JUNE 15, 1957

The AUSTRALIAN MUSEUM MAGAZINE

VOL. XII, No. 6 Price—TWO SHILLINGS

Captain Cook's "Kangooroo". (See Article, Page 186).

Registered at the General Post Office, Sydney, for transmission as a periodical

THE AUSTRALIAN MUSEUM

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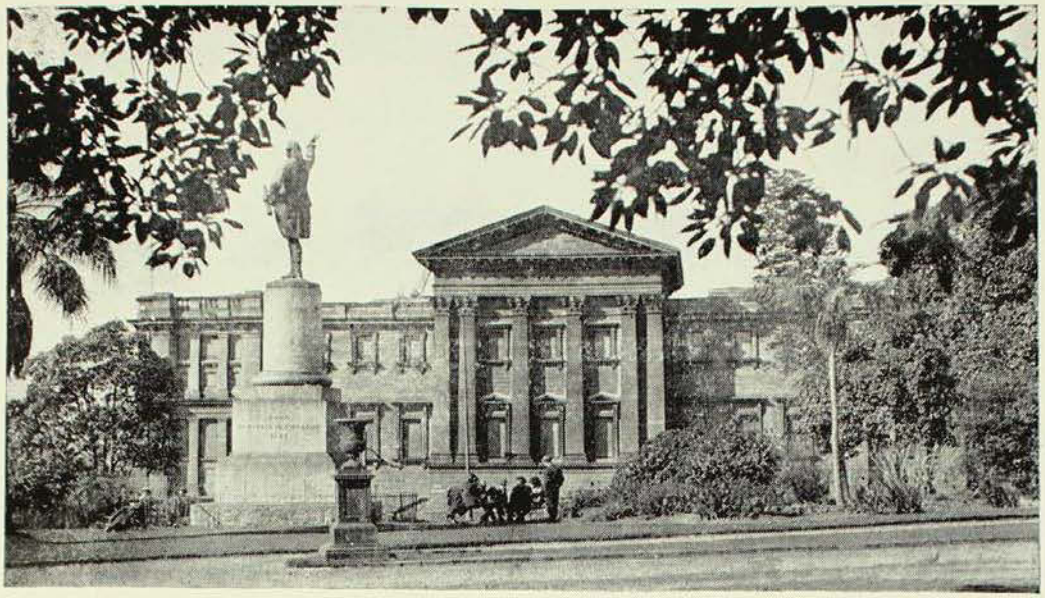

THE AUSTRALIAN MUSEUM MAGAZINE

(Photography, unless otherwise stated, is by Howard Hughes, A.R.P.S.)

OUR FRONT COVER.—Captain Cook's "Kangooroo" (*Wallabia cangaru*) now regarded as identical with the Cape York race of the Whiptail or Prettyface Wallaby. The illustration from Vol. III of *Cook's Voyages* (1773) represents the first and smallest of the "kangooroos" captured and described at Cooktown in July, 1770, when the *Endeavour* was beached for overhaul. Described as about the size of a greyhound, and weighing only 38 lb., the drawing by the naturalist Parkinson depicts the slender shoulders, tapered muzzle, relatively large ears, and whip-like pliable tail which distinguish this wallaby from the Great Grey and other large kangaroos.

Vol. XII, No. 6 JUNE 15, 1957

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

Editor: J. W. Evans, Sc.D. Annual Subscription, Post Free, 9/-

VOLUME XII, NUMBER 6 JUNE 15, 1957

Pioneering in Conchology

By J. HOPE MACPHERSON

Curator of Molluscs, National Museum of Victoria

EVERY so often the vastness of the molluscan fauna of Australia seems to rise up before me like a tidal wave, and all I can think about are the genera that need revising, the distribution that seems entirely erratic, in fact all the usual questions that trouble any zoologist in Australia. Then I think of the pioneers in any of the fields of zoology, and my own in particular, and I wonder at their courage. There are thousands of different shells living round our shores and hundreds even in a bay like Port Phillip. The sorting after a day's collecting must have been a formidable task when there was no Museum collection for reference, and when the descriptions of Australian shells were scattered in ones and twos through a host of books, many of them available only in the Public Library of each capital city.

In Victoria, because it was one of the later settled sections of the Commonwealth, very little progress was made in the study of the animal and plant inhabitants until the end of the nineteenth century. Certainly Western Port Bay figures quite largely in the account of the zoological collections made by the French explorers under Captain D'Urville of the *Astrolabe*, who visited the Bay in November, 1826. The two ship's surgeons, Quoy and Gaimard, described about 20 species and took others back to France for description by other French zoologists.

From the period of settlement until 1880 there was no publication of papers on Victorian molluscs, although the pioneers in other States did from time to time receive material from Victoria which they included in discussions of their State faunas. Thus the names of the Rev. J. Tenison Woods, of New South Wales and Tasmania, Dr. Ralph Tate, South Australia, and W. B. May, Tasmania, are familiar to Victorian workers.

One young Victorian was taking an interest in this group of animals and had been gathering and studying for some years until, in 1887, he felt competent to publish *A list of some of the Shells of the Marine Mollusca found on the Victorian Coast*. J. H. Gatliff had begun to give the conchologists of Australia the benefit of his careful and detailed studies. He was by profession a banker, first with the Bank of Victoria and later the Commercial Bank, in which he eventually held the position of Inspector. In this capacity he travelled over a considerable portion of Australia, including Port Darwin, from

whence he brought back a number of rare and interesting specimens including *Voluta gatliffi*, named in honour of him by J. B. Sowerby. As Gatliff developed his interest in the living molluses another worker was becoming absorbed in the Australian Tertiary Molluses and inevitably he also realized the need for a summary of the then available information on the living species. This was J. B. (later Dr.) Pritchard, lecturer in Paleontology and Geology at the Working Men's College. Pritchard and Gatliff combined and pooled their considerable knowledge to write a *Catalogue of the Marine Shells of Victoria*, which was published in parts in the *Proceedings of the Royal Society of Victoria* between 1897-1904. After the publication of the final part of the *Catalogue*, Dr. Pritchard lost interest in recent mollusca and Gatliff carried on alone describing new species and making additions and alterations to the *Catalogue*.

One son, Tom Gatliff, followed his father's profession, becoming a banker, but none of the family showed an all-consuming interest in his hobby, conchology. However, various members did from time to time help him in the actual collecting of material and this help is recorded in notes, such as " Frank 1909 ", appended to specimen labels. Also he acknowledged the continued help and interest of his eldest daughter by naming *Ancilla edithae* after her. In his nearly fifty years of active work Mr. Gatliff was associated with the naming of approximately 80 new species of molluses, mostly from Victorian waters.

During the 1880's and 90's the Field Naturalists' Club of Victoria was a very live body and most of Victoria's eminent professional and amateur naturalists were closely associated with its activities. Amongst the younger members, Charles Gabriel was taking an interest in the molluses, and he soon came under Mr. Gatliff's notice and received his help and guidance.

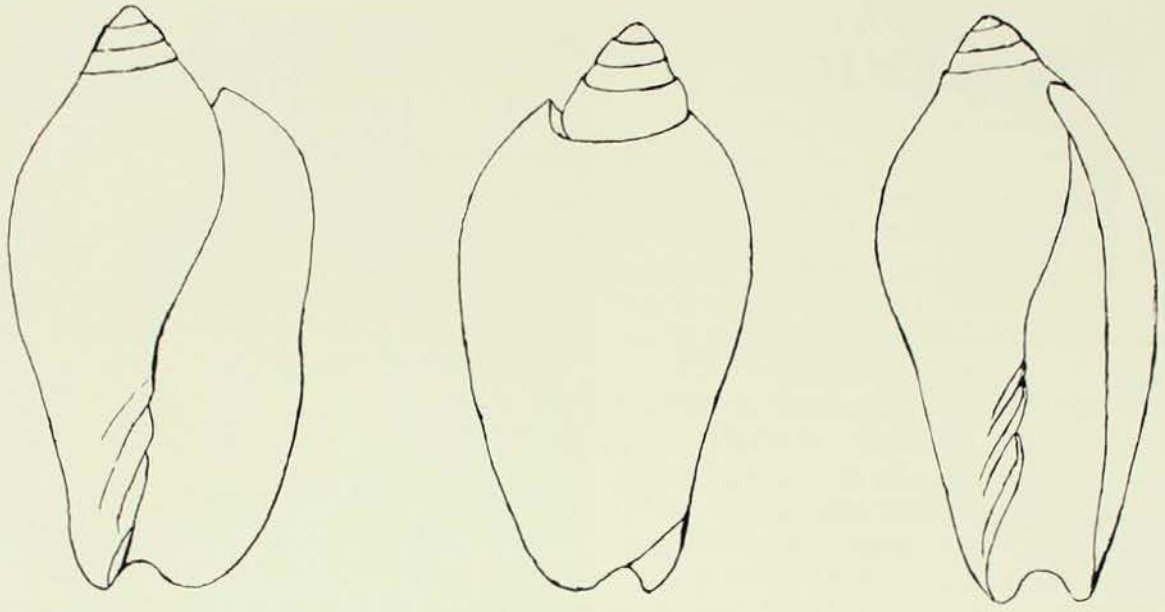
Charles Gabriel's father, Joseph Gabriel, was a pharmacist whose hobby was marine zoology, particularly Bryozoa. He encouraged his son, Charles, to follow in his foot-

J. H. Gatliff at the age of 84, in his shell room at South Yarra, Melbourne.

Photo.—Sadler.

steps (sometimes forcibly, according to Charles) persuading him to take part in naturalists' exhibitions, exhibiting the shells they had collected on their trips. Charles Gabriel is proud to tell the story of his refusal to exhibit and his father's sharp coercion, resulting in a love of the molluses which he has never lost since.

The father enjoyed spending his holidays dredging for Bryozoa and naturally young Charles was soon taking the shells of their catches for his collection. Not a good sailor he gives vivid descriptions of the dawn rising to catch the in-coming tide at Rhyll, Phillip Island, and the long uncomfortable drift across Western Port to French Island. This drift took anything up to six hours, depending on the wind and weather, and during this period they would make a number of hauls with the dredge. Then with the ebb of the tide they would return in the same way.



Voluta spenceriana Gatliff, a shining white species sparsely marked with indistinct yellowish-brown zig-zag lines. Drawn by Mary Edith, Mr. Gatliff's eldest daughter.

The two Gabriels, sometimes in the company of Mr. Gatliff, dredged many Victorian localities including Portland, Port Fairy, Western Port Bay (in great detail) and Reeve's River, Lakes Entrance. Over the years these activities produced a number of new species.

In 1908, Gabriel published his first paper, the results of activities round Stony Point, Western Port Bay. In the same year he and Gatliff published the first joint paper of a partnership that was only dissolved with the death of the senior author. As well as publishing new species they made additions and alterations to the *Catalogue* when the publications of other workers showed these to be necessary.

Gatliff and Gabriel together continued to add new species to the Victorian list and their work has been the main source of knowledge of this group in Victoria for fifty years. They were both careful and meticulous workers and in some ways were the complement of each other. Gatliff's main interest was in the building up of a collection and in the correct naming of the shells in it. Gabriel was also interested in how and where the creatures lived, and so we find in his writings that he passes on some of the information he gleaned over the years. This is particularly noticeable in *Victorian Shells*, a handbook illustrated by Joyce Allan and published by the Field Naturalists' Club, in which he was able to indulge in a greater amount of narrative than in scientific papers.

On J. H. Gatliff's death in 1935, at the age of 87, his extensive and valuable collection of over 7,000 species came to the National Museum of Victoria, where it has continued to be an invaluable source of reference to all the workers associated with this institution.

Since this time Charles Gabriel has carried on alone, and though the management of the pharmacy which he inherited and his increasing age have discouraged him from doing much dredging in latter years, he is still very active in his field and freely gives his knowledge and time to other workers.

JESSICA HOPE MACPHERSON was appointed an assistant at the National Museum of Victoria in 1938. She did a part-time course, graduating B.Sc., and later M.Sc., Melbourne. She became Curator of Molluscs in 1946 and is the author of a number of papers, mostly on mollusca.

The Coucal or Swamp-Pheasant

By K. A. HINDWOOD

SOME thirty species of Coucals, belonging to the genus *Centropus*, have been recorded from the tropical and temperate regions of the world. As a group they range from Africa through southern Asia to Australia. All are largely terrestrial and inhabit scrubby undergrowth, grasslands and marshy places. One species, the Malaysian Crow-Pheasant, about which very little has been recorded, frequents heavy forest country. The various species, for the most part, prefer more open country. The essential habitat requirement seems to be thick ground-cover with a leaning towards rank grasslands and undergrowth in areas adjacent to waterways and swamps.

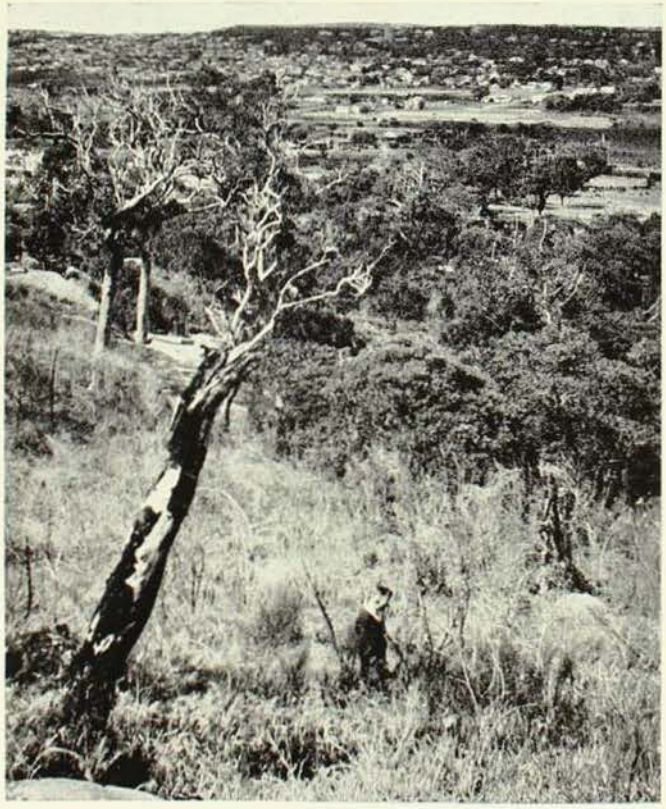
In both appearance and habits Coucals give the impression that they are primitive birds representing an old element in the avifauna of the world. Their loose plumage with its rather open feathering, the rigid, pointed shafts to most of their body-feathers, their white, unmarked eggs, and their rudimentary nests point to such a supposition. They have been placed with the cuckoos and classed as a sub-family of that mixed group of more than one-hundred species, most of which lay their eggs in the nests of other birds, though the Coucals, and a few species of cuckoos, incubate their own eggs and rear their own nestlings.

