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THE AUSTRALIAN MUSEUM MAGAZINE

PEARLY NAUTILUS (*NAUTILUS STENOMPHALUS*) IN THE TARONGA PARK AQUARIUM.

Frontispiece

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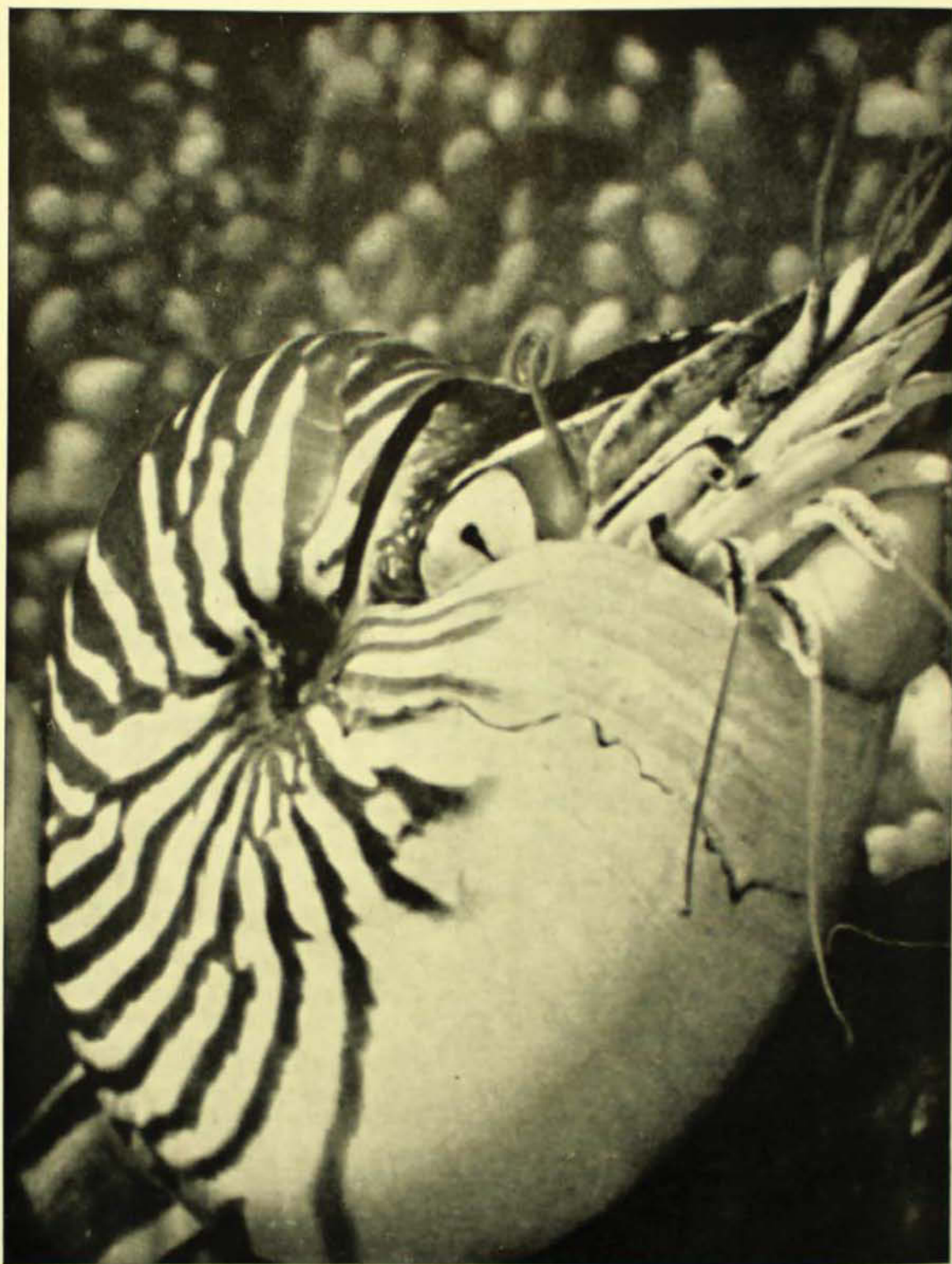
(Photography, unless otherwise stated, is by G. C. Clutton.)

● OUR FRONT COVER. The Emu (*Dromiccius novae-hollandiae* Latham) is by Lillian Medland. It is one of a series of postcards issued by the Trustees of The Australian Museum.

One of the largest of living birds, the Emu stands five feet high, and has very powerful legs but no wings. It is thus incapable of flight, but can run rapidly and even swims fairly well. It is closely related to the Cassowaries, and more distantly to the Ostriches and Rheas, and so forms part of a group of flightless birds, which show evidence, however, of origin from ancestors capable of flight.

The Emu is chiefly a bird of the plains, though occasionally found in the coastal belts, and is distributed all over Australia. It is still fairly plentiful in the interior, but is being driven further and further back by the advance of settlement. It is not beloved of the pastoralist, because of its habit of getting tangled up in and breaking wire fences. It is also accused of spreading prickly pear. In some places a price is put on its head, but a full scientific inquiry into its food habits should be made before sanction is given to unlimited destruction. Otherwise, this noble bird will become extinct, as have allied species in Tasmania and Kangaroo Island.

The Emu makes no nest, laying ten to fifteen dark green eggs which are incubated by the male. Emu chicks for some time after hatching are prettily striped. The bird is omnivorous, but specializes in fruit and the larger insects. Its plumage is remarkable in that each scantily-barbed feather appears double, since the aftershaft is as long as the main quill.



Pearly Nautilus (*Nautilus stenomphalus*) in the Taronga Park Aquarium. The tentacles, each in its sheath, can be seen on the top right. The eye capsule, with its keyhole opening (black) appears to the left of the tentacles above the shell edge. Approximately natural size. (See article, page 112.)

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VOL. VII, No. 4.

MARCH-MAY, 1940.

The Museum and the Cinema

T. R. ADAMS in *The Museum and Popular Culture** says "the modern museum has reached a stage of development where it seeks to spread its educational message beyond its own walls". This has been the policy of the Trustees of The Australian Museum, more especially within recent years. We may indicate, as an instance, the establishment of this MAGAZINE, now in its twentieth year, popular lectures, and assistance in many other ways to various bodies and individuals. But much as this institution would have liked to extend such activities, the financing of them was quite beyond the capacity of the Trustees.

To aid in this movement, however, the Carnegie Corporation of New York has made a generous monetary grant, to which we have referred previously in these pages. This grant has been applied to the production and purchase of natural history cinematograph films for circulation by the New South Wales Department of Education to schools and colleges, an increasing number of which are equipped with projection apparatus. To date twelve films have been passed to the department for inclusion in its film library. Not all of these have been made by the Museum, some were acquired from outside sources, but all are excellent productions of high educational value. Many others are in process of making, for

films of this type are produced gradually, and one must be ever alert to avail himself of material as it offers. Elsewhere in this issue is a description of the Pearly Nautilus, correctly described as a living fossil. Its fortuitous arrival at Sydney, alive, from the south Pacific presented a unique opportunity which was eagerly taken, and it therefore appears in one of these films.

Whilst in the preparation of these films no scenario has to be written, it must not be concluded that a definite scheme may be dispensed with, or that such films are a mere collection of haphazard happenings. Such is far from fact. The quest for material presents many problems, each beset with its own difficulties, and when these have been overcome others not infrequently manifest themselves. Thus in the preparation of one of the films dealing with marine life, a time had to be awaited for a suitable tide and light. When such conditions presented themselves and the party was on the site, boisterous weather prevailed, and the prospects anticipated were not realized, rendering subsequent visits necessary. After the film has been taken there is much additional thought and work necessary in the laboratories to "edit" it and to provide suitable titles.

The films produced and acquired have won the approval of educational authorities and are but the forerunner of more to follow on different aspects of natural science.

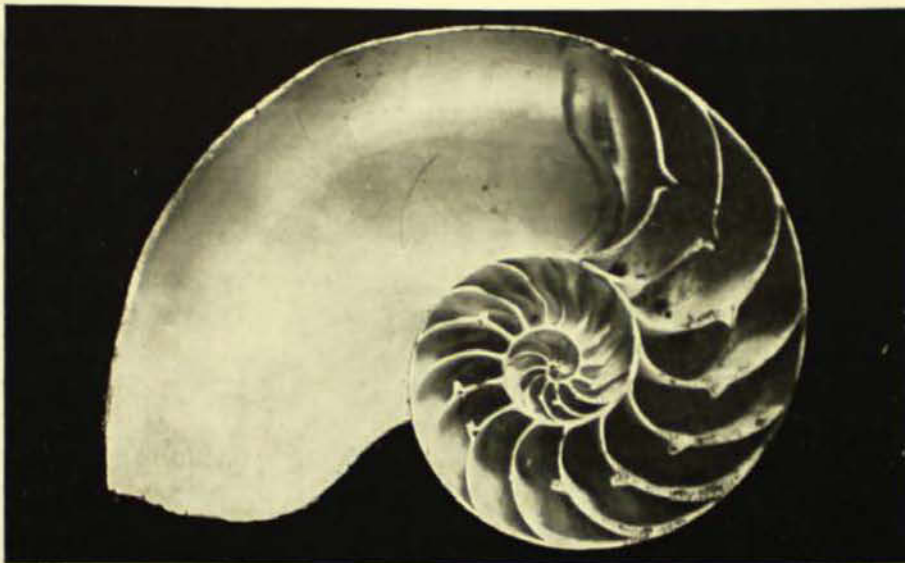
* Published by the American Association for Adult Education, New York, 1939.

The Pearly Nautilus: A Living Fossil

By C. ANDERSON, M.A., D.Sc., C.M.Z.S.

THE capture last year of a living example of the Pearly Nautilus, and its brief sojourn in the Aquarium of the Taronga Park Zoo, Sydney, were events of considerable interest to naturalists. For not only is this creature the sole survivor of a once large, flourishing and widely distributed

the Taronga Park Zoo; so he placed it in a bucket in order to bring it to Sydney. The seawater in the bucket was thoughtfully changed from time to time, the animal reached Sydney alive, and was transferred to a tank at Taronga Park on June 21, 1939. Here it lived for about two weeks and was an object of consider-



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 siphuncle.

race, but the living animal has rarely been seen by white men, though its empty shell, which is very buoyant, is not infrequently washed up on the shores of the seas where it occurs. The circumstances of the capture of this particular specimen and its subsequent history are as follows.

The passengers on the *Pierre Loti*, a vessel of the Messageries Maritimes line, were enjoying a day's fishing near Maré Island, in the Loyalty Group, north-east of New Caledonia. Many interesting fishes were caught, and one angler was astonished when he hauled up a "queer fish with a shell". No one on board knew what the catch was, and the poor creature was left lying on the deck. It occurred to one of the engineers that this strange "fish" might be of interest to

able interest to visitors. During this time Mr. G. C. Clutton, photographer on the staff of the Australian Museum, was able to secure a cinematograph record of the animal, both in colour and in black and white; this is probably the first time that this interesting animal has been filmed. After its death it was preserved and added to the collection in the Zoology Department, University of Sydney.

ZOOLOGICAL POSITION.

The Pearly Nautilus, of which there are four living species, belongs to the same group of molluscs as the familiar squid and octopus. These are all known as cephalopods, and they are generally looked upon as the most highly developed

of all molluses. This is particularly evidenced in their nervous system and sense organs, the large size of some forms, and their predominantly active predaceous habits. Cephalopods differ from the slower moving bivalves (clams, oysters, cockles, and others), and the univalves, such as snails, whelks, and periwinkles, in that one part of the foot surrounds the head (hence the name cephalopod, meaning "head-foot"), and is divided into a number of "arms"; the other part forms a partial or complete tube, the siphon or funnel, through which water is expelled from the mantle cavity, driving the animal rapidly backwards.

Cephalopods are divided into two groups: those with four gills (Tetrabranchiates) and those with two gills (Dibranchiates). Of the former group the Pearly Nautilus is the only living genus, though it has many extinct relatives and a very long geological history. The Tetrabranchiates, represented by the Pearly Nautilus, are distinguished from the Dibranchiates (squids, octopods, etc.) in various particulars. Thus the Nautilus has an external shell, while in the Dibranchiates the shell is internal or absent. In the Dibranchiates the part of the foot surrounding the head is divided into eight or ten arms which carry suckers; in the Nautilus this part of the foot has numerous lobes which carry tentacles but no suckers. In the Nautilus the eye is simple in structure; it has no lens and is comparable with a pinhole camera. In the Dibranchiates the eye is highly developed and the mouth of the retinal cup is closed by a lens. Unlike the Dibranchiates, the Nautilus has no ink-bag.

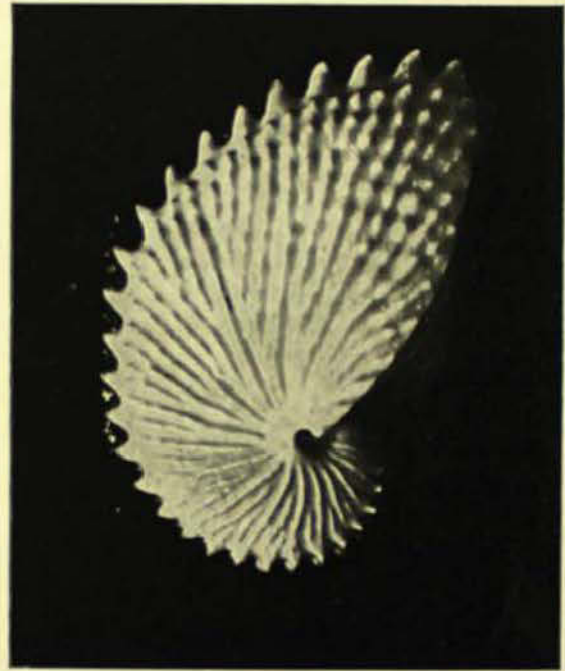
The Pearly Nautilus is sometimes confused with another cephalopod known as the Argonaut or "Paper Nautilus". This is a kind of octopod in which the female constructs a beautiful delicate structure as a shelter for its eggs and developing young. This, however, is not inhabited by the animal and is not chambered; it is a cradle or perambulator, not a residence as is the shell of the Pearly Nautilus. Oliver Wendell Holmes is

evidently thinking of the Argonaut when he writes:

This is the ship of pearl, which, poets feign,
Sails the unshadowed main—
The venturous bark that flings
On the sweet summer wind its purpled wings
In gulfs enchanted, where the Siren sings,
And coral reefs lie bare;
Where the cold sea maids rise to sun their
streaming hair.

It has been supposed that the Paper Nautilus is truly an Argonaut (sailing ship), and that it sails the ocean with two tentacles raised aloft to catch the wind, while the others are used as oars. Pope, too, evidently had this quaint legend in mind when he wrote:

Learn of the little nautilus to sail,
Spread the thin oar, and catch the driving gale.



Paper Nautilus; a cradle, not a boat
as is generally considered.

DISTRIBUTION.

The four existing species of the Pearly Nautilus (*Nautilus pompilius*, *N. macromphalus*, *N. stenomphalus*, *N. umbilicatus*) are restricted to an area of the Indian and Pacific Oceans extending from Macassar Strait to Fiji. Empty shells have, however, been found on the Nicobar Islands, Japan, and the coast of New South Wales, having drifted to these places from the natural habitat of the animals.

APPEARANCE AND HABITS.

