the composition of the magic product. For years—it is impossible to tell how many—countless numbers of sea birds were attracted to Ocean Island, where neither man nor animal disturbed them, and where was found superabundance of fish usual to deep-sea coral islands.

The birds subsisted on fish and created vast deposits of guano, rich in phosphate, which, mingling with the coral rock, rich in lime, by the powerful process of Nature, assisted by periodic and alternate droughts, copious rains and occasional and complete submergings of the island by the sea, were assimilated in one potent, chemical factor, phosphate of lime, a buff-coloured rock containing all the essential qualities of a prime fer-

tiliser. To-day scarcely a bird is to be seen on the island; but a rich treasure has been handed over to the use and ingenuity of men.

The phosphate is of two classes, rock and alluvial. The former is blasted out, while the latter can be removed with pick and shovel. Trucks are loaded with the phosphate rock, and then pushed on to distributing hoppers, great wooden towers dominating the fields. From the hoppers, on trucks down steep decline lines the phosphate rock is sent to huge buildings, where are the dryers and crushers. After all moisture has been evaporated from the crushed phosphate, it is then stored in a great bin holding 50,000 tons. It is then ready for distribution to the ends of the earth. At the present time the bulk of the rock is sent to Australia and New Zealand. In the Commonwealth and the Dominion it is treated and graded and made ready for sale to the farmer.

The native population of Ocean Island is about 600, and is supposed to have come originally from the Gilbert Islands. They are a fine type of people, with many interesting customs, but they are rapidly dying out.

The Pacific is now fast becoming the scene of wonderful commercial activity Foremost amongst the island territories is Ocean Island.

The native constabulary. These men gain promotion and emoluments by their ability to read, write, and speak English. To qualify, they attend night-schools.

Photo—T. J. McMahon.

A Food Hanger with Rat Disc from Fiji.

By Thos. Steel, F.L.S.

That the rat as a pest has been known to primitive man, as well as to his civilised brother, is shown by the food hanger depicted in the accompanying illustration. It is interesting to observe that the device, a disc, employed to frustrate the predatory habits of this rodent, is similar to that used as a guard upon the lines connecting vessels to wharves or lighters which was introduced here only at the beginning of the present century, during the first outbreak of bubonic plague.

Fijian Food Hanger.
Photo—G. C. Clutton.

This interesting object I obtained whilst residing in Fiji in 1885. It consists of a piece of wood roughly carved in human form. On top of the head there projects a peg which is perforated for the suspending cord. Beneath the hole is fitted loosely a disc of wood which projects for some distance all around over the figure. At the feet is another block having four upwardly pointing blunt pegs.

The object of this arrangement is to prevent the access of rats to baskets containing food materials. The baskets holding yams, taro, and other food are hung on the wooden pegs, the whole being suspended from the rafters. Any rats which climb down the suspending cord in their attempts to reach the food are unable to do so, for when they endeavour to get round the edge of the disc they immediately fall to the floor.

An old Fijian, to whom I showed it, by signs indicated its use, adding that when the rats saw the image they were so startled as to cause them to fall off the disc.

I have seen only two hangers carved in this way, they being usually quite plain.

The Australian Museum

The Museum is open Free to Visitors every Week Day from 10 a.m. to 5 p.m., except on Mondays, when Students and Pupils of Schools and Colleges are admitted by arrangement in the afternoons, and, if the Director is informed beforehand, facilities for study are given.

It is open on Sundays from 2 to 5 p.m., and on all Public Holidays, except Good Friday and Christmas Day.

Children under 12 years of age, unless accompanied by older people, may be refused admittance.

Donations of even the commonest specimens of Natural History (if in good condition), specimens of Minerals, Fossils, Coins, and Native Handiwork, are always welcome.

The office is open daily from 9.30 a.m. to 1 p.m.; and 2 to 4.30 p.m. (Saturdays to 12 noon); and visitors applying for information there will receive every attention from the Museum officials.

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THE AUSTRALIAN MUSEUM

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Table of Contents.

FIRST EXHIBITION HELD IN THE MUSEUM, SYDNEY, N. S. W., 1855.

TAKEN FROM A DAGUERREOTYPE BY C. W. A., CLERGYMAN

THE AUSTRALIAN MUSEUM MAGAZINE

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Editorial.

MUSEUMS ANCIENT AND MODERN.

The first institution which bore the name museum, or temple of the Muses, was that founded by Ptolemy Soter at Alexandria about 300 B.C. But this was not a museum as we to-day understand, it was rather an abode of learning.

Although King Solomon and the Roman Emperor Augustus formed collections of curious objects gathered from distant parts, there is no proof of the existence of any permanent or public record of natural objects among the ancients, but it is said that Aristotle, through the generosity of Philip and Alexander, was supplied with materials for his researches. Perhaps the nearest approach to the museum as we know it were the skins of gorillas collected by Hanno from the W. Coast of Africa and placed in the temple at Carthage.

The revival of learning in the Middle Ages brought into being the collecting instinct, which had for so long remained latent, and museums which contained practically everything pertaining to the arts and sciences, a veritable multum in parvo, were the vogue. Most of these were formed by private individuals for their personal enjoyment, and were rarely associated with any systematic teaching or public benefit. In these early museums the contents were apt to be rather curiosities than objects with real scientific interest. Thus we find such curious entries in the catalogues as unicorn's horns, giants' bones, human skulls "that had never been buried" and were supposed to have marvellous medical properties, petrified toad-stools, Vicar of Bray's clogs, and other strange objects, which, however, were exhibited in accordance with the opinions of the times. Of "Mr. Salter's Collection of Curiosities" it was said in halting verse,

"Monsters of all sorts here are seen.
Strange things in nature as they grow so,
Some relics of the Sheba queen,
And fragments of the famous Bob Crusoe."

The first scientific museum actually founded was the Ashmolean Museum, formed in 1667, chiefly as the result of the labours of the Tradescants, father and son, in Virginia and northern Africa. This museum still exists at Oxford. Later, in 1753, the British Museum, the mother of modern museums, was established, Sir Hans Sloane, who was one of the early scientific explorers of America, bequeathing to the nation his collections. It is interesting to observe that both institutions were founded principally on material from the then American colonies.

Museums as scientific institutions, the exhibits specially selected and arranged for the instruction of the public and the advancement of knowledge, and, generally speaking, supported by public funds, are comparatively modern.

Now the first consideration in establishing a museum is that it should have some aim, and the next is that ample means should be forthcoming to enable it to carry out its services in a proper and creditable fashion. Buildings, cases, and exhibits alone do not constitute a museum. A highly skilled staff, suitably equipped, are an essential, for a museum requires constant and vigilant attention. It cannot stagnate; it must either go forward or decay, and the funds necessary to enable it to satisfactorily discharge its responsibilities are rarely adequate. Specimens, and series of them, are necessary to enable the naturalist to unravel the story, or problems, connected with them. And then there is the "man in the street" to be catered for. Series, though of great value, possess little interest for him, but for his especial benefit there are the group exhibits displaying objects in their natural surroundings, or habitat. Now the obtaining of these means money, and the preparation of the groups more money, but, thanks to the generosity and kindly interest of friends, there will be several new displays of this kind added to our galleries before long. To us it is a great satisfaction to find that our efforts are appreciated in such a practical fashion, and we feel sure that the exhibits thus acquired, besides conveying so much visual instruction to our visitors, will afford keen gratification to their donors.

Notes and News.

Mr. C. Hedley, Principal Keeper of Collections, returned on 16th August from a five months' trip to the Canadian Rockies. He was fortunate enough to get as far north as Alaska, where he had an opportunity of viewing the midnight sun.

Mr. A. R. McCulloch, Zoologist, left on August 29th to join Captain Frank Hurley's expedition to New Guinea and the Barrier Reef. The party is well equipped for scientific work, and have two sea-planes at their disposal with which they hope to make an aerial survey of some little-known parts of Papua. The expedition will be absent for two or three months.

Mr. H. O. Fletcher, of the Museum staff, accompanied Mr. G. H. Halligan's expedition to Lake Eyre, and was away from 26th July till 22nd August. It was the intention of the party to launch a boat on the lake from the Frome River and take soundings and collect samples of the water, and the lake deposits, but, unfortunately, the Frome was dry, and as far as the eye could reach the lake was covered with a crust of salt. Mr. Fletcher, however, made notes on the bird life in the neighbourhood of Marree, and obtained a number of interesting photographs.

Mr. A. F. Basset Hull, Honorary Ornithologist, accompanied by Mr. A. A. Livingstone, of the Department of Lower Invertebrates, made a three weeks' visit to the south coast of Queensland in the end of August and the beginning of September, and secured an extensive collection of marine invertebrates.

In the end of August a party from the Zoological Department of the University of Sydney, led by Acting-Professor L. Harrison, made a short biological survey of the Myall Lakes district and kindly invited two members of the Museum staff, Mr. A. Musgrave, Entomologist, and Mr. W. Barnes, Assistant Taxidermist, to accompany the party. A number of interesting marsupials, rodents, birds, and insects were obtained for the Museum collections.

Mr. Ernest Bryce, who has always shown a kindly interest in our doings, recently left on a world tour to places off the beaten track. With characteristic courtesy he has offered to render us any service that may be in his power.

How Savages Use The Sea Shells.

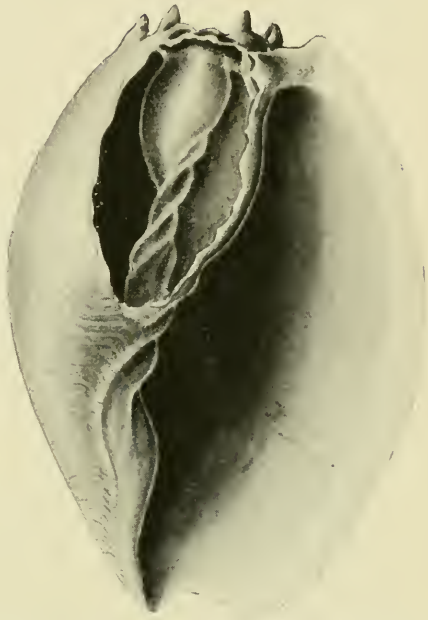
By Charles Hedley.

TO the wild man shells and shellfish were much more valuable than these are to ourselves. In the ages before metals were found, primitive man easily fashioned many useful articles from shells, and without exerting strength or skill he gathered plenty of wholesome food from cockles, mussels, oysters, whelks and limpets.

If a civilised man were so unlucky as to be wrecked on a desert island, being thrown on his own resources and living again the simple life of a savage, he would quickly realise in how many ways he could use his shells. Among the remote islands of the Pacific sea shells are still used not only for ornaments, but for tools, for pots and pans, and many other things. In the galleries of the Australian Museum are many examples of such work, the story of which we will now proceed to tell.

In the good old days the native beachcomber did very well without the trader's store. For the kindly sea gods who managed his fish supply, who brought him the dugong, who guided his turtle to the sand bank where it laid its eggs, also threw upon the beach the material for cups, plates, knives, and all that was needful for his table-ware.

Among such gifts were the giant clam, the great whelk, the helmet shell, and the pearl oyster. One of the most useful of these is the melon shell (*Cymbium flammeum*). Melon shells have been known to reach a length of eighteen inches and a breadth of twelve inches, their backs are as round and smooth as the water-melon from which they take their name, and they are tastefully painted in cream and brown and crowned with a spiral of thorns. The melon shell is at home in the little pools floored with sand that lie among the coral reefs, and, crawling lazily through the wet sand, is the large tough black slug that owns and builds it. In the simple life nothing edible is wasted, so the black slug is wrapped in banana leaves and baked with hot stones for the family breakfast. When rid of its tenant the shell comes into service. In Torres Strait, the islanders, who call it "alup," used it for boiling meat and vegetables. By cutting in it a hand grip they formed it into a bailer; east and west for a thousand miles this melon shell serves the canoe men to bail the water from a leaking craft. The Papuan warrior cut a plate from the melon shell and used it for armour to protect a vulnerable part from his enemy's spear thrust. The womerah of the Cape York Peninsula may be distinguished from every other kind of spear-thrower by the double slip of melon shell at the handle. In fact the melon shell was the handiest thing from which to carve a dish or a spoon or anything else in the crockery line.



Bailer formed from a Melon Shell (Cymbium flammium). The central twisted axis gives a grip for the sailor's hand.

Del.—Miss P. F. Clarke.

Into the upturned hollows of the Giant Clam the rain has dripped from the trees, and a store of water is thus provided for visitors to a waterless cay in Torres Strait.

The giant clam (*Tridacna gigas*) formed excellent water vessels, each valve holding several pints. The people of Torres Strait were found by the explorer, Captain Flinders, in 1802, to store water thus on waterless islands. The fishermen who camped there set rows of clam shells under the trees, and led the rain water by long strips of bark from the tree tops to the upturned shells.

Probably the first musical instruments that were ever invented were made of shells. The most important of the trumpet shells is the great conch shell (*Charonia tritonis*). A mouth piece was made either by slicing off the tip of the spire or by piercing a hole in the side; the apex of a trumpet from New Zealand was protected by being bound with twine. At Tahiti a reed was inserted in the blow hole for a mouth piece. Some practise was required to blow these trumpets properly, but the deep-toned sound reached to a far distance. In the old times it was used as a warning against attack, to assemble the warriors for battle, or to frighten away evil spirits from the village; in modern days the missionaries employ the shell trumpet to call their congregation together for worship.

A trumpet of the Great Conch (Charonia tritonis) decorated as a battle trophy.

Photo.—G. C. Clutton.

In Hawaii the great King Kamehameha possessed a famous military bugle of this kind which had been played in the battles of many generations, and which had exercised supernatural powers in time of peace. Such a trumpet is pictured here from a specimen possessing exceptional interest, having been brought from the South Seas by Captain James Cook, the great navigator. This particular trumpet is thirteen inches long, and the embouchure, as musicians call it, of an inch in diameter is cut in the antepenultimate whorl. It is slung in meshes of flat sennit braid, and a trophy of tufts of long black hair in a stem of human bone is thrust into the axis of the shell. Grim battle souvenirs these seem to be of fallen warriors and cannibal feasts. In Madagascar, according to Dr. Sibree, this conch was called "amjombona," from the trumpeting cry of the flamingo.

Though considerably smaller than the great conch shell, the European conch

A Fijian shell trumpet made from the Giant Frog Shell (Bursa bubo), drilled with a second hole and mounted with a sennit handle.

Photo.—G. C. Clutton.

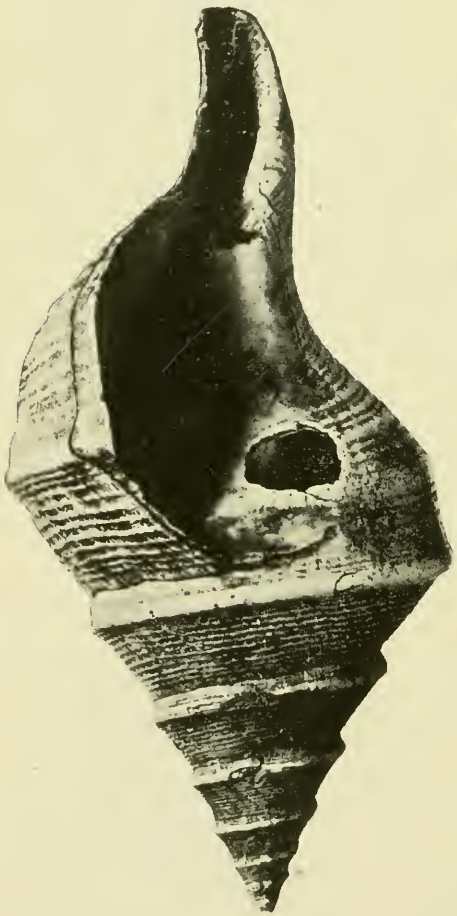
(*C. lampas*) made an effective trumpet. Probably in prehistoric times its use was general throughout the Mediterranean area. The sound which it produced has been compared to the braying of an ass. A century ago, at Nice, Verany relates, disapproval of the marriages of unpopular or ill-assorted couples was expressed by a deafening serenade of lampas trumpets. This is the shell which in groups of statuary the impish dolphin riders hold to their mouths.

From the Fly River in New Guinea the missionary Chalmers collected a trumpet made from the giant whelk (*Megalatractus aruanus*). This shell was also employed as a water carrier as shown in the accompanying photograph.

In old Fiji, a more elaborate trumpet was made from the giant frog-shell (*Bursa bubo*). A strap of thick coir rope was fastened to the anterior end and served as a handle for the trumpeter when grasping his instrument and also to hang it up on the wall when not

A trumpet made from the Helmet Shell (Cassis cornuta), Funafuti, Central Pacific.

Photo.—G. C. Clutton.



A water-carrier made from a Giant Whelk (Megalatractus aruanus), Wellesley Islands, Gulf of Carpentaria. In grasping the carrier the thumb fits into the hole shown in the illustration.

Photo.—T. Whitelegge.

in use. The apex was broken off for a mouth piece and a second small hole was cut near the natural aperture. The bugler varied the notes of his call by stopping the small hole with his finger as in blowing a flute.

A smaller whelk (*Fasciolaria filamentosa*) was made into a shell trumpet by the Papuans of Collingwood Bay.

An unusual pattern of trumpet was made from the helmet shell (*Cassis cornuta*), which was perhaps used only when the large elongate conchs were not available. A helmet trumpet, which I obtained at Funafuti in the Central Pacific, is shown in an accompanying illustration. The shell is about ten inches long and the mouthpiece is cut in the centre of the spire. It was employed to assemble the villagers to a trial or other public ceremony.

The distribution of shell trumpets throughout the world has been mapped by Mr. J. Wilfrid Jackson in the *Manchester Memoirs*, vol. LX., 1916, No. 8. Australia is almost the only country in which shell trumpets do not occur, though material for their manufacture is plentiful. If the Australian aboriginals had blown shell trumpets, they might not have taught the whites to "cooee."

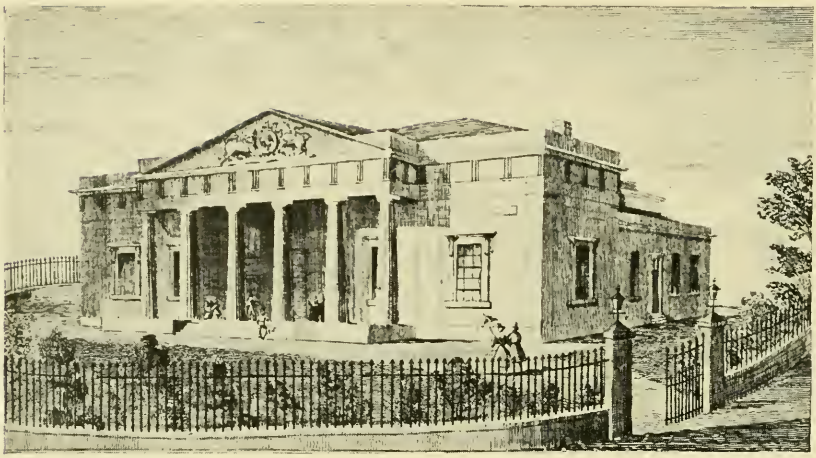
Brief History of the Australian Museum.*

By W. A. Rainbow.

IT has been generally accepted that the Australian Museum was not founded till 1836. Such, however, is not the case. Earl Bathurst in a despatch to Governor Darling dated March 30th, 1827, stated that the advantages of establishing a "Publick Museum" had been represented to him, and though he felt some hesitation in sanctioning money for a building until estimates had been submitted he approved the expenditure of not more than £200 annually to assist the project. As a first step he consented to the appointment of Mr. W. Holmes as Zoologist "who has been well recommended to me as peculiarly fitted for it; and who will, therefore, be immediately sent out to the Colony." In January, 1828, there appeared in the "Australian Journal of Theology, Literature and Science," suggestions for "the establishment of an

The residence of the Chief Justice, in which the Colonial Museum was housed from 1836 to 1840. (After Bladen—"Public Library of N.S. Wales, Historial Notes," 1906.)

* For a fuller account of the museum's history, to the year 1868, see R. Etheridge in "Records of the Australian Museum," vol xii., 1919, p. 339



The Court House, Woolloomooloo, now the Criminal Court, Darlinghurst, to which the museum was removed in 1840. (After Maclehose, "Picture of Sydney, 1838.")

Australian Museum," and a few months later, in the "Sydney Gazette," June 28th, 1828, it is mentioned, that "the Attorney General (A. M. Baxter, Esq.) is resolving on ways and means to start a Museum in the Colony." It is evident that the institution was founded in this year under the name "Colonial Museum," to be known later, about 1836, under its present title. The collections at this period had no permanent home and were housed in different locations at varying times. In 1830 they were contained in the Judge Advocate's Old Office where the Lands Office now stands. In 1831, with the permission of Governor Darling, two allottments in Hyde Park were selected by the Committee of the Australian Subscription Library, "it being understood that suitable provision be made for a Museum . . . which it is conceded may be united with great advantage to the Public Library." In 1835 Governor Bourke approached the Secretary of State for Colonies asking "permission to propose to the Council of this Colony the appropriation of money for the erection of a building to serve as a Library and Museum and to be placed in connection with the Sydney Botanical Gardens." In 1838, £4,000 having been voted for building a Public Library and Museum, Governor Gipps informed the Committee that the Colonial Architect had been directed to confer with them regarding "the purpose of proposing an eligible situation for the erection of an edifice suitable for those Institutions." From the material available it would seem that in 1836 both the Museum and Library occupied the late residence of Chief Justice Forbes. This was on the corner of Bridge and Gresham Streets where the Lands Office now stands. In 1840 they were transferred to what was formerly the Surveyor-General's Office in Macquarie Street, opposite what is now the Royal Mint. It was only whilst in these premises that the two institutions were together and from here the Museum migrated to the "New Court House," Woolloomooloo, now the Criminal Courts, Darlinghurst. Just when the collections went there one cannot say, but in 1849 they were transferred to the situation at present occupied. The erection of the building, begun in 1846, had been slow. It forms part of the North Wing facing Park Street. As the building approached completion there were many enquiries for the use of the "large room." Several local societies met in it, and on the arrival of R.M.S. "Chusan," inaugurating the steam mail service between the United Kingdom and Australia, it was utilised for a ball. This was on August 26th, 1852, and necessitated the closing of the Museum for a month.

Colonial Secretary's Office,
Sydney 14th June, 1836.

HIS Excellency the GOVERNOR directs it to be notified that the following Gentlemen have been appointed "A COMMITTEE OF SUPERINTENDENCE OF THE AUSTRALIAN MUSEUM AND BOTANICAL GARDEN," viz.:—

THE HONORABLE ALEXANDER M'LEAY, Esq.
SIR JOHN JAMISON, K.G.V.
PHILLIP PARKER KING, Esq.
WILLIAM MACARTHUR, Esq.
JOHN VAUGHAN THOMPSON, Esq.
CHARLES STURT, Esq.
EDWARD DEAS THOMSON, Esq.
GEORGE PORTER, Esq.
ROBERT ANDREW WAUCH, Esq., and
GEORGE M'LEAY, Esq.

By His Excellency's Command,
ALEXANDER M'LEAY.

The proclamation, published in the "Government Gazette," 1836, appointing the first committee.

In 1854 there was held in the Museum an exhibition of objects collected for the "Universal Exhibition for Agriculture and Industrial Products," Paris, 1855. This preliminary display, which was held in what is now the palaeontological room, forms the subject of the frontispiece of this issue.

The first committee controlling the Museum and Botanical Garden consisted of the Hon. Alex. Macleay, Sir John Jamieson, Capt. P. P. King, R. N., Wm. Macarthur, J. V. Thompson, Geo. Porter, Hon. E. Deas Thomson, R. A. Wauch, Geo. Macleay and Capt. C. Sturt. The committee was fortunate in having for its officers men like Dr. Geo. Bennett, author of *Gatherings* and *Wanderings*, Rev. W. B. Clarke, "Father of Australian Geology," Mr. W. S. Wall, osteologist, whose brother Mr. T. Wall, collector, perished through the calamitous ending of the Kennedy Exploring Expedition to Cape York in 1848, and Mr. G. F. Angas, author of "South Australia Illustrated," etc. Reference must be made to William Sharp Macleay, who, as a committeeman, and trustee, from 1841 till 1862 contributed so indefatigably to the success of the institution. His severance, due to ill-health, was keenly regretted by his co-trustees.

In 1853 a subcommittee appointed to consider questions of constitution and management reported in favour of the British Museum system and advised its adoption so far as possible by the Australian Museum. In the following year, 1854, the matter of a seal was considered and the design shown was adopted. This year saw the abolition of the committee of management and in its stead was set up, under an Act of Incorporation, amended in 1902, a Board of Trustees.

The seal of the Australian Museum.

In these early years there was associated with the Museum a menagerie, but in 1854 the number of animals had become too many for Mr. Wall to tend, and the collection was accordingly dis-

posed of to Messrs. Beaumont and Waller, who maintained a menagerie at Sir Joseph Banks' Hotel, Botany Bay. One of the understandings was that the exhibits at death reverted to the Trustees.

From time to time the Trustees were favoured with varying amounts to enable them to extend and equip the buildings, to which since the year 1849 additions had been made. The western wing, fronting College Street, was built during the 'Sixties.

On the retirement of Mr. Wall in 1858, Mr. S. R. Fittard, M.R.C.S., was appointed in his place. He took up his duties in 1860, but his service was short, for he died in 1862. The question of appointing his successor gave rise to much argument. Both the Government and Trustees claimed the right of appointment, which was eventually conceded to the Trustees, and in 1864 Mr. G. Krefft was appointed to be followed in 1874 by Dr. E. P. Ramsay.

In 1877 the late Mr. Thos. Walker, of Yaralla, made the generous donation of the Hargraves Collection of Shells. Other notable gifts have been the Egyptian Mummy case presented by Sir Robt. Lucas-Tooth, Bart., and Mr. Dangar's referred to below.

The year 1878 saw many changes. The galleries were made available to the public on Sunday afternoons and on weekday forenoons also. The groundwork for the establishment of the Technological Museum was laid. In 1882 the institution suffered a heavy loss in the Garden Palace Exhibition fire and the entire exhibit of ethnology, together with the nucleus of the collection intended for the projected Technological Museum, was reduced to ashes. With great diligence the Trustees, ably assisted by Dr. Ramsay, applied themselves to making a fresh start, and so successful were they that additions had to be made to the museum, and the Technological Museum was opened to the public at the close of 1883.

In 1894 the late Mr. R. Etheridge, Junr., was appointed Curator and it was during his earlier years that so much attention was given to the collecting of Cook relics and documents. In referring to this, mention should be made of the generous donation from the late Mr. F. H. Dangar, of Cook's M.S. Journal, which forms one of the institution's prominent exhibits. In 1897 the building of the South Wing was begun, and by its completion in 1910 that useful and necessary adjunct, the lecture theatre, was made available, and space was also provided for the proper display of the interesting and instructive ethnological and osteological collections.

His Excellency Sir Walter Davidson, attended by Mr. G. F. Blandy, A.D.C., was present at Dr. J. V. Danes' lecture, "Travels in North Queensland," delivered in the Museum on August 31st. The lecture was illustrated by a superb series of slides, coloured and plain.

Sir James Barrett, K.B.E., M.D., F.R.C.S., lectured on "National Parks and Memorials to Explorers" on September 13th. The lecturer explained the work of the Victorian National Parks Association and its efforts to perpetuate the memories of explorers and pioneers. The values of a national park as a reserve for our indigenous fauna and flora were also dealt with. During the lecture a fine cinema film was shown, depicting birdlife in Bass Strait.

By the death of Mr. Charles Robinson on July 13th last this institution suffered the loss of a link connecting it with the times of fifty years ago. The deceased was secretary here from 1874 to 1879, then being appointed by the late Sir Henry Parkes as secretary to the New South Wales Commission of the Philadelphia International Exhibition, and later selected to organise the Parliamentary Hansard staff, which he commanded until a few years ago. It was our pleasure to receive him a few weeks before his demise, and conduct him through the institution with which he had been so intimately associated.

Experiences and Impressions of a Collecting Trip on a Trawler.

By

Arthur A. Livingstone.

[It is rarely that a museum is afforded opportunities of securing unlimited supplies of deep-sea fauna. In this respect the State Trawling Industry has been the means by which we are able to carry out one of the most important factors of our work. For this great privilege we owe our thanks to the recommendations of Mr. E. B. Harkness, Under Secretary, Chief Secretary's Department of New South Wales, who at all times has fully appreciated the importance of a museum's work in this direction.]

MOST of us are aware that there is a trawling industry. But just how the fish begins its journey from the sea to the table, few of us have any clear idea. It was my good fortune to learn this from actual experience with the fisher-folk upon the salt sea. My five days' collecting trip on the State Trawler "Goonambee" was so interesting and delightful that I would tell the tale to others.

But first a few words about the build and arrangement of the ship. It is substantially built in such a way as to resist the buffeting of the heaviest seas. Comfort is not studied in the construction of such a vessel, but it can venture out in any weather, which is more than can be said of many larger passenger steamers. The usual gross tonnage of a trawler is two hundred and nineteen, and the length one hundred and twenty-six feet, with a beam of twenty-six feet. At a pinch a speed of eleven knots can be attained. They have a high bow; their decks slope down amidships and rise again at the stern, and the draught is shallower for'ard than aft. Most of the centre is occupied by a sort of armoured citadel for the engines, the cabins of the skipper, the mate, and the chief engineer, and lastly the galley. The crew number twelve. In the for'ard hold is stored the fishing gear, immediately aft of which is the fish hold, with its ice store and fish wells. Adjoining this again are the coal bunkers, followed by the engine-room. Right aft and behind the engine-room is a considerable space, utilised mainly as a food store and dining-room for the crew when the weather does not permit them taking their meals above deck. There are two masts, the aftermost of which is provided with a boom supporting a sail, which is used only when the wind is favourable.

On the completion of coaling operations at noon, Sydney Heads were soon left behind, and once upon the open sea, one began to feel the heave and fall of

A rope is tied around the cod-end and this is hoisted inboard. As it hangs dripping over the well-deck for'ard, a greased rope at the bottom is quickly drawn.

Photo.—H. O. Fletcher.

the swell, which for a little time was rather disconcerting.

The chief fishing grounds of the New South Wales coast are off Norah Head, Botany Bay, Montague Island, Eden, and Gabo Island. The Botany ground is particularly favoured about the month of October, when great schools of flathead abound in its vicinity, and then one may see as many as five ships at work together. On the occasion of the present voyage, Captain Flett decided to exploit the ground off Norah Head, and our destination was reached at about five p.m. During the afternoon busy scenes had been witnessed on board. The deck-hands were getting the net ready; the winch was tested and oiled; a general inspection was made of all gear and tackle, and final preparations were made for fishing. As the engines were slowed down there began a scene of great bustle and activity, and all work seemed to be done with utmost promptitude and precision. The vessel had been skilfully manoeuvered into position for the "shooting" of the net. With three-quarter speed ahead, this was passed over the side, and the heavy otter boards attached to each end were lowered with a thunderous rattle and disappeared with a splash into the sea.

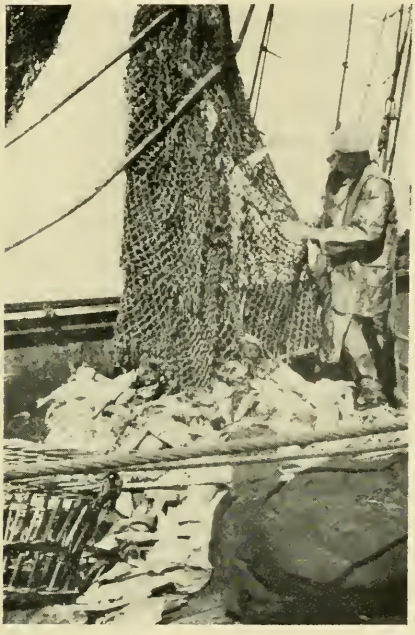
The otter trawl is quite a modern English invention, and appears in diagram very much like a conventional onion bag; the width at its mouth is about ninety feet, tapering off posteriorly to a pointed extremity known as the cod-end. This latter is protected by extra pieces of netting known as the flaps, which are attached by one edge to the outside. The otter boards or "doors" are of massive construction, measuring four feet six inches in height, ten feet in length, and four inches thick; the edges are heavily shod with iron. The action of the water on these doors is comparable to that of wind on a kite, and tends to keep them far apart, and so hold the mouth of the net open. They ride with their long edges on the bottom of the sea, and steel cables or warps are attached to rigid iron frames upon them. The warps pass inboard by way of blocks suspended from the gallows—iron structures shaped like an inverted "U." There are two of these on both port and starboard sides of the ship, one set placed for'ard, and the other aft. Only the gallows of one side, however, are in operation at once.

My attention was attracted by the rattle of the winch, paying out the warps from two separate coils attached to the drums. The winch was straining and screeching, whilst the keen eyes of the operators kept strict watch for the markings on the warps which indicated lengths of twenty-five fathoms. At each of these a temporary halt was made for the purpose of allowing the net to "lay out," thus preventing it from tangling. With the application of the brakes, the winch gradually ceased its noisy part, and held the taut warps secure. By grasping these latter at a point where they left the ship's side, one could feel the vibration caused by the dragging of the net over the sea floor forty fathoms below. This dragging considerably reduces the speed of the ship, so that she only progresses from three to four knots per hour during the period that the trawl is down.

With the completion of the duties associated with the shooting of the net, general quietness supervened, and was broken only by the monotonous droning of the engines, and intermittent jollifications emanating from the region of the galley, where most of the crew had now assembled, busy with their tea. Gradually the glow of the sun waned in the western sky, throwing a red shaft across the sea ere it faded completely. A faint wind fanned the surface of the water and seemed to bring with it night, who immediately began to spread her dusky robes over the watery waste. A dark night without moon, but with a world of stars. Leaning over the side, one saw the dark water agleam with phosphorescent flashes of light, caused by the fish which darted away from the vessel's prow. The vivid revolving light at Norah Head was in the western sky, whilst clusters of smaller lights marked the land in the further distance.

Suddenly the deck was flooded with bright light, and the clanging of the engine-room bell was heard. Within a few minutes all the ship was astir, and

the winch began its contribution to the general noise. When this was warmed up to a certain point, the pin of the block holding both warps together at the stern was freed, and hauling was



A wealth of ocean fauna floods forth.
Photo.—H. O. Fletcher.

begun. For this operation the ship is brought to a standstill with her side to the wind. The net is then hauled slowly to the side, the respective warps rising almost perpendicularly from the depths, and passing over the blocks on the gallows. When the doors are drawn hard up, the net hangs in a semicircle just clear of the ship's side, its outlines appearing strange and grotesque when viewed in the clear water. With the connection to the winch of a line attached to the centre of the groundline, this is drawn over the side. The net itself is then pulled in by hand until the cod-end, with its treasure of fish, lies floating on the surface. A rope is then tied around the cod-end, and with the aid of the winch, this is hoisted inboard. As it hangs dripping over the "pond" in the well-deck for'ard, a greased rope at the bottom is quickly drawn, and almost before the operator is able to leap aside, a wealth of ocean fauna floods forth. Then what a sight! The space is literally alive with fish, wriggling and twisting. Leather jackets (*Cantherines* spp.) grinding their teeth, disregarding the softer-skinned flathead (*Platycephalus* spp.) in their efforts to free themselves from the mass. Saw sharks (*Pristiophorus cirratus*) wave their formidable-looking, but harmless toothed snouts to and fro as they wriggle across the deck. The gaudily coloured butterfly gurnard (*Pterygotrigla polyommata*) is easily distinguished from its allies by the characteristic butterfly-like pectoral fins. Small deep sea whiting (*Sillago* sp.) with their delicate silver-sheen scales, are rudely scattered by their larger neighbours. Huge sting-rays three feet across loudly grunt their protest as the vigorous boots of the seamen bring them to light. They soon subside, however, when their business-like tails are lopped off at the base. These creatures, although repulsive in appearance, provide a dainty dish for the epicure in their wide flappers. There are three principal kinds at present on the market; these are the black ray (*Dasyatis thetidis*), the eagle ray (*Myliobatis australis*), and the sandy-back ray (*Urolophus bucculentus*). The largest of the three is the black ray, which was in great abundance. It is also common in the coastal rivers, and is often speared at night-time when swimming in the shallows. The large thorny tails of this species may be utilised for the making of excellent walking sticks. When these are weighted at one end and placed in the sun to stretch and dry, they closely resemble in appearance the well known and coveted blackthorn. The eagle or bull-head ray, well known for its depredations among the oysters in the river shallows, possesses pointed wing-like flappers, a high bull-like head rounded at the snout, and a short whip tail. It is prettily ornamented with irregular blotches of sky-blue and greenish-yellow. The sandy-back ray is of the conventional shape, and is a delicate

Baskets were passed about speedily and the different varieties of fish were gathered separately with the aid of pointed hooks.
Photo.—H. O. Fletcher.

sandy-pink in colour, with fine reticulating white lines running irregularly over the surface; like its fellows, it has a creamy-white belly. Other things are in abundance; seaweeds, and beautiful alcyonarian corals with their variety of delicate fern-like branches, being strewn about. These particular corals are grouped with the commoner ones of our acquaintance, but to the casual observer such a relationship seems to be out of place. The structure of the "animal" and its habits, however, determines their position under this head (class *Actinozoa*). They are commonly known as "soft" corals, for they are more flexible, and do not possess the same hard calcareous skeletal texture as their reef-building cousins. Multicoloured sea anemones (order *Actiniaria*) and slimy sponges (*Porifera*), dragged from their ocean moorings, lie scattered around, while myriads of sea urchins (*Phyllacanthus*) protest against their harsh treatment by slowly moving their long barbed spines. These latter quaint creatures are evidently extremely plentiful in the depths, for in every haul great numbers were brought to light from their homes at the bottom of the sea. They are armed with long stout spines which are attached by ball and socket joints to the outside of the corona or test of the animal. Their general colour is brownish-green, save for some smaller secondary spines, which are pinkish. Hermit crabs (*Clibanarius* & *Dardanus*) in their stolen shell homes shyly peep out as if to take note of their new surroundings, and hastily retreat at the first sign of interference. Sea lilies (*Ptilometra mulleri*) cling to the net, displaying their frail, red, feather-like arms, doomed to no longer sport these pretty appendages in the current of some ocean garden. Beautiful in its life colours is the "fire-brick" starfish (*Asterodiscus truncatus*), with its red, yellow, and blue mushroom-like tubercles, showing up brilliantly in the glow of the electric light. Amidst such a profusion of wealth from the deep, one is lost in admiration and wonder, and imbued with the truth expressed in the lines of the ancient rhyme.—

"What wonderful sights the diver must see,
When walking alone in the depths of the sea."

The crew soon set to work to clear the deck of the marketable portion of the catch. Baskets were passed about speedily, and the different varieties of fish were gathered separately with the aid of mounted hooks. Almost before one realised it the tally of the catch was shouted to the skipper for notation, and the fish were passed through the hatch into the ice store below. Here each kind was allotted its respective well, where alternate layers of fish and ice were accumulated as the store increased. On the completion of this work there remained only the "rubbish" to be dealt with, which consisted mainly of the small rays and sharks, saw sharks, and other inedible varieties, as well as undersized fishes of the marketable kinds. This was assisted through the scuppers with the aid of hose and broom, a rather unfortunate occurrence, since in its treatment lies the basis of much profit, as a by-product. Meantime the net had been lowered again and quietness recurred as before. With the exception of the man

Many sharks, such as this, were netted, but were cast overboard as "rubbish."
Photo.—H. O. Fletcher.

at the wheel and the engine-room staff, the crew had sought their bunks, and after safely storing the fruits of my collecting labours, I too invited slumber in my quarters aft. This was broken, however, by the occasional thunderous hammering and clanging of the taut steel warps against the ship's side.

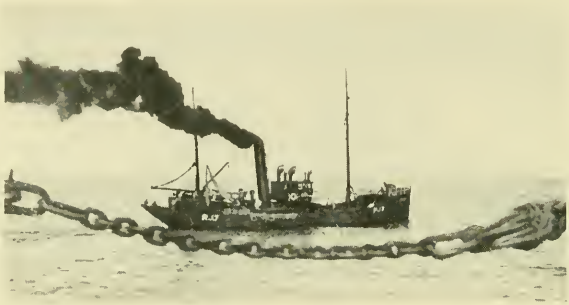
Sunrise the next morning was a memorable sight. Low down on the eastern horizon hung a dark bank of cloud, and as the sun rose, one gazed on a scene of the greatest grandeur; the whole bank was lit up with vast glittering shafts all glowing with the most enchanting hues, until the whole east was flooded with a light like molten gold. The morning broke fine and clear, presenting a vast expanse of ocean over which flew numerous sea birds. Some floated lazily on the swell close alongside, quite unmindful of the frolicking "porpoises" diving about them. The warm sunshine and the pleasant breeze had a most exhilarating effect, so I turned with pleasure to the examination of the collections secured overnight. To the naturalist the microscopic material is just as important as the larger specimens, and on a close scrutiny of seaweeds, etc., I was enabled to disengage quite a lot of minute organisms. Many sea lice (*Isopoda*), and sea fleas (*Amphipoda*), were placed with care in the collecting tubes for later research. Small conical calcareous colonies of sea mat (*Bryozoa*) were found, some sedentary and some free. These colonies often take another form, and are found encrusting either the stem or leaves of marine weeds, or may often be present on the outside of shells. Under the microscope a colony of sea mat reveals numerous primitive animals, each in its tiny cellular home, within the boundaries of which it gathers in food by the aid of delicate tentacles. The cell patterns of individual colonies are wonderfully consistent, and present a scene of exquisite architectural beauty.

In the next haul was an unwanted visitor in the form of a large grey nurse shark (*Carcharias arenarius*), a truly awesome creature when seen out of its natural element. After expending most of its energy by snapping its jaws and beating its tail on the deck, it was despatched by a well placed blow with a sledge hammer, and tossed back into the sea. Many large wobbegongs or carpet sharks (*Orectolobus devisii*), less harmful than their man-eating cousins, were taken in subsequent hauls. Their skin is beautifully marked with a reticulating pattern of brown and lilac, the design of which so resembles that of a carpet that it has earned for the species its vernacular name.

All through the days and nights following the crew shot and hauled with unlimited energy at regular intervals of four hours duration. The store of fish in the hold steadily increased, and in the end totalled about 350 baskets. Every haul, however, was not attended with equal success. Occasionally fortune deserts the crew. This may be by the fouling and consequent tearing of the net on some obstacle on the sea floor. Fortunately this does not often occur, as the regular fishing grounds are by now well known. The nature of the bottom in these localities has been carefully investigated and charted, thus enabling the helmsman to avoid isolated reefs and other submerged objects. Again, trouble may arise from the splitting of a cod-end which has become too weak to support the weight of a catch of fish. This generally occurs while the tackle is hauling it inboard. I witnessed one of these unfortunate occurrences, which caused the loss of half the catch over the ship's side. Only portion of this was regained through the

untiring efforts of the crew, and the use of long-handled landing nets requisitioned for the purpose.

The deck-hands are very experienced in the art of net mending, and most of the minor tears are attended to while the net is being drawn in by hand over the ship's side. I was greatly amazed at the rapidity with which the meshing of an irregular tear was replaced. When extensive damage is sustained, the mending is facilitated by the entire replacement of the particular "section" of the net that has been torn.



Trawling at sea.
Photo.—A. Musgrave.

Marauding Fishes. Mr. E. H. Rainford, a valued correspondent of the Museum, which he has supplied with many interesting specimens, sends us the following note from Bowen, Queensland. "When hunting for star-fish on the North Head banks at dead low tide, I came across a shallow depression made by the rooting of some fish, and, at the bottom of the hole, were the fragments of a large heart urchin; its spines were still moving, showing that the creature had only just been eaten. Further on I came across pieces of another still moving, and then a third, all very large with long spines. All about the banks were the fragments of the skeletons of big heart urchins, showing that the incident was not unusual. I suspected stingrays, but, continuing my wading (this was in two feet of water), I at length came on the marauders, a big mob of blunt-nosed trevally (*Trachimotus ovatus*), heads down, tails up, rooting in the sand. So intent were they that I was able to get quite close to them before they decamped. I knew that they fed largely on cake urchins, but I did not think they would tackle the sharp poisonous spines of the heart urchins."

Mr. F. W. Whitehouse, B.Sc., of the University of Queensland, who is proceeding to the University of Cambridge to do post-graduate work in Palaeontology, came to inspect our collection of Cretaceous invertebrates, and Captain G. Pitt Rivers, A.D.C. to the Governor General, made several visits to the Museum to examine the ethnological collections.

The scientific problems of the Pacific are attracting renewed attention, and recently we were glad to be able to give some assistance and advice to Mr. J. R. Baker, of the University of Oxford, who is making a biological survey of the land and fresh-water fauna of the New Hebrides on behalf of the Percy Sladen Trust, and to Mr. T. T. Barnard, of Cambridge, who intends to do research work in anthropology in the Banks Group.

Mr. Willi Fels, of Dunedin, a generous supporter of the Museum in his home town, who is on his way to England and the continent, spent several days inspecting our ethnological collections, and made arrangements for an exchange of specimens with the Dunedin Museum.

Stick and Leaf Insects.

By

ANTHONY MUSGRAVE.

The female of the Pink Winged Phasma (Podacanthus typhon). This is one of our most beautifully coloured species.

Photo.—A. Musgrave.

OF the many quaint forms of insect life forwarded from time to time to the Museum, none arouse more interest than the stick insects. Their uncanny resemblance to sticks or leaves, and their very often heavily spined bodies excite much curiosity and speculation.

Stick insects are members of the family Phasmidae, and are also popularly known as Spectre Insects or Phasmas. They are placed in the order Orthoptera, which also includes cockroaches, mantids, crickets, and long and short-horned grasshoppers. All these insects have biting mouthparts, and the forewings are usually hard and narrow, and act as wing covers (tegmina) for the large and membranous hindwings.

Many of the stick insects are claimed by their captors to be mantids. The mantids, though closely allied to the phasmas, are placed in a separate family, the Mantidae, and may always be recognised by the presence of their spiny raptorial forelegs. The mantids, too, unlike the stick insects, feed on other in-

sects, which they catch by grasping them with the spiny femur and tibia of the fore legs, which close on one another like the blades of a shears. When at rest a mantid stands semi-erect on the middle and hind pairs of legs, while the spiny fore legs are held together close to the body. This attitude, suggestive of prayer, has earned for them the title of "praying mantids."

Stick insects, however, are purely vegetarian in their diet, and some of our species are extremely voracious and do a great amount of damage to the foliage of our trees. Their attitude, too, while resting, does not suggest any religious pretence. They are chiefly remarkable for their resemblance to the branches and leaves of the plants on which they live. So as to protect themselves from the attacks of insectivorous birds and other enemies, they have evolved a form which enables them to escape detection, and this form always consists of some assimilation to their environment. Added to this mimicry of form, is a simulation of the colours of the plants on which they live; thus we find greens and browns predominating, though at the bases of the hind wings in some of our species beautiful reds and purples are to be seen. These are, however, seen only when the wings are expanded, as the wings are always folded along the sides of the body when the insect is on its food plant so that its resemblance to its surroundings may be maintained.

Phasmas readily succumb to the effects of cold, and they usually disappear after the first frosts.

STRUCTURE.

When we come to examine the structure of stick insects we find that the head is placed obliquely, whereas in the mantids the head is bent downwards. The prothorax (the segment which bears the first pair of legs) is, as a rule, shorter than the mesothorax (the part which carries the middle pair of legs). The body is usually long and slender, and the legs are long and thrust out at awkward angles from the body, so that they resemble the twigs on a branch. Some species are wingless in both sexes and are very stick-like in form, in others the wings may be present in one sex and greatly reduced in the other. In many cases, the wings are present in the male and absent in the female. The fore wings (tegmina) are usually extremely short, and, when at rest, cover only the basal area of the hind wings. The hind wings are divisible into two parts, one, the fore or costal border of the wing, being opaque and usually of the same colour as the elytra, and the other transparent, membranous and usually different in colour from the hard fore border. When at rest the membranous part is folded beneath the harder portion.

In the females there is a large, frequently boat-shaped ovipositor or egg laying organ, situated near the end of the abdomen on the ventral surface, and sometimes projecting beyond the extremity of the abdomen. In both sexes there are, in our Australian species, long flattened appendages which spring from the under side of the last dorsal segment of the abdomen. As the males of most of our Australian phasmas are rarely seen they have been only lightly touched on in this article.

LIFE HISTORY.