The smallest species is the African Black Coucal (*C. grillii*) a bird about twelve inches long; one of the largest is the Australian Pheasant-Coucal or Swamp-Pheasant (*C. phasianinus*), some twenty-four inches in length, more than half of which comprises the tail.

The stronghold of the genus *Centropus* is throughout the Indian and the African regions. Presumably the sole Australian representative, which also occurs on some of the larger islands of Torres Strait and in south-eastern New Guinea, reached Australia either by using the Torres Strait islands as stepping-stones, or over a former land-ridge between New Guinea and Australia. The latter explanation is more likely in view of the weak power of flight of the species.

Subsequent dispersal of the species in Australia seems to have been throughout Cape York Peninsula with one stream continuing down the east coast to south-eastern New South Wales, and another around the Gulf country to northern and north-western Australia. Except in a few instances the Coucal has not been able to extend its range beyond the coastal watershed; even when it has done so it seldom occurs more than two-hundred miles from the coast. The barrier to any considerable extension inland is the absence of dense ground-cover because of low rainfall. Within certain limits altitude seems to have little influence

Distribution of the Coucal in Australia. Arrows indicate probable route of immigration and dispersal.



An immature Coucal (top) which was caught by hand. The figure in the lower picture is standing by a nest. Photographs for both illustrations were taken at Dee Why, near Sydney, where the lagoon area provides a suitable environment for the swamp-pheasant.

on distribution as the species has been noted in coastal mangroves and in localities up to three thousand feet above sea-level. In hilly country its numbers are somewhat limited by the paucity of suitable habitats.

Coucals are fond of sunning themselves in some open situation, it may be on the ground or from a stump; often they will open their plumage to the sun and spread their wings while resting on top of a low bushy shrub or a small tree. A Coucal in northern Queensland was observed dusting itself in the cold ashes from a domestic fire, possibly to rid itself of lice. It would lie on its side in the sun, loosen its feathers and toss ashes over itself in apparent enjoyment, after the manner of a sparrow indulging in a dust bath.

Near Sydney, and doubtless in other parts also, Coucals seldom call during the autumn and winter months (the non-breeding season). Plumage moult and the absence of territorial competition at that time of the year seem to be the main causes of their lack of song, if such it can be called. They are heard calling persistently from early September until the end of autumn. The usual call consists of a run of booming or bubbling notes, dropping in tone and then rising again, best rendered by the words " oop " or " coop " uttered in a deep throaty fashion. An observer who had a pair of Coucals in captivity noted that the call of the larger bird, known to be a female, was much deeper in tone than that of the male. The number of separate notes given may be as many as fourteen, and the entire call will last about five seconds. Sometimes a pair of birds will indulge in a duet of their distinctive bubbling notes, the second bird coming in shortly after the first bird commences to call.

Other calls are also given; all have the same rather mournful quality except an explosive " chew " uttered when the birds are disturbed or alarmed. The fullness of the " oop " notes is imparted apparently by the bird inflating and puffing out its neck, forming a kind of baffle for the sound. The head is frequently bent down with the bill held close to the breast and then gradually lifted as the call is given; at the

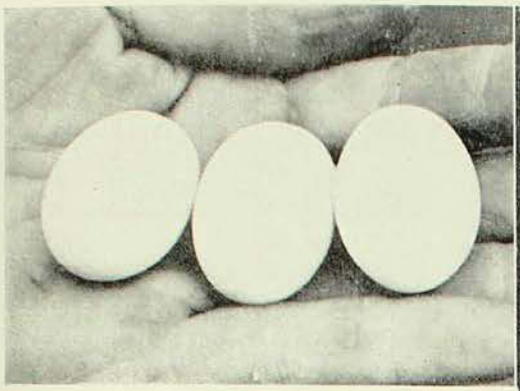
same time the tail-feathers may be expanded. During the breeding season the birds also call at night, as do many true Cuckoos.

Nests are built in a variety of situations, in sword-grass, spike-rush, thick tussocks, a bushy shrub, or a leafy palm, and not infrequently in lantana scrub. It is seldom that they are more than a few feet from the ground. One examined near Sydney recently was placed in the centre of a clump of sword-grass. It was saucer-shaped, some eight inches in diameter, and composed principally of the leafy twigs of gum-trees placed on a foundation or base of dead sword-grass blades and other vegetation. The lining consisted largely of single gum-leaves. The entire material was closely packed to a depth of about three inches. From the state of the gum-leaves, which still retained some of their freshness and pliability, it was obvious that the twigs had been broken off living trees by the Coucals. Around and above the leafy platform, or nest proper, the birds had drawn numerous blades of living sword-grass, forming a globular chamber with a side-entrance. A nest placed among thick vegetation at the base of a tree may have only one entrance. However, many nests have two openings, one for the head and the other for the long tail, so that when a sitting bird is disturbed it may leave by way of the back door; usually it does so in a flurry of feathers, since the bird sits very close and is not easily flushed from its eggs. In the case of nests with only one opening the bird enters head first and then, in turning, brings its tail over its back, just as the female Lyrebird does when brooding.

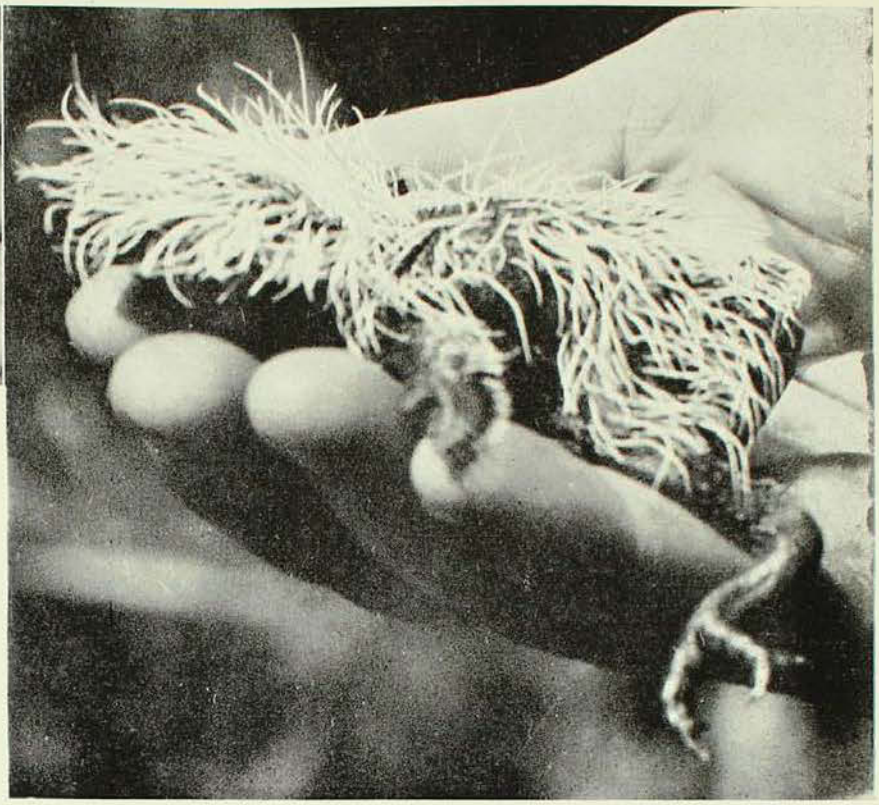
The breeding season usually extends from late September to February or March, the hottest months of the year, with occasional nestings as late as April and May in the more northern parts of Australia. A full clutch may comprise from two to seven eggs, three or four being the normal number. The eggs are dull white, sometimes with a slight gloss, and are rounded-oval or elongated-oval in shape, and measure approximately 40 mm x 30 mm. The incubation period is between twenty and twenty-one days, a fact determined by observations at a nest near Dee Why, a short distance to the north of Sydney. One fresh egg, the first of three, was in the nest when it was discovered on the morning of October 5, and the bird was then brooding. A photographer, working from a hide near the nest on October 25, noticed that one of the eggs was chipped and the young bird was struggling to emerge. One of the adults returned and was seen to break away the shell and help the hatching bird. A second egg hatched on the following day.

Young Coucals, in the first few days of their lives, are the ugliest of ugly nestlings. Their skin is a leaden-black colour and wrinkled. They are sightless and their upper parts are liberally covered with white hair-like structures called " trichoptiles " and much resembling strands of cotton. These threads are prolongations of the horny sheaths that encase the growing feathers. They emerge through the skin of the body before the young bird hatches and eventually drop off as the true feathers break through their sheaths, or quills. Within two weeks of hatching there is no trace of the white strands except, perhaps, an odd one or two on the crown. The young bird is then clothed in soft feathers of mottled and barred browns and black, and has quite a demure appearance caused by its well-developed eyelashes. It is not at all like the unsightly nestling of a fortnight earlier, a nestling that could scarcely look less like a bird as it lies inert and almost concealed by its strange, white, hair-like covering. Early in their lives young Coucals are rather quiet, but within a couple of weeks they continually utter a harsh croaking note while waiting for their parents to return to the nest with food.

An examination of several nests after they have been abandoned by the birds has revealed the presence of shell fragments well below the top layer of rather fresh green leaves. Also, many of the leaves below the floor are moist and stained, caused



A Coucal's egg measures approximately 40 x 30 mm.



A nestling Coucal, about seven days old, showing the white hair-like structures called "trichoptiles".

All photos.—Author.

by the nestlings defecating in the nest. It would seem, therefore, that the parent birds add fresh green leaves to the nest to keep it clean. The presence of faeces among the leaves provides suitable conditions for the larvae of a nest-scavenging fly. This fly (*Passeromyia longicornis*) is slightly larger than the common house-fly. In its larval stage it is known to be both a scavenger and a blood-sucking parasite on nestling birds. I have never seen the grubs on the bodies of nestling Coucals but have found them on a number of occasions in their nests.

Young Coucals have strong, well-developed legs and are able to move about on the ground amongst thick undergrowth long before they can fly. It is seldom that they stay in the nest more than two weeks, often a day or two less. Once when I was handling a nestling about a week old, and which was still in quill feathers, it attempted to leave the nest. A few days later, when walking towards the same nest, but some thirty yards from it, I came across one of the young birds, in mottled plumage, moving about in the low vegetation and uttering a short, harsh croak. Perhaps it was induced to leave its home earlier than usual because of the presence of mites. These were the tropical fowl-mite (*Bdellonyssus bursa*) and the nest was swarming with them, as have been other nests found near Sydney. Another external parasite found on the bodies of Coucals is the tick. Mostly this pest occurs on the heads of the birds which have apparently developed some resistance to tick poisoning, like other animals such as bandicoots, snakes and goannas.

Until recent years the plumage changes and moults of the Coucal were not well understood. John Gould, the famous ornithologist, writing more than 100 years ago, expressed the opinion that both sexes when fully adult were alike in plumage; that is, with black body-feathers and black bill, with the wings and tail-feathers barred. Immature birds were noted as having light-coloured bills and deep brown body-plumage with a tawny stripe down each feather. Within limits Gould was correct, but he was not aware that the black body-plumage is the breeding state, the birds subsequently moulting into the brown, or eclipse, state until the following spring.

The matter is somewhat complicated in the field by the fact that immature birds, hatched in October, are by late summer,

as large as adults which are then still in the black plumage-phase. Thus brown birds and black birds may be in the same locality when only black ones might be thought to occur at that time of the year. Immature birds can always be identified by their brownish bills, and also by the colour of their eyes, which change, as they grow older, from greyish to yellowish-brown and finally to the deep red of the adults. During the same period the bill and legs darken to a leaden-black. The entire change in the bill, legs and eyes from the immature to the adult state was noted as taking some two years in captive birds. The body-plumage, however, was moulted each season, as in the adults, from the time the immature birds were about seven months old.

In 1950 observations were made on an adult female Coucal in an aviary near Sydney. The sex of the bird was known because it laid an egg on the concrete floor of the enclosure. The autumnal change into brown body-plumage commenced early in April and the change back into the black phase was not complete until late August, the bird remaining in the brown state for some three months. The change from one state to the other occupied about a month. In the following year the moults were very protracted and the bird had scarcely assumed the full brown plumage in June, after starting to change in April, before it commenced a long-drawn-out moult back into the black phase, which was completed by mid-September. Some variation from those occurrences was noted in three immature birds kept in the same aviaries; one of the birds even commenced to change from black to brown as early as the end of January. The artificial conditions under which the birds were kept may have had some bearing on their plumage-changes.

From notes based on captive birds and from observations in the field near Sydney, it can be stated that birds in black body-plumage, which is the breeding dress, normally occur from September (spring) to March (autumn), in temperate eastern Australia. In tropical Australia the breeding season and the moults are doubtless influenced by the incidence of the wet and the dry seasons.

The wing-feathers appear to be replaced gradually throughout autumn and winter, though an almost complete shedding of the tail-feathers may take place at some time between late summer and early spring—at least, that is what happened with some of the captive birds studied. The conditions under which the birds were caged, a bare concrete floor and an endless diet of chopped-up meat, could easily have disturbed the rhythm of their moulting cycle.

The tongue of the young Coucal is coloured black and red, the front part being a glossy black (which colour extends down the sides of the tongue), the centre and rear portion being orange-red, or scarlet. The nestlings of many birds have unusual tongue-patterns and in some species the mouth-markings generally are very distinctive, even to the presence of luminescent fleshy gape-nodules. Such markings seem to be " indicators " or " pointers " to the adult birds when they are feeding their nestlings.