Many readers will be familiar with the shell of the Pearly Nautilus. It measures about eight inches in length and is striped somewhat like a zebra. It is in the form of a spiral in one plane, divided into a number of compartments, in the last and largest of which the animal lives, the others being filled with gas consisting chiefly of oxygen and nitrogen, but not in the same proportions as in atmospheric air. All the compartments communicate with one another by a median tube, the siphuncle, which is partly calcareous. The shell is called pearly because of the appearance of the innermost layer, which is exposed after the organic matter and the median layer have been removed.

The tenant of this shell where its body is exposed is brownish, mottled with white spots, its piebald appearance harmonizing with the zebra-like markings of the shell. The anterior part of the foot is divided into numerous slender tentacles, which are arranged in two whorls, an outer and an inner. Although these have no sucking disks, which are such conspicuous features of the arms of the squid and octopus, they have a series of transverse ridges which enable the animal to cling to objects in a manner analogous to the technique used by the small lizards known as geckos. It is by means of these tentacles, which have an adhesive, prehensile, and tactile function, that the Nautilus progresses over the sea bottom.

There is evidence that the Pearly Nautilus lives in fairly deep water, and that it seldom or never comes to the surface unless it is dead or dying. Its food apparently consists mainly of crustaceans, but any kind of animal food is accepted. According to Semon,¹ at Ambon the animal is caught with fishing-rods baited with fish of medium size, while the Fijians capture it in basket traps baited with boiled crab. This basket contains a barbed hook, and when the Nautilus enters the trap a quick pull on the hook secures the intruder.

HISTORICAL.

It is evident that the Pearly Nautilus was known to Aristotle, the Father of Natural History, for he recognized that there were two kinds of "polypi" with shells; one of these was the Pearly Nautilus, the other the Argonaut. But the earliest writer who was able to give a partial description of the animal itself was Rumphius (Georg Eberhard Rumph, 1637-1702), who was born at Hanau, Germany, and spent many years on Amboyna, East Indies. His description and illustrations were published in his work entitled *D'Amboinische Rariteitkamer* (1705). A more detailed and more accurate account was given by the celebrated English comparative anatomist Richard Owen in 1832.² The species described by Owen in this classic volume was *Nautilus pompilius*, the commonest of the four living species, and it was obtained near Erromanga, New Hebrides, by Dr. George Bennett. Dr. Bennett was a distinguished figure among Australian naturalists in the latter part of the last century, and was indeed the first Curator of the Australian Museum. Bennett was born at Plymouth in 1804, and, after graduating in medicine at the University of Glasgow, he joined the *Sophia*, which in November, 1829, began a voyage of exploration in the Pacific. After brief visits to Australia in 1829 and again in 1832, he returned in 1835 and settled in Sydney, where he died in 1893. During their long lives he and Owen (1804-1892) kept up a regular correspondence, and Bennett supplied Owen with many specimens which formed the subject of important researches.

It was while the *Sophia* was at Erromanga that this first example of the Nautilus ever preserved was obtained. In his *Wanderings in New South Wales*, Vol. ii, 1834, p. 406, Bennett describes this memorable catch:

It was on the 24th of August, 1829, in the evening, when the ship *Sophia* was lying at anchor in Marakini Bay on the south-west side of the island of Erromanga, one of the New Hebrides Group, Southern Pacific Ocean, that

¹ *In the Australian Bush*, 1899, p. 487.

² *Memoir on the Pearly Nautilus*. Royal College of Surgeons, London.

something was seen floating on the surface of the water at some distance from the ship; to many it appeared like a small, dead, tortoise-shell cat, which would have been such an unusual object to be seen in this part of the world that the boat which was alongside the ship at the time was sent for the purpose of ascertaining the nature of the floating object.

On approaching near, it was observed to be the shell-fish commonly known by the name of the Pearly Nautilus (*Nautilus pompilius*); it was captured and brought on board, but the shell was shattered from being struck with the boat-hook in capturing it, as the animal was sinking when the boat approached, and had it not been so damaged would have escaped.

I extracted the fish in a perfect state, which was firmly attached to each side of the upper cavity of the shell. On being brought on board, I observed it retract the tentacula still closer than before, and this was the only sensation of vitality it gave after being caught; I preserved the soft parts immediately in spirits, after making a rude pen and ink sketch of its form.

When the *Sophia* returned to England, Bennett presented (July, 1831) this precious specimen to the Museum of the Royal College of Surgeons, where, no doubt, it is still preserved.

Owen's description has since been supplemented and corrected in some details by other workers, notably Graham Kerr,³ Willey,⁴ and Mugglin,⁵ so that the anatomy of the animal is now well known. But we still know little of its development from the egg to adult life.

³ Proc. Zool. Soc., 1895, pp. 664-686.

⁴ Zoological Results based on Material collected in New Britain, etc., Part vi, 1902.

⁵ Vierteljahrsschrift d. Naturforsch. Ges. Zurich, 1939, Parts 1, 2, pp. 25-118.

André Leon Tonnoir, whose sudden death while collecting in the hills near Canberra has come as a shock to all who knew him, was one of the departmental heads of the Division of Economic Entomology, Canberra. He was a Belgian by birth, being born at Brussels, on April 9, 1885. He was Collaborateur Musée d'Histoire Naturelle Brussels up to 1921. He was Research Student at the Cawthron Institute, Nelson, N.Z., up to 1924; Assistant Curator, Canterbury Museum, Christchurch, N.Z., to 1926; Lecturer in Entomology, Canterbury College, Christchurch, N.Z., 1925-26; Field Entomologist, Cawthron Institute to 1929. From September, 1929, he has occupied the post

GEOLOGICAL HISTORY.

Geologically the Tetrabranchiates are much older than the Dibbranchiates, and on account of their resistant shells also much better known. The oldest known Dibbranchiates are found in the Triassic, at the beginning of the Mesozoic era, and are therefore about 150 million years old. The Tetrabranchiates, however, first appear in rocks of late Cambrian age, which were laid down approximately 500 million years ago.

The oldest and most primitive Tetrabranchiates had straight shells in the form of tapering cones, which sometimes reached a length of fifteen feet. Later examples had the cones bent slightly, and still later we find forms in which the shell is coiled in a loose spiral, and others with the whorls tightly wound as in *Nautilus*. There were two main groups of Tetrabranchiates: the Nautiloidea, of which *Nautilus* is a type, and the Ammonoidea, which branched off from the Nautiloid stock and first appeared in the Devonian (approximately 400 million years ago). The Ammonoidea flourished abundantly in the Triassic and Jurassic, but became extinct in the Cretaceous (about 60 million years ago). The Nautiloidea, perhaps because they were more conservative, had a longer life, extending from the Cambrian right to the present time. They culminated in *Nautilus*, which is essentially a Mesozoic genus, being particularly abundant in Jurassic times, some 120 million years ago.

of Senior Ecologist and Curator to the C.S.I.R. at Canberra, A.C.T. He was well known as a student of the order Diptera (Flies) and had contributed a number of papers to scientific journals, and was celebrated for his skill in the preparation of minute entomological specimens and museum technique. He assisted his former chief, Dr. R. J. Tillyard, in the preparation of the latter's well-known work, *The Insects of Australia and New Zealand*, many of the line drawings bearing his initials. While popular among his associates, he was a highly efficient officer, and his death at the age of 53 leaves a gap which will not be readily filled.

A.M.

Insect Habitat Groups

By KEITH C. McKEOWN

THE modernization of our museums constantly brings forward new problems in the realistic presentation of exhibits in the public galleries. Difficulties are nowhere more evident than in the reconstruction of the lives and habits of the insects. Habitat groups using actual specimens of the insects concerned have been employed in other parts of the world, but, on account of their usually small size and perishable nature, such attempts have not been wholly successful. The series of four habitat groups recently placed on exhibition in the Australian Museum represent the latest method of displaying the lives of a few of our insects. In these, accurately coloured models of the insects, enlarged six times, have been used, and are placed in realistic surroundings.

THE ANT-LION.

The first of these groups illustrates the life-history of an Ant-lion (*Myrmelionidae*), one of those curious creatures the larvae of which dig their conical pits in the soft dust in sheltered situations with the object of entrapping unwary ants. In the reconstructed scene one of these pits is shown in section in the foreground, with one of the large Meat Ants endeavouring to escape from the formidable spined jaws of a buried "lion". Behind, and to the left, is another pit with the jaws of the larva projecting from the dust at the bottom as it awaits its prey. Above, on the right, a perfect insect, with mottled gauzy wings, settles on a projecting twig. Meat Ants are busy searching the ground for food, or climb



The Ant-lion.

the trunk of a tree to secure honey-dew from scale and lerp insects in the branches above. A bush track leads away into the distance.

In preparing its traps, the larval Ant-lion shows great skill; first it travels backwards in a circular course, marking out the confines of its pit, using its triangular body as a plough; then it works inwards in gradually diminishing circles, digging deeper as it goes, and from time to time flipping out jets of sand with its spade-like head. This method of ejecting sand with its head is also employed when an ant shows signs of escaping from the pit, a few well-aimed "spadefuls" of sand usually serving to bring the victim within reach of the jaws.

The Ant-lion is capable of undergoing long periods of abstinence—fasts rendered necessary by its hunting methods. When

fully fed, the larva spins an egg-like silken cocoon, which becomes closely covered with sand grains, at the bottom of the pit, and changes into a chrysalis. From this pupa the perfect insect subsequently emerges. A more complete transformation is hard to imagine; gone is the squat gnome-like larva, and in its place is a delicate gauzy-winged insect, that by day clings closely to bark or twig, and by night flies with weakly fluttering wings in search of suitable situations in which to lay its eggs. This winged insect does not feed, and its active life is short.

GUESTS OF ANTS.

The second group illustrates that extraordinary habit of ants of keeping insects of other orders in their nests as guests or, one might almost say, "pets". Here is a section cut through portion of an ants' nest. Above ground, members of the ant community are busy bringing in food, removing pebbles from the excavations beneath, or exchanging the news of the day by mutual contact of their sensitive antennae—a means of communication difficult for us to comprehend. Below in a large gallery in the soil is a remarkable scene. To the left centre an ant is seen feeding a curious little brown beetle, while another awaits nearby with its forelegs raised in an effort to attract attention and secure its share of food. These beetles are a species of *Chlamydopsis*, members of a group of ants' nest inhabiting beetles. These little beetles are carefully tended by their ant hosts apparently for the sake of an attractive secretion produced from brushes of hair upon their bodies. So attractive is this secretion to the ants that they will sometimes carry their devotion to the beetles to such lengths that their own young suffer from neglect. In the right centre two ants are



Some Guests of Ants.

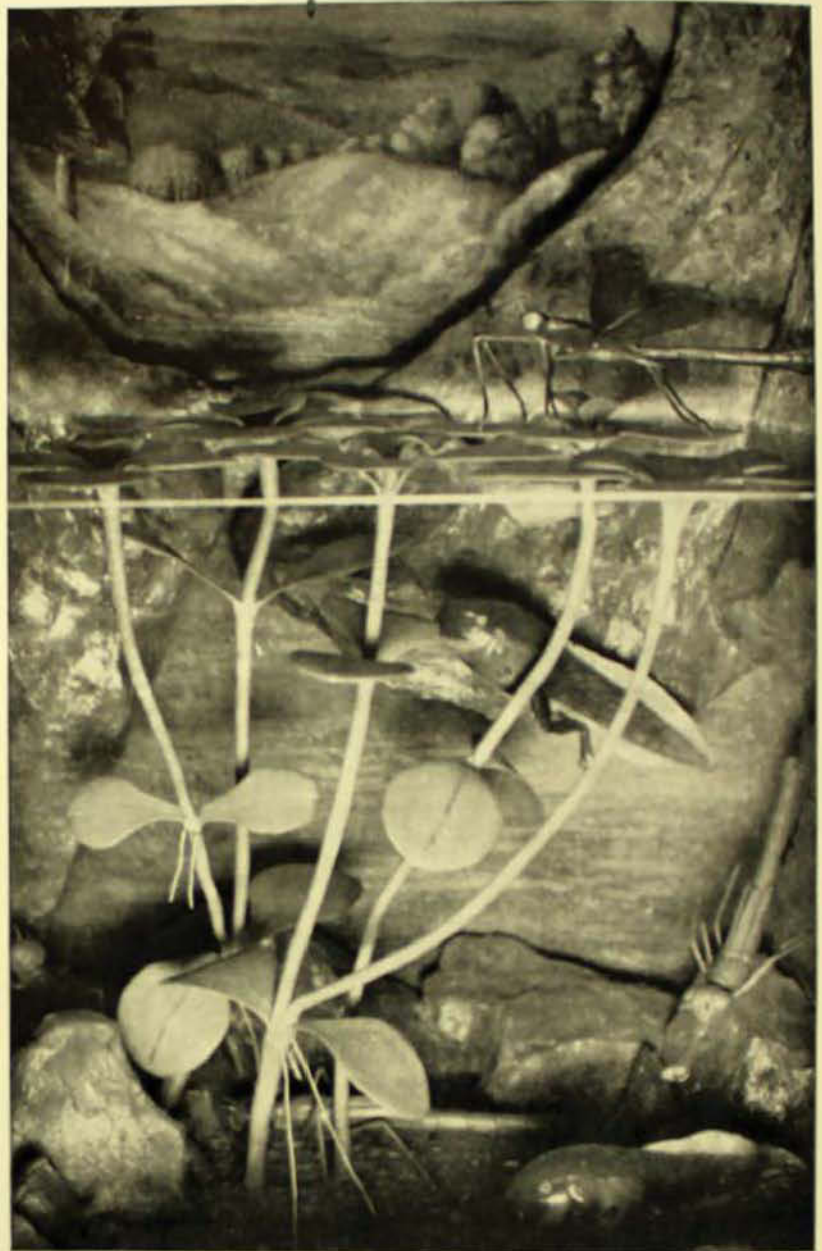
exchanging food in a friendly manner, but a small silverfish has dashed from shelter and is in the act of snatching the food as it passes from mouth to mouth. These silverfish are rather in the nature of uninvited guests, and they are pursued by the ants on sight, but they usually manage to escape by hiding in some crevice until the danger has passed. It is possible that they may act as scavengers in the nest. On the extreme right an ant is attending mealy bugs which cling to a root—another case of "cupboard love", for the ants cherish them for the sake of

the sweet honey-dew which they secrete. These scale insects are frequently found in the galleries of the ants' nests, where they feed on roots, but when necessary they are carried above ground and farmed out upon their special food plants.

THE DAMSEL DRAGON-FLY.

The remaining two groups take us to the underwater world, and show something of the hidden lives of a few of its inhabitants. That depicting the life of the Damsel Dragon-fly shows two of the aquatic nymphs hunting tadpoles among the stems of the water-weeds. These truly remarkable creatures are well adapted for their life, obtaining the life-giving oxygen from the water by means of specialized gills; but, perhaps, their most remarkable feature is the "mask", which is used in securing their prey. The "mask" is a development of the lower lip. When the insect is at rest, this is folded up beneath the head, much as one might press the forearm against the chest while the hand clasps the chin. But when an insect, tadpole, or small fish passes within reach, the mask is shot out to its full extent, and the prey seized in the pincer-like points at its extremity, and drawn back to the jaws to be devoured at leisure. The nymph on the right has the "mask" extended.

Dragon-fly nymphs pass through no quiescent pupal state, but are active and feed voraciously throughout the aquatic period of their lives. When it can eat no more, the nymph climbs up the stem of some plant or other object projecting above the water surface, and here its skin splits and the perfect insect emerges, leaving its cast skin still clinging to its support. On one of the floating leaves rests an adult Damsel-fly. Even in this



The Damsel Dragon-fly.