The young of stick insects, as in all orthopterous insects, on emerging from the egg resemble their parents, and thus a metamorphosis such as we find in butterflies is absent. The eggs are seed-shaped and have very hard shells, which serve as a capsule to protect the egg contained within. The egg capsule, too, has a lid at one end, which is pushed off by the young phasma when it emerges. The eggs are laid by the female while feeding among the leaves of the food plant, and drop to the ground where they remain for a year or more before the phasmid emerges. After death stick insects become very brittle and the antennae and legs are easily broken off, which accounts for the mutilated condition of some of the specimens figured.

Our Australian species may be placed roughly in two divisions, namely, those in which the mesothorax (that part of

the body carrying the middle legs and extending to the base of the fore legs) is short, and those in which it is long.

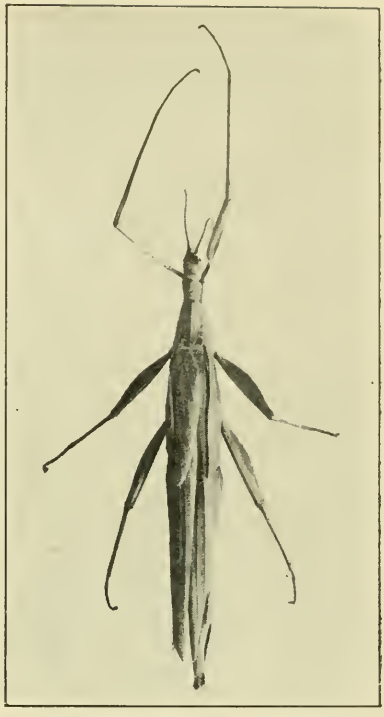
SPECIES WITH A SHORT MESOTHORAX.

The most extraordinary-looking of all our species of phasmas is, without doubt, the Spiny Leaf Insect (*Extatosoma tiaratum*). The female of this species is not uncommon, though the male is very rarely met with. She measures five inches in length, and is green in colour. The head is conical and spiny, and the legs and abdomen have broad, spiny, leaf-like expansions. The wings are reduced to mere flaps in the female but the male has well developed wings. It feeds on the foliage of eucalypts, but Mr. Froggatt, Government Entomologist, has recorded it as having been taken on the foliage of peach trees in an orchard on the Brunswick River. It occurs in Queensland and New South Wales.

The female of the Yellow-winged Spectre (*Tropidoderus childreni*), is much commoner in collections than the male. It measures from five to six inches in length, and from seven to nine inches across the expanded wings. In the thighs (femora) of the middle and hind legs are broad, flat, leaf-like expansions, which in themselves are sufficient to establish the identity of the species and also the sex, the male being without them. The colour of the body is yellow or yellow green, while the thickened parts of the wings and the keel-shaped ventral segments are green. The bases of the wings are yellow, though in some forms the colour is red or purple. The membranous part is hyaline and nearly transparent.

The species occurs in N.S. Wales, Victoria, and Queensland, and feeds on the foliage of gum trees.

The most beautiful examples of our Australian phasmas are included in the



The female of the Yellow Winged Spectre (Tropidoderus childreni) may easily be recognised by the leaf-like expansions on the femora of the middle and hind legs.

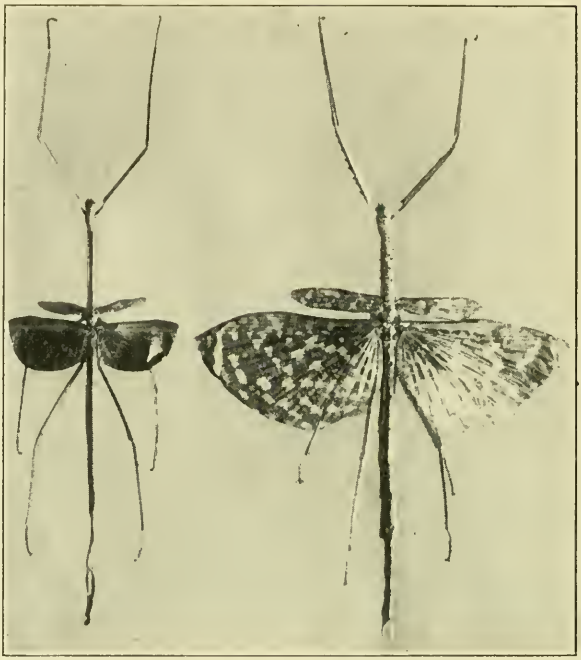
Photo.—G. C. Clutton.

The female of the Spiny Leaf Insect (Extatosoma tiaratum).

Photo.—G. C. Clutton.

genus *Podacanthus*. These usually have the hard parts of the wings green in colour and the fore wings are generally leaf-like. The males are smaller than the females, and their abdomens are slender instead of being broad.

The female of the Pink-winged Phasma (*Podacanthus typhon*) is, perhaps, our most beautifully coloured species. When the wings are outspread the membranous portion is seen to be hyaline in colour and tinged with pink. The bases of the hard fore border of the hind wings are reddish pink, the rest being green. It measures five inches in length and eight inches across the outspread wings. It occurs in Queensland, New South Wales and Victoria.



Male (left) and female (right) of the Great Brown Phasma (Vetilia titan), our commonest species.

Photo.—A. Musgrave.

Another pink-winged form (*Podacanthus viridi-roseus*) resembles the preceding species but is smaller in size and the bases of the hind wings are violet in colour instead of reddish-pink. This violet colour, however, fades after death, and the whole of the thickened fore border of the hind-wings appears a uniform green. The female measures about four and a half inches in length and nearly seven inches across the expanded wings. It ranges from Queensland to Victoria.

The Gregarious Phasmid, or Ring-barker (*Podacanthus wilkinsoni*) is an exceptional stick insect, in that the two sexes are of the same length. They are extremely plentiful in the New England district of New South Wales, where they do great damage, denuding the eucalyptus trees of their leaves so that they appear to have died from the effects of ring-barking. This destructive habit has earned for them their vernacular name of "Ringbarkers." They are said to appear about the beginning of January and deposit their eggs towards the end of February.

The female measures about three and a half inches in length, so it is much smaller than the other members of the genus. It is light green in colour on the upper surface of the body, and almost black on the undersurface. The fore wings are light green and the fore borders of the hind wings are similarly coloured, with the exception of the bases of the wings, which are reddish orange. The membranous portion is purplish-pink.

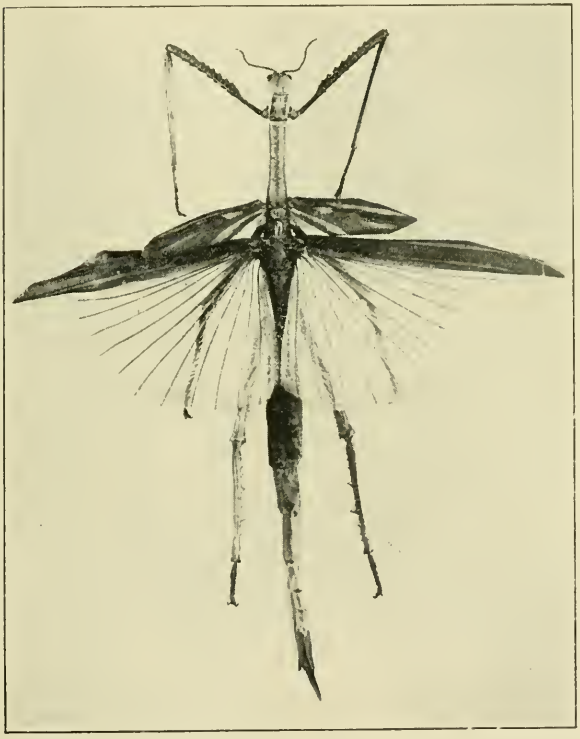
SPECIES WITH A LONG MESOTHORAX.

The species with a long mesothorax seem to resemble sticks rather than leaves as do the short thoraxed forms.

Typical of this section, and by far our commonest species, is the Great Brown Phasma, *Vetilia* (*Acrophylla*) *titan*, which occurs abundantly in the neighbourhood of Sydney and ranges from Queensland to Victoria.

The male of this species, has a body measuring about seven inches in length, while the outspread wings measure only about three inches. The wings are, therefore, reduced in size out of all proportion to the rest of the body so that they are quite useless for flight. The colour of the body is light brown, while the fore wings and foreborders of the hind wings are greenish yellow, the membranous portion of the hind wings being of a brown colour with small light brown mottlings.

The female, on the other hand, is larger in size than the male, and measures eight inches or more in length, while the measurement across the outspread wings varies from seven to eight inches. The wings are thus more strongly developed in proportion to the rest of the body than those of the male. The fore wings are greenish black, irregularly mottled with red, and a cream spot is present about the middle of the front margin. The hard fore borders of the hind wings resemble the wing covers in colour pattern, except that a red spot is present at their base while the cream spot is absent. The membranous portion of the wings is broad and spotted with large irregular white markings.



Female of our largest known stick insect (Clemacantha regale).

Photo.—A. Musgrave.

Our largest Australian stick insect is *Clemacantha regale*, which measures nine inches in length and about the same measurement across the expanded wings. It is a beautiful insect and was originally described from Narrabri, N. S. Wales, but it also occurs in Queensland, and Western Australia. Its general colour is green and yellow, the head being banded with green and pale yellow. The fore wings are green with long white stripes. The hind wings have the hard fore border bright green with white longitudinal bars; the bases of the wings are bright red and their under surface is also of a bright red colour; the membranous portion has a bluish tint and is almost transparent.

On July 19th, Mr. T. Hodge Smith lectured at the Newtown School of Arts; his subject was "The Geological History of Sydney."

Under the auspices of the Parents' and Citizens' Association, of Penrith, Mr. T. Hodge Smith, on September 14th, lectured on "The Formation of the Blue Mountains and the Coastal Plain."

"Belmont British."

By G. C. Clutton.

TO dog fanciers "Belmont British" was known as one of the few almost faultless specimens of bull-dog breed. But the fact that he was Grand Champion for 1922 did not make this far-famed animal impervious to the sudden attack of sickness which quickly removed him from the canine world; death is no respecter of dogs. Must poor old "Belmont British" be put under the sod and forgotten as if he had been no more than a scavenging habitué of the back lanes? Perish the thought! His owner, Mr. G. Parsons, determined that his canine majesty should be preserved in all his wrinkled beauty; and so the carcase of "Belmont British" went not back to mother earth, but became the subject of earnest contemplation and tedious painstaking labour in the workshops of the Australian Museum.

Those who may take the opportunity of seeing this mounted specimen of a bull dog, now amongst the treasures of our Museum, may be interested to know something of the methods employed in carrying out the work.

The mounting was done on a papier mâchè manikin (this being the first attempt made at the Museum to mount a specimen on a manikin) and the task before the preparator was to get a "true-to-life" reproduction.

After the animal had been carefully skinned, salt and alum were rubbed on the skin and allowed to stand for a few

The exhibit completed. The small illustration depicts the manikin employed. So many pins were used to hold the wrinkles and folds in position till the skin had set, that "Belmont British" rather resembled a spiny ant-eater than the Grand Champion for 1922.

Photo.—G. C. Clutton.

days. The skin was afterwards placed in a tank of brine until ready to mount. The body was placed in the position that had been decided upon for the finished exhibit, and a mould made of plaster-of-paris—in this case a two-piece mould. When this had set the body was taken out of the mould and the latter allowed to thoroughly dry, after which a coat of shellac was placed on its inside surface.

The papier mâchè, consisting of flour paste, wood-wool, and plaster-of-paris, was then prepared. The paste and wood-wool were first mixed together, and, as required, the plaster-of-paris kneaded into the mixture. When thoroughly mixed, but left moist enough to be easily worked, it was pressed into the mould to a thickness of about 1½ inches; so that the manikin would be light, the mould was not filled up.

The papier mâchè having set and become quite hard, the mould was removed, the manikin being ready for the skin to be placed over it. Before this could be done, however, the skin had to be pared down, this making it easier to work and causing it to fit snugly over the manikin. This was done by placing the skin over a board prepared for the purpose. Sufficient of the tissue having been pared off, the skin was then placed in clean water to soak out the salt and alum, the removal of which was necessary, as the salt in damp weather would absorb moisture and affect the hair.

The placing of the skin on the manikin was a difficult and tedious task, requiring an unbroken sitting of nearly fifteen hours. The work had to be completed in one sitting, as the skin must not be allowed to dry.

The skin having been placed in position and sewn up, the preparator's attention was then turned to the still more difficult and tedious task of getting the correct facial expression. Photographs of the animal were used, and the owner, Mr. Parsons, gave invaluable assistance in helping to perfect this part of the work. When the wrinkles were made they were kept in place by the use of pins, and not removed till the skin was dry and set, this taking a considerable time. The eyes, of course, were fixed in place at the same time.

Paring the skin.
Photo.—G. C. Clutton.

And now "Belmont British" rests on his polished stand, looking just as he looked in real life—"A Perfect Beauty."

A Useful Publication. A third edition of the "Guide to the Australian Ethnological Collection in the National Museum of Victoria," by Sir Baldwin Spencer, K.C.M.G., F.R.S., Honorary Director, has just been issued. This guide which is well illustrated, is a valuable contribution to the literature of the Australian aborigines, and a most useful work for museum purposes.

Bird Notes.

By J. R. Kinghorn.

THE INDIAN SPOTTED DOVE.

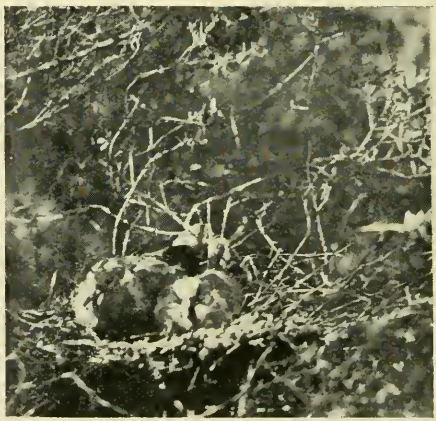
(*Turtur suratensis.*)

Early in December, 1921, while I was walking in the bush at the head of Woodford Bay, Lane Cove River, a rustling caused me to look up just in time to see an Indian spotted dove

The Indian Spotted Dove, Turtus suratensis, a species which has been with us for over 40 years, and one which is very well known, especially in the parks and gardens round Sydney.

Photo.—J. R. Kinghorn.

fly from its nest. This species is an introduced bird which is well known, especially round Sydney. The nest was built of twigs and leaves; it was rather flat, being about the shape and size of an ordinary tea plate, and was built about 8 feet from the ground in a tea tree bush, one of those long, slim, straight stemmed ones which grow high so as to get well up into the sunlight above the surrounding growth. It was situated immediately behind a Christmas bush in full bloom, and was therefore well within view of any persons picking this much sought after table decoration, the beauty of which completely held the attention of such persons; a lucky thing for the bird when small boys were about. I did not get another chance to visit my find until the twenty-seventh of the month, when I noted that there were two round white eggs in the nest, and I am sorry to say that I do not know the exact date on which they were laid. I next visited the site on 1st January, 1922, during the monsoonal weather we had been experiencing, and, much to my surprise, when the parent flew off the nest I saw two tiny, almost bare chicks, very pathetic looking creatures, with large heads, bulging, frightened eyes, and small bodies, through the skin of which was showing a mass of dark coloured quills. I was very sorry to have frightened the mother away from them as the day was very cold and rainy. However,



Nest and young of the spotted dove. The young are about 10 days old and they are incompletely covered with feathers. Their colour is very mottled, and this, together with the effect produced by the sunlight shining on them through the twigs overhead, made it difficult to distinguish them from their surroundings.

Photo.—J. R. Kinghorn.

my little friends survived, as the photograph taken on the 9th January will show. To obtain this I had to construct a rough tripod of wood strong enough to bear my weight, as the scrub round about was of a very flimsy nature. The moment my head appeared on a level with the nest the young birds

became alarmed; one of them stood up on very shaky legs, and almost threw itself out, but I kept very still, and it soon became more composed. When they both became fully aware of my intentions they at once began to settle themselves in a comfortable pose, and made an endeavour to look pleasant. After the camera finally clicked they moved about uneasily, and I was not quite sure whether their looks indicated relief or disappointment because the "bird did not fly out."

EGG COLLECTING CONDEMNED.

That thousands of boys throughout the Commonwealth indulge in egg collecting is a fact that has lately been brought home to me in a very practical way. Boxes of eggs are being continually sent in to the Museum to be named for the owner. Most of these collections contain only one egg from each clutch, without any data or information of any sort; there are no localities given, no information as to the kind of nest, nothing beyond a bundle of eggs. In view of this such a collection is of no use at all either for a Museum or for any worker in ornithology. Very often it is impossible to name correctly many of the eggs sent in because of the absence of valuable data; for instance, several species of birds lay eggs which are almost identical in colour, shape, and size, and in such cases it is necessary to have a knowledge of the kind of nest from which they came, otherwise only guess work can be employed.

I think it necessary to write a few words condemning the deplorable destruction done to our bird fauna by the boy who persists in robbing nests. In the first place many of the birds that are robbed of their eggs are protected, at least for several months of the year, this period of protection always including the breeding season. It seems obvious, though it apparently is not to many people, that protection during the breeding season applies not only to the parents but also to the young, that they may mature without being disturbed or destroyed by man, therefore, as the nest and eggs are necessary to produce the young, anyone who robs a nest of eggs is in reality committing a breach of the *Birds and Animals Protection Act*. From the point of view of law, steps should be taken to stop this, and from a national and sentimental point of view it should be strongly condemned as a cruel sport, more often than not carried out because of a personal vanity on the part of the collector who wishes to obtain a greater number of varieties than his mate. The boy knows no better because he has never been taught, so his parents and his school teachers should impress upon him that it is not only a breach of the Act but gross cruelty. The best way is to show him something more interesting than robbing the nests, for instance he might be encouraged to take up the study of natural history; he might be shown that it is most interesting to watch a bird build, lay its eggs and hatch them out, and to watch it feeding its young. If he kept a note book in which to jot down all this information giving the complete dates of all happenings, and if he has a camera, and could make photographs from life, it would not be long before he became such a nature-loving boy that he would not only give up nest robbing, but he would find the life study so interesting and profitable that he would soon learn to protect his birds, and encourage others to do the same.

Among recent visitors from overseas were, Dr. F. H. Krenkow, of Quorn, Leicestershire, a keen entomologist, whose principal study is, however, Semitic languages; Mr. W. W. Hornell, Director of Public Instruction, Bengal, and Trustee of the Indian Museum, Calcutta; Mr. Walter C. Mead, Trustee of the Colorado Museum, Denver; Professor C. A. Chant, and Dr. Young, of the University of Toronto, Canada, accompanied by Mrs. and Miss Chant, who were on their way to Wollal, Western Australia, to observe the solar eclipse; Dr. Venkata Rau, M.A., of Madras, who is specially interested in entomology in relation to plant life, and is returning to India after a course of study in England and America.

The Queen of Spinners.

By Heber A. Longman.

(Director, Queensland Museum.)

THE large and handsome spider known as *Dicrostichus magnificus*, or, to give it a popular name, the "Magnificent Spider," may well be called the Queen of Spinners. The body of this spider is cream-coloured above, with darker vermiculations and two prominent yellow tubercles, and near the front is a mosaic of fourteen salmon-pink spots. On the head is a dainty little turret, wine-coloured, with an alabaster base, and this supports two pairs of eyes.

This spider is not very rare in Brisbane gardens, but its discovery is usually due to the presence of its large cocoons or egg-bags. These may occasionally be found on the under side of leaves of large palms. In the daytime the spider hides in a cleverly-woven little retreat, in which it stays with its head turned away from the opening. The cocoons vary from three to four inches in length, and are about an inch in maximum diameter. Each contains an inner cocoon, which hangs centrally in the upper half of the outer envelope; it is white in colour and the texture may be compared to fine rice-paper. Within there is a quantity of loose silk surrounding the eggs. From four hundred to six hundred eggs may be present, and as each spider makes on an average six cocoons, about three thousand eggs may be laid in a season. Between the outer envelope and the inner cocoon there is a loose packing of silk, which forms a valuable elastic medium, protecting the precious freight of eggs.

The Magnificent Spider (Dicrostichus magnificus). Natural size.

Photo.—H. Hacker.

As a result of persistent watching, my wife and I have repeatedly seen the whole process of cocoon making by these spiders in our garden. The completion of a single cocoon may take from eight o'clock at night until four the next morning. First the spider slowly spins a strong vertical strand by letting herself down from her lines near the retreat. Then a tiny sheet of web is spun out from the end of this strand. After half-an-hour's work this may be seen as a filmy cloud over the spider's back, to which she, ever spinning, adds to the circumference. Then

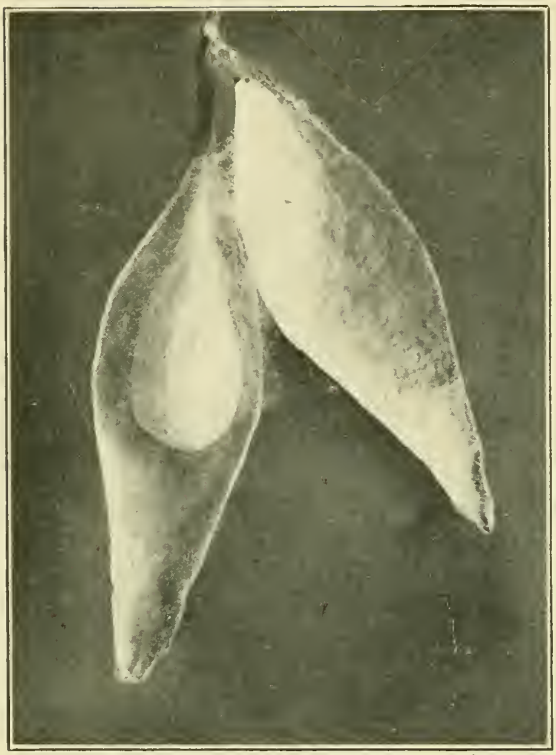
this sheet is gathered into a bag, and into this the eggs are laid with surprising quickness, the operation taking but a few minutes. The eggs form a glistening globular mass about three-eighths of an inch in diameter, which can be easily seen through the substance of the inner cocoon at this stage. The slit in the bag through which the eggs are laid is then closed by the spider, and for over an hour work is unceasingly carried on in building up the fluffy packing around and below the inner cocoon. The great task in weaving the large outer capsule is then commenced. This is by far the most arduous portion of all the mother's labour. The outer envelope has to be made strong enough to protect the inner cocoon from the weather, from friction when blown against leaves and branches, from the attacks of predaceous insects, and from the ovipositors of parasitical insects. Under magnification, its finished texture is seen to be very closely woven, and the final result is a tough material, not easily torn or penetrated.

As the actual method of spinning is of interest, the following extract from my more detailed account is given in full:—

"During the long process of spinning this outer envelope, the spider worked from top to bottom, head downwards, and then from bottom to top on the other side, head upwards. It supported itself by gripping the cocoon with its legs meanwhile. Against the light the minute silk threads issuing from the spinnerets could be seen as a shining band of conjoined lines. The legs were in no way used to manipulate the threads, but the body was moved up and down, up and down, making a stroke of about three-eighths of an inch. One touch of the protruding spinnerets on the cocoon sufficed to attach the strands. The spider moved with surprising quickness, its spinning stroke varying from about sixty to eighty spins per minute. During its journey up and down the capsule two hundred and sixty spinning movements were counted, and this represented but a single narrow sector of the whole circumference. Some idea of the energy expended by the toiling mother in her great work may be gauged by these figures, and one wonders at the strength of the muscles which move the abdomen. With haste and without rest, the process was continued and at mid-

Cocoons of the Magnificent Spider.

Photo.—H. Hacker.



Cocoon sectioned to show structure. Natural size.
Photo.—H. Hacker.

night the cocoon had attained its final contours. The spinning on the outer surface then reached a finer stage, and the glossy waterproofing was being done. Instead of working in vertical lines, the threads were attached from side to side as the spider made its way down and then up the capsule. This lateral movement was very noticeable, and the resultant spinning added to the toughness of the material, giving a criss-cross weaving. The whole surface of the cocoon had been woven over many times."

Spiderlings may emerge from the cocoon in about three months. They are able to penetrate the tough outer envelope without aid from the mother, and, when they emerge through a tiny hole, they spin fine threads and balloon away on the breeze. Apparently very few of these tiny aeronauts survive to maturity, or the species would be far more common.

Dicrostichus magnificus does not catch its prey in a web. Except for the many supporting strands for the cocoons, and the simple lines by which it suspends itself, which are also connected with the closely woven retreat, no other web is spun. None of these lines are sticky and no insect can be caught on them. There is no web entanglement to trap the moths on which it feeds. Shortly after sunset, the spider hangs suspended on a more or less horizontal line near its cocoons. My wife and I repeatedly found it sucking a common species of Noctuid Moth (*Remigra frugalis* Fabr.) which it had secured in some mysterious way. Close and persistent watching through many nights revealed the remarkable method by which it caught them. From its slender bridge it would spin a filament, usually about one-and-a-half inches in length, which was suspended downwards; on the end of this was a globule of very viscid matter a little larger than the head of an ordinary pin, occasionally with several smaller globules above. This filament was held out by one of the front legs, the miniature apparatus bearing a quaint resemblance to a fisherman's rod and line. On the approach of the moth, the spider whirls the filament and globule with surprising speed, and this is undoubtedly the way in which it secures its prey. The moths are unquestionably attracted to an effective extent by the spider and globule, whether by scent or its colour we cannot say. We certainly could not distinguish the slightest odour. But the fact remains that night after night one or two moths would flutter up and be caught. Other moths near by seemed to be indifferent, but two were often secured in the space of an hour, one of which would be packed away on the line to be sucked later. The spec-

tacle of the moth fluttering up to the spider, sometimes two or even three times before it was caught, is one of the most interesting little processes which the writer has ever witnessed in natural history. The supposed desire of the moth for the star is a poet's fancy, but the attraction of the moth to the *Dicrostichus*, although mysterious, can be seen by any patient watcher.

The globule is composed of most tenacious material, and quite large leaves can be suspended on it by a mere touch. The spider can be artificially fed by holding a moth to the hanging globule, to which it can be transfixed by the slightest contact. Occasionally the filament and globule will be drawn up and another manufactured. The spider will ignore a moth which is artifically placed along its upper lines, and apparently its one method of catching them is by the filament and globule. The moth is as helpless when touched by the globule as is a fly on fly-paper. When the insect is secured on the sticky globule it is pulled up, and killed by an injection of venom; it is then neatly bound in a little bundle, leisurely placed in line with the spider's head and there held and sucked, the wings being ultimately discarded.

Probably the study of allied species will reveal other stages in the evolution of this curious habit. *Celaenia excavata*, which makes small spherical cocoons, is also without a web.

The Chameleon.

By J. R. Kinghorn.

ALTHOUGH the Chameleon is not an Australian reptile its name is familiar to us, and the animal causes a fair amount of discussion from time to time. Its true home is Africa, but it has extended to Madagascar, Ceylon and western Asia, only one species being known from India. It is so far removed in structure from an ordinary lizard that it has been placed in a suborder all by itself, the Rhiptoglossa, comprising only one family, the Chamaelodontidae, in which there are about forty-five species known to science.

The body is high and compressed laterally, the head, which is very angular, resembles a hood, and the tail is short and prehensile; that is to say, it can be used after the manner of an extra limb, being curled round branches to enable the reptile to gain an extra hold as it moves about. All the feet are also prehensile; this is made possible by a peculiar structure in the articulation of the digits, the toes being bound together in opposite bundles. In the fore feet the inner bundle contains three and the outer two, while this order is reversed in the hind feet. The eyes are remarkable both as to their structure and their independent relationship; they each rise out of a sunken pit, and resemble large skin-covered cones, each perforated by a minute hole (the pupil opening) at the apex. Being independent of action, one eye can be watching an object ahead, while the other searches about in all directions for possible prey. The tongue is extremely long and extensile, and broadens out into a club-shaped lump towards the tip, and, when fully extended, is seven or eight inches long. The tip is covered with a sticky fluid, and, as the tongue can be shot out with perfect aim, woe betide the unwary fly which comes within range.

Some years ago one of the members of the Museum staff kept a living chameleon as a pet in his room and its movements caused us much merriment It was exceptionally slow and seemed to take a long time to make up its mind

to move forward, keeping one hand, and perhaps a foot as well, poised in air for several minutes before eventually deciding to put them down and continue its journey. The independent movement of its eyes was ludicrous, as one would be looking forward intently at an unwary and unsuspecting fly, while the other would be looking in our direction as if to say "watch me catch this fellow." In its natural wild state the chameleon is not always such a slow moving creature as it appears to be in captivity. It is insectivorous and arboreal, being very clumsy when placed on the ground.

The common Chameleon makes a very interesting pet and is so used in many parts of the world. Its power to change colour is much overrated, and in this respect it cannot compare with some of the Agamas and Iguanas.

Photo.—J. R. Kinghorn.

Although chameleons can change colour, and comparatively quickly, they are rivalled both as to speed of changing and variety of colours by many species of iguanas (the iguana, which is not known to Australia is very distinct from the goana) and even some of the agamas. The following experiments on its colour changes were carried out in the reptile house of the New York Zoological Park, the results being published in *Reptiles of the World* by Mr. R. L. Ditmars.

Four specimens of the common chameleon (*C. vulgaris*) were taken and the first was placed in the sunlight so that only one side was exposed to the rays. The second was also put in the sun, but at such an angle as to entirely suffuse the reptile with rays. A third was placed in a dark box at a temperature of 75° Fahrenheit, while a fourth was placed in a dark box at a temperature of 50° Fahrenheit. After fifteen minutes the specimens were uncovered and the following results were noted:— The first was dark brown on the side that had been exposed to the sun, while the shadowed side was pale brown mottled with green, the second was uniform brown, deeper than the dark side of the first specimen; the third reptile emerged from the box in a brilliant coat of green; the fourth crawled sluggishly from its cold quarters, its colour being a uniform slaty grey.

These specimens were then placed in separate cases with different uniform coloured surroundings, and with uniform light, one on green leaves, another on brown twigs, and a third on white sand. After a time they were all taken out and examined, and were found to be all the same colour, a yellowish brown, which indicates that light and temperature have more to do with the change in colour than have their surroundings. So the story of the chameleon which died through trying to accommodate itself to the diverse colours of a tartan kilt is proved to be a myth.

These little reptiles make very interesting pets, and are much sought after as such in many parts of the world; for a time they were fashionable toys amongst certain society folk who carried them about the streets in this country as well as in many foreign places.

The Australian Museum

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Table of Contents.

Young of the Flying Phalanger Taguan (Petauroides volans). This species was very common at Blue Gum Knob. The fact that the fur is not of commercial value is doubtless responsible for the preservation of the animal. (*See page* 195).

[Photo. from life—*A. Musgrave.*

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Editorial.

MUSEUMS AND ENDOWMENTS.

THEY do these things well in America. A recent number of *Natural History*, a magazine issued by the American Museum of Natural History, New York, informs us that the Endowment Fund has been recently augmented by two gifts totalling $1,250,000, and the trustees hope that during the present year at least $2,000,000 may be raised for this fund. That is the proper spirit, and we hope that this objective will be attained. The great New York museum is the admiration and the envy of similar institutions the world over. It is admired because of its magnificent services to science and education, and its bold adventures in new methods of display, which have become classic models for imitation elsewhere. And it is envied because of its well merited success in arousing the interest of American citizens and gaining their material support for its projects. The greater part of its income is derived not from public funds but from private donations, which enable the trustees to finance vast schemes of exploration and research in all quarters of the globe.

We in Australia are more modest. We have our own continent, with a fauna and an aboriginal population more interesting perhaps than any in the world and presenting many problems yet unsolved. Then we have the Pacific at our doors, teeming with possibilities for zoological and ethnographical research, and Australian museums would be up and doing. Can we not hope for a measure of public support, not, indeed, as great as American museums obtain, but commensurate with the wealth of our own country? It might be said that the public services of this museum are so slight in comparison that we cannot expect private donors to respond to our needs as in America. But we would reply that this museum is prepared, and tries to serve the public as fully as its resources and opportunities will allow. No reasonable request for information or help is refused. We give free public lectures both in the museum and outside. With our all too slender means we attempt, by collecting expeditions in Australia and the Pacific Islands, to gather the materials for scientific investigation, the results of which are published in our Records or in the proceedings of learned societies. We have had classes for the blind. We are ever seeking to make our exhibits more interesting and instructive to the public. We have established this Magazine for the benefit of those who wish to learn

more of natural history, but are not interested in technical details. We do not do so badly after all, but we should like to do more.

A distinguished American visitor to Australia informed us that in America no wealthy man is allowed to die before he has made substantial bequests for scientific and educational purposes. But how much more satisfactory is the Carnegie and Rockefeller method of making the money available during the lifetime of the donor. Sometimes, when lamenting the fact that the lack of money puts an enticing piece of field work beyond our reach, we have wistfully canvassed the possibility that some kindly soul would generously establish for us a fund of, say £10,000, the income to be earmarked for exploring and collecting purposes.

Notes and News.

We are sorry to learn that Sir James Burns, trustee, who is at present in England, had an attack of illness in London. Last accounts were to the effect that he was progressing.

Dr. J. R. M. Robertson, another trustee, who is on a visit to the Old Country, writes from Renfrew to say that he will be back in Australia early in January. He has visited a number of museums, but has seen none to compare with the Natural History Museum at South Kensington. He is looking forward to seeing the American Museum of Natural History on the return journey.

Mr. A. R. McCulloch, who is with Captain Frank Hurley's expedition to New Guinea, wrote recently saying that all was in readiness for the dash up the Fly River to Lake Murray, and a later wireless message announces that the party has reached the lake and are at anchor opposite a headhunters' village.

The late Mr. P. G. Black, who was for forty years connected with the firm of Burns, Philp & Company Ltd., made a very comprehensive collection of ethnological objects from the South Seas. His collection has now been offered for sale to the trustees, who are endeavouring to raise funds for its purchase, as they feel that this fine collection should be kept in Australia.

The last lecture for the session was delivered by Mr. E. le G. Troughton, on November 9th, his subject being "Aquatic Mammals." Since our last issue, Mr. J. R. Kinghorn lectured on "Who's Who among the Reptiles" to the Mechanics' Institute, Goulburn. The attendances at the lectures during the last year have been very gratifying.

A commencement has been made with the work of restoring the devastated area lying between the north wing of the Museum and William Street. This unsightly cut has long been an eyesore and a reproach, and it is hoped that the improvements now in progress will considerably enhance the appearance of the building.

The Museum now comes into contact with outside bodies in an ever increasing degree. Thus we have lately had the pleasure of a number of visits by members of the Naturalists' Society of New South Wales. These visitors were met by officers of the Museum and personally conducted round the galleries. A party of young people from Auburn, where a little circle has been formed to study Anthropology and various human problems, came to the Museum by arrangement to hear an address by Mr. W. W. Thorpe, Ethnologist, on Primitive Man. The same officer has twice lectured by request to the Eugenics Section of the Workers' Educational Association.

A Naturalist in the Upper Chichester Valley.

By Anthony Musgrave.

THE Upper Chichester Valley, which forms the subject of my narrative, lies between two spurs of the Mount Royal Range, about thirty miles from the township of Dungog, on the West Maitland-Macksville line. Some years ago a party of naturalists visited the Barrington Tops, west of the Chichester, but no collecting was done at the foot of the range, and, as the area has seldom been explored by naturalists, I eagerly seized the opportunity to accompany my friend, Mr. J. S. P. Ramsay, to the locality.

We camped in Duggan's Gully, our hut standing on a steep hillside overlooking a small clearing in which rose the gaunt forms of dead gum trees, their light grey trunks standing out against a dark background of dense scrub. Through the clearing Duggan's Creek wound its way, rippling over the stones on its way to the Chichester River and the sea.

Portion of the trunk of a turpentine tree, showing the bark torn off by Black Cockatoos in their search for beetle larvae.

[Photo.—*A. Musgrave.*

A Grey Ironbark (Eucalyptus paniculata) was the Host of the "Elk's horn." (Platycerium bifurcatum).

[Photo.—*A. Musgrave.*

It was an ideal situation for a camp, for only a few minutes walking took us into a dense growth of subtropical vegetation. In front of the hut was an abandoned cultivation paddock overgrown with wild raspberry and nettle bushes, whilst small gum saplings and scrub trees scattered here and there showed that the bush was slowly reclaiming its own. On all sides elematis

festooned the smaller trees with its creamy-white blossoms; directly in front of the hut a huge mass of rocklily was in full bloom, and beautiful evidences of spring daily aroused our enthusiasm. Beyond the clearing the vegetation was on a wild and luxuriant scale and nearly every tree in the scrub seemed to be groaning under the weight of staghorns and orchids. The native figs appeared to be particularly susceptible to parasites, and a large tree growing near the hut was a host for epiphytic plants of all descriptions. The topmost branches were encircled by masses of staghorn ferns, which gave the tree an unwieldy appearance, while the tiny yellow figs attracted myriads of birds.

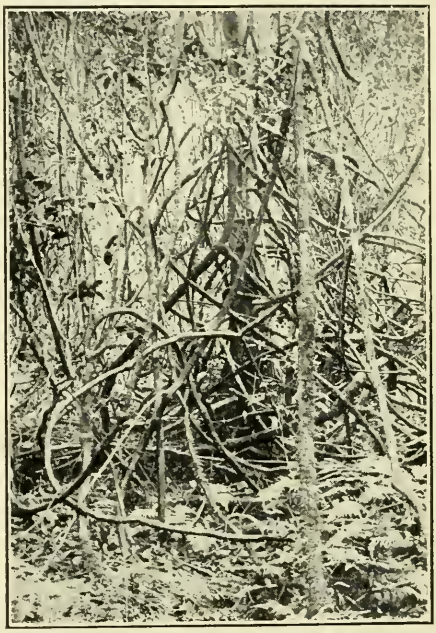
A curious sight was afforded by two dead turpentine trees growing on the opposite side of the gully, and appearing to have light reddish trunks with soft lace-like green foliage. The supposed foliage proved to be masses of "Old Man's Beard" moss, which hung from every branch and twig, while the trunks on examination showed the bark to be hanging in shreds, Black Cockatoos having ripped it up in their search for beetle larvæ.

Liana vines or monkey ropes matted the trees on the edge of the stream and made progress through the scrub an arduous task. The Giant Nettle (*Laportea gigas*) was frequently met with in our rambles, and carefully avoided. The Queensland Lily, or "Cunjevoi," which is found growing in the vicinity of the nettle, and whose juice is said to be a specific for the sting of the nettle, was noted, but fortunately we had no necessity to test its soothing attributes.

The season was too early for the majority of insects, though by diligent log-rolling many ground beetles were taken. The Nettle Butterfly (*Pyrameis itea*), however, was common, hovering over the nettles, and at night we were visited by swarms of a geometrid moth (*Xanthorhoe brujata*), which we dislodged in numbers from our clothing in the morning.

BIRDS.

But though the season seemed unpropitious for insects, bird life flourished in all directions. Here I saw for the first time a male Regent Bower Bird (*Sericulus chrysocephalus*) its black and golden plumage as it flew from tree to tree resembling the gorgeous coloured Troides butterflies of the Malayan and Papuan tropics. The giant fig-tree, previously mentioned, was daily visited by this species, which came to feed on the fruit.



On the banks of the creeks the lianas, or native vines (Vitis hypoglauca) impeded our progress.
[Photo.—*A. Musgrave.*

All day long the scrub resounded to the call of the Coach Whip Bird (*Psephodes crepitans*), a long drawn out note ending in a whip-like crack and in many cases immediately followed by two sharp notes at a little distance away. Trustworthy observers state that these last notes are "reply" calls used by both sexes, but they follow so perfectly upon the first notes that a belief has arisen that the bird at times indulges in ventriloquism.

MAMMALS.

At our camp the rats, which were in great numbers, proved to be a common bush species (*Rattus assimilis*), the difference between their soft fur and the coarse bristly coat of the common introduced brown rat (*Rattus rattus*) making identification easy. We set numerous traps and would frequently be aroused at night by the crack of one of them, indicating the sudden end of an unfortunate rodent who had been injudicious enough to try the raisin bait.

Rats were not our only visitors ; one night a scrambling noise on the tin roof told us that some animal was abroad. We decided to investigate the cause, so with electric torches we sallied forth, and there on the roof sat a ring-tailed " opossum " (*Pseudochirus peregrinus*) gazing with large luminous orbs into the dazzling light as though fascinated by it. He was allowed to depart in peace. In the thick bush on the banks of streams we frequently came across the nests of this animal.

TICKS AND LEECHES.

Ticks and leeches were exceedingly numerous in the scrub, and we usually returned home with both animals well represented on our clothing and bodies. The ticks (*Ixodes holocyclus*), popularly known as the " Bush " or " Dog " tick, were by far the most unpleasant, as their removal invariably resulted in a swelling, which in some cases persisted for weeks. We had many wet days, and during the rain the leeches would stand stiff and straight on the grass stems, and, on our brushing against them, would immediately fasten on to us and proceed to suck our blood. They thrive only in damp situations and are unable to travel on dry dusty surfaces, so that it was interesting to see them enter the hut as far as the line of dampness extended, and halt there, pathetically waving their heads as they sniffed our whereabouts.

BLUE GUM KNOB.

Collecting in the vicinity of the hut having proved rather disappointing, we decided to try our luck further afield, so one sunny morning we set out for Blue Gum Knob, a spur some two miles distant, which divides the Duggan's Gully Creek from the Wangat or Little River. This spot proved to be a most enchanting locality, tall blue-gums rising like giant marble columns on every side, dwarfing our tent into insignificance. Insects were more conspicuous than on the lower slopes among the brush, and the beautiful green butterfly (*Papilio macleayanus*) was a welcome sight as he hovered over the yellow and white flowers of the everlastings.

One night, after setting the rat traps in hopes of obtaining other species, we started out with a small rifle and torch in an endeavour to collect some Flying Phalangers, or Flying Squirrels, as they are erroneously called, for the Museum collection. After wandering along the track for awhile, we espied one fairly high up a gum-tree and a lucky shot brought it to the ground ; the torch helped us to pick our way down the steep hillside through long grass and fallen branches and showed the animal to be a very nice specimen of a female Taguan Flying Phalanger (*Petauroides volans*).

Its black and white fur looked most beautiful and soft in the torchlight, but fortunately for the animal it has little or no market value, being too soft to recover its position if it is flattened or pushed to one side, and known technically as " dead " fur. Shortly afterwards a second one rewarded our search, and, as it proved to be a male, we retraced our steps. A third one, however, with its black back and white under surface making it look for all the world like the cat immortalised by the artist D. H. Souter, tempted our marksmanship, only to our immediate regret, for it proved to be a second female with a fully furred young one in its pouch. This young " squirrel " became for a

while a most delightful pet, living during the day in an old waistcoat pocket, with its long black tail curled round and round its face till the extreme tip just covered his little pink nose. At dusk he would emerge and be fed with weak condensed milk and a few gum leaves.

On our return to Sydney he lived for some time on milk, gum and pepper-tree leaves, the latter being quite a favourite dish. He was allowed his freedom and had a box for the daytime sleep in a corner of the verandah, while a plentiful supply of food was placed on a table each evening. He would leave his box and travel the length of the verandah to his meal, and, after a little exercise, would return to his nest, but ultimately he left his home and was not afterwards heard of.

Our hopes over the rat traps were gratified to some extent by the capture of a Yellow-footed Pouched Mouse (*Phascologale flavipes*) with eight young in the pouch, but this was the only species secured apart from the ubiquitous *Rattus assimilis*. Here, too, this species found the raisin bait an irresistible delicacy, and we soon found our available jars well filled.

We accordingly packed our belongings and trudged heavily laden back to the hut, and a few days later a most delightful trip came to an end, though not without hopes of a further acquaintance with the locality.

The material collected affords a good indication of what the locality would produce during a more propitious season, and in the summer months the whole area must abound with mammal, bird and insect life.

The white and yellow flowers of the Everlastings (Helichrysum elatum) attracted the beautiful Swallow-Tail Butterfly (Papilio macleayanus).

[Photo.—*A. Musgrave.*

A Romance in the Life of the Little Penguin.

By J. R. Kinghorn.

IT is seldom that the Little Penguin (*Eudyptula minor*) comes as far north as Sydney to breed, though occasional specimens have been found nesting on Cabbage Tree Island at the entrance to Port Stephens. This story is about a pair which made their temporary home at Collaroy Beach, a well-known and much frequented seaside resort about six miles north of Manly.

A little over a year ago, Mr. and Mrs. Penguin swam northwards along the coast of New South Wales, in search of a suitable locality in which to make their home. One morning towards the end of August, 1921, they rounded the headland at the southern end of Collaroy Beach and landed to inspect the site. They did not look round for long, however, as their attention was directed to a fine house situated at the top of a sandhill almost on the beach. The gate being open they waddled up the pathway and round the house to the back verandah, where they decided to boldly announce their presence and demand accommodation. They evidently regarded themselves as of sufficient importance to be able to "enter without knocking," and they made straight for the hall, but lo! a screen door barred the way, and, as further advance was impossible, they sat down on their haunches and serenaded the inhabitants with all the weird cries and noises that are known only to penguins, keeping their concert going until the desired result was obtained. Mrs. Brown, the owner of the house, went to see what the unearthly noise was, and, as soon as she opened the door, in rushed Mr. and Mrs. Penguin; once well inside they announced their names in loud voices and shouted at the occupants in a way which suggested that they were telling them to get out, as they were going to occupy the house; furthermore, they scolded Mrs. Brown and her friends when they were told to be quiet or they would be thrown out. At this threat the penguins changed their attitude and became frivolous, danced about, waved their little wings and squealed for forgiveness.

She at first resented my interference and was alarmed at the size of the camera.
[Photo.— *J. R. Kinghorn.*

After a short time, Mrs. Brown decided that they had outworn their welcome and put them outside; they disappeared for the time being, evidently going down to the sea for their lunch; but that house was to be their home, and, as they could not get inside, they went underneath, as far under as they could get, to a place where it would be impossible to disturb them without taking part of the side of the house down, and there they made their nest. The noise every night made by the penguins was almost unbearable; they would scream at each other in anger, they would cackle with laughter, or they would sing songs of thanksgiving for the two little youngsters which were eventually hatched from the eggs after a vigil of about six weeks.

It was about three or four months after their arrival that they disappeared completely and suddenly, and without one word of thanks or a good-bye to those who had given them a home and put up with all the noise, not to mention the odours which came from beneath the floor boards from decaying food, and the sea weeds of which the nest was made. Where the family spent the winter no one knows, and where they were going to spend this springtime was known only to the penguins until late this August, when a terrible cackling outside advised Mrs. Brown that they were back again. When the door was opened, Mr. and Mrs. Penguin marched boldly and triumphantly in, followed by two inquisitive and rather shy youngsters. As soon as Mrs. Brown had fully realised that the same pair had returned with their grown chicks, the birds all began to dance round, shouting approval of their recognition. They sang songs, among which could be recognised "Here we are again," and that more disconcerting one "We're here because we're here." They could not be quietened, and the inhabitants of the district came round to see if all was well, or if anyone had gone mad (for I assure you that four penguins voicing their greetings is not an altogether pleasant sound).

The owners of the house put the whole family down on the beach and drove them away, but later, after having driven away the chicks, the parent birds returned and went under the house to the spot which they had occupied the year before. The celebrations were so loud and long that next day Mr. Brown decided to take some of the boards down and get the birds out. That night they were taken by car to Palm Beach, a distance of about twelve miles up the coast, and liberated, but next morning saw them back again. I understand that they were taken away a second time, but once more returned, and this time were allowed to stay, but were given a home of their own in the far corner of the garden. A large case was turned upside down and placed on two beams, a hole was cut in the fence to allow the birds free access to the beach, and netting was put on the house side to keep them "in their own back yard." Here the couple proceeded to build a nest of sea weeds, and later two eggs were laid. They took it in turns to sit on them, and, if Mr. Penguin stayed out late, he was in for a terrible half-hour when he came home to take his turn on the nest. Then Mrs. Penguin would go out to fish for her dinner or supper, and, as her husband had stopped out beyond his time, she would make up for it by doing likewise; later when she arrived home, after shouting all the way up the beach, she would be severely scolded and would retaliate, then a noisy argument would result, which would last well through the night.

Eventually she came up and posed for her photograph.

[Photo.— *J. R. Kinghorn.*

After about six weeks two sooty-brown chicks emerged from the eggs, and the noise that night and the next few, while the celebrations lasted, caused many people of the district to shudder, thinking that someone was being ill-treated. During the days that followed, the parent birds took it in turn to fish and swim in the sea, but at night, very often, they would go out together to find a suitable supper somewhere in the

bay, and at about nine p.m. they could be heard returning up the beach, chuckling away and jibing at each other until the nest was reached, when all thoughts were turned towards the two little, fluffy, sooty-brown chicks. As I write, the family is still at Collaroy, but is probably making arrangements for the southward journey, to a locality where the summer and winter will be spent.

