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Whistler or White-Throated Thickhead.

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THE AUSTRALIAN MUSEUM

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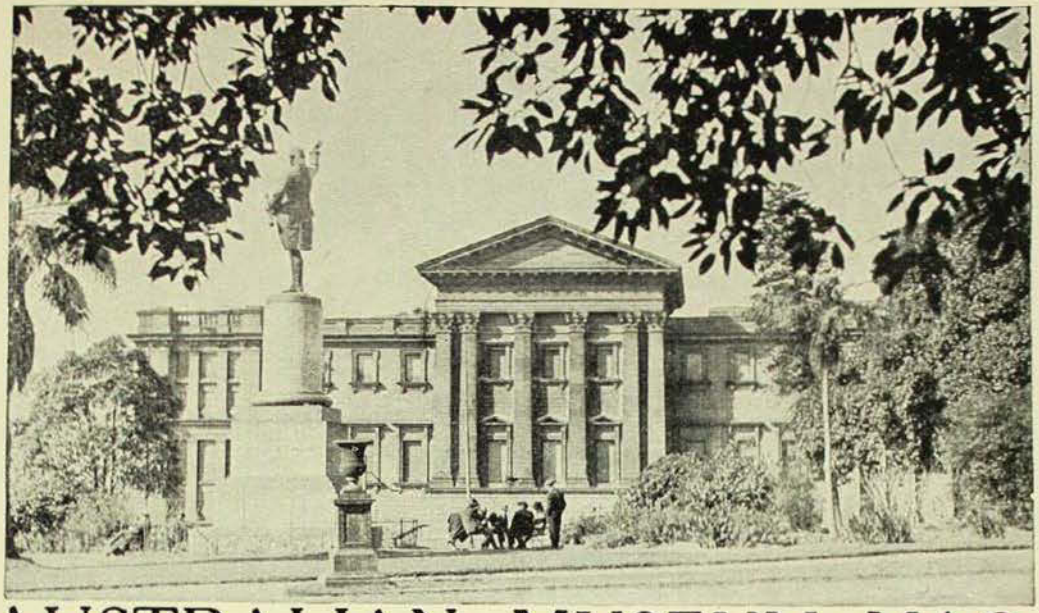

THE AUSTRALIAN MUSEUM MAGAZINE

● OUR FRONT COVER. The Whistler or White-Throated Thickhead (*Pachycephala pectoralis* Latham) is by Lilian Medland. It is one of a series of postcards issued by the Australian Museum.

The Thickheads or Whistlers are distributed all over Australia and have a wide extension into the islands of the Pacific. They fall roughly into three series, one having yellow breasts, the second red in the male, while the third is more or less plainly coloured in both sexes.

The Golden Whistler, as it is often called, is a bird of the scrubs, gullies and heavier forests, and is a glorious songster with loud ringing voice and a variety of beautiful notes. It avoids the interior, but is found throughout the coast and ranges right round Australia. It breeds in the spring, the nest being composed of twigs and placed fairly close to the ground in a shrub or small tree. The eggs are two in number, glossy white or buff, blotched at the larger end with slate and brown.

VOLUME V, NUMBER 11. JULY-SEPTEMBER, 1935.

The Fall of the Weatherboard.
[*After* Skinner Prout *in* E. C. Booth's *Australia Illustrated*, 1874-76.

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VOL. V, No. 11. JULY-SEPTEMBER, 1935.

Darwin in Australia

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

IT is almost a hundred years since Charles Darwin, the famous naturalist and author of that epoch-making work "The Origin of Species by Means of Natural Selection", visited Australia in H.M.S. *Beagle*, which during the years 1831–1836 made a voyage of exploration round the world. Darwin, who was naturalist to the expedition, was then a young man of only twenty-six, but already since the commencement of the voyage he had made a number of important observations on the natural history and geology of the countries visited, particularly in South America, which like Australia, if in somewhat lesser degree, is characterized by a peculiar and distinctive fauna. Unfortunately Darwin's stay in Australia was very brief, he did not see very much of the country, and consequently his opportunities for the study of its geological structure and living inhabitants were restricted. This no doubt accounts for the somewhat superficial character of his observations, and the contradictory nature of some of his conclusions.

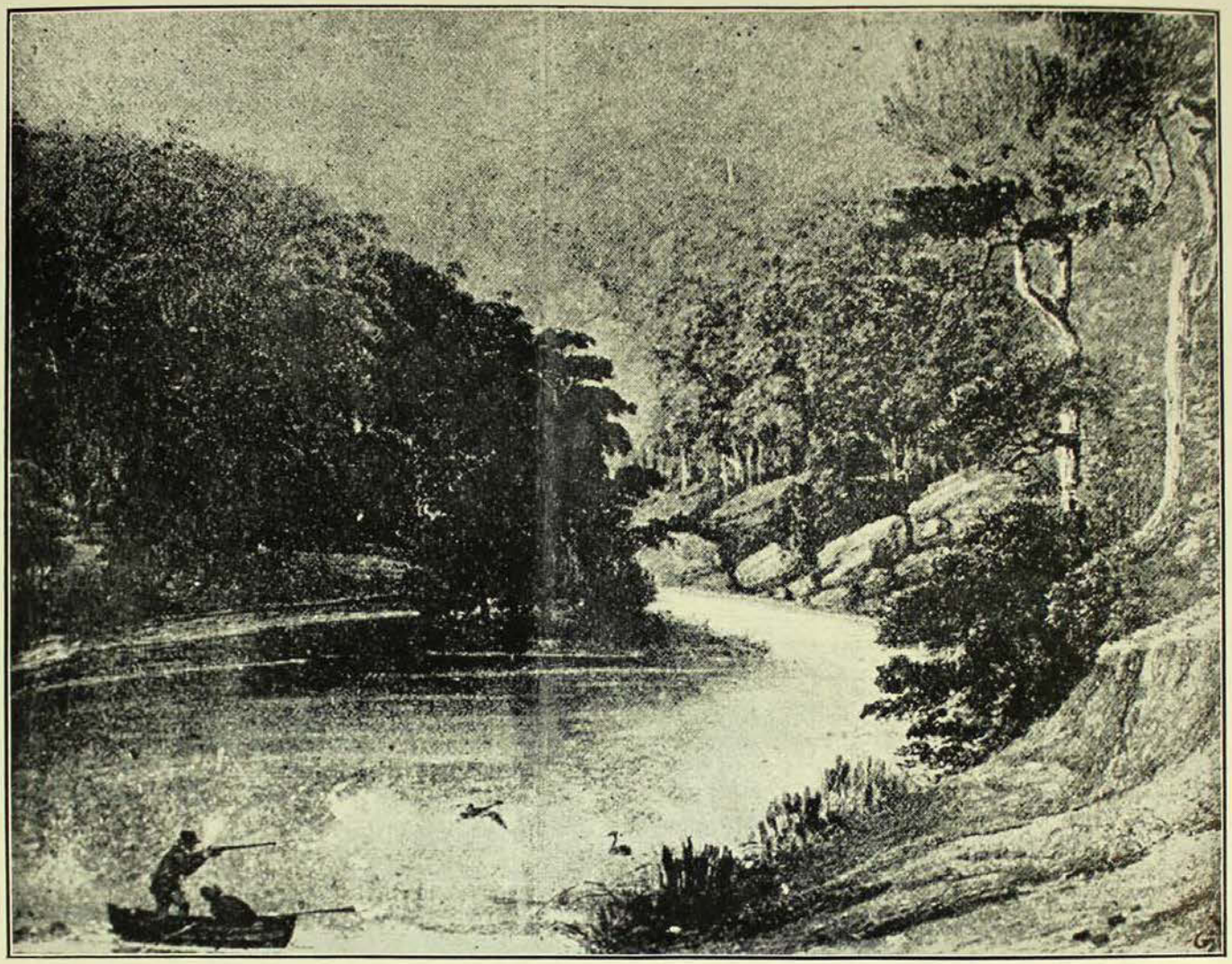
Yet the chapter "Australia" in his *Journal of Researches*, his "first literary child", is not without interest and importance. The work was written before Darwin had formulated the theory which created a revolution in scientific thought and the interpretation of nature, but there is evidence that he was just at the turning point, and indeed it was largely as the result of observations made on this voyage that his conception of the origin of species began to take form in his mind.

SYDNEY.

It was early on the morning of January 12, 1836, that a light air carried the ship towards the entrance to Port Jackson, which Darwin describes as a fine and spacious harbour with cliff-formed shores. In the evening he took a walk through the town and returned full of admiration, remarking that here in a less promising country scores of years have done many times more than an equal number of centuries have effected in South America.

RIDE TO BATHURST.

