The AUSTRALIAN MUSEUM MAGAZINE

Vol. VI, No. 4. OCTOBER-DECEMBER, 1936. Price—ONE SHILLING.

Cingalese Moonstone.

Registered at the G.P.O., Sydney, for transmission by post as a periodical.

THE AUSTRALIAN MUSEUM

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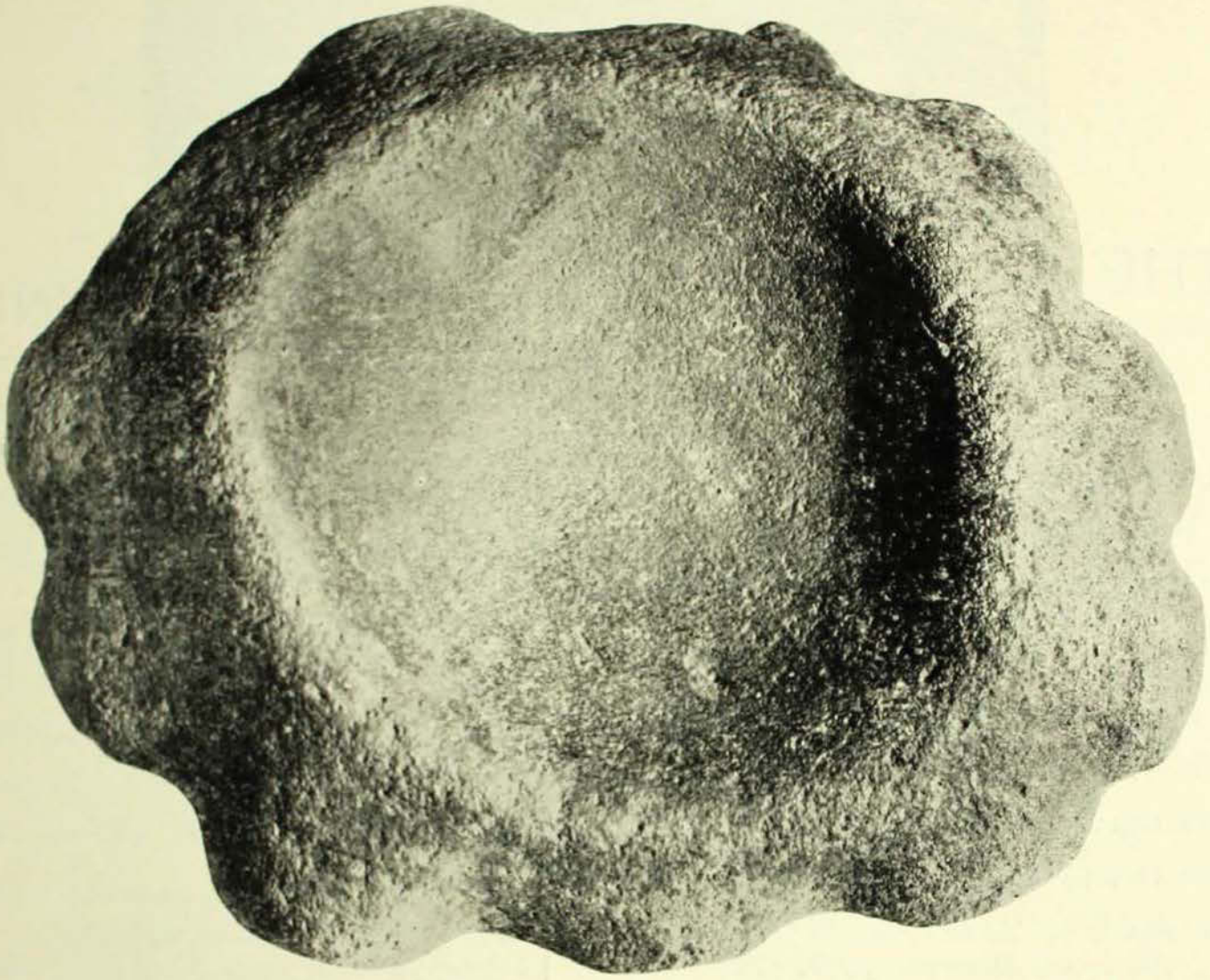
THE AUSTRALIAN MUSEUM MAGAZINE

Photography, where not otherwise acknowledged, is by G. C. Clutton.

● OUR FRONT COVER. This is a reproduction of a beautiful brass tray presented to the Australian Museum by the Kandyan Art Association, Ceylon, through the kind offices of Mr. J. G. McKern, Crown Trustee of this Museum.

The design is that of the sacred moonstone. Moonstones are a feature of Cingalese architecture, and are to be found adorning entrances to many buildings important in the past. They are exquisitely carved, as may be seen from the illustration. The stone is divided into a number of concentric bands, and upon these bands are richly carved a scroll of lilies, a procession of animals—elephants, bullocks, horses, and, strange to say, lions which are not known in Ceylon, and probably never were—floral designs, a procession of sacred geese or hansas, another conventional design, and in the centre the usual conventionalized lotus flower. How old some of these designs are it is difficult to say, perhaps 2,000 years or more, for certain it is that they are of considerable antiquity. Very few examples of moonstones are to be found in India, and these cannot be compared with those of Ceylon.

VOLUME VI, NUMBER 4. OCTOBER-DECEMBER, 1936.



A Prehistoric Mortar from New Guinea. This example was presented to the Australian Museum by Mr. L. V. Waterhouse. It was dredged at a depth of thirty feet in the alluvial bed of Koranga Creek, Bulolo district, Mandated Territory.

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Published by the Australian Museum - - - - - College Street, Sydney

Editor: C. Anderson, M.A., D.Sc., C.M.Z.S. Annual Subscription, Post Free, 4/4

Vol. VI, No. 4. October-December, 1936.

A Prehistoric Mortar from New Guinea

A LARGE number of prehistoric stone objects has been found in New Guinea. These include stone mortars and pestles which are not made by the present-day natives, nor are they used for the purpose for which they were presumably made. The mortars vary in form and size and are usually thick and heavy; some are rough and poorly shaped, whilst others are perfectly symmetrical. A well-defined type has a series of bosses or rounded knobs encircling the implement, as in the example figured in the frontispiece, and a rare type takes the form of a human being. The pestles are generally cylindro-conical in shape, often with a transverse ridge near the middle and a groove along one side; a few pestles carved in the form of a bird have been collected.

These ancient implements are usually made of hard igneous rock, and the surface is finished off by means of a hammer-dressing technique, which produces a pitted surface. A large number of mortars and pestles has been unearthed in the alluvial river beds. Present-day natives make use of them for magical purposes, but they do not know the origin of the implements, and assign it to their spiritual ancestors and culture-heroes.

Prehistoric mortars in the Australian Museum collection from the New Hebrides and Bougainville are of a different type to those from New Guinea. The New Hebridean specimens resemble millstones, in that they have a shallow flat depression bordered by a rounded upraised margin. Those from Bougainville are spherical and egg-shaped, with a deep rounded cavity.

These prehistoric relics evidently form part of a megalithic culture once present in Oceania to which scientists are now devoting a great deal of attention, for the problem of the identity of the people and the period of their habitation of the region is fascinating and difficult of solution.

The specimen figured was presented to the Australian Museum by Mr. L. V. Waterhouse. It was dredged at a depth of thirty feet in the alluvial bed of Koranga Creek, Bulolo district, Mandated Territory of New Guinea. Its greatest diameter is eleven inches, and it is four and a half inches in thickness; its weight is twenty-two pounds. F.D.McC.

Magic Among Primitive Peoples

By ELSIE BRAMELL, M.A., Dip.Ed.

THE performance of an act of magic in a primitive community, unlike our own, is no trivial pastime indulged in for one's own amusement or to arouse the wonder and speculation of admiring friends. On the contrary, it is a serious business, and is believed to be an indispensable aid to a prosperous, or even tolerable, existence. The belief in the efficacy of magic determines the mode of procedure in every undertaking, whether it be to win renown in war or the love of a village maiden, to insure the success of a fishing or hunting expedition, to cause a canoe to be swift or a house to be rainproof. Its aid is also sought to cause or cure sickness, to keep away evil spirits, to bring misfortune upon an enemy, and to discover and punish a violator of the tribal laws.

Magic has been classified into two different types—black and white. Black magic, as its name implies, is the employment of supernatural powers with evil intent. The magician uses his art to inflict death or some bodily harm upon a person, clan, or even a whole community. This malicious magic, also termed sorcery, is definitely illegal in all primitive societies, and that is why it is practised in secret.

Beauty Magic in Wogeo, New Guinea. The young buck who desires to win the affections of a village maiden gathers some decorative flowers and herbs and retires to a secluded spot with his bamboo whistle. He weaves garlands to place on his person, singing a short spell over each ornament, and pausing every few moments to blow his whistle. The magic comes out with his breath and is broadcast with the music; it is thus heard and transmitted to the girl, who is made to realize the beauty of her swain. He, knowing that he will now be irresistible, sets out to find her.

Photo by Dr. H. I. Hogbin. By courtesy of Australian National Research Council. Copyright, Editors of *Oceania*.

The sorcerer bent upon an evil mission takes the utmost precautions against discovery, for, if he were noticed doing anything suspicious, he would be severely dealt with; indeed, probably killed.

White magic covers all those rites and spells carried out for some socially or economically useful purpose, such as that employed in canoe or fishing magic. It is interesting to note that in Papua the Government strictly forbids magic enacted with a malicious purpose, for it is a most fertile source of vendettas and bloodshed; but, on the other hand, it does not censure white magic, which finds expression in the rites of gardening, curing the sick and so on, for this hurts nobody, and seems to afford considerable comfort and satisfaction to the practitioner.

The Stag Hunt. A mural painting in dark red, restored and reduced in size, in the Cueva de los Caballos, near Albocácer, Castellón, Spain. This is the type of painting into which a magical significance has been read. The scene depicts the plea of the artist—a successful hunt.

After Obermaier.

TYPES OF MAGICAL PROCEDURE.

The three following techniques, though they do not cover the whole field of magical procedure, serve to illustrate the working of the native's mind.

The first we may call imitative magic, wherein the sorcerer endeavours to attain his purpose by dramatizing the desired result. For instance, in order to inflict a fever upon an enemy, a New Guinea sorcerer may begin by reciting his invocation to the spirits, then suddenly fall to the ground as if sick and dizzy, and go through all the actions of a man in high delirium. He vividly demonstrates the event he desires, and believes that the enaction of this pantomime will actually bring about the required result.

Many suggestions have been put forward to explain why the Stone Age men of Europe took to carving and painting on the walls of caves and rock shelters. Some say that the artists were prompted by purely artistic motives and the desire to create. But the fact that so many of the drawings are found in places extremely difficult of access, even in caves hidden deep underground without any natural lighting, seems to indicate a rather more fundamental significance. One reasonable suggestion is that the naturalistic drawings were executed as part of a magical ritual which had as its end the increase of the natural species depicted. This was found to be the case in the Kimberleys, north-west Australia. And perhaps a hunting scene was inspired by an anxiety to make a good kill, the artist showing the stags being slain by the huntsmen, and thus demonstrating to the gods of the chase what was wanted; the very act of drawing the stags as already slain gave them confidence for their hunt. All magic of this kind, wherein the desired result is pointed out in drawing or in pantomime, affords some measure of satisfaction to the participants.

The use of contagious magic, the second variety, is widespread. Here the magician gains possession of some object with which his intended victim has come in contact. He believes that some portion of the man's personality still clings to the object he has secreted, and that, by making magic over it, he will be able to bring illness or death upon his victim. For this purpose he collects such things as nail parings, hair clippings or remnants of food thrown away after a meal, pieces of grass on which the man has sat, or even a little of the earth taken from his footprint on the ground. He has to watch his chance to secure these ingredients, because every native is taught from babyhood not to leave such things about carelessly in case some malicious person should manage to get hold of them and make magic with them. Of course, it is not necessarily the actual sorcerer who bears ill-will against the victim, for it commonly happens that he is engaged to perform the magic by a neighbour who bears a grudge against the unfortunate man.

The Roro magician (Papua) carries out a form of contagious magic which has in it a strong element of common sense. He catches a snake whose bite is fatal, and places the creature in a pot together with a piece of cloth that has been worn by his victim. Next he heats the pot, and the snake, lashed into fury by the pain, strikes again and again at the cloth, making it the butt of its wrath. The sorcerer then waits until he knows his victim is to go along a certain path. He hides close at hand, and, at the moment when the man is passing, releases the snake, which, recognizing the hated smell, darts at the man and bites him.

The third technique is termed projective magic, because the objective is gained by an act of will. An example of this is found in "pointing the bone". Here the practitioner points his bone in the direction of his victim, chants his spell, and, by exerting the whole force of his will power, endeavours to make his magic cross space and strike the unhappy man. Within a short time the latter is supposed to sicken and die. Almost invariably it happens that the native, tortured by the chill dread of imminent evil, does die, unless the sorcerer suspected of the deed agrees to nullify his spell.

Contagious Magic. It is at such a fire as this that members of the Marimanindzi tribe, North-West Australia, prepare to carry out palayurle sorcery. This consists of "roasting" personal leavings of an enemy, thus causing him to be inflicted with a lingering illness and ultimately death.