A young penguin is not exactly a pretty bird.
[Photo.— *J. R. Kinghorn.*

NOT THE ANTARCTIC PENGUIN.

This species, which does not grow more than 19 inches in length, must not be confounded with any of the Antaretic penguins, as it does not extend south beyond Tasmania. It is distributed along the coasts of South Western Australia, South Australia, Victoria, Tasmania, and northward along the New South Wales coast as far as Port Stephens. The adult bird is a slatey-blue colour on the upper parts, the sides of the face and neck are inclined to be light grey ; the wings are a darker shade of blue with a white inner edge. The whole of the under surface is silvery white, and the legs and feet fleshy white, while the soles and nails are blackish.

The Little Penguin often builds its nest in crevices in rocks on almost inaccessible cliffs, though on some of the islands off the coast of Victoria it has been found nesting in open burrows in the sandy soil among the grass tussocks. Its food does not consist entirely of fish, the diet being varied occasionally with marine algae and small crustaceans.

I was fortunate enough to be able to visit the scene of the story in October last, and there learnt from Mrs. Brown the outline of the plot, and my very best thanks are tendered here for the information gained and the facilities given for photographing the mother and her young at the nest. I spent over an hour there, hoping to get a photograph of the male bird also, but he did not put in an appearance. He was about two hours overdue when I left (according to his daily time table) and, as the mother was getting very restless, I imagine that he was in for a warm reception when he eventually came home.

She carefully examined the chick which I had photographed.
[Photo.— *J. R. Kinghorn.*

Opal, the Rainbow Gem.

By C. Anderson, M.A., D.Sc.

OPAL is composed of hydrous silica, and differs from quartz, agate, jasper and other silica minerals merely by the presence of a variable amount of water. Unlike most minerals it is a colloid, that is, it shows no sign of crystallization; in fact, it might be described as a silica jelly.

There are many varieties of opal, which is a mineral of common occurence in nature. The purest variety is called hyalite or glass-opal, which is transparent or translucent, colourless, and commonly forms nodular bunches resembling clusters of grapes. The noble, or precious opal, which is also comparatively pure hydrous silica, is the best known variety, although it is found in only a few favoured spots. Common opal, unlike the foregoing, is opaque, by reason of included impurities, and gets various names, such as milk opal, prase, liver opal, and several others.

The most important and most interesting kind is, of course, the precious opal, which is one of the characteristic Australian gems, and is considered by many to be the king of gemstones. The origin of the gorgeous play of colours, to which the opal owes its beauty and its value, is still in doubt. The colours are not caused by any pigment in the stone, as is the case in the sapphire, ruby, emerald, and other coloured gems, for, by transmitted light, precious opal is colourless, milky, or yellowish, but shows no "fire"; it is by reflected light that the wonderful play of colours is seen, green, blue, or red flashing out as the stone is viewed from different angles. The commonly accepted explanation of this phenomenon is as follows. As the silica jelly dried it became traversed by cracks, which were subsequently filled by opal matter containing a different amount of water, and therefore differing slightly in its refractive effect on light. The result of this lack of homogeneity is that each crack acts on light like a soap film, or a thin layer of oil, and produces a similar effect.

The Opal Workings at Lightning Ridge. [Photo.—*Dr. J. V. Danes.*

THE OLDEST OPAL MINES.

The opal mines of Czerwenitza, formerly in Northern Hungary, now included in Czecho-Slovakia, were until recently the only important source of the gem, and they have been worked since very ancient times; the opals known to the Romans, by whom they were highly prized, probably came from there. The workings at Czerwenitza are now very extensive, the underground galleries being several miles in length.

The opal occurs here in an igneous

rock known as andesite, and is usually in small stones, though occasionally larger pieces have been found, and one preserved in the Vienna Museum is as large as a man's fist and has been valued at £3,500.

WHITE CLIFFS.

Australian opals have now almost ousted the European product from the world's markets. Precious opal was found filling cavities in the decomposed basalt of the Abercrombie Ranges, New South Wales, in the 'seventies, but Australian opal did not become important until the White Cliffs field was opened up. In 1889, a hunter was tracking a wounded kangaroo in the drought stricken region beyond Wilcannia, and noticed a brilliantly coloured stone, which he picked up and retained as a curio. Other discoveries followed and soon the White Cliffs opal mines were in full swing.

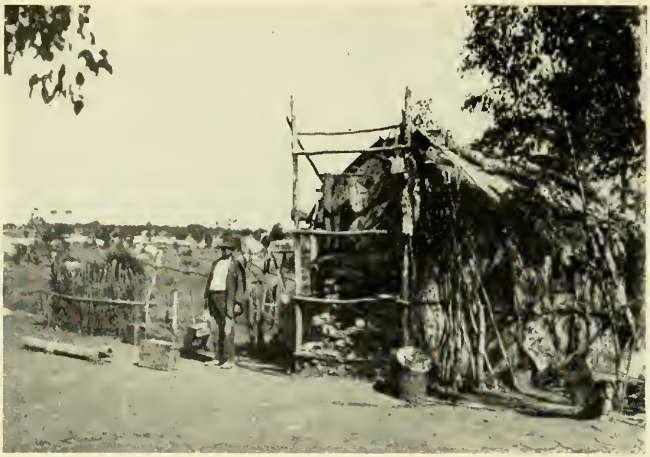
At White Cliffs the opal occurs in a white siliceous rock, a kind of sandstone, of Cretaceous age, filling cracks and seams in the rock, or replacing the material of wood, shells, and reptilian bones. It also occurs as a replacement of a spikey mineral, probably glauberite, a sulphate of soda and lime, forming aggregates which from their appearance have been called fossil pineapples.

Much of the opal found at White Cliffs has very little or no value for gem purposes, and is known as potch, but the field has produced many fine stones. In valuing opal, several points must be taken into account. Colour is the most important, red fire, or red in combination with blue, green, and yellow, being considered the best. Pattern is also an important factor. In pinfire opal the colour is in very small patches, almost pin points. Harlequin opal has the colour distributed in small, fairly regular squares. In flash opal the fire shows as a single flash in large patches.

A Lightning Ridge Opal Mine, showing the mouth of the shaft and the windlass by which the broken rock is hauled to the surface.
[Photo.—*Dr. J. V. Danes.*

BLACK OPAL OF LIGHTNING RIDGE.

The most valuable opal now comes from Lightning Ridge, near Walgett, New South Wales. This field was discovered about 1895, and has produced some of the finest opal ever found. The opal occurs here in a sandstone containing much iron, and the iron is doubtless responsible for the dark colour of the matrix, which makes a splendid setting for the wonderful colours shown by a Lightning Ridge black opal of good quality.



An opal miner's residence at Lightning Ridge.
[Photo.—*Dr. J. V. Danes.*

At Lightning Ridge the mode of occurrence of the opal is the same as at White Cliffs, namely in a white, powdery, siliceous rock, through which it is scattered in an irregular manner. There are practically no surface indications to guide the prospector, who must just hope for the best. Many of the miners work for a long period, perhaps months, with little or no reward, others may make a valuable "strike" in a few days. This lends a fascination to the search, for even the novice may cherish hopes of encountering a rich patch, if not to-day, then to-morrow. No great skill or experience is required, just strong arms, a stout heart and an optimistic outlook. The miners generally work in small parties of two, or three, or four, pick their claim as close as possible to one which is known to be payable, sink a shaft perhaps to a depth of from forty to a hundred feet, and then drive tunnels outwards through the rock in search of the elusive gem.

QUEENSLAND OPAL.

In Queensland some fine opal has been found widely distributed over the south-west, as at Barcoo Creek, Opalton, Yowah, Jundah, and other places. It occurs in the so-called Desert Sandstone, frequently as the nucleus of large ironstone nodules.

STUART RANGE OPAL FIELD.

This, the newest opal field, was discovered about 1915. Stuart Range, about ninety miles west from William Creek station, on the northern railway line, South Australia, forms the divide separating a lake with the handy name of Cadibarrawirracanna from that containing Lakes Woorong, Phillipson, and Wirrida. These "lakes" are usually mere claypans, holding water only for a short time after rain has fallen (which is seldom).

The mode of occurrence of opal at Stuart Range is strikingly similar to that of the opal of New South Wales and Queensland, for it is found in irregular veins and patches enclosed in sandstone and claystone of Cretaceous age, and also replacing the remains of fossils. The method of working at Stuart Range is very simple, a pocket knife being sometimes the prospector's only tool. The soil is carefully worked over in search of fragments of bleached opal, which are followed till the seam is found, then the opal is carefully extracted and trimmed with pliers.

In all the Australian opal fields the miner's bugbear is scarcity of water, for it is only in the dry country, with an annual rainfall of not more than fifteen or sixteen inches, that the rainbow gem is found. And this is probably no mere accident, for it seems prob-

able that the extensive opalization of the sandstones of White Cliffs, Stuart Range, and the other localities where opal is found in quantity, results from "weathering" under arid conditions, whereby silica in solution is deposited in seams and cavities, and replaces the material of shells, belemnites, bones, and other fossils.

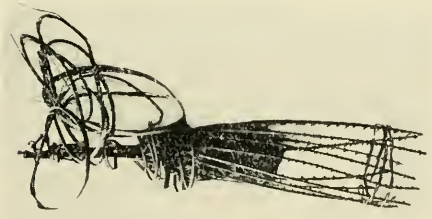
THE GREAT OPAL SUPERSTITION.

It is almost incredible that, in this supposedly enlightened age, many people the world over are firmly convinced that the opal brings bad luck. No more striking proof could be offered of the frailty of the human mind than this "monstrous legend." It is difficult to trace the origin of this superstition. In the Middle Ages the opal was considered a luck-bringing and beneficent gem, symbolical of hope; it stimulated the heart, preserved from contagious diseases, and drove away despondency. It is only in comparatively modern times that the opal has contracted its evil reputation, which has affected its popularity and its value to a very considerable degree. In Scott's novel, *Anne of Geierstein*, evil influence is ascribed to the opal clasp worn by the beautiful Persian wife of the Baron of Arnheim, and it is said that within a year after the publication of the book the price of opal declined by half. A recent Australian visitor to Paris was informed that the opal is regarded as unlucky in France for the following reason. In 1500 there were several large stage coaches in Paris, which were named after the various precious stones, and several notables, including Napoleon in later years, had suffered calamities while passengers in the "Opal," and that even now it would almost be considered disloyal for a Frenchman to wear an opal!

An Example of Parallelism in Human Culture.

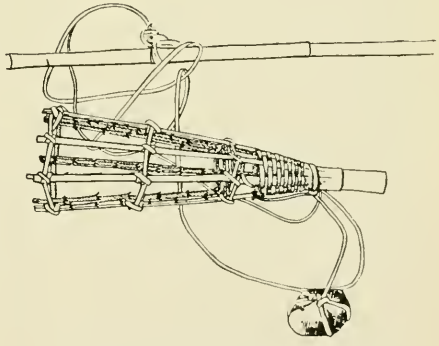
By W. W. Thorpe.

THE attention of those who handle and study the implements and other manufactures of so-called savage man is frequently arrested by the striking similarity between the implements made by native peoples, often widely separated in origin and habitat. The



Barbed Fish Trap from Fly River, New Guinea.
[Photo.—*G. C. Clutton.*

resemblances are, of course, governed by local conditions and requirements,



Barbed Fish Trap from British Burma.
[*After I. H. Burkill.*

but they go to prove that the adaptive mind of man, wherever situated, will often attain the same result. For instance, the Melanesian of the Bismarck Archipelago, and the Papuans of New Guinea, have racially, nothing in common with the Chins of Arakan, British Burmah, yet these three folk manufacture barbed fish traps so similar in idea and effectiveness, that a com-

parative description might be of some interest to our readers.

In the Bismarck Archipelago a number of stems of the prickly palm (*Calamus* or *Daemonorops*) are bunched together at one end and allowed to open out at the other, forming what will ultimately be, when interlaced, a conical-shaped basket. Vine or cane lashing is used and gives the trap rigidity. The palm stems are so arranged that the hook-like thorns point inwards. A piece of string is attached to the trap, a slab of drift-wood tied at the other end, and a bait placed well inside the basket. To set the trap the native sinks it and places a stone on the string, allowing the float to rise on the surface. The fish readily enters the trap, but on trying to back out or turn, it becomes impaled on the thorns.

The trap from British New Guinea is of more solid construction, but the shape and idea is the same. The barbed stems are lashed to cane ribs, and a crossed stick prevents its being rolled over or otherwise displaced

The frame of the Burmese device is made of bamboo. A stem of about twenty inches, butting on a node or knot, is split longitudinally into seven or eight strips. These rib like divisions are interlaced with rattan, as in the forms already described. Stems of the prickly palm are lashed in position inside the cane, and, baited as before, it is placed in the river with the mouth down-stream, and anchored in place by means of an attached stone. Its position is indicated by a bamboo pole inserted in the river bank, this pole being connected to the trap by a length of rattan.

The Yellow Monday Cicada.

By Anthony Musgrave.

TOWARDS the end of October, when the days are getting longer and hotter, the shrill note of the cicada announces the advent of summer. The cicada whose piercing din is so familiar to Sydneysiders is the Yellow or Green Monday Cicada (*Cyclochila australasiae*) though other species occur in and about the city.

Yellow Monday with wings outspread, showing the strong network of veins.

[Photo.—*G. C. Clutton.*

Cicadas, or as they are more commonly, but wrongly, termed locusts, are members of the order Rhynchota, a group of insects which includes bugs, leaf hoppers, scale insects and aphides. All these are provided with a sucking proboscis, by means of which they are able to pierce the bark of plants and suck up the juices. The true locusts, or short-horned grasshoppers, belong to an entirely different order, the Orthoptera, in which are also placed such insects as cockroaches, mantids and stick insects. These, on the other hand, possess mouth parts that are used for biting their food, which may consist of leaves, or grass, or other insects, as in the case of the mantids.

Cicadas are widely spread over the globe, but prefer warm countries. Only one species is recorded from England, where it is by no means common, while

over two hundred species have been recorded from Australia.

When we come to examine a Yellow Monday Cicada, we find that it measures nearly two inches in length and has a wing spread of five inches. It is usually yellow in colour, as its vernacular name would suggest, though green varieties are common, but after death their colour frequently changes to a yellow brown. The most noticeable thing about the broad head is the triangle of ruby-like ocelli situated between the pair of large eyes. Projecting before the eyes may be seen the small antennae, consisting of a stout basal segment and terminating in a bristle. Springing from the sides of the thorax are the strong, transparent, shining wings (tegmina), with a network of stout green-coloured nervures or veins. The hind wings which follow are smaller and not so heavily veined. These glistening wings were, at one time, much sought after by the urchins of Sydney, under the extremely erroneous impression that they were of commercial value. How this fallacy arose is not clear, but it was every year responsible for the mutilation of many of these unfortunate insects, which were forcibly stripped of their wings and left to crawl about the footpaths until they eventually succumbed to the attacks of ants or the footfall of some passer-by. On the under-surface of the body are the legs, which are well developed and enable the insect to cling to a swaying tree-top without fear of being dislodged by the wind. At the base of the abdomen there occur in the male the sound producing organs, which are recognised by the tympanal coverings on the upper part of the abdomen, and the broad plates or opercula on the lower surface of the abdomen. These are absent in the female, which is somewhat larger than the male.

The Yellow Monday Cicada, showing the normal position assumed by the wings while the insect is clinging to a tree trunk; when singing they are lowered at the sides of the body.

[Photo.—*A. Musgrave.*

THE SONG OF THE CICADA.

It is interesting to learn that the ancient Greeks knew and venerated the cicada, and one of these insects sitting on a harp or lyre was regarded by them as symbolical of music. The Latins, it is said, were not impressed by the charm of the cicada's song, an impression which is shared by all Australians who have listened to their noisy screech. Virgil describes them as "bursting the very shrubs with their noise," a saying which could be felicitously applied to the arboreal orchestras of our suburbs.

The song of our Yellow Monday usually commences with a few opening notes given with staccato-like effect, followed by a continuous whirring screech, which is taken up by all the cicadas in the neighbourhood, until the noise seems to burst the very drums of one's ears. The refrain is kept up well into the night, with intervals of rest, unless an atmospheric change, such as a thunderstorm or cool southerly, springs up, when their voices are hushed and comparative silence reigns where was pandemonium. No article on cicadas would be complete without the famous lines of Xenarchus, a Greek poet, who sang:

"Happy the Cicadas' lives
For they all have voiceless wives."

This cynical reflection serves to impress upon us the important fact that the sound-producing organs occur only in the male. These are situated on the upper surface of the first segment of the abdomen. The sound is produced by the bending of a stiff horny membrane which is acted upon by a muscle. The same effect is produced if one rapidly buckles the bottom of a kerosene tin backwards and forwards. The opercula, or "drums," as they are wrongly termed, which are seen on the ventral surface of the abdomen as thin plates, probably serve as resonators but have nothing to do with the production of the sound. When singing, the Yellow Monday usually lowers his wings from their roof-like position and elevates his abdomen.

The Yellow Monday has, in common with other species, been the plaything of the boys of Sydney, probably since the earliest days of the colony. The unfortunate insect is subjected to every indignity and abuse that childish ingenuity can devise. An outrage frequently perpetrated by juvenile offenders on the defenceless "locust," is to insert a blade of grass into its body, then to liberate the victim and watch it fly into the air with the long appendage trailing behind it. A more common practice is to take them into school, where they serve to enliven the somewhat dull proceedings of a lesson by giving vent to loud protesting squarks in response to an occasional shake by their captors. Every Sydney schoolmaster during some time of his career has had cause to execrate these noisy insects. Not even during its "pupal" period is the locust safe from these young marauders, for in our parks during the summer it is no uncommon sight to see small boys carrying bottles of water and searching most diligently for cicada burrows. These they flood with water, causing any pupae that may be within to ascend to the surface of the ground, where they are promptly secured.

LIFE HISTORY.

The female cicada is provided with a strong saw-like ovipositor, or egg-laying organ, by means of which she is able to rip up the bark of small branches and deposit her eggs in rows in the excisions thus made. Little is known of the life history of our Yellow Monday, but as many cicadas lay about three hundred eggs, it is generally supposed that she lays about the same number.

Portion of a eucalyptus branch ripped up by the ovipositor of the female when laying her eggs.

[Photo.—*G. C. Clutton.*

When the young cicadas emerge from the eggs they are tiny and shrimp-like in appearance. They make their way to the ground, many falling off the branches. On reaching the ground, they work their way down to the roots, where they pass the greater part of their life, deriving nourishment from the sap. The length of time passed underground has been estimated at three years, since they are most numerous every third year. An American species, *Cicada septendecim*, spends seventeen years of its life underground. During its subterranean existence the cicada moults many times, but in the case of the Yellow Monday this important detail of its life history still remains undiscovered.

When we examine a hole from which a cicada has emerged, there is no accumulation of dirt around the entrance, as is the case with those insects which tunnel *into* the ground. A question that is often asked is: What then becomes of the earth that the pupa dislodges as it tunnels upwards to the light? The secret has been shown to lie in the insect's method of excavating. The front pair of legs of the pupa are seen on examination to be much larger and more powerful than the middle and hind pairs, the femur being broad and spade-like, the tibia pick-like, while the hooks of the tarsus can be likened to a rake. With these powerful implements the pupa pounds its way upwards from its earthly dwelling-place. The earth is first dislodged by means of the strong claws of the tibiæ, and the debris raked in towards the body by means of the claws of the tarsus. The dirt is then seized by the tibia and the large flat femur, the legs are thrust outwards, and the dirt is rammed hard against the earth wall. In this manner the wall to the tunnel is at length constructed.

The writer has sometimes observed a turret of clay placed over the openings of the tunnels from which the pupae have emerged, and, though this habit is not confined to our Yellow Monday, the reason for it is unknown. It has been suggested that they serve to protect the burrow from flooding, but there does not appear to be enough evidence to support this conjecture. Another theory, which is probably the correct one, is that the pupa comes to the surface before it is quite ready to emerge. It therefore constructs a turret as a temporary retreat.

Though the cicada, when it emerges from the ground is usually termed a pupa, the name is really misleading, as it is not a true pupa, such as we find in moths and butterflies, where the pupal stage indicates a quiescent condition during which the insect is incapable of movement. The cicada "pupa" is, on the other hand, extremely active, as we have seen, and the term pupa is, therefore, used only as a matter of convenience. The pupa is very similar to the larvæ, except that wing pads are present during the pupal stage.

The adult cicada emerging from the pupal shell.

[Photo.—*A. Musgrave.*

TRANSFORMATION.

According to Mr. Froggatt, the pupa emerges from its tunnel about eight o'clock in the evening. It then climbs a tree, fence, or some similar object and fastens itself firmly to the bark by means of its claws. This is very necessary, as the claws will have to bear the whole weight of the insect during its movements while the subsequent process of transformation takes place. The skin then splits down the middle of the pupa's body, from the head to the first segment of the abdomen, and the back of the adult cicada emerges. Then follows the head, after which the insect falls over backwards and draws out the legs and the wings. At the same time the linings of the thoracic air tubes which take the form of long white threads, are drawn out of the body of the adult. These are plainly seen in the photograph of the old shell of the Yellow Monday. The adult cicada now bends back again into a forward position, and seizing hold of the front of the pupal shell draws out the abdomen. After this growth is very rapid, the wings gradually lengthening and becoming hard and dry, so that, when morning dawns, the insect is ready to

The pupal skin remains clinging to the tree long after the adult has departed.
[Photo.—*A. Musgrave.*

join its comrades in the tree tops. The shell of the pupa remains clinging to the tree long after its owner has departed.

FOOD.

One of the curious anomalies that one meets with in Australia is the readiness with which many of the indigenous insects forsake their native food-plants for those of introduced species. Thus we find the larvæ and pupæ of the Emperor Gum Moth (*Antheraea eucalypti*) on the introduced pepper tree, though its natural food plant is the eucalypt. And so with the Yellow Monday, while in the bush one rarely meets with the insect, in the city and suburbs their numbers on the introduced trees are prodigious and their noise deafening. They seem to have acquired a preference for the English oak, and Mr. Froggatt, who has given a good account of this insect in the *Agricultural Gazette of New South Wales* for 1903, states that he has counted over forty on the trunk of one oak tree. As the tunnels occur in numbers at the foot of these trees, it may be taken as indicating the fact that in the larval stages they derive their nourishment from the roots of the trees. During the adult stage, Mr. Froggatt states that he has never known them to feed, a habit which is certainly not shared by all our "locusts." In a garden at Parramatta, one of the oldest in the State, I was kindly permitted by its present owner, Mr. J. Bradley, to take photographs of the shells of the Yellow Mondays which occur there abundantly at times on the trunks of the English oaks and other trees. Though eucalyptus trees did not occur in the grounds, shells were to be seen on the camphor laurel and pine trees. The Yellow Monday would seem, therefore, to be most catholic in its tastes.

The Wilderness.—By Amy E. Mack.

Boronia Babies; *Gum-Blossom Babies*; *Gum-Nut Babies*; *Wattle Babies*; *Flannel Flowers and other Bush Babies.*—By May Gibbs.

One looks for something bright and interesting from the pen of Miss Amy E. Mack (Mrs. L. Harrison) and in "The Wilderness" this is fully realised. It is an account of the wild life frequenting a not much traversed plot within an area already well marked with homes. The disadvantages to the builder have converted it into a veritable sanctuary. The nature lover will find much enjoyment in this booklet, which reflects credit upon all concerned —author, artist, publisher and printer.

Miss May Gibbs' charm and style is well maintained in the series above listed. The appeal to young folks should be strong. The mind of the child is a naturally enquiring one, and reading material of this nature cannot but have a good effect in moulding the outlook towards all things living, and rendering, perhaps, less necessary the provisions of the *Native Animals and Birds' Protection Act.* The booklets are admirably produced.

Our copies from Angus & Robertson, Ltd.

War in the Garden.

By Allan R. McCulloch.

The Yellow and Black Sand Wasp (Exeirus lateritus) which every year exacts heavy toll from the cicada world.

[Photo.—*A. R. McCulloch.*

WHEN the sun is shining his hardest and the cicadas, or screech-bugs, as our American cousins appropriately call them, are screeching their loudest, the time is ripe for unlimited tragedies. In an old Parramatta garden, where the soil is loose and sandy, and oak trees form a thick leafy canopy overhead, the cicada finds everything to his taste. In his larval life, when tunnelling his way through the ground, he finds no difficulty in moving the soil with his powerful front legs in search of food. And later, when he has crept out of his brown, hard skin, and emerged a slim, shiny creature, he has merely to spread his gauzy wings and fly into the nearest tree-top to trill away the few remaining days of his life. So well does it suit him and his kind, and so much noise does he make, that he attracts numerous small boys, who delight to catch and shake him violently in a hot dirty hand, causing him to rattle loudly in protest. Boys and birds and what would seem to be still more dangerous enemies, wasps, harry the poor cicada from the cradle to the grave.

In a corner of the garden, a number of Digger-wasps (*Exeirus lateritus*) have established themselves, appearing year after year to wage war upon the host of cicadas living in the trees above them. They burrow deep tunnels in a small space several yards square, and heap up small hillocks of it at the entrance to their subterranean dwellings. Each burrow is about the size of a mouse-hole and the sand excavated from it would fill an ordinary cup four or five times.

Each year, about the middle of November, when the sun has warmed up the earth, they may be seen industriously shovelling sand out of the tunnel mouth and scattering it far behind them. Standing firmly on the two hinder pairs of legs, with the abdomen raised, they turn the front pair inwards till their tips almost touch, and scoop away the sand with quick short strokes, throwing it backwards beneath the body. The amount of sand moved at each throw is, of course, small, so one can imagine what a large amount of energy is expended in digging out several tunnels ten to twenty inches long, from which every grain has to be shifted to the surface with many successive throws, and piled up outside the burrow.

When a wasp considers its burrow deep enough, it flies off in search of a cicada to entomb within it for the

The wasp engaged in excavating its burrow for the reception of the cicadas.
[Photo.—*A. R. McCulloch*

nourishment of one of its babies. It may be seen hovering over the trees in search of its prey, and one is led to wonder by what means it can detect them. The suggestion that it traces the cicada by the noise it makes is not to be relied upon, because I have known a wasp to secure a "locust" at a time when none were "ringing."

Further, the wasp must be guided by form rather than colour, since it is equally partial to both Green and Yellow Mondays as well as the black and yellow Fiddler, any of these being seized as soon as discovered. Finding a cicada, the wasp stings it in such a way that it becomes paralyzed, and the two drop to the ground, sometimes from a great height, with a thud which provokes a last rattle from the now moribund captive.

Once the cicada is quieted, the next thing is to get it home to the nest. According to a work on Australian insects, the wasp rides the cicada to its nest, but no details are given as to how this is done. In this garden they always fall from the tree with the locust as described and then set to work to drag it through grass and weeds, over sticks, or anything else that may be between it and the burrow. A wonderful part of the whole business is the unerring instinct which guides the wasp in an almost straight line to its own burrow. Even though it be ten, fifteen, or twenty yards away, and notwithstanding that it has flown all round the tree in search of its captive, the wasp unhesitatingly turns in the right direction, passing by other burrows without faltering until it comes to its own.

Throwing the cicada on its back so that it will glide along easily, and straddling across it, the wasp grips it firmly with the middle pair of legs. Using its long hind legs and shorter front ones, and often assisting itself with its wings, the homeward journey is commenced. The wasp travels along the ground at an amazing rate. Nothing stops its progress, and every available grass stem or other hold is made use of by the long and spiny limbs. The wasp's legs not only end in two long curved claws, but every joint bears a series of strong spines, which

are as useful as the foot proper to catch against anything that may afford a hold. The loose soil outside a burrow appears to offer the greatest difficulty since it offers no foothold for the wasp. I have seen a cicada abandoned after a struggle lasting several minutes, and their dead bodies are not uncommon around the burrows.

Having once secured its prize, the wasp is not willing to lose it without a struggle. One which I caught soon after it had come to the ground would not loose its hold upon the cicada even in the folds of the net, but struggled around with the captive while endeavouring to find a way of escape, even though the wasp weighed but fifteen grains, while the cicada turned the scale at thirty-two.

Each wasp recognises its own burrow, and avoids trespassing into that of a neighbour. Though its course may take it past the mouths of several other burrows, it rarely hesitates. On one occasion I noticed a wasp dragging a cicada up a sand heap in which there were two burrows within a few inches of one another. It came first to the wrong opening and, after momentarily hesitating at the entrance, turned round in a circle so that it came back to the same tunnel. But it refused to enter and made off again to its own burrow, into which it quickly disappeared with its prey.

Again, I once saw two wasps, each with a captive cicada, travelling along within a few inches of each other. Their struggling with the coarse grass, brought them into collision, but they seemed far too interested in their work to notice each other. One, getting a little ahead, passed over the sand around the mouth of a burrow, but without hesitation, passed on to his own. The other then arrived and turned in with such certainty that no doubt was left as to its being the proper owner. Once, when I was photograph-

A wasp dragging a paralyzed cicada to its burrow.

[Photo.—*A. R. McCulloch.*

ing, I placed a dead cicada and wasp at the mouth of a suitable burrow in the most life-like manner possible, and, while focussing the camera, noticed the rightful tenant bringing in a cicada. It could not pass without bumping against the dead wasp, but gave no sign of interest in it whatever and passed rapidly down into the depths.

I dug the ground up around several burrows and found cicadas buried ten to eighteen inches from their mouths. It would seem that several tunnels are scooped out, each of which is connected with the main opening, and a cicada is placed at the end of each tunnel. Several cicadas were found in an area of about two square feet, each providing nourishment for a more or less advanced larval wasp. These are blind, legless and very helpless creatures, very soft and translucent, whose principal claim to solidity lies in the possession of a large pair of horny jaws, terminating the ridiculously small head. Their large bodies rest upon the locust, only their small heads being inserted into its body. One cicada, fresher than the others, had a white, spindle-shaped egg attached to the lower surface of its thorax, near the bases of the legs, which is probably the place selected by the mother wasp to deposit her eggs, since all the cicadas were attacked by the grubs in the same part. The cicadas in the burrows belonged to two species the common green Monday and the black and yellow Fiddler being about equally numerous and of both sexes.

Reminiscences of the "Challenger" Expedition.

By W. H. Hargraves.

[H.M.S. *Challenger* cruised for three and a half years over the oceans, dredging and exploring the depths, and laying a broad foundation for the science of oceanography and making most valuable contributions to zoology in general. Mr. Hargraves, now a trustee of this Museum, and a life-long student of conchology, well remembers the visit of the famous exploring ship to Sydney in 1874, and in this short article he recalls a few incidents of her stay.]

THE *Challenger* arrived in Port Jackson on 5th April, 1874, and remained until early in June. From the Manly boat I frequently saw the ship's steam pinnace dredging in the harbour, and one afternoon, as Mr. John Brazier, afterwards of the Museum staff and still happily alive, and I were dredging between the Sow and Pigs Reef and the South Head, the ship's party came close to us and commenced operations. After an hour or so our dredge ropes became entangled, which served as an introduction and started conversation.

"What are you dredging for?" we were asked. "Oh, anything we can find in the way of shells," I replied, "What are you trying for?" "Trigonias[1], and we have got five. Did you get any?" "A few," said I, and, taking the bailer from under the thwart, I exhibited our catch of twenty-five or thirty *Trigonias*, one or two with a beautiful *Myochama* attached. The *Challenger* party were delighted at seeing such a quantity of this rare shell and wished to buy the lot. I said "They are not for sale, but as you do

[1]Trigonia is a shell of common occurrence as a fossil, but living specimens are found only in Australian seas. It resembles a small cockle.

not appear to have been very successful, we shall be pleased to give them to you."

Before we parted, we received an invitation to visit the ship, and on the appointed day we went on board. Professor Moseley, Dr. Suhm, Dr. Crosbie, and others were there, and we spent a very pleasant afternoon. All on board were eager to have *Trigonias*, and before the ship left Sydney I had parted with all my duplicates.

Prior to the departure of the *Challenger* for New Zealand, Captain Nares and his officers and the scientific staff invited a number of Sydney residents, including myself, to accompany the ship on a trip outside the Heads to witness dredging and trawling operations. Captain Nares consulted me as to the best place to cast the dredge, and I advised him to wait until we were six or seven miles outside the Heads, as, nearer in, it would probably bring up some of the silt dumped by the punts. However, on the advice of Dr. J. C. Cox, who was later Crown Trustee and President of this Museum, the dredge was lowered when we were but two and a half miles out. The following extract from the *Evening News* describes the result :—

> As soon as the donkey winch commenced to heave away, an anxious crowd gathered on the bridge, and, as the rope came in, the eager throng held their breath in expectation. When the chain attached to the dredge appeared in view, the interest heightened. There stood the scientists, like bloodhounds on the leash. Professor Thompson[2] tried to look as dignified as a man of his experience in such matters should look. Drs. Cox and Bennett strained their necks and eyes. Messrs. Hargraves and Brazier, the possessors of every known shell on our coasts, wore a look of painful anxiety. Even those not immediately interested in Conchology, or any other science, were infected. The Reverend W. B. Clarke was excited and uneasy. The eager crowd was not kept long in suspense. First appeared the shackles and chain, then the arms of the dredge, and then the object of all their hopes itself—*empty and bare* ; not a specimen was visible. The lengthening of jaws was perceptible, and even groans escaped from the enthusiasts. Silently and sadly they laid it down on the deck of the bridge.

When we were about four miles out the trawl was cast and some rare fish were obtained. Six miles out the dredge was again let down in much deeper water and brought up a number of interesting specimens, including *Voluta undulata*, a new species of *Murex*, three species of *Trigonia*, a new *Comatula*, crabs, and other rare animals.

After lunch we lost one dredge off Long Bay and another between Coogee and Bondi, in consequence of the rocky nature of the bottom ; before this the *Challenger* had lost only one dredge on the whole voyage.

Just before dark the ship returned to her moorings off Fort Denison, everyone having spent a most delightful day.

[2]Professor C. Wyville Thomson, leader of the scientific staff of the *Challenger*.

Mr. J. F. G. Stokes, Ethnologist of the Bernice Bishop Pauahi Museum, Honolulu, worked for some time at this Museum recently. He is specially interested in Polynesian peoples and their culture.

Lieutenant-Colonel L. Hore, District-Officer, Kokopo, New Guinea Territory, is at present on holiday in Australia, and took the opportunity to examine our entomological collection. He hopes to do a good deal of natural history collecting when he returns to New Guinea.

Mrs. Wilson, widow of Dr. E. A. Wilson, who perished with Captain Scott's last Antarctic Expedition, recently called at the Museum to examine our collection of Australian bats, a group to which she has devoted considerable attention. Mrs. Wilson is an accomplished naturalist and a skilful collector.

The coral pool group is now installed and makes a striking and beautiful exhibit. We hope to publish a description of the group and its construction in our next number.

The Mystery Lake.

By Harold O. Fletcher.

[Mr. G. H. Halligan recently organised an expedition to investigate Lake Eyre and kindly invited the Trustees to send a member of the staff to accompany the expedition for the purpose of making zoological collections. Mr. H. O. Fletcher was chosen for this task, and the following article describes his experiences.]

LAKE EYRE, a vast expanse of salt water far more briny than the sea, is situated in the interior of South Australia, over five hundred miles north of Adelaide, and is known to many people by name only, but the writer is one of the fortunate ones who has had the opportunity of visiting it, as a member of a party of scientists who went there with the object of carrying out a number of investigations.

The lake is divided into two parts, North Lake Eyre, which is ninety miles long by fifty miles wide, and connected by a narrow channel, ten miles in length, to the southern portion of the lake, which is forty miles long and fifteen miles wide. The district around Lake Eyre is over thirty feet below sea level, and it naturally follows that the bed of the lake is much more than this, as it is supposed to be between fifteen and thirty feet deep in the centre.

One of the most puzzling features of Lake Eyre is its power to hold enormous quantities of water for a short time, and then without any warning whatever to absorb most of it, so that only a comparatively small lake is left in the centre, surrounded by impassable mud and slime, coated to a depth of a few inches with glistening white salt which extends for miles. This water shifts about under the action of the wind, and may move either north, south, east or west, as the wind varies.

Very little is known about the centre of the lake, or the life that might be there, but Prof. W. Howchin, in his *Geography of South Australia*, says: "There is reason to believe that Lake Eyre, in its earlier history, was a fresh-water lake covering a much greater area than at present, with an outlet to the sea, but in which direction is not at present known. At that time the Diamantina and other large rivers had a permanent flow of fresh water and were frequented by crocodiles, turtles and the curious mud-fish Ceratodus; large marsupials (such as the Diprotodon and others) now extinct, and giant birds of the moa and emu type lived on the plains."

An expedition was organised on information gained earlier in the year when the leader flew over the lake area in an aeroplane lent by the Defence Department. At considerable risk a large number of photographs were taken, to show the extent of the water in relation to the surrounding mud and desert, and at this time the lake appeared to be full enough to allow the launching of a boat at the mouth of the Frome River, which enters North Lake Eyre from the south.

The party, consisting of Mr. G. H. Halligan, F.G.S., hydrographer, of Sydney (leader and organiser), and Messrs. S. M. R. Sharland (from the *Mercury* office, Hobart), H. W. Strong (from the Melbourne University), and the writer, started from Adelaide some months later, to try to add scientific information to that which is already known, and to attempt to solve problems relating to hydrography and the existence or non-existence of certain mound springs. A considerable quantity of equipment accompanied them, included in which was a sixteen foot boat complete with sailing gear and a small collapsible canoe.

For several hundred miles north of Adelaide we travelled, through the well-known wheat areas, until Quorn was left behind, and the train, gradually creeping away from the crops, entered into the desert regions, a seem-

ingly endless waste composed of sand, gibbers, and salt bush, while here and there emus and kangaroos would be seen, either feeding unconcernedly, or scampering away to a safe distance at our nearer approach.

At Maree, two days' journey from Adelaide, we detrained and all preparations were made for transferring the equipment to the camel team which was to convey it to the Frome River, where the main base was to have been made. The team driver, however, who had just completed a round-up of camels in the country close to the lake, informed us, much to our dismay, that the lake was almost dry, and, where our photographs showed water, there was only a treacherous mud and salt marsh, making it impossible to use the boat.

To investigate this report, some of us left Maree for the lake in a camel buggy, and, after a very trying day's travelling over undulating sand hills and through gibber country, which was here and there dotted with clumps of salt bush and prickly acacia, the only flora which will thrive there, we arrived at the Government Camel Station at Muloorina. Next morning a further start was made for the lake, and, as the sand was beginning to get much softer, two more camels had to be attached to the buggy. Unfortunately these two camels were rather fresh and commenced to play up, thereby frightening the other two, and all four bolted and were soon tearing along at their highest speed with the buggy swaying perilously behind. They did not pull up until our driver steered them into the thick shrub surrounding a water hole; even then they continued on through this, almost capsizing the buggy, and, when they were eventually brought to a halt by the density of the undergrowth a genuine sigh of relief was given.

After this little escapade they behaved well for the rest of the trip to the lake, where we saw a most disappointing sight; for instead of water, there was, as far as they eye could see, nothing but soft treacherous mud, covered with a coating of white glistening salt. Returning reluctantly to Maree, we decided that it was impossible to make any investigations on North Lake Eyre, and so our attention was turned to South Lake Eyre, the southern shores of which could be reached from the railway line about thirty miles north from Maree. As the next train north to Oodnadatta was not due for two weeks, we arranged with the railway authorities for the hire of one of their motor trolleys, which went by the name of "Casey Jones," and a very interesting journey was made as far as the lake cottages, the nearest point to the lake.

The country passed through on the way to South Lake Eyre. The stream is an overflow from an artesian bore.

[Photo.—*H. O. Fletcher.*

Some very interesting country was passed through during this thirty-mile trip to the cottages, the line at times being hardly visible owing to the shifting of the sand caused by the winds, while a short time after we would be rattling across single line bridges, spanning some of the gullies, at our fastest speed, which was about fourteen miles an hour. Large mobs of emus and numerous kangaroos were passed, while various species of interesting and rare birds were observed.

There being an absence of trees for many miles, a crow builds its nest on a telegraph pole.
[Photo.—*H. O. Fletcher.*

A number of very peculiar nesting-places of crows were noted and photographed, nests being found built on the iron standards carrying the wires of the Trans-Australian Telegraph, which spans Australia from Adelaide to Darwin. No doubt the crows thought these ideal positions, as trees are few and far between in that district. The smoothness of the poles also afforded the birds and their homes great protection against possible raids by small mammals, goanas and other reptiles which are known to be fond of eggs.

When crossing one of the larger bridges we were astonished to see a crow fly from almost under the trolley, and, on stopping to investigate, we found to our great surprise that the bird had almost completed building a nest on a sleeper between the two lines. Whether the nest was ever completed we cannot tell, but probably, after the bird had survived the experience of a train thundering over the line, it thought less of its choice, and hurriedly left for a quieter and safer position.

After walking a distance of about three miles we arrived on the shore of the lake, and, much to our surprise, found that although we sank in the salt crust and mud for a few inches, it held our weight and allowed us to walk almost a quarter of a mile into the lake. As the water was only a few inches deep and did not appear to get any deeper, no attempt was made to float either of our boats. After getting a number of water samples for the Melbourne University, we returned to Maree.

LAKE LETTY.

Hearing from residents of Maree that a large number of birds were to be seen at Lake Letty, a freshwater lake about fifteen miles from the town, we decided to make an excursion there. Getting provisions for a week's stay, we made arrangements with the camel team

On the shore of South Lake Eyre. The foreground is salt, not sand.
[Photo.—*S. M. R. Sharland.*

that was leaving for Muloorina next morning, to drive us as near Lake Letty as possible. Rising at daybreak next morning we reached the outskirts of the town with our luggage, fully expecting to see the camels harnessed up waiting for us, as the driver had told us that he would be making an early start. But, owing to the absence of feed, the camels had wandered to the far end of the paddock, where he had found them feeding on some coarse herbage that was growing along the sides of what was once a water hole. As the "paddock" was fifteen miles across, it is not to be wondered at that it was almost four o'clock before we moved off. There were fourteen camels in the team and they kept up the one steady pace, three miles an hour, with clockwork regularity, whether it was over soft sand or over the harder gibber country, where the huge wheels of the waggon would not sink in and so impede progress.

By the time it was dark we had arrived at a place called Box Hole, where there are a few welcome trees and here the night was spent. Leaving the camel team next morning we set out for Lake Letty, and, after a hard morning's walk across soft sand, arrived there to find bird life in profusion.

Camping that night under the mulga trees that surround the lake, we were awakened at daybreak by the chattering of thousands of birds and a loud whistling, which would almost deafen one. This was put down to the Whistling Eagles, which were seen in large numbers during our stay there. After walking down to the water's edge we watched and identified a number of water birds; Avocets, with their long turned up bills were there in the largest numbers, parading around in the shallow water, with the White-necked Herons, and spoonbills intermingling with them in their quest for food. Hoary-headed Grebes were seen swimming lazily and diving, whilst flocks of Black Ducks and White-eyed Ducks would rise from the water with a rush when startled, and, after flying the length of the lake several times, would alight once again. Overhead circled dozens of hawks and eagles swooping and gliding, ever on the alert for some hapless small mammal which might delay in the open too long. Hundreds of skeletons and pelts bore mute testimony to the large toll these birds take of the rabbit. Pushing our way through the overhanging trees and entangling vines we would often startle a hawk as he waited tirelessly on a low bough with his beady eyes concentrated on the ground, knowing that sooner or later his prey would pass through on its way to drink. Crows were there in thousands and used to assemble on the trees surrounding our camp, watching every movement we made for hour after hour, until one of the party, resenting their sinister aspect, would arise with a shout, and, picking up the nearest object would hurl it with all his strength at the black fiends, as he called them. Although temporarily scared away, they would soon come back and take up their old position, once more awaiting their opportunity to swoop down and gather a few of the scraps that were lying about.

On the way to Lake Letty. This is typical of the sandy country travelled over.
[Photo.—*H. O. Fletcher.*

Flying from one tree to another were

Aboriginal carvings at The Haunted Shack, representing the tracks of emus, kangaroos, and human beings.
[Photo.—*H. O. Fletcher.*

seen hundreds of the Chestnut-eared Finch, and another frequent, but noisy, visitor was the White Eyebrowed Babbler. Numerous other birds were seen and identified during our stay there, and we were very downhearted when we had to bid farewell to this pleasant spot, an ideal place for bird lovers, and start on our fifteen mile tramp back to the township. As the heat was too great in the daytime for travelling, we left at dusk, and arrived back at Marree early next morning.

Another short excursion was made to a place locally known as The Haunted Shack, situated about seven miles S.W. from Maree, where an interesting discovery was made in the form of a large number of aboriginal carvings. Almost all the rocks on one side of a hill had been carved, but the marks could be discerned only when looked for closely, as they had not been very well done. Situated about half-way up this hill, on a piece of smooth quartz-like stone we found a number of carvings which were distinct and very well done ; these included the tracks of emus and kangaroos, and also the imprints of human feet.

Following the course of a dried-up river bed, we came across the mud nests of the Fairy Martin, plastered in great numbers on the overhanging rocks and caves. It is worthy of note that the Fairy Martin was almost the only bird that was found in this district.

The mud nests of the Fairy Martin (Petrochelidon ariel).
[Photo.—*H. O. Fletcher.*

Recently requests have been received for the loan of lantern slides, of which the Museum now possess an extensive collection, illustrating various branches of natural history. Slides have been lent to several schools and to the Workers' Educational Associations of Newcastle and Goulburn. We shall be glad to assist in this way as far as possible.

The Red-whiskered Bulbul.

By J. R. Kinghorn.

IN the July issue of this *Magazine*, page 157, I wrote a note on the habits and distribution of this introduced bird, concluding my remarks by raising the question of its food, *i.e.*, whether it is destructive or otherwise. In other countries, especially in its native habitat, India, much controversy exists as to whether it eats more fruit than insects, or *vice versa*. Some hold the opinion that it is a fruit eater, and therefore destructive, while others assert that it eats orchard insect pests, and is therefore to be encouraged.

In Australia we have not as yet had a very long acquaintance with the Bulbul, or Top Knot, as some have locally named it, and I am endeavouring to gather as much information as possible regarding its food habits.

To this end readers are requested to observe it carefully, with field-glasses if available, *carefully*, because a big economic question is involved, and to make available the results of their observations. It matters little how short the note may be providing that it is faithful. Assistance of this nature is essential, for only with it, and an analysis of the stomach contents, can a true estimate of the bird's habits be obtained. A few reports have already been received, but there is need for many more.

A full description of the bird will be found in the issue above referred to.

The Bulbul.
[Photo.— *J. R. Kinghorn.*

Mr. E. Wunderlich, trustee, recently returned from an extended European tour. During his absence he paid particular attention to matters of museum interest.

A short collecting excursion to Upper Colo, led by Mr. J. R. Kinghorn, assisted by Messrs. H. O. Fletcher and J. H. Wright, added valuable material to the collection. A number of interesting field notes and photographs were also obtained.

The Palolo Worm.

By W. W. Thorpe.

THE Palolo, or Balolo (*Eunice viridis*) is a ringed sea-worm common to the Fijian, Samoan and Tongan Islands ; it lives in crevices of the coral reefs and interstices of other encrusting growths.

This worm has an interesting life-history, showing the change of habit often adopted by animals during the breeding season. On the approach of maturity, the eggs and sperm ripen in the female and male respectively, and a curious metamorphosis takes place in the anatomy of the worms themselves. Each sex develops lateral paddle-like processes and a number of body-eyes, and the animal turns end-for-end in its coral home. The tail-end, now outwards, revolves violently for some time and then floats off, while the head portion remains in the reef. The headless bodies contain the eggs and sperm, which either break through the abdominal walls, or exude through the open end, and in their myriads they form a milky substance in the water. These eggs and milt, now set free, coalesce while drifting about, pairing takes place, and a new palolo is born. This in its turn takes up its abode in the coral reef, and awaits its nuptial voyage. The head-ends in the burrow must not be overlooked. These soon recover from the rupture of the parts, and forthwith begin to grow a new body, and in the fulness of time the same process is repeated.

According to an observer "the palolos rise out of the reefs just before daybreak, first in small numbers, but just about sunrise in such masses that the sea looks more solid than liquid." The natives of the islands evince considerable interest in the natural phenomena, but their concern is purely gastronomical. They marvel not at this provision of nature for the perpetuation of the species, but are quick to turn it to account as provision for the inner man.