After four days' stay in Sydney Darwin hired a man and two horses to take him to the "village of Bathurst", hoping



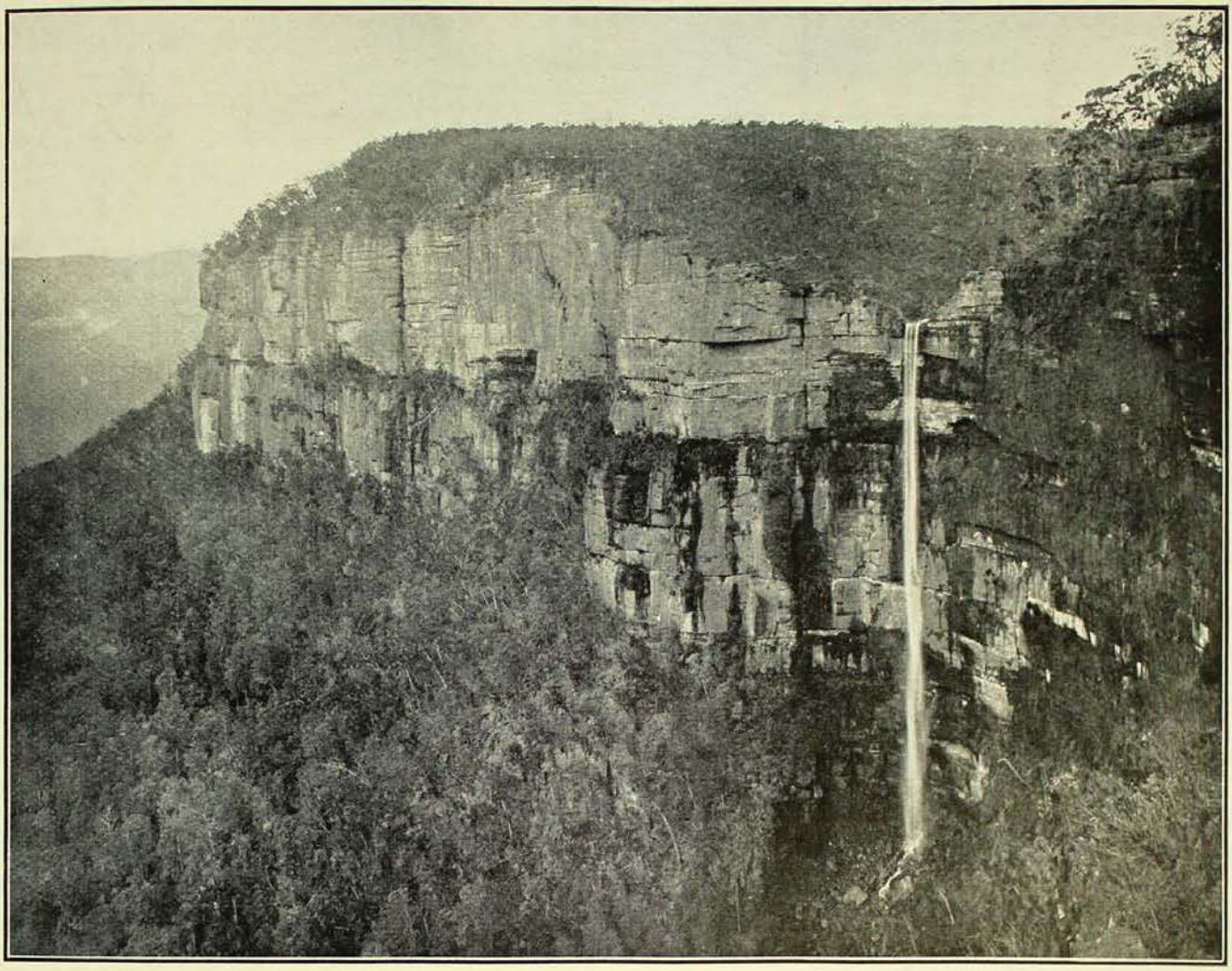
Emu Ford. From a reproduction in "The Australian Field", 1904. The original water-colour is in the possession of Mr. R. H. Antill, Jarvisfield, Picton, New South Wales. The picture was made when Lewin accompanied Governor Lachlan Macquarie on a journey to Bathurst in 1815.

[J. W. Lewin, *del.*

by this journey to gain a general idea of the appearance of the country. He set out on the morning of January 16, travelling by the Great Western Road, and that night slept at Emu Ferry, now Penrith. The roads, he writes, were excellent and made on the macadam principle, whinstone having been brought for the purpose from a distance of several miles. The countryside struck him as bearing a close resemblance to England, though he remarks: "Perhaps the ale-houses here were more numerous".

ABORIGINES.

At sunset the travellers encountered a party of aborigines, who were induced to throw spears for Darwin's amusement; he speaks in high terms of their skill at this and at tracking. Darwin's remarks regarding the aborigines are interesting considering that they were made a century ago by a close observer who in his travels had encountered many native races and was thus in a position to make comparison with other primitive peoples, though we must bear in mind that his contact with native Australians was exceedingly brief. On the whole they appeared to him to stand some degrees higher in the scale of civilization than the Fuegians, an opinion, however, which is not very flattering, for in the same work he asserts his belief that in Tierra del Fuego "man exists in a lower state of improvement than in any other part of the world". It appeared curious to Darwin that in Australia a set of harmless savages should wander about in the midst of a civilized people, gaining their livelihood by hunting, keeping up their ancient distinctions, and sometimes warring with one another. He mentions



Govett's Leap, near Blackheath. The water leaps 530 feet from the plateau to the valley below.

[Photo.—*Government Printer, N.S.W.*

a recent tribal conflict which had taken place in the centre of the village of Bathurst, a most serviceable battle-ground for the vanquished side, as the runaway warriors took refuge in the barracks !

It is perhaps not surprising to learn that at the time of Darwin's visit it was already apparent that the aborigines were rapidly declining in numbers ; this decline he attributes to the introduction of spirits and of European diseases, and to the gradual extinction of the wild animals. These are evident causes of destruction, but Darwin mentions that there is some more mysterious agency at work through the influence of which death appears to pursue the aborigine wherever the European has trod.

THE BLUE MOUNTAINS.

Early on the following morning the little party crossed the Nepean by ferry-boat and started up the incline of the Blue Mountains, baiting their horses in the middle of the day at " a little inn called the Weatherboard " (now Wentworth Falls). Here Darwin encountered a kind of view which was to him quite novel and extremely magnificent. He thus describes a typical Blue Mountain valley : " Following down a little valley and its tiny rill of water, an immense gulf unexpectedly opens through the trees which border the pathway, at the depth of perhaps 1,500 feet. Walking on a few yards one stands on the brink of a vast precipice, and below one sees a grand bay or gulf, for I know not what other name to give it, thickly covered with forest. The point of view is situated as if at the head of a bay, the line of cliff diverging on each side, and showing headland behind headland, as on a bold sea-coast. These cliffs are composed of horizontal strata of whitish sandstone, and are so absolutely vertical that in

Bathurst from the west in 1840. From a photograph of a sketch in the Mitchell Library. [Artist unknown.

many places a person standing on the edge and throwing down a stone can see it strike the trees in the abyss below."

In the evening "the Blackheath, a very comfortable inn kept by an old soldier", was reached, and early on the morning of January 18 Darwin walked to Govett's Leap, where, he remarks, the view is similar to that seen at the Weatherboard, but perhaps even more stupendous.

He was led to consider the mode of origin of these mountain valleys, many of which, though several miles wide at their heads, contract towards their mouths to such a degree as to become impassable. We now know that these valleys and gorges have resulted from the long-continued action of running water, a view which was considered by Darwin but abandoned as untenable. He supposed that: "the strata were heaped by the action of strong currents and of the undulations of an open sea, on an irregular bottom; and that the valley-like spaces thus left unfilled had their steeply sloping flanks worn into cliffs during a slow elevation of the land; the worn-down sandstone being removed, either at the time when the narrow gorges were cut by the retreating sea, or subsequently by alluvial action".

THE PLATYPUS.

At Hassan's Walls Darwin made a detour to "a farm called Walerawang", where he stayed for a day. He remarks that this farm, which seems to have been a sheep run with some cattle and horses, was well stocked with every necessity and employed forty convict servants, yet there was an apparent absence of comfort and not a single woman resided there. Next day a kangaroo hunt was arranged, but sport was poor, not a single kangaroo or even a wild dog (dingo) being seen, though the party enjoyed a pleasant ride. Here Darwin saw several living platypuses and one was shot for his examination. "Certainly", he writes, "it is a most extraordinary animal; a stuffed specimen does not at all give a good idea of the appearance of the head and beak when fresh, the latter becoming hard and contracted".

Next day, January 20, they resumed the ride to Bathurst, experiencing a hot westerly, "the sirocco-like wind of Australia, which comes from the parched deserts of the interior".

After a stay of only one day in Bathurst, which did not impress Darwin, the return journey was commenced on the 22nd, a new route called Lockyer's Line being

followed, but on the second day they joined their former road, ascended Mt. Victoria, and again slept at the Weatherboard. On the way to Sydney a very pleasant evening was spent with Captain King at Dunheved, near Kingswood, and thus ended Darwin's "little excursion in the colony of New South Wales".

GENERAL OBSERVATIONS.