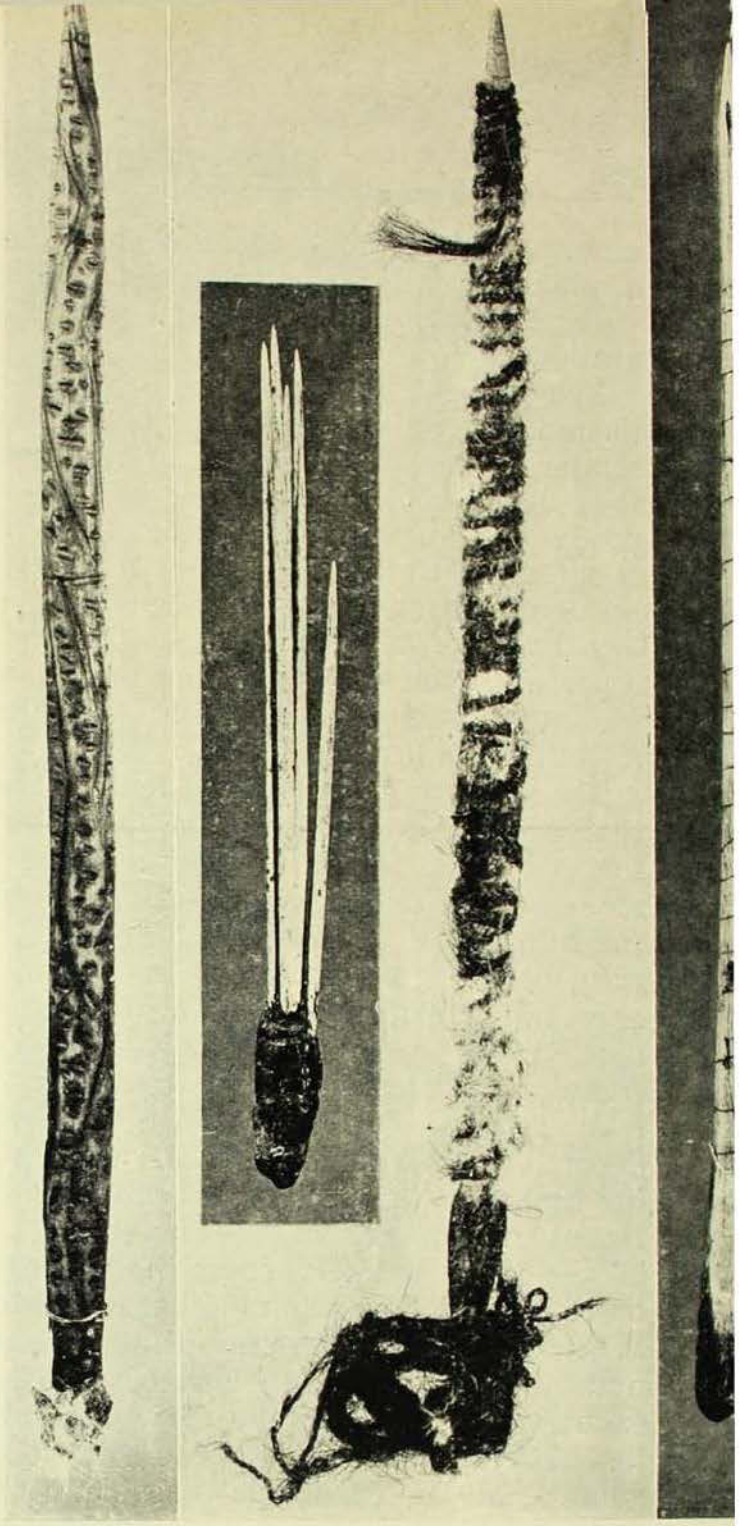
Photo.—W. E. H. Stanner (courtesy of Australian National Research Council).

THE SORCERER.

The sorcerer, or sorceress, is an interesting personality. It is not only men who acquire skill in magic, for in some parts of the world women are credited with considerable supernatural powers. In Dobu, when a person dies or any mischief is afoot, there is excited comment on the work of the flying witches. These creatures are blamed for all occurrences of an unfortunate nature, and a conventional and oft-used remark is: "Oh, the flying witches have been at work again."

The sorcerer may acquire his skill in several ways. Among the Aranda of Central Australia he may be made a wizard by the spirits or by other medicine men. One sorcerer claimed to have acquired his art with the help of the evil spirit Eruncha. He believed that, by supernatural means, spirit snakes and magical substances, such as pieces of quartz and bones, had been inserted in his body. An incision was made in his stomach to permit the insertion of these objects, but, of course, no scar was left by the spirits. He had, moreover, to undergo many physical trials which were arduous enough to discourage some aspirants from going any further. The period of training was lengthy, and enlightenment came only gradually to the novice, who learnt to guard his hard won knowledge with jealous care.

In certain Melanesian communities skill in magic may be inherited. From childhood onward a man is taught his magic by his father, or in matrilineal societies by his maternal uncle. In Dobu there are numbers of rites and spells with which everyone is familiar, and which are the common property of the community. But more important than these are the vast resources of potent private magic. Every family possesses its own formulæ which it uses in gardening, hunting, and so forth; some families are envied for their particularly successful garden magic. It should be understood that in this part of the world hard work in the garden is not enough to insure plentiful



Australian Death Pointers. Four varieties chosen from the Australian Museum collection. 1. *Made of sandalwood and incised, Mt. Margaret District, Western Australia.* 2. *Multiple-pointed, consisting of four bone needles bound together, Pennefather (Coen) River, West Cape York Peninsular, Queensland.* 3. *Wooden, with a binding of human hair string, North Queensland.* 4. *A small leg bone of a kangaroo, incised in spirals. Aranda Tribe, Charlottte Waters, Central Australia.*

crops; a man must precede each stage of planting with the suitable ritual, otherwise the chances of getting a good crop are slight.

Sometimes it is possible to buy magical formulæ to which the former owners surrender all rights. But, as a rule, only that magic may be bought which is the product of an individual's ingenuity and is not family property. Any man, if he is clever enough, may use spells of his own making. By using these spells with repeated success he may find ready sale for them, or be rewarded for using them for another's benefit.

The sorcerer is generally a man of more than average intelligence. The rain-maker, for instance, is an astute student of meteorology; if he knows that all natural conditions are against the likelihood of rain, he will not carry out his ritual at once, but will wait for a more favourable opportunity to demonstrate his skill. Again, the magician who discovers the man responsible for a murder rarely depends on divination alone. He takes his time over the process, investigates the recent movements of the deceased and of the latter's likely enemies, and thus bases his conclusions on logical reasoning. When he has to confess failure in any undertaking, he has no lack of plausible excuses to offer, any one of which satisfies his credulous client. There is, too, a good deal of conscious deceit in the methods of curing sickness, as happens when the medicine-man pretends to withdraw a sharp stick that is said to have caused the pain. Still, such sleight of hand tricks are a legitimate part of his methods, and do not lessen his confidence in his supernatural powers. It will be readily understood that the medicine-man must be familiar with all tribal lore, and have at his finger tips all available practical knowledge. He must be capable of thinking and acting, albeit to a limited degree, apart from the traditional pattern in order to maintain his supremacy over his fellows.

THE ACT OF MAGIC.

It may now be interesting to analyse the act of magic itself. There are four aspects to consider—the spell, the rite, the condition of the sorcerer, and the magical ingredients.

First comes the spell, or spoken words, which are believed to have some peculiar potency if said according to formula. Generally it is essential that the spell be recited with perfect accuracy as to word order and intonation in order to have any effect. In other areas the spell is so old and has been passed on by so many operators that the meaning of it has been forgotten, and even the words themselves are unfamiliar and really consist of a jumble of nonsense syllables. The fact that it is unintelligible does not however, lessen its efficacy. The spell is often accompanied by a rite or a pre-

Women's Magic. Women of the Djaru tribe, East Kimberleys, performing the Yirbindji secret corroboree, a form of love magic. The boomerangs, fighting sticks and kulamons taken from the camp and used in the ceremony become possessed of a magical virtue, and, should a quarrel rise, the men are chary of handling the objects, for, having been "sung", they are a potential source of sickness. The dress of the women is the unfortunate result of their proximity to white settlement.

Photo.—Miss P. Kaberry (courtesy of Australian National Research Council.)

scribed series of actions. It may be that the sorcerer has to take up a definite posture when reciting the words, or has to follow out a specified mode of behaviour. Thirdly, the person who would perform magic has to prepare himself for the operation. It is customary for him to withdraw from the society of his fellows for a time, to partake of a frugal diet, or even to undergo a partial fast. A Papuan sorcerer may refuse all food except boiled taro and coconut milk; another man may be obliged to take only liquids for as long as two weeks beforehand.

A necessary part of the magician's equipment are charms and other implements or ingredients of magical import. The charms appear to us a motley collection of queer objects. They are chosen for such qualities as: (1) similarity in form to the object to be influenced, *e.g.*, stones shaped like yams or bananas are used to promote the growth of these plant foods; (2) rarity or unusual character of an object, *e.g.*, large quartz crystals; (3) unusual shape of common things, *e.g.*, water-worn pebbles, or stones with natural holes in them. Certain charms are so highly charged with magical power that even the owner may not touch them with his bare hands. He may keep his charm in a bamboo cylinder and handle it with sticks; no one other than he cares to look upon it. In the Papuan Gulf ginger is believed to be a potent source of magical power; it is rubbed on spears to insure straight aim, and is sprayed from the mouth over hunting dogs to enhance their skill.

MEDICINE AND MAGIC.

Seldom is sickness or death believed by primitive peoples to be a natural occurrence. Misfortunes of this nature are invariably attributed to the work of spirits or malicious individuals who have the power of inflicting them. Even death by drowning, or falling from a tree, or a wound gained by stumbling over a spear is not considered an accident, but is put down to the machinations of someone who has a grudge against the injured person.

In the case of illness a sorcerer is called in either to use his own skill in curing the sick person or, if his power is not great enough, to make negotiations with the individual whom he considers responsible for the evil. It is when he is unable to prevail upon this individual or spirit to remove the spell that the victim dies.

In many communities the demise of very old people is accepted as a natural event, but the normal course of action in the case of the death of a younger person is the exhumation of the body. This is done in the Trobriands to determine the reasons for death. The body is first examined for signs of sorcery. If yam-like swellings appear on it, then the dead man has been too avaricious. He has hoarded more yams than is permitted a commoner; therefore, the chief has had him put out of the way for daring to encroach upon one of the chiefly privileges. Such exhumations are in reality a valuable practice in that they offer some solution as to the cause of death; the minds of the relatives are set at rest, and no vendetta is sought.

This avoidance of ill-considered bloodshed following upon a death is an admirable element in Trobriand culture, but the situation is not so well conducted in other parts of New Guinea, where chiefs are not nearly so powerful and sorcerers are not in their pay. In many Papuan tribes, if a native gets an idea into his head that his kinsman has died through the machinations of a particular man, he will avenge his relative's death by killing the suspect sorcerer, who, incidentally, may be quite ignorant of the whole affair. Thus black magic is creative of bad social feeling; the consequent and inevitable feuds are the most fertile source of assault and bloodshed.

Attempts to stamp out sorcery have not been very successful. It is too deeply rooted in the supernatural system to be suddenly cast out; it is backed up by myth and tradition; its very antiquity is its protection. Nor have efforts to reason with the native met with much success. It was hoped that when he was shown the futility of the sorcerer's

Canoe Magic. Since the lives of the crew depend upon the strength of the outrigger and the lashings that attach it to the hull, the natives of Wogeo (Schouten Islands, New Guinea) take care to bespell the creepers used as ropes, and, as a final precaution, tie to the outrigger booms a magical bundle of thorny creeper, which is believed to prevent them from slipping. This rite is part of a complex system of canoe magic explained and illustrated by Dr. H. I. Hogbin in "Trading Expeditions in Northern New Guinea" ("Oceania", V, 4, 1935).

methods the black art would lose many of its adherents, but no one has been able to demonstrate its futility convincingly enough for the native. His knowing tolerance and polite disbelief of the white man's explanations are baffling. He always has some plausible reason to offer for the failure of a particular act of magic. He puts it down to the counter-magic exercised by another sorcerer, or to some mistake in the ritual when the act of magic was being performed. He will not accept failure as a proof of its absurdity. In the long run, enlightenment will come with a more perfect education and a greater understanding of the difference between magic and reality.

MAGIC IN ECONOMICS.

Prior to every stage in the building of a canoe, such as when the great log is being hollowed out, or when the hull and outrigger are lashed together, magical rites are enacted to make certain that all will go well. The finished vessel has charms attached at bow and stern, and lucky tokens dangle from the sails. Similar magical rites are enacted in the various stages of gardening, in the making of pottery and the fashioning of valuable ornaments. Failure is certain from the outset unless such precautions are taken. But in spite of this conviction the native knows that magic by itself is not all-powerful. When planting his seed yams, for instance, he does all that his knowledge of husbandry can tell him, and only after he has exhausted all his practical knowledge does he seek supernatural aid. He does this to make favourable conditions over which he has no control, such as drought, blight or theft.

Thus it is seen that in the economic sphere and in sickness, magic is of supreme value to primitive man because it gives him confidence to overcome difficulties to which he might otherwise succumb; it enables him to face crises with stoicism, and is a weapon with which to fight the fates.

In the maintenance of law and order, too, the dread of supernatural punishment instigated by the sorcerer exercises a restraining influence upon thieves and other would-be evil-doers. Magic, then, enters and colours all spheres of native life, and, despite its essential falsity, performs many valuable services for its primitive practitioners.