In Fiji the months of October and November have from time immemorial been known as the palolo moons. When the appearance of the palolo is imminent, a period like our Easter, governed by the phases of the moon, the natives set out in their canoes with nets and other devices and wait patiently for the uprising. Suddenly, one calls out "A palolo! a palolo !" as he draws the much prized worm into his hand net. The cry is taken up, and everybody is on the alert, nor is it a false alarm, for shortly the whole surface of the water is a vermicelli-like mass. All efforts are now put forth to obtain a heavy draft of these squirming delicacies.

The natives work with a will, for the visitation lasts only for about two hours, then twelve months must elapse before nature will be so kind to them again. As the sun rises they dissolve, and by about eight or nine o'clock they have practically disappeared. Those tail ends that escape the nets and are not immediately eaten by fishes or sea-birds, melt away in the sea. This rapid disappearance led to the former incorrect assumption that they had returned to the reefs, it not being known at that time that the drifting palolo was only a tail end.

These tail ends are collected in such quantities by the natives, that the canoe gunwales are often awash as they turn shorewards with their wriggling freight. The folk on shore are both delighted and excited on the return of the worming-fleet, and for several days there is a season of festivity.

It takes some time to cook them all, a job which must be tackled at once, for they rapidly deteriorate. Small parcels are made by wrapping them in bread-fruit leaves. These are placed in the ground ovens and steamed for twelve hours or more, and then eaten.

The early European navigators refer to these palolo events as times of ceremonial activity amongst the natives, but these old rites are no longer celebrated.

The Australian Museum

The Museum is open Free to Visitors every Week Day from 10 a.m. to 5 p.m., except on Mondays, when Students and Pupils of Schools and Colleges are admitted by arrangement in the afternoons, and, if the Director is informed beforehand, facilities for Study are given.

It is open on Sundays from 2 to 5 p.m. and on all Public Holidays, except Good Friday and Christmas Day.

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Table of Contents.

Young White-breasted Sea Eagle on Nest, Capricorn Group, North Queensland. The nest is built on a Sophora bush, whilst in the background is seen Tournefortia argenta. The leaves of this, which cluster on the ends of branches, are clad with silvery hairs, but the general colour is sage green.

[Photo.—*C. Barrett.*

See page 225.

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Editorial.

THE AUSTRALIAN FAUNA.

AT the present time there is a good deal of public discussion on the subject of our native mammals and birds, and some of the participants are inclined to strike a note of pessimism as regards the future of these members of our fauna, particularly the marsupials. It is undoubtedly true that the total number of our wild animals is less now than formerly; that is an inevitable consequence of the advance of settlement, clearing operations, bush fires, the introduction of animals like the fox and the rabbit, and the widespread use of poison in the endeavour to control these pests. It is probably true, too, that some species which inhabited Australia when Captain Cook first landed on these shores are now extinct, but we hope that the number of these is small, and that some deemed extinct are yet lingering in some of the less accessible and more sparsely inhabited portions of our great continent.

As Dr. W. K. Gregory pointed out in a previous* issue, the Australian marsupials are in many respects the most interesting group of animals now existing, and their undoubted depletion is a deplorable fact. It behoves us as good Australians to do what we can to prevent, or at any rate postpone, their extinction. A rigid application of the laws protecting wild life would do much to save our marsupials, and the dedication of suitable reserves, where those species which are less able to cope with changed conditions, could find sanctuary, should be strongly urged on our legislators.

At the same time we would deprecate the desire evident in some quarters to curtail the operations of scientific collectors, especially those representing extra-Australian institutions. A little consideration of the facts will convince anyone that, so far as collecting for scientific and educational purposes is concerned, the damage done to our indigenous fauna is so slight as to be negligible. Within the last few years two of the leading American museums have had collectors in Australia, and between them they have accounted for about one thousand marsupials. During the same period the number of marsupials slaughtered for their skins runs into millions. Let us devote our energies and ingenuity to controlling trade in our wild animals and birds, which has for its object, not scientific or educational advancement, but mere gain. On the other hand, if the pessimists are right, and our marsupials are

*THE AUSTRALIAN MUSEUM MAGAZINE, Vol. I., No. 3, December, 1922, p. 65.

doomed to extinction, surely it is advisable that scientific institutions should be allowed to obtain the comparatively few specimens necessary to exhibit to posterity the characteristics of these interesting animals.

Let us not, then, put unreasonable obstacles in the path of our scientific confreres. Their efforts will result in a distinct gain to Australian zoological science. There is yet much to be done in the investigation of our marsupials, and, along with our fellow citizens in other parts of the Empire, surely our American cousins have a right to share in our heritage, for, in their land as in ours, there are still existing members of the marsupial order of mammals so characteristic of Australia. But we may claim with justice that Australian scientific collectors should obtain special facilities and support in their work. The resources of our own museums are deplorably slender and it is to be hoped that public-spirited men like Sir William Macleay, Sir Thomas Elder, W. A. Horn, and Mr. H. L. White, will always be forthcoming, men who realise the necessity for the investigation of our wild life, and are prepared to give practical support to the work. All honour to them.

Notes and News.

Dr. J. R. M. Robertson, Trustee, has returned to Sydney after an extended trip to Europe and America. Another Trustee, Sir James Burns, has also returned from Europe. We are pleased to hear that his health is now improving.

Dr. T. Storie Dixson, President, left last month on a trip to the United States.

Mr. A. R. McCulloch, who has been away for five months with Captain Hurley in New Guinea, has now returned.

Among recent scientific visitors may be enumerated Professor P. B. de Rautenfeld, Commissioner, Chinese Maritime Customs Service, formerly of the University of Peking; Mr. J. Emblom Gullberg of the Smithsonian Institution, Washington, who has returned from New Guinea and is now engaged in craniometric investigations in the Museum; Major H. Newport, Department of Agriculture, Rabaul, who is in charge of the museum there and is keenly interested in museum methods.

Mr. H. C. Raven, collecting for the American Museum of Natural History, returned from Tasmania and later left for the United States. Mr. Raven has been successful in obtaining a fine collection of Australian mammals for anatomical purposes and for display in the projected Australian Hall in the New York museum. During his stay in Sydney Mr. Raven made a careful study of our collection of marsupial skulls.

Professor T. T. Flynn, of the University of Tasmania, recently spent several weeks at the Museum, working on the description of the squalodont whale skull discovered by him at Table Cape, Tasmania, and on the Mawson Collection of Antarctic Pycnogonida. A cast of the Table Cape Skull has been put on exhibition in the Museum, and a description by Prof. Flynn of the find and its significance will be published in our next issue.

The Museum lecture season will open on April 12th, when Mr. A. R. McCulloch will discourse on "The Mud People of Papua." The lecture will be illustrated by an exceptionally fine series of lantern slides.

Some Birds of Prey.

By Charles Barrett, C.M.Z.S.

As home pets, the birds of prey are not popular, though some persons (eccentric, you may say) have made a hobby of cherishing eagles and hawks, and members of the owl tribe. I am not one of these "peculiar people," but I am keen on making friends with the hunting birds in their native wilds, and in the course of many rambles afield, with binoculars and camera, I have met with a measure of success.

Perhaps it is too much to claim that one has gained the confidence and goodwill of eagles and hawks, unless the limitation is stated. Only young birds, in the nursery or just out of it, are promising subjects for overtures. My photographs are the evidence that I have not failed completely with them.

COWARDLY SEA EAGLES.

My first attack on an accipitrine citadel was surprisingly successful. On a little isle of the Capricorn Group, Queensland, a pair of White-breasted Sea Eagles (*Haliætus leucogaster*) had built a huge nest of sticks among low branches of a *Sophora* bush. It contained a lusty eaglet, almost ready to fly. As soon as I approached, carrying a half-plate stand-camera (which I find the most useful size and type for general nature photography), the old eagles flew out to sea, leaving their fledgling to its fate. Not a harsh fate, luckily, for I merely wished to "snap" it. But the youngster, bolder than its parents, greeted me as an enemy. It turned on its back in the bowl of the nest, and menaced me with beak and claws. I tried gentle persuasion, and at length the eaglet perched on the rim of the nest and remained fairly quiet for a minute. The camera was below, focussed on the spot and all ready. A quick pressure of the bulb release, the shutter clicked, and my first portrait of a bird of prey was secured.

Sea Eagles, judging by evidence gathered amongst the Capricorns, are fond of sea snakes; we found many skeletons, apparently of these reptiles, on the ground beneath several nests, mingled with those of fish.

The beautiful White-headed Sea Eagle (*Haliastur indus*) I have watched very often with admiration, in the coastal regions of North Queensland, but hitherto it has dodged my camera. These fishing birds, perched on piles or rocks, and in flight, look fine in their white and rich chestnut-coloured plumage.

Whistling Eagles are not rare, and most folk who are interested in wild birds must be familiar with them. The Ornithologists' Camp, on Wallis Lake, New South Wales, was close to a tall gum tree which held, in the loftiest boughs, a nest of this species. The curious whistling notes were constantly heard, and often we saw the birds sailing high, over land or sea.

THE EAGLE-HAWK.

Though it has been greatly persecuted in many districts, our noblest bird of prey, the Wedge-tailed Eagle (*Uroætus audax*) is still far from the trail that leads to extinction. In some places, indeed, it is numerous.

I am a champion of the Eagle-hawk, for though, in drought times especially, it may do some harm among sheep, it performs good service in the war against rabbits. In the nests, and on the earth beneath, you will find remains of bunny. In his *Birds of the District of Geelong*, Mr. C. F. Belcher records: "I have heard of eagles which had a nest of young in a paddock where two thousand ewes with lambs were depasturing, yet the birds fed themselves and their young upon rabbits alone." Plenty of similar evidence in favour of the Wedge-tail could be produced if it came to a trial by jury formed of pastoralists and bird lovers.

Nest of the Wedge-tailed Eagle.
[Photo.—*C. Barrett.*

We should save our eagles and other birds of prey from the fate that is overtaking their "cousins" in the British Isles. Happily, in Australia, we do not pamper partridge and pheasant against the "Opening Day." Gamekeepers as a class, I believe, are largely responsible for the decrease of hawks and owls in England. In the army I met one of these game preservers, a bulky sergeant-major. I argued with him in vain. "They're vermin, are 'awks and owls," he declared.

On the train trip across Australia I saw scores of huge Eagle-hawks, flying low, soaring, or perched on stunted bushes. The Nullarbor Plain, where dingoes roam and rabbits are not unknown, had some of the hunting birds to show to weary travellers. Observing wild life from a carriage window is one way of increasing the interest of the trans-Australian trip.

One of the Eagle-hawk's victims. [Photo.—*C. Barrett.*

"Leave me alone."—Young Brown Hawk. [Photo.—*C. Barrett.*

On my latest rambles in the Mallee, around the Pink Lakes, Victoria, I found half a score of nests of the Wedge-tailed Eagle. Some were in low trees, others fifty feet up, in "Belars," which are favoured also by White-winged Choughs (*Corcorax melanorhamphus*) as sites for their mud-bowl nurseries. Many nests, but all deserted: some had not been used for years. Settlement is driving the Eagle-hawks into the untamed wilderness, where, some day, wheat may grow.

A FRIENDLY FAMILY.

Near the settler's home where I camped with a brother bird-observer, in a barn next door to a heap of "cocky chaff" a pair of Brown Hawks (*Ieracidea berigora*) had a nest, accessible even to an unskilled climber. But we could not contrive to fix the camera safely in the boughs. The three young hawks that filled the nest almost to overflowing, were well grown, so we elected to risk an experiment. The nest, after much hard work with tomahawk and ropes, was lowered, with all its natural supports, to within five feet of the ground. A screen of green branches saved the nestlings from sun-stroke—if hawks are ever injured by solar heat—and they were made quite comfortable.

While we were exposing plates rather recklessly (they cost money nowadays), one of the parent birds appeared afar. She flew to a tree fifty yards away, and we saw that a lace lizard (or "goanna" as folk will call our monitors) hung limply from her beak. In the nest were the mummified remains of a "stump-tail." So it would seem that lizards are favourite food with these hawks.

At first, the young hawks were inclined to be "nasty." They took the offensive whenever we came near, and

clawed and snapped at intruding hands. Thus it was on the morning when their home was shifted nearer to the ground. Next day we visited them to see whether all was well with the trio. They had been fed and were fairly contented. Still, they rather resented our presence. Our third visit, twenty-four hours later, was memorable. For the youngsters seemed to recognise us, almost to bid us welcome. Daily, after this, our relations improved, until we were on the most excellent terms with the family. They made no protest when we handled them. In the early stages of making friends, when one baby was posed on a bough, he assumed an attitude of fierce defiance, as shown in my photograph.

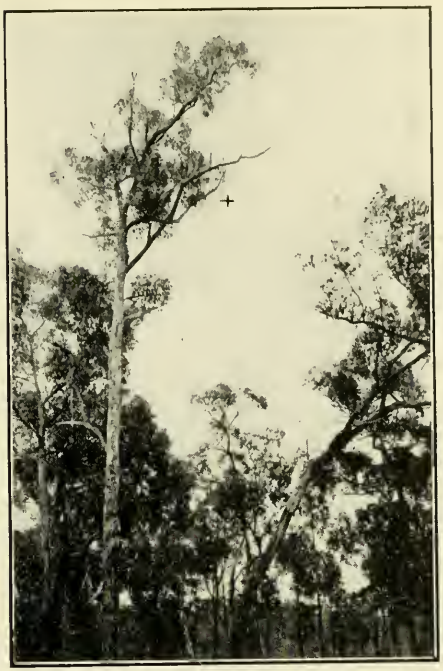
Brown Hawks are our most abundant birds of prey ; they are to be seen both in town and country districts, perched very often on a telegraph post. They are good citizens from our point of view, preying, as they do, upon mice and insects, as well as lizards—though I am not aware that the latter do us much harm, excepting, of course, the "goannas," which are destroyers of eggs and young birds.

THE GOSHAWK.

Lately (in December, 1922) I had the good fortune to be introduced to a family of Australian Goshawks (*Astur fasciatus*). They had flown from the nest, which was sixty feet up in a gum tree, growing in a paddock at Mooroolbark, Victoria, and were camped among thick foliage in a native cherry tree (*Exocarpus*). There, ranged in a row on a horizontal bough, they remained daylong, while the old birds at intervals brought them food.

When my friend, Donald Thompson, who had discovered the nest, guided me to the cherry tree, the young Goshawks glowered, but showed no signs of fear. They watched us closely, though, and, when my companion commenced to climb, two of the trio took wing. The one that remained was incapable of flight, for the nonce. He had eaten, not wisely but too well, and was at table still. We were shocked to

Nest and young of the Brown Hawk. [Photo.—*C. Barrett.*



Where the Goshawk makes its home.
[Photo.—*C. Barrett.*

find the legs of a bird (evidently an Indian Myna) protruding from the Goshawk's beak—*and feebly moving.* It was no pleasant sight, but, in the cause of science, it had to be recorded. So the fierce-eyed little glutton was placed on a stump and photographed. He tried to show fight, but his efforts were feeble.

We heard the loud twittering call, a single note repeated quickly many times as the parent birds circled over neighbouring trees. They had two of their offspring in hiding somewhere, but were fearful for the fool of the family, who had been greedy beyond measure.

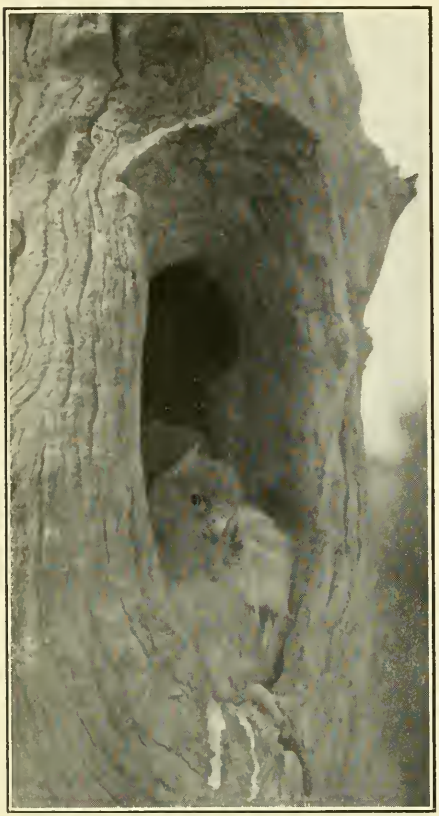
Swift upon its way is the Goshawk, and powerful, too—one of our finest hawks. It has been branded as a poultry thief, but, I think, without a fair trial. I do not assert that it never offends, only that it preys chiefly on small wild birds. Near the paddock where our trio was reared a poultry-run exists, yet we heard no complaint regarding the Goshawks, and the refuse at their feeding camp contained no chicken's bones.

CHARM OF THE KESTREL.

Of all the birds that are "red in beak and claw," after good hunting, I like best the beautiful Nankeen Kestrel (*Cerchneis cenchroides*). Its habit of hovering above haystacks, on the watch for mice, has made the Kestrel a most familiar bird, and a favourite with wise farmers. On wide-spread wings the little hawk hangs motionless until it tires of hovering, or a mouse rustles in the hay and earns swift death. Frogs, lizards, and insects are also included in the Kestrel's menu, and rarely it takes a small bird.

In Riverina one season, I found many nests of the Kestrel—homes in hollows, all of them, some high, some within easy reach. One nursery was a deep hollow in the bole of a dead gum standing in creek water. A little exertion and ingenuity, and taking the risk of a fall, enabled me to get one indifferent photograph—a baby Kestrel at the "door" of the home. The

Young Goshawk swallowing prey brought by parent. Legs of victim (? Indian Myna) are seen protruding from hawk's bill.
[Photo.—*C. Barrett.*



Young Kestrel at entrance to nest hollow.
[Photo.—*C. Barrett.*

family was a quartette. Taken from the hollow under protest, they made a charming group when settled on a log. We returned them, of course ; but they had tried their wings, and were eager to remain out in the world.

Years afterwards, when wandering amid the noble ruins of Karnak, in Egypt, I remembered the Kestrels of Yanco Creek. On ledges and in crevices in the Hypostyle Hall, that forest of mighty columns reared of old, Kestrels were nesting. Their shrilling calls echoed through the aisles—fancy transformed the pillars into gum trees, and the voice of the wind in the palms to a murmur of running water in Australian wilds.

* * * *

I have given only side glances at some of our birds of prey. Those not even mentioned are worthy of pictures and praise. See them in Nature if you can, and learn, as I have done, to think of them as "Good Australians."

Ball's Pyramid.—In an article by Mr. A. R. McCulloch, published in this Magazine (Vol. I., No. 2, p. 41), it was mentioned that Ball's Pyramid, "a pinnacle rising eighteen hundred feet into the sky, yet but sixty chains long at the base," is practically a *terra incognita*, none but a party of surveyors having ever landed upon the rocks around the base. Recently, however, the intrepid Morrisby brothers succeeded in landing on the Pyramid, and Mr. Logan H. Morrisby ascended the steep rocky face for about seven hundred feet, after a three hours' arduous and dangerous climb. Last year Mr. Morrisby sailed all round the Pyramid and scanned it eagerly through his binoculars, but was unable to land. He was then under the impression that the pinnacle was entirely bare of vegetation, but he now finds that, on the northern faces, there is a certain amount of short grass, rushes, and small tea-trees ; the southern sides are practically bare, perpendicular, and unscalable. Streams of fresh water trickle down the cliffs, which are formed of basalt. As for animal life, beside the innumerable gannets, which nest in the caves that honeycomb the cliff sides, the daring explorers found some small lizards and a sort of "Silver Fish" (*Lepisma*), but think it probable that there are other insects on the island. We are indebted to Mr. Camden Morrisby for these particulars.

Sea-Dragons

(Phyllopteryx)

By Allan R. McCulloch.

WHENEVER the winds blow harder than is usual from the sea, the waves churn up the animals and plants which live just below the lowest limits of the tides. Our ocean beaches at such times become strewn with an assemblage of marine organisms which are rarely exhibited to our view under any other circumstances. They live among rocks where they are safe from capture by either nets or dredges, and, unless lured to destruction with a baited hook, they are almost entirely safe from ill-treatment at the hands of human beings.

A South Australian Sea-dragon. One step more, in evolution, and it would become a bunch of kelp. [Photo.—*G. C. Clutton.*

After almost every storm, one or more specimens of the queerest of fishes, the Leafy Sea-dragon, are picked up by some wandering beach-comber, and find their way to the Australian Museum. There are several species of these remarkable animals, some of which are even more extraordinary than the others, but all are provided with a larger or smaller number of leaf-like appendages from which they derive their popular name. A species from South Australian waters, which is here illustrated, is provided with a whole series of not only leaves, but branches and shooting twig-like growths, which are so perfectly developed in shape and colour that they must render the fish well nigh invisible when it secretes itself among the weedy growths of its haunts.

The species common around Sydney is highly ornate, being decorated with brilliant scarlet, yellow, and dashes of violet, which suggest that its haunts are among the red sea-weeds of the littoral zone. Its leafy appendages are less developed than in its South Australian cousin, being confined to the end of each of the spines which project like outstanding bones from its queer shaped body.

The Sea-dragons are members of a large group which includes the Pipefishes and Sea-horses, all of which are encased in a jointed armour of tough horny plates. Their mouths are tiny openings at the ends of long tube-like snouts, and are so small that they can

engulf nothing larger than the minute crustaceans which run over the weeds of the sea just as do ants upon terrestrial plants. They are very helpless creatures, with fins so small that their fastest movement is not much better than a snail's pace. They therefore rely upon their imitative ornamentation, their hard armature, and their powers of clinging firmly to stems of weeds by their prehensile tails, for protection from enemies.

A remarkable feature of the group, is that the males take charge of the eggs as soon as they are deposited by the females, and carry them around in special brood-pouches until the young are hatched. In some species the pouch is complete with overlapping sides to protect the developing young, but in others, as in the Sea-dragons, there is merely a pulpy area on the under surface of the tail or the abdomen to which the eggs become fastened by some sticky substance.

Several attempts to describe the quaint appearance of the Sea-dragons have been published, but none is more successful than that of the Rev. Tenison Woods in *Fishes and Fisheries of New South Wales*. He writes "It is the ghost of a sea-horse, with its winding-sheet in ribbons around it ; and even as a ghost it seems in the very last stage of emaciation, literally all skin and grief. The process of development by which this fish attained to such a state must be the most miserable chapter in the history of 'natural selection.' It this be the 'survival of the fittest' it is easy to understand what has become of the rest. . . . . Never did the famishing spectres of the ancient mariner's experience present such painful spectacles. If these creatures be horses, they must be the lineal descendants of those which were trained to live on nothing, but unfortunately perished ere the experiment had quite concluded. . . . . If this be development, it stopped only just in time ; one step more and it would have been a bunch of kelp."

The Sea-dragon of Sydney beaches is less weedy, but decorated with rich colours.
[Photo.—*G. C. Clutton.*

Essay Competition.

Mr. George A. Taylor has generously presented five guineas to be awarded as a prize for the best essay by a pupil of a New South Wales school, the subject being "A Visit to the Australian Museum." The competitors, who must be between the ages of twelve and sixteen on 1st March, 1924, may select any department or may write a general account of the whole institution, the essay to contain 1500 to 2000 words. Teachers are asked to select the three best essays by pupils of their school and forward them to the Director of the Australian Museum on or before March 1st, 1924. The successful essay will be published in THE AUSTRALIAN MUSEUM MAGAZINE.

A Talk about Shells.

By Charles Hedley.

THE Army of the Animals is ranked in regiments, one of which has for its official title "The Mollusca." This name means the "soft things," and is properly given to the slug, the snail and the squid. In days of old the knights put on coats of hard and heavy armour, to save their soft flesh from thrust of spear or chop of axe, when fighting with their enemies. In the same way most soft things among the Mollusca have put on some hard covering that they might battle better with the cruel world.

These hard coverings, the shells of the sea shore, have been considered by all people in all ages to be some of the prettiest things in the world. Birds, butterflies, and flowers are painted no brighter, and their beauty soon fades or decays. Not only have the shells a lasting brilliance of colour, but they are wrought in most exquisite and dainty shapes. Appreciation of such attractive tints and forms is older than our civilisation; a thousand generations ago the sea shells were loved for their beauty. Even in prehistoric graves one finds beside mouldering bones some fragments of sea-shell or crumbling pearls, brought from far distant shores; records of pyramid and tumulus show that both the dark queens of the East and the fair princesses of the North clasped some favourite pearl or cowry as they were laid to their rest.

Indeed, as the race grew more civilised, as it grew older, richer, and wiser, so it grew to forget most of what it once knew about the mollusca. Before metal knives were seen in the world, the mollusca were more important to mankind than they are now. For one kind of shell-fish eaten at present, a dozen good and wholesome kinds were eaten formerly. To people whose life was one long picnic in the open air, these shells presented ready-made cups, spoons, or knives. This tractable material was always at hand, and was worked up by savages into innumerable odds and ends. Shells were pierced and strung into necklaces, or were cut into bracelets or earrings, or made into fishhooks or trumpets.

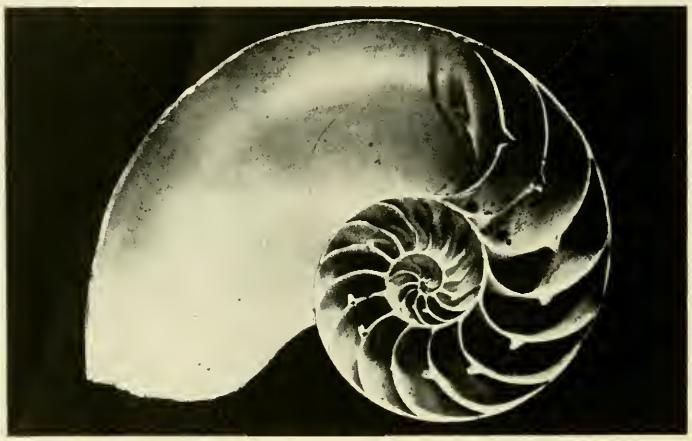
The best advice to give to anyone who wishes to know about shells is to begin a collection. Most people collect something or other. A financier collects bank notes, a philatelist his stamps, other folk have pictures or porcelain, while a naturalist takes to butterflies, beetles, birds, shells, fossils, or plants.

There are few objects easier to obtain or to preserve than shells, for they are not liable to decay, and they can be found almost everywhere. They occur even in freezing water, under polar ice, and among the scorched vegetation of the desert: but the most beautiful in shape and colour are those found among coral reefs, where the water is warm and clear. The smallest are atoms which would almost go through the eye of a needle, and the largest are the Giant Clams, which may reach a length of four feet and a weight of five cwt.

The first thing to remember about a shell is that it was made by something that lived in it: that some soft live thing once sat in the shell as the kernel of a walnut sits in the walnut shell, and and that it built that shell with lime, just as our body builds our bones. In some cases that live thing does without a shell, and crawls naked on the ground as a slug, or swims naked in the sea, as an octopus. So the shell may be considered as the costume of a snail. Now, sometimes that costume is in one piece, as with a whelk or a periwinkle, and at other times it may be in two pieces as with an oyster, a cockle, or a clam. These are the principal arrangements, but there are a few other fashions in shell costume, such as that of the chitons, which wear a suit of armour in eight pieces, and that of the squids, which, by a curious perversity, wear their costumes inside their bodies.

Probably about sixty thousand different kinds of mollusca have been discovered and named, but many remain yet unknown. About four thousand are recorded from the partially explored fauna of Australia.

Naturalists have classified mollusca into four main groups—the *Cephalopoda*, the *Gasteropoda*, the *Pelecypoda* and the *Amphineura*.

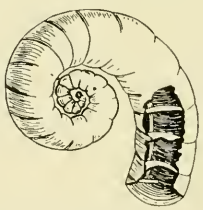


Pearly Nautilus shell, cut in half. As the animal moved forward to inhabit a larger room it built a fresh partition; communication with each apartment is maintained by a central siphon.
[Photo.—*G. C. Clutton.*

CEPHALOPODA.

Though largest in size, the Cephalopoda are fewer in number of individuals or species than the other orders. They are exclusively marine, making a home in every climate and on every coast from the Equator to the Polar Circle, and from the rock pool left by the retreating tide to the abysses of the ocean. This wide distribution through geographical space is rivalled by that through geological time, for the fossil remains of these organisms occur in every stratum from the youngest beds to the ancient rocks of the Silurian epoch.

Like other mollusca, the Cephalopoda are usually provided with a shell, external in rare and archaic forms, but usually internal. The Pearly Nautilus has a shell of many chambers, in the last and largest of which it lives. An example cut in half shows how a pipe communicates with all the inner chambers, by which the specific gravity of the whole organism can be raised or lowered The Post-horn shell (*Spirula*), common on the ocean beaches near Sydney, is similarly partitioned by septa, but it is half internal, small and loosely coiled. The shell possessed by the



Post-horn shell. Several joints broken open to show the siphon.
[*C. Hedley, del.*

squid (*Loligo*) is a slender internal spine or pen; because this animal also carries a vessel of sepia ink, it has been called the "clerk of the sea." The Cuttle-fish (*Sepia*) has a large, oblong, white shell, or bone, which is also internal; this is commonly seen among drift rubbish on the ocean beaches.

A Cuttle bone; the internal shell of Sepia.
[Photo.—*G. C. Clutton.*

The *Sepia* has its English name from the way it "cuddles" down to rock or sand on the sea floor. An exquisitely graceful hull, with a texture like the finest porcelain, is constructed by the Paper Argonaut. A fairy tale told how the molluscan mariner hoisted a sail upon this dainty craft and sailed away across the summer seas. But in truth the shell of this Paper Argonaut is not a dwelling as other shells are, but a nest in which the eggs are laid and hatched while carried about in mid-ocean, clasped in the mother's arms. Finally, the octopus or polypus has out-grown its shell, leaving no trace of it either within or without.

Cephalopods are more highly organised than other members of the molluscan family. Indeed, no other invertebrates are so elaborately constructed, furnished with so quick an eye, so sharp a tooth, so long an arm, or so cunning a brain. Probably a cephalopod is more than a match for anything its weight in the marine world. If pursued by a stronger foe, none can dart quicker through the water; should speed avail not, the resourceful cephalopod discharges an inky cloud of sepia, in which it disappears.

Commonest of the Cephalopoda is the octopus. When seen at rest in an aquarium tank, the large flabby body of the octopus is bag-shaped; it contracts and expands as the animal pants heavily. Round it are curled the long arms, of which the inner sides are beset with a double row of disks, tapering down from the size of a shilling at the base to the tiniest dot on the tips. These are the suckers; when their surface is applied to anything they contract, and by pneumatic action obtain the firmest possible grasp. Below the arms there is on either side a bulging eye with a narrow slit-like pupil.

At rest, this octopus imitates in form and colour the ground on which it lies, till it becomes almost invisible. It smoothes its skin, or puckers it, fades or blushes, till it has assumed the appearance of some particular dark rough rock or smooth gray sand, on which it chances to be. Around the entrance of its den is strewn the refuse of the hunt, heaps of broken shells and bones, for the octopus is a voracious animal which greedily devours fish, crabs, or cockles.

Paper Nautilus; a cradle, not a boat as is generally considered.
[Photo.—*G. C. Clutton.*

When the octopus launches itself in the water, it expands a large web, like an open umbrella, the ribs formed by the eight arms or feet, to which its name refers. In the centre of the arms is the mouth, the point of whose black parrot-like beak rises above the lips. The octopus has many ways of swimming; sometimes it rows itself along with the arms for oars, or it spreads the umbrella web and then darts backwards with a jerk by suddenly furling it, or the arms may be held straight and together while the animal drives backwards by pumping jets from the siphonal tube.

An Octopus at rest.
[Photo.—*G. C. Clutton.*

Some fanciful writers like Victor Hugo treat the octopus unjustly, describing it as the most horrible and dreadful creature in the world. The following account of an octopus hunt from the pen of that able naturalist, Mr. J. K. Lord, describes the octopus as it really is:

"The Indian looks upon the Octopus as an alderman does on turtle, and devours it with equal gusto and relish, only the savage roasts the glutinous carcase instead of boiling it. His mode of catching octopi is crafty in the extreme, for Redskin well knows from past experience that were the octopus once to get some of its large arms over the side of the canoe, and at the same time a holdfast on the wrack, it could as easily haul it over as a child could upset a basket. Paddling the canoe close to the rocks and quietly pushing aside the wrack, the savage peers through the crystal water, until his practised eye detects an octopus (with its great rope like arms stiffened out) waiting patiently for food. His spear is twelve feet long, armed at the end with four pieces of hard wood, made harder by being baked and charred in the fire; these project about fourteen inches beyond the spear haft, each piece having a barb on one side, and are arranged in a circle round the spear end and lashed firmly on with cedar bark. Having spied out the octopus, the hunter passes the spear carefully through the water, until within an inch or so of the central disk, and then sends it in as deep as he can plunge it.

"Writhing with pain and passion, the octopus coils its long arms around the haft; Redskin, making the side of the canoe a fulcrum for his spear, keeps the struggling monster well off and raises it to the surface of the water. He is dangerous now; if he could get a holdfast on either savage or canoe nothing short of chopping off the arms piecemeal would be of any avail.

"But the wily Redskin knows all this, and has taken care to have another spear, unbarbed, long, straight, smooth, and very sharp, and with this he stabs the octopus where the arms join the central disk. I suppose the spear must break down the numerous ganglions supplying the motive power, as the stabbed arms lose at once strength and tenacity; the suckers that a moment before hold on with a force ten men could not have overcome, relax, and the entire ray hangs like a dead snake, a limp, lifeless mass. And thus the Indian stabs and stabs until the octopus, deprived of all power to do harm, is dragged into the canoe, a great inert quivering lump of brown-looking jelly."

Though our people despise cephalopoda as food, they are esteemed a dainty in many parts of the world. The fish markets of the Mediterranean are always stocked with *Loligo*. In Ancient Greece, the epicures feasted on them, boiled, roasted, stewed, or grilled. Squid is a reliable bait for sea fishing; the bulk of the Newfoundland cod is taken by it. An international dispute once arose over the question of the squid bait for cod-fishery.

The stories of prodigious monsters that could pull down ships were idle tales. But there are still alive in the sea some cephalopods of gigantic size. Authentic measurements show that some have tentacles thirty feet in length, and some can fight with whales.

Mateship with Birds. By Alec. H. Chisholm. Whitcombe and Tombs, Melbourne. (Angus and Robertson, Ltd.) 7/6.

This represents probably the most definite attempt that has yet been made in Australia to link nature and literature as was done by the late John Burroughs in the United States and the late W. H. Hudson in Britain. Mr. Chisholm began his nature studies in Victoria, and continued them in Queensland, where for many year he was a leader among working field naturalists; he was, variously president of the Gould League of Bird-lovers, President of the Field Naturalists' Club, State Honorary Secretary of the Royal Australian Ornithologists' Union, etc. His book is not in any sense a text-book; it is a literary record of the experiences of a roving naturalist. Commencing with Victoria, the author gives, in "A Pageant of Spring," an intimate study of the re-awakening of the Southlands from the respite of winter. Reading this, one hears the vital voices of returning birds, sees the small nests taking shape in secret coverts, and catches the fragrance of the small orchids of September and October days. The "Pageant" concludes with a study relating to children in Birdland, a chapter derived largely from the author's experiences when lecturing in schools or leading boys and girls in the bush.

Possibly more value attaches to the second portion of the book, if only for the fact that its subject, "Biographies of Birdland," has not been well explored in Australia. In various chapters of this section intimate details are given of the life-histories of our honey-birds, robins, crested birds, whistlers, and other avian notabilities, the whole concluding with the firsthand account of the long search for, and discovery of, the rare Paradise Parrot, of Queensland, a bird that, like many of the *Neophema* parrots of New South Wales, has been lost to sight for many years.

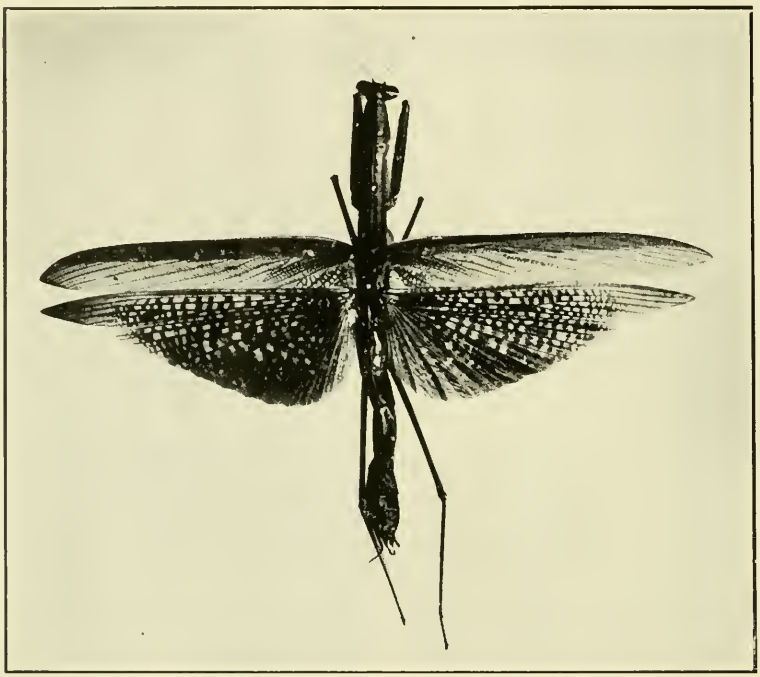
"Mateship with Birds" is enriched with an introduction by Mr. C. J. Dennis, who further assists to ally nature and literature, and with a comprehensive index and list of scientific names.

How to Study Birds; a Practical Guide for Amateur Bird-lovers and Camera-hunters. By H. K. Job. The MacMillan Co. 1922. (Angus & Robertson, Ltd.) 8s., Post free.

Birds have ever been a favourite subject with nature-lovers and these will find much to interest them in the above work, which, though dealing with the birds of America, will appeal to ornithologists in all countries. The author is a born bird-lover, and his enthusiasm will infect his readers with something of his own spirit. He explains how and where to study birds and gives useful hints as to cameras and the art of photographing birds in the wilds. The book is enlivened with many incidents of the author's adventures in the field and contains some fine photographs.

The Praying Mantis.

By Gilbert Whitley.



The Long-winged Praying Mantis. (Tenodera australasiae.) The coarser fore-wings, when at rest, cover the more delicate and gauzy hind-wings.

[Photo.—*G. C. Clutton.*

PRAYING Mantids are found in all the warmer countries, and on account of their quaint appearance and peculiar habits, have excited interest since the earliest times. Their grave and apparently devout actions led the Greeks to apply the name *mantis* (meaning prophet) to them and for the same reason they became known to the Romans as soothsayers. In France they have been given the title of Prie Dieux (pray to God) in reference to the praying attitude that the forelimbs so often suggest, while among the practical American people they are often designated Camel-Crickets or Rear-Horses. To Australians they are sometimes known as Forest Ladies but the old name mantis has stood the test of common usage throughout the ages, and to this now universal title is often prefixed the word "praying."

LEGENDARY.

It has been claimed by the Arabs that the mantids face Mecca when "praying," while to the simple Hottentot tribes of Africa these insects were sacred and received full-hearted worship which protected them from the only too frequent ill-use and destruction to which they are so often subjected. In consideration of the above facts it is hardly surprising that the mantids have been responsible for the weaving of

many legends, not a few of which have been handed down from very early times. The old English naturalist, Thomas Moffatt wrote that "they resemble the Diviners in the elevation of their hands, so also in likeness of motion ; for they do not sport themselves as others do, nor leap nor play, but walking softly they retain their modesty and shewe for th a kind of mature gravity . . . So divine a creature is this esteemed that if a child aske the way to such a place, she will stretch out one of her feet, and show him the right way, and seldom or never miss." A ludicrous incident also related is that St. Francis Xavier saw a mantis with its legs elevated as in prayer, when he desired it to sing the praises of God, and the creature immediately raised its voice in a beautiful canticle. Further, the Roman writer, Piso, deceived by the likeness of certain exotic species of mantids to foliage or twigs, thought that, when they alighted on the ground, roots grew from their feet so that they were gradually transformed into perfect plants.

STRUCTURE.

All mantids possess a more or less elongated body, which is divisible into the three main regions characteristic of insects—head, thorax and abdomen. The head is small and can be freely moved by its owner on a short and flexible neck-region. From a front view it roughly resembles a triangle in shape, the two upper angles of which are formed by the large opalescent eyes. Each eye possesses a small black pupil, capable of movement in various directions, so that, when the mantis is stalking its prey, it need not betray its evil intentions by any unnecessary turning of the head. Between the eyes on the upper half of the head are two thread-like antennae, and at the lower angle is situated the mouth region. The thorax or chest bears the three pairs of legs, and sometimes two pairs of wings in addition ; these latter, however, may be absent in certain species. When wings are present they are borne on the upper surface of the thorax, and are usually smaller in females than in males. The forewings (tegmina) are coarser in structure and act as a protection for the more delicate and gauzy hinder wings, which are folded fanwise beneath them. The front legs are thick, heavily armed appendages, and very different from the two slender pairs behind . They are usually carried folded against the long anterior section of the thorax (prothorax), and it is the assumption of this curious posture that gives one the impression of a worshipper engaged in prayer. The abdomen is long and narrow, and divided into several well-defined segments, the most posterior of which bears two long jointed horns or cerci.

The mantids are often confused with the phasmids or Stick and Leaf Insects,* to which they bear a general superficial resemblance. The phasmids may be readily distinguished from the mantids, however, by the absence of any raptorial modifications of the forelimbs. Again, the head is practically immovable, and the cerci on the abdomen are unjointed. Another important difference is that of diet, for, in direct contrast to the carnivorous habits of the mantids, the phasmids feed exclusively on vegetable matter.

PROTECTIVE IMITATION.

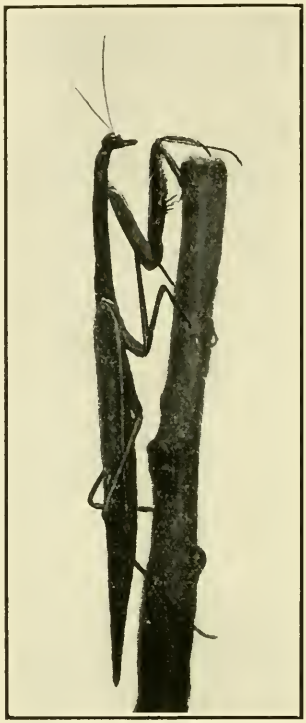
Like the phasmids, the mantids have been endowed by Nature with form and colour which often render them inconspicuous when in their customary surroundings. Several Indian species imitate various kinds of flowers, particularly orchids, and are renowned for their beautiful colours. In some cases this resemblance is so perfect that the mantids not only successfully deceive their insect prey, but on several occasions have misled botanists also. Those inhabiting the deserts of Arabia exactly match the colour of the sand, and are indistinguishable at a little distance. The Australian species, while they do not offer such sensational examples of imitative colouration, simulate to a greater or lesser degree the leaves or sticks among which they live.

* See Musgrave, THE AUSTRALIAN MUSEUM MAGAZINE, Vol. I., No. 6, 1922, p. 177.

HABITS.

There are over thirty species of mantids in Australia, and though each has its own specific habits, these are all alike in a general sense. For the sake of convenience the habits and life-history of a common local species, the Long-Winged Praying Mantis (*Tenodera australasiae*), will be hereafter discussed as typical. This widely distributed Australian mantis has often been observed by the writer in the coastal bush around Sydney, where it occurs fairly plentifully during the spring and summer months. It may be found on the ground or in low scrub, stealthily walking from twig to twig, sedately unfolding its front legs to assist itself in the process. Sometimes it stops and sways from side to side, as it stands delicately poised on its hinder legs. When performing this action its resemblance to a stick moving slightly in the breeze is very striking. If its attention be attracted by some moving object, the mantis will quickly turn or lift its head in order to investigate. This action is a comical one and almost human in its impression, for one can imagine the presence of a quizzical expression on the face of the insect as it "takes stock." It is a proficient jumper and leaps from relatively great heights, always landing safely on its feet like a domestic cat. When at rest, the well-known praying attitude is assumed, when the forelimbs are folded with their inner surfaces closely adpressed. So far as the Long-Winged Mantis is concerned the males appear to be more efficient on the wing than the females, for these eventually develop a bulky form of body which is quite out of proportion to their wing capacity. The species in question is sometimes attracted by artificial light, and, during its active nocturnal wanderings, may enter dwellings in order to satisfy its curiosity.

The gruesome work performed by the forelimbs is quite out of keeping with their sanctimonious appearance, as they are used for the purpose of killing insects for food. These weapons of destruction can be manipulated with deadly speed and accuracy when directed at an unsuspecting prey. If a grasshopper or any other insect or spider that the mantis has a gastronomic fancy for is espied, the serrated forelegs are launched at the prey, and the spines along their inner edges penetrate the wretched captive's body, gripping it so firmly that all its struggles are in vain. If the victim be a large one, the mantis puts an end to its efforts to escape by biting it at a point situated just behind the head; a procedure which causes almost instant death. In the case of smaller "fry," no such delicacy of feeling is exhibited, and the ruthless captor may begin eating at the head, feet or sides, without regard to the sufferings of its victim.



The fore-limbs of the Mantis are well-developed and are used principally for securing prey, which is held by the prominent spines.
[Photo.—*G. C. Clutton.*

The mantis is a voracious insect, and an example kept in captivity by the writer was observed to eat fourteen young locusts (short-horned grasshoppers) in a single day, consuming

an individual portion of this meal every five minutes. The remains of the feast consisted of wings and other portions which were discarded as unpalatable. At the termination of this greedy procedure the mantis commenced to clean off the remaining food particles adhering to the spines on its forelimbs by passing these appendages and also its antennae and hind legs through its jaws.

BREEDING.

During the mating season, which occurs about midsummer, an extraordinary substitute for divorce is revealed to us. The female mantis calmly, and with apparent relish, devours her own husband. The male, docile creature that he is, makes no attempt to resist his mate in her somewhat gruesome expression of affection, but allows himself to be slowly crunched and consumed in small mouthfuls, a sordid spectacle of which the writer has been more than once a witness. Then, too, the lady mantis is polyandrous, and may devour several consorts in the same breeding season.

When the time is ripe for the deposition of her eggs, the female mantis rests on a twig, usually with her head towards the earth. From the extremity of her abdomen issues a greyish volume of foamy matter. This frothy substance is full of minute air-bubbles, and, as it issues forth, two lateral processes situated on each side of the abdominal tip churn it up until the soft nest gradually begins to form. Within two minutes of delivery the material becomes transformed into a hard parchment-like porous mass. The slow turning of the tip of the abdomen during the hardening is instrumental in moulding the oval outline of the gradually forming case or nest, the building of which occupies a period of about two hours. The mantis stands on all six legs during these actions, and is not disconcerted by an occasional jolt from an inquisitive observer. Ordinarily she is practically motionless except for a slight rocking movement as the eggs are being laid and packed in the foam. Just how they are laid and put into position baffles explanation, yet the eggs are plainly visible to one facing the head of the mantis and looking along the under surface of the body. When the nest has reached its required dimensions, the extremity is often produced by the mantis into a curved tail as she moves slowly away from her handiwork. No further attention is now paid to the finished structure by the maker, for the writer has seen a large grasshopper pounce on to a nest immediately after its completion and bite deeply with its strong mandibles into the papery covering, the artificer standing barely two inches away, apparently quite unconcerned about the outrage.

THE NEST.

The nest itself is a marvel of architecture and is likely to be found in the bush attached to anything with a rough surface. It is an egg-shaped, tough, pithy structure a little over an inch in length, and of a dirty cream colour. It lies at a slight angle to the surface

The nest of the Mantis with several young soon after hatching. The cast and shrunken skins of the insects may be seen as small, white, bubble-like structures adhering to the surface.

[Photo.—*A. Musgrave.*

upon which it is laid, the end last constructed being somewhat elevated and free. Along the top of the newly made nest is situated a groove, which is sealed with a substance whiter in colour than the main mass. This latter, however, is gradually weathered and eventually disappears as the nest ages. Within the groove lies a longitudinal row of small openings leading into tunnels which penetrate to the middle of the nest, where the egg layers are situated. The egg mass may be somewhat likened in form and position to the stone in a date. The arrangement is vertical, and the eggs in each layer have their anterior ends converging to one of the tunnels. If a nest be cut transversely these structures may be studied to better advantage. The mantis, unconsciously, and apparently with little effort, raises an incubator for her hundreds of eggs, which leaves us lost in admiration of her art.

THE YOUNG.