Darwin closes this account with some observations on the state of society among the higher classes, the condition of the convicts (on which he reports in rather favourable terms) and the attractions which the land offers to immigrants. On the whole he was disappointed in the state of society, as the community seemed to be rancorously divided into parties on almost every subject. It will be remembered that the emancipist question was a fruitful cause of dissension at this period, and there was much political agitation concerning law procedure, taxation, and whether or not transportation of convicts from the Old Country should be abolished. But Darwin was favourably impressed by the material possibilities of the colony and the readiness with which wealth could be acquired without much exertion. He says:

"The capital of a person, without any trouble on his part, produces him treble interest to what it will in England; and with care he is sure to grow rich. The luxuries of life are in abundance, and very little dearer than in England, and most articles of food are cheaper. The climate is splendid and perfectly healthy; but to my mind its charms are lost by the uninviting aspect of the country . . . The rapid prosperity and future prospects of this colony are to me, not understanding these subjects, very puzzling. The two main exports are wool and whale-oil, and to both of these productions there is a limit. The country is totally unfit for canals, therefore there is a not very distant point beyond which the land-carriage of wool will not repay the expense of shearing and tending sheep . . . Agriculture, on account of the droughts, can never succeed on an extended scale: therefore, so far as I can see, Australia must ultimately depend upon being the centre of commerce for the southern hemisphere, and perhaps on her future manufactories. Possessing coal, she always has the moving power at hand."

TASMANIA AND WESTERN AUSTRALIA.

On January 30, 1836, the *Beagle* sailed to Hobart Town, where she remained for ten days, during which Darwin made some pleasant little excursions, chiefly with the object of examining the geological structure of the island. He was impressed by the great size of some of the eucalypts and of the tree-ferns, one of which was at least twenty feet high to the base of the fronds and in girth exactly six feet.

On February 7 the *Beagle* left Tasmania, and on March 6 reached King George's Sound (Western Australia), where the ship remained for eight days—"and we did not during our voyage pass a more dull and uninteresting time".

While in Western Australia Darwin witnessed a "corrobery" or great dancing-party of the "White Cockatoo" tribe of natives, and he gives a short description of the entertainment, which seemed to him "a most rude, barbarous scene and, to our ideas, without any sort of meaning . . . Everyone appeared in high spirits and the group of nearly naked figures, viewed by the light of the blazing fires, all moving in hideous harmony, formed a perfect display of a festival among the lowest barbarians."

FAREWELL TO AUSTRALIA.

On March 14 the *Beagle* finally left the shores of Australia on her course to Keeling Island. Darwin takes a rather unkind farewell of our Australia of which we are so proud, his words being: "Farewell Australia! you are a rising child, and doubtless some day will reign a great princess in the south; but you are too great and ambitious for affection, yet not great enough for respect. I leave your shores without sorrow or regret."

It is, perhaps, some slight consolation to Australians to learn that Darwin's opinion of New Zealand, surely one of the finest countries in the world, was even more unfavourable. On leaving New Zealand on December 30, 1835, Darwin

shot this Parthian arrow: "I believe we were all glad to leave New Zealand. It is not a pleasant place. Among the natives there is absent that charming simplicity which is found at Tahiti; and the greater part of the English are the very refuse of society. Neither is the country itself attractive."

As an antidote we quote with pleasure from the prophetic poem on Sydney Cove by Dr. Erasmus Darwin, grandfather of the more famous Charles, written many years before Darwin's visit and inspired by Josiah Wedgwood's medallion in Sydney clay, representing Hope encouraging Art and Labour:

There shall broad streets their stately walls extend,
The circus widen and the crescent bend;
There ray'd from cities o'er the cultured land,
Shall bright canals and solid roads expand;
There the proud arch colossus-like bestride
Yon glittering streams and bound the changing tide.[1]

It is surprising that Darwin makes no reference in his *Journal of Researches* to the discovery in the Wellington Caves of the bones of fossil mammals, a discovery which proved that the recently extinct mammals of Australia were closely related to the existing marsupials and quite unlike those characteristic of the caves of Europe. This was in full accordance with Darwin's own observations in South Australia mentioned elsewhere in the *Journal*, and would have reinforced his opinion that the catastrophic hypothesis of Cuvier, who supposed that at certain periods in the geological history of the earth the entire fauna of a country was destroyed by some convulsion, to be succeeded by a different assemblage of animals, was fundamentally unsound. This omission is the more surprising since we know that while in Sydney Darwin became acquainted with Major Thomas Mitchell, who some years before had obtained a collection of fossil bones from the Wellington Caves and was acquainted with their nature and significance. Darwin learned of this important discovery only after his return to England in 1836, but he subsequently made full use of it in his writings.

* * * *

I am much indebted to Miss Ida E. Leeson, B.A., and the staff of the Mitchell Library for assistance in connexion with illustrations.

[1] The Sydney Harbour Bridge, completed in 1931, crosses the harbour in one great arch of 1,650 feet—the greatest single-span arch in the world.

Obituary

MRS. M. J. WATERHOUSE, an Honorary Correspondent of this Museum, who died at Lindfield, June 13, in her eighty-second year, had always taken a keen and active interest in natural history, particularly conchology. Part of her fine collection of shells, including a series of cowries obtained many years ago in Sydney Harbour, where today they are seldom if ever found, was presented to the Museum some years ago, and forms a striking exhibit in the gallery. She was an Honorary Member of the Royal Zoological Society of New South Wales, and a Life Member of the New South Wales Naturalists' Society.

Mrs. Waterhouse was the eldest daughter of the late E. Vickery, and the widow of G. J. Waterhouse, of Woodford, and throughout her life she had been a generous supporter of various benevolent institutions and charitable organizations. The Weroona Home for Aged Women, Leichhardt, owed much to her generosity, and after her husband's death her home at Woodford was handed over to the Methodist Church for use as a convalescent home by the War Memorial Hospital, Waverley.

She is survived by three sons, Dr. G. A. Waterhouse, B.E., F.R.Z.S., F.R.E.S., a Trustee and Honorary Zoologist of the Australian Museum; Professor E. J. Waterhouse, M.A., University of Sydney; and Mr. L. V. Waterhouse, B.E., mining engineer.

C.A.

A Reptilian Combat

FROM Mr. Paul Wenz the Australian Museum has received these extremely interesting photographs of a combat between a Black Snake (*Pseudechis porphyriacus*) and a Jew Lizard (*Amphibolurus barbatus*). Mr. Wenz, who is a prominent pastoralist, took the photographs upon his estate, Nanima, Forbes, New South Wales.

He has furnished the following notes:

"The other day we came suddenly upon a big black snake trying vainly to swallow a much inflated jew lizard, whose head and neck had already disappeared. Slowly the snake was making efforts to swallow its prey, spreading slime on it all the time.

"We watched them for the best part of an hour, and very little progress was made by the snake, who only managed to get the lizard to disappear into its gullet up to the shoulders. He was trying his hardest to make the lizard deflate itself by opening his jaws and closing them in a firm and drawing movement on the lizard's neck, at times lifting his prey two or three inches high, and slowly dragging it about. Once it drew the wind from the lizard's body, but since its own throat was packed by the head of the lizard it had to force the wind back and blow the other up again. The latter kept himself all the time completely 'dead', except twice to lift his forelegs as though to prevent the snake swallowing beyond his shoulders. Meanwhile the balloon remained inflated to its full capacity.

"Finally, after resting a few moments, the snake lifted its head and made towards a netting fence, carrying its

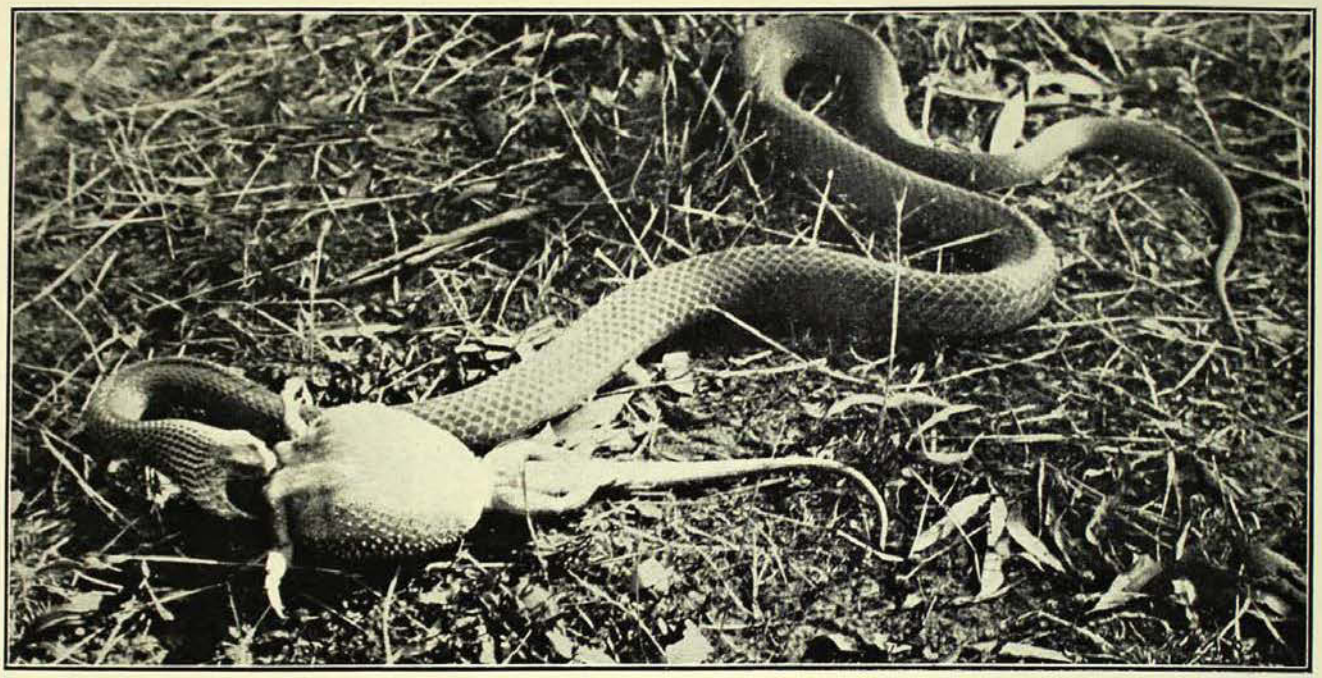
Jew Lizard attacked by Black Snake.