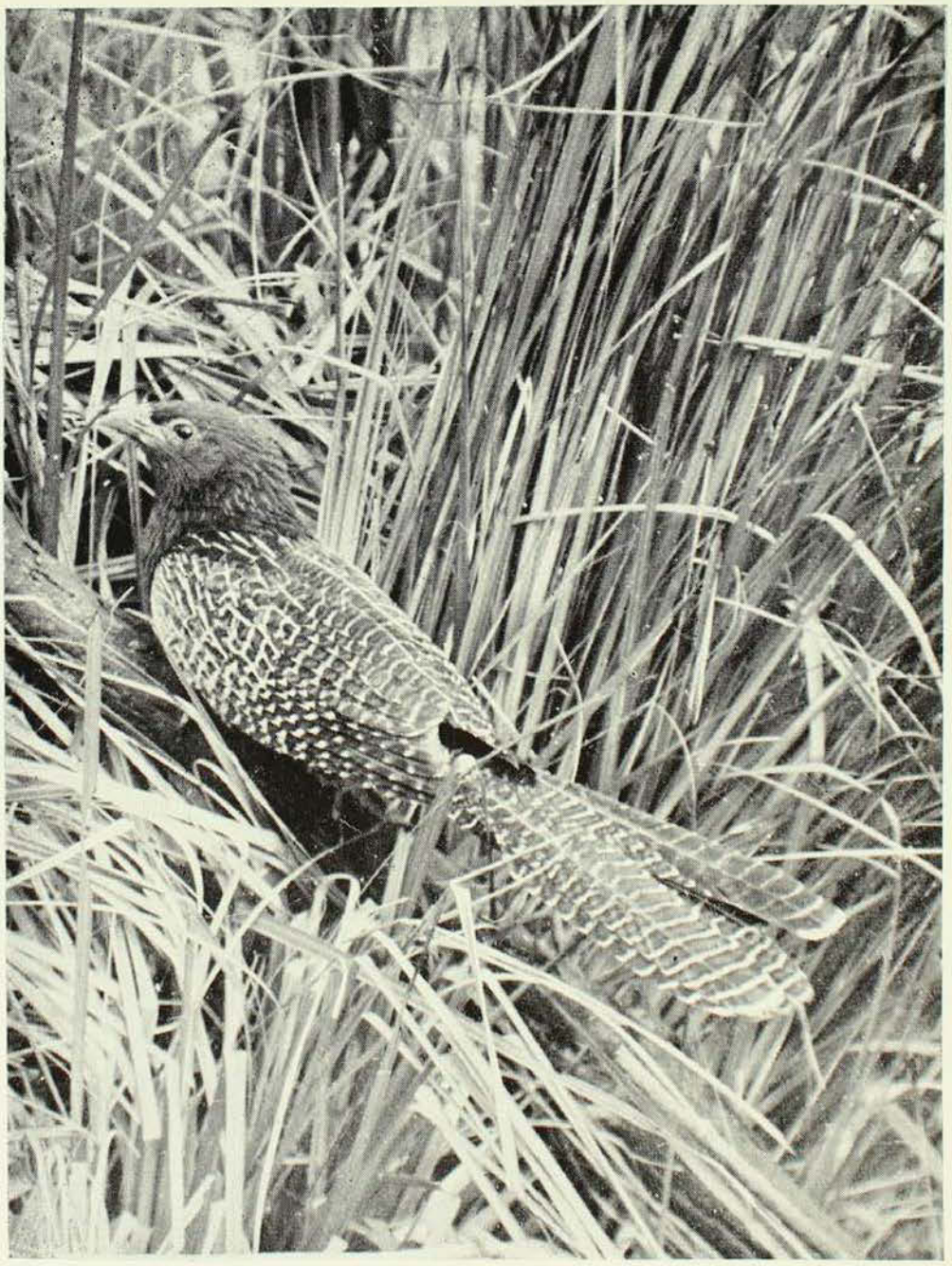
One June day some years ago, at Dee Why, I saw a Coucal running ahead of me on a narrow track. The bird was chased but it veered off into the grass and was lost to sight. Scouting around I noticed it crouched close to the ground in an effort to escape being seen. It was captured, photographed, and then released in an open spot, whereupon, after running for some ten yards, it rose in ungainly flight for twenty yards or so before dropping back into the thick vegetation. It was an immature bird, as denoted by its greyish-brown eyes (red in adults), and dark-brown bill (blackish in adults). The body-plumage was brown, being similar to that of adult birds, which at that time of the year are in eclipse or winter dress.

Many species of birds are able to effectively cleanse and waterproof their feathers through the possession of powder-down feathers, or an oil-gland, or both. Powder-down feathers may occur in patches, such as in herons, or may be scattered through the contour feathers. The somewhat greasy

powder from these specialised structures is generally distributed over the plumage by bill rubbing and preening, thus, as an illustration, one not infrequently sees cockatoos with the appearance of having been dusted with fine chalk.

The oil-gland in birds is situated on the rump close to the base of the tail. Its purpose seems to be much the same as that of powder-down, that is, a preservative for the body-feathers. In the Coucal the oil-gland is shaped rather like an inverted golf-tee but is thinner, about half-an-inch in length, and bluish-white in colour. Normally it lies along the body, pointing towards the tail. When in use it is elevated, forming a more-or-less elongated, inverted cone. The feathers on the rump are raised and the exposed gland is grasped by the bird, whose head is bent well back and held sideways for that purpose. It is nibbled and squeezed for oil and the bill is then rubbed through the body-plumage, or perhaps the wing-feathers may be passed through the bill in a deliberate manner.

Normally the oil-gland is concealed by the feathers of the rump. On a number of occasions, while watching Coucals sunning and preening themselves, I have been



A Coucal at its nest.

Photo.—Norman Chaffer.

Block by courtesy of the Royal Australasian Ornithologists' Union.

interested to note the muscular control the birds have of their somewhat loose plumage. They are able to raise most of their feathers almost at right angles to their bodies.

The Coucal is not specially selective in its choice of food. Mice, small snakes, lizards, frogs, insects and their larvae and the eggs and young of native birds, as well as seeds and various kinds of fruits, all find their way into its muscular and capacious stomach. In settled areas the nests of domestic fowls are robbed and the eggs sucked. Coucals in captivity will eat raw meat, fish, bread, and all kinds of food-scraps. A bird that will swallow evil-smelling wood bugs or raid a tree near a house for ripe mulberries is truly omnivorous in its diet.

KEITH ALFRED HINDWOOD, F.R.Z.S., C.F.A.O.U. (U.S.A.), is the Australian Museum's Honorary Ornithologist. A Sydney business man, bird study is his recreation and, besides serving terms as president of the Royal Zoological Society of N.S.W. and the Royal Australasian Ornithologists' Union, he has found time to write *Birds of Lord Howe Island*, and (with E. S. Hoskin) *The Waders of Sydney*. He is also a regular contributor to scientific publications.

Australia's Fiery Rain

By W. A. CASSIDY

Department of Geophysics & Geochemistry, The Pennsylvania State University

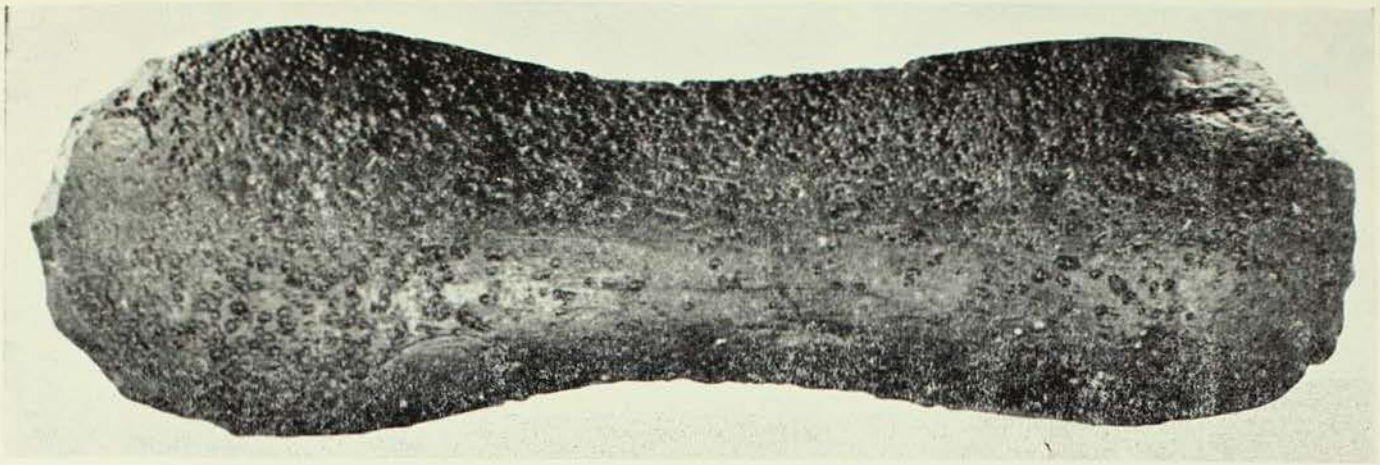
WILLIAM CREEK, South Australia, is a name on the map of Australia localized by a dot near the railroad line between Adelaide and Marree. William Creek is also a general store standing alone in the centre of a vast gibber plain; the only features as far as the eye can see are the general store, run by Mr. and Mrs. Thompson, and, along the Adelaide-Marree railroad track, a line of telephone poles stepping off precise distances across a plain that stretches to the sky. This country is a place of unbearable heat in the summertime and moderate cold in the winter.

Several years ago, little Janet Thompson was playing around the general store when she found a strange stone about the size of a walnut that was much blacker than any of the other common stones littering the gibber plain.

Attracted perhaps by its strangeness, she kept it for a while and then forgot about it until a day in the spring of 1953, when a field party from the South Australian Museum stopped at the William Creek General Store for a chat and a glass of one of South Australia's most distinguished fermented products. I was a member of the party.

We asked about Australites, describing a type of natural glass that made Janet think of the black stone she had found many months before. It took a little while to find, but it proved to be an Australite, and a very good specimen at that. Janet was willing to give it to us, and we were very happy to accept it, since this was almost undoubtedly a fragment of matter that had come to William Creek from the vast, cold, exceedingly inhospitable regions of interplanetary space.

On that trip and on later ones, I was able to form a modest collection of Australites to take back to America with me for study. Most of my specimens came from people who, like Janet, were interested enough in the world of Nature to notice peculiar stones and save them. For parts of my collection I owe thanks to people of such diverse occupations as station owners,



A dumb-bell shaped Australite, between 3 and 4 inches long.

fence menders, school teachers, and railroad workers. For these people, and for other interested persons, I should try to answer a few questions. Chief among these is, " What are Australites "?

THE NATURE OF AUSTRALITES

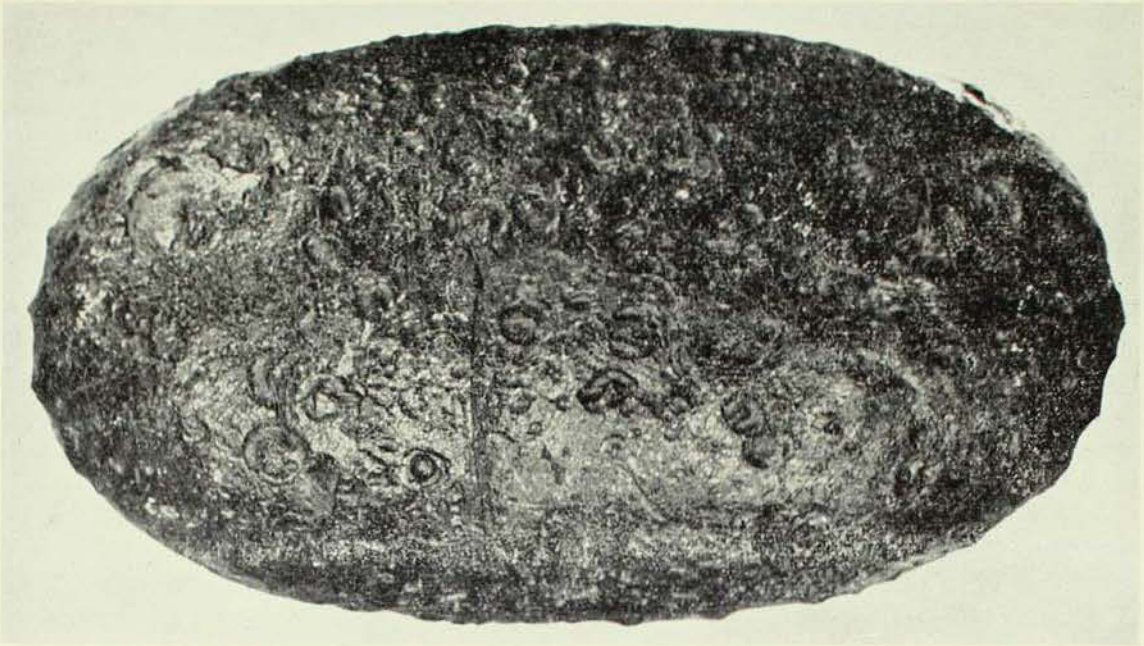
Australites are small pieces of natural glass found scattered over the southern and western half of Australia. They represent an intriguing problem to meteoriticists (those who study meteorites) and to some petrologists and geologists, because their origin has never been satisfactorily explained. Many people have *tried* to explain their origin, however, and these attempts have produced a curious spectrum of hypotheses, some with sound scientific reasoning behind them, others based on more shaky foundations. The questions that bother the aforementioned workers are, " Are Australites terrestrial or extraterrestrial in origin?"; " If terrestrial, how were they produced?"; " If extraterrestrial, why aren't they like other meteorites?".

Of great importance in answering the first question is the fact that Australites are related in chemical composition, physical form, glassy physical state, and mode of occurrence to other natural glasses found in other regions of the world. But none of the hypotheses of terrestrial origin can explain all features of all these geographically separate occurrences. Over the years, then, it has become increasingly apparent that Australites are extraterrestrial in origin. The fact that the Australites (or any of the other related groups) have not been seen to fall is embarrassing in this respect, but need not concern us too much since the future is presumably infinite and we can probably expect a shower of them eventually, somewhere in the world, that will provide rigorous observational proof of their meteoritic nature. If this sounds like levity it is meant only to emphasize that not having seen a certain rock fall does not constitute proof that the rock is not a meteorite.

To continue this discussion further, we must now briefly consider some aspects of meteorites and terrestrial rocks in general.