The nest remains for months, resisting all weathers until the day arrives for the baby mantids to emerge from their common cradle. When this happens, the young are seen to issue forth from the tunnels in the nest, and each is invested with a protecting skin for the lanky little legs and feelers; but this sheath is almost immediately discarded by the insects as they hang suspended from the nest by minute silken threads.

The productiveness of the mantis calls for some consideration. Hundreds of eggs are deposited in a single nest by a female that is often able to build as many as two, or two normal and one half-sized nest in a single season. Despite this fact, however, there is never a superabundance of these useful and harmless insects. Considering the enemies that the young mantids have to contend with before and after they reach the outer world, it is not surprising that these insects are comparatively scarce. As if by some incomprehensible understanding swarms of ants are attracted to the nest just about the time that the hatching commences. Even before the mantids develop in the eggs, the long egg-laying tube of a tiny hopping chalcid wasp may desecrate their abode, with the result that many wasp-grubs hatch out and feed upon the eggs and nest. The mantids that are fortunate enough to overcome these and many other difficulties at once begin an active and free-roving life, the early stages of which are spent in frolicking about like a litter of kittens. They are quarrelsome little chaps, and, not content with successfully evading natural enemies, will often turn upon and devour one another. They also search for such small prey as the aphis, gradually tackling larger insects as they become older and their size and strength increase. Their growth is slow, and, after some weeks, wing-buds appear, which gradually assume a length more proportionate to the size of the insect. The full adult stage, however, is not reached till nine to twelve months after birth.

Robert Grant, a former employee of the Trustees of this Museum, recently passed away at the age of sixty-nine. He was born in Scotland, and while carrying on his duties as a gamekeeper to the Duke of Hamilton, he imbibed a love for natural history which he never lost. Coming to Australia as a young man he worked for some time as a miner, but soon abandoned that work and was employed by the Trustees as a collector. He made many excursions into the wilderness of Queensland and New South Wales, bringing back valuable collections and natural history notes on the districts visited. He was an accomplished taxidermist and in this capacity was subsequently employed at the Museum, where many of the exhibits are a testimony to his craftmanship. He retired from the Museum's service in 1917.

Crustacean Camoufleurs.

By Frank A. McNeill.

CAMOUFLAGE is a term which has only recently come into almost universal usage. It had its origin many years ago in France and, before the days of the World War, stood for the art practised by the people of that country in producing artistic but deceptive screen effects on the legitimate stage. On the outbreak of hostilities a new use was found for camouflage, and the term was expanded to embody all those well-known and elaborate measures adopted by the various belligerents for the protective colouring, screening, and covering of vital objects both in attack and defence. Just as the art has been developed by man, so do we find many parallel instances of its use among some of nature's more lowly organised children.

Mother Nature has paid particular attention to the crabs, for example, and many of them are endowed with wonderful modifications of structure which enable them to escape the notice of their enemies or creep unobserved upon their prey.

Many of the Spider Crabs are remarkably clever and proficient in their methods of disguise, and as a consequence are usually very sluggish in their movements. One of the common Australian representatives of this group of crabs is a species known as *Hyastenus diacanthus*, commonly called the Sponge Crab. It has a wide range along our eastern shores, occurring very plentifully in the bays and estuaries, and is very common in Port Jackson, where it frequently inhabits water over muddy bottoms. When captured, it is invariably found to be almost completely hidden under a luxuriant growth of marine life, principally various types of sponges. On close examination, it will be seen that the attachment of the disguise to its back and legs is effected by means of numerous, stout, hooked hairs, which are embedded in the substance of the hard shell. But if an example of the species were secured immediately after it had cast its shell, as it must often do, it would be found to be covered with a thick coat of these hairs; and their tips, instead of being curled over, would be seen to be almost straight. With the hardening process which takes place, these tips, like the tendrils of a vine, soon begin to curl and twine around the stems of marine growths placed in position by the crab.

The Sponge Crab (Hyastenus diacanthus), with half of the body denuded of hairs and protective covering. One has only to block out this bared portion to obtain an impression of the shapeless appearance which the creature assumes in life.

[Photo.—*G. C. Clutton.*

With protective covering such as this the Sponge Crab is practically immune from attack as it lies huddled-up on the bottom, and the same tactics ensure it a meal when hungry if practised on an unwary prey. The animals which provide the cloak, however, are apt to grow if uncontrolled, and envelop their bearer—a contingency doubtless overcome by the crab pruning off superfluous portions. This would undoubtedly be

effected by means of the nippers, which curiously are never covered. Sometimes, however, mere pruning is ineffectual in controlling the growth of an ill-chosen cloak, and then the unfortunate bearer has to await the seasonal moulting, when the encumbrance is shed along with the discarded shell.

Harlequin Crabs (Camposcia retusa). The upper example is disguised with a cloak of seaweed and sponges. Below is depicted a half denuded specimen, showing the stiff hooked hairs on one side and a dense mass of conglomerate sponge growth on the other.
[Photo.—*G. C. Clutton.*

A near relative of the foregoing is the Harlequin Crab (*Camposcia retusa*) of the tropical Australian coast, which also possesses a growth of hooked hairs; but these are much denser and coarser than those of the Sponge Crab. This species gathers unto itself a marvellously varied assortment of marine growths which cover it with a coat of many colours. The covering completely harmonises with the brightly tinted objects amongst which the Harlequin lives, and provides means of escaping unnoticed in any sudden emergency or disarms suspicion in the case of smaller prey. The Harlequin Crab stands alone amongst its kind as a master of disguise, and, as it lies quietly at the bottom of a shallow coral pool, with its legs and nippers (*chelae*) tucked in close to the rest of the body, its real identity is often unrecognised by the human eye. Collectors have time and again grasped what they supposed to be a beautiful conglomerate mass of marine life, only to discover that what they held was mostly crab.

With regard to the protective resemblance of form, it will be as well to mention here the peculiar adaptation of another Spider Crab called *Huenia proteus*, a species which exhibits a most striking example of modification in external structure. The carapace or shell is flat and extraordinarily variable in shape. In most of the males it is more or less triangular in outline, but in the majority of the females as well as in some males, it is broadened by leaf-like expansions of the lateral edges. This crab commonly lives among the seeweed, *Halimeda*, to the fronds of which it bears a striking resemblance in both form and colour. It is found only in the shallow reef waters of the Indian and Pacific Oceans.

The Halimeda Spider Crab (Huenia proteus), photographed alongside a portion of the seaweed from which it derives its name.
[Photo.—*G. C. Clutton.*

Among other crabs possessing the same habit of hiding underneath portable coverings are several species included in two allied families known as the *Dromiidae* and *Dorippidae*. In the former the various members lead a more or less sedentary life. The adults have the last pair or the last two pairs of legs short and placed in a most unusual position over the back, where they serve to hold a mass of living sponge or other marine growth.

The Shell-dwelling Crab (Conchoecetes artificiosus) belies its name, for its association with shells is purely for the sake of disguise, and the creature is just as active, or more so, when disengaged from such a weighty covering.
[Photo.—*G. C. Clutton.*

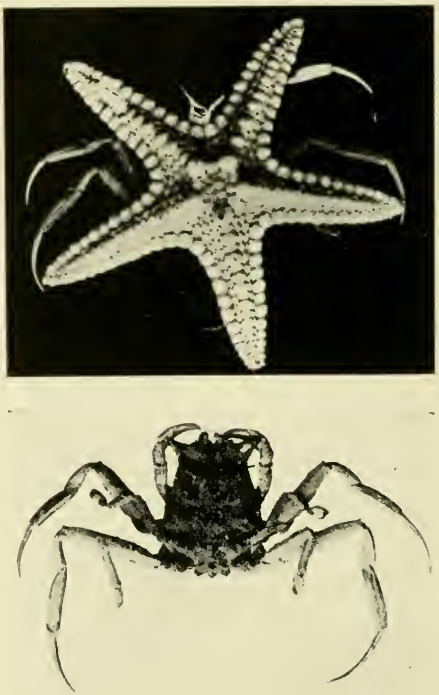
This forms an adequate cloak to protect and conceal the bearer, and is firmly secured by a pair of nippers on the hinder legs, which are very perfectly developed, sharp and strong, and, like those of the hand, are formed by the opposition of the terminal joints to prolongations of the last joints but one. As its name implies, *Conchoecetes* is a shell dweller, and there are several species which practise this peculiar mode of hiding. One can easily imagine the surprise of the naturalist who first discovered these peculiar crabs. The appearance of shells apparently walking along the shore must surely have tried his conscience had he happened to have been a little indulgent the night before. By a wonderful arrangement of the terminal joints of the second last pair of legs, as previously described, *Conchoecetes* is enabled to grasp the edge of the single valve of a bivalve mollusc, beneath which its presence when stationary would never be guessed. From a downward view the only visible signs of habitation are the two tiny terminal claws of the prehensile hinder limbs of the occupant, which overlap the edge of the covering. One species of the genus is fairly common in shallow water at low tide on the sand and mud flats of the north-east Australian coast, whilst others are widely distributed throughout the warmer seas of the Indian and Pacific Oceans.

Another near ally of the foregoing is the Shaggy Crab (*Dromidiopsis excavata*), which invariably has a covering of either sponge, or a more or less bulky growth of a compound animal colony belonging to the class of the Ascidians. It is this latter covering which seems to give camouflaged crabs the most trouble. In many instances the ascidian colony assumes such comparatively huge dimensions as to seem more annoying than useful to the bearer. The whole body of this species is covered with a thick growth of coarse hair, and the back is beautifully rounded in shape. This fits comfortably into the cavity of its protective covering, giving the impression that the hole was cut to the order of the occupant. The species has a wide range along

A Shaggy Crab (Dromidiopsis excavata), showing the relation of its size to the comparatively huge dimensions of a covering consisting of a colony of compound ascidian. The crab has been extracted from the cavity it has created in its four-and-a-half inch wide enveloping cloak.
[Photo.—*G. C. Clutton.*

the eastern Australian coast, where it occurs in depths down to forty fathoms, and it is commonly secured in the nets of the trawlers.

In the crabs of the family *Dorippidae*, we find the hinder legs in a position corresponding to that of the same appendages of the members of the *Dromiidae*. These creatures are not so prone to the hiding habit as their near allies, and they are commonly secured without any covering other than an accumulation of silt, which probably helps to render them indistinguishable as they lie on the bottom. When coverings are affected, however, they are always novel in form, and of such a nature as to excite but little suspicion in the minds of natural enemies. A species occuring in the waters of the Malay Archipelago, and known as *Dorippe astuta*, has the peculiar habit of grasping a mangrove leaf with its hinder limbs in the same manner as *Conchoecetes* grasps a shell. With this covering held over its back for protection the crab offers an unusual spectacle as it moves along the shore. Another member of the genus (*D. dorsipes*) is not uncommon on the sand and mud flats in and around Port Denison, Queensland, and an example recently forwarded to the Museum by Mr. E. H. Rainford was captured whilst carrying a starfish on its back. Considering the nature of this covering, it is interesting to note here some of the impressions of the collector, which are vividly set out in a note accompanying the specimens. He writes that he was walking on the beach at low water when his attention was drawn to the erratic progress of a small starfish. It was apparently rolling and staggering about like a sailor "half seas" over. Accustomed to the demure, quaker-like movements of these creatures, Mr. Rainford could not fathom for the moment the true meaning of the scene he was witnessing. On closer examination, however, he found that the starfish was firmly held on the back of the crab by the four posterior legs, which accounted for its "unseemly conduct." He says that he admired the instinct which taught the crab to camouflage itself in this way, but could not but feel that in this case it fell somewhat short of perfection. He considers that a starfish is quite an unsuitable disguise for *Dorippe dorsipes*, which apparently finds its burden a clumsy one to balance, tending rather to attract than escape the eye of an enemy.



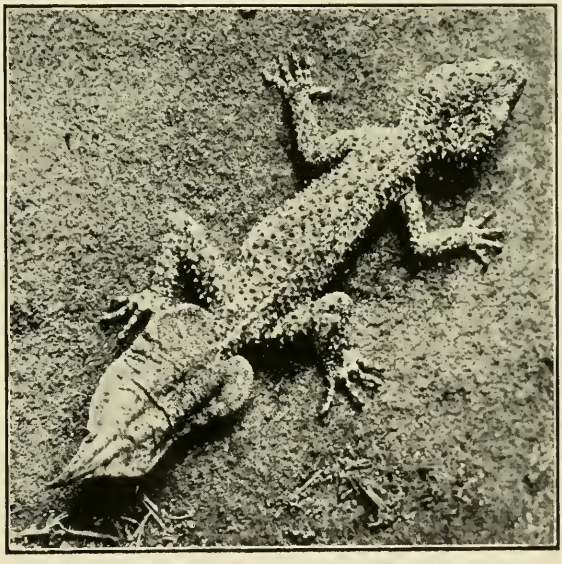
A Crab (Dorippe dorsipes), with its burden of starfish (Pentaceros nodulosus), as it was received at the Museum from the collector, Mr. E. H. Rainford. The lower illustration is that of a similar crab about the same size, and shows the wonderful prehensile modification of the hinder limbs.

[Photo.—*G. C. Clutton.*

Some Little Known Lizards—
The Geckos.

By J. R. Kinghorn.

MANY species of geckos are variously known throughout Australia as Rock Adders, Rock Scorpions, Wood Adders, as well as other frightful misnomers freely given by persons who are afraid of them, and who can relate highly coloured stories concerning their supposed poisonous properties. Many readers, therefore, will doubtless be surprised when they are informed that all geckos are harmless and inoffensive. These little creatures appear to have given rise to a greater number of fables and legends than have any other animals. So great is the fear of them among some native races that they are referred to as devils ; they are almost worshipped as such, and the natives will not kill them for fear of possible consequences following on the death of one. In Egypt they were once widely known as "Abou burs," which means the father of leprosy. In spite of all these myths, science has proved, and most people now know, that the gecko does not possess any fangs, poison apparatus, or venom, nor does it secrete any irritant mucus. It might be as well to mention here that there is only one genus of venomous lizard in the world, and that is the Gila Monster (*Heloderma*) of Central America. Throughout Australia we have over sixty species of geckos, and it would be hard to determine which is the most common, but the accompanying illustrations may be relied upon to represent the two most typical forms, the broad, or leaf-tailed, and the cylindrical-tailed varieties.



Broad-tailed Gecko (Gymnodactylus platurus).
[Photo.— *J. R. Kinghorn.*

The reason they are seldom seen is that they are nocturnal in habits, living under loose bark or stones during the daytime, coming forth at night-time

only, in search of food. I have often seen the leaf-tailed variety, in wet weather, climbing up the walls of houses in search of a dry bed. Geckos may be freely handled, and in some countries are encouraged as pets, when they are allowed to crawl all over the inside walls of the houses where they eat up the flies. Occasionally, if cornered or frightened, these lizards open their mouths very wide and, by clicking the tongue against the roof of the mouth, emit a sound which resembles "yecko," hence the probable derivation of the name.

The gecko has a peculiar and very disconcerting habit of throwing off the tail when handled too roughly, or when too closely pursued by a hungry enemy. The discarded member continues to wriggle furiously for some time, thereby attracting the attention of the pursuer while the owner makes good its escape, and in its place a rather rudimentary one is grown. The colour and texture of the skin of these lizards affords wonderful protection, and at a distance of a few feet it is very hard to distinguish one of the broad-tailed varieties from any rough rock upon which it may be resting.

Their food consists of almost any small insect, especially the small beetles which may be found under bark and stones.

One of the Wood Geckos (Diplodactylus vittatus).
[Photo.— *J. R. Kinghorn.*

During the last year over 208,000 visitors were admitted to the Museum, whilst more than 2000 availed themselves of the popular lectures provided by the institution. The attendance and interest of school pupils is extremely encouraging. For these, arrangements are made to enable them to visit the galleries on Mondays, a day not available to the public, unless it be a holiday—so that the teacher-in-charge may make freer use of the exhibits than would otherwise be possible.

At the present time a considerable interest is being displayed in the recent discoveries at Luxor, Egypt. The opportunity is here taken to draw attention to those exhibits in the Museum's galleries illustrating the culture of the race which in the past inhabited that land. Amongst these exhibits may be mentioned the mummies, in their original coffins, our possession of which is due to the munificence of the late Sir Robert Lucas-Tooth, Bart.; a large series of ornaments presented by Mr. E. Wunderlich, trustee, in association with Mr. A. Wunderlich, some of which were previously described in THE AUSTRALIAN MUSEUM MAGAZINE; there are also examples of pottery and fragments of mural decorations.

In the last issue of THE AUSTRALIAN MUSEUM MAGAZINE an appeal to our readers was made for observations regarding the Bulbul, an introduced bird which may, or may not, become a serious pest to our orchardists. The metropolitan press very kindly gave this appeal prominent notice in their columns. In response a number of replies has come to hand—all containing valuable information but there may be still some who, whilst possessing first-hand knowledge have not written. We would ask that they reply as soon as possible, for every detail, no matter how trivial it may seem, possesses some value.

Primitive Fire Production.

By William W. Thorpe.

IT is commonly accepted by students of ethnography that the production and use of fire, now so essential to us, was a comparatively late discovery of primitive man, and that our ancestors were for a very long time content to eat their food uncooked. How man first discovered fire is a subject for conjecture. According to classic mythology, Prometheus stole fire from Jupiter and conveyed it surreptitiously to earth concealed in a hollow tube. Less romantic and fanciful views are that the discovery was made by observing the result of a lightning stroke, the heat produced by the rubbing of trees in contact during a gale, or the sparks emitted by striking two hard stones together. In countries where active volcanoes exist fire would always be available, but in other parts of the globe man must have had other natural or artificial indications to guide him to its discovery. It is a curious fact that the Andaman Islanders although possessing fire when first brought into contact with civilised man, were no longer acquainted with the means of producing it, and the onus of keeping it alight devolved upon the women-folk, who in truth, had to "keep the home fires burning."

All methods of producing fire practised by primitive races are based on friction. The three principal fire-producing implements are the "drill," the "plough" and the "crosscut." The first named consists of two sticks, one placed horizontally on the ground and held in position by the feet of the operator, or the hands of an assistant; while another upright stick is rapidly twirled between the palms of the hands, working in a slight depression previously made in the horizontal one. A lateral slit, allows the surplus of triturated wood to fall away. As the speed is increased the wood begins to char, first smoke and then a spark appears; this is carefully nursed, blown upon, and tinder added to the spot until fire results. The writer has

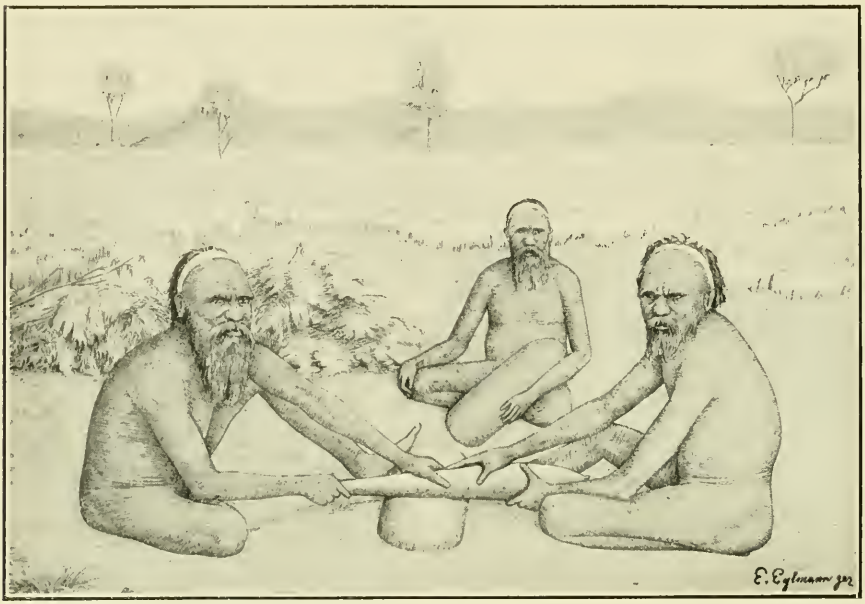
Australian aboriginal producing fire by "twirling."
[After *N. W. Thomas.*

frequently tried this method without result; the hands, in bearing on the twirling stick work down and the difficulty seems to be in recovering the top without losing speed of rotation. Our aboriginals used this method, and in Cape York the working ends are kept dry in a double sheath often decorated with red *Abrus* seeds.

The Eskimo produce fire by means of a rotary bow drill, the upper end of the spindle revolving in a bearing gripped by the teeth.

The "plough" outfit consists of a tongue shaped stick rubbed along a groove in a softer piece of timber. This is the method adopted by the Polynesians.

The "cross-cut" method, as its name applies, consisted in rubbing one piece of wood across another. Usually the nether timber is cleft and tinder is placed in the gap. The aborigines of Central Australia used a flat spear-thrower on edge across a soft-wood shield. A variation in this method is followed in New Guinea, where a



Arunta men (Central Australia) making fire by womerah and shield "crosscut."
[After *E. Eylmann*.

Maoris employing the "plough" as a means of fire production.
[After *E. Tregear*.

flexible cane is passed beneath a dried stick held under the feet, the cane being see-sawed up and down by each hand alternately. Sand is sometimes added to increase the friction.

The Tierra del Fuegians obtain sparks by striking together pieces of iron pyrites, while in the northern regions of America, pyrites and flint are used in conjunction.

This brings us to the practically modern method of flint and steel, still practised by some of the "old hands" in the bush. Perhaps the most remarkable of all fire-producing implements is the fire piston of the East Indies. It consists simply of two parts, a cylinder of brass closed at one end, and a neatly fitting plunger of the same metal. Some tinder is placed in the bottom of the tube and a smart hand blow, combined with pressure, produces fire by the compression of the imprisoned air.

In concluding this short description of fire-production it may be added that fire is ever associated with domestic felicity. The sentiments connected with our hearths and homes and the inglenook are universal, and civilised races have no monopoly of these feelings; even our aborigines recognised that the marriage was ratified when, according to custom, the dusky bride had built a shelter and kindled a fire for her husband.

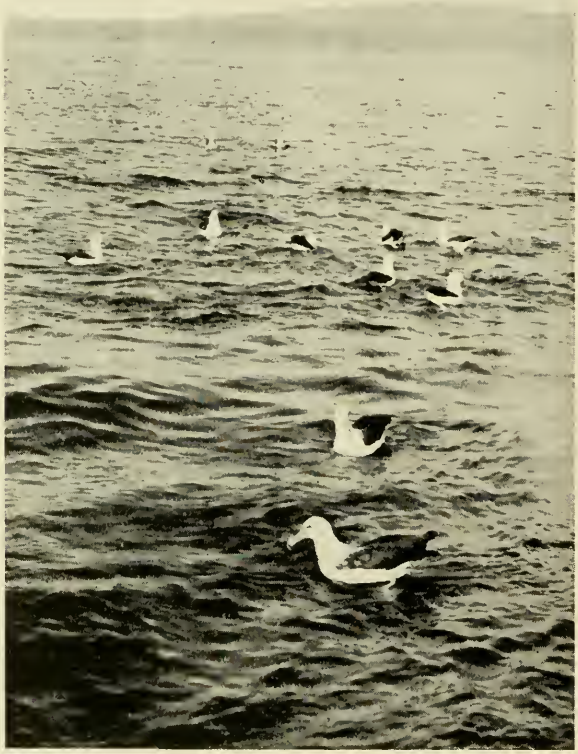
Life and Strife Among the Sea Birds.

By Arthur A. Livingstone.

WHILST accompanying one of the State trawlers on several cruises off the coast of New South Wales, I have had excellent opportunities of observing the habits of some of the larger species of our sea birds. During the whole period of the cruises they were in constant attendance on the ship. The Black Eye-browed Albatross (*Diomedia melanophrys*) was in great abundance, and proved itself to be quite as active at night as in the daylight. This bird, known to the trawler's crew as the Mollyhawk, levied its tax on every haul. No sooner did the winch sound its warning than they gathered together close alongside, waiting to snatch up any fish that might become disengaged from the net. Of a naturally disagreeable temperament, they ever failed to evince an amiable disposition towards each other, and fought and squabbled over the fish they captured. On one occasion an unfortunate accident precipitated half of the trawler's catch over the side, providing food in plenty for the ever hungry birds. This untoward happening attracted a greater number of mollyhawks than usual, and they were to be seen sitting on the water, tearing at, and swallowing the floating fishes. When one fish seemed more tempting than another, they drove their weaker brethren away, and fought over it as if the sea was not covered with others equally good. All the time the noise they made, "poultering" down in the water, and squawking or quacking—I do not know which to call it—was deafening. No bird could really claim a fish as its own until it was safely within its stomach, which seemed to provide ample space for a prodigious feed of this kind. On one occasion I observed a bird greedily attempting to swallow a flathead which was much too large for its throat to accommodate. Ejection of the fish was prevented by the large backwardly directed spines on its head, and, after a fruitless struggle, the bird lay outstretched and exhausted on the water. Had it not been for the timely help afforded by its comrades, this bird must have choked; but, prompted by greed rather than compassion, the rest of the flock pounced on the invalid, and tore the fish bit by bit from its mouth.

In their eagerness to obtain fish, these birds often approached within

reach of our hand-nets, and, on one occasion, a fine large specimen was secured and lifted inboard. When placed on the deck it was practically helpless, but uttered shrill cries of protest and flapped its wings in impotent efforts to escape from its captors. Though failing utterly to take wing from the deck, it soon proved its ability to rise from the surface waters of the sea when ultimately released overboard.



No sooner did the winch sound its warning than they gathered close alongside.

[Photo.—*H. O. Fletcher.*

Mollyhawks measure as much as six feet from tip to tip of the wings, and lift their heavy bodies into the air much as an aeroplane " takes off " from the ground, assisting their gradual ascent by pushing backwards against the water with their broad webbed feet. They are very strong and graceful on the wing, and, though they scarcely seem to move their rounded pinions, they can fly in the teeth of a gale, now swooping into the dark troughs of the sea, now skimming over the white foaming crests.

Another bird particularly noticeable was the Giant Petrel (*Macronectes gigantea*), which paid the ship intermittent visits either singly or in pairs. In contrast to the almost uniform white of the Mollyhawk, from which they always seem to hold aloof, the colour of these birds was sooty-black, and their heavy orange-yellow bills seemed to be quite out of proportion to their shapely heads. They were as formidable as they appeared, and contact with them was always avoided by the mollyhawks. At times I was amazed to see a single Giant Petrel drive as many as six or eight of its larger antagonists away from a tasty morsel.

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THE AUSTRALIAN MUSEUM

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Table of Contents.

A new Museum exhibit representing a nesting colony of sea-birds on the Admiralty Islets, Lord Howe Island. Wideawake Terns, Gannets, Mutton Birds, Noddies, and Blue-billies crowd together to nest and rear their young. *See page 258.*

[Photo.—*G. C. Clutton.*

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Editorial.

THE AUSTRALIAN MUSEUM BUILDINGS.

In planning a museum it is difficult to foresee what the future needs of the institution may be so that adequate provision may be made for expansion and evolution. In the case of our own Museum the intention at one time was to erect a building which should be at once a Library, an Art Gallery and a Museum. This intention was abandoned, but, though the Library and Art Gallery now have their own buildings, the original plan has been adhered to more or less in the additions that have since been made to the nucleus of the building erected in 1849.

As generally happens building has not kept pace with the expansion in the collections housed in the Australian Museum, and now an extension of the existing buildings is urgently required. Extra space is needed for exhibition purposes, for storage of specimens, for the library, for work rooms.

To the public the exhibition halls are the Museum, and it is quite proper that in a state-owned museum the education and entertainment of the public should be one of the first duties of the management. To every museum there comes a time when the exhibition galleries are filled to their utmost capacity and no new exhibits can be introduced without displacing others. Up to a certain point this is no disadvantage, for few exhibits are so good that they cannot be replaced by better. But the process cannot go on indefinitely, for at last the stage is reached when it is no longer possible to withdraw exhibits without seriously impairing the usefulness of the museum. In the Australian Museum we have now reached that stage. For example we have a large and valuable collection illustrating the ethnography of the Pacific Islands, but only New Guinea, the Solomons and Bismarck Archipelago are adequately represented in the ethnographical galleries. The large and interesting collections from the other island groups, comprising practically the whole of Polynesia and Micronesia, are mostly packed away where the public have no opportunity of seeing them.

In the department of zoology the most striking and most instructive exhibits are habitat groups, showing the animals in their natural surroundings, as in the case of the coral pool and the Admiralty Islets bird group described in this number. But to show these effectively considerable space is necessary and to make room for them other exhibits, themselves

of great interest to the public, must be sacrificed.

Like many other museums ours has suffered from the failure to make adequate provision for the storing, as distinguished from the exhibiting, of specimens. Storage is just as important as exhibition, if the museum is to be not only a repository for natural history or other objects but also a research institution. Large series of specimens are necessary for study and comparison, and these should be housed in a safe place where they are readily accessible. In the Australian Museum the reserve and reference collections are for the most part accommodated in darksome basements or in unsightly galvanized-iron sheds, which on account of the large amount of wood used in their construction are badly infected with white ant and also liable to fire risk. This should not be, and, when an extension of the building is planned, adequate and suitable provision for storage should be made.

An important adjunct to a museum is its library and this constantly increases in volume. Our library contains a very valuable collection of scientific books and journals, and specialists in other States and even in New Zealand, who find it necessary to consult works otherwise beyond their reach, frequently appeal to us for help. But the library of the Australian Museum has outgrown the space assigned to it and has overflowed into corridors and into a basement which is not at all suitable for the safe custody of books. This entails considerable inconvenience and waste of valuable time. Moreover the library lacks a reading room, where those, members of the staff or others, who wish to consult its treasures may do so in comfort.

The Lecture Hall has fulfilled a useful purpose. Our lectures have become so popular and well attended that as a general rule the accommodation is inadequate, and more than once a large number of people have been unable to obtain even standing room. If a larger hall were provided the present one could be converted to other uses or reserved for special smaller audience.

The State Government has in the past extended a generous measure of support to the Australian Museum, in which a large amount of capital is now, in a manner, invested. To get the fullest return from this capital an extension of the buildings is now essential.

By the death of Mr. G. McRae, Trustee, the Museum has suffered a distinct loss. Mr. McRae, who only recently retired from the position of Government Architect, had been associated with this institution since May, 1921, and his professional advice and assistance was at all times highly esteemed by his co-Trustees.

During the past year the Gallery Collection of Insects has been subject to much revision and alteration. A new departure from the old system has been the placing of labels at the head of each order and family giving a brief résumé of their characters. This, it is hoped, will assist in the elucidation of insects, enabling the tyro to at once identify his material.

The great changes which specialists are to-day making in the old nomenclature has necessitated the re-naming of many old insect friends, therefore, in labelling the species the better known name has been placed as a synonym beneath the correct name.

The Australian insects may still be found in the wall cases, with the exception of the beetles, which have been placed in the table cases over-looking the Fossil Gallery.

Some of the groups are still under revision, which accounts for any bare panels that may be seen in the cases.

Two New Museum Groups.

By Allan R. McCulloch.

(A generous joint subscription of the necessary funds by Messrs. A. E. and O. Phillips, Sir Hugh Dixson, Mr. William Dixson, and Sir James Burns, enabled the Trustees to despatch a party from the Museum to Lord Howe Island, with the object of procuring material for the construction of three group exhibits in the Museum galleries. One of these has already been described in The Australian Museum Magazine, and the following are notes describing the natural conditions which we have endeavoured to represent in the other two.—*Editor.*)

A Nesting Colony of Sea Birds on the Admiralty Rocks at Lord Howe Island.

SEA Birds wander far and wide over the oceans during the greater part of the year, but, at the call of the mating season, they foregather at chosen places to nest and rear their young. The colonies thus formed often include countless thousands of individuals, and may be comprised of either a single species or of several different kinds. There is reason to believe that many birds repair to the same places year after year, regardless of the great distances they may have travelled between whiles, and it is probable that young birds return to the islands upon which they were reared when the time comes for them to undertake the responsibilities of parenthood.

The Admiralty Rocks at Lord Howe Island are a group of islets of fantastic form, with a scanty growth of grass and occasional low bushes upon their rocky faces. They are difficult of access except in very calm weather, and are favoured accordingly by many sea-birds as nesting sites. Early in December each year thousands upon thousands of Wideawake Terns (*Onychoprion fuliginosa*) wend their way in from the sea, and, meeting with their fellows, chatter loudly as they select favoured positions. Not that any one site would appear to be better than the

The Admiralty Islets lie off Ned's Beach, Lord Howe Island.

The Reef at Lord Howe Island encloses a broad shallow lagoon.

[Photo.—*A. R. McCulloch.*

others, because, as no actual nest is built, any surface flat enough to rest the egg upon seems to be all that is required. As the month goes by the terns become more and more numerous, and, when the chickens make their appearance, the ground is covered with a living mass. Walking among them, one must tread warily to avoid crushing a young bird or an egg under foot, while clouds of their distracted parents fly close above one's head, screaming and chattering, and occasionally swooping down to peck at the intruder.

The egg of the Wideawake is excellent eating, and, though the yolk is richly coloured, it lacks that fishy flavour which is common to most sea-bird's eggs. Great quantities of them are collected for the table by the residents of the island during the early part of each season, but, as each bird robbed of its egg soon lays another, the numbers are not diminished. The eggs are beautifully mottled and blotched with brown, and no two appear exactly alike. Maybe each bird recognises its own by the marking upon it, though experiments have shown that its position is largely the parent's guiding feature. What happens when a crowd of similarly marked chicks are disturbed by some intruder can only be left to the imagination, for they scramble off in every direction and become hopelessly confused as they jostle and tumble over one another in their frantic efforts to hide.

The chickens develop rapidly, changing from little balls of fluffy down to fledglings with a sooty black plumage speckled with white. When they are ready to fly their parents encourage them seaward and introduce them to the stern realities of their future lives. They are taught the art of fishing and of battling with adverse winds and waves. But they return to their rocky homes at nightfall, and one hears them high overhead as they struggle with youthful effort against the fresh breeze, their shrill cries being ever answered by the rolling notes of their guardians calling "Wideawake Wideawake" as they guide them in from the sea.

Gannets (*Sula cyanops*) are also plentiful on the Admiralties, their bulky white forms being everywhere conspicuous from afar. Their large white eggs are deposited upon bare rock, and, though always dirty, are white upon their outer surfaces; if scratched, however, the inner layers of the shell are shown to be pale green in colour. At sea gannets are particularly powerful birds, flying with ease and speed, and often diving headlong from considerable heights upon some luckless prey; but on land they are ungainly in the extreme, and if disturbed are apt to trample cruelly upon their offspring in their confusion. They are armed with powerful beaks and occasionally show fight when approached, while squawking harshly at the intruder. But, as though well aware of their awkwardness, they more often vomit up half-digested fish which they leave as spoils to the victor, and, deserting their hapless chickens to fate in a most cowardly manner, make their escape at the first opportunity. Their wings are so long, however, as to beat upon the ground if the birds attempt to arise from a flat surface, so they must reach a ledge or slope before they can take off into the air.

When first hatched, gannet chicks are sprawling, naked, and remarkably ugly objects, but by dint of much feeding they grow apace, and soon rival their bulky parents in size, even while covered with fluffy white down. Grey feathers then make their appear-

ance, which develop into a speckled plumage strangely different to the black and snowy white of their parents, as is the fashion among sea birds.

The few scattered bushes growing upon the rocky islets are tenanted by graceful grey-capped Noddies (*Anous stolidus*), which construct crude nests of grass among their branches. Mutton birds (*Puffinus pacificus*) scoop out shallow burrows where they can find sufficient soil, or secrete themselves among grass tussocks and in holes among rocks. The parents share the duties of incubating the eggs and of keeping their ever hungry babies supplied with food, and upon the sea around the islets one sees long black ribbons which are composed of thousands of the adults fishing together around a shoal of fish or some other massed marine life. Shelves upon the cliffs serve the graceful little Blue-billies (*Procelsterna caerulea*) as nesting places, the more inaccessible their position the greater their favour with the birds.

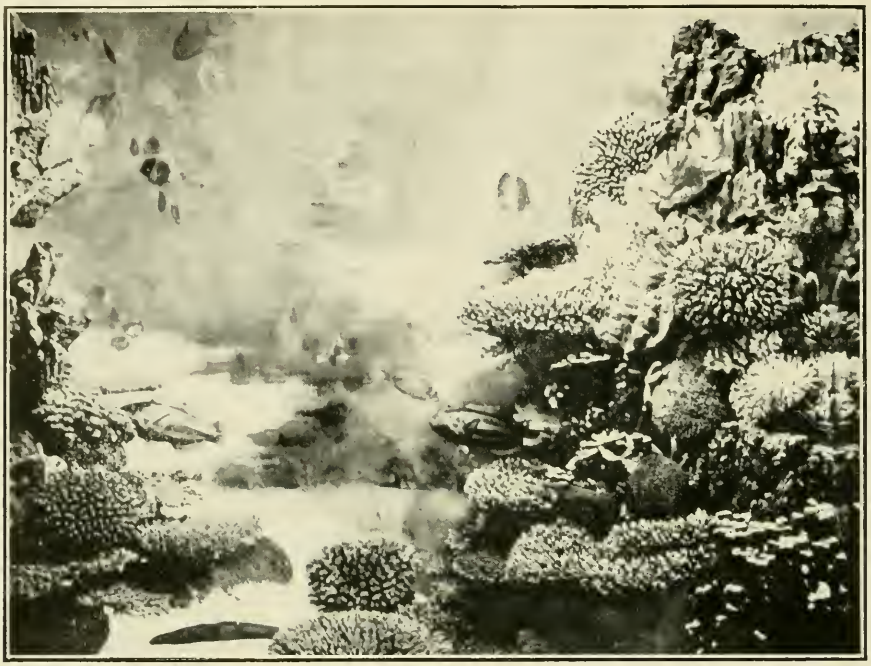
The group illustrated in the frontispiece of this issue is a recent addition to the Museum galleries, and represents a corner of a nesting colony of seabirds on the Admiralty Islets. Representatives of the five species are assembled just as they occurred under natural conditions, chicks and fledglings being mounted in life-like attitudes with their parents. A vivaciously painted back-cloth picturises the turbulent seas encompassing the rocks, with Lord Howe Island in the background, and the whole is carefully copied from photographs of an actual scene, and will doubtless interest and instruct visitors to the Museum. The construction of the exhibit is the work of Messrs. H. Grant, J. H. Wright, and W. Barnes, of the Museum staff, while the back-cloth was painted by Mr. H. R. Gallop.

A Coral Pool.

The Great Barrier Reef of Australia, extending for twelve hundred miles along the coast of Queensland, is the greatest coral formation in the world. It forms the western boundary of the Coral Sea, which is beset with many atolls and coral-banks, most numerous towards the equator, and becoming more scattered as they approach cooler waters. The southernmost reef fringes the shores of Lord Howe Island, which lies eastward of Port Macquarie, New South Wales, and only about one hundred and seventy miles northward of Sydney.

A number of widely different animals are commonly recognised as corals, among which the precious Red Coral, *Corallium*, and the white bleached skeletons of the Stony Corals of the order Madreporaria, are best known. The latter are the reef builders, and secrete hard stony skeletons, although their bodies are only of the consistency of thin jelly. The coral polyps or "insects," as they are usually but very erroneously called, can thrive only in the open sea where the water is crystal clear and far removed from the influence of mud. When expanded they resemble tiny flowers, with petals radiating around a central opening, and their colours often vie with those of a luxuriant garden. But the similarity ends there, for they are not plants but true animals. They are able to extract lime from sea-water and thus they secrete around themselves a hard stony skeleton, which protects their soft bodies from the battering effects of the waves.

There are a great number of different kinds of Stony Corals, each of which has its own type of skeleton, some being so massive and solid that they can scarcely be chipped with a hammer, while others are so brittle that their branches snap at the slightest touch. Some grow best where the surf breaks heavily upon them, flourishing under



A coral pool, reconstructed from material collected at Lord Howe Island.
[Photo.—*G. C. Clutton*.

conditions which destroy the most powerful works man may devise. Others prefer less turbulent waters, and thrive in the shelter of their more hardy fellows.

In their living state all are more or less coloured, but they are better known to most people by their limy skeletons, bleached snowy white upon a mantel shelf.

The regions where coral-reefs occur support a much greater wealth of life than is to be found anywhere else. Myriads of minute organisms abound in their vicinity and form the main food supply of a host of larger animals such as crabs, shell-fish, worms and echinoderms. These in their turn are preyed upon by an endless variety of fishes, which teem in the holes and channels of the reef edge and patrol the neighbourhood in search of food. Such sand as occurs consists solely of the triturated remains of reef animals, and not infrequently almost every grain is a more or less eroded shell of a tiny creature called *Tinoporus*. This, a mere speck of jelly, lives upon seaweeds, often in such numbers as to cover them entirely. They also extract lime from the sea, and secrete it around themselves as hard star-shaped tests; when the animals die these fall to the bottom, filling up holes and cracks between the corals and adding largely to the final solidity of the reef. Their jelly substance, and that of allied and even more minute animalculae, is eagerly sought by star-fish, sea urchins, and beche-de-mer which creep among the crevices in the coral ever engulfing sand, which passes through their long intestines while the animal matter is sorted out and assimilated,

A recently constructed exhibit in the Museum attempts to show something of the beauty and abundance of life upon a coral reef. The visitor is supposed to be beneath the water, looking through the glass into a pool formed of growing corals as one would look into an aquarium. All the rock is covered with coral growths of many different kinds and colours, which branch and creep over one another like

Bringing the coral ashore.
[Photo.—*A. R. McCulloch.*

plants in a tropical jungle, each endeavouring to secure as much food as possible and crowding out its neighbour. Brilliant green and brown *Madrepores* spread their innumerable fronds outward in the form of flat shelves, while dark coloured and massive *Porites* reach upward in pillar form, their tips brightly tinted with blue or yellow. Stocks of *Pocillopora*, variously tinted with carmine, lemon-green, or salmon pink, add colour to the duller brown creeping madrepores which form the greater mass of the solid structure. White coral-sand covers the floor of the pool, upon which some black slug-like beche-de-mer are creeping, while orange starfishes and spiny sea urchins secrete themselves among the coral branches. Brilliantly coloured fish are also shown in the pool.

All the specimens used in the construction of this exhibit were collected on the reef at Lord Howe Island, with no small amount of labour and difficulty. Most of the corals desired occurred only in crevices on the outer edge of the reef, and could be approached only on calm days and when the tide was at its lowest. Living corals cannot bear exposure to the air, so our quarry had to be searched for in the deeper holes, which were submerged at even the lowest spring tides.

A small party manoeuvred a flat-bottomed dinghy over the shallows, and, by means of water-glasses, peered down through the water in search of suitable corals. They were in plenty, but generally in such positions as made them too difficult to procure. Upon finding some likely looking pieces several of the party dived overboard and, with the aid of swim-glasses which enable one to see clearly under water, endeavoured to detach and bring them to the surface. They were unusually firmly secured, however, and much diving with crow-bars, cold-chisels and hammers, was necessary before they could be loosened. And it is not easy to manipulate such tools beneath the water while holding one's breath till almost at bursting point and at the same time fighting the constant tendency to float upward. So, with feet waving above our heads, and ever swimming downward, we struggled and tussled with the refractory bits until they were loose, to be either carried up to the boat in one's hands, or, if too heavy for this, to be hoisted inboard with ropes.

One needs leather gloves and heavy boots to protect hands and feet from severe scratches and cuts which are inflicted by the jagged coral whenever it comes into contact with naked flesh. Further, the slimy animal matter of the living polyps readily inflames any such wounds, so all precautions must be taken to minimise the inevitable injuries. At the slightest touch, the long needle-like spines of sea urchins projecting from unexpected crannies penetrate far into one's flesh from

The corals were bleached by burying them in the sandy beach between tide-marks.
[Photo.—*A. R. McCulloch.*

which they can be extracted only with difficulty. To plunge one's hand into a mass of these, as happened to one of us, is therefore a serious matter, resulting in severe inflammation and poisoning for a long period afterwards. Reef eels live among the coral, ready to snap at an offending hand thrust near them, and octopi with their nasty suckers, while thoughts of sharks sometimes flash through one's mind when swimming in deeper water.

With our dinghy laden, sometimes so heavily that some of the party had to swim ashore, we carried our gatherings to the beach. Here the corals were bleached by the simple process of burying them in the sand between tide levels. A few days sufficed to kill the polyps and macerate the animal matter, leaving their skeletons more or less clean and white. Fragile and special specimens were boiled in a tub with soda, which speedily removed the slime and left them snowy white. Samples of each were then recoloured with oil paints from living specimens on the reef, while many coloured sketches of fishes and other animals were prepared from living specimens to ensure accuracy in the reconstructed exhibit.

The construction of the exhibit is the work of Messrs. G. C. Clutton and J. Kingsley of the museum staff.

The Mammals of South Australia, Part I., containing the Monotremes and the Carnivorous Marsupials. By Frederick Wood Jones, D.Sc. (*Handbooks of the Flora and Fauna of South Australia*), issued by the British Science Guild (South Australian Branch), Adelaide, Government Printer, 1923: price four shillings.

Although this work professedly deals with the mammals of South Australia only, it is a fine contribution to Australian mammalogy, and will be of the greatest value to zoologists in general. The gifted author has dealt with his subject in a thoroughly scientific manner, and the treatment is so fresh and original that one returns to the work again and again and always with renewed delight; the non-scientific reader too, will be able to peruse it with pleasure and profit.

The handbook is divided into a general part, wherein, after defining a mammal, a restrained and readable account is given of external features, some anatomical details and the classification of mammals, followed by a section dealing with some special problems connected with the mammalian fauna of Australia. Then comes a special part dealing with the Monotremes and Marsupials respectively, describing the various genera and species in detail. A useful feature is the series of simple keys by which the genera and species may be identified. Perhaps the most interesting sections are those in which are discussed the distribution and part history of the Marsupials (which the author prefers to call Didelphia), their place in the mammalian world, and their classification. Professor Wood Jones will probably find that not all zoologists will agree with him at all points. He favours the view that the marsupials entered Australia from the north by way of the Malayan chain, rather than from the south by way of the Antaretic continent, which latter is the view preferred by many. Again his classification of the marsupials by their foot structure into Syndactyla and Didactyla, rather than by their dentition into Diprotodonts and Polyprotodonts, will not meet with acceptance from everyone. The author has certainly made out a very strong case, which can be demolished only by very sound arguments.

The Recent Archaeological Discovery in Egypt.

By Ernest Wunderlich, F.R.A.S.

NO event of recent times has so fired the public imagination as the discovery of Tutankhamen's tomb and storehouse in the Valley of the Kings at Thebes. Indeed it has become a craze. Newspapers which had never before devoted an inch of their space to such subjects have taken it up. From the commotion made one would fancy that Egyptology was quite a new thing; and yet the only extraordinary part of this discovery is the fuss that has been made of it. After all, it is only an episode in forty years of systematic excavation; only one of a long series of similar discoveries. However, this extensive publicity has had the effect of drawing attention to archaeology and in particular to the important bearing Egypt has had on our present civilisation. A sign that the general public is taking a greater interest in such matters is evident from the large audiences that attended Professor Flinders Petrie's lantern lectures on "Royal Burials" recently held in London.

Who was Tutankhamen? Shorn of "ankh" and "amen," which are mere titles, and mean respectively "to whom long life" and "beloved of Amen" (the deity of Thebes), the name condenses to Tutu. He may or may not have been of royal descent. It is believed he was the natural son of Amenhotep III., the great Emperor-King, and his chief claim to fame is having married the daughter of Amenhotep IV. (or Akhenaten) the legitimate son of that Monarch. Akhenaten was the religious idealist and reformer, whose lofty ideas were in advance of the time and who, in endeavouring to stop war, lost the greater part of Egypt's Empire. On his death Tutu claimed the throne as Tutankhaten, but repudiated the idealistic doctrines of his predecessor, and, changing his name to Tutankhamen, became a pliable tool of the all powerful Theban hierarchy of Amen.

Tutankhamen has come into the limelight. He is the craze of the hour. But the glamour is undeserved. Little is known of his reign, and the very objects found in his tomb were probably never his. His illustrious ancestors pass unnoticed: Akhenaten, the prince of peace, who preached the religion of love and suffered the most pathetic disappointments: Amenhotep III. the serene monarch, during whose long and untroubled reign Egypt reached the zenith of its power and expansion of peaceful enterprise, arts and commerce; Thotmes III., the great warrior, conqueror, and builder of the Empire that Akhenaten again lost. And yet the lives of these and of many other kingly figures of a remote past are as accessible to anyone interested as the history of the Middle Ages, thanks to the patient labours of men of science. But it must be regretfully admitted that the vast literature on ancient Egypt is read only by a very limited public who look a little beyond the routine, fads and fancies of the day.