[Photo.—*Paul Wenz.*

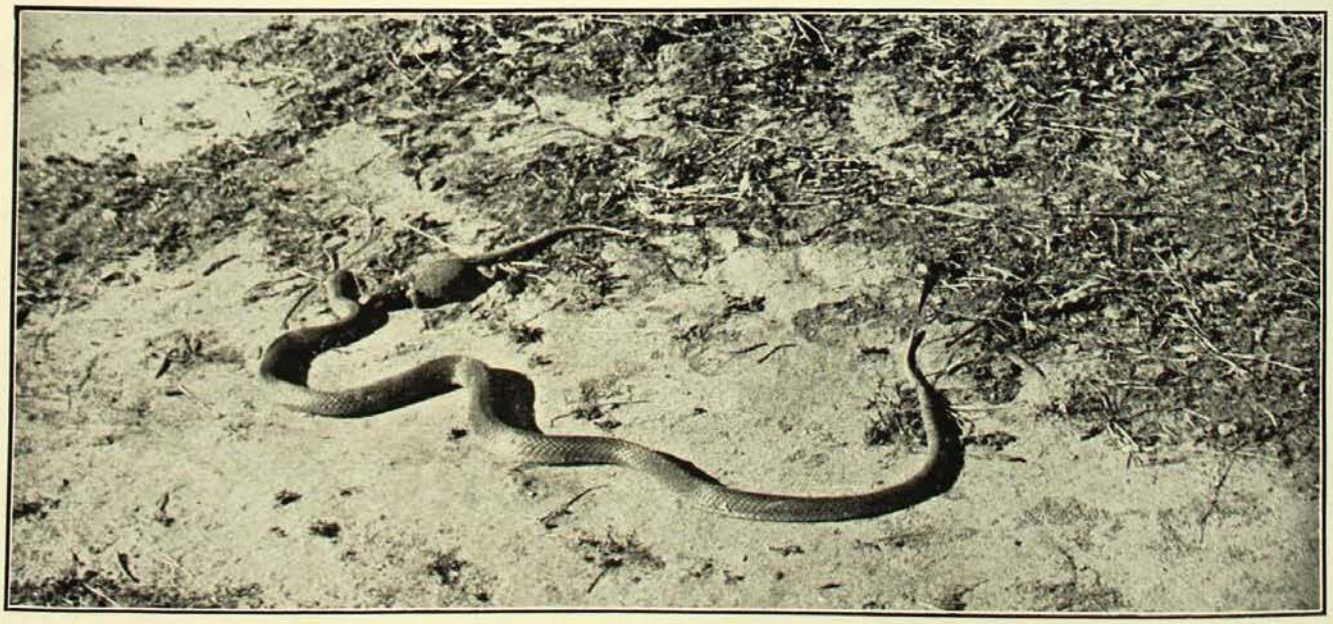
prey. I then killed the wriggler. At the second blow it dropped the lizard, which shortly afterwards opened its mouth. Two hours afterwards the lizard was well alive and ready to fight. Next morning it had disappeared.

"Right or wrong, we have come to the conclusion that the faculty the jew lizard has of blowing himself up like a balloon is his most effective means of defence.

"We measured the snake and found him over 6 feet long."



Highly inflated, the Jew Lizard effectively prevents the snake from swallowing it.
[Photo.—*Paul Wenz.*



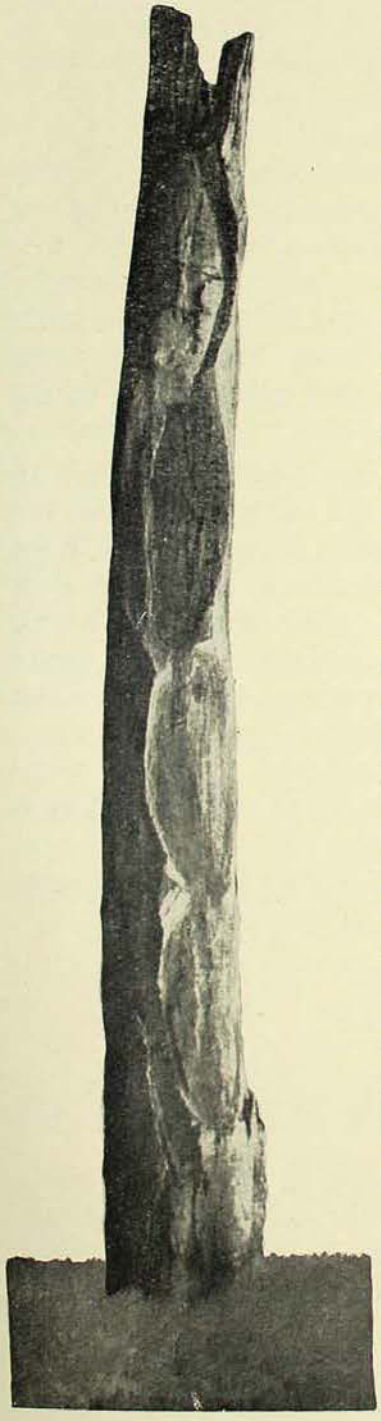
Frustrated.

[Photo.—*Paul Wenz.*

A Shield Tree

By F. D. McCARTHY.

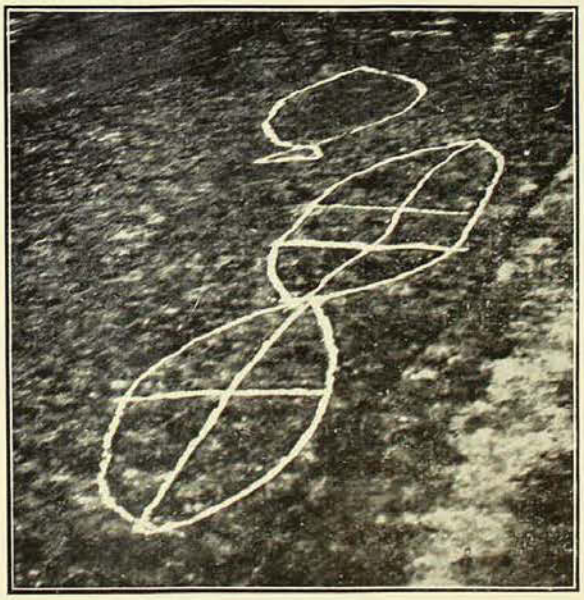
THROUGH the kindly offices of Mr. E. Hawdon the Australian Museum recently acquired the trunk of a grey-box tree from which a number of shields had been cut by the aborigines.



Grey-box tree from which shields have been cut by aborigines, Kiora, near Moruya, New South Wales.
[Photo.—*G. C. Clutton.*

It was standing on the property which he is managing for his brother, Mr. L. D. Hawdon, who willingly gave permission for the specimen to be presented to this institution. The property is situated on the fertile flats of Kiora, within three miles of Moruya, on the south coast of New South Wales. Mr. R. Nickson, an old resident, states that the tree was standing fifty years ago in much the same condition as it is now.

The trunk is eighteen feet long, and two feet six inches in diameter at the butt. Three elliptical depressions on one side measure, respectively, thirty-nine by sixteen inches, forty by seventeen, and forty-five by nineteen; on the other side there are also three measuring thirty-eight by fourteen inches, forty-seven by eighteen, and forty-seven by sixteen. At the top, on one side, a shield has been marked out with a groove almost three inches deep, and from two and a half to three and a half inches wide, but it has not been cut right out. It measures thirty-nine by fourteen inches; the dimensions of the pieces cut from the other six depressions also have to be reduced all round by the width of the groove. The tree is thus a valuable record of the method employed by the aborigines in making this type of shield. Although steel tools were evidently used, the large number of shields made from the tree indicate that this timber was particularly suitable for the purpose.