ANALOGY BETWEEN METEORITES AND TERRESTRIAL ROCKS

The earth is thought to consist of a metallic core surrounded by a mantle of rock. Seismologists believe this on the basis of their studies of earthquake waves and astronomers believe it from their studies of the motion of our planet, in particular the rate of change of the equinoxes. The rocky mantle is made up in large part of what we call the " basic " rocks but is enclosed by a surface " crust ", varying from five to thirty miles in thickness, made up of what we call " acidic " rocks. " Acidic " rocks can be thought of here as containing over 65% silica; " basic " rocks as containing less. Since meteorites probably originate as fragments of a former planet, petrologists like to employ analogies between the different types of meteorites and the different types of material thought to comprise the



The "O'Malley" Australite is ellipsoidal in shape and some 3 inches in length. The surface was melted during the Australite's fall to earth.

earth. Thus, the material of the metallic core corresponds to the metallic meteorites, the material of the mantle corresponds to the stony meteorites, and the transition zone between them corresponds to the Pallasites or stony-iron meteorites (see this MAGAZINE, September 15, 1956, Page 86). The only hitch in the analogy lies in the fact that we have never found any granitic ("acidic") meteorites to correspond to the surface crust of the earth. Since the analogy suggests there should be granitic meteorites, we should not be surprised to find them.

ARE AUSTRALITES GRANITIC METEORITES?

The question can be asked, "Have we actually found granitic meteorites but not recognized them as such?". Since the surface of the earth is of granitic material, it is conceivable that a weathered granitic meteorite could easily pass unnoticed even by geologists because of its resemblance to common surface rocks. On the other hand, of the 600 to 800 meteorites that have been recovered after having been seen to fall, none are of granitic composition. Surprisingly, however, the question ultimately may be answered, "Yes, we have found granitic meteorites". The reason is that the Australites are almost the same as granites in chemical composition; Australites differ from stony meteorites in composition in the same way that granites differ from "basic" rocks. Unlike granites, however, which are completely crystalline, Australites are glass. The symmetrical shapes of Australites also set them apart from all other natural glasses (see illustrations).

INFERRED HISTORY OF AUSTRALITES

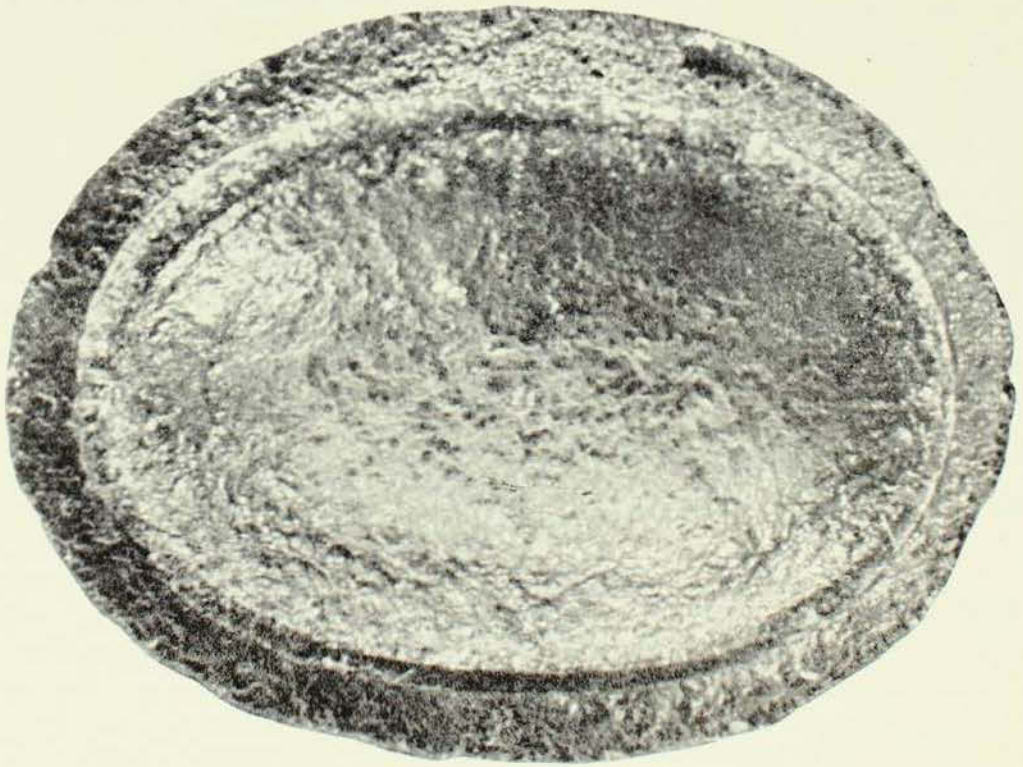
Because the best-preserved and freshest-looking specimens of Australites show features that suggest passage through the atmosphere of the earth at extremely high velocities, it is believed that these features were impressed on all Australites when they fell as meteorites in one great fiery shower. The features referred to are (1) pits and depressions similar to those observed on other meteorites, and (2) evidence that material has melted on one side of each Australite and flowed toward the unmelted side. This action produced concentric and spiral-shaped ridges and troughs, and flanges of glass which collected around the widest part of each Australite. [1]

1. Probably the most active Australian worker on Australites today is Mr. George Baker, of the Mineragraphy Division, C.S.I.R.O., Melbourne, whose collection of Australites is one of the best in the world. His recent paper on the Nirranda Strewnfield Australites (*Mem. Nat. Mus. Vic. No.* 20, 59-172, 1956) gives an extremely comprehensive insight into the peculiar features of Australites and the reasons for these peculiar features. See also, "Flanges of Australites" *Mem. Nat. Mus. Vic.*, No. 14 (1), 7-22, 1944, by Mr. Baker.

Stripped of these features that have been produced in the earth's atmosphere, the pre-atmospheric characteristics of Australites become apparent. Thus it can now be seen that the Australites were glassy bodies before they entered the earth's atmosphere, and furthermore each possessed one of the following rotational shapes: oblate spheroid, general ellipsoid, dumbbell, teardrop. They were therefore greatly different from the crystalline, irregular-shaped, stony meteorites even before they entered the earth's atmosphere. If we knew why this was so it would undoubtedly contribute much to our understanding of the solar system. At present we can only speculate on the events that caused these "acidic" meteorites to be so different from their "basic" analogues, but some speculations might show themselves to be more logical than others, so it is to our interest to pursue them as far as possible to see if any of their implications can open new lines of thought on cosmological theory.

The analogy between meteorites and terrestrial rocks leads us to expect that Australites and other meteorites came from the same place. Some workers have supposed that Australites began their meteoritic careers as common chunks of granite produced by the breakup of a former planet whose path was located between the orbits of Mars and Jupiter, and that somehow all these granitic fragments passed close enough to the sun to melt completely and separate into spinning blobs of glass that congealed as they moved away from the sun. This does not seem too probable, because it implies that the fragments of the surface material of the planet were somehow separated from other fragments from deeper within the planet in such a way that all the "acidic" surface material was carried close to the sun, while none of the rest of the fragments approached closely enough to undergo melting.

Thus eliminating the sun from our speculations as the agent that melted the Australites, it will be necessary to postulate that the "acidic" crust of the planet itself was molten at the time it was disrupted, while the material deeper within the planet was in the solid state. The most plausible explanation for such a state of affairs is that the surface of the meteorite planet was heating up, and had already melted due to decay of radioactive material. For comparison, recent studies of the distribution of radioactive material in the



Top view of an Australite (about 1 inch long) outlined by a flange of material accumulated from the "melted" under side. Probably the other specimens illustrated have lost similar flanges.

Specimens illustrated are in the South Australian Museum.

earth have indicated that the main source of heat near the surface is that derived from natural radioactive decay. We also know that if the earth as a whole contained as much radioactive material as the surface rocks, the additional heat generated would make of the earth a liquid hell. Since the earth is not in that condition we conclude that whatever process originally segregated the metallic core from the rocky mantle also concentrated most of the radioactive elements in the crust, so that most of the radioactive heating in the earth is occurring in the crust.

The crust of the earth once contained two to three times as much radioactive material as it now does (the amount has decreased with time as a function of the half-lives of the various radioactive elements) so it was once much hotter than it now is, and it is probable that the surface of the earth went through a molten stage before geological history began. Because it then cooled slowly, taking millions of years to become solid again, it became completely crystalline, forming the crystalline surface rocks familiar to us all. If something had caused the earth to break into pieces while its surface was still molten, however, the molten material would be dispersed as spinning droplets which would cool to a glass—crystals would not have time to grow. The solid inner part of the earth would be dispersed into space as irregular-shaped, crystalline fragments like stony and metallic meteorites. Something like this may have happened to the meteorite planet to produce the glassy Australites and the crystalline stony and metallic meteorites.

WILLIAM A. CASSIDY graduated from the University of New Mexico in 1952. He then spent two years in Australia on a Fulbright fellowship for the study of meteorites. Now, at Pennsylvania State University, he is working for a Ph.D. degree in geochemistry, on a National Science Foundation scholarship.

The Kangaroo Family

Brush Wallabies

By ELLIS TROUGHTON

IN the last article[1] on pademelons or small scrub-haunting wallabies, it was noted that the original genus *Macropus* (long-foot) contained thirty-odd species ranging from a hare-sized pademelon to a man-sized kangaroo. Originally listed as Small and Large Wallabies, and *the* Kangaroos, each section, though anatomically similar, warrants a distinctive popular title and Pademelon, Wallaby, and Kangaroo are most appropriate for these rather loosely defined groups.

The first description of a hopping marsupial, by the Dutch Captain Pelsart, in 1629, when wrecked on Houtmans Abrolhos, Western Australia, referred to the Tammar pademelon-wallaby as " about the size of a hare " with a head like a civet-cat. In 1658 another Dutchman, Samuel Volckersen, described the Quokka or Short-tailed Pademelon on Rottnest (rat-nest) Island, off Fremantle, as a " wild-cat, resembling a civet-cat ". In 1699 William Dampier on his second voyage to the western coast after gold for the British in the ancient H.M.S. *Roebuck*, described a " Sort of Racoons ", now known to be the rare Banded Hare-Wallaby.

[1] Troughton, E., this MAGAZINE, Vol. X, No. 7, September, 1951, p. 218; and No. 8, December, 1951, p. 261.

But it was on the eastern coast of " New Holland ", about 150 years after Pelsart's description, that Captain Cook's naturalists at Cooktown in 1770 (not Botany Bay as sometimes stated) first recorded a striking disparity in the size of animals called " Kangooroo " by the local tribe of aborigines. One adult weighing only 38 lb. was obviously a wallaby, while another of 80 lb. was evidently the local wallaroo or rock-haunting species of kangaroo.

The Brush or Large Wallabies

Inhabiting the coastal brush or more open forest, members of this group may be regarded either as medium-sized kangaroos or large wallabies. The foot-length, less the long nail, ranges from 6½ to 10 in., the skull-length from 4½ to 5¼ in., and the body-weight from about 30 lb. in females to 50 lb. in old males. Gracefully built and sometimes brightly coloured and distinctively marked, they represent possibly the most beautiful of the more typical kangaroos. Seven species of the genus *Wallabia* are recognized, from the mainland and Tasmania, one of which is represented by a subspecies in Papua.

All of the kangaroo family undergo a dental growth-change in which two milk-teeth are replaced by a single permanent premolar known as the "secator" or shearing tooth. Although striking variation is shown between the upper and lower premolars of the species, some mammalogists persist in grouping the brush-wallabies in a fossil genus *Protemnodon* (front-cutting-tooth) which Professor Richard Owen founded on the lower jawbone of an extinct giant kangaroo which he named *anak*. Judged by the teeth and portion of the jaw, the fossil kangaroo browsed on thick foliage and its head was about the size of a pony's, whereas the head of the leaf-nibbling and grazing brush-wallaby averages about that of a sheep-dog's. However, the most appropriate generic name *Wallabia*, based on the aboriginal's "wallabee" of the Sydney district, is permanently established for the brush-wallabies. Anyway, dental and cranial characters become too complex for popular comparison, and the following brief descriptions may assist in distinguishing the attractive and historically interesting species of brush-wallabies.

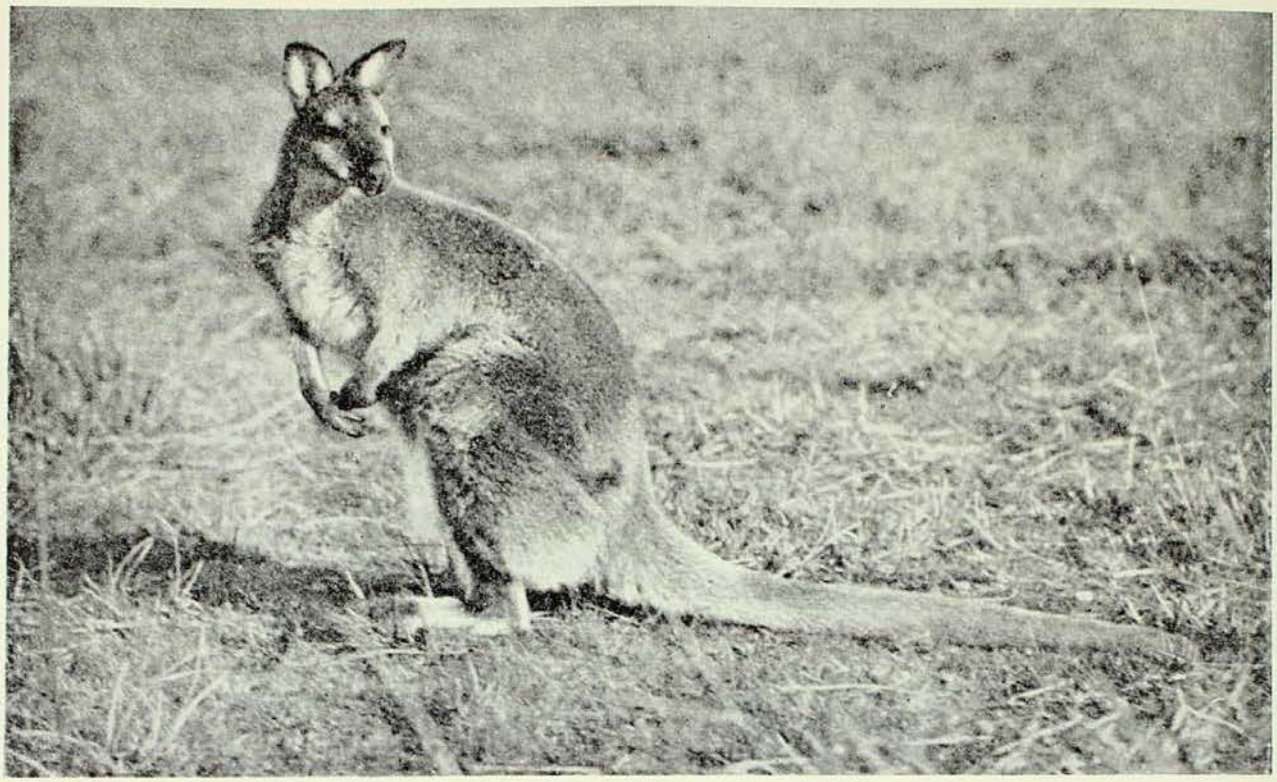
Black-tailed Wallaby or " Swamper "

Described in 1804 from coastal New South Wales, the Swamper became the type species of *Wallabia*, while its specific name *bicolor* indicates the contrast of the reddish-yellow belly with the dark-brown back. The sombre, rather shaggy, coat reflects its favoured haunt of damp gullies and swamps, suggesting the name of swamp-wallaby. It may be seen hopping through mangrove shallows with evident enjoyment, but it is a true brush-wallaby and visits the hill-tops which are often mist-covered. It inhabits the eastern region from western Victoria north to about Cairns in Queensland, in which State northern and southern races have been described. A reddish wallaby (*welsbyi*), described in 1922 from Stradbroke Island, possibly represents a hybrid with the Sandy Wallaby (*agilis*) which also inhabits the Island. Fortunately, survival of the Swamper is reasonably assured owing to the varied nature of its habitat.