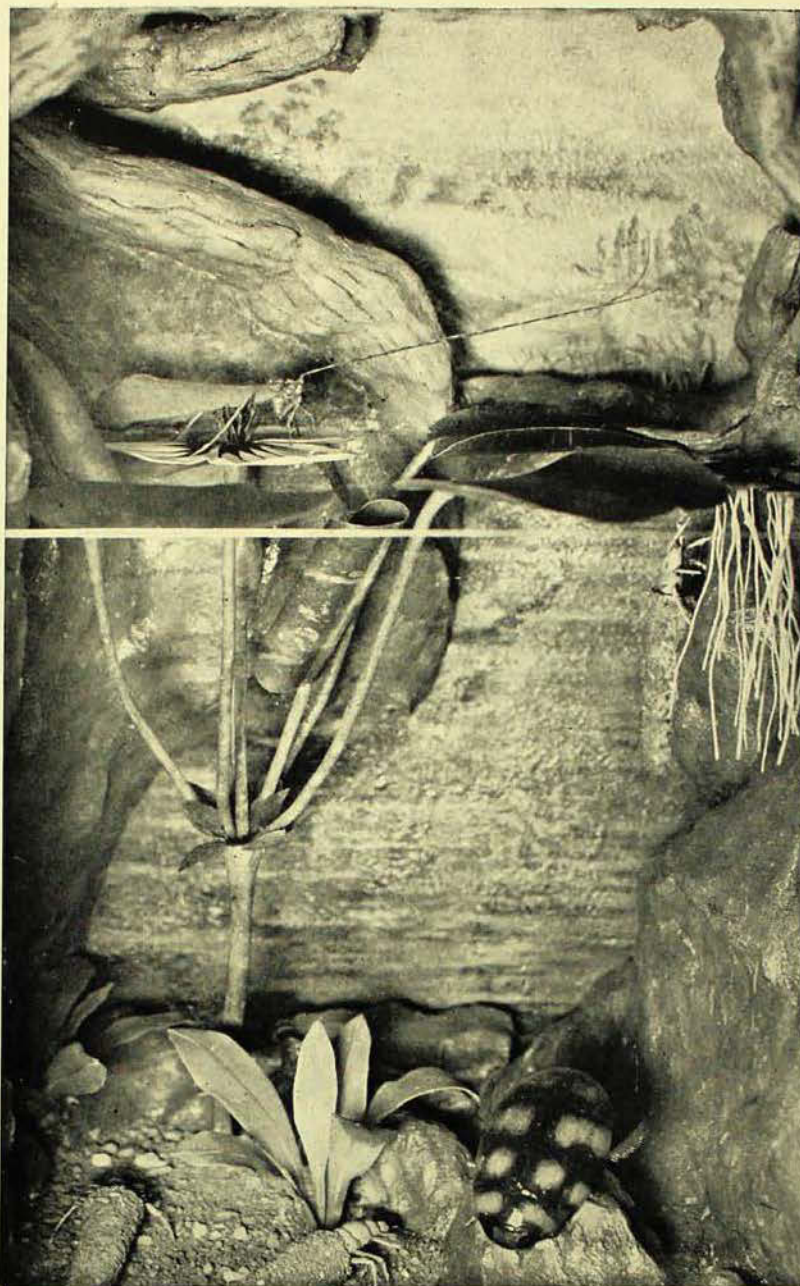
stage the insect has an insatiable appetite, and hawks the air for mosquitoes and other small insect life.

The Damsel-flies (Zygoptera) are more slender and delicate than the larger Dragon-flies (Anisoptera), and can fold their gauzy oar-shaped wings over the back; those of the Dragon-flies always remain outspread. The nymphs of the latter are broad, sluggish creatures, popularly known as "Mud-eyes" from their habit of crawling about in the mud.

THE CADDIS-FLY.

The Caddis-flies (Trichoptera) form a remarkable group of aquatic insects. The larvae, or caddis-worms, are vegetable feeders (with the exception of a small section of the order which are carnivorous), and they construct portable houses of stick, sand, gravel, or snail shells with which to protect their otherwise almost defenceless bodies. The forepart of the larva which projects from the case is armoured, but that portion within the case is fleshy and soft. The insects crawl about over the sandy bottom or rock walls of the pool, laboriously dragging their heavy cases behind them by means of strong hooks at the extremity of the body, which grip the case walls, making it almost impossible to withdraw the creature from its shelter. The Caddis group shows six of these larvae in cases constructed of sand-grains.

When ready to pupate, the larva withdraws within its case and spins a silken grating across each end, allowing the free passage of water over its gills. Here it changes into a chrysalis, and emerges later as a Caddis-fly. One of these insects, a brown, moth-like creature with exceedingly long, slender antennae, rests upon the yellow flower of an aquatic plant. With the coming of dusk these winged insects fly over the surface of the water and deposit their eggs in masses, which give rise to small and defenceless larvae which hasten to construct tiny fortresses for themselves from the sand, enlarging them as they grow. While possibly effective against many enemies, their defences avail them little against fish, which gulp them down cases and all.



The Caddis Fly.

At the bottom of the group swims a water-beetle (*Bidessus bakewelli*), an example of those insects which have not fully adapted themselves to an aquatic life, and find it necessary to rise to the water surface to obtain air.

The backgrounds and the colouring of the models are by Miss M. Soady and the late Miss E. A. King; the modelling and construction of the groups by Mr. J. Kingsley, Assistant Articulator.

Notes and News

Dr. Walther Horn, the well-known Director of the Deutsches Entomologisches Institut in Dahlem, Berlin, passed away on 10 July, 1939. He was born in Berlin in 1871, and though he graduated as a doctor of medicine, he did not practice his profession except during the years 1915-18. He was at first an assistant to Dr. Gustav Kraatz, a well-known German entomologist, and a man of means, who in 1886 donated his collections and provided a sum for the establishment of the German Entomological National Museum. Dr. Kraatz died in 1909, nominating Dr. Horn as his successor as Director of the Museum. (British entomologists may find a parallel in the Hope Museum at Oxford, containing the collections of the Rev. F. W. Hope, and J. O. Westwood, who was the first Hope Professor.) In 1912 the Museum published two scientific journals, *Entomologische Mitteilungen* and *Supplementa Entomologica*. In 1920 the title of National Museum was altered in favour of Deutsches Entomologisches Institut. In collaboration with Dr. S. Schenkling, Dr. Horn published in 1928-29 the *Index Litteraturae Entomologicae*, which dealt with the insect literature of the world up to 1863, and which included a number of references overlooked by H. A. Hagen in his *Bibliotheca Entomologica*. In 1934 appeared three other journals, *Arbeiten über morphologische und taxonomische Entomologie aus*

Berlin-Dahlem, Arbeiten über physiologische und angewandte Entomologie aus Berlin-Dahlem, and Entomologische Beihefte aus Berlin-Dahlem. In 1935-37, in collaboration with I. Kahle and R. Korschefsky, appeared his *Ueber Entomologische Sammlungen* (Ein Beitrag zur Geschichte der Entomo-Museologie), a work showing the disposition of the chief insect collections of the world. In addition to his duties of editing these journals, Dr. Horn found time to write a number of papers on his favourite group, the Tiger-beetles (Cicindelidae), and had described a number of Australian species. In my *Bibliography of Australian Entomology, 1775-1930*, I made the unfortunate lapse that he had died in 1931, having mistranslated a biographical account celebrating his sixtieth year. This blunder led, however, to his writing to me and sending me a photograph, and in 1934 I had the pleasure of meeting him and his colleague, Dr. Hans Sachtleben, at the Institut in Berlin-Dahlem. The entomological and scientific journals of the world today all pay tribute to this genial personality, whose enthusiasm and ability have placed his Institut as a unique creation among the scientific institutions of the world, an institution devoted to the study of insects in all its numerous branches, and a Mecca for students of entomology the world over.

A.M.

KOONWARRA. By Chas. Barrett, C.M.Z.S. (Oxford, 1939). 8vo, pp. 315, 48 plates. Price 9s. 6d.

Charles Barrett, journalist and naturalist, is known throughout the length and breadth of Australia for his enterprise in producing that most welcome series, the *Sun Nature Books*.

Here, in *Koonwarra*, a splendidly produced and illustrated volume, we find the tale of Charles Barrett's wanderings in Australia in search of the curious in nature, and few of our nature lovers have seen so much of our land. Commencing with an account of his experiences with Black Swans, for which Koonwarra is an aboriginal name, the author leads us on, north, south, east and west, now in the tropics, now in the arid centre, with sometimes, it must be confessed, disconcerting swiftness. The book tells us in breezy style of things seen and heard, of meetings with naturalists and explorers, from E. J. Banfield of Dunk Island to Roald Amundsen of Antarctic fame. A panorama of Australian fauna

and flora passes before our eyes as the journey takes us into little-known jungles and deserts.

The narrative has obviously been written for the nature lover and the general reader, and especially for those who have already some more or less detailed knowledge of the animal life of our continent. The overseas reader may find difficulty in obtaining a very clear idea of many of the creatures referred to, since there is often but little of a descriptive nature in the book regarding them. One wishes that the author had given us more of the material which he must have gathered in his years of wandering regarding the lives and habits of the lesser-known animals he has encountered. A careful search has failed to discover any reference in the text to the subject of some of the magnificent photographic illustrations.

Despite this criticism, this account of a naturalist's wanderings can be heartily recommended to those who enjoy travel in imagination into the less accessible regions of Australia.

K.C.McK.



Maori Carving



AN exhibit showing how Maori carving patterns are based on human figures has been prepared by the Auckland Museum and Institute, and is to be shown in rotation in the various State museums. The Australian Museum has been fortunate to receive the first loan of the exhibit, which is at present on display in the Lower Ethnographical Hall.

Excellent replicas of two series of carvings are to be seen. One consists of human heads, and the other of full figures; both illustrate the change from naturalistic to grotesque treatment, and the use of conventionalized motifs in forming decorative patterns.

Canoe figure heads, decorations for a house gable, and canoe balers are chosen to show various stages in the transition from natural to grotesque in carvings

B.

of the human face. The mouth and tongue are early selected for exaggeration; the mouth is enlarged, the lips thickened, and the tongue made to protrude to an alarming degree, while staring eyes add to the terrifying aspect. The features are enlarged and flattened

to permit of ornamental scroll work. In the profile representations shown, the lips are drawn out to a beak-like curve in order to fill the field of the panel, which also requires a lengthening of the face. To this particular design, sometimes termed a *manaia* or bird-headed man by other students of Maori art, Mr. Gilbert Archey of the Auckland Museum would grant a human derivative.

The series displaying the whole figure commences with a carving closely representative of the human form. The second figure is less life-





like; the hands are curved in readiness for further manipulation, while the whole face has become a grotesque mask with wide open eyes and protruding tongue. In the third figure the fingers are stretched over the abdomen, and the pattern spreads over the body. The fourth figure is incorporated into a panel. It has been broadened and squared off in rectangular fashion to fit the panel upon which it stands out in high relief. The head has become an even more elaborate mask, and the shoulders and thighs bear broad scrolls. The encircling background consists of a network of scrolling. Figure five has been stretched



to cover the whole panel, and has been so flattened as to form merely a low relief. With this development the figure loses much of its realism and terrifying aspect. The entire surface is covered with spirals and scrolls. Further panels carved in low relief show a human figure with head tilted to one side to permit of a harmonious joining of a right-angled beam. This distortion of the body lends to the composition a vigour missing in the strictly straight figures.

An example of the intricate combination of numerous figures is to be seen in the door lintel at the end of these

notes. Nine figures have been worked into this complex design. The three main figures are easily seen. Rather more difficult to discern are the two conventionalized portions of the human face or form between the central and lateral figures, and on the outer edge of each of the latter a further figure.

In addition to the school of carving that portrays "figure rhythm", there is on the east coast a school which devotes great attention to the expression of "spiral rhythm"; probably the best examples of this work are to be seen in the carved prow and stern pieces of the large war canoes. Each tribe had its own

rendering of the conventional style, varied in quality by the skill of the craftsman, and departure from the traditional pattern might be punished by death. There has been much controversy over the meaning of the contorted figures that are so characteristic of Maori wood carving. No definite evidence has been drawn from native tradition, and the exact origin is not yet generally agreed upon. The human interpretation here given is that advanced by Mr. Gilbert Archey, who devised the exhibit.

When regarding the art of a primitive people, we are accustomed to inquire into its significance not only to the artist, but



also to the people in general. The decorative value of the drawing or carving is universally admitted, but there are invariably one or more other functions of primary importance. In some areas it is either the ritualistic, religious or magical significance that is stressed. In New Zealand the decorative intent is accompanied by a commemorative motive, a desire to pay honour to the exploits of an ancestor or to a tribal deity. The Maori always had great respect for his ancestors, and this was nurtured by the custom of erecting carved slabs bearing not the likeness but the distinguishing mark of some revered forefather or culture hero. Thus was the community bound together by a common tradition of respect for the past. Local myth and ritual were closely connected with the sculptures, and in them found tangible expression and support.

As a result of a strong aesthetic impulse, the Maori was prompted to beautify objects of utility and to ornament his own person. He decorated almost every article he used, such as clubs, digging sticks, pigeon snares, adze handles and feather boxes; but his greatest skill perhaps was devoted to the ornamentation of his communal houses, commemorative sculptures, and war canoes. It was in these that he took his greatest pride, for they were the epitome of the artistic skill of the community. The craftsman responsible for a well executed piece of work enjoyed high renown beyond the confines of his own tribe.

May we, then, invite our readers to witness some of the handiwork of these native artists? In a short time the Auckland exhibit will be transferred to another State.

E.B.



Scientific Libraries

In the previous issue of this magazine, under the above heading, a tribute was paid to the Fisher Library, University of Sydney, for assistance in the micro-filming of literature.

Mr. H. M. Green, B.A., LL.B., Fisher Librarian, has written to the effect that such

help was personal from Mr. K. H. Burrow of his staff, who has devoted much time to this phase of library work. To Mr. Burrow, then, we tender our thanks, for his services have been much appreciated by various scientific correspondents of this Museum.

Australian Insects. VIII

Orthoptera: 3. Stick and Leaf Insects

By KEITH C. McKEOWN.