Aboriginal rock-carving near Smith's Creek, Kuring-gai Chase, New South Wales, depicting two shields of the type cut from the Moruya tree. The other figure shown is a fish.
[Photo.—*B. L. Hornshaw.*

Along the coast of New South Wales, shields were made in the following manner: A section of the desired shape was marked out upon the bark, usually of a mangrove or gum tree. A deep groove was cut round the outline through to the underlying wood, probably with a ground-edge stone axe or a chipped flake of siliceous stone. The piece was then eased off with either

stone or wooden wedges. The rough outer bark was then scraped off, and the shield trimmed into shape. To form a handle two holes were bored through it in the middle in a line parallel to its longer axis, into which the two ends of a green twig or a short strip of jungle vine were inserted; when this dried it set quite firmly in place. The shield was then ornamented with one or two longitudinal and two transverse lines of red ochre. Very few specimens have been preserved, there being only two, from the North Coast, in the collections of the Australian Museum. This shield is the crudest made by the aborigines, and is the type depicted in the rock carvings of the Sydney district. Such shields were used in tribal combats as a protection against spears and boomerangs. They are known as "Arragong", and also as "Hilaman". In duels a shield of a different type, with a narrow face, was used to deflect missile weapons.

In Victoria, along the Murray River, and in southern New South Wales, shields similar to the coastal type were used, but the workmanship is much superior. In form and decoration they rank amongst the finest examples of primitive art in Australia, in striking contrast to those of the coast. The wood is pared down to a thin edge round the border, but is much thicker in the middle, for the handle is carved out of the back. The front surface is gently convex, and is invariably incised with attractive geometrical patterns broken up into sections, each consisting of sets of parallel lines, chevrons, zigzags, and concentric diamond figures often infilled with white pipeclay; the plain surfaces dividing the panels are coloured with red ochre. These shields vary greatly in size, ranging from thirty to forty inches in length, and up to ten inches broad in the middle. The ends form projecting apices. Those from Eyre's Peninsula in South Australia form a double-pointed oval, and are not so well finished; they are decorated with sets of crescentic lines in red ochre on a white base.

Shield from the Bellinger River, New South Wales. The longitudinal and transverse lines, which are painted on the shield with red ochre, may be discerned.
[Photo.—*G. C. Clutton.*

In eastern Australia huge sheets of bark for the making of canoes were cut off various species of trees, especially the gums growing on the river banks, by the same methods as were employed in the making of shields. There are many trees along the Murray and Darling Rivers which have yielded material for the craft of the aborigines.

LARGE STONE IMPLEMENTS

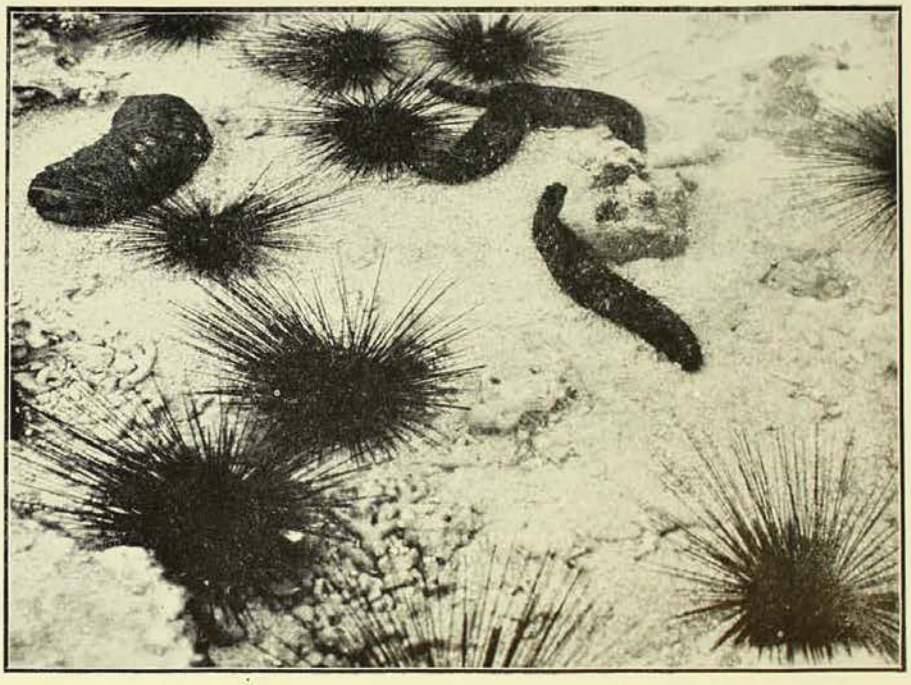
A FINE series of large ground-edge stone axes and other implements from Australia and the Pacific has recently been placed on view at the main entrance to the Australian Museum. The largest axe is one of a series from Kiwai Island, which weighs nearly seventeen pounds. A splendid example made of schist from Queensland weighs nine and a half pounds, while a basalt Maori adze, used for felling trees, weighs nearly eleven pounds. An interesting type is that made of Giant Clam (*Tridacna gigas*) shell, of which two examples from Santa Cruz are shown.

The exhibit illustrates well the skill of primitive man in the working of stone. The size, shape and finish of these unwieldy implements indicate that they are of more than utilitarian significance. Moreover, they are important in the gift-exchange of the Melanesians and Polynesians. As with other elements of his culture, the so-called savage lavishes his best work upon objects which play some part in his ceremonies or are symbols of religious beliefs and of social groups.

The Life and Uses of Bêche-de-Mer

By ARTHUR A. LIVINGSTONE.

WADING quietly, with protected feet, into the limpid waters of a tropic tidal pool, the observant visitor will notice the swift retreat of gaudy fish into some coral mass and the sideways scamper of a highly coloured crab, actually falling over itself in its dominant desire to reach a haven of shelter. Here and there the brilliant colours of living coral will meet the gaze, and the head and watchful eyes of some wandering reef eel, as it backs its slippery and sinuous body further into the protective coral fronds. When the fast-moving denizens of the immediate surroundings have disappeared and all is quiet again, the visitor will commence to take stock of what remains. Very often a black or gaudily coloured sausage-shaped object will be noticed —or perhaps several—lying motionless in the shallows and taking no apparent interest, either in the recent disturbance nearby, or the approach of a human. And so we find the bêche-de-mer of the tropic seas. A scene such as this is admirably reproduced in the coral-pool exhibit in the Australian Museum.



The common and well-known Cotton-fish (Holothuria impatiens) lying in a sandy lagoon off Hayman Island, Whitsunday Passage, Queensland. In the top left corner may be seen the edible variety commonly known as Curry-fish (Holothuria scabra). Surrounding them are Long Spined Sea urchins (Centrechinus setosus).

[Photo.—*F. A. McNeill and A. A. Livingstone.*

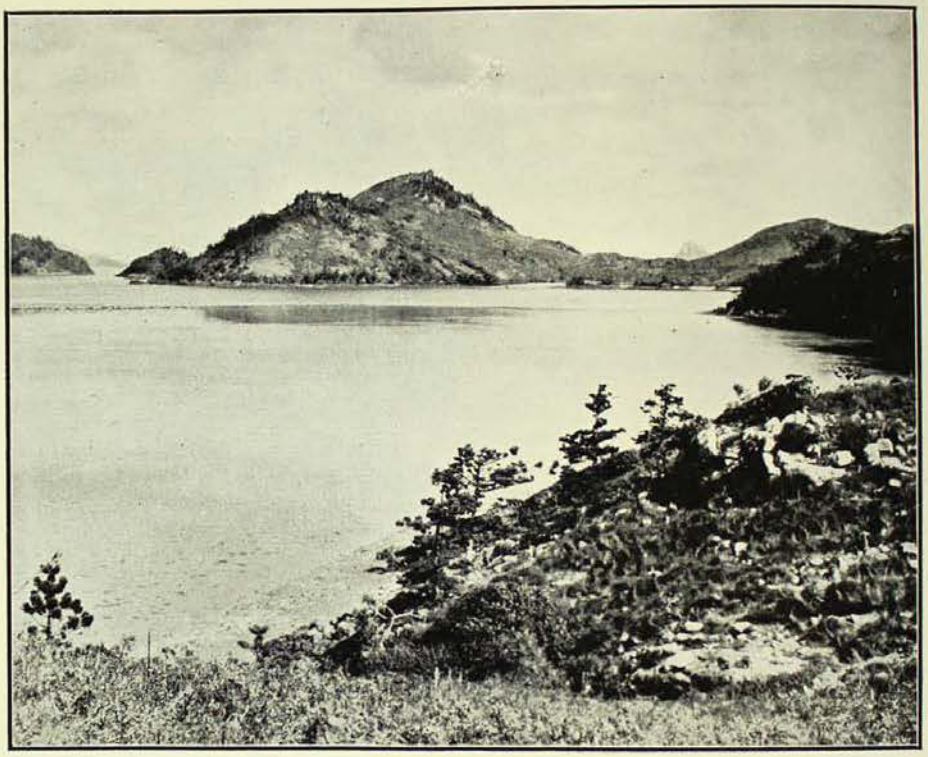
Bêche-de-mer is a name given by the French to these sausage-like, marine creatures, which scientifically are referred to as Holothurians (Holothuroidea). The Malay fishermen prefer the use of their own name, trepang, while others choose the vernacular name of sea-cucumber, which all will agree is most appropriate. The creatures are world wide in distribution, living in all zones and depths, although the shallows of the tropic seas seem to be the best suited to their needs so far as size and numbers are concerned. About seven hundred species are known, but it must not be assumed that all kinds are used commercially for the manufacture of the celebrated soup.