A Rock-Pool Dining Room

By ARTHUR A. LIVINGSTONE

WE have all at some time attended a banquet to partake of numerous delicacies, make speeches, and generally behave in such a manner as would suggest the last word in table manners. However, a somewhat different assemblage gathers at the particular banquet the writer has in mind. A gathering which, while feasting, brings to mind the tales of "the good old days" of the seventeenth century, when even aristocrats ate with their hands, threw refuse on the floor, and used the contents of the finger bowl as a gargle.

Imagine a rock-pool on our coast in which a helpless fish or some other edible object has been left by a receding tide. Here the inmates ignore etiquette, are not in the least perturbed if someone, even a "lady", is pushed rudely aside in the mad scramble for the provender. Both young and old bustle and jostle, even glare at one another, but at all times covering the ground between them and the edibles. Then the fighting and gorging is on. The tenants of the pool are agog, and all turn out to witness the nature of the windfall. The worms, the tiny rock-pool fish, the crabs and the urchins, and indeed all within range of the effluvial eddies, hurry to secure their share of the banquet at hand.

From a rocky, miniature cavern issues a long, sinuous arm, light brown on the top and studded below with creamy sucking disks. Another questing arm comes forth, at first warily, as though danger were at hand, but later boldly, to be followed at length by a dark, bulbous body surrounded by writhing arms. The octopus is out and on his way to the feast.

Mottled green and brown crabs, lithe and swift of movement, shyly peep from crevices to survey the happenings and calculate the chances of securing a good meal safe from marauding enemies. A hermit crab, dragging on its back a stolen home of shell, bluffs his way through the gathering throng until he meets a friend. But here is no place to extend greetings or exchange a goodwill. With a menacing wave of fore-claws, each hurries onward.

Even the tiny rock-pool shrimps intend to be in on the hunt. Their delicate transparent bodies, flecked with blood-red spots or stripes, flash backwards through

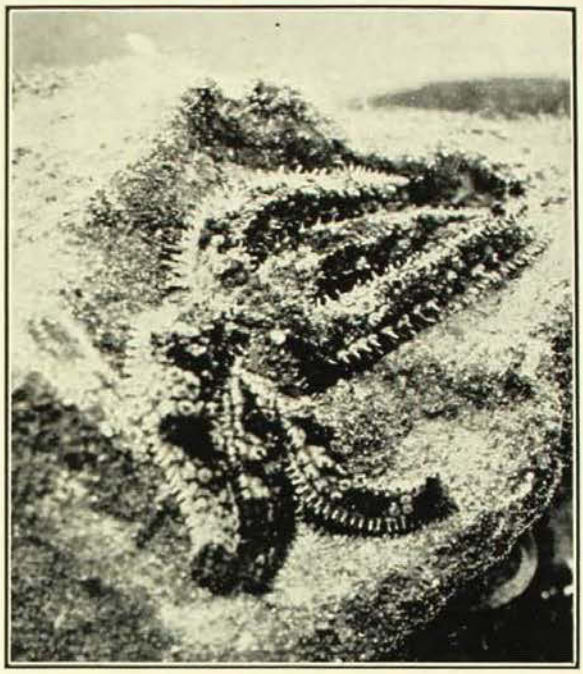
A few minutes' wrestling and the octopus is more or less exhausted. In the centre of the tentacular mantle may be seen the teeth laid bare by the out-turned limbs, each carrying two rows of suckers. The fleshy membrane between the limbs assists in swimming.

Photo.—F. A. McNeill.

the water with violent flicks of their fan-like tails. The hermit crabs, being among the last to arrive at the "table", are not in the least disturbed about not securing a "seat". One big fellow, seemingly in a greater hurry than his friends, begins by sweeping aside with one formidable claw several of the assembled diners, and with the other tears from the choicest part a large and succulent morsel. Then it seems that he shoulders the responsibility of giving a display of table manners. With almost human fastidiousness he performs a gastronomic feat in such a dainty and accomplished manner that one is forced to admiration. Holding his first "course" in one claw, he plucks with a small pincer-like appendage piece after piece, and carries each shred into his mouth with a truly delicate precision. He then sets to and daintily preens himself with his nippers, scraping and wiping hairy mouth-parts with slow deliberate movements. But this attempt at refinement is purely temporary, for no sooner has he completed the task of "washing" than he dashes into the *melée* again in a most ungentlemanly manner.

Meanwhile, the "king" of the pool, the octopus, merely looks on with a wicked eye. Is he contented that way, or is it the human witness to all this feasting that is a possible menace to his well-being? Untroubled by such intelligence, however, are the darting shrimps. They seem to be everywhere. Each waits for some ragged piece to show out from the mass; then a rush forward is made. Long fragile nippers cling on and with vigorous back-lashings of a powerful tail a miniature tug-o'-war commences. During this spasmodic tugging one is amazed that the delicate nippers are not wrenched from their sockets. Every floating fragment is disputed by these active crustaceans, which dart hither and thither in a tireless quest for food. The successful hunters can easily be noticed among their less fortunate fellows, for, having transparent bodies, their full stomachs can be readily seen.

Before the feast comes to an end one may see the operations of the rock-pool glutton—the sea-star. This fellow, like some humans, is always late to "table". Its excuse is not procrastination; rather it is because Nature has decided against speed for these invertebrates. With slow movement, the short sucker feet of the star move as one towards the provender.



The sea-star, Coscinasterias calamaria, prefers the sheltered and dark recesses of inter-tidal rock-pools as a habitat.

Photo.—F. A. McNeill.

Each little foot gains a hold on some object and collectively the feet move the dainty creature onwards. Having secured with sucker feet a large morsel dropped by some hasty diner, the star proceeds to take stock of his share of the spoils. He is confronted by the hopelessness of getting such a large meal past his mouth intact. He has no teeth like his cousin the sea-urchin, so adopts another plan. This new measure takes time to develop, so the onlooker must have plenty of time at his disposal. Slowly the sea-star throws out through his mouth a thin, milky coloured, membranous cloak, which in time completely envelops the entire bulk of the morsel. What has actually taken place is that the sea-star, knowing that it would be impossible to devour the meal as one would expect, has thrown out folds of its stomach through the mouth, preparing to digest the food outside the body instead of within.

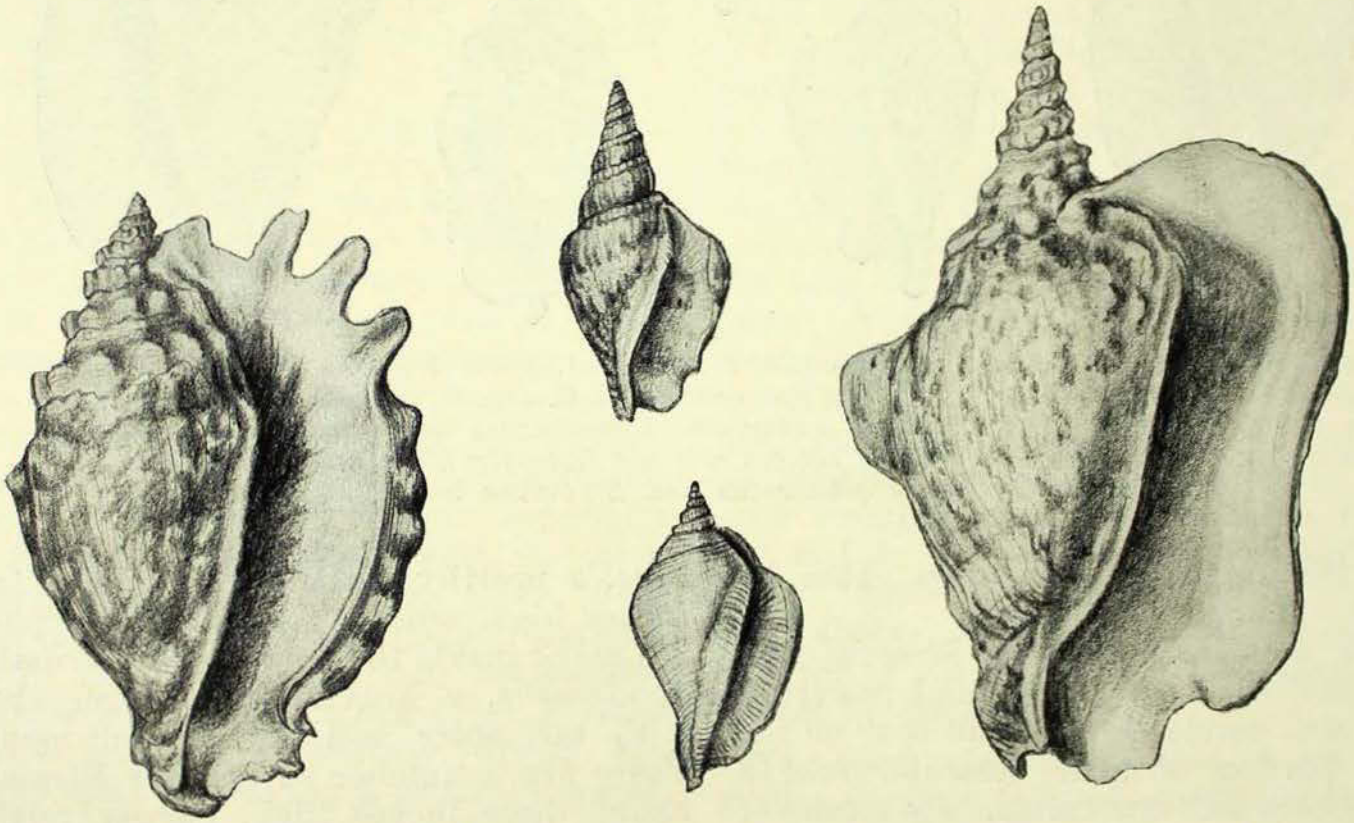
Australian Shells

Strombs, Scorpion, or Spider Shells, Sea Butterflies and Ladder Shells

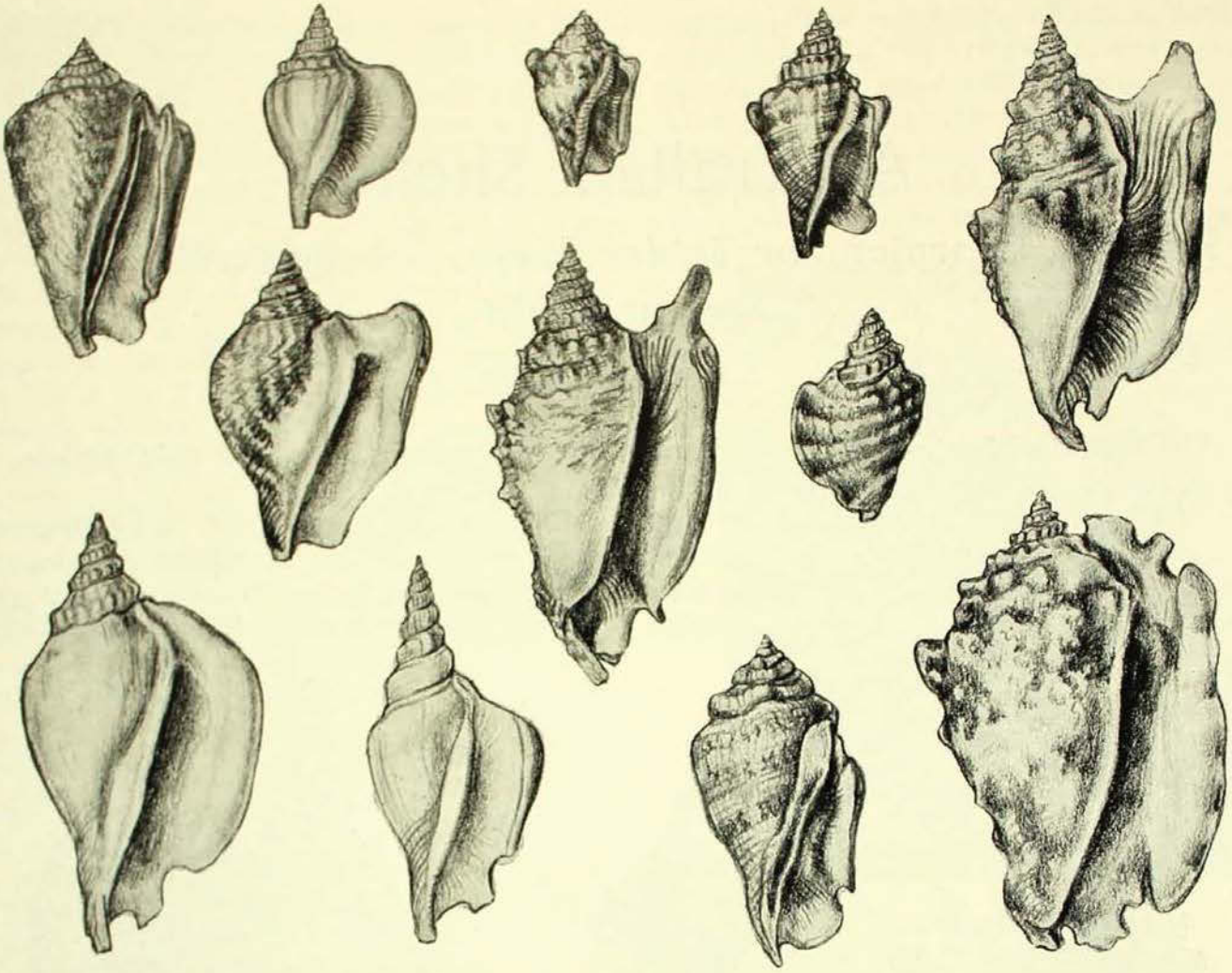
By JOYCE ALLAN

HALF-TONE illustrations give little idea of the true beauty of Strombs and Scorpion shells. They are typically tropical individuals, and as such display the remarkably rich colouring and range of form usually associated with shells found in warm shallow waters of coral reefs. Tropical Australia and the South Pacific islands possess many different species, some of which are closely related, and numbers wander down from the islands to Australia. For the reason, therefore, that many forms occurring in New Guinea, New Caledonia, New Britain, Solomons, and such islands, also live in Australian waters, some island species are included in this article on Australian shells.