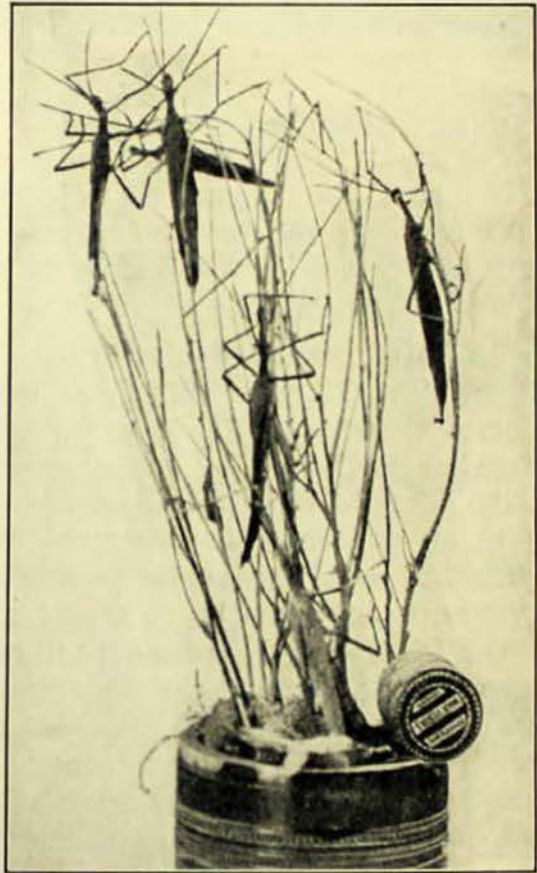
THE third section of the order Orthoptera brings us to the family Phasmidae, perhaps one of the most remarkable of the groups included in this ancient and extraordinary order. In form these insects bear a superficial resemblance to their relatives the Mantids. But here we have an assemblage of vegetarians, placid feeders among leafy branches, none of them possessing carnivorous habits and, consequently, lacking the remarkable adaptations of the Mantids described in the preceding number of THE AUSTRALIAN MUSEUM MAGAZINE, the pointed head, rending jaws, and the spined, trap-like forelegs for seizing and holding their prey. The adaptations of the Phasmids to their particular mode of life are none the less perfect, but they are almost exclusively devoted to rendering their possessors inconspicuous among their leafy surroundings, protective resemblances that aid in concealing the insects from the keen eyes of their enemies.

For convenience we may, perhaps, divide the family into stick-like and leaf-like forms, although the line of demarcation between the two is somewhat arbitrary, and there are a number of intermediate types. Examples of each will be discussed in some detail later.

In some forms both sexes are winged, in others the males are winged while these appendages in their mates are wholly inadequate; in others again both sexes are lacking wings. The males of all species are usually smaller and more slender than their egg-laden females.

In essential details the life-histories of all stick insects are generally alike. The insects frequent the upper branches of trees and shrubs, resting motionless, as a rule, by day, and feeding at night. The

eggs are deposited singly by the females as they cling to the foliage, and it is obvious to the most casual observer that the Phasmids are casual mothers, simply dropping their eggs indiscriminately and allowing them to fall to the forest-floor beneath, with no care as to their sub-



Podacanthus wilkinsoni, the gregarious stick-insect.
Agricultural Gazette of N.S.W.

sequent fate. Possibly a hundred or more eggs are laid by each female in the course of her life, but not very many at one time. These eggs are truly remarkable objects and differ markedly according to the species concerned. A typical egg is comparatively large, hard and seed-like in appearance, and is provided with a stopper-like cap, which is pushed off when



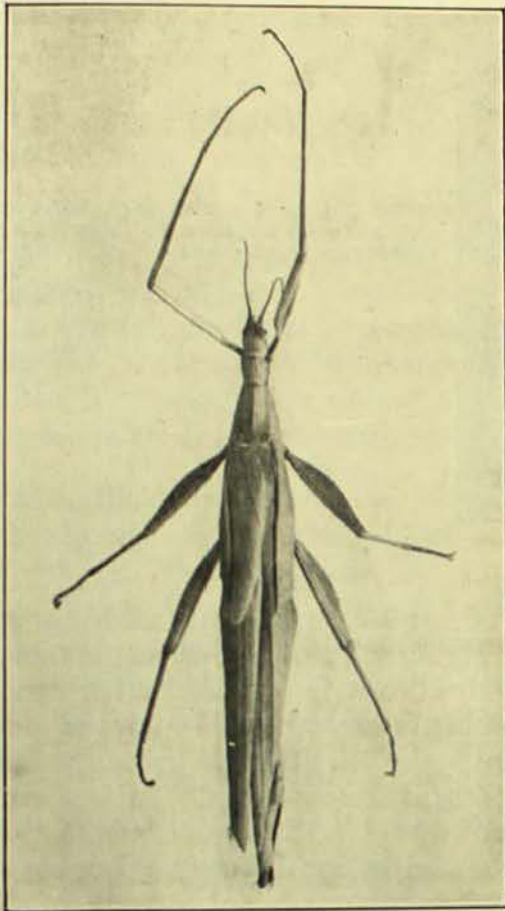
The Great Brown Pasma (*Acrophylla titan*), which so closely resembles a dead branch among the foliage it frequents as often to escape detection.

Photo.—K. C. McKeown.

the young stick insect emerges. The enclosing walls are often adorned with ridged or bark-like decoration. Hatching may occur within a few weeks or months, or may be deferred for upwards of two, or possibly three, years.

On hatching, the baby Phasmids are small, pale, and weak, and look rather like little crumpled bits of dried grass-stem. They are, of course, quite wingless, and, like other members of the order, cast their skins at frequent intervals, until with the last moult maturity is attained. The young insects hasten to crawl away from the leaf-littered ground and climb up into the foliage, where they conceal themselves, and it is remarkable, even where Phasmids are numerous, how seldom one finds one of these bush babies; indeed, it is but rarely that one sees any immature forms. I believe they dwell on the topmost foliage of the tall trees. It is certain that, despite their protective form and tints, many fall a prey to birds and other enemies, as kookaburras and hawks. The rate of growth of stick insects is slow, and it is possible that they do not attain maturity under two years, or possibly longer. With maturity the wings, in those species which acquire them, are developed, and the insects are capable of reproducing their kind.

Most Phasmids are more or less solitary in their habits, but several species occur in vast swarms, stripping the trees of their foliage and causing great damage in forest areas. One of these gregarious forms is that popularly called the "Ringbarker" (*Podacanthus wilkinsoni*). W. W. Froggatt has written of this species. He says: "In 1891, Olliff . . . published a note on this insect; they were recorded as very numerous at Murphy's Creek, near Walcha, and since then they have been recorded as appearing in similar swarms every alternate year, which points to the fact that it takes two years from the time the eggs are dropped on the ground until the perfect development of the phasma. . . ." Describing a visit to the district in 1905, he continues: "The country over which they range is about 50 miles long, comprising a wide strip of forest, including what is known as Murphy's Scrub, through Upper Tia, and Nowendoc Station to the Gulf, a depression in the mountains towards the Manning River, in which district they are known as the 'Ringbarkers', 'Murphy's Ringbarkers', or 'Lowrie's Flying Gang' on account of the dying brown appearance of the trees covering the ranges after they have been feeding through them. So like the effects of ring-barking upon the trees is this damage, that I was told that many years ago the



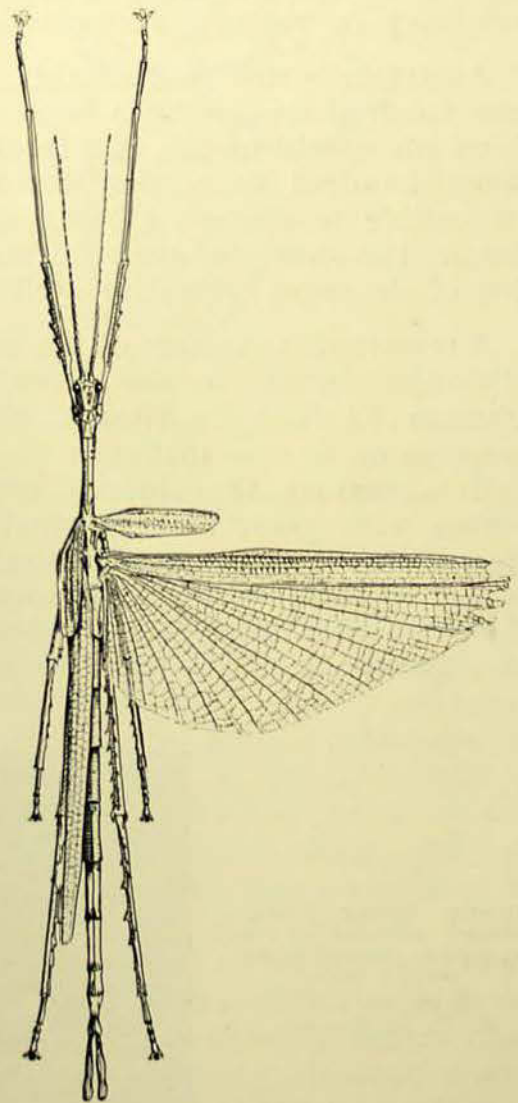
The Female of the Yellow Winged Spectre (*Tropidoderus childreni*) may easily be recognized by the leaf-like expansions on the femora of the middle and hind legs.

forester, new to the district, noting the brown foliage, accused the squatter of ring-barking timber on leasehold land without permission. At the present time (February) the adult insects are hanging in couples, or clambering over the tops of the young gum scrub, which are completely stripped of every leaf right down to the ground in many instances, while the tops of the large gum trees above are quite leafless, and many of them covered with dead branches that have died back for several feet from the effects of former attacks.

"All species of eucalypts are devoured, but no other scrub trees are molested."

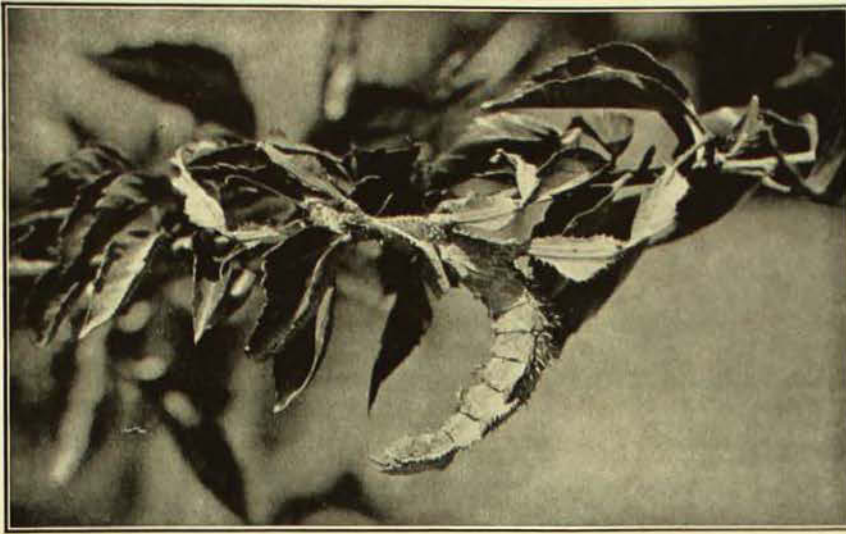
As with all protectively coloured insects, their camouflage is wholly effective only so long as the creature remains motionless. No matter how leaf-

like an insect may be at rest, the illusion is lost immediately it moves; a quiescent leaf is natural, but a moving leaf must immediately attract the attention of the hunter. Nature has provided against such voluntary or involuntary movement in the Phasmids. When disturbed or frightened in any way, the insect immediately becomes immobile, indeed, it would seem that this immobility is wholly outside the control of the animal, and resembles a state of coma, and may persist for some considerable time. When all danger has passed the stick insect slowly stirs again into life, and crawls away to take up its customary activities. It is a very remarkable example of the interaction of various



Clemacantha regale, our largest Phasmid. Male.

Nancy B. Adams, del.



The Spiny Leaf-Insect (*Extatosoma tiaratum*) among foliage; an almost perfect example of protective mimicry.

Photo.—K. C. McKeown.

factors to bring about the maximum of efficiency in protective adaptations.

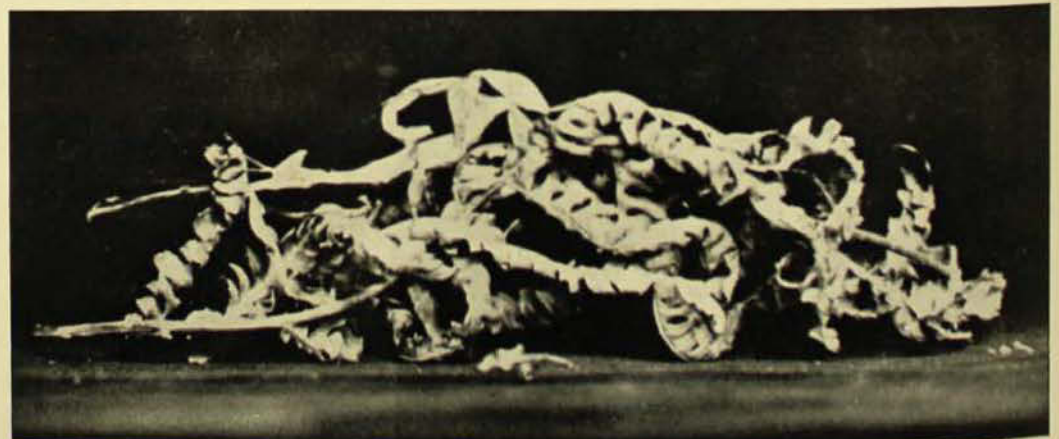
Australia is rich in Phasmids, and over one hundred species have been described from our continent out of a total of some seven hundred from the world. It is impossible to discuss all our species in detail, but mention must be made of a few of the more typical or striking.

A remarkable example of the most truly stick-like forms is the Great Brown Phasma (*Acrophylla titan*), which may measure up to nine inches in length. The entire creature is coloured bark-brown varied with grey, and, it must be confessed even by the most unimaginative observer, resembles nothing more nor less than a broken stick about the thickness of a lead-pencil. The head is short and

rounded, and is surmounted by a pair of short antennae; the thorax is smoothly cylindrical, but is studded with numerous short points or spines scattered over its surface; the abdomen is elongate and fleshy, and terminates in a pair of flattened cerci. It is covered at the base by two wholly inadequate wing-covers, or tegmina, which conceal a pair of tightly folded, fan-like, gauzy wings of a rich purplish-brown colour varied with marbling of a lighter shade. This description applies to the female only; the male is smaller, very slender, and furnished with long, pointed flying wings; those of his heavy-bodied mate serve as little more than a parachute to support her in the air as she planes from one tree to another. When at rest, these insects hold their forelimbs straight for-

Young Spiny Leaf-Insect among dried bracken. Insect is on upper left.

Photo.—
K. C. McKeown.



ward in front of the head in continuation of the horizontal plane of the body and, so that the limbs may lie close together and not break the continuous line, they are notched at the base, so as to fit snugly around the head.

Equally stick-like, but shorter and more slender, is *Ctenomorpha marginipennis*, a very common species in bush and gardens around Sydney. Like *Acrophylla titan*, it is coloured with tints of brown. It measures about six inches in length, with the male smaller.

Intermediate between the stick- and leaf-like forms are members of the genera *Podacanthus*, *Tropidoderus*, and *Clemacantha*; these are large insects, coloured with bright green or bluish-green, with tapering bodies and well-developed wings in both sexes. *Podacanthus wilkinsoni*, which has been mentioned in connection with its gregarious habits, has green and brown tegmina or wing-covers, with the large fan-shaped flying-wings shading from pale yellow or green at the base to a delicate rose-pink at their apices. Both sexes measure about three and a half inches in length and about four inches across the outspread wings. *Clemacantha regale* is our largest Phasmid, the female measuring about ten inches in length, while the male is smaller and very much less bulky. Apart from its great size, few insects can approach it for beauty. The fan-like membranous flying-wings are delicately tinted with clear green and bluish-green and the entire body is a rich pea-green colour. Members of the genus *Tropidoderus* are stout insects with a relatively short thorax, and have the middle and hind femora expanded and flattened in a leaf-like manner. *Tropidoderus childreni* and *T. rhodomus* are richly coloured and not uncommon species.