Red-necked Wallaby or " Brusher "

The " common " brush-wallaby was one of the first marsupials seen about Port Jackson and reported by Captain Phillip after landing with the First Fleet in 1788. The specific name *ruficollis*, referring to the reddish nape and shoulders, like the slightly earlier name *rufogrisea* (reddish-grey), actually applies to the King Island wallaby observed in 1802 by the naturalists of Francois Peron's expedition, temporarily marooned in Bass Strait. The name for the mainland race of *rufogrisea* is *banksiana*, given to a Blue Mountains specimen in 1825 by the French naturalists Quoy and Gaimard in tribute to Captain Cook's famous botanist.

As a true brush-lover, this large roan wallaby seldom appears in open grasslands, preferring the heath and brush of coastal slopes, and dense undergrowth to fairly high altitudes. Its mainland range extends from the South Australian border to about



The Red-necked Brush-Wallaby (*Wallabia rufogrisea*). This large wallaby is distinguished by the redness of the nape and shoulders, contrasting with the fawn-grey body. There is no dark spinal stripe, or light hip-mark.

Photo.—Noel Burnet.

Rockhampton in Queensland, where it is called the " Roany " because of the lighter colour. But the species is invariably distinguished by the contrast of the reddish shoulders with the fawn-grey body, without trace of a dark stripe down the back.

It is the only large wallaby in Tasmania, the race being named *bennetti* in 1838 in honour of the Secretary to the Zoological Society of London, but the name is antedated rather appropriately by *frutica*, for a shrub or bush. The newspapers of Hobart Town once advertised for thousands of skins which were quickly supplied by settlers and exported to England for footwear. Past exploitation for " sport " and trade, and the clearing of great tracts of brush and timbered country, have driven this handsome " common " species from vast areas of its original range. But excepting for isolated occasions when crops are unfenced near its haunts, this brush-loving wallaby is relatively harmless and worthy of the almost continuous protection now afforded.

Black-striped Wallaby or " Scrubber "

A dark stripe down the nape and mid-back, according with the specific name *dorsalis*, distinguishes this wallaby from the Red-neck or Brusher; it also differs in its greyer body and the presence of a definite whitish hip-stripe. Once plentiful north-west of the Dividing Range (N.S.W.), especially in the brigalow brushes of the lower Namoi River, the wallaby is now abundant only on the far north coast, and in the dense brigalow and lantana patches of south-eastern Queensland. The naturalist John Gould said that the Aborigines wrought havoc amongst them for meat and skins for clothing, often catching them in large nets or driving them with dogs and spearing or killing them with waddies.

According to H. H. Finlayson, mammalogist at the South Australian Museum, who observed the wallaby about Rockhampton in the summer of 1928-29, it dislikes the dripping scrub after rain, when it can be seen along the edges of the Bauhinia flats.

Because of its shy communal habits within the impenetrable "jungle" of vine-interlaced brigalow, often infested by prickly-pear, the Scrubber has been unusually successful in surviving the effects of systematic snaring and shooting since settlement.

THE SANDY OR AGILE WALLABY

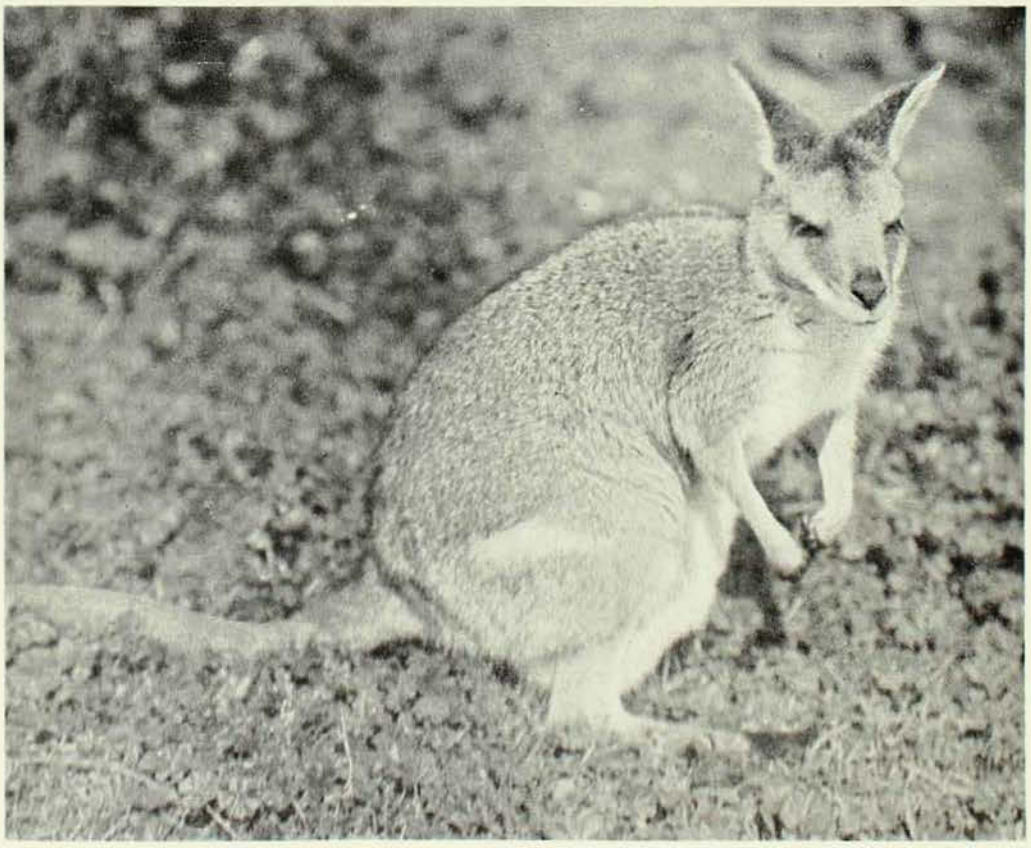
This brightly coloured species (*Wallabia agilis*) was first found in great abundance by explorer-naturalists around swampy areas on the North Australian Coast. Its remarkable agility in easily eluding dogs, leaping over tussocks and through mangrove flats, is recorded in the specific name given by Gould in 1842 to a specimen from Port Essington, north of Darwin. The very extensive range extends from the region of Broome in the north-west, eastwards to Cape York, and southward to Stradbroke Island, near Brisbane; a Papuan race inhabits the coastal region about Port Moresby.

The Sandy species differs from all other brush-wallabies in its uniformly yellowish-brown colour, though a whitish cheek-stripe, and fairly distinct whitish hip-stripe, are invariably present. The very large permanent premolars ally this species with the Swamp-Wallaby, which has rather similar habits but is much darker. The two mainland races are defined on colour in which individuals may intergrade. The brighter eastern race, with darker toes and tail-tip, is named *jardinii* in honour of the famous Frank Jardine of Cape York; the most westerly race *nigrescens* is slightly darkened by some blackish hairs.

It is the only species of brush-wallaby so prolific as seriously to clash with pastoral interests. But this is in far north-west Australia where elaborate methods of control are being employed. The southern wallabies, on the contrary, are of increasingly restricted range and numbers. Failing the provision of adequate sanctuaries and protection they are threatened with ultimate extermination, which has already overtaken the following exquisite species.

THE TOOLACHE OR GREY'S BRUSH-WALLABY

Most beautiful of the kangaroo family, this elegant wallaby was named in honour of Captain (afterwards Sir) George Grey, explorer and early Administrator of South



The Black-striped Brush-Wallaby (*Wallabia dorsalis*), distinguished by the dark brown stripe along the spine and definite white hip-mark, is known as the "Scrubber" in south-eastern Queensland.

Photo.—H. Burrell.

Australia, who sent the first specimens to the British Museum. Its range, even prior to settlement, appears to have covered but a small part of the State's total area. All too soon this was restricted to the region south-east of Adelaide, and across the Victorian border where it was well-known to settlers. As late as 1910 it was not uncommon in scattered bands inland from Millicent and Kingston, but by 1927 the last of these bands had gone, and with the death of a captive female the species was exterminated.

The Toolache was distinguished by the pale greyish-fawn colour, contrasting with a blackish cheek-mark underlined with white, and by a soft " rippling " of the rather woolly fur of the lower back, with alternate bands of light and darker grey. A similar banding, not obvious in all lights, occurs only in the western Black-gloved Wallaby, from which the Toolache differed in its paler ear-tips and hands, and whitish instead of black-crested tail. The slightness of its forelimbs in comparison with the powerful hindquarters accounted for the remarkable speed of the Toolache, now traditional in districts where the lovely wallaby was " coursed " by dogs as a regular source of " amusement "!

H. H. Finlayson in the *Transactions of the Royal Society of South Australia* for 1927, states that odds greatly favoured greyhounds in more open country, but the fleetest wallabies, usually the lighter females, outpaced dogs capable of short bursts of up to 42 m.p.h. In belts of tussocky scrub the advantage went to the wallaby, which, changing its direction with great leaps, demonstrated the perfection of the hopping action. Because the fleetness and beauty of pelt made the Toolache most attractive for " sport " and trade, the scattered bands were harried continually and skins were marketed in great numbers.

Its disappearance was expedited by rapid spread of the fox, which took heavy toll of the young, while the constant dog-hunting of foxes resulted in further killing of the wallabies, on the excuse that " nothing spoils a dog like checking him ". Apart from man and fox, the only serious enemy was the Wedge-tailed Eagle which mainly attacked the young, like the fox. The courage of the doe sometimes thwarted attack, as when an eagle was seen persistently manoeuvring to separate a mother and large joey. When the great bird dropped to within three feet of her young the doe sprang to strike slashing blows with her feet. The blows may not have registered but the wedge-tail retreated while the joey regained the safety-zone of its mother's pouch. Such encounters, alas, did not often end so satisfactorily, as proved when some small boys periodically visited nesting-sites of eagles, as Finlayson wrote, " to recover scalps from the remains of young Toolaches to be found lying underneath; this at a time when a bonus of sixpence was paid *on all marsupial scalps* "!

The urgency of protective measures for the last group of Toolaches on Konetta sheep-run was repeatedly stressed by the late Professor Wood Jones. In May, 1923, when prospects for conservation seemed hopeless, a " drive " was organized to " round-up " the wallabies for transfer to the Kangaroo Island sanctuary. It is distressing to contemplate the failure of the ill-planned operation, which yielded only four dead or dying remnants of the precious marsupial stock, due to over-driving the wallabies, with the *assistance* of dogs, in directions contrary to their usual habits.

The total result of this attempt at conservation was the rescuing of a doe from the kangaroo dogs, evidently the last of the Toolaches, and a few specimens to add to the meagre museum representation of six skins and skulls. Surely, it would have been more humane and efficacious to have shot the parents to obtain the young of both sexes for the Island sanctuary, without the preliminary torture of the doomed colony by fear and exhaustion? Yet either drastic expedient could have been avoided by the unselfish co-operation of a few nature-conscious graziers in setting aside a small portion of adjacent properties for the gentle Toolache, the existence of which was never threatened by the aboriginal men who evidently named it.

BLACK-GLOVED OR WESTERN BRUSH-WALLABY

This lone south-western representative (*Wallabia irma*) shares the perilous distinction, with the tragic Toolache, of being one of the most beautiful and speedy of the kangaroo family. Although more brush-loving it has a similar preference for grazing instead of browsing, as indicated by the smaller size of the two rear incisors. The coloration is similar to the Toolache, though less bright, with some indication of the light and dark banding of the rump. It differs in the darker tipped ears, black crested tail, and blacker "gloved" hands. Described in 1837, the original specimen came from the Swan River and it was reported as still common near Perth about 1932. The range is given as from the vicinity of Geraldton southwards towards Esperance, with an approximate eastern limit to the No. 3 rabbit-proof fence.

The black-glove's habits are more like those of a large kangaroo, and its range is similar to that of the Western Great-Grey, except for a small area between Cape Naturaliste and the Leeuwin. It is said to be one of the fleetest of animals, doubling like a hare in the scrub, with the doubtful distinction, in some quarters, of being "the best sporting animal in the south-west". However, nature reservations have been dedicated by respective Governments in Western Australia and the survival of this beautiful wallaby seems assured. But the threats of advancing settlement and depredations by foxes remain. For some unexplained reason, the black-glove makes a difficult captive and it is to be hoped that a colony will be established in some island sanctuary, if there is ever the remotest risk of it sharing the fate of the Toolache.