The shells are very porcellaneous, especially round and within the mouth, which usually ranges from a creamy pink to a bright orange or flame colour. The outer surface of the shells is covered in life with a brownish epidermis, and frequently with silt and algæ, which hide the exquisite markings and colourings so conspicuous in the empty shell. Once the animal within the shell dies, the epidermis loses its protective power and can be removed easily. In other parts of the world, where very large species occur, the shells are used for ornamental purposes,



The large Stromb on the left is Strombus laciniatus, and that on the right is S. ponderosus. The upper middle one is Doxander campbelli, and below it, Strombus sagittus.



Stromb Shells. The five top illustrations represent, from left to right, Conomurex luhuanus, Dolomena plicata, Canarium flammeum and C. urceus, and Euprotomus aratum. In the middle row are Strombus canarium, Euprotomus aurisdiane and Strombus variabilis. From left to right in the bottom row are Labiostrombus epidromus, Doxander vittatus, Strombus gibberulus and Strombus lentiginosus.

and the animal is sometimes eaten by man.

The animals inhabiting Strombs and Scorpion shells are active and powerful, with well developed eyes, and bear on the hind portion of their muscular foot a sharp claw-like operculum. By means of this foot the animal moves along in ungainly leaps, but, if overturned, it is able to right itself by a somersaulting movement. They are believed to act as scavengers, and are said to have a strong sense of smell. Young shells are very unlike the adult forms in structure, and their classification is often a difficult problem for an amateur collector.

STROMB SHELLS.

Two of the largest Strombs from Southern Pacific waters are *Strombus laciniatus*, a prettily marked shell about four inches high, with a rich, dark, purplish-red mark inside the mouth, and *Strombus ponderosus,* a heavier and larger shell, with tall spire and widespread mouth. There are a number of smaller Strombs, about three inches high, closely related to one another, which occur on the Great Barrier Reef as well as on the reefs of many of the South Pacific islands. Of these, *Euprotomus aratum* is very like *E. aurisdianæ,* but has strong tooth-like ridges inside the white mouth, and *E. melanostoma* has an orange-pink mouth like *E. aurisdianæ,* but this is overlaid by a rich black colour, and the same tone edges the outer edge of the mouth and the single prolongation. Of the two species *Doxander vittatus* and *D. campbelli,* the latter is the more solid and less

graceful, and extends in its range as far as north-west Australia. A New South Wales form of *E. aratum* has been obtained in dredgings in Sydney Harbour, and is named *E. donnellyi.* Two wide-mouthed species of Strombs which occur in Queensland are *Dolomena plicata,* a small, white, heavily ribbed shell with a bronze mark on the outer and inner lip of the mouth, and portion of the teeth marked with orange-brown, and *Labiostrombus dilatatus,* a larger form, very similar to the previous species, differing slightly in sculpture, and extending in range as far south as Sydney Harbour, where it has been obtained in dredgings. *Labiostrombus epidromus,* from the South Pacific islands, is like a larger *plicatus,* but has no teeth on the inside of the mouth, and *Strombus sagittus,* from New Guinea, is marked by revolving lines and conspicuous teeth.

Of the remaining Strombs, all of which occur in Queensland as well as the South Pacific islands, *Strombus lentiginosus* is very solid, nodulose, and pearly mouthed; *S. gibberulus* is irregular in shape, with a dark purple mouth; *Canarium flammeum* (previously well known as *floridus*) and *C. urceus* are common small forms, easily recognized; *Strombus variabilis* has conspicuous bands of brownish-red colour, especially on the back of the shell; and *Strombus canarium* is another well-known form with a peculiar zigzag colour pattern. One of the best known and handsomest Strombs is *Conomurex luhuanus,* covered in life by a thick, velvety, brown epidermis, and possessing a brilliant watermelon pink mouth, with a black mark along the inner columella.

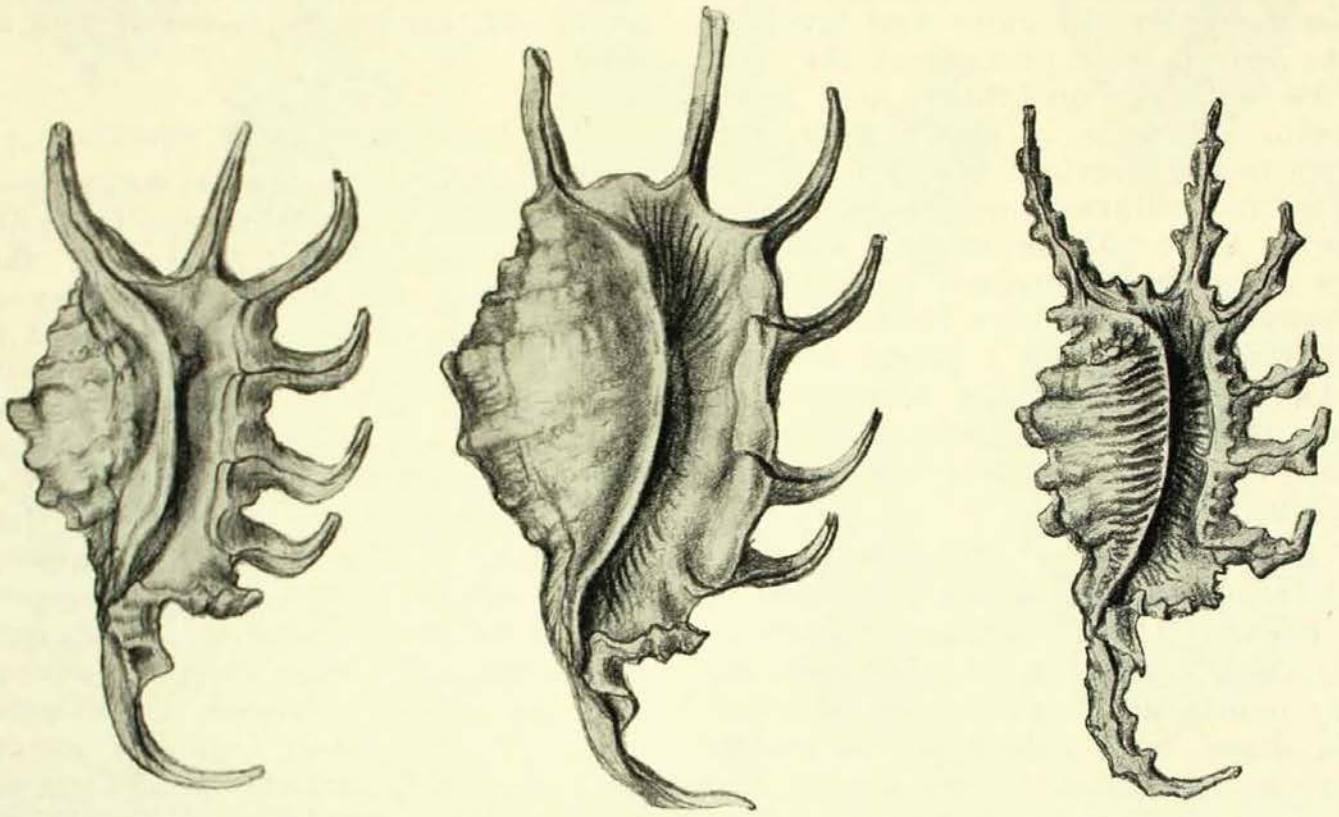
While on North-West Island, Great Barrier Reef, Mr. G. P. Whitley observed a *Strombus gibberulus* moving about, and made some interesting notes on its habits. The animal, he says, was mottled green dorsally, and pink to white ventrally. Its eyes were most conspicuous and carried on long stalks, and at the end of the tail was a vicious, sharp, jagged-edged blade (operculum). When placed in a basin of water the animal emerged from its shell as far as possible, then, with a convulsive slash of its tail, drove its sharp-edged operculum into the dish; if at this time it was lying on its back, the animal righted itself. Just as Mr. Whitley observed, the Strombs have been noticed in other parts of the world to use this operculum similarly, and when moving along will constantly thrust it into the sand.

SPIDER OR SCORPION SHELLS.

The Spider or Scorpion shells are of such unusual shape that there is no difficulty in identifying them, and their classification is very simple. They are heavy spiral shells, the outer lip of the mouth being prolonged into finger-like processes of varying size and number. Their home is the shallow tropical waters of the eastern hemisphere, and they are quite common on the Great Barrier Reef, as well as on the reefs of the numerous South Pacific islands. The corresponding American form of these shells expand the mouth into a wide wing, and have not the long curved processes of the eastern ones. Their closest relatives are the Strombs, which in their young form they more closely resemble. It is only with adult growth that the processes develop as long hollow canals on the outer lip, each canal containing a filament from the mantle of the animal. The surface of the shells is ornamented with ridges and knobs, and the smooth polished interior of the mouth is a rich shade of orange or deep orange-red.

The most common species of all the Spider shells is *Lambis lambis,* about six to eight inches long, with six upwardly curved prolongations on the outer lip. The mouth inside is orange varying to rose-pink. There is a slightly larger, closely allied, species, *Lambis chiragra,* but it is easily distinguished by the stronger revolving ridges on the shell, and the rosy interior, heavily marked with wrinkles. Moreover, the tentacles are very solid, four on the outer lip curling upwards, and two on the opposite side of the mouth, an anterior and a posterior one, also curling outward and

upward. There are several small forms which are closely related. Of these, *Lambis scorpio* is the only species figured here, and is characterized by the nodules on the spines, and conspicuous white transverse ridges within the mouth and on the inner lip, between which the shell is purplish or nearly black. It is about four to five inches long. *Lambis pseudoscorpio* is a larger shell than the previous species, with a more expanded mouth, the internal ridges not so conspicuous or the spines so nodulose. Numerous short prolongations, or digitations as they are commonly called, characterize *Lambis millipeda*, which also has only moderately developed wrinkles on the mouth, and lighter coloured interstices between them. There also occurs in these southern tropical seas, a small form like *lambis*, but which has a stronger outer lip, and more curved, stronger digitations. The inside of the mouth is orange coloured and appears practically free from wrinkles. This species is *Lambis aurantia*. The largest Spider shell found is *Lambis bryonia*, a very coarse, ponderous shell over a foot long, with the inside of the lip whitish, fawn or pink, and the six digitations very short in comparison to the size of the shell. This species resembles a very large form of *lambis* with its digitations stunted. Strombs and Spider shells belong to the family Strombidæ.



Three typical Scorpion or Spider Shells. From left to right these are Lambis aurantia, Lambis lambis and Lambis scorpio.

BEAK SHELLS.

The Beak shells, of which only two species are mentioned and figured in this article, are a small group belonging to the same family as the Strombs, which they resemble in habits. They possess a powerful elastic foot, and by bending and straightening this organ are able to move by rolling and leaping over and over. Though dead shells may be found in shallow water or on sandy beaches, Beak shells are deep water forms occurring in the Red and China Seas, the Philippines and the South Pacific islands. Of the two species figured, *Rostellaria powisii* is creamy white, about one and a half inches long, and has been found at New Caledonia, and the strongly sculptured, purple mouthed species, *Rimella cancellata*, occurs in New Britain.

The narrow delicate shell on the left is a Little Screw shell, Terebellum subulatum, widely distributed throughout the Indo-Pacific and South Pacific, with two Beak shells, Rimella cancellata and Rostellaria powisii, alongside it.

LITTLE SCREW SHELLS.

Screw shells are smooth, shining, very slender relatives of the Strombs, but the animals are extremely shy and take fright easily, quickly retracting into their shell at the slightest disturbance. The species figured here, *Terebellum subulatum,* is the common form widely distributed through the Indian Ocean, China Seas, Indo-Pacific and the South Pacific islands. It also occurs in Queensland.

SEA BUTTERFLIES.

Only the shells of these beautiful little creatures are likely to come the way of the average collector, as the Sea Butterflies are pelagic shellfish living generally in communities far out at sea, and reach the shore only when accidentally driven there by storms. Their food consists of microscopic molluscs and crustaceans which abound in the waters where they live, and they in turn provide food for other animals frequenting the same parts. The animals are small, and either have no shell at all or small, transparent, internal or external ones, which assume a variety of shapes. They swim by means of fin-like lobes of the foot, the position of the body in swimming being the opposite to the normal manner, that is, with the abdomen up. The animal has a large proboscis and a tongue armed with recurved spines; it is so transparent that the blood corpuscles can be seen circulating through the body. The Sea Butterflies belong to the class Pteropoda, and, though they seem out of place, are grouped near the previous family on account of certain anatomical structures. Only three species of the shells are figured here, all of which were dredged in deep water off Sydney. Of these, *Carinaria australis* is limpet-shaped, one-quarter inch wide, and is white, with strong ridges. It belongs to the family Carinariidæ, the animals of which are very much larger than the shells, enabling them to move quickly and freely through the water, and are provided with a small sucker on the margin of the ventral fin. By means of this they are able to anchor temporarily to floating bodies when tired. The shell of *Atlanta rosea,* another species, is minute, glassy, compressed and keeled, and the very lively owner is able to retire within it. The animal also has a sucker, by which it can cling in the manner of a leech. This species and the remaining species figured, *Oxygyrus keraudrenii,* belong to the family Atlantidæ.