The Spiny Leaf Insect (*Extatosoma tiaratum*) is a truly remarkable example of the leaf-like Phasmids, and one quite frequently encountered in the bush. The

female is heavily built, and measures about five inches in length. She is of a bright grass-green colour, with the margins of the abdomen fringed with flattened, leaf-like plates, the legs, too, have similar leafy expansions, while the whole insect is armed with short sharp spines. The head is large and conical, with the peak rising into a bizarre head-dress something like a dunce's cap. The wings are quite minute and functionless. The male is rare, and I have never met with it in the bush, although specimens



An Asiatic Leaf-Insect, *Phyllium* species.

After Imms.

are sometimes sent into the Museum by country correspondents; it is smaller than its mate and quite slender, although it bears the typical leafy appendages on body and legs. It is provided with a pair of elongate, pointed, gauzy wings. The young are curious leafy, greyish-brown creatures, and may sometimes be discovered among dry bracken fern, which they resemble in an extraordinary manner, and are very difficult to detect even when they are directly before one's eyes. The accompanying illustration well shows the perfection of the camouflage of one of these little creatures. A second species, *E. elongatus*, has been described

by the late W. W. Froggatt; this insect is patterned with greyish, lichen-like spots and blotches.

Mention must be made of the genus *Phyllium*, the members of which are the most truly leaf-like of all Leaf Insects. They are almost entirely confined to the moist humid parts of the Oriental Region, and particularly to the islands of the Indian Ocean. In the females the tegmina are extensive and leaf-like, ribbed with veins and blotched with markings like the ravages of fungus; the body is broad

and flattened, and the limbs are expanded. The males are slender and bear well-developed wings. Two specimens of a species of *Phyllium* have been captured within recent years in the vicinity of Cairns, Queensland, but whether these are native or some accidental introduction is not known. Their occurrence in Australia is extremely interesting and is worthy of further investigation, and I would be pleased to learn of their further occurrence, and, if possible, to secure specimens for examination.

A New Bird of Paradise*

By J. R. KINGHORN, C.M.Z.S.

A STUDY of the special exhibit of the Birds of Paradise in the Australian Museum will reveal that the red or golden plumes of some, the fiery and metallic feathers of others, or the green button-like tail tips of the dainty King Bird are more gorgeous than any tale could unfold or artist could paint. As you stand in front of that case of birds you cannot but admire their surpassing beauty, and you wonder why and how such apparently delicate creatures live in the rain-soaked tropical forests, or the cold misty mountain tops of the wildest parts of New Guinea. The Birds of Paradise Group does not contain every known species, it is true, but it was thought that all of the beautiful and extraordinary kinds were there, and that no others of any great interest or spectacular nature remained to be found by man. But Nature is for ever revealing new creatures to those who search, and recently the Museum received through the Administrator, Brigadier-General Sir Walter Ramsay McNicoll, K.B.E., D.S.O.,

V.D., three birds collected by Messrs. J. L. Taylor and R. J. Black, leaders of the 1939 Hagen-Sepik Patrol. These birds proved to be new to science, and because of the long ribbon-like central tail feathers have been named McNicoll's Ribbon-tailed Bird of Paradise. Subsequent correspondence shows that actually the species was first seen in its native haunts by the late Jack Hides about five years ago when he encamped on the cloud-wrapped heights of Mount Champion; though a specimen was shot by one of the native police and the tail feathers kept for reference, no further information was received at that time. In May, 1938, Mr. F. S. Mayer, who was collecting live birds in Papua, met a member of Hides' party and two miners, all of whom remembered seeing the birds. Some time later, two tail streamers were given to him by a missionary, who had secured them about ten miles west of Mount Hagen from a native who was wearing them as a head dress. These were forwarded to the British Museum of Natural History for examination, and a

* See coloured plate.

reply was received by Mayer that the feathers belonged to an unknown kind of Bird of Paradise, and requesting him to try to get complete specimens.

Without knowledge of this request, Messrs. Taylor and Black forwarded their specimens (collected a year later) to the Australian Museum, where they were described as new, and will be stored in the special reference cabinets reserved for the safekeeping of rare and valuable specimens.

McNicol's Ribbon-tailed Bird of Paradise measures about twelve inches from beak to tip of the tail proper, but the two long, ribbon-like, central feathers, which are white with black tips, measure another thirty-eight inches. The bird is covered with velvety feathers of a brownish-black colour, and there is a metallic green sheen on the head and back. The throat and upper breast are bright green, and there is a fiery copper-coloured band across the chest. This description is of the male bird, the female, like many other Birds of Paradise, having been noted by Mr. Taylor as brown, with a short tail, perhaps only six inches long. Taylor forwarded the following note with the birds:

This bird was observed in the forested range of the main cordillera west and north-west of Mt. Hagen between longitude 143 degrees 30 minutes east and 142 degrees 30 minutes east on both sides of the Strickland (Fly) Yuat (Sepik) watershed. It is probable that the bird will be found further west in the Star mountains of Dutch New Guinea.

The species appears to be confined to altitudes between 8,000 and 10,000 feet above sea level and is more numerous at 9,000 feet than at

any other height. There are not many of them, but one meets them here and there in the high forest. They make a clicking or hammering sound something like a pneumatic riveter at work, and appear to have some difficulty in flying, the long tails being an encumbrance. Their flight is slow and jerky, and over short distances only.

In display they jump from branch to branch, raising the tail slightly. The female, speaking from memory, is light brown in colour, with a shorter tail.

The local people (natives) know the bird as Yaka Yan-gi, yaka meaning bird.

Nature may not have given the Birds of Paradise any musical powers, but she most certainly has endowed them with most beautiful and inspiring plumage.

We are indebted to the Royal Zoological Society of New South Wales for permission to reproduce the accompanying coloured plate of *Taeniaparadisea macnicolli*.

Since the above bird was fully described and figured¹ it has been brought to my notice that a worker in the British Museum had given a scientific name² (*Astrapia mayeri*) to the pair of tail feathers which had been sent to England some time previously. This worker had not seen the bird, nor had he any idea of what it looked like, but his scientific name must be used for the species, whilst my generic name must be retained. Hence the scientific name will become *Taeniaparadisea mayeri* (Stonor) and my descriptions and this illustration are the first and only ones of the bird.

J.R.K.

¹ Kinghorn.—*Australian Zoologist*, ix, 3, December, 1939, pp. 295-296, pls. xxv-xxvi.

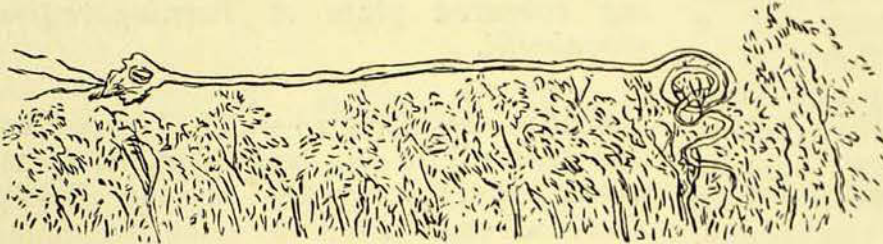
² Stonor.—*Bulletin of the British Ornithologists' Club*, lix, no. 419, February, 1939, pp. 57-61.

Mystery Animals of Australia

By GILBERT WHITLEY.

RECENT reports of a mysterious "crocodile" from the Angourie district, northern New South Wales, have revived interest in the weird animals which have been rumoured from time to time from various parts of Australia. As if our natural animals (platypus, kangaroo, koala, emu, lyre-bird, and countless more) are not wonderful enough, imagination or distorted observations have peopled our bush and billabongs with "tigers", bunyips,

Serpent (a widely distributed myth), and the *Mindi*. The *Mindi* of the Lower Murray River was said to have a large head, and when he hissed he protruded a three-pointed tongue; rainbow-like, he stretched across a forest, clinging to trees by his tail like a possum. All sorts of epidemics were caused by the *Mindi*, whose scales appeared as smallpox scars. This snake had a disgusting odour, which warned people of its approach; this was just as well, for to see the *Mindi* was to



The *Mindi* stretching across a forest.
After Brough-Smyth.

serpents of fabulous length, and other apparitions which compare with similar figments from other lands: the Loch Ness monster, the Abominable Snowmen of Tibet, the *Taniwha* of New Zealand, the Minotaur, the Sphinx, the Roc, the Phoenix, and hosts of unicorns, centaurs, dragons, gorgons, basilisks, cockatrices, fairies and fauns, mermaids, werewolves, and other chimerical creatures. Then there have always been stories of Sea Serpents, concerning which see Dr. Anderson's article in an earlier MAGAZINE (Vol. v, No. 6, 1934, p. 204).

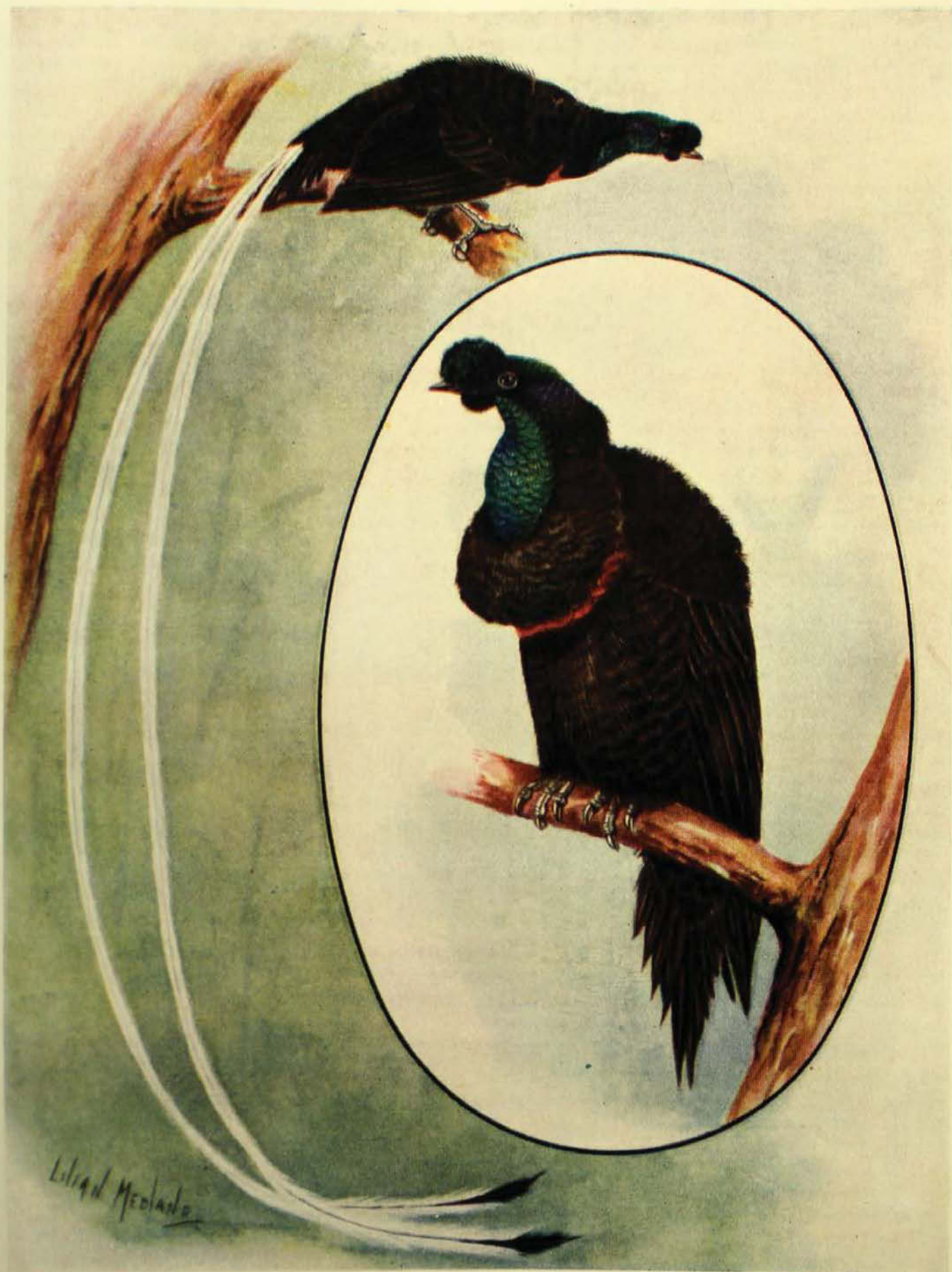
NATIVE BOGIES.

The aborigines had many stories of mythical animals, mostly relating to a dream-time before man inhabited the land, when half-animal and half-human creatures and totemic "species", from which mankind sprung, existed. Such were the heroes of the storms, lightning, and other phenomena, and monstrous snakes like the *Wollunqua* or totemic snake of Central Australia, the Rainbow

die. One variation of the Rainbow Serpent was a beast known as *Gauarge*, described as being like a featherless emu which sucked down in a whirlpool anyone who dared to bathe in one of its holes. On the Atherton Tableland, in Queensland, an aboriginal would never take me across the centre of a lake in his boat because of some mythical animal which lived in its depths. Perhaps this was a *Yero*, the huge eel or serpent whose large head is adorned with red hair and has a large mouth out of which rapids are said to originate. Perhaps the most imaginative of the blackfellows' myths were the little toothless, frog-like men, the *Yara-ma-yha-who*. These lived in fig-trees and had suckers on their hands with which they clutched any children who happened to be playing below, holding them for a long time and draining them of their substance in an "all-day-sucker" fashion!

HISTORIC "JITTERBUGS".

The first white visitors to Australia, the indomitable Dutch, using charts on which



Ribbon-Tailed Bird of Paradise
(*Taeniapardisea maenicolli*).

the Great South Land was doubtless already peopled with imaginary monsters, were immediately impressed with the strange animal life here. So Jacobszoon, who was Tasman's pilot-major, landing on Maria Island in 1642, perhaps started the mingled truth and fable which have persisted in our natural history. Seeing notches cut at long intervals in the gum trees, he thought these were the footholds

Dampier's "Hippopotomus" has since been determined as a dugong, but not until after much speculation as to its identity; it is also of interest to note that his was the first description of an Australian shark. From Western Australia, too, came a mysterious report from some white men of the crew of the *Géographe* in June, 1801. Charles Bailly, mineralogist attached to Baudin's expedition, and his



"Bringing home the bacon." A woman at Shark's Bay with the "Head and Boans of a Hippopotomus" (= a Dugong) in a perambulator.

Photo.—G. P. Whitley.

of giants, and he also saw "footprints not ill-resembling the claws of a tiger" (possible a Thylacine). Another "tiger" is mentioned from Western Australia in an anonymous despatch of 1705. A myth came true, however, when, in January, 1697, Vlamingh discovered that "impossibility", the Black Swan, in the Swan River, Western Australia, the living embodiment of a classical paradox. Soon after, Dampier, in August, 1699, discovered Shark's Bay, where an 11 ft. shark was caught:

Its Maw was like a Leather Sack, very thick, and so tough that a sharp Knife could scarce cut it: In which we found the Head and Boans of a *Hippopotomus*; the hairy Lips of which were still sound and not putrified, and the Jaw was also firm, out of which we pluckt a great many Teeth, 2 of them 8 Inches long, and as big as a Mans Thumb, small at one end, and a little crooked; the rest not above half so long. The Maw was full of Jelly which stank extreamly: However I saved for a while the Teeth and the Sharks Jaw: The Flesh of it was divided among my Men . . . so that we were now all much brisker than when we came in hither.

companions were frozen with terror by a terrible roaring, like the bellowing of a bull, but much louder, which seemed to come out of some reeds in the Swan River. This noise, has never been explained, unless this was the first encounter between bunyip and white man! We of the cities nowadays hardly know what silence is, yet in some parts of Western Australia I have known silence so utter that it was quite oppressive, and the sound of my solitary footsteps seemed, by contrast, to be a crunching roar. There were no cattle in Western Australia in 1801, but there were many seals and sea-elephants, so perhaps the noise which frightened the Frenchmen came from them.