Few realise the extent of research since Champollion, working on Dr. Young's clue, first found the key to hierogylphics just a hundred years ago, and in deciphering the Rosetta Stone established exact data upon which science has since built. What great men have worked in this field since then, most of them without, or almost without pay, purely for science's sake. To mention a few: Lepsius, Brugsch, Mariette, Maspero, Naville, Bunsen, De Rouge, Wallis Budge, Flinders Petrie.

So exact are the data in this field of research that we know more about the private life of the ancient Egyptian than we do about the Greek or Roman.

It must be asked what use it is to know all this. But archaeology, or

the inner history of mankind, is part of nature's history. By tracing to its source the mental ancestry of man, it shows that our thoughts, habits, and institutions are the outcome of ancient civilisations. And these, in many respects were higher than ours, both in mechanical and intellectual achievement. It proves, moreover, that civilisation itself is an intermittent phenomenon, reaches its culmination, then declines and perishes, pointing to the ultimate fate of our own.

The late Lord Carnarvon's find is by no means the first sensational discovery made in Egypt. It is merely a confirmation of Maspero's prognostications and the completion of work commenced by Davis. These prepared the way, and Mr. Howard Carter's perseverance and luck did the rest. In 1881, at Deir-el-Bahari, were found the many royal mummies now in the Cairo Museum. It was a veritable hypogeum of Pharoahs. In 1888, at Tel-el-Amarna on the ruins of Akhenaten's capital, were unearthed hundreds of terra-cotta tablets on which were recorded in cuneiform language the diplomatic correspondence between the courts of Egypt and Babylon about 1440 B.C., a discovery throwing a flood of new light on the two cradles of civilisation, the valleys of the Nile and the Euphrates. But these and many other epoch-making discoveries did not create the stir this latest and lesser one has caused. What perhaps gives a unique cachet to the Carnarvon find is its richness, and the prevalence of so many unusual objects never before dug up in Egypt, also the excellence of their workmanship. But most of these objects of gorgeous oriental splendour do not come up to the simpler and nobler art standards of the classic age of Egypt. They are entirely foreign, being importations from Mesopotamia, with which country Tutankhamen's father in-law and (probably) half brother, Akhenaten, and before him Amenhotep III., had many dealings, as the Tel-el-Amarna tablets show.

I cannot do better than quote Professor Flinders Petrie's comments (*Ancient Egypt*, 1922, pt. IV.) on the objects brought to light.

A most interesting historical link is seen in the strange animal-headed couches. The cow-head couch has spotting inlaid on it of a trefoil form ; this is foreign to Egypt, but is well known in Mesopotamia, as on the couchant bull in the Louvre. The weird dog-head of another couch is also entirely un-Egyptian. Now, as Kallimasin, king of Babylonia, sent to Amenhetep III a couch of *ushu* wood, ivory and gold, with three couches and six thrones of *ushu* wood and gold, it is certain that there were Babylonian couches in the Theban palace ; and this description of ivory and gold refers to the dog head with ivory teeth and tongue, while the other couches are of wood and gold only. Later than Amenhetep III, Syria was too much disturbed, and Egyptian prestige in Mesopotamia was too slight, for such presents to be sent. They must be as old as Amenhetep III, and there seems no doubt that these are the very furniture described in the Amarna letter. In accordance with this, we find that each was constructed in four parts, with bronze jointing to fit together. Furniture made in Egypt is naturally all united in one, with fixed joints. But for a rough land journey of over a thousand miles, it was needful to make couches with separate sides, frame and base, in order to pack and transport them.

No doubt there was an imitation of Egyptian motives, as in the Hathor cow-heads, and the tails copied from lion couches. This only shows that they were made for presents to Egypt, and not that they were the work of foreigners in Egypt, because there would be no purpose in the elaborate bronze jointing, instead of solid joints. This detail would not be necessary if they were merely moved about the palace or put on a Nile boat. We see then, for the first time, court furniture of Babylon, and it will be of great interest to examine the technical details of the construction and compare it with Egyptian work. The short form of the couches shows that the Babylonian slept contracted, like the prehistoric people, while the Egyptian couches are all full length.

If some articles were thus of a previous generation, it is very likely that others were likewise old ; and the footstool, with nine foreigners under it, may well be that used by Amenhetep II as figured a century before. On the death of Tut'onkhamen, who was the last legitimate king of the great family, it seems that the palace furniture was largely buried with him, as there was no heir to inherit.

Of all the Egyptian work the most informing to us will be the dress and personal detail. The colour weaving, the attachment of ornament, the construction of jewellery, will show much that is new to us. The glove has astonished people, but, as Miss Murray observes, gloves are figured in scenes, both among offerings and also worn.

The immediately urgent matter is that all these things should be preserved in the dry air of Qurneh, and not taken to the winter fogs of riverside Cairo. A large new

building must be provided in any case, as the Cairo Museum is far too full to take in properly all the objects which are piled up in four chambers of the tomb. The obvious site is Qurneh, somewhere south of Deir el Bahri. There a substantial museum should be built, without any upper floor, and entirely lighted from the north. Then will come the question of the efficient publication of all this mass of objects. The Egyptian Government should begin by an appropriation of £30,000 for the museum and £20,000 for publication. They cannot grudge a few *per cent.* of the value of what has been found for them, if they get everything for nothing. No one can hope that these things will last for another three thousand years ; probably this sheen of gold will perish by ignorant greed within three hundred years. A complete photographic and coloured reproduction of every object from various points of view, and with full diagrams of details, is the least that this generation owes to the past, which has guarded its treasure till now.

Circumstances which caused the death of a White Cockatoo (*Cacatua galerita*) in July of last year were probably unique. The bird had apparently escaped from captivity and was enjoying its recovered freedom in the vicinity of Maroubra, New South Wales. For some months it had been observed flying along the coast, and often venturing some distance seawards. During one of these excursions, and when within fifty yards of the shore, the cockatoo was attacked by two Silver Gulls (*Larus novae-hollandiae*) who, in the quarrelsome mood common to sea-birds, resented the trespassing of this clumsy stranger into their domain. The gulls being more than a match for the cockatoo in their better wing control and swifter flight, the short conflict that followed was a one-sided affair, and it was not many seconds before they had driven their still fighting antagonist into the sea from a height of one hundred feet. Despite its experience in this unfamiliar element the cockatoo managed to keep afloat, and flapping its outstretched wings grotesquely valiantly struck out for the rocky shore. Relieved now of the attentions of the harassing gulls, the bird made good its escape, but, on reaching shallow water, was caught up by several large white rollers which completely enveloped it for several seconds. Eventually it was carried close enough inshore to be assisted out of the water with the aid of a landing net requisitioned for the purpose from some fishermen nearby, and had just sufficient strength to grasp the loop of the net with its beak, when its feet began to draw up and its body to stiffen with the cold. Every effort was made to revive it, but it soon died from the effects of exposure and of salt water.—*Frank A. McNeill.*

A Whale of Bygone Days.

By Professor T. Thomson Flynn, D.Sc. *University of Tasmania.*

ONE of the saving graces of civilisation lies in this, that while man has much degenerated as regards many of his faculties—he has lost to a great extent the powers of sight, hearing, and smell—he still retains his gift of imagination. And one of the most stimulating methods of applying this gift lies in reconstructing the bodily forms and methods of life of animals which are long since extinct and which may have been the ancestors of those interesting living beings which form man's companions on the earth's surface to-day. It is obvious that no living being can exist for very long if its environment is unfavourable. It must be capable of responding to any exacting requirements which its condition of life may impose upon it. There are, perhaps, no living animals which have responded more to their environment and mode of life than have the whales —animals which have always been objects of interest and wonderment to the observer. The monstrous proportions to which some of them attain, their comparative rarity, the vivid impression of the story of Jonah, and the association of their capture with stories of human hardship, strength, and daring in the wind lashed seas of the "Roaring Forties" are all ideas which have been associated in producting this effect on the "Man in the Street."

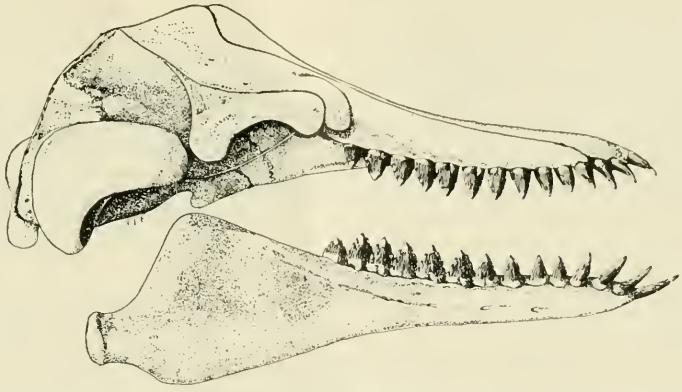
An examination of the body structure of whales has long ago shown us that they have descended from land animals. There are some who have suggested that their ancestors were reptiles, but it is almost universally agreed that these primeval ancestors belonged to the group known as mammals. Most of the larger animals on the earth's surface to-day belong to this mammalian group, which includes four footed, air breathing animals with a covering of hair and which suckle their young. The ordinary dog may be taken as a typical example.

Removing the remains of the fossil whale from the cliffs at Table Cape, near Wynyard, Tasmania.

There could hardly be two creatures more different at first sight than a whale and a dog. Yet the fundamental resemblances are there. The whale, just as the dog, breathes by means of lungs. It has to visit the surface of the water periodically to renew its air supply. The whale calf is born and nourished in exactly the same way as is the young of the dog.

Two of the most conspicuous differences between whales and the ordinary land mammal lie in the absence of hair on the former and the arrangement of their limbs.

It is usually believed that whales are

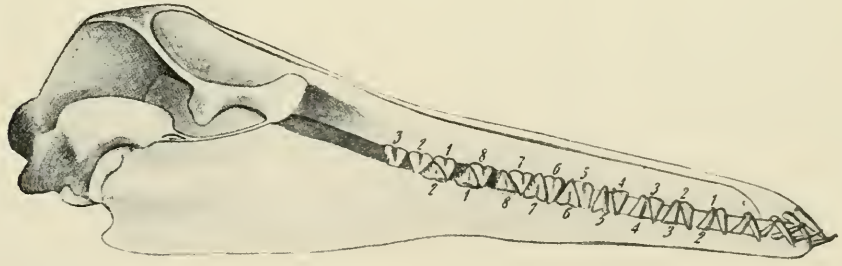


The skull of the Tasmanian whale (Prosqualodon davidis) fully restored. It will be seen that the snout is much shorter than that of the Northern shark-toothed dolphin, shown below. The teeth, however, are very similar.

quite devoid of hairy covering. This is only partially true. It is a fact that some whales when full grown have no hair of any sort, but in some of these it is found that the young one develops a small amount of hair which is afterwards shed. Some grown-up whales have hair but it is never well developed, and in fact the hairs are so few that they can be quite easily counted. They are always situated in the region of the upper lip, forming a sort of sparse "moustache." The structure and development of these hairs shows that they are quite of the same type as in other mammals, and that there is not the slightest doubt that they are the relics of the ancestral hairy covering now almost entirely lost.

The flippers or paddles of a whale correspond to the fore limbs of the ordinary mammal, although at first sight they are very different. They possess bones which agree exactly with those found, for example, in the fore limb of a dog, and these divide the flipper into parts representing the upper arm, the fore arm, and hand. The bones, however, are so flattened and brought so closely into contact that the only movable joint left is at the shoulder. This flipper forms a very efficient balancing organ.

Of the hind limb nothing is externally visible in whales. Some of its bones however, have been found in a degenerate condition in many whales, buried in the flesh in just the position



Shark-toothed dolphins inhabited the seas of the Northern Hemisphere in past geological ages. This represents the skull of one of them. The snout is very long compared with that of the Wynyard whale, but the number of teeth is about the same. These teeth, fang like in front and, at the back, cutting past one another like scissor blades, form an ideal means for the capture and preliminary mastication of such slippery and active prey as fishes.

[*After O. Abel.*

which would be occupied by these limbs if present. The hind limb must have disappeared at a very early stage in the evolution of whales, but one of the most remarkable and instructive happenings in connection with this question was the discovery in Canadian waters some two years ago, of a whale with a pair of well developed hind limbs each over four feet long.

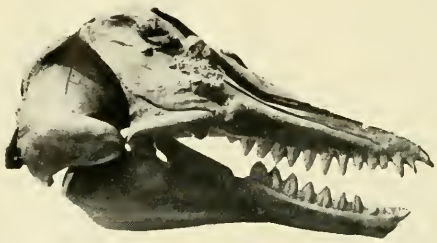
Whales are divided into two groups, those with teeth and those without. The latter group live on very small organisms in the water, these organisms being secured by a very efficient sifting out apparatus into the complex structure of which we will not enter here. Sufficient to say that it is composed of plates of horny material called "whalebone." But even in these "whalebone" whales it is found that the embryo develops a series of ordinary teeth which are later on shed and their place taken by the above-mentioned plates of whalebone.

It is however with the "toothed" whales—dolphins, porpoises, "killers," sperm whales and the like—that we are more concerned in this article and we will, I hope, be able to elucidate some of the chief features in the story of their evolution.

The story is of particular interest to us because recently there have been found, in the cliff beds at Table Cape, Tasmania, near the little town of Wynyard, the fossil bones of a very ancient whale, whose wonderful condition of preservation entitles it to rank as one of the finest fossils yet discovered. A cast of the skull and jaw of this whale has now been placed on exhibition in the fossil gallery of the Australian Museum. A photo, of this exhibit is shown on this page.

The specimen was observed in the face of a precipitous cliff, whose base is washed by the waves of the sea at high water. It was necessary to construct a platform for convenience in removing the remains. This was a matter of some difficulty, but the result paid for the trouble.

I have named this new whale after Sir T. W. Edgeworth David, the great Australian geologist and teacher, whose



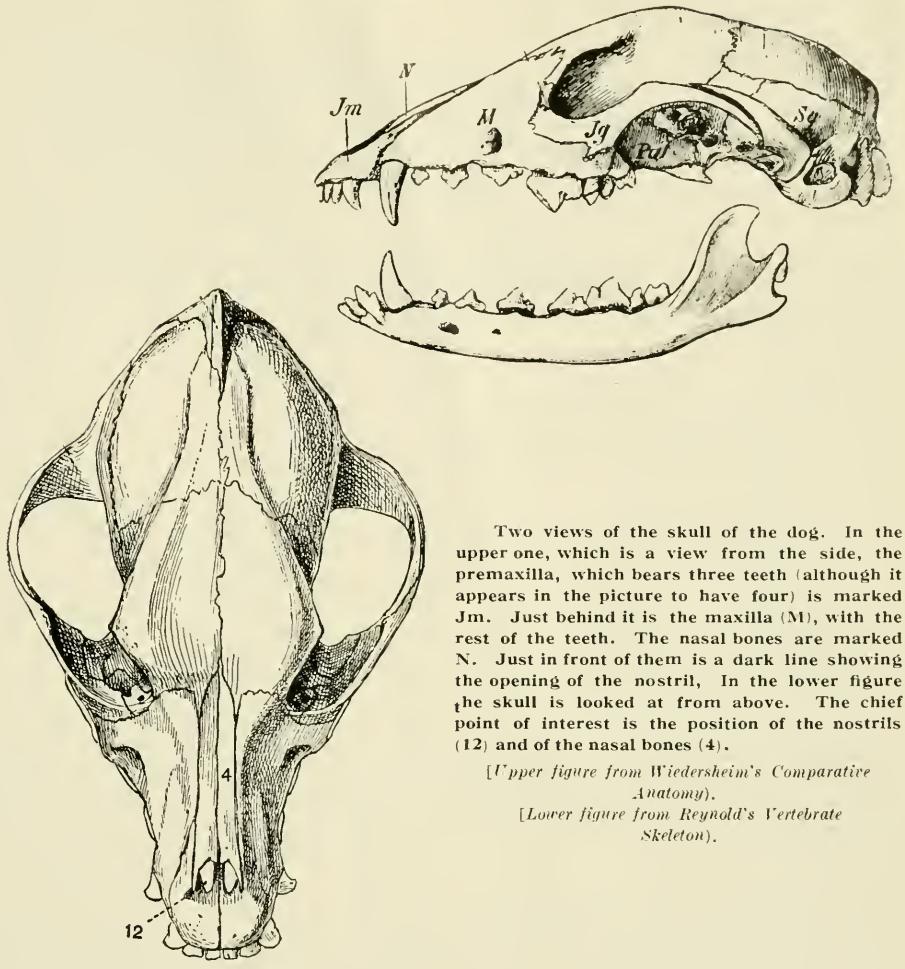
Cast of the Tasmanian fossil whale as exhibited in the Fossil Gallery of the Australian Museum. [Photo—*G. C. Clutton.*

reputation has extended far beyond the country in which his work is carried on.

The mind of the ordinary mortal cannot conceive of the age of the beds in which the fossil was found. They cannot be less than some 20,000,000 years old—the age of Tutankhamen's tomb is a mere trifle by comparison.

A fearsome tooth, notable for its massive strength and a form which makes for great cutting and shearing power.
[Photo.—*G. C. Clutton.*

This ancient whale was extremely fierce, and was a fish feeder. It possessed extraordinary teeth one of which is pictured here. Notice, the shark like nature of this tooth. It is made for cutting and grasping. No whale of the present time has teeth like it. Yet we can never tell what scientific surprises the depths of the sea may hold in store for us. In his evidence before



Two views of the skull of the dog. In the upper one, which is a view from the side, the premaxilla, which bears three teeth (although it appears in the picture to have four) is marked Jm. Just behind it is the maxilla (M), with the rest of the teeth. The nasal bones are marked N. Just in front of them is a dark line showing the opening of the nostril, In the lower figure the skull is looked at from above. The chief point of interest is the position of the nostrils (12) and of the nasal bones (4).

[Upper figure from Wiedersheim's Comparative Anatomy).

[Lower figure from Reynold's Vertebrate Skeleton).

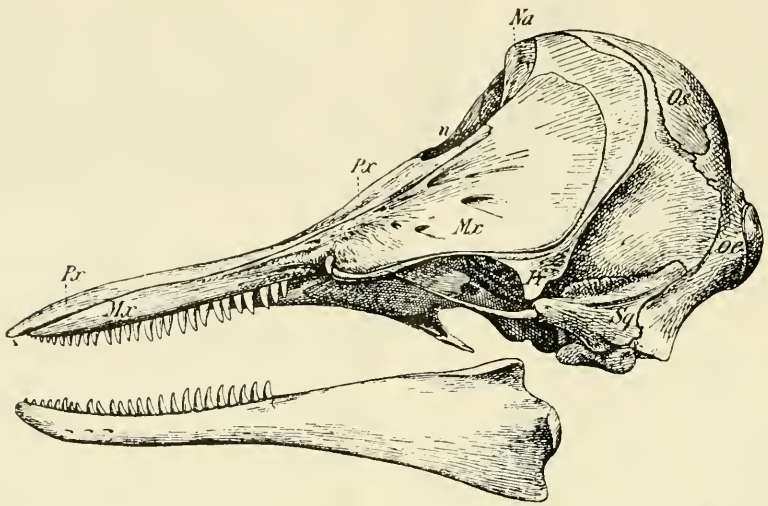
the Tasmanian Royal Commission of Fisheries in 1882 a witness stated that he had caught in the fishing beds at one time a warm blooded animal with teeth like a shark. This description would apply perfectly to these extinct or supposedly extinct whales and to no other animal.

There are many respects in which this whale shows a nearer approach to the ancestral mammals than do the toothed whales of the present day.

I show here the skull of a dog and that of a dolphin of the present time. Notice that the upper jaw of the dog on each side is formed of two bones, the premaxilla and the maxilla. Each of these contains teeth, the premaxilla bearing the three front teeth (incisors) while inserted into the maxilla are the remainder of the teeth which are divided into different sets according to their shape and function.

In the dolphin the jaw is also formed of the premaxilla (Px) and the maxilla (Mx). The maxilla bears all the teeth, the premaxilla having none and the teeth are more numerous than in the dog and of similar shape throughout. They are made simply for holding, not for cutting.

Let us see what are the conditions in this region of the skull in the Tasmanian fossil. The premaxilla and maxilla are present but the former has three teeth as in the dog, while the maxilla



Skull of a modern whale, a dolphin. All the teeth are borne on the maxilla (Mx.) while the Premaxilla (Px.) has none. The nostrils, or "blowholes," are towards the top of the head at the position marked n, while the nasal bones indicated as Na are quite behind the blowholes.

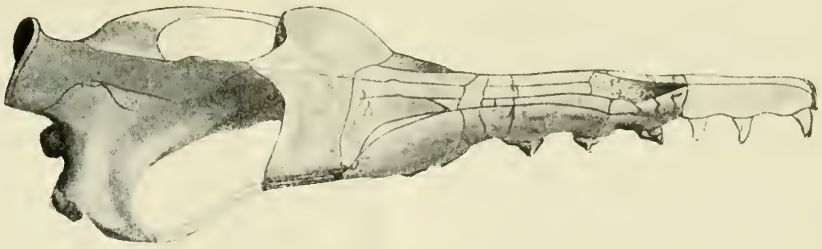
[*After Boas.*

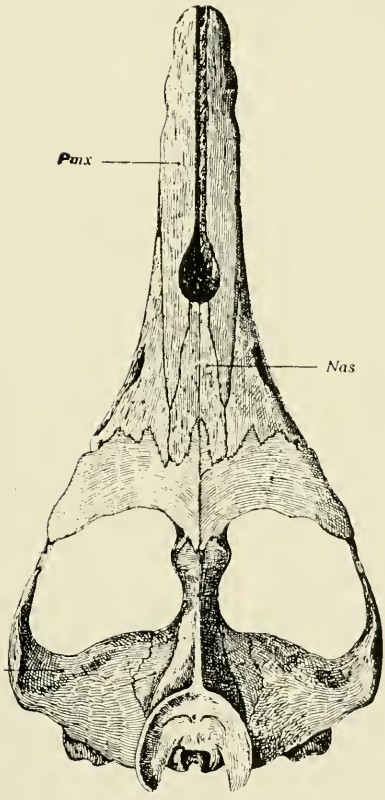
bears other teeth which are divisible into sets according to their shape. Further while the number of teeth is less than in the dolphin it is more than in the dog. In all these points then, the Wynyard fossil whale is intermediate between the typical mammalian skull and the skull of a present day whale.

The dog's nostrils are situated right at the front end of the snout and are roofed over by two bones called the nasal bones, these being in the form of a pair of flat plates. What correspond to the nasal openings of the dog are, in the dolphin, situated towards the top of the skull and form the two "blowholes." They have been moved back and in the process have pushed behind them the nasal bones which have each become a mere nodule at the back of the blowhole. Various fossil whale skulls have been discovered showing the gradual movement backward of the nose and two of them I show here.

Accompanying this backward movement, the whale gradually loses its sense of smell. This sense is almost entirely absent in the whales of the present day and the blowholes are just passages to the lungs for breathing purposes. Consequently the nerves from the brain to the nose which have to do with the sense of smell have practically disappeared. The Wynyard fossil whale shows this process just on the verge of completion. The blowhole is nearly in its final position but the nasal bones are plates which still roof the blowhole slightly. Further than this, large passages for the transmission of the nerves of smell from the brain to each blowhole, have been found, so that the olfactory sense must have been fairly well developed in this ancient inhabitant of prehistoric seas. In such respects again, the Wynyard fossil shows a gradation between the living whales and their ancestors.

It is by means of discoveries such as this that we are able to piece together the whale story. This story is very incomplete. Numbers of whale-like animals have lived on the earth's surface and have died without leaving any deseendants. One of the most widely distributed was the enormous *Zeuglodon*, a long, narrow, snake-like creature, measuring about sixty feet in length, which probably crept and swam among the shallow waters of the bays, and estuaries, of Europe and America. It has not been found fossil in Australia but the teeth of a nearly





These skulls of very ancient fossil whales, have the blowhole, or nostril, in a very peculiar place, about half way along on the top of the snout. The nasal bones are marked Nas. in the lower picture and are still in the form of flat plates, but a comparison of these skulls with that of a dog will show that these bones have moved back, and instead of lying over the nostril, are behind it. The upper skull has exactly the same number of teeth as a dog.

[After E. Fraas and O. Abel.

related monster named *Kekenodon* have been unearthed in New Zealand.

The Tasmanian fossil belongs to a primitive group called the Squalodonts (or shark toothed whales). A group of these with very long snouts was very abundant at one time in the seas of Europe and America and have left many skulls and teeth in the marine fossil beds of these countries. None of these long-snouted forms have been found in the Southern Hemisphere. The fossil whose east is shown in the Australian Museum is much shortened in the muzzle. Two skulls of a closely related animal have been found in Patagonia so that these small but fierce carnivorous whales probably roamed the Southern Seas of that period.

The greatest light on the origin of whales, however, has been shown by discoveries in a district called the

Fayûm in Egypt. These indicate that the land mammals from which whales were derived were probably very primitive flesh-eating or insect-eating mammals.

It may not be amiss to speculate somewhat on what will be the future history of some of our whales. I have already spoken of the huge size and bulk which many of them attain. It is an inexorable law of nature that when an animal gets "too big for its boots" so to speak, it must become extinct. Time after time we come across examples amongst fossil animals of huge size which sooner or later have disappeared, while their smaller and more active congeners have lived, flourished and left numerous descendants.

In the ordinary way we can expect that extinction will very soon descend upon our larger whales, and the commercial instinct of man has hastened the process and made it the more inevitable.

"Records of the Australian Museum" vol. XIV., No. 1, was recently published. It contains, principally, the accounts of the research work performed by the scientific staff of the Museum :—

Mr. C. Hedley has prepared notes on some Australian *Cassis*, and clears away confusion surrounding *C. fimbriata* and *C. bicarinata*.

Mr. A. R. McCulloch supplies keys to the Australian fishes of the genera *Chaetodon, Callionymus* and *Cubiceps*, together with illustrations of several species, and collaborates with Mr. W. J. Phillipps in describing the variation of several New Zealand fishes. In a paper by Mr. McCulloch and Mr. F. A. McNeill a small crab, *Scopimera inflata*, described in 1874 from the East Indies and not again recognised till its recent re-discovery on the coasts of Queensland and New South Wales, is figured, and excellent illustrations, showing its method of burrowing and forming sand pellets, are given, and a new shrimp, *Atya striolata*, from the Nepean River, the first record of this genus from Australia is described.

Mr. W. W. Thorpe describes an aboriginal magical plate which is said to have been used both for curative and malevolent purposes. This plate originated in the north-west of Australia and travelled down to Ooldea, on the Trans-Australian Railway.

Mr. E. Le G. Troughton contributes a paper in which the genus *Leporillus* is revised and the stick-nest building rat *Leporillus conditor*, of which little has been known since its discovery by Sturt in 1844, is fully described. Illustrations and references to literature not previously cited, are given.

Mr. J. R. Kinghorn describes a new genus of elapine snake (*Oxyuranus maclennani*). This interesting specimen was presented to the Museum by Mr. H. L. White, whose collector, Mr. W. McLennan, obtained it whilst on an expedition in the Cape York Peninsula, North Queensland.

Professor T. Harvey Johnston, B. Sc., University of Adelaide, and Mr. G. H. Hardy, Walter and Eliza Hall Fellow in Economic Biology, University of Queensland, contribute a paper on some sarcophagid flies from Lord Howe Island, collected there by Mr. A. Musgrave of this Museum. One new species is described, and the others are identified with Australian forms. The question of their distribution is discussed.

Professor T. Thomson Flynn, D. Sc., University of Tasmania, shows that an Australian lizard (*Tiliqua scincoides*) is viviparous and possesses a well developed allanto-placenta of the conjoint type —a structure now recorded for the first time from a reptile, and which may, perhaps, have an important bearing in elucidating the difficult problem of the origin of the mammals.

In a Brisbane Garden.

By G. H. Hardy.

ONCE upon a time our garden was properly and elegantly cared for and there are many ruins about to indicate the pride taken in it by some former owner. Now, horticulturally, it is all but a desolate waste, and it has therefore reached the height of its entomological glory. One long wooden fence is falling with decay, and is barely sturdy enough to support its burden, a tangled creeper beloved by the butterflies. Under shelter of this and overhanging trees, a border of thick ferns is almost buried by newly fallen and long-decayed leaves. On the lawn, that looks as if it had never felt a mower, two well grown mango trees with dense foliage will be found to shelter quite a colony of miscellaneous insects if you care to hunt for them. The verandah, abandoned to the ravages of a wisteria, is also an insect sanctuary.

At the foot of the garden is the Milton Reach of the Brisbane River with its almost straight run of three miles to the city's only bridge. A steep slope of over thirty feet descends here, and the whole area on this hill side is waste land given over to one banana stool, one peach tree, two or three gum saplings, numerous weeds, grasses, and a creeping convolvulus.

From the road the house stands almost hidden by abundant foliage, and is surrounded by many trees in its own and neighbouring gardens. This gives such an air of solitude to the house that a more isolated spot could not be found within the whole of Brisbane's suburbs.

The animated stock includes many handsome insects, spiders of all sorts and sizes, lizards, frogs, harmless snakes, bats, opossums, native bears, numerous birds, including the kookaburra, another kingfisher, the frogmouth, owls, doves, and smaller kinds. About a mile away is the Mt. Coot-tha reserve, and most creatures found there will be found somewhere and at some time in our garden. The eagle visits the retreat at times and the curlew cries across the reach. Owing to the wild aspect of the river front, stray tortoises, seeking a safe and neglected spot wherein to lay their eggs, are induced to visit our grounds.

Frogs, wasps that build mud-nests, spiders, and (unfortunately) mosquitoes are constant inhabitants of our house. Moths, white-ants and other insects dance nightly attendance on our illuminations, which flying visits are fully appreciated by the entomologist. Here if anywhere is a vast amount of life to be observed and recorded.

THE LANTERN FLY.

One night, whilst we were sitting at dinner, a will o' the wisp visited the darkness of the adjoining room, and, with his lantern, showed a light only to be extinguished the next moment. This being repeated several times induced me to desert my wife and my meal, only to be bogged later in speculating on this problem of nature. Doubtless you have guessed that my will o' the wisp is the lantern-fly (*Luciola*), a beetle whose self-illumination one would expect to be more destructive than beneficial. Scientists generally admit that the light which exists near the apex of the abdomen on the underside, is not phosphorescence, and they describe it as luminescence. Some consider that it is caused by a slow combustion within the luminous organ, because, in respiration, the increasing and diminishing of the air supply would account for the intermittent light.

The luminescence is amply sufficient to tell the time by if the insect is rested upon a watch in the dark. Placed in an entomological glass-bottomed box, it gave off sufficient light to illuminate the whole of the interior, which, being

white, reflected enough light to reveal the colour of the red thorax against the black elytron.

One specimen at the end of the lantern-fly season contrived to get herself where she was not wanted, and, later, when retiring for the night, I found her still "luminescing" but enveloped within a robe of silk and resting upon the dressing table whereon the spider had ejected her. The next morning she was still in this condition but dead, and the whole area where the luminescence took place was quite bare of the web: it was quite easy to slip the beetle out of her silk night-dress through this aperture.

Whether this absence of web on the underside of the last two segments of the abdomen was due to the spider's refusing to face the luminescent area, or whether the slow combustion that is supposed to take place was sufficiently strong to burn away the web, I am sorry to say I cannot tell, for this was the last of the season, and nearly a year must pass before more can be procured to experiment with.

THE WAY OF THE FRUIT-FLY.

The peach tree which stands on the slope to the river is completely hidden from the house; it is only a small tree, but it was prodigiously laden with fruit that needed but a week to ripen. A basketful was picked for stewing purposes, and one or two when opened were found to be infested with fruit-fly maggots. Two days later a second basketful was picked and only one in ten found free from the maggot. Three days later not one peach of the whole remainder of the crop could be found, they had all disappeared. Such a wholesale disappearance was not due to the activities of the fly, nor yet to flying-foxes; it was a thief with the best of intentions that had gathered the lot, and who ever it was that had our fruit he was himself "had."

The sudden raid on, and complete ruin of a crop by the fruit-fly, is typical of a fruit-fly attack, for within a few days the whole are infected, even although no fly may be noticed as in this case. The flies have been observed to attack almost every kind of fruit, many of which do not succumb to the evil. After the episode of the peaches, the flies invaded the mangoes, and the fruits attacked were marked for further observation, but in no case did the maggots develop therein, showing that mangoes have properties that make them resistant to the fly. Thick-skinned lemons, known locally as bush-lemons, are also resistant stock, as the flies cannot pierce the skin with their ovipositor, though they are often seen attempting it. Some thin-skinned fruits such as Japanese plums may have a different but quite as mechanical a method of resistance. This plum is a remarkably juicy variety, which property is its safeguard against the fruit fly, for, when the skin is punctured the juice squirts out and the egg and ovipositor are ejected on a succulent globule.

THE SLEEP OF THE NATIVE BEE.

Have you ever seen a native bee asleep? The female is supposed to retire within the hole or burrow and sleep upon her job. Not so with the male, however, for this wanderer spends the night out, sleeping along the highways and byways of the bush. The males of some bees collect together for company, and they can be seen clustering on a twig, blade of grass, or other support they may choose, their numbers per cluster sometimes reaching up to hundreds.

Near the front entrance to the garden there is a wooden archway abandoned to the growth of wild nature and the remains of a fernery it once harboured. It is from here that the tumbling down fence with its old-man-of-the-sea creeper has its beginning, and it is at this place nightly, as long as their short span of life lasts, that the males of a species of *Anthrophora* collect for their nightly bivouac.

But there is one curious habit about this bee that I have never before noted in a sleeping insect. Doubtless you would expect, as I did, that the bee would cling by its claws to its twig and

settle down for the night. I watched them collect, first one, then a second, each feeling round for a place to rest on a long, bare, drooping tendril of the creeper. When two or three had settled, others began to gather faster, and, several arriving from various directions almost simultaneously, the vacant spaces were soon filled. One feeling himself jostled threw out all his six legs at once and began to wave them, in unison, to and fro, and yet he retained his position in a most miraculous manner. Soon another was doing the same, and yet another, without apparent support, was beating the air.

With a twig I touched all those at rest and had every one doing the trick. It was then I found that this bee did not cling by his claws at all; his legs fell together beside the thorax in the same position as they occupied just before he emerged from his cocoon, and all the support he had was secured by the mandibles. No matter how one held him when asleep, head up, head down, or in a horizontal position, his body still lay parallel to, but not touching, the object to which he attached himself, as, gripping by his jaws, he fell to slumber.

"*A Bush Cinema*," By "Te Whare," Sydney, 1923.

This interesting booklet contains many interesting natural history notes and illustrations, mostly from original photographs. Much of the matter has already appeared in the "Aboriginalities" column of the "Bulletin," in the "Sydney Mail" and in "Smith's Weekly." Nature lovers will be glad to have these scattered notes collected in a handy form. Our copy from H. V. Edwards, Bega.

There was recently issued a report by Miss Mary J. Rathbun, of the U. S. National Museum, Washington, D.C., U.S.A., upon a portion of the Decapod Crustacea dredged by the late F. I. S. "Endeavour." The report forms vol. V. part 3 of "The Biological Results of the Fishing Experiments carried on by the F. I. S. 'Endeavour,' 1909-14." These reports are issued by the Commonwealth Department of Trade and Customs, but their production is supervised by the Australian Museum. As an illustration of one of the Museum's activities it may be noted that the suggestion to collect the valuable material being dredged whilst exploring for fishing grounds, and to submit it to leading authorities for elucidation emanated from here. These authorities, without remuneration, willingly gave their labors in the cause of science, the advance of knowledge being their sole reward. Some thousands of specimens were collected upon these trawling cruises, many for the first time. These were all sorted and primarily classified here before being despatched to the various specialists. Rarely has a continent had such an opportunity to have its pelagic, or deep sea, fauna so thoroughly investigated at such low cost.

The Sulphur Island.

By L. H. Morrisby.

DISTANT about 200 miles due east from the southern end of New Caledonia, and not far off the passenger route from Sydney to Suva lies Hunter Island. Although it is marked on the map accompanying the latest hand-book of the Pacific Islands, that work contains no description of the island. There seems no doubt that the island has never been visited by scientists, since no information is available, at all events in Sydney, as to its formation, fauna, or flora. And, indeed, it is most probable that no white man had ever landed there before November of last year, when my brother and I made it our business to land, while on our way from Norfolk Island to Fiji in the ketch "Tasman." But as to the certainty of that, I am open to correction.

It was at night when the "Tasman" reached Hunter Island, but, as we were unable to anchor, we hove to till the following morning, and then ratched up under power to a poor shelter under its lee, where we anchored in twenty fathoms. Taking with us in the dinghy our camera, tools, and specimen bag, we tried to land in a small bay on the N. by E. end, in which there is a large rock with a passage between it and the island, forming a bay, with a foreshore of boulders. The sea here has a trick of breaking suddenly and treacherously, and a huge breaker, dashing up without any warning, combined with a fierce undertow to upset the dinghy with all its contents, to stave in two of its planks and throw us against the rocks. We were badly bruised, while oars, camera, tools, and a twenty fathom rope all disappeared. The rope and camera I managed to rescue, but nothing else.

At the base of a cliff, immediately in front of where the boat capsized, is a sulphur spring from which strong fumes arise, as from a bucket of burning sulphur. All the rocks nearby are hot. Inside a forty-foot radius were lying a number of dead birds, and, on the rocks, some crabs of a yellowish-green colour. The surf as it fell here on the mouth of the blow and on the hot rocks, was turned instantly into hissing and growling steam. The birds and crabs had undoubtedly been overcome by the noxious fumes. Further along, at the base there are hot vapour-jets, some of which have a white, lime-like, stalactite formation in their bore; others are of a cream colour, others a sulphur. These stalactites crumble into powder when one tries to remove them; their fumes cut the breath and make the eyes tingle.

The cliffs themselves are of a rocky composition unknown to me, but basalt is in plenty. Some of the rock when broken disclosed various tints.

From the boulder shore a slight incline, up which we climbed, leads to the top of the island. There were signs hereabouts of a huge landslide. In places where tons of rock and earth had fallen and rolled to the sea, the ground was barren of herbage. In other places the cliffs had split asunder, and big boulders were lying about, some needing but a touch to dislodge them. The climb to the first level was about 700 feet, over a floor of plentiful, coarse, short grass, pig's face and white convolvulus. We noticed some creepers, one of which has a fruit or pod like the passion-fruit; also a grass like the pampas-grass, knee-deep, and carrying a beastly burr, which clings to your clothes, woollen or cotton, and makes walking a horror. No vicious Australian burr can be compared to it. It works up your trousers and down your socks and draws blood. The first flat was covered with this curse, and with a few acres of bush resembling a Moreton Bay Fig, but only eight to ten feet high, with a spreading top upon which hundreds of sea-birds had their nests; the ground here was knee-deep with droppings.

The birds were mostly blue-billies and gannets and bos'n birds, such as inhabit Lord Howe Island and the Admiralties. Of the *Notornis alba*, a white bird with a red bill, which seems to have become extinct since Lieut. Ball discovered it on Lord Howe Island in 1788, I saw no trace. One large black bird, with pink wattles and a hooked beak, which lays a huge egg of a beautiful and delicate shell, full in the centre and tapering rather quickly at each end, is very plentiful here. I have been told it is the frigate bird. And then there is, in its home in the deep clefts of the cliffs, a little, shy, speckled grey and brown bird, about the size of a carrier pigeon. It moans continually in a weird, distressing way, not unlike a man in mortal agony. Its name I do not know. The little whale-bird, so common at Norfolk Island, is here also. The only insect we saw was a green grasshopper; no lizards, snakes, or rats were observed.

From the summit of the highest point we had a good view of the greater part of the island, disclosing patches of the above-mentioned fig, a few stunted pandanus trees, a few hibiscus. There was no sign of any timber or other shrubs. The soil is extremely porous and rich. We found no fresh water; it is doubtful if there is any, because of the porous nature of the place. But, as time was short, the wind and sea growing angrier every hour, and progress so difficult on account of he burrs and concealed bird and sulphur holes, we had reluctantly to be content with only a few hours inspection. The problem of finding our way back to the ketch, on which was the third member of the crew, our collie mascot, had yet to be faced, robbed, as we had been, of our oars, and faced with such a break in the bay where we had been capsized that any attempt to launch the dinghy from there would have been madness. There remained only a piece of board for a scull. With the aid of the rope-painter we dragged the boat up a nasty cliff of 200 feet, and with difficulty succeeded in launching her from a jutting reef of rock; and then, using the board, we reached the ketch at 8.30 that night. Next morning we saw that further landing was hopeless, so we heaved up the anchor and shaped a course for Fiji.

Landings might be made, here and there, but they would afford no access to the interior, being bounded by unscalable cliffs. I secured specimens of sulphur rocks, alum, and basalt, but most of them disappeared as we launchd the dinghy. The photographic negatives we made were also broken, These losses were very disappointing. but I hope to make up for them when I next visit Hunter Island. When I have more time I intend making a thorough investigation of this strange and unknown place, with its jets and its fumes, visible from the sea on three sides, that call to mind awesome Doré drawings of hissing pools reserved for doers of ill-deeds.

In the coming August the Pan-Pacific Congress will meet in Melbourne and Sydney to discuss problems which are of special interest to the nations bordering on the Pacific. There will be representatives, eminent scientific men, from all these countries, and the meeting cannot fail to give an impetus to the study of some of our fundamental questions, zoological, geological, sociological and economic. The meetings of the congress will be held in the Universities of Melbourne and Sydney, and it is expected that all those who are interested in the advancement and welfare of Australia will become enrolled as members. Various attractive functions, including receptions, popular science lectures, excursions to localities of interest, will be held in connection with the congress.

The Use of Australian Fig Trees and Their Associated Fig Wasps in Reafforestation Work in the Hawaiian Islands.

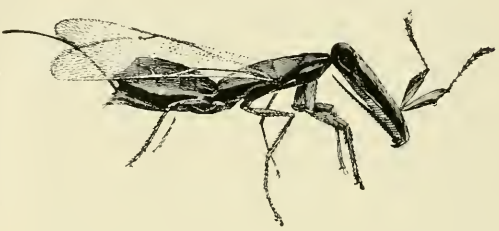
By C. E. Pemberton (*Assistant Entomologist, Hawaiian Sugar Planters' Association.*)

RESIDENTS of Australia, familiar with the Moreton Bay Fig tree, *Ficus macrophylla*, and the Port Jackson Fig, *Ficus rubiginosa*, will be interested in the progress of a reafforestation project now in operation in the Hawaiian Islands, wherein these two splendid trees are being particularly utilized.

In December, 1920, the writer was detailed to Australia to study and introduce these and other Australian trees of the genus *Ficus* to Hawaii. A few fine specimens of both *Ficus macrophylla* and *Ficus rubiginosa* were already growing in Honolulu but had never produced fertile seed and could not hence be used as mother trees for extensive planting. The prime object of the visit was to obtain quantities of fresh seed of these trees, and particularly to ascertain precisely why such trees produce viable seed in Australia but not in Hawaii and elsewhere where a few have been planted.

Both the Moreton Bay and Port Jackson Figs produce fertile seed in and about Sydney. Through the courtesy of Mr. J. H. Maiden, Director of the Sydney Botanic Gardens, the privilege was obtained to pursue a study of the problem and collect seed of these trees in the Sydney Gardens and Domain. Briefly summarised, the results of this work were as follows.

The Moreton Bay and Port Jackson Figs were found to produce fertile seed only through the agency of certain minute insects which act as pollinators. Each type of fig tree has its particular fertilizing or pollinating species of insect. The insect peculiar to the Moreton Bay Fig occurs in its fruits,



Pleistodontes froggatti, the Moreton Bay Fig Wasp, magnified about twenty-three times.
[*Agric. Gazette, N.S.W.*

pollinates the minute flowers within the fig in the manner described below and lives tightly enclosed therein during all but a few important hours of its nine to twelve weeks of life. This insect was not found in the fruits of any other tree, plays no part in the development of seed of any tree other than the Moreton Bay Fig, and naturally has developed or evolved into its own peculiar form coincidentally with the development of this tree in the coastal regions of New South Wales and Queensland, where it is indigenous.

The placing of fine cloth gauze over branches bearing small figs just forming, prevented the fig-insects from reaching them, and in every case no fertile seed developed. Other figs, so screened, but given one or more of the fig-wasps, developed perfectly and contained fertile or germinable seed. Moreton Bay Fig trees planted by man in Melbourne, New Zealand and Fiji, where the tree is not native and where the particular fig-insect above mentioned does not occur, were examined. No fertile seed develops on the trees in these localities. The reason is evident; the necessary pollinating insect is not there. If it has ever

reached Melbourne it has not survived, probably because of the cold winter.

The process of seed fertilization in the case of the Port Jackson Fig was found to be exactly similar to that of the Moreton Bay Fig, excepting that a different species of fig-insect is concerned in the transfer of pollen.

A form of the Port Jackson Fig, growing near the National Art Gallery, Sydney. This species may be easily recognised from the Moreton Bay Fig by its smaller leaves.

[Photo.—*A. Musgrave.*

The life habits of the fertilizing insect associated with the Moreton Bay Fig and the complex structure of the fig itself, all adapted perfectly for the fulfilment of their mutual needs, are too elaborate to present in detail here. The principal facts, however, may be given. The insect emerges from a ripe fig by boring out. It has been a developing larva, or worm-like individual for many weeks within the fig, together with from fifty to one hundred other larvae of the same sort. It has lived and fed in a particular part of the fig. When the fig has finally become fully developed, certain of its flowers, all tightly enclosed inside the fruit, open and scatter a profusion of pollen-grains within the interior. It is then, through the marvellous provision of nature, that these worm-like creatures have completed their development, pupated and become transformed into active wasp-like fig-insects. These mature insects immediately bore out of the fig, as noted above, and come to light with many pollen grains, excessively small, adhering to the body. As soon as the insect is out it searches over the tree or another one in the vicinity, for a very young fig just forming on the tree, carrying the pollen unconsciously with it. It so happens that the young fig, for which the insect is searching, is filled with certain flowers just ready for the reception of pollen. When the fig-insect has found such a fig, it immediately bores into it and begins laying eggs to the amount of about seventy-five. In doing this it accomplishes the principal work in its own life—the housing for the feeding and development of its progeny. But in attaining this object, it has done the tree a service of vital importance. It has carried pollen into the young fig at exactly the time the female flowers within the fruit need the pollen for the fertilization and development of seed. The tree is thus absolutely dependent upon this particular insect for its reproduction or perpetuation and the insect equally in need of this tree, and no other, for the continuance of its existence. This is a marvellous provision of nature to ensure cross-pollination.

Fruit and leaves of Ficus macrophylla, the Moreton Bay Fig.

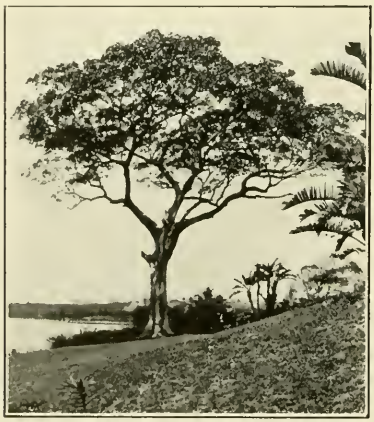
[Photo.—*A. Musgrave.*

The Port Jackson Fig was found to be inhabited and pollinated by another insect, related to, but different from that in the Moreton Bay Fig. The important relation-

ships of this insect to the development of seed on the tree and the beautifully adapted habits of the insect to the special structure of this fig were found identical with those determined for the Moreton Bay Fig.

The insects in neither case are new to science. Mr. W. W. Frogatt has collected *Pleistodontes froggatti* and *Pleistodontes imperialis* from the Moreton Bay and Port Jackson Figs respectively, and was the first to publish interesting data respecting them. This appeared in *The Agricultural Gazette of New South Wales* for June, 1900, and in his *Australian Insects*. The complete details of the writer's work have been published in the *Hawaiian Planter's Record* for June, 1921.

With the above facts in hand one could be certain that an introduction of these living insects to the Hawaiian Islands was essential before the few trees already in the Islands would be made to produce good seed. This was done. Shipments of live insects from the Moreton Bay Fig were successfully made from Sydney in September, 1921, and January, 1922. Both became well established in the trees in Honolulu on which they were liberated and have continued living through many generations of their cycle, actively operating



A Moreton Bay Fig, Ficus macrophylla, growing in front of Kirribilli House, Sydney. This tree is over a century old.