LADDER SHELLS.

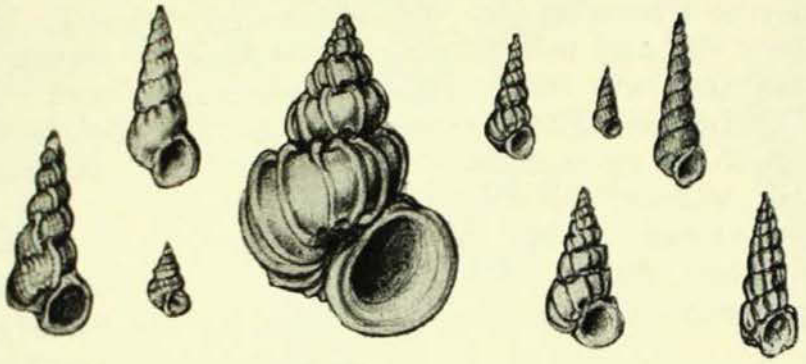
Ladder Shells are a family of wide distribution, ranging from cold to tropical seas, and from shallow to deep water. They are carnivorous animals, related to the Violet Snails, and when molested

Shells of the beautiful, but rarely met, Sea-butterflies. Their life is spent far out at sea, and they reach the shores only when accidentally driven there. On the left is Oxygyrus keraudrenii, with the little Atlanta rosea in the middle and Carinaria australis on the right.

exude a purple fluid. The shells are mostly white, turreted, and many whorled, the whorls sometimes separated, and are ornamented with transverse ribs. The handsomest of all the Ladder shells is *Scala scalaris,* the Precious Wentletrap, which occurs in the China Seas, and has in recent years appeared off the Queensland coast. About the year 1770 these shells fetched a high price, as much as forty guineas being paid for a single specimen. The Chinese copied the shells

in a rice paste, and sold many of these counterfeits before they were discovered. Round the Australian coast numbers of Ladder shells are found, and by the aid of a small lens in the case of the very small species these can be distinguished into many kinds. As the New South Wales species of this family, Scalaridæ, have been recently revised,* only a few of the well-known forms are figured here, and these can be easily recognized and distinguished from one another. Of these Ladder shells, *Acutiscala minora, Acrella acuminata, Cirsotrema varicosa* and *Pomiscala perplicata* have a wide range of distribution, extending from South Pacific islands to eastern Australia, the second and third species at present only reaching as far south as Queensland, the others coming into New South Wales. The remaining species, *Acutiscala jukesiana, Opalia australis, Granuliscala granulosa,* and *Limiscala helicornua,* the latter a New South Wales form of *Scalaria lyra,* a Queensland shell, are eastern Australia species extending in their range into southern Australia.

* Iredale: "Australian Molluscan Notes. 2." *Rec. Aust. Mus.*, Vol. xix, No. 5, 1936, pp. 294-306.



A few of the well-known Ladder Shells. The large one in the centre is the very handsome Precious Wentletrap, Scala scalaris, and on either side of it in the top row are Granuliscala granulosa, Acutiscala minora, Acutiscala jukesiana, and Acrella acuminata. In the bottom row, from left to right, are Cirsotrema varicosa, Limiscala helicornua, Pomiscala perplicata, and Opalia australis.

Book Reviews

FANGS OF THE SEA. By Norman Caldwell, in collaboration with Norman Ellison. (Angus and Robertson Ltd., Sydney, 1936). 8vo., 282 pages, illustrated. Price 8s. 6d.

Anybody who commences this book will enjoy some hours of interesting and entertaining reading, for, in a breezy and quietly humorous style, Mr. Caldwell writes of his experiences, many of them exciting, as a professional hunter of sharks. His first-hand knowledge of these creatures and the means of catching them is responsible for descriptive accounts which are vividly informative, and his chronicle of the infant sharking industry is of no little historical and commercial importance.

The author carries his readers from New South Wales to the Whitsunday Passage, Queensland, where most of the action takes place, and then to north-western Australia. Every page maintains the interest as we read of thrilling adventures with sharks, crocodiles, eels, and other marine monsters. Even a Sea Serpent, that

> Wondrous worm that won the height
> Of fame by keeping out of sight,

puts in a brief but sensational appearance. Ghoulish night crabs, ferocious octopi, and tropical turtles play vigorous rôles in dramas of the deep. Primarily, though, this is a shark book, and nobody who goes shark-fishing for sport or for a living and no surfer or lover of the

outdoors should fail to read it. There is indeed a refreshing open-air quality about the book, although a whiff of shark flesh and blood intrudes at times.

Many persons ask: Are all these tales true? The reviewer knows Mr. Caldwell and some of the people and places mentioned in his book, and if Mr. Caldwell vouches for a story, then it is not exaggerated. One tale which may perhaps be taken with a grain of salt is not one of Mr. Caldwell's own, but was related by persons who state: "No, we did not see this. We sensed it."

Mr. Caldwell mentions "Madame X", a supposed new type of shark which grunted and spurted water in a most unladylike manner. This particular kind was recently named the Tawny Shark (*Nebrodes concolor ogilbyi*) by the reviewer, who, nevertheless, almost prefers Mr. Caldwell's cognomen.

The printing and illustrations are very good, but a few quite minor mistakes may be mentioned. The Basking Shark is said to have "had no teeth, only crushing plates". Actually, however, that shark has rows of small peg-like teeth. There are a couple of misspellings of scientific names: the Devil Ray is not *Manta berostris* [*sic*], but should be called *Dæmomanta alfredi*, and the turtles are *Chelone,* not *Chelene.* The animals referred to as Saw Sharks would be more accurately termed Sawfish. De Puke is an unfamiliar spelling of Depuch Island, Western Australia.

G.P.W.

WONDERS OF THE GREAT BARRIER REEF. By T. C. Roughley, B.Sc., F.R.Z.S. (Angus and Robertson Ltd., Sydney, 1936.) 8vo., pp. 282, with 50 plates, 36 in colour. Price: 12s. 6d.

Much has been written regarding the Great Barrier Reef, its geography and zoology, its beauty and attractions as a tourist resort. The volume under review, by the Economic Zoologist of the Technological Museum, Sydney, is the latest addition to this library, and it will hold its own with any of its predecessors as a popular and informative account of one of the most wonderful phenomena which Australia or any other continent can offer.

The author is an accomplished photographer, and a striking feature of the work is the numerous coloured plates, produced from actual photographs. Some of these are exquisitely beautiful; one may instance the frontispiece (a coral garden), Plate 35 (banded shrimp and squid), and Plate 39 (sea slug). The earlier chapters give a readable account of coral itself, its growth and mode of life, and the general accepted view of the manner in which this twelve-hundred-mile rampart has been built up along the Queensland coast. But there are many other fascinating subjects for our author's ready pen — delicate sea anemones ("flowers of the reef"), gaily coloured fishes in coral grottoes, quaint crabs and other crustaceans, clams, some of huge dimensions, others with brilliantly beautiful mantle edges, turtles, birds, dugongs and a host of others. The waters of the Barrier Reef have a high reputation as fishing grounds, and the description of two days with rod and line off Heron and Hayman Islands is excellent reading for the brothers of the angle.

The economic resources of the Reef form the subject of a chapter, dealing with pearls and pearl-shells, trochus, bêche-de-mer, shark products, turtle soup, and the fishing industry. One recalls the remark of a visitor from abroad, who declared that if the Great Barrier Reef were in his country it would support a population of several millions. Are we making the best of our heritage?

For the scientifically minded there is a glossary containing the vernacular and technical names of the animals, with a page reference to where they are mentioned in the text. This is an excellent device, for the general reader is not continually faced with long words which for him have little meaning or importance.

The printing and get-up of the work are of a high order, and we extend our congratulations to author and publishers on the issue of a fine book on Australia's wonderland.

C.A.

A Creed for Nature Lovers

I BELIEVE:

That the Australian continent not only provided the cradle but the everlasting home of all the fascinating flowers, birds and furred animals which awaited the coming of civilization.

That I should not harm any living thing unharmful to me, as I hope to avoid harmful things, and that even harmful creatures should be controlled with due regard to their scientific importance and right to survival.

That to enjoy the living plants and animals is a more lasting and universal source of pleasure than to collect their remains, excepting where science is aided, and their exhibition increases knowledge and love of nature.

That the nests of birds, built with such skill and patience, should not be destroyed in a moment of curiosity, and that the eggs should be left to hatch forth lovely feathered songbirds, rifling of their homes being as wicked as theft from my own.

That as the bushes and trees provide food and shelter for birds, and marsupials such as the koala, such shelter should not be destroyed without reason or adequate replacement, and that wild flowers should be gathered with all the care due to living things of exquisite scent and beauty.

That wholesale sacrifice of native animals for monetary gain in a country rich in natural resources of minerals, grain, and stock, is a confession of greed and incompetence unworthy of the Australian Commonwealth.

That, as Australia has the gentlest and least harmful furred animals the world has known, they should be given sanctuary and conserved with benevolent care for their future survival, subject only to vital needs for the existence of man, their more advanced but oft-times unnatural brother.

E. Le G.T.

Scientific Literature and the Museum

THE average man or woman probably takes but little interest in a museum and its requirements, beyond wandering through the galleries, picking up from the labels some titbit of information, gathering an impression or two as to the nature of the objects exhibited, or sending in some specimen with a request for particulars concerning it. Probably little thought is given as to the means whereby the information they seek has been obtained. Only those who write asking if any book is available on a certain subject are unconsciously arriving at the crux of the matter; for books are the tools of trade of the museum worker, or, to change the metaphor, the very life-blood of a scientific institution. Without adequate library facilities, research is practically out of the question, for it is only by reference to published research work that students of science are able to proceed.

We find, on the other hand, the presses of the world turning out scientific books and periodicals at a rate which leaves those concerned with the equipping of a museum library somewhat dazed. While on a recent visit to England, the writer was informed that "a new scientific periodical appears every fortnight", and that "the British Museum is finding it hard to cope with the output". These remarks would perhaps apply chiefly to foreign or extra-British publications, since the British Museum, like our Public

Library, comes under the copyright law, and is entitled to receive all works published in the United Kingdom.

It may be asked: Why should an institution like the Australian Museum consider the acquisition of these publications? The answer is: Because in many of them appear descriptions of new species of Australian animals, or papers with an important bearing on Australian geology and anthropology, all of which sciences form part of the Museum's activities. Nor can we afford to overlook the general works on biology, anthropology, and geology. A glance through Pitt's *Catalogue of Scientific Periodicals in Australian Libraries* shows that many serials are represented only by odd copies; in few instances do the libraries contain complete sets of any given periodical.

This state of affairs has not been entirely lost sight of, and, in order to conserve funds, efforts have been made to prevent undue overlapping. To offset this scheme comes the question of distance between the capitals, which is a vital one to Australia in matters other than those of libraries. A library interchange system is in operation, however, and so students are enabled to proceed with their research work.

The housing of this yearly avalanche of scientific literature is a problem occupying the minds of many librarians abroad as well as in Australia, and the lack of library storage space has long been a major difficulty in this institution, which possesses possibly the largest scientific library in the southern hemisphere. While in England the writer visited the new University Library, Cambridge, which contains forty miles of shelving, of which twenty-five miles are already occupied; the remainder at the present rate of expansion will be filled in twenty years. As an indication of the rate at which storage space is filled, one periodical, the *Zeitschrift für Physik*, in twenty years has run to ninety volumes. Another work, the *Annalen der Physik*, which began in 1790, had, in 1934, 411 volumes. It will be seen how embarrassing it is for libraries to try to cope with the output of scientific works. Under the copyright law, Cambridge, like the British Museum, is entitled to receive everything published in the United Kingdom, but many publications are an encumbrance, and requests have been made to certain firms not to send their periodicals, such as comic papers.

Another aspect of the scientific literature question is the importance of finding the correct date of publication of scientific papers, for upon such a date may hang the validity of a species. Of recent years matters of this kind have become of such paramount importance that a "Society for the Bibliography of Natural History" has been founded in London.

If Australia is to keep her place in line with other countries, more attention will need to be given to the question of providing adequate funds and facilities for libraries, in training assistants in library work so that they can help students in finding the works they need, and in elucidating problems relating to books and scientific papers.

A. MUSGRAVE.

At the October meeting of the Board of Trustees of the Australian Museum, Mr. E. C. Andrews, B.A., F.G.S., who has returned from an extended trip abroad, during which he visited Europe and America, was welcomed back by the President, Mr. F. S. Mance, on behalf of the Board.

During his tour Mr. Andrews visited many museums and learned societies, and from them he brought greetings.

The Daily Life of the Australian Aboriginal

By EDGAR ROY EDWARDS

[*Editorial Note.*—An essay competition for school children was recently promoted by the Trustees. Various subjects, based on Museum exhibits, were prescribed, and money prizes were awarded to successful candidates in three age divisions, namely, under 12; over 12 and under 15; over 15. In addition, a medal, presented by the President, Mr. F. S. Mance, was awarded for the best essay in any division. The first prize in the highest division and the President's medal were won by Master Edgar Roy Edwards, Neutral Bay Boys' Intermediate High School, with an essay on *The Daily Life of the Australian Aboriginal.*]

THE Australian aborigines are dependent upon what Nature offers them for their food supply, and so their daily life is mainly concerned with hunting, fishing, and collecting the natural products. Under similar conditions the white man would starve in a few days, but the aborigines have developed an amazing technique in obtaining food. With this and their adaptiveness they have been able to survive through the ages.