Holothurians are classed in a large group of invertebrate marine animals known as the Echinodermata, which means "spiny-skinned", and includes the sea-stars, sea-lilies, brittle-stars and sea-urchins. While the name "spiny-skinned" seems ill-applied to the comparatively smooth skinned bêche-de-mer, it may be explained that these creatures are of a lower type and have only small limy spicules embedded in the body walls as

vestigial representatives of such well developed skeletal plates as we find in the sea-urchin.

Most types conform to the conventional cucumber in the shape of the body. The body wall is leathery in texture and in some species is extremely thick, especially in the commercial varieties. In the body wall there are both longitudinal and transverse muscles which enable contraction and expansion of the body at will. The mouth, which is situated at one end of the sausage-like body, is surrounded by a circlet of branched tentacles or "feelers" which sweep mud or sand, according to environment, for minute food particles, and pass such matter into the mouth. The food and sand are passed through a well developed alimentary canal, which terminates in the form of a cloaca at the posterior end of the body. Some species, when handled, contract the body to such a degree that a mass of whitish material like tangled cotton is ejected from the cloaca. This mass is really an assemblage of tubes called Cuvierian organs, and are the modified basal branches of a respiratory system called the respiratory trees. In the tropical waters of eastern Australia a very common purplish-black species (*Holothuria impatiens*) occurs in great abundance, particularly in shallow water on sheltered sand-flats, and because of the habit of throwing out its Cuvierian organs in the form of long white threads, has earned for itself the vernacular name of Cotton-fish. The ejected Cuvierian organs in this and other species, when floating about in the water, have been known to enmesh and drown large crustaceans (crabs and lobsters, etc.). Being extremely sticky, the white threads are very difficult to remove, and often hands and bare legs covered by them have to be rubbed vigorously with wet sand before complete removal is effected.

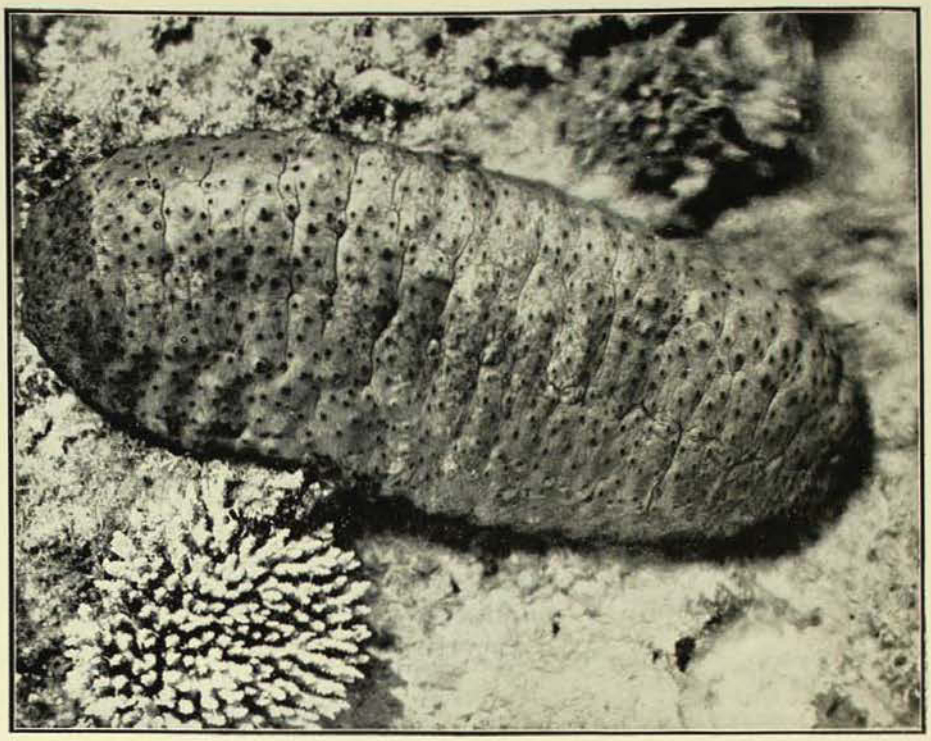
Creatures wilfully mutilating themselves by throwing out their Cuvierian organs seem to suffer very little as a result of the practice, and, if left alone, new organs will soon develop to replace those lost.



The protected shallows off Hazelwood Island, Whitsunday Passage, Queensland, offer ideal conditions for the Cotton-fish (Holothuria impatiens). In the foreground many examples are to be clearly seen through the shallow waters of the sandy reef flats.
[Photo.—*F. A. McNeill and A. A. Livingstone.*

In Australia edible bêche-de-mer are thick skinned and live exclusively in tropical waters. Special boats, called luggers, of about ten ton burthen are used to fish for the delicacy, and often the gathering of bêche-de-mer is undertaken as a "side line" by trochus lugger crews. Fishing vessels are provided with several small flat-bottomed dinghies which are carried inboard and floated only when fishing operations are to be carried out. Normally two or three natives or Malays man each dinghy when fishing, one taking the oars and the others swimming nearby in water from three to

sixteen feet in quest of bêche-de-mer. The usual practice is to await the ebb tide before beginning operations seriously, for during that period a better view of the bottom is obtained. The waters of the Great Barrier Reef and Torres Strait are the favourite grounds for bêche-de-mer fishing, and many clever devices are used by the fisherfolk when diving is not possible. Into a large piece of lead, with a long cord tied to it, is inserted a barbed spike, and when a "fish" is seen in deep water through a glass-bottomed box floating astern, the lead, with its contained spike perfectly balanced, is dropped overboard. The "dart" sinks like a plummet, and being cast with dexterity and precision, "harpoons" the motionless bêche-de-mer, which is soon hauled inboard by pulling up the cord.



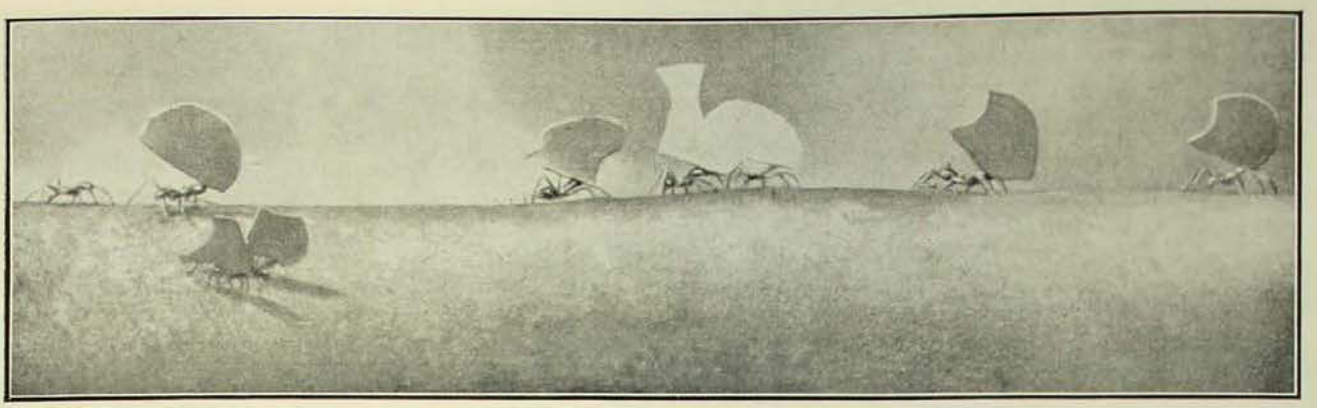
The edible bêche-de-mer, Curry or Sand-fish (Holothuria scabra). The body measured about fifteen inches long and five inches across; its estimated weight was about six pounds. The upper surface was pale yellowish-brown, very like curry, and speckled with black dots. The under surface was pale greyish-yellow.

[Photo.—*F. A. McNeill and A. A. Livingstone.*

Some of the edible types taken by fishermen operating in the tropical waters of Queensland and the Great Barrier Reef are the Prickly-red Fish (*Thelenota ananas*), the Black-fish (*Actinopyga miliaris*), the Teat or Mammy-fish (*Actinopyga nobilis*), the Leopard, Spotted, or Tiger-fish (*Holothuria argus*), and the Curry or Sand-fish (*Holothuria scabra*), which is illustrated on this page.