[Photo.—*A. Musgrave.*

An avenue of Moreton Bay Fig trees growing in the Sydney Domain.

[Photo.—*A. Musgrave.*

in those trees and inducing the development of hundreds of pounds of fertile seed right up to the present writing (January, 1923). Hundreds of thousands of young seedling trees have been since secured through the planting of this seed, and it has been made possible only through the introduction of these particular insects. Up to the present at least a million of these young trees have been set out in the Hawaiian forests to serve the desired purpose of aiding in the future conservation of rainfall, increased humidity, cloudiness, fogs and rain. This propagation of seedlings and planting is going on today and will continue.

These trees are hardy, have vast soil-gripping, soil-holding root-systems, are not timber trees and hence not likely to fall under the ruthless axe, are semi-tropic and exceedingly prolific, which makes them in general ideally fitted for reafforestation in large, partially denuded forest-reserves, much in need of a new blanket of green, deeply-shaded growth. The day should come when Australia can be looked to as a country which has given us one of the most important elements of our necessary forests.

Barter, Currency and Coinage.

By William W. Thorpe.

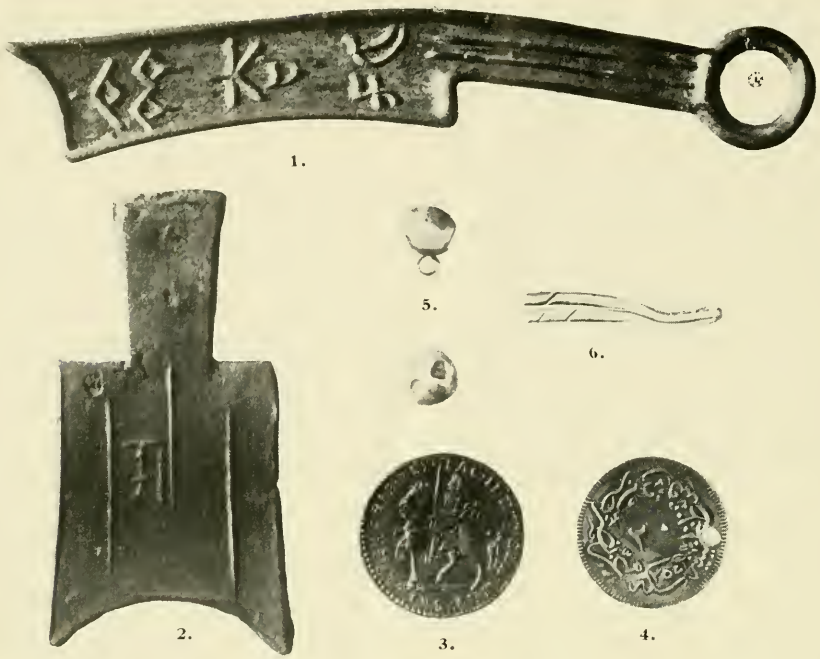
TO-DAY, when one handles money, one is more concerned regarding its purchasing power, or value, than its appearance. As a work of art a coin may be disparaged, but all would realise how essential money is to our life, and what an important factor it is in the mechanism of commerce.

In days of old, those days so often spoken of, money as we understand it was unknown and barter ruled in its place, one commodity being exchanged for another. As an instance of this, one may cite a trading custom that obtains to-day in Papua, where stone-age man yet lingers. The natives of Port Moresby are adept potters, but the sago palm, which affords their principle article of food, does not thrive in their district. Away to the west in the Papuan Gulf the sago palm flourishes, and, as the natives there are not pottery makers, what is more natural than for them to trade? So every year, at the end of September or beginning of October, the season of the south-east trade wind being then at its close, a fleet of lakatois, or large sailing canoes, laden with pottery leave Port Moresby on a voyage to the deltas of the Papuan Gulf, whence they later return with cargoes of sago.

This primitive form of exchange, through which all communities must have passed, later gave way to currency or the adoption of articles not easily acquired or manufactured. A host of things have served in this capacity—grain, wheat, rock-salt, tobacco, gold-dust, cinnabar, sheep, cattle (from which the word *pecunia* is derived), skins, cloth, knives, armlets,

Loading Lakatoi at Port Moresby.

[*After Lindt.*



(1) Chinese "Knife Money." (2) Chinese "Spade Money." (3) Bronze Crown of James II., 1690. (4) Turkish Coin with kalima, 1839. (5) Siamese "Bullet Money," or "Pical." (6) Indian Currency, or "Larin."

Reduced by one-third. [Photo.—*G. C. Clutton.*

rings, and many other commodities. Even to-day some are employed as currency. In the early days of settlement here, rum was used in this manner. It was quite usual for a contractor to be paid in this spirit, and we read that the best inducement to recapture an escaped convict was to offer a reward of five gallons of grog. This form of currency was at first tacitly recognised, but later it became an almost ineradicable curse, and before its final disappearance as a medium of exchange, it caused much recrimination between those favouring its retention and the local authorities.

Some of the forms of currency were perpetuated in the shape give to the coinage. Chinese annals record the issue of bronze "knife money" as early as the 7th century B.C., and shell shaped coins, or metallic cowries in the 6th century, B.C. Later, in China also, "spade money" was circulated. It seems that currency and coinage were for some time recognized side by side, as in B.C. 221, the emperor forbade the use of gems, pearls, cowries, and other natural forms.

Lydian Coin.

[*After MacDonald.*

As distinct from currency, a coin may be defined as an object, usually of metal, bearing an authoritative imprint. The credit of striking the first coin has been divided between Europe and Asia. Sometime about 700 B.C. silver coins were struck at Aegina, Greece, by Pheidon, King of Argos: but almost contemporaneously electrum coins were made at Lydia, Asia Minor, at the instance of King Gyges. These electrum coins contained the proportions of twenty-three per cent silver and seventy-three per cent gold. These early

coins are just oval or bean-shaped lumps of metal, bearing on one side the seal of authority responsible for their purity and weight, and on the other side the scars produced by pressure against the square-headed anvil when the seal mark was hammered on. This simple process was improved upon later, by the addition of a second engraved die, beneath the piece of metal intended for a coin, so that the single blow of the hammer would provide it with a reverse. While most countries to-day have a circular coinage this form is not universal. Other shapes seem to predominate in the east. The Chinese have, since B.C. 275 issued circular coins with square holes which have only recently been superseded. This perforation was for the convenience of threading the coins, a feature which has its good points. In Bijalpur, Bombay there is a form of silver wire currency known as "larin," while in far Siam inscribed silver bullets are passed from hand to hand in business transactions.

According to the exigencies of state, makeshifts and substitutes have been improvised. Amongst these may be mentioned siege or obsidional money, of which there exists to-day a fine series to teach us history. James II., when compelled to flee to Ireland, produced a series of coins known as "Gun money," composed of bronze, and marked with a fictitious value. In justice to this monarch, it must be stated that he intended to redeem them at their face value, when he was once again secure upon the British throne. Other kings have been in similar straitened circumstances, notably Charles I. when he was contesting with Oliver Cromwell for the governance of England. Pieces of plate of varied shapes and sizes bearing curious portraits of the castles wherein he was besieged have been handed down to us and form part of the collection in many museums. The greater number of European coins have on the obverse, if the country is a monarchy, the portrait of a king or queen or a crowned regal monogram. Should the country be a republic the obverse has a design emblematic of freedom. In Mohammedan countries, as it is contrary to religious principles to depict a sultan or kaliph, his place is taken by the *kalima*, or creed, which reads "there is no god but God, and Mohammed is the prophet of God."

Notes and News.

Under the auspices of the British Museum Captain G. H. Wilkins is leading a collecting expedition into the wilds of Queensland and has commenced operations on the Moonie River in the South West of that State. The expedition will last for two years and will operate chiefly in Queensland and the Northern Territory. The British Museum and Captain Wilkins are to be congratulated for their enterprise and we wish all success to the expedition, but we cannot help reflecting rather sadly that our own Museums are so handicapped by lack of funds that they find it impossible to do more than a little sporadic collecting, and no Australian museum has even one collector whose whole time could be given to field work.

Among the recent visitors to the Museum were Dr. Casey Wood, the well known ornithologist of Chicago, U.S.A., who has for many years been making a special study of the eyes of birds ; Dr. T. T. Flynn, Professor of Biology in the University of Tasmania ; Professor Watson and Professor Mainwaring of Adelaide.

From the daily press of 14th May we learn that " A cormorant drive was held on Umeralla and Murrumbidgee Rivers. Shooters were allotted stations along the river banks by the Cooma Progress Tourist Association which organised the shoot." It cannot be too strongly emphasised that we have to be very cautious in interfering with the balance of nature. Years ago an organised and fairly successful attempt was made to shoot down the cormorants on the Lower Murray. But, we are told, this slaughter did not result in an improvement in fish life as had been anticipated. On the contrary it had a harmful effect, for, with the reduction in the number of cormorants, eels, " yabbies," and other forms which prey on the fry of useful species, flourished unchecked, and there was a decided diminution in the number of edible fishes.

By the passing of E. J. Banfield of Dunk Island, North Queensland, Australia has lost a naturalist and writer whose fame has spread far beyond the confines of our island continent. Twenty-five years ago the " Beachcomber " selected Dunk Island as his residence for health reasons, and so congenial did he find his tropical isle, that it became his permanent home till his death on June 2nd. He was an accomplished naturalist, a keen observer, and a writer of delightful books. His first work " Confessions of a Beachcomber " weaved a romantic spell round his little island, which subsequently became a sort of Mecca for scientists and tourists. His succeeding books, " My Tropic Isle " and " Tropic Days," did but enhance this spell, and many readers of these charming works have felt the impulse strong within them to leave the " roaring street " and go " a-Dunking."

The late Mr. Banfield had long been a valued correspondent of this Museum, which was indebted to him for many interesting specimens and natural history notes.

Mr. C. Hedley, who is the Australian Museum representative on the Barrier Reef Committee, left Sydney on 19th May to join a party led by Professor H. C. Richards of Melbourne for the purpose of exploring the reef. A Queensland Government steamer has been placed at their disposal and the expedition intends to proceed along the reef, making lands at several places. Important scientific data are expected to result from their surveys and observations.

The Ornithological Section of the Royal Zoological Society of New South Wales held its April meeting in the Lecture Hall of the Museum. There was a good attendance of members and their friends as well as of the public, and the proceedings took the form of a number of short lectures illustrated by numerous lantern slides.

The Australian Museum

The Museum is open Free to Visitors every Week Day from 10 a.m. to 5 p.m., except on Mondays, when Students and Pupils of Schools and Colleges are admitted by arrangement in the afternoons, and, if the Director is informed beforehand, facilities for Study are given.

It is open on Sundays from 2 to 5 p.m. and on all Public Holidays, except Good Friday and Christmas Day.

Children under 12 years of age, unless accompanied by older people, may be refused admittance.

Donations of even the commonest specimens of Natural History (if in good condition), specimens of Minerals, Fossils, Coins, and Native Handiwork, are always welcome.

The office is open daily from 9.30 a.m. to 1 p.m.; and 2 to 4.30 p.m. (Saturdays to 12 noon); and visitors applying for information there will receive every attention from the Museum Officials.

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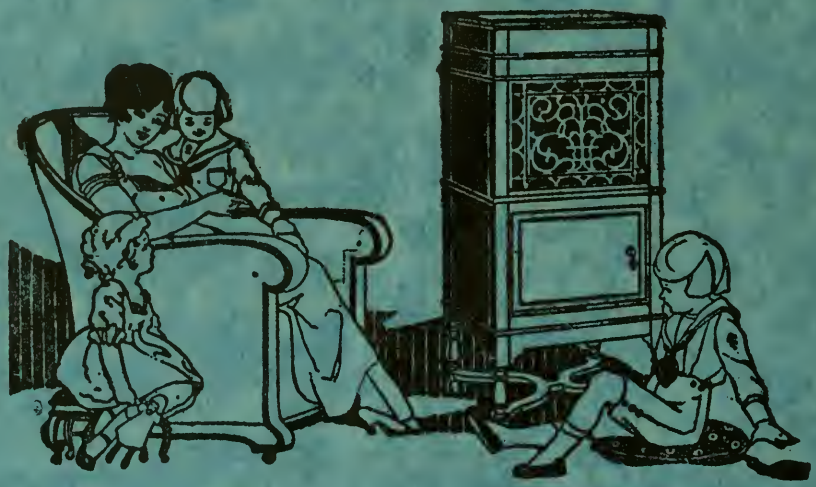

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Allan R. McCulloch, *Zoologist, in charge of Fishes.*
William W. Thorpe, *Ethnologist.*
J. Roy Kinghorn, *Zoologist, in charge of Birds, Reptiles, and Amphibians.*
Ellis le G. Troughton, *Zoologist, in charge of Mammals and Skeletons.*
Anthony Musgrave, *Entomologist.*
F. A. McNeill, *Zoologist, in charge of Lower Invertebrates.*
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J. A. Trimble.

Table of Contents.

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THE GREAT RAVI OF KAIMARI, GULF OF PAPUA.

The entire village is elevated upon platforms built over a huge mud-flat and stick bridge-ways connect the many houses. The family dwellings are of comparatively small size, but the men's club-houses, or ravis, are huge buildings, some hundreds of feet long, and occasionally rise to a height of sixty feet at the entrance.

[Photo.—*Captain Frank Hurley.*

THE AUSTRALIAN MUSEUM
MAGAZINE

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Editorial.

An event of more than usual importance to Australian museums was the recent meeting in Melbourne of representatives appointed by the various State Museums and Universities to discuss matters of common interest. This conference was partly the outcome of a suggestion made by our President, Dr. T. Storie Dixson, who, in an address before the Board of Governors of the Public Library, Museum, and Art Gallery of South Australia, urged that a fuller measure of co-operation between the various Australian museums would be to the advantage of all. The authorities of the South Australian Museum thereupon proposed that a conference should be held to discuss the matter. Later the scope of the conference was extended so as to include such questions as the conservation of our indigenous animals, the issue of permits to collectors, the disposal of type specimens, and cognate matters.

The conference met on August 17th, concurrently with the Melbourne session of the Pan-Pacific Science Congress, and passed the following resolutions for transmission to the Federal and State Governments.

1. That this conference expresses its gratification at the action of the Commonwealth Government in appointing Advisory Committees in each State to assist the Customs Department in connection with permits to take protected animals.

2. That it be a recommendation to the State Governments that they appoint similar committees.

3. That in all cases where specimens are exported the exporter be required to produce the State authority for collecting such specimens, and no person be allowed to export more than the number of specimens shown on the collecting permit. Three days' notice to be given of intention to export, in order to permit of proper inspection.

4. That in all States a gun license be imposed, and a royalty placed on skins obtained for commercial purposes, revenue derived from these two sources to be available for defraying the cost of administering the Animals Protection Acts and the conservation of the indigenous fauna.

5. That overseas collectors be required to furnish types or paratypes of new species and duplicates of rare species obtained in the Commonwealth and its territories to an Australian museum, preferably of the State in which the collections are made, and that local collectors should, as far as possible, make provision for the retention of types and rare species in Australia.

6. That the desirability of establishing additional faunal sanctuaries be strongly urged upon the Federal and State Governments, and that such sanctuaries be selected with a view to ecological requirements.

7. That this conference urge upon the Government of Western Australia the desirability of establishing a sanctuary, or sanctuaries, in a suitable area in the south-western portion of the State, for the preservation of the peculiar fauna and flora of that region.

8. That as far as practicable, there should be co-operation between the various museums and universities, so that overlapping and waste of material be avoided.

9. That this conference urge upon the Australian National Research Council the necessity for alleviation of the present onerous conditions governing postage on scientific works and periodicals.

10. That this conference affirm the value of meetings of this nature, and suggest that arrangements be made for continuance upon some suitable permanent basis.

Notes and News.

By the death of His Excellency Sir Walter Davidson, K.C.M.G., this State has lost one of the most popular and democratic Governors that it has been its fortune to have. His universality was notable, and all educational matters appealed to him. He took considerable interest in the Museum and its exhibits, and on more than one occasion he presided at lectures held in our lecture theatre.

Colonel Sir James Burns, K.C.M.G., M.L.C., who had been a Trustee of the Australian Museum since 1911 died on September 22nd after a long illness. He was one of the best known and most respected men in the commercial and business life of the Commonwealth, and his public spirit and benevolence found expressions in many directions. Probably the finest monument to his memory are the Burnside Homes for Orphans, which he founded and supported so liberally, but this was only one of the many worthy objects of his philanthropy.

Sir James took great interest in scientific matters and was a highly esteemed member of the Board of Trustees. When funds were required for an expedition to Lord Howe Island he was one of the first to make a donation. He was interested in the subject of ethnology, and had accumulated a valuable collection of objects from the South Seas and the mainland of Australia, which are tastefully displayed in his beautiful home, "Gowan Brae," near Parramatta.

The name of Sir James Burns will long be honoured throughout Australia as that of a great citizen and leader, a highly respected business man, and a practical philanthropist.

On September 7th Sir William Vicars was elected a member of the Board of Trustees, to fill the vacancy caused by the death of Mr. George McRae. The new Trustee is well known as a leading manufacturer, and public spirited citizen. He was the chairman of the State Repatriation Board, 1919-1920, and President of the New South Wales Chamber of Manufacturers, 1900 and 1914. Sir William was knighted in January, 1922.

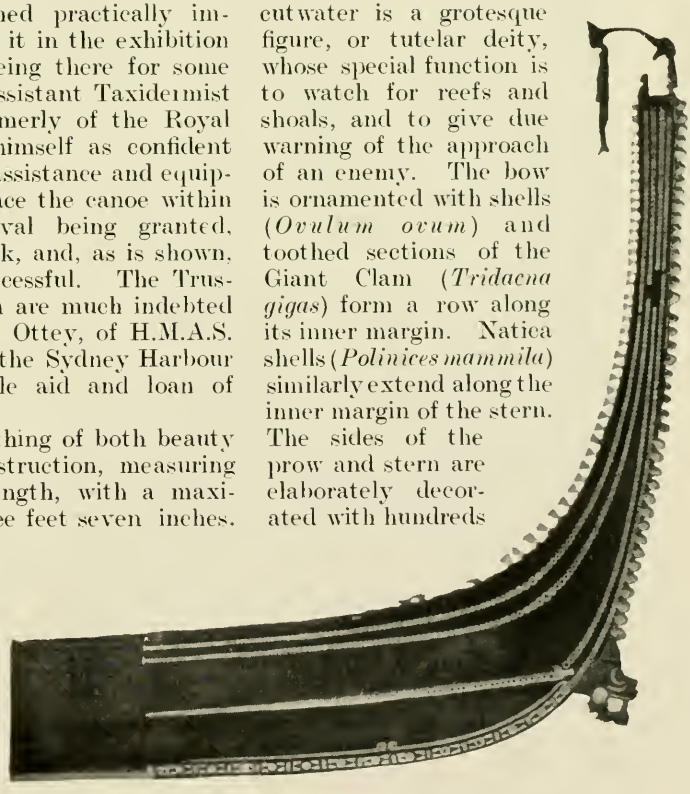
A Tomako, or Head-Hunters' Canoe, from the Solomon Islands.

By William W. Thorpe.

A FEW years ago the Trustees received from Mr. Harry Wickham, of Hobu Peka, Roviana (Rubiana), Solomon Islands, a large and beautiful example of a "tomako" or head-hunting canoe. It is a choice specimen of the craftmanship of savage man, and hough made especially for Mr. Wickham, is true to type, and was looked upon by the dusky inhabitants of the Roviana lagoon with as much pride as we regard a modern battleship.

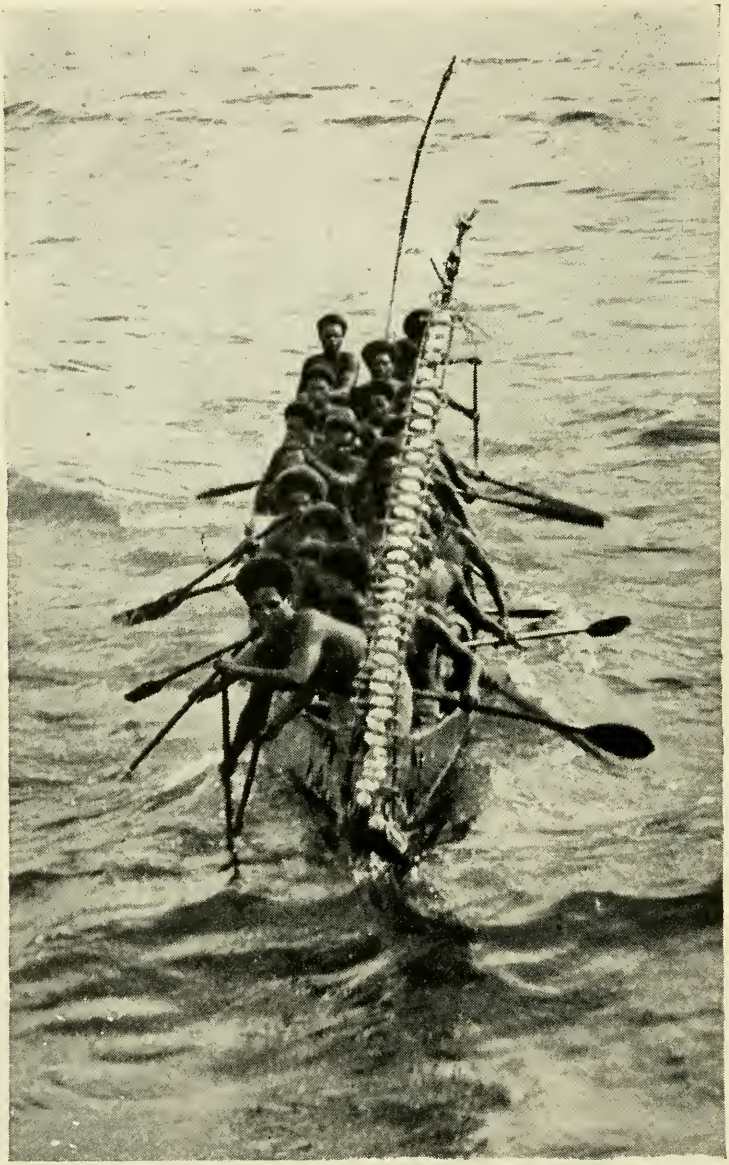
It was greatly to our regret that, owing to its size and unwieldiness, it had to be placed on its even keel in a store, for it seemed practically impossible to display it in the exhibition galleries. After being there for some time, however, Assistant Taxidermist J. H. Wright, formerly of the Royal Navy, expressed himself as confident that, with proper assistance and equipment, he could place the canoe within the halls. Approval being granted, he essayed the task, and, as is shown, was eminently successful. The Trustees of the Museum are much indebted to Warrant-Officer Ottey, of H.M.A.S. *Melbourne*, and to the Sydney Harbour Trust, for valuable aid and loan of tackle.

The canoe is a thing of both beauty and intricate construction, measuring forty-six feet in length, with a maximum beam of three feet seven inches. Others are recorded ranging from sixty feet long and having a beam of four or five feet. The prow and stern are gracefully curved, the former rising to an elevation of nine feet six inches, while the stern is about eighteen inches higher; the effect of these is to produce what seems to be an elongated crescent. They are purposely high to protect the crew against arrows and other missiles when advancing or retreating. Diminutive carvings representing human figures and feather plumes surmount the prow and stern, while attached to the cutwater is a grotesque figure, or tutelar deity, whose special function is to watch for reefs and shoals, and to give due warning of the approach of an enemy. The bow is ornamented with shells (*Ovulum ovum*) and toothed sections of the Giant Clam (*Tridacna gigas*) form a row along its inner margin. Natica shells (*Polinices mammila*) similarly extend along the inner margin of the stern. The sides of the prow and stern are elaborately decorated with hundreds



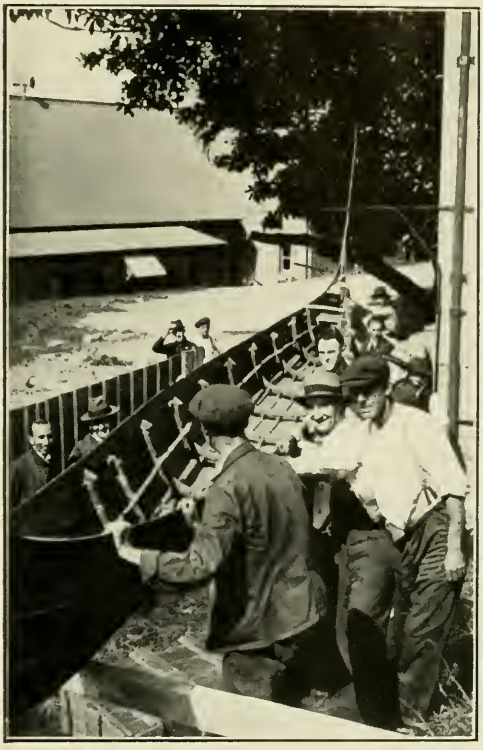
The prow of the canoe, showing the handsome inlaid work and other ornamentation.

[Photo.—*G. C. Clutton.*



A Solomon Island tomako or war canoe, showing the tall prow and stern which partially protect the crew from arrows and other missiles of the enemy. The prow is decorated with white cowries, Ovulum ovum.

Block by courtesy of *The Sydney Mail.*] [Photo.—*G. Toombs.*



The canoe in process of transference. Note its beautiful lines and sound construction. Seats rest upon the bearers attached to the ribs.

[Photo.—A. *Musgrave.*

of inlaid sections of pearl or *Nautilus* shell, each piece of which is carefully and accurately carved into various patterns, which harmonise with those adjacent to it. These sections are embedded in the same putty utilised in making the various seams and joints watertight.

The process of inlaying is a wearying task. Each fragment has to be either rubbed or filed into shape and placed into putty whilst that is yet workable. The workmen who do this shaping are not necessarily skilled. A chief calls upon his dependants to supply these pieces, about one or two thousand per village, which the artist fashions into designs upon the canoe. The Solomon Islanders seem to be the only natives of Melanesia who favour this form of decoration. One will find inlay work on many of their productions, and this is an almost infallible guide in localizing native handiwork. Clubs, bowls, combs, staves, etc., are treated in this manner; moreover, the pearl shell is largely used for personal ornaments such as breast pendants, the favourite design being the frigate-bird and the bonito.

Canoes are generally believed to be "dug-outs" or more or less shaped logs from which the centre has been hollowed out. This vessel, however, is a much more elaborate attempt at shipbuilding, and its lightness and slender lines conduce towards both speed and seaworthiness. In building a "tomako" a V-shaped keel is first laid down accurately, and the sides are built upon it in sections. The planks forming the latter are carefully fitted to one another, their edges being bevelled and having holes drilled through them so that they can be sewn tightly together with split cane or the stem of a climbing fern (*Lygonia*). The seams are caulked with a compound of red ochreous earth and tita resin, made from the fruit of a tree (*Parinarium laurinum*) which grows abundantly in the island jungles. Ribs, carefully selected and shaped, and to which the planks are lashed, keep the sides rigid and give them the correct curve. Seating accomodation is provided for twenty-two rowers, the seats being loose slabs which rest on a bearer or stringer much the same as those of our boats. Nineteen oval-bladed paddles were presented by Mr. Wickham with the canoe, and the whole is a wonderful example of the work of native artisans who, with a simple equipment of stone and shell implements, fashioned these wonderful vessels for their head-hunting expeditions.

Years ago, when the "blackbirder" and the "beachcomber" made the South Pacific their happy hunting ground, these canoes played a ghastly part in head-hunting and slave-raiding expeditions. Head-hunting was a strong feature of the life of the Solomon Islander, and numbers of these great canoes, with their occupants armed to the teeth, set off at intervals on these missions. They would glide along the coast in such a way as to be indis-

Hoisting the canoe—a difficult task. The window opening only allowed about an inch clearance on either side.
[Photo.—*A. Musgrave.*

tinguishable, so much would they resemble the island reefs. The marauders dearly loved to take a village by surprise at dawn and, posting sentinels at the exits of each house, they would tomahawk their victims as they attempted to escape. Or perhaps they would engage in a friendly transaction with the inhabitants, trading or buying slaves, and then suddenly turn upon their hosts. In this manner, whole villages were occasionally destroyed. These slaves, generally speaking, were well treated; but when a sacrifice was required to celebrate the launching of a new canoe, or something equally important, they supplied it.

Special houses were constructed in which the canoes were kept, and they were regarded as "tambu," or sacred, and reserved for men only. In them were also kept the heads of the poor unfortunates who made the sacrifice.

As raiding and head-hunting expeditions are now sternly discountenanced by the authorities, the need for these war-canoes is fast disappearing, and the time is not far distant when they will be no longer manufactured, and the art of ship-building in the Solomons will die with those who, living to-day, alone understand it.

Prize Essay Competition.

Mr. George A. Taylor has generously presented five guineas to be awarded as a prize for the best essay by a pupil of a New South Wales school, the subject being "A Visit to the Australian Museum." The competitors, who must be between the ages of twelve and sixteen on 1st March, 1924, may select any department or may write a general account of the whole institution, the essay to contain 1500 to 2000 words. Teachers are asked to select the three best essays by pupils of their school and forward them to the Director of the Australian Museum on or before March 1st, 1924. The successful essay will be published in THE AUSTRALIAN MUSEUM MAGAZINE.

The Mud-Dwellers of Kaimari.

NOTES FROM THE DIARY OF ALLAN R. McCULLOCH.

October 7th, 1922.

WE are anchored at the village of Kaimari far up in the Gulf of Papua, and our little vessel, trim with wireless aerials complete, and the flying-boat "Seagull" alongside, compare strangely with the weird ravis and fantastic huts of the natives. Surely such circumstances as bring these ultra-modern contrivances into direct contrast with the dug-out canoes of primitive natives must be rare indeed.

It is the heart of a huge mangrove swamp extending over hundreds of square miles, and we are walled in on all sides by wonderful and beautifully green mangroves, varied only with a few coconut palms which have been planted on some made ground. A myriad waterways intersect the forest, and swift tides run to and fro, flooding everything at the springs and exposing a huge expanse of mud-flats at low water. Strangely enough, we are not bothered with mosquitoes, the torrential downpour of rain which occurs nightly together with the tidal streams scouring the mud so thoroughly that they are unable to breed. Tiny sand-flies, however, appear as evening sets in, and cause some little annoyance with their irritating poison.

Kaimari is a queer village, and its inhabitants live almost entirely upon stick-platforms erected above the mud. The houses are on piles five or six feet high, and from each a narrow bridgeway leads out to the "road," which is likewise built of sticks laid upon countless uprights. These are sadly out of repair, and we are ever in danger of breaking through their rotten timbers, which are apt to roll under one's feet or tip up and so precipitate us into the soft squelchy mud below. The natives are very nimble upon them, and scatter in every direction at the slightest sound of a crack. At high water fish, crabs, and wading birds move about beneath the houses, while large pigs and their families nose among the slime in search of food when the mud is exposed.

Most conspicuous among the numerous buildings are several huge structures known as ravis which are the fore-runners of our city clubs. The men foregather within them to smoke, feast, and while away the hours making dance-masks, etc. Twenty years ago, before the government took control, a ravi was the fortress of the village, and the warriors remained on hand ever on the alert against sudden attack. The women and younger children paddled off in their canoes to plantations in the mud, or went in search of shellfish, crabs, and fish to supply the family larder. But now fighting is forbidden and, save when building canoes or houses, the men have but little to occupy themselves, so they sleep through much of the day, while their women-folk carry on the heavier work as has been decreed by custom.

Stepping ashore a few days ago, we made our way to the big ravi illustrated in the frontispiece. I took a tape-measure with me, and found it to be two hundred and eighty-five feet long and thirty-three feet across the entrance, while its curious peaked top rose to a height of sixty feet. It was short in comparison with a ravi of Kerowa, in Goaribari Island, which was four hundred and ninety-five feet from end to end, but its height made it more imposing than the longer one, of which the roof rose to a uniform elevation of only fifteen feet. We found a group of men sprawled about the entrance some sleeping, others yarning and smoking, and still others initiating some boys into the art of making fantastic masks or "kaivu kuku." These

THE DELTA REGION FROM AIRD HILL, GULF OF PAPUA.

Showing a vast expanse of mangrove forests intersected by endless waterways, which extends for hundreds of square miles, and is inhabited by strange mud-dwellers, who scarcely know what dry land is.

[Photo.—*Captain Frank Hurley.*

vary from small hat-like masks to huge structures fifteen feet in height. They are constructed of fibre over a framework of cane, and wonderful patterns are woven upon the surface which are later picked out with red and black upon a white ground colour. A long beak-like snout represents the jaws of a crocodile and a grass skirt covers the bearer who carries the mask over his head upon a central pole.

Some hundreds of these, in various stages of completion, hung from the walls and along each side of a central aisle, and in the gloomy interior, with the smoke ascending from several fires, appeared so weird and impressive that we subconsciously moved among them quietly and spoke in subdued tones just as one does in a cathedral. All appeared so strange and grotesque that we felt we were enacting some scene from one of Sir Rider Haggard's African fantasies. The natives eyed us suspiciously, having little confidence in Hurley's cinema and other cameras, and a wholesome fear of the flying-boat which had descended upon them like a demon from the skies.

Sullen and brown-skinned, they were scantily arrayed in their finery of dog's-teeth necklets, shell armlets, and head-dresses made of the gorgeous plumes of the Bird-of-Paradise. The coming of the 'plane called for much discussion among them, and some favored a retirement to the bush to hide from its baneful influence, while others believed its evil spirit could be propitiated with an appropriate sacrifice. We encouraged the latter idea, for it would be disastrous to lose such splendid "movie" subjects. Accordingly, the life of a large pig was abruptly terminated with a few well-directed arrows, and a procession of decorated bow-men proceeded solemnly towards the "Seagull," and laid the sacrifice ceremoniously upon her bow.

In addition to being a club-house, and fortress, a ravi is a native museum and the stronghold of the village sorcerers. The front portion is a general meeting place where the juniors, freshly

initiated into the status of manhood, foregather with their elders. Further back it is subdivided into cubicles which seem to be allotted to the males of different family groups. Each has its own fire-place of clay built upon a frame-work of cane, and bows, arrows, and other properties hang upon the walls. Long wooden hooks with a disc of bark above them are suspended from the roof, and serve to keep food, which may be hung upon them, from the ravages of numerous rats which find comfortable shelter in the thick thatch. But strangest of all are racks of human skulls adorning each cubicle, which are the remains of enemies. In days gone by the skulls of Kaimari numbered many thousands, and were added to as opportunity offered by raids upon neighbouring villages. So they were destroyed by order of the government, and but few are left. In Urama nearby, however, skull-racks are still preserved, and are greatly valued by their owners. We endeavoured to purchase them, offering untold wealth in the form of tobacco, arm-shells, brightly coloured cloths, and other things treasured by the natives, but our blandishments were in vain until we chanced upon a happy scheme. Hurley informed the owners, through an interpreter, that they were required for a great ravi in Sydney far bigger than any the Gulf had ever known, and wherein were stored skulls from north, south, east and west. And we told them this ravi would exist for all time, when they and their children's children were long dead, and that the skulls we asked for would be shown to everybody so that they might know what a great race of fighters the Urama people were. This flattery succeeded where all else had failed, and at last the old head-man Gormi went to his rack, and, after much deliberation, selected a skull which he exchanged for approved trade goods. His example was followed by the others, and Hurley succeeded in procuring a small number for exhibition in the Australian Museum. We packed them carefully in cases, the natives providing soft fibre for the purpose, and they obviously approved of our appreciation of their treasures.

Beneath the racks of human skulls are ranged crania of pigs and crocodiles, and rows of strangely carved boards which seem to have some ancestral significance. They are conventional representations of a face, with many accessory decorative scrolls and angular lines, and, being coloured with red, white, and black pigments, demand attention among their sombre surroundings. They are of endless variety but each of the delta villages has some characteristic feature in the design which is carved upon these boards, and, though they are interchanged between the various villages, their source can be recognised by those who are familiar with them. We collected many at Kaimari which had come from quite a number of neighbouring villages, though by what means and why, we were unable to ascertain.

Hurley photographed all these strange decorations assiduously, expending endless plates and many hundreds of feet of film until his record was complete. We then passed on to a dark inner sanctum which was carefully screened from public view, though many presents of the coveted "kuku" (tobacco) had to be distributed before we were permitted to enter.

This portion of the ravi was over sixty feet long, but had narrowed down to twelve feet wide and was only eleven feet high. When our eyes had become accustomed to the darkness, we perceived seventeen queer figures made of interlaced cane, and in part resembling a four-legged cassowary with the yawning gape of a crocodile. Beneath each one was a strange bundle wrapped in spathes of palm-leaves and bound with cane. What was concealed within them, and what was their significance? It is part of a naturalist's training to be curious about things which are unknown to him, and the very fact that we were not permitted to touch them, made us desire more than ever to examine their contents.

For several days we sought an opportunity of investigating and photographing these sacred precincts, and

A CENTRAL AISLE OF A RAVI AT URAMA, GULF OF PAPUA.

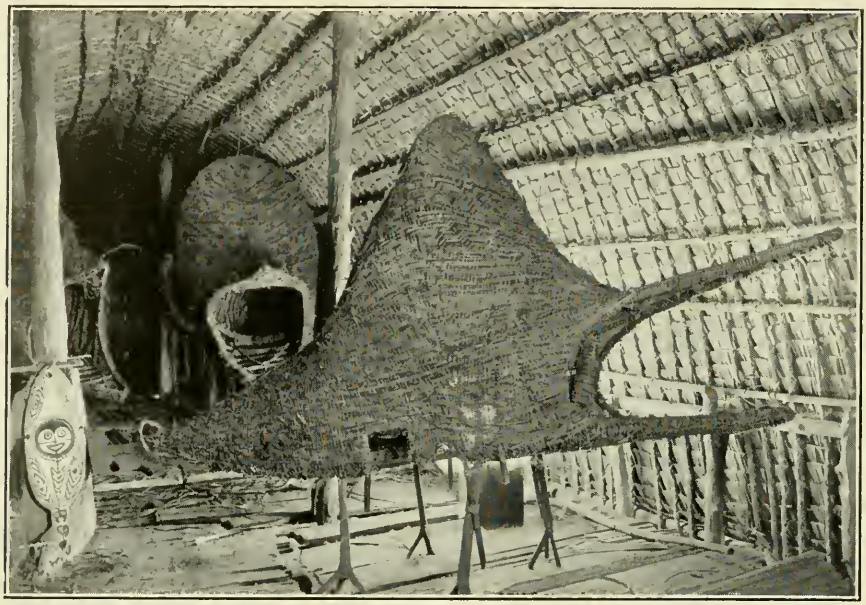
This picture illustrates the cubicles on each side of the building, with the skull-racks and properties hung upon the walls. It is constructed upon piles above the mud, and the water flows beneath it at high tide. The floor-boards are the bark of the Goru palm and the building consists of a frame-work of saplings thatched with leaves of the sago palm. Men alone are permitted to enter, it being considered that sickness would befall any women who were to gaze upon the sacred kaiva-kuku masks before the appointed time.

[Flashlight Photo.—*Captain Frank Hurley.*

A SKULL-RACK IN A RAVI AT URAMA, GULF OF PAPUA.

The skulls of enemies are preserved and handed down as heirlooms from one generation to another. They are greatly valued, and efforts to procure them for the Museum collection were usually unsuccessful. Some were procured, however, and it is hoped to exhibit them in the gallery arranged as here illustrated. The end of a ravi will be constructed and all the properties, such as dance-masks, carved gopi-boards, bows, arrows, etc., will be brought together in their correct association.

[Flashlight Photo.—*Captain Frank Hurley.*



THE SACRED GOPI RAVI IN THE INNER SANCTUM OF A RAVI AT KAIMARI.

Cane figures of mystic significance which are seen by the senior men only. Fear of them serves to keep the younger men in subjection, who provide appropriate sacrifices which are confiscated by the attendants, or so-called sorcerers.

[Flashlight Photo.—*Captain Frank Hurley.*

fortune favoured us one day when all the village was gathered at the house of one who had died, and the ravi was left almost empty. With large bribes an old keeper of the sanctum was induced to permit the introduction of the cameras. The barrier screen was moved farther forward and one of the figures called "Gopi-Ravi" was posed before the camera. When all was ready a large charge of flash-powder was ignited, and the picture secured, which is represented on this page. Our old guide fled to the outer part of the ravi, and could be induced to return only when he perceived that no harm had befallen anybody.

Negotiations were then entered into for permission to examine the contents of the mysterious bundles, which, after much wrangling, was finally gained. The old chap was fearful lest the men should return to the ravi, and insisted upon haste. But this was not easy for the wrappings of bark and cane were very stiff and dry, and I had to lie prone on the floor in the cramped space, while spiders, lizards and scorpions ran out over my hands as I untied them. I found each bundle to contain a number of "bull-roarers" or carved pieces of wood which create a humming or droning sound when whirled around on a length of string. Our efforts to purchase a bundle of them aroused much ill-feeling, a fact that was readily explained later when we learnt that each member of the ravi is apparently represented by a bull-roarer, and believes himself to be under the protection of the particular gopi-ravi under which it is stored. Such beliefs are cultivated by the older men or so-called sorcerers, who thereby dominate the younger members and so ensure their proper regard. The juniors are taught that pig is injurious to them as food, and likewise crocodile and other dainties, and that only the older hands can eat of them without evil consequences. We witnessed a number of young men returning from a successful hunt a few days ago, with four pigs which they had killed in the bush, and they chanted a wild song of triumph, while their canoes were decorated and

streamers of palm leaves hung from their arms. We supposed they would feast royally upon their kill, but discovered later that the older men were the only ones who benefitted. It was doubtless a sacrifice to the demands of the gopi-ravi skilfully manipulated by the older men in their own interests. Perhaps there had been an unusually violent whirling of the bull-roarers, through whose droning voice the younger men had received intimation of the wants of the gopi-ravi and their attendant rogues.

The canoes of the Gulf region are extraordinary craft, being merely hollowed logs without a keel and so lightly balanced that they topple over at the slightest provocation. Stranger still is their cut-away stern, which has nothing to prevent the ingress of water, and must needs, therefore, be plastered across with a bridge of mud. That they are well adapted to cope with swift running tidal currents is certain, and they are readily propelled against streams which would sweep our larger vessel away in spite of her motor. Every day we saw the good ladies of Kaimari paddling off to their plantations with several members of their families, each assisting with a paddle suited to his or her small size. Occasionally we hired a large canoe, and, loading in cameras and guns, were paddled through the maze of waterways in search of pictures and specimens for the Museum. We scarcely dared to move within them for fear of disturbing their balance, but our native canoesters stood upright, and, dipping their paddles rhythmically, drove us along at fine speed. Winding up long waterways we passed through a maze of forests, with the branches of the trees meeting over our heads and tempering the hot sunshine. Gorgeous green and black butterflies flitted through the undergrowth and gaily coloured kingfishers darted from the overhanging branches to snatch some unwary fish from the muddy waters.

The manufacture of these canoes is a very important feature in the lives of the natives of this region and plays a prominent part in trading relationships with the natives of different parts of Papua. Each year, when the south-east trade wind is nearing the end of its season, large canoes from Port Moresby are tied together and a platform is built over them and fitted with shelters and large crab-claw sails. These are called lakatois and are sea-going vessels in which the Motuans travel north-west to the Gulf country and meet with the natives of Kaimari and other villages. They bring with them arm-shells, clay pots and other trade goods such as are otherwise unknown to the Gulf people, and exchange them for sago and new canoes. There are no trees suitable for canoe-making around Port Moresby, so they must be secured from districts farther west, and it is the business of the Gulf natives to supply suitable trunks. About Christmas time the lakatois make their appearance in the Gulf and trading commences, accompanied by feasting and general merry-making. The "kaiva-kuku" ceremonies take place and the giant masks that have taken so long to prepare are brought out of the seclusion of the ravis. They are exhibited in public for the first time, the women and children witnessing the dance that takes place. But their life is brief, and they are soon cast into a fire to complete their sacred cycle. Their destruction is apparently all important and may not be varied, so that our efforts to secure specimens were futile though we offered wealth beyond comparison in exchange. It is even against the rules for them to leave the ravi until the time comes for the dance that ends in their destruction, but Hurley managed to arrange a special rehearsal performance in which over one hundred masks appeared and which he successfully filmed. It was firmly believed that if any woman or children caught sight of these kaiva-kukus, they would surely perish, so a large screen was erected upon a platform in front of the ravi to hide them from public view. At Urama, where kaiva-kuku danced likewise for us, all the women and uninitiated boys were dispatched from the village in canoes at

dawn, and none but the men remained dressed in all their barbaric finery.

The endless mud and the fact that much of their lives is spent in canoes has induced the Kaimari people to adopt an extremely simple type of clothing. This never draggles in the mud and offers but little restriction to any movement. The mud itself is often utilised as a partial covering, and many Kaimarians are plastered with it for one reason or another. As a mourning costume it is in general favour, and widows smear themselves with it so thoroughly as to almost hide their identity. String armlets and necklets likewise indicate family bereavement and, combined with the mud, serve to produce a distinctly unhappy effect. Before retiring for the night small children are likewise smeared over by their fond parents to protect them from the bites of irritating pests.

The Kaimari village is large, including perhaps fifteen hundred residents and the food-supply of so large a crowd is an important feature. They obtain many fish by setting barriers across tidal creeks to trap those which enter them at high water. Crabs and shell-fish are also plentiful in the mud and wild pigs are occasionally captured in the mangrove forests, but most important is the wild sago, which flourishes along the banks of the waterways and not only supplies the mud-dwellers with food but also provides a surplus which is traded with visitors from other districts.

A widow plastered with mud.
[Photo.—*Captain Frank Hurley.*

It is intended to construct an exhibit in the Australian Museum galleries representing a portion of a Urama ravi in which the masks, weapons, and other properties will be exhibited in their proper association.

In a lecture, "Passing of Wild Animals," delivered at the Museum recently Mr. A. S. Le Souef, Director of the Taronga Park Zoological Gardens deplored the fact that wild animals are disappearing before the advance of civilisation. This is happening in every country in the world and is perhaps inevitable, for man has to choose between domestic and wild animals and naturally prefers to have the land reserved for the former. In America, Africa, Asia, Australia, the story is the same, though here the forces of extermination have not yet proceeded so far as in the older countries. It has often truly been stated that the indigenous mammals of Australia are the most interesting in the world, and it behoves us to take what steps are possible to prevent, or at any rate postpone, the threatened extinction of these original inhabitants of our continent.

Several of the delegates at the Pan-Pacific Science Congress visited the Museum during the Sydney Session and, on August 29th, the Section of Anthropology and Ethnology came as a body under the leadership of Professor A. C. Haddon. The delegates were received and welcomed by the President, Dr. T. Storie Dixson, and conducted round the Ethnological galleries by Mr. W. W. Thorpe. On August 30th the section held its ordinary meeting in the Museum Lecture Hall, and Dr. P. H. Buck, delivered a cinema lecture on the arts and crafts of the Maoris.

"The Beachcomber" and His Tropic Isle.

By Charles Barrett, C.M.Z.S.

IT was pleasant, after a stormy passage from Townsville, to see "The Beachcomber," a slim figure in oilskins and sou'wester, wave a greeting from his tossing launch, in Brammo Bay. We made the coral beach in darkness, and presently I was following my host through coconut palms to the bungalow.

While the storm raged, we sat indoors, and talked at ease. I heard Dunk Island news, and stories of the

"The Beachcomber" in his bungalow garden. A characteristic portrait.
[Photo.—*C. Barrett.*

The Bungalow, Dunk Island. Viewed from the coconut avenue leading to the beach in Brammo Bay.

[Photo.—*C. Barrett.*

tropic sea; and gave, in return, a budget from the busy world, which my friend, so many years ago, had counted well lost for the peace and beauty of his favoured isle. I have golden memories of my busy-idle days as Mr. E. J. Banfield's guest, and the letters he wrote to me are so crowded with pictures of the isle and its wild life, that, reading them, I win back the pleasure of our rambles together. It is hard to believe that he is dead.

His years were no burden to "The Beachcomber." I marvelled at his vigor, as I toiled after him through the brush, or along the sunlit beaches. He tired me often, but showed no sign of fatigue himself. And all the way he talked delightfully of the joy of life on a tropic isle, of birds and their ways,

and, more rarely, of war and its aftermath.

You have read "The Beachcomber's" books, and need no detailed description of his island. I give you only a visitor's impressions, with glimpses of wild things seen around the bungalow and farther afield.

For two days the rain continued; then came a clear, calm day for "exploring." But, for a while, I was content to observe near home, to loiter in the garden, and ramble through half-tamed country a little beyond, with, for variety's sake, a stroll along the beach in search of shells.