They are true nomads within the limits of their totem country. The old men decide when to change camp and on the new site. This is of great importance, as the life of the tribe depends upon the water and food supply.

Before leaving, a bent stick is placed in the ground, pointing in the direction of the new camp. This indicates to any blackfellow where to go.

If the tribe has been living on meat, the members may feel the need for a change in food, say, yams. The shift begins. Hunting as they go, the men carry only their weapons, and are ever on the look out for game. The lubras struggle on, carrying tremendous and very assorted loads in their dilly-bags; but the lubras' main jobs are to keep alight the fire-sticks and dig special roots with their yam sticks. Often one carries a pitchi of water balanced on her head. If food is scarce, the tribe splits up into family hunting groups in order to cover a large area. Thus they move, forced to keep going until water is reached.

Should the fire-stick go out, the fire-lighter is produced from the lubra's dilly-bag. Fire is caused by friction, either by the drilling or sawing method. The drilling method needs two dry pieces of wood. The first, the drilling stick, has a round blunt end, which is fitted into a cavity in the second, a thick, flat piece of wood; a notch is cut from this cavity to the edge. The drilling stick, twirled rapidly between the hands, produces a fine hot dust, which moves along the notch until it reaches some dried and rubbed bark, when it is either whirled or blown into flame. Flame is generally obtained in about one minute by this method.

To obtain fire by the sawing method, either a hardwood womerah is rubbed with a sawing motion across a softwood shield, or a special cleft in a piece of wood is filled with tinder and then "sawn" with a hardwood stick.

As they have to catch their food before they can eat it, the aboriginals are skilled hunters, possessing an amazingly keen observation and a wonderful store of nature knowledge. Besides, they are the best trackers in the world.

The blackfellow employs many traps and weapons to catch his dinner, and, in fact, any device he can think of that will enable him to secure game.

Accuracy can be depended upon up to sixty yards with the spear and womerah,

but the black hunter always tries to be within about thirty yards of his prey. The womerah or spear-thrower gives greater accuracy, distance, and speed to a spear than otherwise could be obtained. Larger animals, such as kangaroos, are usually speared, stalked or killed "on the run".

Other hunting weapons are the hunting boomerang, the throwing stick, for small animals, and the cross boomerang, which is thrown into a flock of birds. The wich-wich, used in the Riverina District, New South Wales, by the Yota-Yota and Waradgery tribes, consisted of a long lignum shaft and an oval wooden missile attached to one end. It is employed in such a way that the released missile touches the ground, rises with terrific speed, and flies on to kill the intended prey. Its range is two to three hundred yards. The kylie is for bringing down birds on the wing. It is carved of hard-wood and shaped like an "L", or slightly curved. It curves spirally when thrown, and returns to the thrower.

Various methods are used to catch birds. Ducks are caught in a clever manner. Into a plaited ring of rushes about a yard in diameter are stuck branches of tea-tree. The hunter, his head and shoulders concealed by tea-tree, which floats lightly on the water, works towards the wild fowl. Reaching them, he sinks, and, pulling one beneath the surface by its feet before it can cry out, tucks its head under his belt. Coming up to breathe under his "floating island", he continues until he has sufficient or they take fright.

A clever ruse is employed to capture budgerigars. Stretching from a water-hole to neighbouring trees where the birds roost, two divergent fences of thick bushes are built, eight to nine feet high. The narrow end of the trap is cleared of bushes inside, but the wide end left alone. In the early morning men creep up to the roosting trees and, with loud shouts, begin throwing boomerangs and sticks into the trees. The terrified birds, thinking that they are attacked by hawks, dash out of the trees and away from the attacking enemy, but are unable to penetrate the fences. Flying down the trap, they are caught in hundreds in a fine-meshed net held by two men standing just in front of the opening.

Many methods of fishing are in use, but the most interesting is spearing, which is always done in shallow water. Fish spears have one, two, three and four plain or barbed points. Sometimes a womerah is used. Either the spearing is done from a canoe or the river bank, or the fisher stands ankle deep in the water.

Traps are also used for fishing. In the Kimberleys the natives enclose the end of a lagoon by a causeway of boulders, with a gateway in the centre of a small race. Men and children enter the deep side of the trap and scare the fish through the gate, which is then closed. The fish are then driven on to the banks of the lagoon. Huge sausage-shaped masses of spinifex are sometimes used. These "sausages" are placed at right angles across small creeks and rolled from the deep to the shallow part of the stream, the fish being then easily caught.

Fish are also caught with hook and line, but perhaps the easiest method is to throw the bark of the yakka tree into the waterholes. The fish, sick, float to the surface and are easily obtained.

Honey is very much relished by the blackfellow, who will go to much trouble to obtain it. A bee hive is located by sticking a piece of fluff to a captured bee, liberating it and following it to the hive, or by listening outside a tree where a hive is known to be. Some experienced natives can find a hive by scent. Trees often have to be climbed to obtain honey. This is done with a tough vine about sixteen to eighteen feet long. If the trunk is smooth toe holds are cut. The honey-ant is also regarded as a delicacy, and the lubras will often spend half a day digging to obtain only a few ants.

The aboriginal uses for food nearly every animal, large or small, even caterpillars, grasshoppers, termites and other insects. Snakes and lizards are also on the bill of fare. Many of the vegetable foods, such as cycads, grass seeds, yams, and water-lilies, take a lot of trouble to

collect and prepare. Some of them are very bitter and even poisonous, but after treatment by the lubras they form nourishing foods.

When the blackfellow has time his cooking is elaborate and effective. The ovens are holes in the ground, three feet in diameter and eighteen inches deep. Any lumps of clay found while digging the oven are kept. The hole is swept out and filled with firewood, upon which the lumps of clay are placed; these lumps are about the size of cricket balls. The wood is lit and allowed to burn away, and the red-hot clay removed with two sticks handled like tongs. The ashes are swept out and the bottom and sides of the oven covered with a thin layer of moist grass. The skinned animals are packed on the grass and then covered with more grass. The hot clay is put on top of this, and is in turn covered with earth. Ashes are never used because they are too fine and would get to the food. The meat is cooked before the clay and bottom of the oven get cold. The same hole is used for cooking as long as the camp remains, but fresh clay has to be used.

Another method is paper-bag cookery. The fish or game is sewn up in dampened paper-bark, buried in the ashes, and a blaze made. In three-quarters to one and a half hours the fire is reduced to embers and raked away. The bark is removed, and the skin, feathers or fur peel off, and the intestines are shrivelled up, but the flesh is very tasty and juicy.

Well worked clay is sometimes used instead of paper-bark, but these methods take time, and after a fast of a day or two the blackfellow throws his prey on the fire and eats it half raw and without ceremony.

If game is plentiful, one full day's hunting in every three is usually sufficient. When he is not hunting the blackfellow spends his time making weapons, tools, string, etc., having a "play about", lazing in the sun or making drawings.

The children have toys, such as miniature weapons and peg tops, spun by rubbing with the palms of the hands. The girls have primitive dolls.

Simple and complicated "cat's cradles" delight both young and old. In Queensland the aborigines are very adept in making string patterns. Dr. W. E. Roth has published nearly eighty string figures from North Queensland. These show a wide range of subjects and great ingenuity. They represent plainly such things as a lizard running up a tree or a scrub fowl scraping an opening in its nest mound in which two eggs are shown.

If the moon is full a corroboree will probably be held at night, just dancing and singing, not an important ceremony like initiation to manhood or food production so often wrongly called corroborees. Accompanied by clashing boomerangs and a droning didgerydoo or wooden trumpet (North Australia), the actors dance and mimic until exhausted.

In conclusion, it can be said that the daily life of the Australian aborigines is mainly concerned with obtaining food. They have developed an amazing technique in this respect, and are wonderfully adapted to their wild life.

The Origin of Australian Mammals

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

IT is a well-known fact that each large division of the globe is characterized by its own peculiar assemblage of animals. In Africa, for example, we find the giraffe, antelope, and zebra; in South America the sloth, armadillo, and tapir; in Australia the wombat, kangaroo, and platypus. And each region is marked also by the absence of certain forms which are common elsewhere. Thus there are no true crows in South America, no bears in tropical and southern Africa, no woodpeckers in Australia. So accustomed are we to the general facts of animal distribution that we are apt to forget that there is no aspect of nature which is not explicable in a rational manner did we but know all the facts.

There are many curious problems encountered by the student of animal distribution, and Australia offers some striking features which have not yet been fully elucidated.

It was at one time considered that climate and plant life were the determining factors in the distribution of animals, but that this is not the case is proved at once by the observation that two regions with similar climate, soil, and vegetation, yet differ conspicuously in their animal population; we need only instance parts of South Africa and Australia, or New Zealand and parts of Europe. It is obvious that other factors have to be taken into account, and this article is devoted to a brief consideration of the problem presented by the mammalian fauna of Australia and the neighbouring islands.

At the outset we must remember that by an exceedingly slow process of development or transmutation, all animals now living have been evolved from others which preceded them in past geological periods. Therefore, in any discussion of animal distribution we must take account not merely of the present-day distribution of any particular group of animals, but also inquire into its past history and its migrations as indicated by its occurrence in fossil form.

For purposes of reference the accompanying table of geological periods has been included to show some critical stages in the appearance of mammals on the earth.

AUSTRALIAN MAMMALS.

The mammalian fauna of Australia is very distinctive. Thus in no other part of the world do we find monotremes, represented by the platypus and the Native Porcupine, usually known as the Echidna. These are true mammals, with a hairy covering, and, as in all mammals, the young are nourished on milk secreted by the mother; but in their structure they exhibit certain characters reminiscent of the reptiles, and, like reptiles, they lay eggs. The predominant Australian mammals are the marsupials, in which the young are born in an immature and helpless condition after a very short gestation. It is true that the marsupials are still sparsely represented in America, but in Australia the order is wonderfully developed and exceedingly diversified, forming eight families. Of the higher (placental) mammals, which in other parts of the world are the dominant types, Australia possesses very few other than those which have been introduced by the white man; leaving aquatic and flying mammals out of account, there is only one family of rodents, the Muridæ (rats and mice), and the dingo, which was probably brought from Asia by the aborigines.

Approximate Age in Millions of Years.	Group.	System.	Mammals.
	Quaternary.	Holocene (recent).	Marsupials, North and South America, Australia. Monotremes, Australia.
		Pleistocene.	Marsupials, North and South America, Australia. Monotremes, Australia.
1	Cainozoic or Tertiary.	Pliocene.	Marsupials, South America. Oldest Australian marsupial (*Wynyardia*). ? Oldest monotreme, Australia.
		Miocene.	Marsupials, Europe, South America.
		Oligocene.	Marsupials, Europe, North and South America.
		Eocene.	Marsupials, Europe, North and South America.
60	Mesozoic or Secondary.	Upper Cretaceous.	Oldest marsupials, North America and (?) South America. Oldest placentals, Mongolia.
120		Lower Cretaceous.	? Ancestral marsupials.
		Jurassic.	Primitive mammals, England, North America, East Africa.
180		Triassic.	Oldest mammals, England, Germany, South Africa.

THE MONOTREMES.*

These are primitive in many ways, yet they have become well adapted for their special modes of life, and, as the two families display considerable divergences, it is clear that they have a long evolutionary history. Yet their fossil remains, so far as known, are of comparatively recent age, and the extinct forms show little difference from the existing platypus or echidna, as the case may be. They have never been found fossil elsewhere than in the Australian Pleistocene (or possibly Pliocene as well), and they have no close relatives anywhere, either living or fossil. At one time it was thought that they had affinities with an extinct order of mammals called the Multituberculata, but close comparison proves that the skull and skeleton of the multituberculates are radically different from those of the monotremes. The Multituberculata were an important order in the Mesozoic, and survived into the Eocene, but they became extinct without leaving any recognizable descendants. It is possible, however, that the monotremes and multituberculates had a common ancestry at an earlier period from some mammal-like reptile.

The question arises whether the monotremes originated in Australia or migrated hither from some other region. It is impossible at present to give a satisfactory answer to this question; but the fact that no remains of mammal-like reptiles, though known from other parts of the world, especially South Africa, have been discovered in Australia, would indicate that in the remote past stragglers found their way into Australia and formed the stock from which the mono-

* Troughton: AUSTR. MUS. MAG., iv, 10, 1932, pp. 327-334.

tremes have been derived. We have no data as to the time when entry took place, but assuredly it was at a very early period, and there is a general consensus of opinion that they came in from the north.

MARSUPIALS.

The case of the marsupials is somewhat different, as they are not confined to Australia, and we know something of their past history. Living American marsupials belong to two families, the Didelphiidæ (opossums*), which are found both in North and South America, but chiefly in the South, and the Cœnolestidæ, which have a restricted distribution in South America. Neither family is closely related to Australian marsupials, but it is generally held that the didelphoids are the stem form from which all living marsupials are descended.

Marsupials, then, furnish an example of widely discontinuous distribution, for the two regions in which they are now found are separated by leagues of ocean and land. Yet we must assume a common origin for all of them, and must therefore seek for some means of migration between the two centres where they are now found.