THE WHIPTAIL OR PRETTYFACE WALLABY

In elegance of build and colouring this wallaby (*Wallabia elegans*) is the north-eastern ally of the lost Toolache and the south-western Black-glove. It is of paramount historical interest also because its more mouse-coloured Cape York race probably represents the first and smaller of the "kangooroos" described by the naturalists of Cook's party when the *Endeavour* was careened at Cooktown for repairs in 1770. The small to medium size of the first kangaroo to be described in detail is indicated in the *Journal* of Sir Joseph Banks, kept in consultation with the naturalist Solander, whose names grace the headlands at Botany Bay. After preliminary comparisons of size and length of tail

The Southern Whiptail or Prettyface Wallaby (*Wallabia elegans*), distinguished from all other brush-wallabies by the slender tail, equalling the head-and-body length, and by the striking cheek-marks. Note comparison with cover illustration of Cook's Kargaroo.

Photo.—A. Enor, in *Wild Animals of Australasia*.

with his greyhound, which chased the kangaroos, Banks recorded that on 14th July:

> Our second lieutenant had the good fortune to kill the animal that had so long been the subject of our speculations . . . Its forelegs are extremely short . . . its hind again as disproportionately long; with these it hops seven or eight feet at a time, in the same manner as the jerboa, to which animal indeed it bears much resemblance, except in size, this being in weight 38 lb., and the jerboa no larger than a common rat. *15th:* The beast which was killed yesterday was today dressed for our dinner, and proved excellent meat . . . *July 27th:* This day was dedicated to hunting the wild animal. We saw several, and had the good fortune to kill a very large one weighing 84 lb.

The small size of the first kangaroo, apart from weight, was implied by the greyhound comparison and limit of leap when pursued. But misled by the giant jerboa comparison, which Banks himself had " debunked ", authors persisted in applying the specific name *giganteus* (1777) to the Great-Grey Kangaroo, partly with the mistaken idea that Cook's party had seen that animal at Botany Bay, where it was commonly seen after the first settlement in 1788. The Great-Grey does occur on Cape York but has never been seen in the area about Cooktown where Cook's party hunted, and their larger animal was evidently the local species of wallaroo. There is, however, at least one decisive passage in Solander's Latin description which positively distinguishes Captain Cook's Wallaby from the Great-Grey Kangaroo. It describes the muzzle-tip as being " naked between the nostrils and there [*ibique*] covered with very black rugose skin " like the muzzle of a dog. The muzzle of the Great-Grey, on the contrary, differs from all other wallabies and kangaroos in being completely *haired between* the nostrils, which are narrowly-edged with naked skin.

Comparison of a skin and skull of the plainer Whiptail from near Cooktown with Solander's description indicates its specific identity with the first and smaller " kangooroo " described by Cook's party. The northern whiptail therefore takes the earliest name of *cangaru*, based by the German naturalist Muller, in 1776, on the description, and drawing made on the spot by Parkinson, artist of Cook's party. Anyone who studies that drawing in *Cook's Voyages*, Vol. iii, 1773, must realize that the slender-tailed animal with sloping shoulders, pointed snout, and relatively very large ears could not possibly represent a Great-Grey Kangaroo. The popular name " whiptail " refers to the unusually long slender tail, which equals the combined length of the wallaby's head and body. The specific name *elegans* for the southern race refers to the build and silvery-grey colour, and it is also known as the Prettyface wallaby because of the white cheek-marks outlined with dark brown; the backs of the ears have a contrasting dark brown base with greyish tips. These markings are much less conspicuous in the " mouse-coloured " Cape York whiptail and would therefore have made little impression upon Cook's naturalists, obsessed by the strange form of the " giant jerboa ".

The charming whiptail is one of the most inquisitive and least timid of wallabies, making it an ideal attraction for the sanctuaries so essential for its survival. Yet it is such ideal qualities, coupled with drastic shrinkage of suitable habitat, which today threaten its existence. It is surely a matter of human concern that for many years the skins were exploited for making those stuffed travesties of the koala, which can be much more convincingly made of clipped sheepskin. Because of the rapid disappearance from much of its scattered coastal range, the Whiptail has been totally protected as an item of " Rare Fauna " in New South Wales, with severe penalties for its destruction, or possession of skins. With humane tolerance, and the adequate fencing of crops and pastures instead of pressure for indiscriminate " open seasons ", the whiptail may yet be rescued from the tragic fate of the beautiful Toolache.

Nature Quiz

Q.: What are the facts about the Kookaburra's propensity for killing and eating snakes, and what else constitutes its food?

A.: It has been popularly accepted that this Australian bird is a wholesale destroyer of snakes. Competent observers accept this claim with reservation. While they have seen the birds actually killing snakes and flying through bushland with dead victims trailing from their bills, the snakes have all been comparatively small (not more than 2 ft. to 2 ft. 6 inches long). It is reasonable to assume that large snakes would be beyond the capacity of a Kookaburra to attack, and certainly beyond its ability to carry aloft in its bill. As the feet and legs are rather weak, and no talons are present, the heavy bill is the bird's only weapon of offence. It is entirely relied upon, too, for breaking a snake carcase into sections small enough to swallow. When a bird darts from above and grasps a snake in its bill, it commonly flails its victim against a rock, and often bears it aloft to be beaten against a tree branch or dropped from a height on to hard ground.

Lizards are also eaten by Kookaburras, and quite sizable ones are often swallowed whole after being beaten to death with the bird's heavy bill.

Other items of food are large and small beetles, as well as occasional frogs which are dived upon either in or on the borders of pools and creeks. This frog- and lizard-eating habit is the same as that of other non-laughing and often more brilliantly coloured members of the Kingfisher family.

A seldom mentioned aspect of the Kookaburra's behaviour is the marauding of the nests of small birds to devour both eggs and young.

Q.: Is it only the females among mosquitos, and certain kinds of wasps, that bite and sting?

A.: Yes! Females among these insects are notorious for the distress and pain they can inflict on humans. In mosquitos, the females are remarkably equipped for biting. The specially modified mouthparts are sword-like piercing organs used for making a wound in the skin of a victim. Male mosquitos have no biting equipment; their feebly developed mouthparts are used in feeding on the sap of soft plants. While certain mosquitos are mere irritating disturbers of our comfort, particularly after dark, others transmit to the blood stream of humans the causes of distressing, as well as dangerous, ill-health. The viruses of both dengue and yellow fever are thus introduced by a number of species. Others transfer from their bodies the asexual stages of the dread parasites of malaria. A blood feed is necessary for the biting female mosquitos to ensure the production of their young.

In a somewhat different way the stings of certain female wasps, some of which are popularly called hornets, are linked with the insects' progeny. They are either solitary insects, both large and small, or ones which live a community life around their papery nests. The sting is at the tail end of the body—a tubular stylet-like structure (ovipositor) serving the double purpose of depositing eggs and stinging. As a weapon of offence the structure is remarkably efficient. It connects with a poison gland and is used for paralysing prey—other insects of various kinds, and spiders. In some cases these victims of female wasps are carried to papery and mud nests above ground or to tunnels burrowed underground, where they remain entombed but fresh and ready for consumption when the larval young hatch from the eggs. Other female wasps kill insects such as caterpillars, and masticate them before feeding their larvae. Others again even lay their eggs in prey that has been stung into insensibility. The hapless humans who have innocently incurred the displeasure of a large solitary hornet in the foliage of some vine or thicket, or disturbed a swarm of wasps in and around an occupied nest, can vouch for the determination and ferocity of an attack. Unlike the bites of some mosquitos, the stings of wasps leave humans with no more than local soreness and inflammation which gradually diminishes.

Q.: Should spiders be referred to as insects?

A.: No! The practice of referring to spiders as insects is far too common; both are in well defined classes of their own. "Insects" is a name derived from the class Insecta, all members of which have six legs. Spiders, on the other hand, are grouped in a class called the Arachnida, and have eight legs.

Q.: Are the so-called Porpoises of Australian seas correctly named?

A.: There are no porpoises in the seas of the Southern Hemisphere; they inhabit the Mediterranean Sea and range across the Atlantic Ocean to America. The well known local small marine mammals so commonly called porpoises are strictly Bottle-nosed Dolphins, characterized by their greatly elongated snout, very different from the rounded, blunt snout of the porpoise. It should be noted, however, that not all dolphins are bottle-nosed. Some also have blunt snouts, such as the comparatively large Risso's Dolphin occurring in local waters.

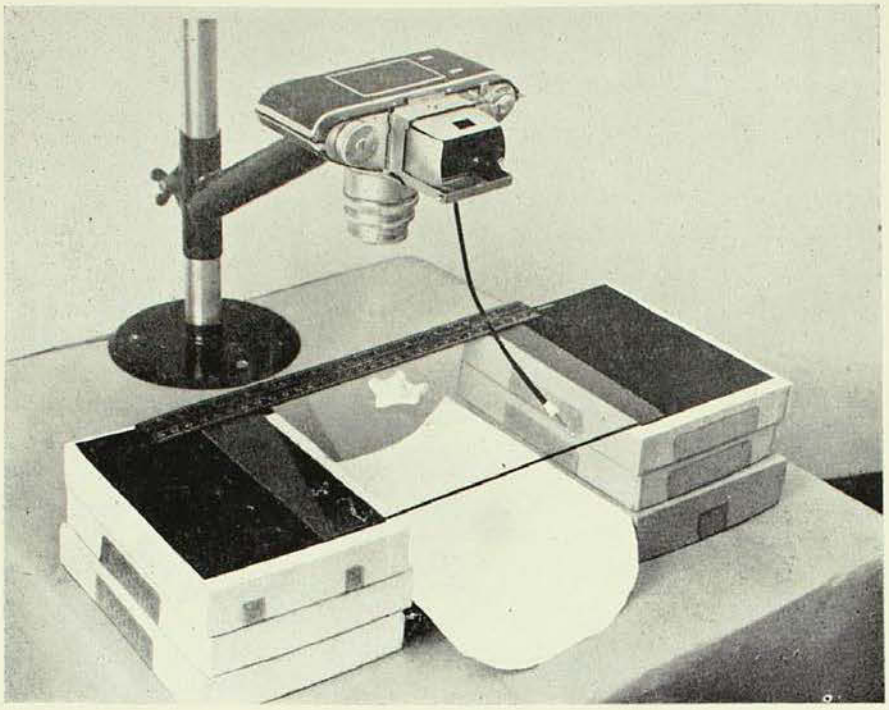


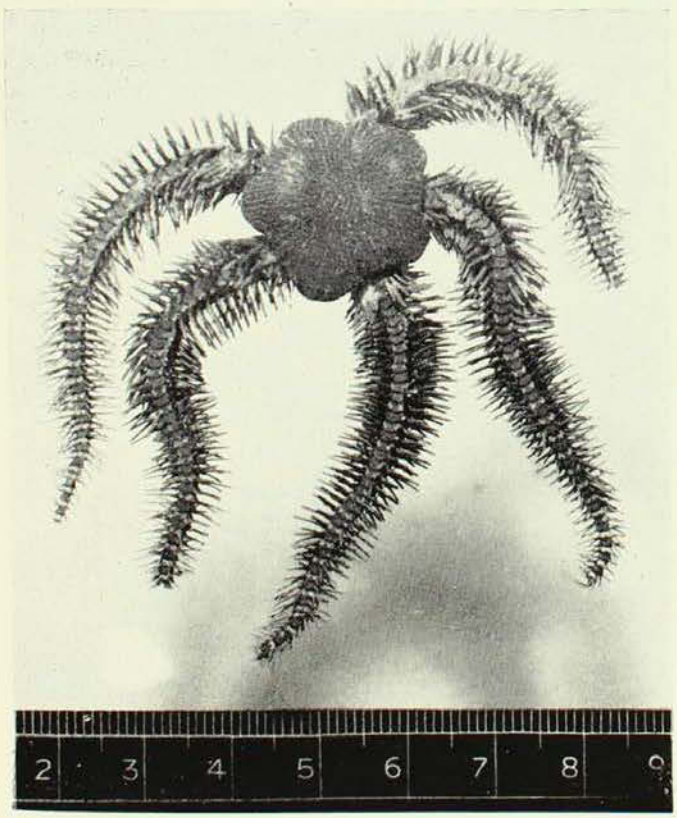
Fig. 1: A 35 mm camera set up to photograph a starfish. A *large* sheet of glass is used to prevent a shadow from the front edge of the glass falling across the paper background. The ruler is photographed with the specimen, to give the scale. To avoid unwanted glare or reflections, particularly when working with colour films, the boxes and table could be covered with black velvet.

Photographs Minus Backgrounds

By HOWARD HUGHES

WHEN specimens are being photographed to illustrate scientific material it is often desirable that the prints should not include distracting background details.

A number of methods can be used to achieve the right effect. Where the negatives are fairly large, and the image outline is not too intricate, the background can be painted out on the negative, using



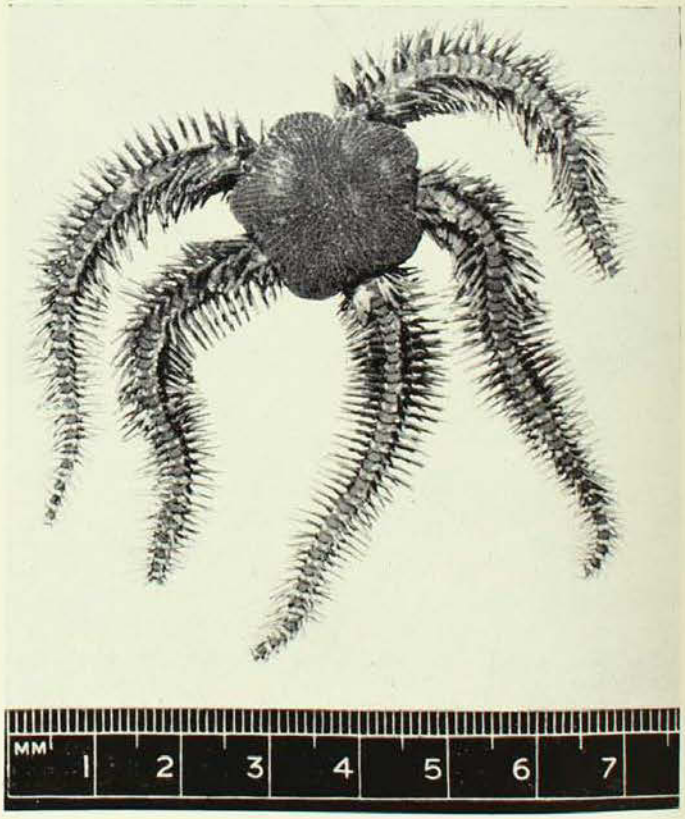


Fig. 2. (*left*): A deliberately faulty photograph of a difficult subject—a Brittle Star (*Ophiocoma pica*). The floodlight and background were too close to the specimen when the photograph was taken. Note the reflection of the room-light in lower left hand corner. Fig. 3. (*right*): A good illustration ($\frac{1}{4}$-plate negative). The room-light was turned off, the glass was raised, the ruler moved to a better position and the floodlight moved a little further away from the specimen.

special photographic opaque water colour; or the print itself can be air-brushed; or if a block for printing purposes is to be made from the photograph, the process engraver can etch out extraneous details.