When collected, the bodies of the bêche-de-mer are slit open longitudinally and gutted. After preservation in boiling water, the saltiness in the flesh is removed by repeated boilings in fresh water. The process of curing is carried out either by smoking or by drying in the sun.

Cured and marketable bêche-de-mer is exported from Australia and sent chiefly to the markets of the East. In the year 1932 bêche-de-mer valued at £19,265 was obtained in Australia. In eastern countries, such as China, bêche-de-mer is regarded as a great delicacy as a base for soup, and is much prized by the epicure. Being somewhat repugnant at first sight, both when alive and when cured, bêche-de-mer may be imagined by many to be repugnant also to the taste, but the experiences of the author may lend some measure of assurance to the contrary. Nothing more palatable could be imagined or actually tasted than a soup made from small green turtle flippers and bêche-de-mer.



South American Leaf-Cutter Ants carrying fragments of leaf to their nest, where they are used as a basis for their fungus gardens.
[Courtesy of New York Zoological Society.

Wonders of the Ant World

By KEITH C. MCKEOWN.

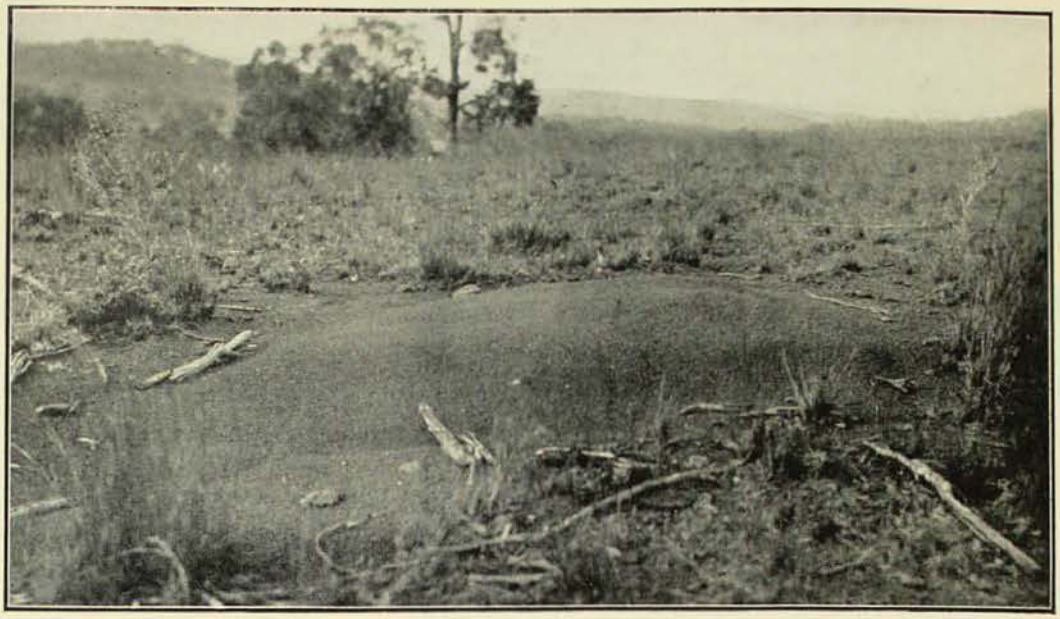
Part II.

Ants, like primitive man, may be divided into three main groups, the hunters, the pastoralists, and the agriculturalists. The majority of ants belong to the hunting group. The well-known Australian Bull-dog Ants (Myrmecia) are inveterate hunters for game as food for their young. It is a curious feature in connection with these ants that, while it is necessary that the young be fed upon flesh, the adults live only upon the nectar of flowers and similar substances. It is remarkable that the ants should collect for their young a food which they do not eat themselves. The large Meat Ants (*Iridomyrmex detectus*), as their name implies, feed mainly upon the bodies of insects and dead animals. In times of drought the Meat Ants may be seen tearing fragments of flesh from the dead bodies of sheep and cattle, and carrying them off to their nests. It is considered that these ants play some part in the control of the Sheep Maggot-fly by assisting to destroy the carcasses in which the flies breed.

The most outstanding examples of the hunting ants are the Driver Ants of Africa and the Legionary Ants of South America, which have been described as "the Huns and Tartars of the insect world." They are nomadic, making no permanent nests but taking advantage temporarily of any suitable cavity in the ground. When on the march they make camps by hanging in clusters from the branch of a tree. Small streams encountered in their forays are bridged with living chains of ants over which the marching armies cross.

These ants travel in immense armies, destroying all living things they may come across in their line of march, which may not be sufficiently swift to escape the marauding host. They will soon kill the largest animal if confined. Monkeys, pigs, fowls, lizards and snakes, besides innumerable small creatures, fall a prey to them. Villages are abandoned by their inhabitants when the marching insects approach, the natives returning to their homes when the invading army has passed on leaving the huts freed from cockroaches and other pests which shelter in the thatched roofs and walls.

The great naturalist Belt has described the habits of the South American Legionary Ants. He says: "One of the smaller species (*Eciton prædator*) used occasionally to visit our house, swarm over the floors and walls, searching every cranny, and driving out the cockroaches



The large gravel nest of the Meat Ant (Iridomyrmex detectus).
[Photo.—*K. C. McKeown.*

and spiders, many of which were caught, pulled or bitten to pieces and carried off. [Some of the larger species have been recorded as destroying rats and mice.] . . . I saw many large armies of this, or a closely allied species, in the forest. My attention was generally first called to them by the twittering of some small birds, belonging to several different species, that followed the ants in the woods. On approaching to ascertain the cause of the disturbance, a dense body of the ants, three or four yards wide, and so numerous as to blacken the ground, would be seen moving rapidly in one direction, examining every cranny, and underneath every fallen leaf. On the flanks, and in advance of the main body, smaller columns would be pushed out. These smaller columns would generally first flush the cockroaches, grasshoppers and spiders. The pursued insects would rapidly make off, but many, in their confusion and terror, would bound right into the midst of the main body of ants . . . The greatest catch of the ants was, however, when they got among some fallen brushwood. The cockroaches, spiders and other insects, instead of running right away, would ascend the fallen branches and remain there, whilst the host of ants were occupying all the ground below. By and by up would come some of the ants, following every branch, and driving before them their prey to the ends of the small twigs, when nothing remained for them but to leap, and they would alight in the very midst of their foes, with the result of being certainly caught and pulled to pieces. Many of the spiders would escape by hanging suspended by a thread of silk from the branches, safe from the foes that swarmed both above and below."

To turn now to the "pastoral" activities of the ants. It is well known that the aphides, scale insects, tree-hoppers, etc., secrete a sweet, sticky fluid or honey-dew, which is attractive to the ants, and for the sake of which they "milk" the aphides, or other honey-dew producing insects, by stroking them with their antennæ, under the stimulus of which the insect exudes the honey-dew in a droplet, which is greedily eaten by the ant. The ants, however, go further than simply "milking" such aphides as they may meet in the field, and actually rear herds for this purpose. The eggs of the aphides are collected by the ants in autumn, and are taken underground into their nests, where they are cared for as carefully as their own. In spring, when the young aphides emerge from the eggs, the ants farm them out upon the roots of their respective food-plants, and later transfer them to above ground to feed upon the leaves and stems. Here they are closely guarded by the ants to protect them from enemies. With some species of ants, however, covered enclosures or "cow-sheds", formed of vegetable fragments and soil made into a coarse papier-mâché, are erected over the feeding aphides, and here, protected from excessive heat and enemies, they can thrive in safety. The "sheds" are open at the ends, but a strong

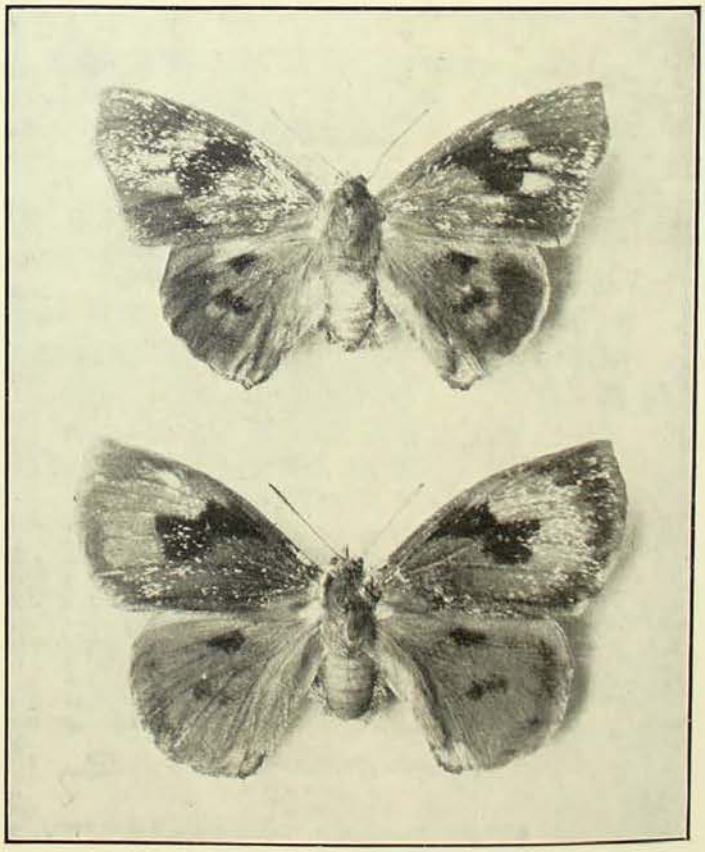
"Cowshed" built by ants over feeding "tree-hoppers".
[Photo.—*K. C. McKeown.*

guard of ants is always on duty here to repel marauders.