Groups of animals with discontinuous distribution are usually of great antiquity, for vast periods of time are necessary for their migration. And we should expect that after long separation and sojourn in different environments the characteristic forms of the different centres would show striking differences, while retaining the basic plan of anatomical structure. Thus the Australian marsupials have deviated considerably from the primitive didelphoid type, while the American survivors have retained the ancient pattern to a remarkable degree. In Australia, where the marsupials had a more or less free field and varying kinds of environment, they have produced many diverse forms; thus we have running and hopping types, burrowers, gliders, and tree climbers; we have grass eaters, leaf eaters, insectivorous form and carnivores, all probably evolved from forms with an originally insectivorous habit.

GEOLOGICAL HISTORY.

When we turn to the geological record of the marsupials, we find some interesting facts. The oldest known marsupial is *Eodelphis,* discovered some years ago in the Upper Cretaceous of Alberta, Canada, and in the Upper Cretaceous of North America other undoubted marsupials, varied in size and character, have been found. They are remarkably like the living opossum, and might even be placed in the same family. A didelphid which may be of Cretaceous age has also been recorded from South America.

But the Upper Cretaceous marsupials are not the oldest known mammals, nor, in all probability, are they the earliest marsupials. They already exhibit a considerable degree of divergence, and indeed show more variety than do recent opossums. The earliest fossil mammals date from the late Triassic, and have been found in England, Germany, and South Africa; their affinities are obscure, though they may be multituberculates.

It is probable that marsupials arose in the Lower Cretaceous, evolving from still older Jurassic ancestors which were not definitely marsupials. Their subsequent geological history, so far as known, may be briefly summarized. In the Eocene, immediately following the Cretaceous, fossil marsupials have been found in Europe, North America and South America. European marsupials survived into the Miocene, but in North America no fossil marsupials have been found in the Miocene and Pliocene. In South America the record is complete from the Eocene to the present time, and in the Miocene particularly there was an extensive radiation of the marsupial fauna.

The first discovery of a marsupial in Australia is from the Pliocene of Table Cape, Tasmania, consisting of parts of the skeleton of *Wynyardia,* a somewhat primitive but undoubted member of the phalanger family.

* The so-called Australian opossums are really phalangers.

MIGRATION OF MARSUPIALS.

From this record one might be led to conclude that marsupials originated in the American Cretaceous and spread thence to colonize the world, including Australia. But there are many gaps in the record, and we cannot be certain whether these indicate that the animals never occupied a particular area, or whether their fossil remains have so far escaped detection. Their total absence from Asia is very significant, especially as primitive placentals (insectivores) have been described from the Upper Cretaceous of Mongolia, showing that the earliest placental mammals were practically contemporaneous with the earliest marsupials. Yet it is not impossible that the cradle of the marsupials was in some region where to date no actual evidence in the shape of fossils is forthcoming. It is extremely unlikely that they originated in Australia.

When we inquire into the route by which the marsupials found their way into Australia, we find authorities divided in opinion. Australia has long been separated from the other continents, but assuredly this was not always the case, for there are many land and freshwater Australian animals, not to speak of plants, for which a land connection with other parts of the earth must be postulated. It is probable that Australia has been an isolated land mass since the early Tertiary, otherwise its fauna would be very different from what it actually is. But when and how did the marsupials in particular find their way into Australia?

On the north, Australia is separated from Asia by the Indo-Malayan seas, which, however, contain many islands, large and small, of which some, such as Celebes, the Molluccas, Waigou, and others, contain phalangers, evidently recent immigrants from New Guinea and Australia, and other animals of Australian type. It requires no great stretch of imagination to suppose that in the long interval of time which has intervened since the Lower Cretaceous period, narrow land bridges may have existed connecting islands now separated by deep channels, furnishing the means by which marsupials could reach Australia by a series of advances, spread perhaps over millions of years.

One serious objection to this view is that no marsupial fossils have been found in Asia or Malaya, and it is also difficult to account for the fact that no placental mammals were able to make the crossing, although, as mentioned above, these are just as old as the marsupials. We have, therefore, to make two assumptions, namely, that marsupials did formerly exist in Eastern Asia, although so far no evidence of this has been found, and, secondly, that the marsupials had some means of making the passage which was not available to placentals.

Another view, which was very ably supported by the late Professor Launcelot Harrison, was that the marsupials and many other elements of the Australian fauna came from South America, over the Antarctic continent, at a time when that enjoyed a much more genial climate than it does at present. This opinion is based on the undoubted resemblances to one another shown by the fauna and flora of South America and Australia; this community is shown, apart from the marsupials, by the tree frogs (Hylidæ), freshwater crayfishes, certain turtles, and other groups.

Those who argue for a northern origin of the marsupials and other forms of life now characteristic of southern lands, account for the similarities exhibited by the plants and animals of these southern lands by the principle so strongly urged by the late Dr. W. D. Matthew. This, briefly, is as follows. Animals migrate from their place of origin in successive waves, each wave consisting of forms higher than those composing the preceding wave. Thus the most advanced types are to be found nearest the centre of dispersal, the more primitive farthest from it. On this hypothesis, and assuming that the northern hemisphere was the original home of the marsupials and other forms of life, which were succeeded by higher types better equipped for the

struggle for existence, we should expect to find in the southern "dead ends" an assemblage of the more primitive forms. These would naturally show certain affinities to one another due to their common ancestry, even if they are now separated by intervening oceans.

CONCLUSION.

It will be observed that the question of the migration route of the Australian marsupials is still an open one, and until their past history is better known no finality is possible. It is to be hoped that marsupial fossils of Early Tertiary or even Cretaceous age may yet be found in Australia; such a discovery would be hailed as one of the most sensational palæontological events of our generation.

It is significant that no one worries over the means by which the indigenous rats and mice were enabled to enter Australia. That happened a long time ago, for they have since developed characteristic features which distinguish them sharply from old-world forms, and their bones are found in cave deposits along with those of extinct marsupials. It is certain that they entered since Australia became isolated, and it is generally assumed that they made the crossing on floating logs or vegetation, or by other precarious means; it is in this manner that oceanic islands receive their rat population. Is it not possible that the earliest Australian marsupials, which were probably small mouse-like creatures, made their entry similarly, and that an actual land connection was not necessary?

REFERENCES.

For much of the information given above I am indebted to the following works, which should be consulted by anyone who wishes to pursue this subject further.

Bensley, B.A.: "On the Evolution of the Australian Marsupialia", *Trans. Linn. Soc. Lond.* (Zoology), ix, 3, 1903, pp. 83-217.

Harrison, L.: "The Migration Route of the Australian Marsupial Fauna", *Australian Zoologist*, iii, 1924, pp. 247-263.

———: "The Composition and Origins of the Australian Fauna, with Special Reference to the Wegener Hypothesis", *Rept. Austr. Assoc. Adv. Sci*, xviii, 1926, pp. 332-396.

Matthew, W. D.: "Climate and Evolution", *Ann. N.Y. Acad. Sci.*, xxiv, 1915, pp. 171-318.

Raven, H. C.: "Wallace's Line and the Distribution of Indo-Australian Mammals', *Bull. Amer. Mus. Nat. Hist.*, lxviii, 1935, pp. 177-293.

Simpson, G. G.: "Post-Mesozoic Marsupials", "Fossilium Catalogus (Animalia)", Part 47, 1930.

———: "The First Mammals", *Quart. Review of Biology*, x, 2, 1935, pp. 154-180.

Wood Jones, F.: "The Mammals of South Australia", British Science Guild (South Australian Branch), Part i, pp. 20-28. Adelaide Government Printer, 1923.

VICTORIAN SEA SHELLS: A Handbook for Collectors and Students. By Charles J. Gabriel, with numerous illustrations by Joyce K. Allan. (Field Naturalists' Club of Victoria, Melbourne.) 8vo., 67 pp., 5 plates and 1 in colour, and many figures. Price: 1s. 6d.

This publication, the second of a series of handbooks designed to encourage an interest in the fauna and flora of Victoria, is an excellent guide and worthily fulfils the object prompting its publication. The letterpress is concise, and the illustrations are good. Those responsible for the brochure are well-known authorities upon this subject. Mr. Gabriel, the author, is the honorary conchologist at the National Museum, Melbourne, and in a lifetime's work has done much to advance his science. The same may be said for Miss Allan, whose fine illustrations embellish the brochure under notice as they have enriched her own researches. The publication is completed with a dictionary of terms and illustrations defining them.

The publication cannot but be of assistance to the tyro, whether adult or juvenile.

By Sea and Mountain: With Orchid Hunters in the Mullumbimby District

By A. MUSGRAVE, F.R.E.S.*

DURING August an invitation was extended to Mr. E. Le G. Troughton and myself to accompany a party of orchid-hunters to the Mullumbimby district on the North Coast of New South Wales, for which preliminary arrangements had been made by Mr. F. Fordham (schoolmaster at Brunswick Heads) for the organizers, Mrs. C. A. Messmer and the Rev. H. M. R. Rupp. The district having been somewhat neglected by collectors in the past, we looked forward to reaping a rich harvest, but had reckoned without a knowledge of the unusual seasonal conditions reigning at the time.

The headquarters of the orchid-hunters were established at Brunswick Heads, a township at the entrance to the Brunswick River, which flows into Byron Bay, the town of Byron Bay lying some ten miles to the south-east.

* Photographs by the author.

At first opportunity a reconnaissance of the neighbourhood was made under the guidance of Mr. Fordham. Not far from Brunswick Heads a grassy hill, "Devine's" Hill, affords a fine panorama of mountain and sea-coast, including the long sweep of Byron Bay, indented at Brunswick Heads, the little township, the three-branched Brunswick River, the mountains near the Queensland border, Mt. Warning, and the ranges extending down the coast.

Out at sea whales were rising and ever and anon sending up fountains of spray. At our feet was the middle branch of the Brunswick River bordered here on its northern shore by mangroves, with a patch of brush, a remnant of the jungle for which the North Coast district of New South Wales was once famous, the Hoop Pines standing out among the surrounding trees. This district has long been settled, and the scrubs have disappeared to make way for cattle pastures.

Brunswick River from the northern headland at Brunswick Heads, looking towards Mt. Chincogan and Mullumbimby Peaks.

The northern headland of the entrance to the Brunswick River is rocky; the southern side, on the other hand, consists of a sandy vegetated bank rising only a few feet above high water mark. The southern arm of the Brunswick River flows between it and the town of Brunswick Heads. In order to get to the surfing beaches adjacent to the heads it is necessary at present to procure a boat to cross the narrow channels or to wade at low tide. The northern arm of the river sweeps round past the more elevated northern headland and Harry's Hill and keeps parallel with the coast for some distance; the middle arm joins the northern and southern arms at Brunswick Heads and continues on past Mullumbimby, where tidal influence is still felt. It rises in the mountains. Looking from this northern headland, we could see Mt. Chincogan and the Mullumbimby Peaks rising up above the flatter country bordering the sea.

COLLECTING AT BRUNSWICK HEADS.

A few days were spent by Mr. Troughton and myself in collecting at Brunswick Heads. The rock pools on the northern headland were combed by Troughton and Mr. Fordham for marine life, and representatives of most of the animals to be met with were secured for the Museum. The rocks here extended reef-like in a north-easterly direction, their seaward faces for the most part encrusted with the white tubes of Galeolariid worms like those on the sandstone rocks in Port Jackson. The marine life here, doubtless owing to the exposed situation, did not impress one as being as prolific as that of Sydney Harbour and the rock pools of the nearby coast.

On the sandy hills bordering the sea the Pandanus or Screw Pine was in evidence, and beyond the beach plants was a small zone of jungle-like forest, which, despite the fact that the season was not advanced, yielded some interesting animals. A few butterflies flitted along the forest glades, but as the blazing heat of the summer was yet four months away, we could not expect to encounter many of those lovers of heat and light. Under logs we found the curious arachnids called harvestmen, as well as carab beetles and the flattened slaters and flea-like isopod crustaceans, the warmth and moisture of such situations being eagerly sought for by many of the smaller fry of the jungle.

At low water the Brunswick River near the heads consists of a series of sand flats, along whose channels the "flatties" and launches lie stranded. At present, as previously pointed out, communication with the beaches at high tide can be made only by means of a boat; but a bridge to span the southern arm of the river is in course of construction, and residents will be saved the labour of hauling their boats which have been caught by the ebbing tide over the flats to deep water. Fishing naturally occupies the attention of this small town, the population of which, as is the case with many of these northern coastal towns, is considerably increased during the summer months by visitors from the north-western plains. Forsaking the burning plains for the cool breezes of the Pacific, they make their camps among the banksias and occupy their time in surfing and fishing. A map issued by the local authorities shows the best places for catching such edible fish as bream, whiting, flathead, jew, tailer and blackfish.

One pleasant day was spent in company with the orchid-hunters in the bush near the middle arm of the Brunswick River. With Mr. Fordham as guide, we sampled quite a variety of country, from Paper-bark (*Melaleuca*) and She-oak (*Casuarina*) swamps to the patch of jungle near "Devine's" Hill. Some interesting orchids were secured by the botanists, those growing on the trunks of the Casuarinas calling for a display of agility from the younger members of the party, the services of two of Mr. Fordham's pupils being in great demand. Among those secured were the charming Lily of the Valley Orchid (*Dendrobium monophyllum*) and the Tangle Orchid (*Cleinostoma tridentatum*), with a sweet scent, both occurring on the Swamp Oaks.

In the valley of Cooper's Creek, Huonbrook. Showing the densely-wooded slopes of the Nightcap Range, and clearings for banana plantations.

An insignificant little orchid, rejoicing in the scientific name of *Tæniophyllum muelleri*, was also secured. Here, too, we met with the Climbing Bamboo (*Bambusa*), which ascends to the summit of trees and sends down loops or festoons towards the ground.