THE BUNYIP.

We may class Bailly's reported noise as that of the first Bunyip, perhaps, but the first *sight* of this Bush Bogy seems to have been obtained in eastern Australia, by Hamilton Hume, the explorer. Five

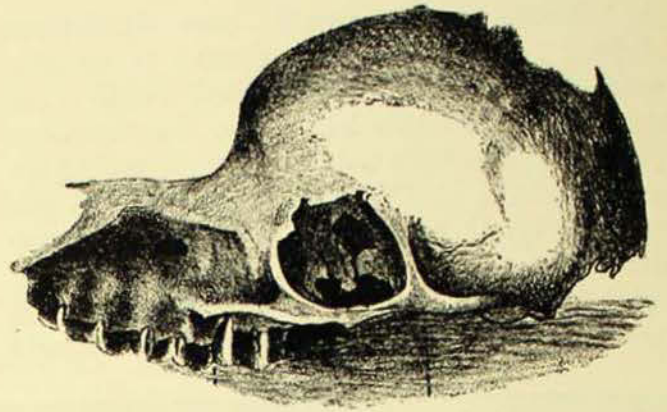
learned gentlemen, members of the Philosophical Society of Australasia, met in Sydney on 19th December, 1821, and their Secretary penned the following minutes:

Read the Journal of an Expedition from Lake Bathurst to the Pigeon House, on this Coast, performed last month by an European Native of the Colony, Mr. Hamilton Hume. Mr. Wollstonecraft informed the Society, that Mr. Hume reported the existence in Lake Bathurst, of an animal, supposed from his description to be the manatee or hippopotamus.

Resolved, That Mr. Wollstonecraft be authorized to reimburse Mr. Hume any expense he may incur, on the part of himself or any black natives, in food or labour, for the purpose of procuring a specimen of the head, skin or bones of this animal; and that the Treasurer do make good the same.

Unfortunately, however, the "manatee" was never caught and merely laid the foundation for a long line of bunyip legends. Lieutenant W. H. Breton wrote of Lake George: "It is pretended that a species of seal, or, as it was called a devil, had been seen in it; but as Satan is made to personify all animals whatever, when of the non-descript or wonderful kind, it is not improbable that the creature in question may have been altogether imaginary." A somewhat different account of the Debil-Debil was later given by Carl Lumholtz: "The devil in various parts of Australia is described as a monster with countless eyes and ears, so that he is able to see and hear in all directions. He has sharp claws, and can run so fast that it is difficult to escape him. He is cruel and spares no one either young or old. . . . The natives on the Gulf of Carpentaria say that the devil's lips are fastened by a string to his forehead."

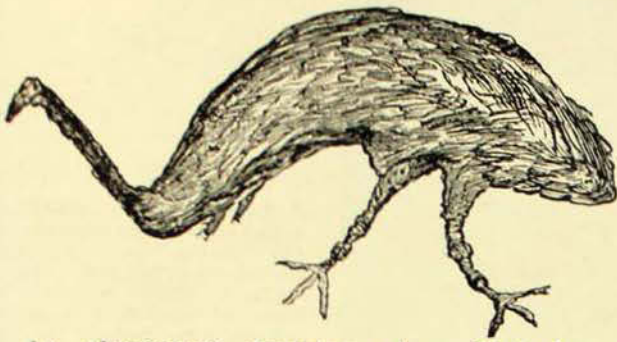
In 1847 Governor Latrobe procured copies of aboriginal drawings of the two "species" of Victorian Bunyip and sent them to Tasmania, but these have apparently disappeared, like their living (?) counterparts. An imperfect skull, found in 1846 on the banks of the Murrumbidgee, was sent to W. S. Macleay as that of a veritable Bunyip. Macleay regarded it as that of a much deformed colt, but Professor Richard Owen, from examination of an illustration sent to him in London, considered it was a calf's. The



The famous Bunyip Skull from the Murrumbidgee River.
After R. C. Gunn.

specimen was illustrated in the third volume of the *Tasmanian Journal of Science*, and deposited in the Australian Museum, but is not here now. One of the figures is here reproduced, together with drawings of two kinds of Murray River Bunyips made by an aboriginal for Dr. Brough-Smyth in 1848 and reproduced in his *Aborigines of Victoria*. In 1848, in the Eumeralia, Port Fairy, Victoria, a large brown creature with a head like a kangaroo's, an enormous mouth, and a long neck with long shaggy mane appeared. This Bunyip was said to have some magnetic attraction to lure human victims through the water towards it.

Several bunyips have been reported from the Tasmanian Lakes. In the autumn of 1852, a "large devil" was seen in the water of Lake Tiberias. It was 4 to 4½ feet long, black, with a bulldog head, was hairy and had very short legs; it disappeared in deep water. A sheep-dog-like animal was seen in the Great Lake in 1863; it had two small flappers or "wings" and travelled at about thirty miles per hour. Several water animals were later seen in the same lake, sometimes splashing the water seven or eight feet in the air; they were three or four feet long, with the heads "round like a bull-dog". Reports of them were numerous in the 1860's and 70's, and one actually bumped a boat. In spite of the Waddamanna Dam and the alterations to the Great Lake caused by Tasmania's hydro-electric power schemes, as late as

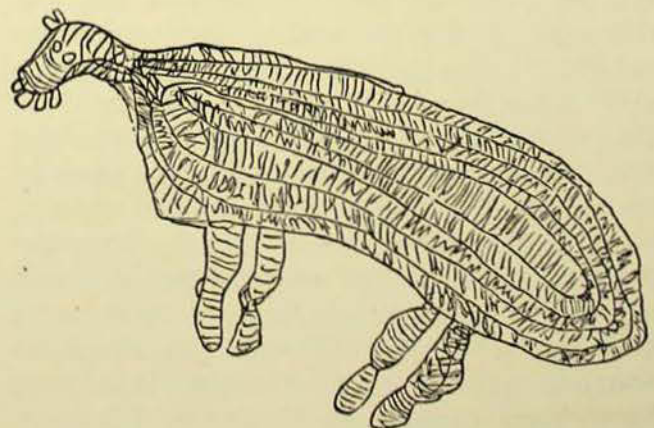


An aboriginal drawing of a Victorian Bunyip, having many emu characteristics. After Brough-Smyth.

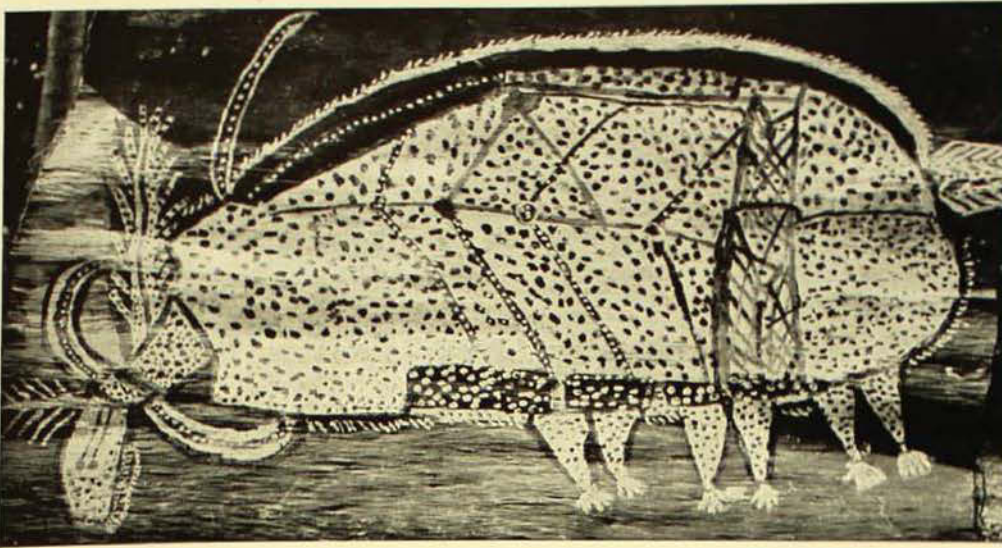
1932 some excitement was caused by a rumour of another bunyip there. Charles Gould, a son of the famous ornithologist John Gould, believed in the existence of the Tasmanian Bunyip and argued that "the Moa of New Zealand has only been checked from expanding into some horrible prodigy by the fortunate fact of its bones having been secured as unimpeachable witnesses of its true nature and dimensions". Professor J. W. Gregory believed that the fabulous *Kadimakara* of the Central Australian aborigines was based on a knowledge of the living *Diprotodon*. The 1870's were vintage years for bunyips. About 1872, in Lake Burrumbeet, near Ballarat, an animal like a big retriever dog, but with a round head and hardly any ears, came so close to a boat that the men therein capsized it. This and others of like case were recorded in the *Geelong Naturalist* of January, 1896. The Rev. George Taplin tells us of the *Moolgewanke*, the Bunyip of Lake Alexandrina, a curious being, half-man and half-fish, which had a matted crop of reeds instead of hair; his voice was a booming sound like that of distant cannon, but quite unlike the booming of bitterns; this noise was believed to cause rheumatism in those who heard it. Bunyips continued to make apparition in various places, in the Malmsbury reservoir, at Wagga, and elsewhere in New South Wales and Victoria, the accounts reading like distorted descriptions of seals. Thus the *Wee Waa* or Bunyip in a lagoon near Narrandera, seen in March, 1872, and again in 1873, was about half as long again as a retriever

dog, with jet black shining long hair over its body. Also in 1873, near Dalby, Queensland, arose a creature with a head like a seal and a tail of two fins, one larger than the other. As in the case of the Hairy Nondescript of Crystal Brook, South Australia, in 1876, the specimen disappeared, although rewards were offered for the Bunyip's capture. Some horsemen, fording the Molonglo River, saw an apocalyptic amphibian in 1886; it was "whitish in colour and about the size of a large dog. Its face was like the face of a child." The riders frightened it away with a shower of stones. A description, evidently corrupt, of a Port Phillip district Bunyip or *Tunatpan*, reads: "It was as big as a bullock, with an emu's head and neck, a horse's mane and tail, and seal's flippers, which laid turtle's eggs in a platypus's nest, and ate blackfellows when it was tired of a crayfish diet." Surely the Great Euroa Monster, hunted in 1890 by an intrepid party from the Melbourne Zoo, was not arrayed as one of these. As late as the summer of 1929-30, Dame Rumour was broadcasting Bunyip yarns, this time of a two-headed Bunyip which could swim both ways (though not tail-first) "without changing gear"; this phenomenon was hunted in the Tuckerbil Swamp near Leeton, but eluded its pursuers as bunyips generally do.

About fifteen years ago, Mr. Charles Barrett investigated a Bunyip report in the Haunted Hills near Melbourne, and



Another aboriginal impression of a Victorian Bunyip. Can this be a bullock from a native point of view? After Brough-Smyth.



A very conventionalized mythical serpent, painted on bark by Arnhem Land aborigines. Numbers of these figures, no two of which are quite alike, are found in the Liverpool River country, where they are associated with stories of the Creation.

Photo.—Charles Barrett.

found that the fearsome noises which had been frightening people were caused by the harmless Koala bears. More recently, Mr. Barrett came across many fine paintings of mythical animals in Arnhem Land, and kindly supplied the accompanying photograph of one.

Apart from the more extravagant fabrications, we must be struck with the comparative uniformity of bunyip descriptions over a long period. The Bunyip has been thought to have been an extinct marsupial, otter-like animal,¹ rumours of whose existence have been handed down in aboriginal legends, the latter corrupted or confused with crocodiles in the north of Australia and seals in the south. Seals have been known to penetrate the Murray-Darling River system over 900 miles from the sea (to Conargo, N.S.W.), and a fur seal was caught at the junction of the Kangaroo and Shoalhaven Rivers. A ten foot Leopard Seal was caught in 1870 in the Shoalhaven with a full-grown platypus in its stomach: surely a bunyip within a bunyip. However, some savants link the Bunyip with the culture-heroes and mythical creatures which lived in swamps and pools. Often it was described as roaring or booming; though this may have been caused at times by bitterns,

¹Hochstetter definitely reported the presence of an otter-like animal in the mountain lakes of the South Island of New Zealand.

perhaps the blacks themselves provided an *obligato* with their "bull-roarers". The splashing has been attributed to the movements of the platypus or the musk-duck, but surely the aborigines would have known all about these creatures' habits. Perhaps all the scientists are wrong, and there is a Bunyip, as yet unclassified (but our readers may remember what the girl said in *Pygmalion*). Some bunyips may well have been straying cattle; such animals would be strange to the blackfellows in the early days of settlement. Indeed, bullock's bones have been pointed out as those of the bunyip, but everyone said they couldn't be a bunyip's because they were a bullock's. So let the Bunyip continue in its mystery and as a topic around the camp-fire; it is pleasing to see the "Bunyip's Pool" (in Rope's Creek, near Sydney) in the map in W. Hardy Wilson's delightful book, *The Cow Pasture Road*, wherein too we read:

A few years ago, a number of "Bunyip" Manuscripts were lodged, together with a large accumulation of Court correspondence, beneath the floor of the old Courthouse at Berrima, where they could be readily examined by taking up a loose board and prospecting in the darkness with a long-handled rake until a likely feeling bundle was encountered. Unfortunately nearly all these manuscripts were written on much softer paper than the correspondence, and the opossums of the neighbourhood, who drew regularly from this store, preferred the MSS. as a lining for their nests. Thus, doubtless, perished many precious documents which could have shed further light on the Bunyip and its ways.

"TIGERS."

The absence of any large and dangerous carnivores, such as lions and tigers, in a continent the size of Australia was always a puzzle to early settlers. However, attempts have been made from time to time to remedy this deficiency either from escaped menagerie specimens or from pure imagination. Thus staid Victorians were very bustled in about the year 1895 when a fearsome tiger was reported from Tantanoola, where it made appalling noises. There was much ado over this animal in the Press of the period. A beast was eventually shot and exhibited, but was identified as a calf, much to the disgust of the supporters of the tiger theory, so the exhibit was withdrawn. Another interpretation of the "tiger" was that the noise (and the myth) was due to cattle-duffers, who hit upon this scheme to ensure solitude for their nefarious activities.

There have also been reported from time to time a Moruya Tiger; also a Gippsland Tiger from a forest near Colac, which, when shot, proved to be a pig gone wild; and a Riverina Tiger, said to have been an escaped wild dog, whatever that is.

For about seventy years there have been reports of a Marsupial Tiger or Striped Marsupial Cat from the jungles of Cape York, Queensland; some of these may have been based on feral cats. Though this animal has been seen on several occasions, no specimen has been sent to any zoo or museum. It is possible that a large and undescribed dasyurid mammal still exists there, and it is hoped that any future observer of such will try to secure a specimen and make certain of preserving the remains (*skull* as well as skin) by heavy salting or any available means before sending to the nearest museum. This cat- or tiger-like animal is well known to the aborigines and has been seen on several occasions by whites. The Police Magistrate at Cardwell (B. G. Sheridan) wrote the first authentic account in the *Proceedings of the Zoological Society of London* in 1871. Near Rockingham Bay, Mr. Sheridan's son found a mammal

"about as big as a native dog. Its face was round, like that of a cat. It had a long tail, and its body was striped from the ribs under the belly with yellow and black. . . . The animal ran up a leaning tree." Others were seen at the head of the Tully River and near Atherton, and one was trapped at Mundubbera, but was unfortunately not preserved.