It is preferable, however, to produce photographs which have not been retouched in any way, so that there is no suspicion that some feature of the specimen has been altered or obliterated. If the specimen is fairly flat it can be laid on a smooth surface and photographed (depending on the placement of the light) with a dark shadow emphasising its outline. When the specimen is sufficiently large it can be placed at a reasonable distance from a plain background to allow any objectionable shadows to fall outside the limits of the picture.

At the Australian Museum a well-established, professional photographer's technique has been used for many years to record small objects (see illustrations).

The aim is to separate the object from its background. This is achieved by placing a large sheet of paper on the floor or a work-table and, by means of boxes or an adjustable frame, suspending a sheet of clean glass at a suitable distance above it (Fig. 1). The specimen is placed on the glass, under the vertically mounted camera and, if necessary, it is held in position with small dabs of plasticine. By careful arrangement of the lighting (either artificial or natural) to avoid reflections or shadows, it is possible to photograph the object against a completely blank background. It is in this way that many of the illustrations in this MAGAZINE are made.

Notes and News

New Aboriginal Exhibits

Eighteen new exhibits are being installed in the Museum's Australian Aboriginal gallery. Exhibits on hunting and fishing methods, dress and ornament, magic and medicine, tribal distribution, trade, fire-making, methods of communication, and spirit beliefs are nearing completion in a new series of island cases.

Jellyfish Stings

The summer season just passed was notable for yet another spate of attacks by medusae (Jellyfish) along the coasts of Queensland and New South Wales. Two reported cases (one fatal) in the tropical north were almost certainly due to stings from Sea Wasps (carybdeid jellyfish). At Townsville on December 13, 1956, a 58-year-old man died within half-an-hour of being stung while wading in shallow water. On February 3, near Mackay, a 12-year-old boy suffered partial paralysis before recovery; he lapsed into unconsciousness after being stung and had to be carried from the water. In New South Wales, the temperate waters off Sydney's surfing beaches have had the usual visitation of small mauve coloured jellyfish (*Pelagia panopyra*) apparently with stings more distressing than usual to susceptible bathers. A number of severe cases have been reported both to the Press and to the Museum. The worst stinging case was at Collaroy on January 24, where *Panopyra* is believed to have stung a young girl, who was paralysed for several days and whose limb joints swelled.

It is interesting to learn that, after so many cases of fatal stingings in Queensland waters, interest is at last being aroused in the biochemical nature of the Sea Wasp jellyfish poison.

Gallery Closed

The New Guinea anthropological gallery has been closed to the public so that it may be used to house ethnographical specimens from the Pacific Islands, Africa and other places. This extensive collection, used for reference and study, is largely irreplaceable, being the result of over a century of collecting. It was formerly stored in sheds in the Museum grounds but the difficulty of protecting the specimens from dust and insect pests, and the danger of fire in the hot summer months, has necessitated a transfer to safer quarters.

Exploring Between Tidemarks

V. Hints to Shore Explorers

By ELIZABETH C. POPE and PATRICIA M. McDONALD

KNOWING the ropes is always a great advantage in any undertaking of a practical nature and seashore exploration is no exception. So a few hints will not be amiss and some advice as to simple projects for scientific exploration will also be suggested.

DRESS

Experienced shore ecologists generally look like ragamuffins, but old clothes and shoes are best when one may be thoroughly wet by sea-water. To spend an hour or so poking about on the shore in pleasant sunshine is very different from working for the duration of a low tide, and even in summertime warm clothing should be taken to the shore in case of need. The possibility of sunburn while on a reef *must not* be forgotten even in winter, nor should it be treated lightly, especially in the tropics, and so we recommend the following garb. In summer, shorts, or long cotton overalls if fair-skinned; a shirt with a collar to cover well up the back of the neck and sleeves that can be rolled down (against sunburn); a wind cheater or old windjacket. Shoes must be worn; old sandshoes with socks to keep one's heels from being chafed by salt water and rubbing are best. Above all always wear a hat, however sunless the day, in preference to caps or other headgear that leave the neck exposed as one bends over pools, etc. Never wear just bathers unless inured to long periods in the sun. In winter suitably heavy garb with long trousers can be worked out according to individual needs. Long trousers wet from the knee down are warmer than dry shorts.

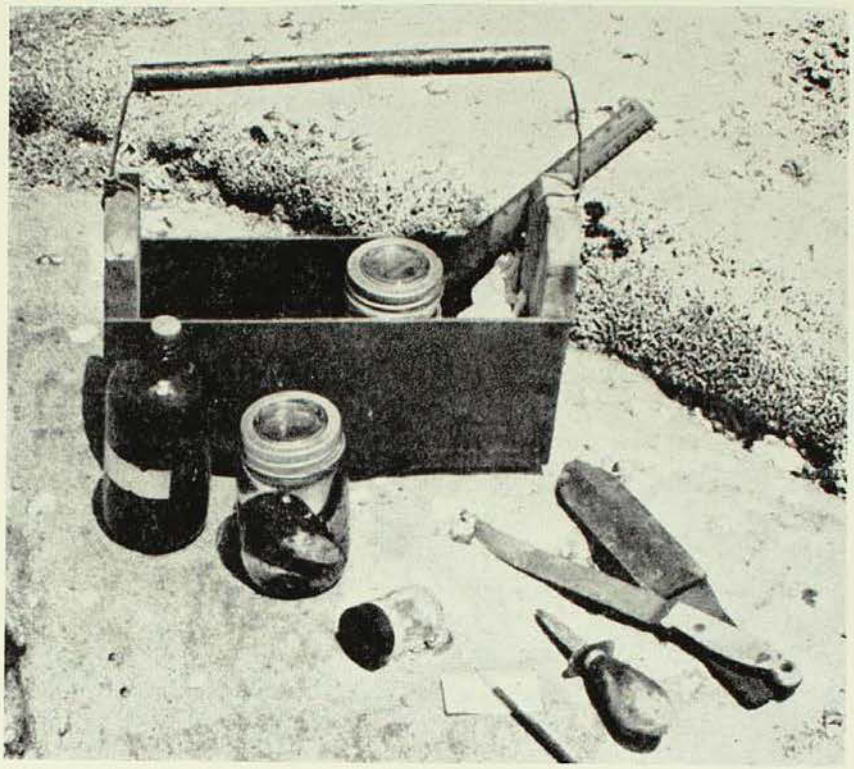
COLLECTING GEAR

The minimum requirements for collecting gear are a galvanized bucket or tin billy, and a tool such as a flat-bladed oyster knife, which can be used in a variety of ways—as a spatula (picking up delicate worms), for digging in rock crevices, for gouging sea urchins out of holes and for prizing limpets off stones. Also it can be used like an ice pick for chipping off encrusting species from rocks. The authors' standard collecting gear is illustrated on page 197. The strong wooden carrier has a drainage hole to allow the escape of any fluids spilt in it. It is fitted with jars and bottles of varying sizes and a bottle of pure (40%) Formalin to be used as a preservative when diluted with seawater. An oyster knife, paper labels, and a pencil for writing, completes the outfit for most reefing trips. The reader will in time work out for himself the most suitable gear for his particular kind of collecting.

PRESERVATION OF SPECIMENS

Ideally, each group of animals requires special treatment and preservation after capture. Whole books have been written

Summer dress for shore workers; note the shady hat and long sleeves.



Basic equipment for shore collecting (see text for description).

on this one aspect of zoological collecting so we merely mention here the modern one by Wagstaffe and Fidler [1] and the more modestly priced but very useful publication by A. R. Main, *A Guide for Naturalists* [2]. However, a solution of Formalin in seawater in the proportion of approximately 1 part to 20 will be found quite effective for preserving most school or university class or private reference specimens. Since most commercial Formalins are somewhat acid they should be neutralized with borax before being used to preserve any creature with a limy shell or protective covering, *e.g.*, for molluscs, echinoderms or worms with limy tubes, (*Galeolaria* and relatives). These limy specimens may best be preserved in a mixture of 75 parts methylated spirit and 25 parts tap water.

Most beginners at shore exploration tend to collect far too much during their visits to the shore. Then, when it comes to the narcotizing, killing and preserving and, above all, the labelling of the haul from a single tide's activities, they weaken and throw away much they have gathered, probably leaving the animals to die far from their normal habitats. How much better it is to take only what is essential to further studies and explorations and leave the rest on the shore. There will always be other low tides on other days and on other reefs.

Keeping Records and Labelling

The gradual building up of written observations and records of habits of each species is something that can and should be done only on the shore. A rock pool can make a good temporary aquarium and photographing in colour or, if you have the talent, sketching and drawing the live animals should be far more fascinating and rewarding than accumulating dull and colourless pickled specimens. The beauty of form and colour is often lost when invertebrates are preserved and while collections are necessary for study the best place for them is in museums and other research and educational institutions. A well kept and illustrated diary and field book on the other hand can be of great value to a shore explorer. So notes should be kept of what is seen.

1. *The Preservation of Natural History Specimens* Vol. I. Invertebrates. H. F. and G. Witherby Ltd., London. £2 2s. 0d. stg.

2. Published by the West Australian Naturalists, Perth, W.A. 6/-.

If collections are to be made for scientific purposes, correct labelling is essential. Labelling of specimens would at first sight seem easy but few people do it well. Most often forgotten is the necessity for using a quality of paper that will not deteriorate over the years, or be affected by solutions of Formalin or alcohol. A smooth water-colour sketching paper (even of a cheap quality) will be found to stand the above tests best. Writing on the label must be clearly done in waterproof India ink or preferably a dark pencil. Include the label *in* the storage bottle or glass tube with the specimen. External glued-on labels tend to fall or tear off. Always label specimens in the field, even if tidy labels have to be written later. It is surprising how soon one can forget "what specimen is what".

A label should show the place and date of collection, the kind of niche or habitat in which the specimen occurred, and the name of the collector. If known, the name of the specimen can be added but it is the least important information in many cases. Keep the label as small as possible, and write on both sides of the paper.

Name: Patiriella calcar	*Remarks*
Locality: Steel Point, Vaucluse, Port Jackson, N.S.W.	Colour:
Habitat: In pools in crevices from mid-tide to low water neap tides.	Breeding: [Back of Label]
Date: 2.XI. 1956. Collector, J. Doe.	Food:
	Notes:

When to go Exploring

The best times to go collecting on a shore have been mentioned in an earlier article, but a repetition here will not be amiss. Low spring tides are best, when a calm sea coincides with an offshore breeze to minimize the surf. While bright sunny days are delightful from the point of view of enjoyment, the best observations will be made on grey, overcast days, when many of the cryptic animals will venture forth and notes can be made of unusual and interesting feeding and breeding habits which otherwise can be studied only when night-prowling with a torch.

Tide tables covering twelve months can be bought but for rough and ready reckoning ahead remember that spring tides occur on or near the times of full and new moon. Begin explorations about 3 to 4 hours after the tide begins to fall and follow the receding tide line as it goes out. In this way the animals will be seen before they have hidden themselves to await the return of the life-giving waters.

Safety First

A reef fossicker should always be able to swim and even then no trip should be made to a surf-washed shore alone. Don't get cut off by the rising tide; always keep an eye on the sea. It is possible to become absorbed with the animals on a reef and to forget to watch for the dangerous, and unexpected, large wave. If working in pairs or numbers one member can keep a weather eye on the waves while the others search. Tragedies can happen to "lone wolves".

If about to be engulfed by an unexpected wave either stand your ground side-on (as in the surf) with feet firmly planted apart or, if the danger is really great, imitate the starfish. Lie flat and cling with all your strength to the rock. The wave will probably pass over you.

Make sure that all collecting gear and cameras are well above the highest level that any wave will reach. There's nothing so maddening as seeing one's prize specimen bobbing out to sea in a tin billy.

Carry some simple antiseptic to apply to cuts from barnacles, oysters and above all, corals (on the Great Barrier Reef) for seashore cuts often become infected and are slow to heal unless treated at once.

Sunburn has already been stressed but its seriousness must be underlined for it is the mishap most likely to befall a rock-hopper. When a severe reddening of the skin is noticed roll down shirt sleeves and don overalls. In this way sun-poisoning and blisters may be avoided.

Very few animals on local shores are dangerous or poisonous. The Bluebottle (*Physalia*) is about the worst sting one is likely to encounter, or the bite of a small green reef eel if fingers are poked indiscriminately into dark hollows.[3]

THINGS TO DO

While it is interesting merely to poke at random among shore boulders and rocks, it is much more exciting to undertake set projects and through them gradually to learn something of the fascinating, ecological pattern of the shore. The authors therefore suggest some ideas for planned explorations and these could be applied also to school excursions for the study of biology and zoology.

1. One or two field days may profitably be spent learning "who's who" on the seashore and observing the variety of organisms. Do not forget the cryptofauna when making your census. By 1889, 1,681 species of marine animals had been recorded in Sydney Harbour and its environs by Thomas Whitelegge and many more have been added since that date. How many can you find in one low tide?

2. Study in detail one animal community, such as the animals of the *Galeolaria* band, those of the mussel clumps, the oyster band, the Cunjevoi belt or the seaweed mat. How many of each kind live in a square foot? Find what animal eats what and work out the food-web. Is a square yard of rock in the oyster zone more productive of animal matter than a square yard of good arable land? What are the seasonal variations, if any, in this community? If any creature lives only in one community, what is the reason?

3. Make simple studies of single animals throughout a year or more—life cycles, growth rates and habits. How does this animal affect other species living with it? Individual studies of this kind are sadly lacking for most local seashore creatures. Keen aquarists could rear some species in captivity and make useful observations on feeding habits, seasonal behaviour and breeding.

4. The recording of the basic zonation of any rocky reef is an essential preliminary to a proper understanding of almost any research project undertaken on shore reefs. One orientates oneself by reference to the plant and animal zones. It is not necessary to map vertical zoning as accurately as a surveyor or map-maker would; the following rough and ready method is sufficiently accurate. Equipment needed includes a straight stick graduated in six-inch lengths

3. *Marine Stingers*, this MAGAZINE Vol. XI, No. 4, and *Some Sea Animals That Sting and Bite*, Vol. IX, No. 5.