GARDEN ACQUAINTANCE.

A tropic garden never fails to yield spoil to the naturalist; nowhere have I found a richer "field" than that about Dunk Island bungalow. When, on the first morning, I surveyed the little rain-drenched world from shelter, unfamiliar scents and sounds crowded to greet me, and I saw birds and blossoms that were old acquaintances, because they seemed to come straight from the pages of my good friend's books. He has described them so faithfully, you see, and with the perfect understanding of the true naturalist.

A coucal (*Centropus phasianus*) flew heavily from the grass into a small tree, shaking rain drops from leaf and bough as it alighted. It saw me, not three yards away, but showed no sign of fear. Soon it commenced to utter the mellow "Glooc! glooc!" notes, like the gurgle of cream from a bottle, as "The Beachcomber" has said. Later I heard the resonant "Toom! toom! toom! toom!" and some other notes. For the swamp pheasant is a gifted vocalist, though most of us are familiar chiefly with its "glooc! glooc!" call. Every day, on the isle, I heard the coucal's voice; and once, near the bungalow, I came upon one so busy in the high grass that it failed to rise until I was barely a yard away. Mr. Banfield befriended all the wild birds of his demesne, and even a stranger shared a little in the confidence that his kindness had won from the coucal and some other species.

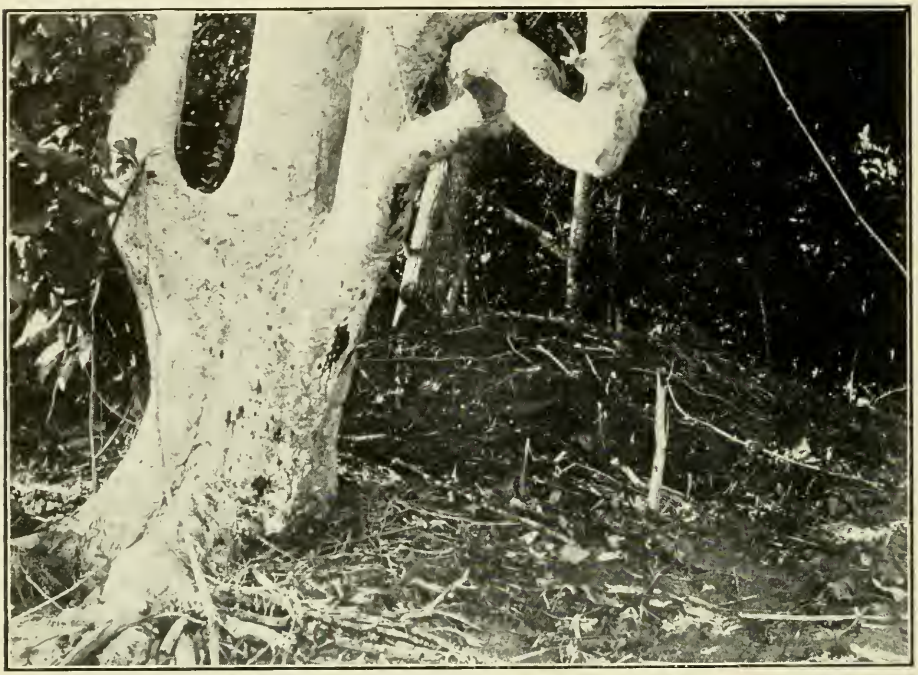
Honeyeaters were calling in the rain, and I heard the notes of an unseen dove—the barred-shouldered species—(*Geopelia humeralis*), which tried my patience as a photographer, at a nest on Masthead Island, long ago. Fruit-pigeons, too, were calling, in trees beyond the garden fence; and perhaps the friendly little green *Chalcophaps* was pecking on the ground beneath the boughs.

SPLENDID BUTTERFLIES.

Though the weather "lifted," I still found it profitable to remain near home; the garden lured so many birds, and a host of butterflies. Nowhere, except on a spring day's journey from Jerusalem to Bethlehem, have I seen such troops of splendid butterflies. Over the crimson Hibiscus flowers, swallowtails (*Papilio ulysses*) and "bird-wings" (*Troides priamus*) hovered or soared on widespread, shining pinions. There were scores of these glorious insects about the Hibiscus hedge, and all other flowering plants in the garden had their wooers too. I noted nearly twenty species, and not a dingy-colored "fly" among them. Some were smaller than the common "painted lady" (*Pyrameis cardui*), but rivalled in brilliant coloring the huge papilios.

On an orange tree near the window from which, each day, I saw the mists of the morning rise, both caterpillars and pupae of a swallowtail were found. These larvae were protectively colored; but compared with those of another species (not identified), they were bold advertisers of their presence. The unknown caterpillar, viewed from a distance of barely a yard, resembled one of the grey-brown leaves on which it had been feeding—a leaf nibbled curiously on one side of the mid-vein, and hanging "face on."

In the garden also were many strange insects; a mantis which, facing one, tried to mimic a tiny pink and green flower; and, on the under surface of broad *Macaranga* leaves, gem-like bugs, all emerald green, camouflaged as



Mound of the Scrub-Fowl (Megapodius reinwardt) in the shade of a giant fig tree, growing on the edge of the jungle.

[Photo.—*C. Barrett.*

beetles. I gathered, around the bungalow, a tube full of real beetles, and one proved to be a new species. Shells and insects alone were collected during my stay on Dunk Island. This place for years has been a sanctuary, and tabu to the man with a gun. Had I been a mammal or bird collector, "The Beachcomber" would never have given me the freedom of his isle. But he did not forbid a modest toll of insects and mollusca.

THE MOUND-BUILDERS.

Of "The Beachcomber's" favourites among the bigger birds, I saw little, but I heard their curious calls, and examined several "nests." The scrub-fowl (*Megapodius reinwardt*) likes the sound of its own voice and is vocal both night and day. It prefers shadowy places, and I never saw one in the open. But the island birds have become confiding, at least when visitors are not present. Soon after I had departed, Mr. Banfield wrote, describing the "circumloctuory" gambols of scrub-fowls in the bungalow garden. This species, so remarkable for its nesting habits, is also a clown, it appears. "The Beachcomber," in his *Confessions* says that it has no ear for music: "It seems to have been practising 'cock-a-doodle-doo' all its life in the solitary corners and undergrowth, and to have not yet arrived within quavers of it."

A mile from the bungalow, on the fringe of the forest, there is an unused mound of *M. reinwardt*. It was, when I saw it, like a weather-worn hillock, and grasses and other plants were growing upon the summit and slopes. Beneath the boughs of a great fig tree (*Ficus sp.*), it was shadowy and moist; although as the sun descended, it re-received a promise of light. Other mounds were seen in the jungle, some distance from the sea. The birds were heard calling near them, and one was being "worked."

SMALL FRIENDLY BIRDS.

None of the island's tame-wild birds

Brammo Bay Beach, Dunk Island. A Flame Tree in foreground, whilst in the distance is seen the Queensland mainland. This beach was Mr. Banfield's favourite promenade.

[Photo.—*C. Barrett.*

charmed me more than a honey-eater, which came every day to feed upon a bunch of over-ripe bananas hanging in a shed. From its favorite perch, in a tree nearby, it would fly straight to the pendant fruit, provided solely for its benefit. A few quick pecks, and back to the bough; and thus many times, until hunger was appeased, or some sudden fancy took the bird away to the jungle creek. "Jacky," if I remember aright, was the name of this feathered pensioner.

The sunbirds (*Cinnyris frenata*) were not nesting when I stayed at Dunk Island, but they foraged about the bungalow, and so I had the rare pleasure of seeing Australia's "humming birds" at their best. They are beautiful small beings, active and graceful as Oberon's people, but rather assertive than gentle, in regard to their "place in the sun." I never tired of watching them flash from flower to flower, in the sunshine, or visit the cool verandah, where, in some seasons, they select a building site. "The Beachcomber" has described their aerial frolics when the flame tree's flowers are due: how they gather, six or more, in a circle, and "with uplifted heads directed towards a common centre," utter their twittery song notes in unison.

THE DRONGO AND OTHERS.

Trees in the neighborhood of the bungalow were frequented by the curious drongo-shrike (*Chibea bracteata*), the "bully, swaggerer, swashbuckler," of a biography in *Confessions of a Beachcomber*. He is a permanent resident, and his actions indicate that he regards himself as, at least, one of the lords of the isle. Though a bully, and "boastful," he is no coward, for bigger and stronger birds go in fear of the drongo. I walked right beneath a fish-tailed, scolding "king-crow."

He became silent, but did not leave his perch on a high bough. When nesting cares are over, this noisy and assertive fellow becomes quiet and peaceful; he is seen far more often than he is heard.

Concerning the nutmeg pigeon (*Myristicivora spilorhoa*), I can say little from personal observation, for only the forerunners of the flocks had arrived among the islands when I departed south. But my host told me that the days of migrating multitudes had gone, perhaps for ever. This splendid species, once so amazingly abundant, is threatened with the fate that befell the passenger pigeon of America. Nutmeg or Torres Strait pigeons have been ruthlessly slaughtered for "sport" in the nesting season, on the Barnard Islands and other haunts of the species.

Nest and egg of the White-capped Noddy (Anous leucocapillus). These birds nest in thousands among the Capricorn Isles.
[Photo.—*C. Barrett.*

In his last letter to me, Mr. Banfield urged the need for strong measures to "save the nutmeg pigeon."* He was ever ready to champion wild birds, and, in North Queensland, no one has done more in the cause of protection. I know that he had fears for the future of other birds besides the nutmeg pigeon, From his own island sanctuary some forms have disappeared, or become rare, notably pigeons and sea birds. Various destructive agencies are responsible, including a cyclone, when the tern rookeries were wrecked by a raging sea. But the man with the gun must answer for the pigeons' scarcity.

BEACHCOMBING.

Day after day we walked abroad, my host and I, and I learned a little of the gentle art of beachcombing. We paraded the beach in Brammo Bay, from the boatshed to the point, sometimes gazing over the water, but more often with bowed heads, scanning the sand for shells and any strange creatures that the sea had forsaken. Our harvest was poor one morning, and rich the next. On the western beaches, in our longer rambles, we gleaned nuts and hard shelled seeds, that had drifted from other isles. And here we saw many birds, reef-herons, and noddies and other terns. None of the sea birds was nesting, but the croaking call of a white-capped noddy (*Anous minutus*) brought to memory the scene on Masthead Island, where, in early summer, these dainty little sea-swallows have thousands of nurseries among the *Pisonia* trees. Barefooted, like my friend, I went on little "coastal" journeys; but, wading over the reef at low tide, I found even stout rubber soles a poor protection; coral fangs cut the soles to pieces. Barelegged, but leather-booted, reef roaming became a very pleasant occupation. Mr. Banfield knew Brammo Bay "like a book," and he guided me to favorite spots in his tropic sea garden. We saw wonderful corals and shells, and a host of curious animals, including a mantis-shrimp, which, captured after a chase through shallows, now has a home in the Australian Museum. In the reef pools, sea-slugs or bêche-de-mer (*Holothurians*) were seen crawling over the sand. Some,

* Before he died, his efforts to gain protection for the pigeons were crowned with success, I believe.

In the reef-pools, sea-slugs, or beche-de-mer (Holothurians) were seen crawling over the sand. Some species are black and slimy, others coral pink or red.

[Photo.—*C. Barrett.*

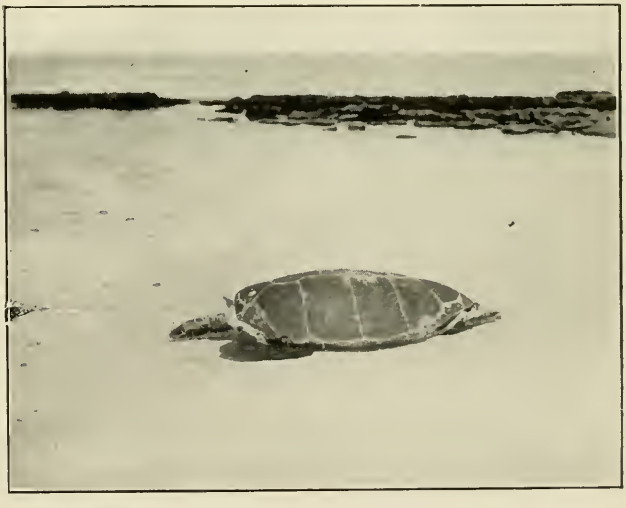
black and slimy, were covered in sand grains; others were red and shiny, with blunt spikes on their leathery bodies. When I touched one of the slimy "slugs," it contracted, and ejected scores of thread-like filaments, white and sticky. Among the coral, cowries, giant clams (*Tridacna*), ear shells (*Haliotis*), and many other kinds, were discovered in abundance. The gem of the garden, for me, was a disc of *Fungia* coral, quaint but beautiful, and with a fairy-tale life history. But indeed, all the corals are wonderful, though the "toiling coral *insect*" is no longer praised by preacher and moralist, who, like the rest of us, have now a little knowledge of marine zoology.

TURTLES AT HOME.

The green turtles (*Chelone mydas*) frequent Dunk Island waters, and their ways have been described by "The Beachcomber." My own acquaintance with them was made much farther south, among the Capricorns. On Masthead Island beaches they were often seen, and at North-west Island I counted more than one hundred, ashore or in the lagoon. It was easy enough to enjoy a turtle ride, if one caught a reptile napping. Only, the ride was short, and exciting when the turtle reached the sea. I never could gain De Rougemont's skill and guide my steed, or keep its head above water when it entered the lagoon.

On the northern isles, green turtles make their nurseries. The eggs are deposited in hollows scooped in damp sand, on the fringe of the scrub. They are covered deep, the sand is smoothed down, and the turtles return to the sea. When the eggs hatch, the baby turtles must make a perilous passage to begin their aquatic life. Crossing the beach, numbers must fall victims to birds of carnivorous tastes.

When the net was drawn near the boatshed, strange fishes often were revealed. Some were good eating; and others, bizarre in shape and coloring, most suitable for an aquarium,



The Green Turtle (Chelone mydas) frequents these waters and nests on some of the coral beaches amongst the isles.

[Photo.—*C. Barrett.*

or the zoologist's specimen tank. The midget beauties that dwell among the corals, of course, were never netted. To see them we had to wait for low tide, wade knee deep, and find a pool where coral masses could be broken easily. From the fragments, if we were lucky, the little fishes appeared, to dart away like flying splinters of many-colored glass. There were crabs, too, in vivid scarlet; but neither crustaceans nor fishes were lovelier than big anemones and the mantles of *Tridacnas*. All the rainbow's colors are seen on a coral reef.

Amongst the Island's bird visitors was the Sacred Kingfisher (Halcyon sanctus).

[Photo.—*C. Barrett.*

THE SWIFTLETS' CAVE.

"You *must* see the Swiftlets' Cave," my host declared. The launch was out of action—"engine trouble"—so we had to make the trip to the rocky landing-place, on the island's weather-side, in a dinghy. Not a comfortable pull, when we left the shelter of Brammo Bay, and switchbacked over heaving seas. It was worth while though. You see, folk who have visited this famous nesting place of the grey-rumped swiftlet (*Collocalia francica*) number barely a score. It was a privilege to be taken there by the discoverer.

The cave, though close to the water's edge, is deep in jungle growth, and one might search for hours without locating it, though aware of its near vicinity. "The Beachcomber" found the swiftlets' colony in this gloomy cave (which is not entered by man with ease) through the excited fluttering of birds that he could not see. The nests were fastened to the "roof" with a semi-transparent substance, secreted by the builders. There were more than fifty of these strange, shallow nurseries; many contained one pearl-white egg; the others were empty, in some cases not completed.

I had read of this cave in *My Tropic Isle*, and the star item of my Dunk Island programme was to pay it a visit. Only an ardent naturalist can know what joy I had in reaching the cave, and peering up at the swiftlets' primitive nests. Discomforts of the dinghy voyage, the landing on wave-swept rocks, and the scramble among great boulders in the jungle, were less than trifles now. I was weary and limp with heat, and had lost fragments of skin in breaking a path to the cave; but never, in Birdland outings, have I felt happier than I did in that silent, gloomy spot, walled and roofed with rock.

Doubtless, for many years, the cave will keep its secret from all but naturalists, and other folk who go on pilgrimage to Dunk Island determined to "see everything." How will they find it, I wonder. I could not be confident of locating it myself, without a long search in the jungle.

Mr. Banfield once captured a swiftlet on her nest, placing a hand gently over her. She fluttered for a few moments, and became quiet again. Returned to the nest, she settled down, showing no fear. The breeding season had not commenced at the time of my visit, and no birds were seen near the cave. But often, from the bungalow, I had watched swiftlets skimming high over trees on the hill-side. Their nests

"The Beachcomber's" Boatshed, Brammo Bay beach. In the foreground is seen the beautiful Umbrella Tree, one of the most remarkable trees in the world, and a "sight" not to be missed by any visitor to Dunk Island.

[Photo.—*C. Barrett.*

may not be very palatable, but they are cemented with the birds' saliva (coagulated), and in substance and general appearance resemble those of the "edible nest" species, which form a Chinese luxury.

SERPENTS IN EDEN.

A Pocket Paradise, Dunk Island has been called, and, like the Garden of Eden, it is not free from serpents. I saw some in my jungle walks; and when stripping bark from a dead tree in search of beetles, nearly placed my hand on a venomous species. The death adder (*Acanthophis antarctica*) is not rare, and its slothful habits and obstinacy in declining to move when one approaches without perceiving it, make it more dangerous even than our most aggressive snake, the tiger (*Notechis scutatus*).

"The Beachcomber" often walked bare-footed in "snaky" spots; and I, on one occasion, was constrained to follow his example, but without enthusiasm. We had been wading on the reef, and took a short cut through the brush, and, as we went, my companion cheered me with a story of a Queensland girl's hairbreadth escape. She placed her hand on a sunlit boulder within six inches of a basking adder. Looking down carelessly she saw the reptile and went pale to the lips with fear. The hand was lifted swiftly before the adder moved.

TROPIC PLANT LIFE.

With all his love for bird life and creatures of the sea, Mr. Banfield found time to botanise. His pleasure it was to learn the names and virtues of tropic trees and shrubs, and the more lowly

plants of his island. He had favourite trees, he told me, and often I saw him lay his hand on a slender bole, almost tenderly. His knowledge of plant lore was equal to that of many amateur botanists who devote all their leisure to the study. He knew living plants, as he knew living birds and butterflies, and has praised them in perfect prose.

Dunk Island is a great wild garden. When my friend was busy at some task in which I could not share, I wandered alone to the Valley of Tree-ferns, whence the bungalow's water supply is drawn by an ingenious system of pumps and pipes. There, deep in shadow and silence, I saw at the hub of its web, a large and beautiful spider that was almost a pet. Fairy foliage was all about, and the fringe of silence was stirred by a sleepy murmur of water, sliding over stones below my resting place.

The trees and shrubs and creepers of the jungle were bewildering in variety, and many were quite strange to me. Beach plants were more familiar. The handsome but nearly branchless *Macaranga tanarius*, whose slender stems, straight as a rod, were used, long ago, by the natives for fish-spear handles, grew freely in many spots. On the big, flat leaves, I searched profitably for insects ; one yielded a wonderful *Brenthid* beetle, not hitherto recorded from the isle, and many of the shining green bugs, mistaken at first for rare beetles.

Dunk Island trees include splendid specimens of *Brassaia actinophylla*, "unique among the many novelties of the tropical coast," as "The Beachcomber" has said. Close by the boat-shed, they stand in groups, and give unfailing pleasure to a nature lover's eyes. My friend was proud of his umbrella trees, and he loved to tell his visitors their history. I shall quote from *Tropic Days*, the passage read so often on the isle :—"Queensland has a monopoly over this handsome and remarkable tree, the genus to which it belongs being limited to a single species occurring nowhere else in a native state. Discovered by Banks and Solander at Cooktown in 1770, the second record of its existence, it is believed, was made from specimens obtained on this island by MacGillivray and Huxley in 1848." And the very trees that the naturalists of the *Rattlesnake* admired, may be those in my photograph, which pleased "The Beachcomber" beyond all others that I obtained in his realm.

On July 11th, in the presence of the Hon. A. Bruntnell, M.L.A. Minister for Education, and Mr. S. H. Smith, M.A., Under Secretary, Department of Education, Messrs. J. McGeorge and E. Brandon Cremer presented a cinema film "Astronomers and Aborigines." This depicted doings of the party under the direction of Prof. W. W. Campbell, at Wallal, which observed the total eclipse of the sun at that locality on September 21st, 1922.

The film clearly showed the difficulties which the party had to contend with and overcome, and is well worth seeing by those interested. It is interspersed with pictures showing the life of the aborigines, and this contributes to its general interest.

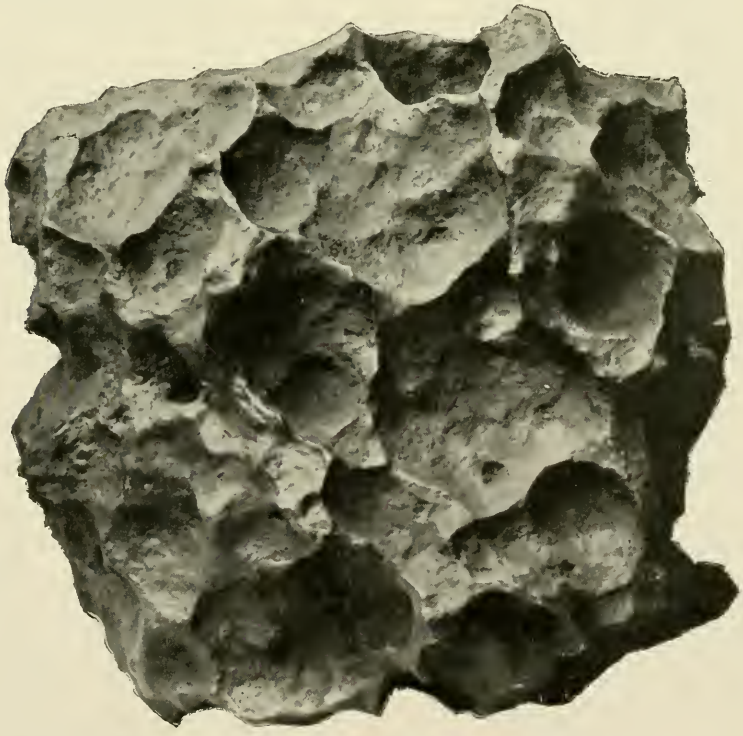
During a recent cruise of the *Geranium* in the Gulf of Carpentaria, Dr. W. E. J. Paradice, R.A.N. interested himself in collecting specimens for the Museum and secured a particularly valuable collection of fishes. A number of these have not been previously recognised from Australian waters, and they are clearly related to the estuarine forms of the great rivers of Papua. A considerable quantity of fish was utilised as food by the ship's company, and Dr. Paradice's notes upon them afford valuable data as to their edible quality and abundance. By arrangement with Dr. Paradice, duplicates of the fishes will be forwarded to the Queensland Museum.

Meteorites.

By T. Hodge Smith.

NUMEROUS attempts have been made of late years to receive messages from the planet Mars, but, as a matter of fact, we have long been receiving messages probably from far greater distances; they have been coming to our earth from time immemorial and have been collected and carefully preserved in museums. With the exception of spectroscopic analysis they afford the only real evidence of the composition of things outside our atmosphere. Science has given the name meteorite to these messages, which are in reality masses of iron and mineral matter. Everyone has seen on a clear night shooting stars or meteors; these are identical with meteorites, and as many as fifteen to twenty million enter our atmosphere every day. Only a few ever reach the earth's surface, for the majority are dissipated by the intense heat produced by friction with the atmosphere, while others are travelling in such a direction and at such enormous speed that they are able to keep on their course and resist the attraction of the earth.

Our ancestors looked upon the stars as the abode of the gods, and consequently the shooting stars, or falling meteorites, signified to them the arrival on earth of a god or his image. Thus meteorites were worshipped, and they were kept as sacred objects in specially built temples. The early



The "Mount Stirling" Meteorite (siderite) found at Mount Stirling, 130 miles east of Perth, Western Australia. Observe the irregular shape and characteristic depressions termed "thumb-marks."

[Photo.—*G. C. Clutton.*

Greeks called them "Betyls," probably from the Hebrew word *Bethel*, meaning home of God. From about 300 B.C. to 300 A.D. coins or medals were struck by kings in honour of these supposed divinities.

A great number of theories have been put forward to account for the origin of meteorites, but as Professor Sir T. H. Holland has said, "the number and variety of theories concerning a subject often forms a coefficient of our ignorance." All that can be said with certainty is that they come from outside our atmosphere and perhaps from outside the solar system.

The size of meteorites varies very considerably; for example the "Ahnighito" meteorite found at Cape York, Greenland, in 1818, weighed thirty-six and a half tons, while another found at Muhlau, near Innsbruck, Tyrol, in 1877, weighed only seventy-seven grains. The largest meteorite yet found in Australia, at Cranbourne near Melbourne, Victoria, weighed three and a half tons, and is now preserved in the British Museum (Natural History), London.

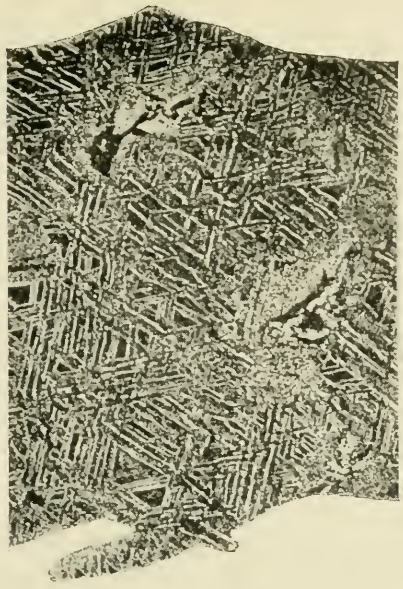
The "Bugaldie" Meteorite (siderite) found at Bugaldie, near Coonabarabran, New South Wales. Note the comparatively smooth surface.

[Photo.—*G. C. Clutton.*

The external appearance of meteorites also varies: some are quite smooth, while others have characteristic indentations which have been called "thumb-marks"; some are more or less spherical or pear-shaped, others are quite irregular.

The analysis of various meteorites has not led to the discovery of any element that is not found in the material of the earth; on the other hand only about one-third of the elements found in the earth have been found in meteorites. However, certain chemical compounds are found which do not exist, or at least have not been found, as terrestrial minerals, for example oldhamite (monosulphide of calcium), troilite (monosulphide of iron) and schreiberite (phosphide of iron and nickel).

The chemical composition of meteorites is by no means constant, and they have been classified according to this variation into four classes, the first of which is represented by the metallic meteorites or Siderites. These are composed essentially of various alloys of iron and nickel. They are magnetic and look exactly like a mass of metallic iron; in fact when the "Delegate" meteorite was discovered near Delegate, New South Wales, by Mr. Alex. Pauline in 1913, one of the local explanations of the meteorite was that it was either a bag of bullock bells smelted together by a bush fire or a small blacksmith's anvil that had suffered the same fate. However, the want of homogeneity in composition is seen when a polished surface is treated with bromine or other suitable etching agent. Owing to the difference in solubility of the various constituent alloys, a regular pattern is etched on the surface and is known as a Widmanstätten figure.



A portion of the etched surface of the "Delegate" meteorite (siderite) showing Widmanstätten figures. This is reproduced direct from a contact print taken from the meteorite.

The second class of meteorite is known as the iron and stone meteorites, or Siderolites. As their name implies, they consist of a mixture of the nickel iron alloys and one or more of the silicate minerals. The "Molong" meteorite is a very interesting example of this class. It was found by Mr. John Williams on E. Farrell's farm on the Molong Creek, New South Wales, in August, 1912, and weighed sixty five and a half pounds. Exposed to the air it rapidly oxidises and crumbles away, and part of it is preserved in the Museum in a glass vat containing kerosene. It consists of rounded crystals of olivine occupying the interstices of a network of nickel iron alloy. The Sydney Technical College cut this meteorite into two portions, but owing to its hardness ordinary metal-cutting appliances were useless, and saw blades made of sheet copper fed with emery and carborundum were used; in all it took 141 hours to cut through. The great majority of the olivine has been fractured, but by careful examination the late W. H. Gilding was able to obtain a small piece of gem quality which he cut and polished. This gem is now preserved in the Mining and Geological Museum, Sydney.

The next class is represented by the stony meteorites or Aerolites, which consist essentially of silicate minerals such as pyroxene, olivine and felspar. There may be present a little nickel-iron alloy. A meteorite of this class was discovered by Mr. A. McCormack near Binda, New South Wales, on the 5th June, 1912. He was engaged in rabbit trapping when he noticed what he took for a newly-formed rabbit burrow; on tracing the burrow to its termination he discovered the meteorite. It consisted of felspar, pyroxene, chromite and a little nickel-iron alloy. It is almost certain that this meteorite was seen to fall on the night of Saturday, 25th May of the same year, when a meteor was seen passing over Goulburn and Crookwell, and was accompanied by a loud noise which one resident mistook for a passing aeroplane.

Australites, a variety of Obsidianite, showing the characteristic shapes.
[Photo — *G. C. Clutton.*

The fourth class is represented by the glassy meteorites or Obsidianites, which consist entirely of glass, and are invariably small in size. These very interesting objects occur in only a few very widely scattered localities—Australia, Bohemia and Malaysia. It has been suggested that these obsidianites are of volcanic origin, but they always occur in regions far removed from volcanic activity, and are now generally accepted as meteoric.

A Dinosaur Exhibit.

By The Editor.

[This article describes some exceedingly interesting specimens which, through the good offices of Dr. W. K. Gregory, were obtained by exchange with the American Museum of Natural History, New York.]

THE rise and development of the successive faunas which have peopled the globe can be traced by a study of their fossil remains found embedded in the sedimentary rocks of the earth's crust. These rocks were at one time unconsolidated clay, sand, or mud, and in ages past, as to-day, the bodies of animals sometimes became buried in these deposits, and, as the loose sand and clay became hardened into sandstone and shale, the hard parts of these animals were converted into stone. Now in a quarry or rock cutting our curiosity is sometimes excited by the discovery of the petrified remains of some strange creature that lived and died, perhaps millions of years ago.

Thus the sedimentary rocks by their contained fossils furnish a record of the past history of life, the lowest rocks containing the most ancient fossils, and palaeontology, or the study of fossils, is the science which deciphers this wonderful record. Geological time is measured not in centuries but in millions of years, and the life of man and the whole duration of the human period, is such a short span that it is difficult for us to realise the vast period of time during which life has been evolving on our planet. Since its beginnings the earth has suffered many changes and majestic revolutions, and its living inhabitants as well have had a strange and eventful history. Race after race of animals and plants came into existence, had their day, then wholly or partly disappeared, to be replaced by others in accordance with the law that the fittest survive.

The latest chapter in this enthralling history we in our pride call the Age of Man, a comparatively short period which stretches over no more, perhaps, than a few hundred thousand years. The preceding Cainozoic (recent life) or Tertiary period, which endured for millions of years, is commonly known as the Age of Mammals, for, during that time, there was a wonderful evolution of mammalian life, which reached its climax about the middle of Tertiary time and is now on the wane. The next oldest period is the Mesozoic (middle life) or Secondary, distinguished by a marvellous profusion and variety of reptilian forms, so that it has been called the Age of Reptiles. Below the Mesozoic lie the Palaeozoic (ancient life) sediments, in which the most abundant fossils are invertebrates, such as corals, molluscs, and crustaceans, though primitive fishes, amphibians, and reptiles are also represented. This is known as the Age of Invertebrates.

The Mesozoic period, which chiefly concerns us here, is divided into three sections, which, in order of decreasing age, are called the Triassic, Jurassic, and Cretaceous. All through this vast period of time, which lasted for at least twelve million and perhaps several hundred million years, reptiles were the lords of creation. Birds and mammals did exist, it is true, but they were apparently poor in numbers and organization, and presented but slight resemblance to the birds and mammals of the present day. The mammals, now the dominant race, were then small furtive creatures, mainly arboreal in habit; their nearest living relatives are probably the monotremes and marsupials, the characteristic mammals of our own Australia.

The reptiles of the Mesozoic period flourished amazingly in the absence of serious competition by other forms, and, as will always happen in nature under

similar conditions, they branched out in many directions in obedience to the law of Adaptive Radiation so convincingly expounded by Dr. H. F. Osborn. Some were swift destructive flesh-eaters, preying upon their weaker fellows as the lion, the wolf, and other carnivores do to-day; others were vegetable feeders, comparable with modern hoofed mammals. Some, as the *Ichthyosaurus* and *Plesiosaurus*, became adapted to a marine life like our whales and porpoises; still others, the pterodactyls, took to themselves wings and flew through the air like birds.

But of all the reptiles of the period the dinosaurs were the most remarkable. Apparently they originated in the Triassic as lizard-like forms with long limbs and tails, having five toes on each foot armed with sharp claws. These ancestral forms were probably adapted to live on dry land, and their gait was more or less bipedal or kangaroo-like. This central type gave rise to a great variety of forms. Some were carnivorous, others herbivorous, some were gigantic, almost equalling modern whales in bulk, others were quite small, some walked on all fours, others on their hind legs; some were dwellers on the dry land, others wallowed in the waters of rivers and lakes like the hippopotamus. Many were provided with bony armour-plates or armed with formidable horns or spines; some had long sharp claws, others hoofs. In fact, in their time, the dinosaurs played much the same part as the larger mammals now inhabiting the earth. And the explanation is simply that in nature there are certain roles to be filled, and the actors are chosen by natural selection from the material available. As Dr. W. D. Matthew has well said, if birds and mammals were to be exterminated by some cataclysm, it is probable that existing lizards would, in the course of ages, evolve into a fauna not unlike the dinosaurs of old.

The remains of these land dragons have been found practically all over the world; even in Australia, which seems to have been a "lonely continent" for many ages, we find slight traces of dinosaurs. But it is in America tha tthe greatest finds of these long extinct creatures have been made. From the great delta formations of the Middle Western States and the Alberta district of Canada, successive exploring parties sent out by the leading American museums have brought back a wonderful series of dinosaur bones, and the patient labours of many scientific workers in America and Europe have made the structure of some of these long dead creatures almost as well known to us as that of animals now living. We know even what their integument was like, through the fortunate circumstance that the mummified body of a dinosaur became embedded in fine sediment which took an impression of its skin.

THE AMPHIBIOUS DINOSAURS (SAUROPODA).

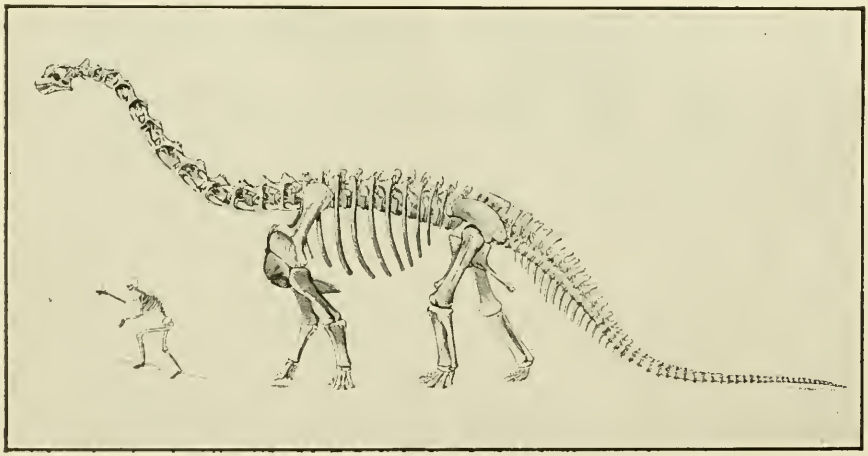
Dinosaurs are divided into groups according to their structure. The Sauropoda or Lizard-footed Dinosaurs were the largest of all, and *Diplodocus*, *Brontosaurus*, and *Brachiosaurus*, which belonged to this group, were much larger than any animal now living, with the exception of the largest whales. *Diplodocus*, for example, was over eighty feet long. As the Sauropoda are supposed to have lived partly on land and partly in water they are sometimes called the Amphibious Dinosaurs. All the members of this group were quadrupedal in gait. They had a very small head, blunt teeth, long neck and tail, a compact slab-sided body, and massive limbs terminating in five-toed feet. They lived during the late Jurassic and early Cretaceous, becoming extinct in the mid-Cretaceous period. *Camarasaurus*, a smaller relation of *Diplodocus* and *Brontosaurus*, is represented in our collection by an original thigh bone five feet three inches in length and weighing 388 pounds in its petrified state, by a beautiful model, one-tenth natural size of the animal as it appeared when alive, and by a fine drawing of the skeleton. The model and drawing, both executed by the late

Model of the amphibious Dinosaur, Camarasaurus. It was fifty-two feet long and about twenty feet in height. Constructed by Erwin S. Christman, American Museum of Natural History.

[Photo.—*G. C. Clutton.*

Erwin S. Christman, whose early death was a signal loss both to art and science, are the outcome of fifteen years' research by President H. F. Osborn, Dr. W. K. Gregory, Dr. C. C. Mook, Erwin S. Christman of the American Museum of Natural History, and other experts. The pose of the skeleton was worked out in a miniature model with flexible joints, and the museular restoration is based on a careful comparison with living reptiles. This reptile was fifty two feet in length and about twenty feet in height.

Its skeleton offers a striking example of adaptation to special needs. A body of such huge dimensions required an adequate scaffolding for its support and for attachment of the muscles which served for locomotion ; the bony framework of *Camarasaurus* shows us how admirably the problem was solved. Its long neck demanded strong and firmly anchored muscles, and these required large surfaces of bone for their attachment, therefore we are not surprised to find that the neck vertebrae of the animal were of complicated design, hollowed out by lateral cavities



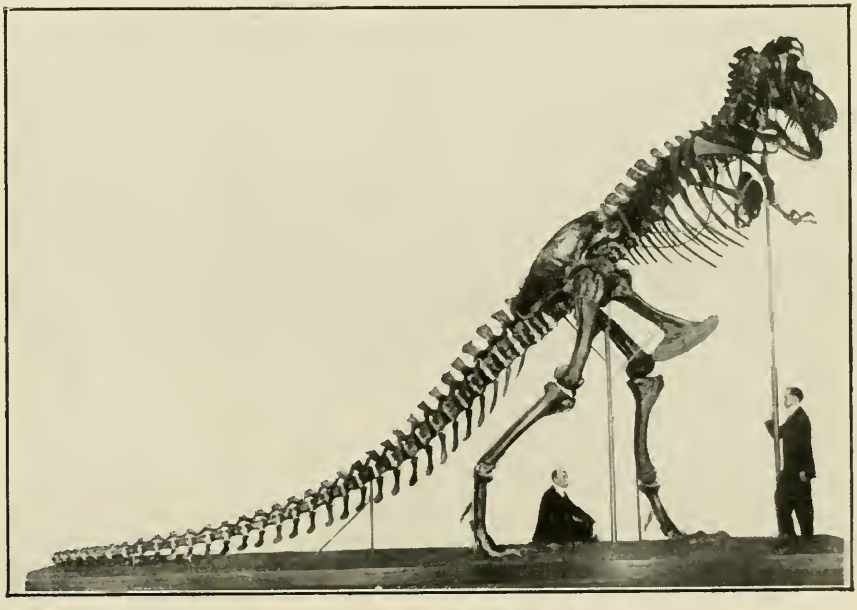
Skeleton of the amphibious Dinosaur, Camarasaurus, with human skeleton for comparison. From drawing by Erwin S. Christman.

[*Courtesy of the American Museum of Natural History.*

with numerous keels, buttresses, and struts, so as to combine the largest possible surface with minimum weight. The rest of the vertebral column shows the same features, but not in so pronounced a degree. The ribs and limb bones, on the contrary, were solid and heavy, which has suggested the view that these reptiles spent much of their time under water, wading about on the bottom of rivers or freshwater lagoons, their massive limb bones counteracting the buoyancy of their bodies, like the lead in a diver's equipment, while their giraffe-like necks enabled them to thrust their heads up from the depths like the periscope of a submarine, to renew their air supply and have a look round. From the structure of their teeth the conclusion is drawn that their food consisted of succulent vegetation such as grows in swamps and marshes. The amphibious dinosaurs had apparently no means of defence against possible enemies, unless they were able to use their long flexible tails as a sort of lash, and it is probable that they were accustomed to seek safety by retreating to the water. Some authors consider that they never came ashore at all, while others believe that they were wholly land animals. Who knows ?

THE CARNIVOROUS DINOSAURS (THEROPODA).

Compared with the amphibious dinosaurs, the carnivorous types were much more diverse in structure and size. Some were no larger than a cat, and *Tyrannosaurus*, with its length of forty-seven feet, rivalled modern elephants in bulk. They were armed with numerous long sharp teeth and sharp curved claws, and their general structure indicates that they were active and formidable beasts of prey. In appearance they were a sort of cross between a bird and a lizard, with long hind legs on which they habitually walked, their long tail balancing the weight of their body ; the fore legs in forms such as *Tyrannosaurus*, were almost ludicrously small in proportion, and quite inadequate to support the body of the animal. The skull cast of *Tyrannosaurus* shown in the case, and the photograph of the complete skeleton in association with the human figures, show that the reptiles, unlike the amphibious dinosaurs, had a large head, as we should expect in a predatory animal. Its brain, however, was small compared with that of a modern crocodile or lizard, and probably *Tyranno-*



Mounted Skeleton of Tyrannosaurus in the American Museum of Natural History. This reptile was forty-seven feet long, the largest flesh-eating land animal that ever lived.

[Courtesy of the American Museum of Natural History.

Cast of the skull and lower jaw of Tyrannosaurus. Prepared at the American Museum of Natural History.

[Photo.—*G. C. Clutton.*

saurus was not a subtle hunter, like the cat or the fox, but depended on brute strength and mass action to provide him with a meal. This gigantic reptile, the largest flesh-eating animal that ever walked the earth, lived in the Cretaceous times and was the culminating effort of evolution in this particular direction. It probably preyed on the giant herbivorous dinosaurs of the same period, which were mainly slow-moving, dull-witted creatures.

BEAKED DINOSAURS.

The huge amphibious dinosaurs had already passed away before *Tyrannosaurus* appeared, but there were other huge vegetable-feeding reptiles, the Beaked Dinosaurs or Predentata, which flourished contemporaneously with *Tyrranosaurus*. One of these was *Triceratops*, a clumsy strongly built reptile somewhat resembling a rhinoceros in size and appearance. It had a huge head, three strong horns, and a great bony crest or frill projecting from the back of its skull over its neck. The animal was quadrupedal, with short massive legs, terminating in hoofs, a short thick tail, a stout body, and a short neck. Its muzzle was encased in a horny beak resembling that of a turtle, and its teeth had broad crowns, indicating that it chewed its food, instead of swallowing it whole as modern birds and reptiles do. Even *Tyrannosaurus* would find no mean antagonist in this ponderous reptile, for the latter was practically its equal in bulk, and, with its great horns, which sometimes reached a length of almost three feet, and its armour-plated neck, it was well designed to withstand the rushing onset of the great carnivore. It is probable that there was many a battle royal between these two formidable antagonists in the distant geologic past, when these dragons of the prime stalked the earth in their might. The accompanying photograph, reproduced from a drawing by Charles R. Knight, depicts the preliminaries of such a combat. The *Triceratops*, male and female no doubt, are waiting with lowered head, prepared to give battle to the advancing Tyrannosaur, while their young one seeks safety by pushing close to its bulky parent.

The giant carnivorous Dinosaur, Tyrannosaurus, approaching Triceratops, a herbivorous relative on which it probably preyed. From a drawing by C. R. Knight.

[Courtesy of the American Museum of Natural History.

EXTINCTION OF DINOSAURS.

Many suggestions have been made to account for the extinction of these reptiles, which seem to have been built to endure for all time, but it is always difficult to discover the causes of extinction of organic types. Looking down the great vista of the past we are apt to think that the dinosaurs evolved, reached their culmination, and then suddenly died out. But in reality the process was one of extreme slowness, spread over millions of years, and, once we realise that important fact, we cease to wonder at their disappearance. The great American naturalist, Cope, suggested that the small cunning mammals, which had already made their appearance before the Age of Reptiles drew to its close, would seek out and eat the eggs of their formidable contemporaries. A more plausible explanation is that great geographical changes took place, the swamps necessary for some kinds of dinosaurs were drained by elevation of the land, aridity increased and the climate grew more severe. Reptiles as a class are more susceptible than birds or mammals to changes of temperature, for they are cold-blooded and have no covering of feathers or hair to protect them against cold. Then, too, the large size and over specialization of many dinosaurs handicapped them for life's race. A large animal requires more food than a small one, and any considerable alteration in environment is fatal to a creature which has become specially adapted to live in a certain way and cannot adjust itself quickly enough to changed conditions. Palaeontology is continually enforcing the lesson that large size and extreme specialization almost always presage extinction.

Professor T. Thomson Flynn, University of Tasmania, Hobart, is at present carrying on certain investigations relating to the internal organs of the Blue Tongue or Sleeping Lizards, a large well-known species belonging to the genus *Tiliqua*. As a large number of specimens is required, readers would be rendering a great service by sending any they may secure to the Australian Museum. It does not matter whether they be alive or dead so long as the abdominal organs are intact and uninjured.

The Pan-Pacific Science Congress.

The recent meeting of the Pan-Pacific Science Congress was the most important scientific gathering that has taken place in Australia since the British Association for the Advancement of Science met here in 1914. Australia is so far removed from the great centres of scientific activity, and the scientific workers are so few that even a short sojourn in our midst of the leaders of research in neighbouring countries is bound to have a stimulating effect.

The Pacific Ocean and the lands bordering upon it present many unsolved problems which can best be attacked by co-operation. Some of the problems have no immediate economic bearing but others are closely concerned with the material well-being and happiness of the peoples, white or coloured, inhabiting Pacific lands. Such questions as irrigation, diseases of farm crops and farm animals, the ravages of the prickly pear and the blowfly, the distribution of insects in relation to disease, are of vital importance to us, and others such as the decline in native population, the evolution of plant life in the Pacific, the origin and structure of coral reefs, the physiographic unity of the Pacific, are of absorbing interest, not merely to scientific men but to all. Most important of all perhaps is the bringing together of chosen representatives of the various Pacific countries to discuss questions of common interest, which cannot fail to promote that feeling of international brotherhood which the world so much needs. To quote the noble words of His Excellency the late Sir Walter Davidson, in the inaugural address of the Sydney session.

"Always in the deep recesses of our hearts we wonder, nay we hope, and indeed we believe, that meetings such as ours will exorcise the demons of jealousy and unrest, and lay them in a limbo with the brutalities and follies of the past. Nationhood and pride of race is a glory only so long as its inspiration is actuated by peace on earth and goodwill among men."

Lecture Notes.

On September 14th, Mr. J. R. Kinghorn, under the auspices of the Teachers' Federation, Goulburn, delivered a Museum Extension Lecture entitled our "Feathered Friends." There have been several of these lectures delivered at this centre, and the proof of their popularity is shown by the consistently good attendance at them.

The extension lectures were founded in the interests of those, who, by reason of distance, are unable to attend the series delivered in the Museum. The services of the lecturer are provided by the Museum, but it is expected that local residents will make arrangements for the hall, lantern, and generally do their part to make the scheme a success.

On September 20th, Mr. W. H. Thorpe lectured to the students of the Presbyterian Ladies' College, Croydon, utilising the College ethnological collection to illustrate his remarks.

Prof. E. Cossar Ewart, M.D., F.R.S., of the University of Edinburgh, on September 25th, lectured on "Feathers and the Hatching of King Penguin."

Further lectures will be delivered in the Museum lecture theatre on the following dates at 8 p.m. Admission is free.

October 11th — "Bats and their Habits," by Mr. E. L. Troughton.

November 8th—"A Naturalist on the Nepean River," by Mr. A. Musgrave.

The
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The Museum is open Free to Visitors every Week Day from 10 a.m. to 5 p.m., except on Mondays, when Students and Pupils of Schools and Colleges are admitted by arrangement in the afternoons, and, if the Director is informed beforehand, facilities for Study are given.

It is open on Sundays from 2 to 5 p.m. and on all Public Holidays, except Good Friday and Christmas Day.

Children under 12 years of age, unless accompanied by older people, may be refused admittance.

Donations of even the commonest specimens of Natural History (if in good condition), specimens of Minerals, Fossils, Coins, and Native Handiwork, are always welcome.

The office is open daily from 9.30 a.m. to 1 p.m.; and 2 to 4.30 p.m. (Saturdays to 12 noon); and visitors applying for information there will receive every attention from the Museum Officials.

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