About 1900, at Kairi, N.Q., Mr. J. McGeehan found a "striped marsupial cat" crying harshly as it was being killed by dogs. Well-defined hoops of colour, about $2\frac{1}{2}$ inches wide, dun and white, surrounded the body. The head was like that of a Pomeranian dog and the length of the animal must have been over two feet (*N. Qld. Naturalist*, vi, 1938, p. 3).

Mr. Ion Idriess, well-known writer and traveller, met with a similar animal several times. He first saw one attacking a kangaroo in York Peninsula country, and lost a prized dog to another on the Alice River. Further south, Mr. G. de Tournoeur wrote of a "cat" seen between Munna Creek and Tiaro: "As far as could be judged in the dusk and rain it was nearly the size of a mastiff, of a dirty fawn colour, with a whitish belly, and broad, blackish, tiger stripes. The head was round with rather prominent lynx-like ears, but, unlike that feline, there was a tail reaching to the ground and large pads. On cracking stockwhips the animal bounded away, stopping at the creek-bend to growl back at the men."

Mr. E. Le G. Troughton, mammalogist of the Australian Museum, is of the opinion that, although there is some diversity in the accounts as to the size of the animal and disposition of the stripes, there seems no doubt that a large striped marsupial cat haunts the tangled forests of northern Queensland. The creature seems to be rare, but probably lives in the thick forests which man seldom penetrates, or in which he makes so much noise in getting through that the more wary animals are never seen. The fact that the Tasmanian Tiger (*Thylacinus cynocephalus*) is conspicuously striped adds to the feasibility of a similar large carnivorous marsupial having sought a

refuge from the competition of the wild dog in the rocky and forest-covered region of north Queensland.

Other lion- or tiger-like creatures have been listed by R. W. McKay, who (in *The Sydney Morning Herald*, 9/12/39) wrote:

There are records from Pipers Creek, Mansfield, Lockwood, Chiltern, Briagolong, and other places in Victoria; from Harden, Tantawonglo, Goulburn, Gloucester, Wellington, Jamberoo, Orange, and other places in New South Wales; from the Three-Mile Scrub, Brisbane, the St. George district, and Normanton in Queensland.

Mr. Estoppey, of Briagolong, Victoria, has taken people to the habitats attributed to these creatures, and the smell has been like that from zoo cages, whilst measurements of footprints and other data have not tallied with those of properly classified species. Shall we therefore be surprised that in March, 1935, a "cross between a crocodile and a wild pig" briefly materialized in the Barwon River near Brewarrina, where it sustained itself upon the local cattle?

"GORILLAS" AND BIRDS.

Perhaps the records of gorillas or animals like them in the bush may have been based on hirsute blackfellows or "wild white men", of which there were numbers in the early days. The Koala Bear was called "Monkey" by the early settlers, and that term is used to this day for the Cuscus of Cape York. The aborigines had a legend about Thaballa, the laughing boy, who never died and whose laughter can still be heard in lonely parts of Central Australia. Otherwise there appear to be no other primates in Australia apart from ourselves. The laughter in the bush immediately recalls the kookaburra, yet I do not know of any legendary Australian birds. In *Noah's Cargo*, George Jennison sought to identify as an Australian Lyre-Bird the "*Gallus indicus*" of Aldrovandi's Natural History, published at Bologna in 1599. However, our lyre-bird was not discovered until nearly 200 years afterwards, and Aldrovandi's "Indian Fowl" seems to me more like the Fung Hwang, or mythical

Chinese Phoenix,² in which are suggestions of the pheasant and the peacock.

A remarkable bird was mentioned in Joseph Banks' Journal in October, 1769, at Jubolai Island, New Zealand:

While Mr. Sporing was drawing on the island he saw a most strange bird fly over his head. He described it as being about as large as a kite, and brown like one; his tail, however, was of so enormous a length that he at first took it for a flock of small birds flying after him: he who is a grave thinking man, and is not at all given to telling wonderful stories, says he judged it to be yards in length.

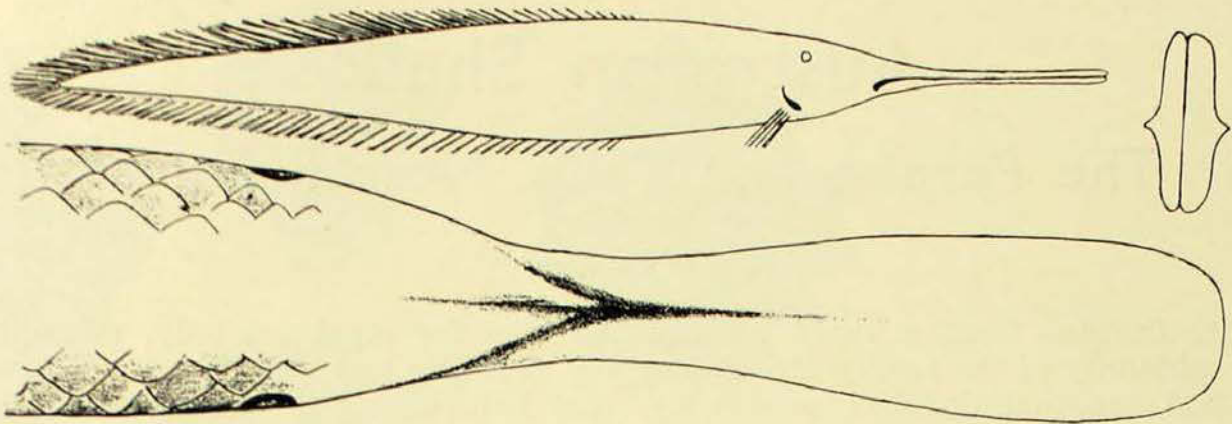
Both D'Albertis and Haddon tell of a mythical Torres Strait bird, the Kusa Kap. It was twenty-two feet across the wings, the noise of whose flapping was like a steam engine. This bird, some kind of a Hornbill, but so gigantic that it looked "all along same as island in the sky", would often carry dugongs high in the air.

THE ANGOURIE CROCODILE.

At the end of November, 1939, an engine-driver on a light railway which runs to Angourie Beach, northern New South Wales, was amazed to find that a "log" near which he had stopped his locomotive was a 15 ft. crocodile. The reptile appeared threatening, so the driver hastily started the engine and left the spot.

Soon afterwards a number of residents of the district recalled having seen a crocodile in the vicinity, and others related how, a varying number of years ago, a "sick circus crocodile" had been brought to Yamba and was thought to have died. Booming noises had been heard at night. Search parties were organized, politicians joining policemen in exploring every likely haunt. Dynamite was employed to blow up burrows, many snakes were extirpated, and a 5 ft. goanna was displayed for a while at a local hotel. The bones of the defunct circus crocodile were disinterred, the booming noise was traced to a bittern, but *the* crocodile, or "Yamba brew Bunyip", continued at large. Crocodile hunts were organized for

² Compare Gould, *Mythical Monsters*, 1886, p. 373, frontisp. and fig. 91, with Jennison, *Noah's Cargo*, 1928, p. 216 and plate.



The mysterious "Ompax", a fabricated "fish" which puzzled generations of zoologists.

After Castelnau.

Christmas tourists, and one of these brave forays "produced a mass of goannas and five courting couples". Aboriginal bucks said there was a devil in the lake and white men locked their doors before retiring at night. Pigeon-toed tracks were seen and a cast was made of one of these and sent to Sydney. Here Mr. J. R. Kinghorn examined it in collaboration with detectives, and found that it agreed in shape and size with a crocodile's paw. Interest died down when there was no sign of the monster for several weeks, but some of the local residents still argue strenuously as to whether the animal exists or is yet another legendary creature.

OMPAX.

Anglers are a maligned race: they have a reputation for mendacity which has really been "lived down" long ago, so that nowadays they are, on the whole, a very truthful lot, and their stories of strange fishes pale before the curiosities of sea and river which are known to science. Nevertheless, there are occasional rumours, quite unsupported by evidence, of, for example, the spectacle of Broadbill Swordfish breeding in millions in the Gulf of Carpentaria; this, in modern jargon, is "wishful thinking". The mythical fish, *par excellence*, of Australia was *Ompax*. Count Castelnau, French Consul in Australia and an

ichthyologist of the 1870's, gave it that name from the "mysterious historical one of *Ompax*" employed in the Eleusinian mysteries. This fish was said to live in a single water-hole of the Burnett River, Queensland, together with the Queensland Lungfish. The unique type-specimen was eaten for breakfast and then a drawing was made of it, after the repast. It had a spatulate beak, a long body, "ganoid" scales, and a fringe-like tail-fin, and was "of a dirty mahogany colour" and about 18 inches long. Science waited in vain for a specimen of *Ompax spatuloides* until, only about ten years ago, a writer in *The Bulletin* "blew the gaff". He described how the hard-cases of the Gayndah station had prepared a new fish for a naturalist there by uniting the tail of an eel with the body of a mullet and, it seems, the head of a platypus; this novelty was nicely cooked and the concoction passed off as a specimen. "Whenever a marine [!] mystery was captured afterwards in the Gayndah district", continued *The Bulletin*, "the locals would remark with a grin that it 'must be an *Ompax*!'."

[The author is indebted to members of the staff of the Mitchell Library, Sydney, and his Australian Museum colleagues (Messrs. Troughton, Kinghorn, McCarthy, McKeown, and Rainbow) for assistance in the compilation of this article.]

Australian Shells

The Purples and Their Near Relatives

By JOYCE ALLAN*

THE Purples form a large natural subfamily of the family Muricidae, and are distinguished mainly by prominent nodules on the shell. They are usually solid, with a shortened spine, although, through their environment, they may be distorted into irregular shapes, or heavily coated with growth. They are, generally speaking, a group well adapted to succeed in the race for life, as their strong shells, often heavily toothed on the outer edge of the mouth, protect them from the ravages of wave action and predatory birds. Members of this subfamily are found throughout the world, from shallow to deep waters, the brighter coloured and more ornamented species coming from warm waters of coral reefs.

Tyrian purple, the famous dye used for colouring robes, parchments and other

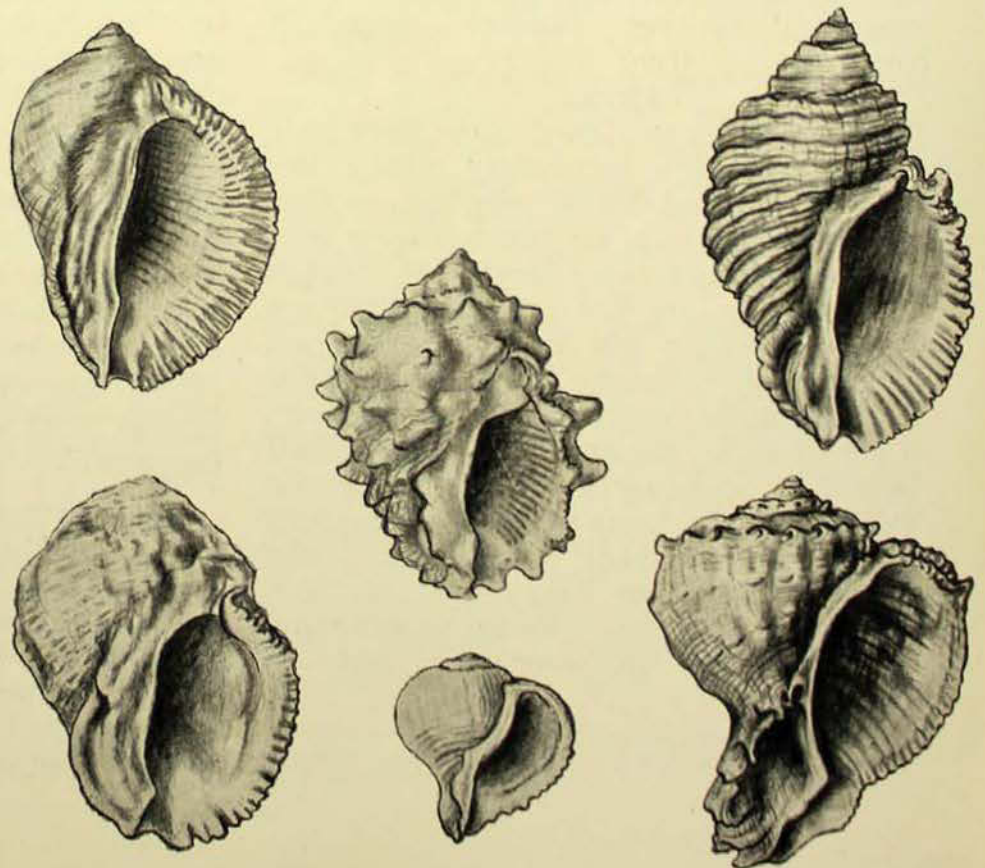
articles for royal use only, was obtained by crushing certain species of Purples in pot holes along the rocky coast of Tyre and other Mediterranean ports. This colouring matter, which probably serves the same purpose—namely, protection—to its owner as the better known ink of the squids, is made in a special colour gland inside the animal. A detailed account of the Tyrian purple industry as carried out by the ancients was given in an earlier number of this MAGAZINE.¹

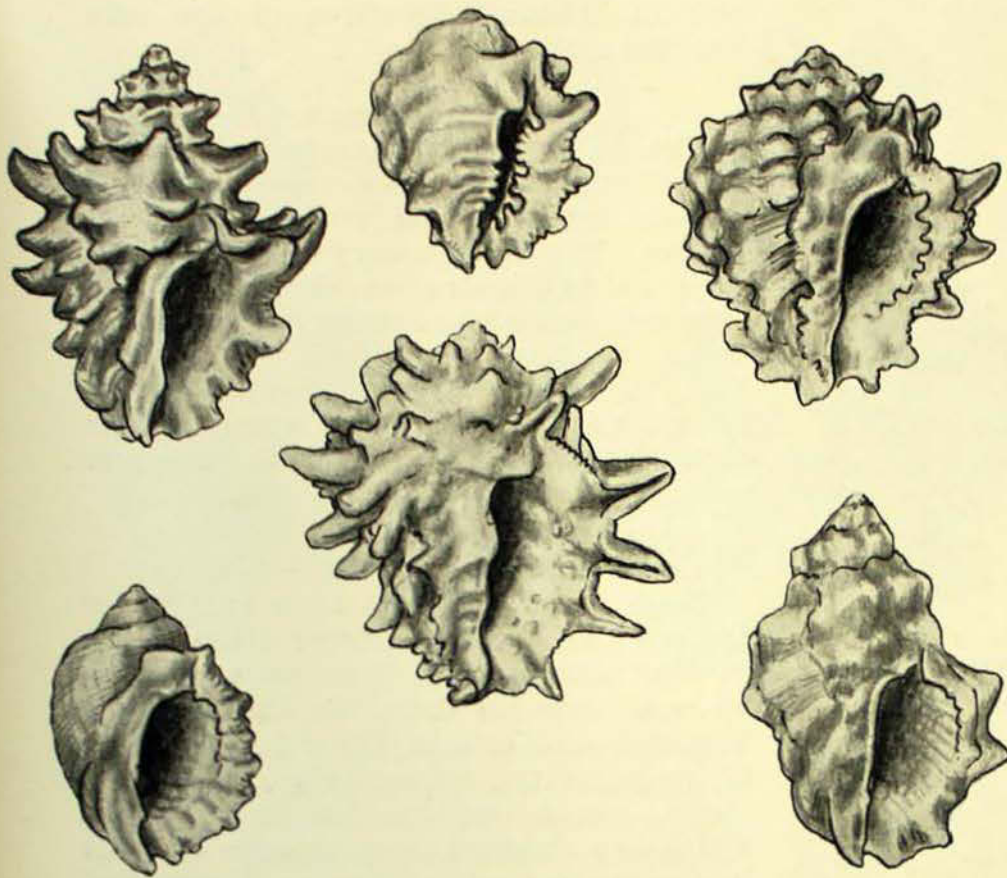
The family Muricidae is an extremely large one, and it was found necessary to publish portion of this article, consisting of the Rock and Smoke Shells and the Trophons, in the previous number, leaving the Purples and their near relatives for this present number.