A mangrove swamp near the Brunswick River was crossed to gain the bank of the river, and, by the aid of Mr. Fordham's flat-bottomed boat, the party was ferried across the river. The mangrove swamp consisted of two species of mangroves, which also occur in the vicinity of Sydney, namely, the Grey Mangrove (*Avicennia officinalis*) and the Black or River Mangrove (*Egiceras majus*), which have already been dealt with by me in this magazine. The specimens of the Grey Mangrove, which we found as inliers (that is to say, at the back of the swamp), were the finest specimens I have seen.

IN THE MOUNTAINS AT HUONBROOK.

As Brunswick Heads proved somewhat unprofitable from a zoological point of view, we determined to try our luck further afield, and, through Mr. Fordham's efforts, were able to get accommodation at Huonbrook in the upper reaches of Cooper's Creek. This spot is some twelve miles from Mullumbimby, and the cars that took us out traversed a winding road to the hills. A few miles from Mullumbimby we came to the valley of Wilson's Creek, and found the banks of the stream white with the flowers of a weed which is everywhere abundant.

Crossing a divide, we came to the valley of Cooper's Creek, its southern boundary the Nightcap Range. The country here is rapidly being denuded of its vegetation, and on our way out to the valley we saw evidence enough of the way the scrubs are disappearing. Formerly these valleys supported dairy cattle, but since it has been discovered that the banana will grow on the rocky hillsides which formerly were not considered worth clearing, and since bunchy top can now be controlled, the scrubs are being felled. Burning off goes on continuously, and on the day of our arrival and for the week which followed the valley was rarely free from the funeral pyres of the remains of the old scrubs. Not all of these fine forests are doomed, however, as the Government has set aside some 30,340 acres on the Nightcap Range, to be called the Nightcap National Forest, which was to be dedicated and declared open by the Minister for Forests (Hon. R. S. Vincent, M.L.A.) on 3 October, 1936.

The goal of the party and the head of vehicular traffic was the sawmill at the foot of Mt. Jerusalem on Cooper's Creek, where, under the branches of a Blue Fig (*Elæocarpus grandis*), the orchid-hunters and ourselves forgathered for lunch. We were fortunate in having with us for the first day the little band upon whose fund of botanical knowledge we were

permitted to draw. Mr. Cyril White (Government Botanist of Queensland) was a member of the party, and he was able to identify for me the most outstanding examples of the brush flora.

Our first excursion was up the steep slopes of "Jerusalem", which rocky-crowned peak overlooks the fertile valley of the Tweed River. That day we did not ascend higher than the tick fence, about half-way up the mountain. The track up the mountain side was along a log slide, and, after passing through cleared grazing land, we came eventually to the "brush", as the jungle is here termed.

At the edge of the brush there were some interesting trees, such as the Beef Nut (*Hicksbeachia pinnatifolia*), the magnificent Flooded Gum (*Eucalyptus grandis*), and the Brush Box (*Tristania conferta*). In the brush many orchids were in flower on the tree-trunks, while we noted Elk Stag-horn, and Bird's Nest Ferns, some of these latter showing the effects of the drought.

Conspicuous among the trees was the Fig (*Ficus watkinsiana*), its trunk buttressed at the base and extending lattice-like to the heavy crown of verdure. Here and there were Bangalow Palms (*Archontophœnix cunninghamii*), their graceful stems and symmetrically arranged foliage forming a contrast to the other types of vegetation, with their less regularly arranged foliage. A species of climbing palm which forced itself upon our notice was the Lawyer Cane (*Calamus muelleri*), forming almost impenetrable thickets in places. Its spiny stem and leaves would seem to be protection enough, but springing from the leaf-sheath is "a long slender thong-like prickly pedunculated rachis", as Moore's *Handbook to the Flora of New South Wales* describes it. This slender filament has the pleasant habit of attaching its recurved prickles firmly to one's clothing, or even to the skin on the back of one's neck or hands, and dislodgment can be effected only by stopping and removing the offending "tendril" by taking it in a contrary direction, or by using a knife or secateurs and snipping the slender barbed shafts. Some of our botanical friends carry as part of their equipment the last-named implement, and so are in a better position to cope with this plant than their zoological associates.

Mt. Jerusalem, whose summit overlooks the fertile valley of the Tweed on its northern and western aspects. It forms a boundary to Cooper's Creek.

ASCENT OF MT. JERUSALEM.

The crowning achievement of our trip, or perhaps one of the bright spots, was our ascent of "Jerusalem" under the guidance of Mr. Alan Gibson. One morning we set off for the summit, passing over the old familiar ground of a few days previously, and, after battling through lawyer vines, at length emerged from the Austro-Malayan jungle to find ourselves suddenly among the grass-trees and eucalypts of the real Australia.

At an elevation of about 2,200 feet we had lunch in the shadow of the cliff which extends for a few hundred yards along the base of the rocky crown of the mountain. About 100 feet still remained to be conquered, which could have been ascended in comparative ease had we chosen to travel along the cliff face for some little distance to where a gradual ascent is possible. Instead, we climbed the almost vertical face of rock until the little plateau was reached. The cliffs here supported numerous flowering examples of two kinds of orchids, the Pink Rock Lily (*Dendrobium kingianum*) and the Scented Sun Orchid (*Thelymitra aristata*), and it was regretted that the botanists were not there to share our good fortune.

From the summit we gazed into the Tweed River Valley, which, with the wind from the right quarter, would have rewarded us with fine panoramas, but, owing to so much burning off, we were doomed to look into a smoky Gehenna. In the valley at our feet lay Doughboy Rock, an isolated pinnacle; away on the right, barely visible through the smoky mirk, was Mount Warning, while at the left loomed the Nightcap Range, its lower slopes a patchwork of banana plantations, lit here and there with some of the fires whose smoke obscured the densely wooded upper slopes. After securing photos, we made our descent from the mountain, striking a dry creek and following it down until it junctioned with a pleasant little stream, where we relieved our thirst.

COLLECTING AT HUONBROOK.

The following days were spent in general collecting and looking for suitable locations for setting the traps for mammals. On the slopes of the Nightcap Range above the house in which we stayed, in a pocket on a spur leading to Cooper's Creek, was a banana plantation which suggested a likely place for rodents. After obtaining permission from the owner to set traps in or about the plantation during the evening, we decided to spend the remainder of the day collecting along a new logging track leading to the sawmill. This rocky road through rich soil proved the best part of the valley so far encountered, while our labours were greatly assisted by a team of bullocks whose work in dragging logs and rocks to the side of the road enabled us to get many specimens which would otherwise have escaped notice. The removal of these large logs and rocks exposed to view all sorts of curiosities, amongst which were land shells so large that even one unversed in conchology could scarcely fail to be attracted to them. These, on being taken back to the Museum, were identified by Mr. T. Iredale. The largest of all was the Australian Native Snail

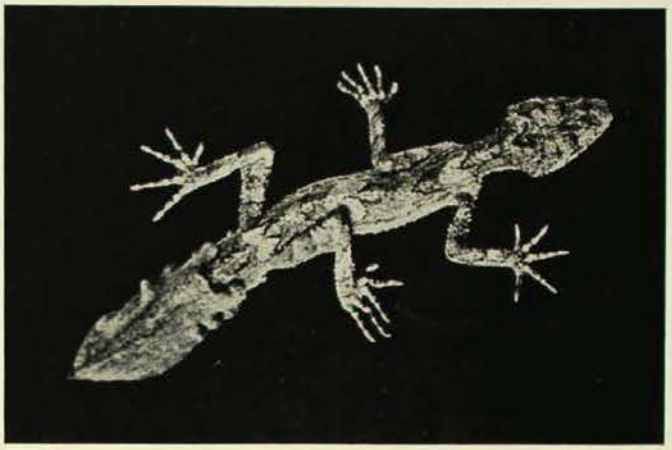
Land shells from Huonbrook; a dainty dish for a Noisy Pitta. The two large shells at the back are Hedleyella falconeri, the one on the left is Thersites richmondiana, that on the right, Pedinogyra cunninghami.

(*Hedleyella falconeri*), not unlike a colossal example of the introduced garden snail. A curious dorso-ventrally flattened shell was *Pedinogyra cunninghami*, while a conical-shaped shell with a pronounced keel was *Thersites richmondiana*. Another species of the same genus, *Thersites fraseri*, is a Queenslander extending its range southwards, while the first-named three, according to Iredale, have their area of distribution from the Hunter River to the Brisbane district.

One of the men engaged in clearing the track found a Leaf-tail Lizard, also known as a Wood Adder or Wood Gecko (*Gymnodactylus sphyurus*), a northern species occurring in southern Queensland and coastal areas of northern New South Wales. Two small snakes secured under logs were also identified by Mr. J. R. Kinghorn. One which we thought was the common Black Snake (*Pseudechis porphyriacus*), owing to its having reddish-coloured scales on its belly, was shown by him to be a specimen of *Denisonia nigrescens*, a species which does not possess a vernacular name. The former known maximum length was about twenty-four inches, but our specimen was twenty-seven inches, thus constituting a new record in size. An allied species, the Black-bellied Snake (*Denisonia signata*), which grows only to about thirty inches, was also captured, but this specimen was not a record breaker.

Some logs which lay near the sawmill deeply embedded in mud were rolled over by our friends of the mill with crowbars; here were exposed families of frogs, one species, *Adelotus brevis*, a dark brown spotted animal, being particularly plentiful.

Birds were not collected by us, but while we were in residence at Brunswick Heads, upon examining his traps one morning, Troughton found to his dismay that he had caught a beautiful specimen of the Noisy Pitta (*Pitta versicolor*), a species occurring in eastern Queensland and coming as far south as northern New South Wales. This third is, as its specific name of *versicolor* suggests, brilliantly plumaged, blue, red, green, yellow, and brown forming its colour pattern. It is known to feed on snails, certain stones in the scrub being utilized as blocks upon which to smash the shells. It was probably on a quest for snails when it was caught.



Leaf-tail Lizard or Wood Adder, Gymnodactylus sphyurus.

From a series of twenty-four traps which Troughton set out daily it was found that the valley supported a remarkably large rat population. This unfortunately interfered with the collecting of the marsupial mice which one would expect to find in such an environment. However, a fine series of the Brush Rat (*Rattus assimilis*) was secured which will be of interest as coming from an intermediate locality, the species ranging from the Murray to as far north as the Atherton Tableland in North Queensland. The little Pademelon Wallaby (*Thylogale thetis*) was common in the mountain scrub, together with a larger Brush Wallaby, but much difficulty was experienced in obtaining them, as a pair of beagles in the locality were noted for their industry in hunting the wallabies, though their efforts were never crowned with success. Water Rats occur along the banks of the streams, but the ubiquitous introduced rat (*Rattus rattus*), or the ordinary house mouse, both of which are equally at home in the bush, usually forestalled them in visiting the traps. The prolific rat population of this area and the difficulty of securing small marsupials

would suggest that their prevalence may be seriously affecting the native fauna as well as the interests of man.*

INSECTS.

The dryness of the brush had its effect on the insect life, which was scarce even for so early a time of the year. Log-rolling again proved the most profitable means of collecting, most numerous being the black Passalid beetle (*Mastochilus australasicus*), sluggish creatures for the most part, creeping away to some crevice when their roof and home is suddenly removed, exposing them to the light.

In the same situation we came across various species of the family Tenebrionidæ (Ground Beetles), one we secured being later submitted to Mr. H. J. Carter, well known specialist in the group. This he identified as *Coripera wilsoni*, a species described by him only last year from a specimen taken at Eukey, South Queensland. Our single specimen of this species, the second in existence, thus extends the range of the insect. Another interesting member of the same family is the Iron-bark Beetle (*Zopherosis georgii*), a beetle measuring about an inch or so in length and black in colour. It occurs in Queensland and New South Wales, and is chiefly remarkable for the fact that it is impossible to drive an entomological pin through it without turning the point.

On the Bleeding Heart (*Homalanthus populifolius*) were collected specimens of a plant bug, *Hyrmine dispar*. This typical Pentatomid bug measures about half an inch in length, is black in colour, with a yellowish patch on the underside of the abdomen.

CONCLUSION.

The early season and exceptional dryness were not conducive to success in collecting a representative series of animals of the locality; but we brought away with us much interesting material and memories of a beautiful spot—a valley about which one could wax lyrical and wish for a poet's pen to describe its charms.

To those dwellers in the valley who did so much to make our stay both interesting and enjoyable, particularly Mr. and Mrs. N. Maclean and Mr. Alan Gibson, we are deeply grateful. Likewise to those who dwell within sound of the surf at Brunswick Heads, especially the Fordham family and several of Mr. Fordham's nature-loving pupils, who proved so helpful to the entire party, we express our warmest thanks for pleasant memories.

* See "Rat Problem of the Cane-fields", AUSTR. MUS. MAG., 1935, v, 395.

Recent visitors to the Museum include Dr. John Mauritzon, University of Lund, Sweden, who is collecting Australian plants, shells, and fishes; Dr. Allan Mozley, of London, who is interested particularly in land shells and limnology; Dr. Folke Linder, Uppsala, Sweden, who is making a study of freshwater Crustacea; Miss L. E. Cheesman, on her return from New Guinea; Mr. John W. Hope, formerly preparator in the American Museum of Natural History, New York; Mr. H. D. Skinner, Otago University Museum, New Zealand; Mr. D. A. Casey, Honorary Archæologist, National Museum, Melbourne; Mr. N. B. Tindale, Ethnologist to the South Australian Museum, Adelaide.