Group of students making a line traverse on the rocks at Balmoral. The back group is measuring the height of the barnacle zone. The front group is counting the various animals lying within six inches of either side of a traverse line and recording the results.

Gently-sloping, smooth rocks such as the granites at Bicheno, Tasmania, provide a textbook-like arrangement of plant and animal zoning and are easy to map.

Photos.—E. C. Pope.

for measuring heights, a long line (rope or twine), a measuring tape or carpenter's rule (for use in traversing), several T-squares of different lengths, a spirit level and several wooden school rulers.

The choice of a suitable area is most important because of the time limit imposed by the tides. The ideal area is one where fairly smooth rocks slope at an angle of from 15° to 20° to the water as illustrated on this page. Unfortunately such rocks are not always available in the area to be worked and it is best then to select a place where the rocks ascend in a series of steps from low to high water mark. Also make sure that the reef to be worked

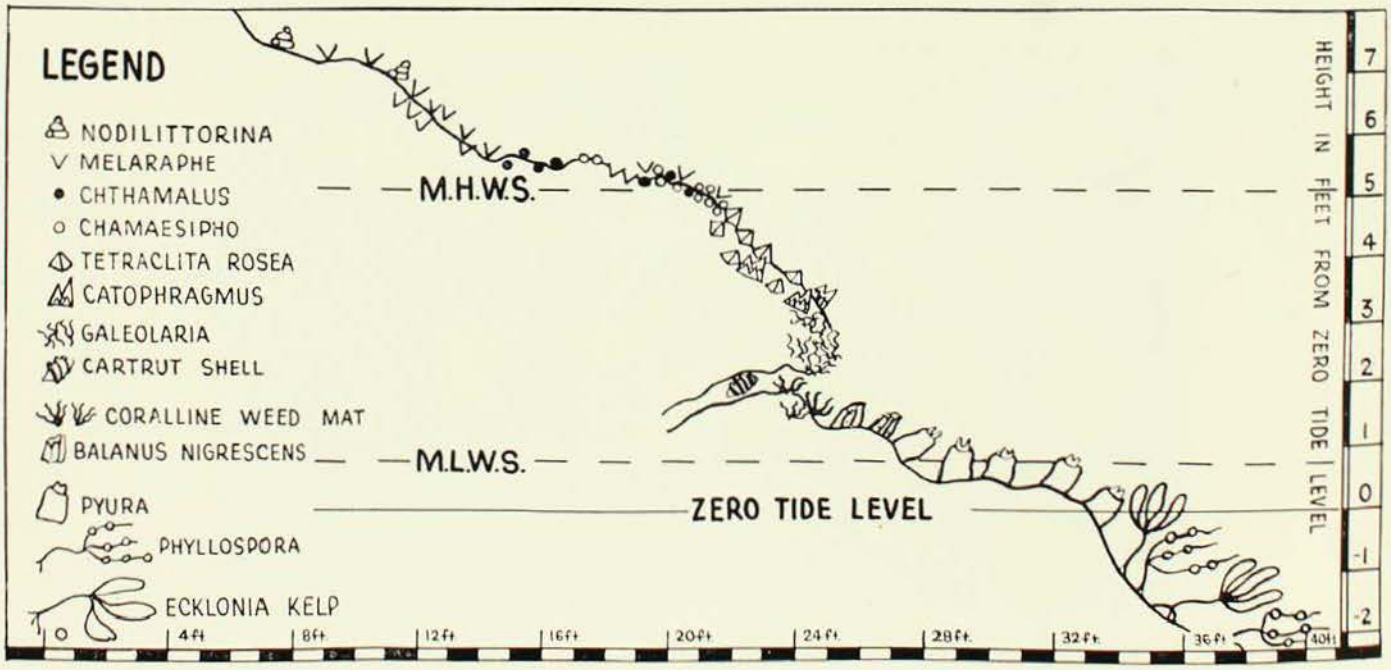


Diagram of the profile of a rock platform with common zoning organisms recorded for a typical sandstone reef near Sydney, where exposure to waves is sub-maximal.

F. J. Beeman del.

is not too wide or the survey will be incomplete before the return of the tide. Suitable areas will be seen in some of the illustrations in earlier parts of this series of articles.

In the selected area lay down the rope so that is stretches from extreme low water mark to well above the high tide level. This will be the line along which the transect is made. Then measure and draw a profile chart along the line selected for work, using the simple equipment already mentioned and following elementary mapping methods. (Here school biology groups might call in the aid of the geography or mathematics group). Then draw the profile on graph paper to a suitable scale, remembering that the vertical scale will have to be exaggerated in comparison with the horizontal one in most areas. The next step is to record the occurrence along the line of the traverse of the plants and animals prominent as zone markers, and their relative abundance. It is customary to note only the organisms that lie within six inches of either side of the traverse line (here use school rulers) and record them as set out below:

This information is superimposed on the profile chart using symbols as in the diagram on page 200. The result should be a clear picture of the zonation pattern for the area being studied. It is then possible, by repeating the experiment in different localities, to compare the zonation under different sets of environmental conditions.

AIDS TO FURTHER STUDIES

Australian Books

Australian Seashores (Angus and Robertson, Sydney and London). By W. J. Dakin, Isobel Bennett and Elizabeth C. Pope. 45/-. Profusely illustrated, it will help to identify most common seashore animals. It also gives an account of their habits and habitats.

Australian Shells (Georgian House, Melbourne). By Joyce Allan. 75/-. (Soon to be reprinted). Illustrated by colour plates and the author's drawings; gives details of the structures and habits of the molluscan fauna.

Field Work in Animal Biology. (Angus and Robertson, Sydney and London). By Mary Besly and G. R. Meyer. 7/6. This book gives hints on how to carry out simple field projects suitable for beginners at shore exploration.

The Australian Museum Magazine (The Australian Museum, Sydney). 2/- a copy (some "back copies" at 1/-). These magazines provide some

Galeolaria band *Ibla* 4 molluses 15 worms 4	3 ft.	*Galeolaria* band and associated animals *Ulva* 4 Crevice 6" high contains cartrut shell
Galeolaria band coralline weed and associated fauna Patelloid limpets 10 *Balanus nigrescens* 20 *Pyura* 2	2 ft.	*Galeolaria* band Coralline weed mat *Balanus nigrescens* 10 *Pyura* 1
Pyura 3 Cartrut shell 2 Sea urchins 3	1 ft.	*Pyura* 10 tent shell 1 *Ulva* sea lettuce 10
← 6"	zero tide level	6" →
Pyura 2 Large brown algae *Ecklonia* & *Phyllospora*		*Pyura* 1 Kelp fronds

of the best pictures and field accounts of intertidal animals, especially those of the sandy-mud, sand, and the mangroves.

Overseas Books

The following, selected from the wealth of books available, will provide general reading of interest. The information in them can be adapted for local conditions.

Life of the Shore and Shallow Sea (Nicholson and Watson Ltd. London). By D. P. Wilson.

Between Pacific Tides (Third Edition, revised by Joel W. Hedgpeth, Stanford University Press, Stanford, California). By E. Ricketts and J. Calvin. An excellent ecological approach to the subject.

The Living Tide (Victor Gollancz, London). By N. J. Berrill.

The Seas (Frederick Warne and Co. Ltd., London and New York). By F. S. Russell and C. M. Yonge.

The Edge of the Sea and *The Sea Around Us* (Staples Press Ltd., London). By Rachael Carson.

For those who are newcomers to the field of marine ecology, some knowledge of the basic structure of the animals is essential. Many textbooks have been written on this subject but by far the best and most accessible of these is Ralph Buchsbaum's *Animals Without Backbones*, recently published in two volumes in the "Pelican" series.

(Concluded)

Aboriginal Rock Engravings in a Mosman Garden

By FREDERICK D. McCARTHY

IN May, 1956, Mr. R. Bergraff informed me that there were some interesting rock engravings in the garden of an old home in Ben Boyd Road, Mosman, Sydney. They had been known to his family for fifty years or more but no record of them was held by the Museum, although the figure of an emu on another rock five chains to the north was recorded by W. D. Campbell in his rare but well known memoir on the subject.

I examined the figures shortly afterwards in company with Mr. Bergraff and Mr. G. M. Carson, North Sydney Council's Engineer. They illustrate well how almost every group of rock engravings one examines reveals a figure either completely unknown hitherto or an important variation of a known type. The figures at present visible in the Ben Boyd Road group comprise a wallaby in a restful pose, a small headless man, and a duck-like bird in flight, all dwarfed into insignificance by the enormous figure of a mythological creature almost twelve feet high. It has the body and leg of an emu, a bag-shaped foot (probably representing a human one), a huge projection in front (probably a penis), and although the head is missing it could have been that of a kangaroo. The creature is unique among the numerous rock engravings of the Sydney-Hawkesbury district.

This highly imaginative symbol of aboriginal beliefs is a composite human and animal figure, one of a type of ancestral spirit beings mentioned in the mythology of south-eastern Australian tribes. It is one of a group of culture heroes believed to have created the land, animals and plants, the natives and their customs, and to have established the ceremonial places of the tribes and taught them the rituals to be performed. During ceremonies some of

Mr. F. D. McCarthy, Curator of Anthropology at the Australian Museum, recording aboriginal engravings in a Mosman garden.

these beings were said to appear in various guises, particularly on the Bora grounds during initiation ceremonies. Some, like Daramulan, were believed to initiate youths. These beings could appear in a composite form of human characters combined with those of totemic animals. The Ben Boyd Road figure is thus an important one, and the site is, or was, a sacred place at which rituals of a totemic nature, probably associated with initiation were carried out by the local Aborigines.

As the illustration shows, the engravings now visible are hemmed in between a house and a fence of the adjoining cottage. I was anxious to find out the shape of the head, and of the end of the long projection (which looked like an arm holding some object) from the body of the large figure. The occupants of the cottage kindly permitted the Council to demolish part of the fence and take up portion of a path, but to my great disappointment it was found that a drain had been cut in the rock under the path and the head of the figure destroyed in the process. We were able to complete the recording of the balance of the figure.

It is probable that more figures are engraved on the rock surface under the house, which is some one hundred years old. In fact, Mr. Bergraff, when a child, was told by his grandmother that there were some fine carvings covered by the house. Large groups commonly occur on such rocks. It is hoped that eventually it will be possible to see what they are.

There are not many groups of rock engravings so close to the city, but the rapid expansion of the outer suburbs is enclosing seme groups in private gardens, destroying others, and exposing a large number to vandalism. The Museum has had several other reports of engravings in private gardens and these will be investigated when time permits. The preservation of endangered groups rests largely upon local councils and residents, particularly the latter who, in many instances, can prevent children and visitors from damaging them.

The Museum is grateful for the co-operation of the North Sydney Council, and of the occupants of the two houses in Ben Boyd Road, for so willingly assisting the recording of these interesting relics of the Aborigines.

Book Review

PRIMITIVE ART: By Franz Boas. Dover Publications Inc., New York, 1955. 372 pages, 308 text figures, xv plates. Price $1.95.

The number of books on primitive art has increased tremendously during the past decade, but among them all this volume by Boas, published originally some thirty years ago, still retains a leading position. Its author became one of the leaders of antaropological theory in America, and his vast contributions to our knowledge of Indian and Eskimo cultures gained for him world renown.

In this book Boas analyses formal and representative art, and also style and symbolism. The conclusions reached are applied in a description of the fascinating art of the Pacific North Coast tribes of North America. A final chapter is included on literature, music and the dance. Each point discussed is illustrated by a clear diagram, and although the bulk of the examples quoted are American the author has used for comparison art material from all over the world.

Boas bases his discussion on two principles. One is that there is a fundamental sameness of mental processes in all races of man and in all cultural forms of the present day. Thus he rejects the idea that the mental equipment of primitive man is distinct from that of civilized man, and points out that behaviour is determined by the traditional material of a culture. His second principle is that each culture can be understood only as an historical growth determined by the social and geographical environment in which each people is placed, and by the way in which they develop the cultural material that comes into their possession from the outside or through their own creativeness. Within these terms of reference he discusses the nature of art, technical perfection, manual action or motor habits, virtuosity, rhythm, repetition, form, stability, and many other aspects of primitive art.

As a diffusionist, Boas tempers his acceptance of the principle of the spreading of culture from people to people by a keen appreciation and intense study of local inventions and developments. He discusses, in their bearing upon this problem, the relationship of geometric and representative or realistic art, the existence of several distinct art styles among the one people or in the one culture, and the importance of the geographical distribution method (the age and area theory of the biologists) in the analysis of primitive culture and art.

This is a book of outstanding importance to all interested in the development of art because of its unbiased analysis of designs and their possible origins, and of the well documented discussion of every aspect of primitive art of importance to the layman, student and anthropologist.

F. D. McC.

RECEIVED: Sea Shore, Swamp and Bush: Exploring Nature's Mysteries. By Ada Jackson, M.Sc. Paterson Brokensha Pty. Ltd., Perth, W.A. Second ed. (Price, 28s. 6d.)

Popular Science Lectures

Fortnightly lectures on popular science subjects were commenced at the Australian Museum in May. The lectures, which are usually illustrated by films or lantern slides, begin at 8 p.m.; doors open at 7.30 p.m. Admission is free. Lectures yet to be given are as follows:

Date	*Subject*	*Lecturer*
June 19	"Frogs with a Family Tree"	E. M. Stephenson, Ph.D.
July 3	"Unique Australian Mammals"	E. le C. Troughton, F.R.Z.S., C.M.Z.S.
July 17	"Whales"	W. H. I. Dawbin, M.Sc.
Aug. 7	"In Quest of the Golden Bower Bird"	N. Chaffer
Aug. 21	"Exploring in Fiordland, New Zealand"	H. B. Wisely, M.Sc.
Sept. 4	"Fiji, Past and Present"	A. Capell, Ph.D.
Sept. 18	"Animals in Armour—Starfishes and Sea-Urchins"	E. Pope, M.Sc.
Oct. 2	"Freshwater Fishes of Australia"	G. Whitley
Oct. 16	"The Amateur Mineralogist in the Field"	L. E. Koch, Ph.D.