¹ Allan.—AUSTRALIAN MUSEUM MAGAZINE, Vol. V, 5, January-March, 1934, pp. 147-151.

* Illustrations by the author.

In the top row are two Purples, *Thais persica* and *Dicathais orbita*; *Mancinella aculeata* is in the middle row, and in the bottom row, from left to right, are *Mancinella bufa*, *Rapa rapa*, and *Rapa rapiformis*.





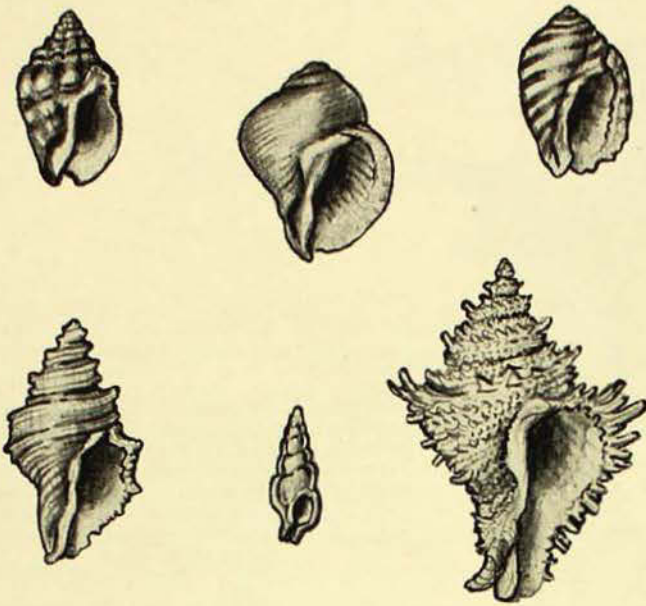
Purples. From left to right in the top row are *Mancinella bitubercularis*, *Drupa morum*, *Drupa rubusidacus*; in the middle is *Drupa spathulifera*, and in the bottom row, *Mancinella luteomarginata*, and *Mancinella pica*.

One of the most important genera in the Purples is *Mancinella*, a name now used for a number of species known previously under the more familiar names *Thais* and *Purpura*. In this genus are most of the larger species of the subfamily, three or more inches long. As frequently happens in large families of shells, they fall into more or less natural series, but for these articles only one or two species of each series are figured. A striking characteristic of the larger Purples particularly is the predominance of brown colour marking, usually deposited in bands or patches, especially in the mouth of the shells, and varying from a golden-brown to almost black-brown. The marking on the back of the shells of many species is obscured by a bleached condition, due to their living amongst coral growths or rocks.

A large series, the members of which closely resemble one another, exists round two well-known species, *Mancinella pica* and *Mancinella bitubercularis*, both from northern Australia, and principally dis-

tinguished from one another by the red radiating lines inside the mouth of *pica*. Two handsome, larger species from Queensland are *Mancinella bufo* and *Mancinella armigera*. These are about three inches high, and the former is only slightly nodulose, with a beautifully tinted orange-red mouth, while the latter, which reaches as far as Japan in its distribution, has rows of extremely prominent, strong spines.

Of the smaller species of Purples, those from one and a half to two inches high, the ones figured here are *Mancinella aculeata*, a north Australian shell, with a deep orange mouth crossed with red lines; *Mancinella luteomarginata*, which has a deep orange band outlining its white interior, and *Mancinella echinata*; the latter two occur in Queensland and the South Pacific. An easily recognized species, which can be mentioned with these, is very rare on the outside reefs of the Great Barrier Reef, though more common in the South Pacific islands: this still retains the earlier generic name



In the top row are *Cronia avellana*, *Coralliophila neritoidea* and *Provexillum vexillum*. In the bottom row, *Afer quadrata*, *Aspella anceps* and *Tolema sertata*.

Thais and its specific name is *persica*. One of the commonest shells along the rocky shores of New South Wales is the Cart-rut Shell, *Dicathais orbita*, better known as *Neothais succincta*, a species distinguished, as its name suggests, by deep rut-like furrows between revolving ridges. It lives wedged in rocky crevices, and is frequently distorted, or covered with various marine growths, such as worm tubes, and is one of the shells found in the kitchen middens of the aborigines along the coast. In its range this species extends round southern Australia to Western Australia, in which State it goes under the name of *Dicathais aegrota*. Forms of it occur at Lord Howe Island and in the northern part of New Zealand.

Two small shells figured here in no way resemble the other members of the sub-family. These are *Cronia avellana*, from Western Australia, and *Cronia pseudamygdala*, which occurs in northern New South Wales and Queensland. Other distinct species are *Afer blosvillei* from Queensland and *Afer quadrata*, a north Australian shell marked with pronounced revolving ridges, some of which are more prominent than the others. This species is a little over an inch high, and is pale

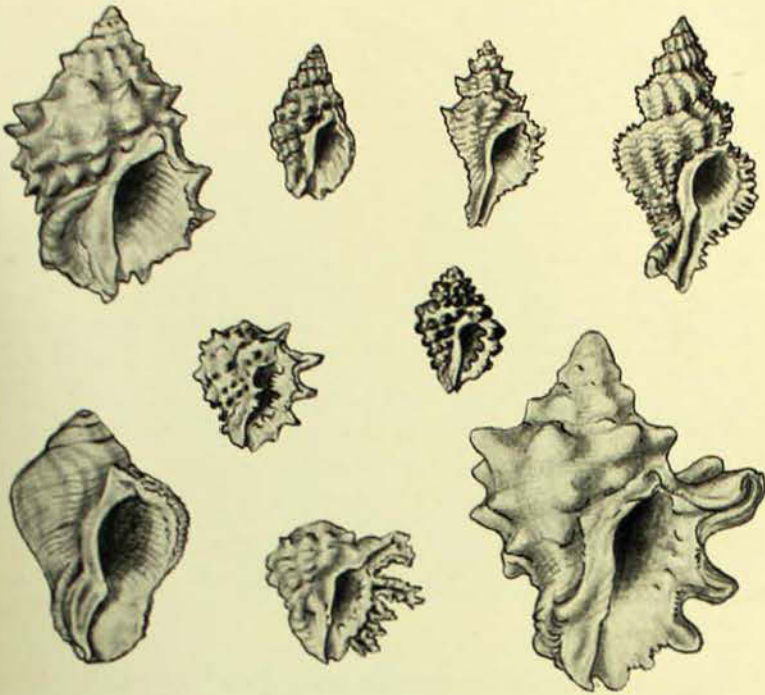
buff in colour. Relatives of the true Purples are as follows.

TURNIP SHELLS.

This is a well characterized group, including only a few species which usually inhabit coral reefs in tropical waters. It is unnecessary to describe the shell, as an illustration shows its structure well. Only two species are mentioned here: one, *Rapa rapiformis*, a three-inch high Queensland and South Pacific islands shell, and a small species, *Rapa rapa*, from Queensland. Both these are recorded also from Japan.

CASTOR BEAN SHELLS.

These are not known as a rule under the popular name of Castor Bean Shells in Australia, but, as there appears to be no local name for them, the American one is used in this article. These form a group of very pretty, attractively ornamented shells, about one to two inches high, which live amongst coral growths on reefs in the South Pacific islands. A considerable number of closely allied species of Castor Bean Shells are found along the Great Barrier Reef, but it is possible here to figure only a few of the better known ones. These are *Drupa rubusidaeus*, with puce marking on the inner side of the mouth, *Drupa spathulifera*, with sharp spikes and brown markings; *Drupa albolabris*, a black-spotted, white-mouthed shell, and *Drupina grossularia*, an extremely pretty, yellow-mouthed species. These are found amongst coral along the Queensland coast and in the South Pacific islands, the two first species also being recorded from Japan. The Castor Bean shells can be easily recognized by their compact shape, usually bleached irregular backs, and narrow mouths, rendered even more narrow by groups of teeth on one or both sides. The mouths also are in most cases vividly marked with yellow, orange, or violet. The only other species of the Castor Beans I have figured is *Drupa morum*, a heavily toothed, violet-mouthed species from the South Pacific. This is sometimes known as the Mulberry Shell, but that popular name is more



The four top figures are *Mancinella echinata*, *Cronia pseudamygdala*, *Afer blosvillei* and *Lataxiena lataxiena*; in the middle row are *Drupa albolabris* and *Morula marginalba*, and in the lower row, from left to right, are *Coralliophila squamulosa*, *Drupina grossularia* and *Mancinella armigera*.

often applied to *Morula marginalba*, the Boring Whelk, a small shell with black nodules which is extremely common along the New South Wales coast, extending into southern Queensland. Almost every pool is inhabited by one or more Boring Whelks, and at low tide masses of them can be found scattered over rocks, generally performing their favourite pastime of preying on other shellfish. Throughout the year they cause considerable damage in oyster beds along our coast, for by means of their rasping tongue they are able to bore holes in the hardest shells and suck out the juices of the inhabitants.

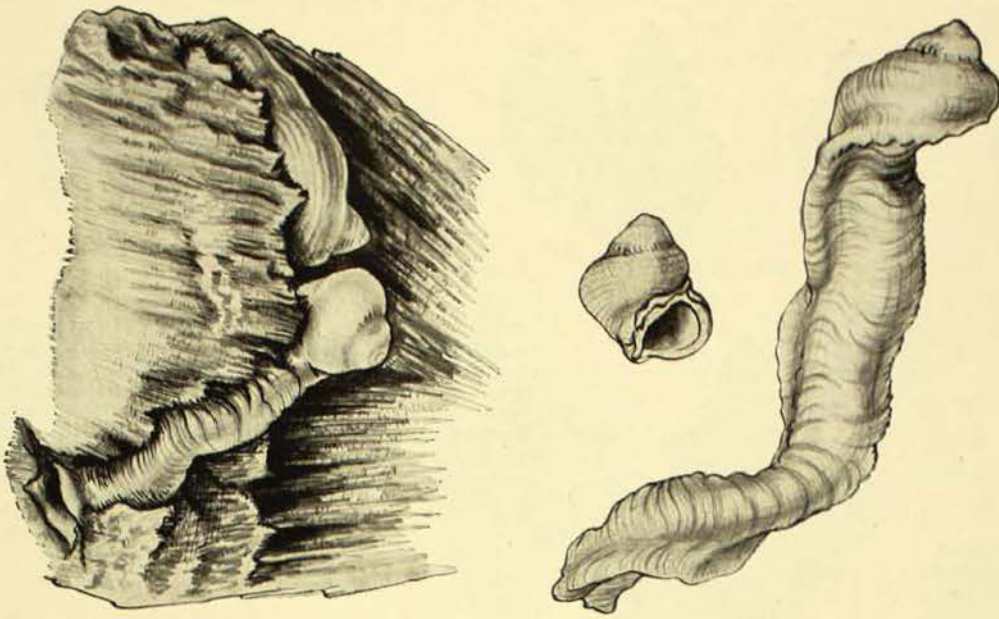
Other species of shells figured here which are near relatives are a small New South Wales, Queensland, and South Pacific shell, *Proveillum vexillum*, easily recognized by its brown revolving lines; a very beautiful, delicate, spiny, deep-water species from New South Wales, *Tolema sertata*; a half-inch high, white shell, *Aspella anceps*, which extends its range from New South Wales into southern Queensland; and *Lataxiena lataxiena*, a strongly sculptured Queensland shell.

TUBE-FORMING CORAL DWELLERS.

In the subfamily to which the Purples belong are some coral-dwelling species of

rather extraordinary habits. Amongst these are those of the genus *Magilus*, the best known species of which, *Magilus antiquus*, from northern Australia and the Indo-Pacific, is here figured. These shells begin life with an ordinary, pretty, smooth shell, but when very young, and after a short period of free locomotion, they take up a position in a coral growth and from then on remain stationary. In order that the shell inhabitant may get food and oxygen, the aperture of the shell must remain in contact with the surrounding water. It is necessary, therefore, for the growth of the shell to keep pace with the substance in which it dwells, and this is accomplished by the animal prolonging the mouth of the shell into a long irregular tube. The original shell is vacated and blocked up by the shellfish. It then moves up into the tube towards the upper end, near the newly formed aperture, where it can receive food-containing water without moving from the shelter of the growth in which it lies. In the illustrations of *Magilus antiquus* accompanying this article the shell with its tube-like prolongation can be seen imbedded in the coral.

Another group of somewhat similar habits includes the genus *Coralliophila*.



A tube-forming coral dweller, *Magilus antiquus*, showing the shell complete with tube living in the coral, a shell before the tube has formed, and a shell and tube removed from coral to show its structure.

These settle on corals, slightly extend the outer and inner lip of the shell and clasp the axis of the coral growth. The mouth of the shell becomes closed, and the animal communicates with the outer world only by means of a short shelly

tube. The shells are fairly small, pale-coloured, with often violet- or rose-tinted mouths. The two species figured here as representatives of this genus are *Coralliophila squamulosa* and *Coralliophila neritoidea*, both from Queensland reefs.

PRIMITIVE INSECTS OF SOUTH AUSTRALIA: SILVERFISH, SPRINGTAILS, AND THEIR ALLIES. By H. Womersley, F.R.E.S., A.L.S. (Handbook of the Flora and Fauna of South Australia, issued by the South Australian Branch of the British Science Guild. Government Printer, Adelaide, 1939.) 8vo, pp. 322, 84 text-figures, 1 coloured plate. Price 7s. 6d.

This is the first handbook of the Fauna and Flora series to be devoted to the Insects of South Australia. Like its predecessors, the Handbook is well printed on a good quality paper. The author is well known as an authority on the primitive orders of insects, Thysanura, Diplura, Collembola, and Protura. Most of these insects are so small and obscure that they have been quite neglected or entirely overlooked by entomologists. Yet, as the author points out in his preface, several species of the Collembola and Thysanura are now only too well known as pests. Among the Thysanura, the family Lepismatidae includes the destructive Silverfish, *Lepisma saccharina*, and *Cteno-*

lepisma longicaudata, which feed upon the starchy matter under wallpaper and book-bindings, while the introduced "fire-brat", *Thermobia domestica*, is found in bakeries near the ovens and is believed to feed on farinaceous food. Among the Collembola injurious to plants (pp. 276-277 are devoted to a list of these harmful forms), the most outstanding example is the introduced Lucerne Flea or Clover Springtail, *Sminthurus viridis*, a species which in recent years has become a very serious pest in Australia.

The Handbook, in spite of its title, includes not only forms occurring in South Australia, but embraces those of the other States. Descriptions of all genera and species are given, in addition to dichotomic keys to the genera and species of the different orders. Diagrammatic figures further enhance the value of a work which reflects the highest credit on author and printer. It should prove an invaluable aid to all workers in the science of Australian entomology.