The caterpillars of a number of species of Blue Butterflies are also cherished by the ants on account of glands situated on their backs which secrete a substance attractive to their attendants. The story of the ants and the caterpillars of *Miletus ignita* has been told by Dr. G. A. Waterhouse in the Australian Museum Magazine.*

In the nests of the Green Tree Ant are found the larvæ of one of these butterflies (*Liphyra brassolis*), and it has been reported that the butterflies will not deposit their eggs upon trees where there are no ants, or where the proper species is not present. The caterpillars are believed to feed, at least partially, upon the ant larvæ, but the ants, apparently ignorant of this, tend them with the greatest care. The caterpillars of this butterfly are remarkable in being covered with a horny covering, apparently to protect them from the jaws of the ants, and when fully fed, they pupate, or change into the resting chrysalis stage, while still enclosed in this shell. The butterfly, when it first emerges, is covered with a coating of loose, white scales, which are later completely lost. Should the ants interfere with the newly emerged butterflies the scales become attached to the feet, antennæ and jaws of the attackers, causing them acute embarrassment.

The agriculturalists among ants, the Harvesting Ants, have, perhaps, received credit for habits, which, actually, they do not possess. Many species of ants collect the seeds of various plants, which they store in their nests, to be used as food. They have, however, been credited with cultivating these favoured plants in the vicinity of their nests in order to have

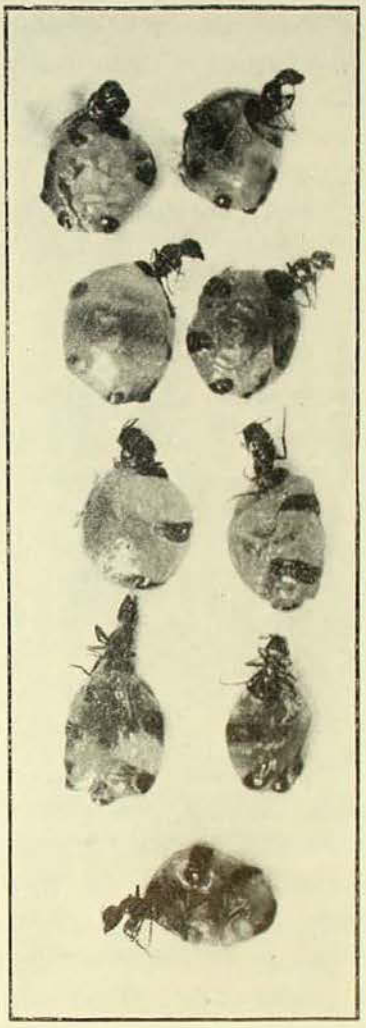


Liphyra brassolis, a butterfly whose larva lives in the nest of the Green Tree Ant. Note the loose white scales which cling to would-be molesting ants.
[Photo.—*G. C. Clutton.*

* AUSTR. MUS. MAGAZINE, iv, 7, 1931, p. 219.

a good supply of food close to their doors, but there is no actual evidence that the ants really plant the seeds, and it would appear probable that the plants found growing near the nests have their origin in seeds dropped by the foragers on their way home. Another possible source is from seed which has been stored and has become damp and germinated before the ants could cope with it, and has been thrown out. The usual method of the ants when stored seed has become damp and commences to germinate is to bite off the radicle, or rudimentary root, and take the seed out of the nest to dry in the sun, where it becomes malted and the starch converted into sugar. Where there is a prolonged spell of wet weather, the ants, finding themselves unable to follow their usual practice, throw out the seed upon the communal garbage heap, where it readily germinates and takes root.

One group of ants (Atta) does, however, engage in undoubted agricultural activities, this includes the Leaf-cutting Ants of South America. These ants ascend trees with foliage suited to their purpose, and cut off oval fragments from the leaves. These they carry away, held high over their heads, umbrella fashion, to their nests. There are two streams of ants passing up and down the trunk of the tree, those coming from the nest, as it were "empty-handed", and those returning looking like a green stream, each ant carrying its fragment of leaf. What is the purpose of these leaf fragments? It was at first thought that they were used as food, but their actual use is much more remarkable. The leaf fragments are carried underground and stored in large chambers, and when they have completely rotted, these beds of decayed vegetable matter are inoculated by the ants with the spores of a fungus. This fungus if unchecked would grow up through the soil to produce a mushroom-like fruiting head above ground level, a condition useless to the ants who, therefore, prune the fungus threads, causing them to develop into small, rounded, button-like swellings, which they use as food. When the queens leave the old home on their nuptial flight to found new colonies, each carries a small quantity of fungus from the ancestral fungus bed carefully hidden in a special cavity or pocket in the mouth, with which she infects the leaf mould in the new nest.



Honey Ants of Central Australia — living containers in which food is stored for the needs of the community in time of want.
[Photo.—*G. C. Clutton.*

Although they are hardly agricultural, we may perhaps refer here to the Honey Ants. The Honey Ants inhabit arid areas where food is scarce, and the harvest of a good season must be conserved to the best advantage. The Honey Ants make provision for lean years by collecting honey-dew from insects and the exudations of plants, and, since they do not make cells in which to store the honey, they convert individuals from among their own workers into living honey tubs.

These workers, gorged to their utmost capacity by their companions, cannot walk, their bodies being swollen to the size of a grape, but remain, perforce, clinging in clusters to the roof of the nest quite incapable of movement. In times of want the other members of the colony approach these repletes, as they are called, and solicit food; to these advances the repletes respond by disgorging a drop of liquid from their store. When the store of honey is exhausted the replete resumes the form of the normal worker. This remarkable adaptation is found among ants of allied genera in the desert areas of Australia and North America. The aborigines of Australia have discovered the hidden stores of honey in these ants, and dig them up from their nests and eat them, providing themselves with one of the few sweets of life which fall to their lot.

Some ants keep slaves, and this custom, as in the case of the slave-making empires of antiquity, leads to the decline of the community. The slaves are usually captured in the course of organized raids upon nests of other species situated in the vicinity. The raiders surprise the community, and, killing the guards, swarm into the nest overcoming and destroying all ants that oppose them, and entering the nurseries seize and carry off all the larvæ and pupæ to their own nest. The larvæ and pupæ are reared among their own, and when these captured ants develop they carry out all the duties of the community. Some species have become so degenerate and so dependent upon their slaves that they are quite unable to feed themselves, and if separated from their slaves will perish miserably, even although surrounded with plenty of food. If slaves are again placed with them they will immediately proceed to feed the starving ants, their masters.

In other cases the queen of another species may boldly enter a nest; it is possible that she may be killed immediately, but should she be tolerated to stay in the nest long enough to acquire the nest odour of the species, she will be permitted to remain. Seizing her opportunity, she will spring suddenly upon the back of the legitimate queen, and cold-bloodedly saw off her head with her powerful mandibles. The true queen dead, the soldiers and workers accept the intruder as queen, and care for her eggs. As the young develop they will also carry out the duties of the nest, so that as the original species dies out it is replaced by the invading species until it remains as a pure colony.

In almost every ants' nest a number of insects of different orders take up their abode; some prey upon the larvæ of the ants, others are scavengers in the nest, while others again are kept by the ants for the sake of secretions attractive to them. Silverfish inhabiting the nest seem to live by a kind of piracy or highway robbery, rushing out from concealment and snatching droplets of food as they are being passed from mouth to mouth between two worker ants. A small staphylinid beetle seems to live by similar means.

The habits of a small Histerid beetle, investigated by Dr. Wheeler, are of interest. The beetle is fed and cared for by the ants for the sake of an attractive secretion, but the insect also seems to live upon the remains of insects brought by the ants into the nest. Dr. Wheeler says that when a beetle happens to be touched by the antennæ of a passing ant it begins to wave its forelegs as if to attract attention. The ant stops, and begins to lick the little beetle or seizes it in her jaws. She either seizes it by one of its legs, since the beetle does not feign death nor withdraw its appendages, but allows itself to be carried about the nest, or she stops, seizes it with her fore feet and, holding it in a vertical position, proceeds to lick its head in a very quick and effusive manner. For some time the beetle keeps its head withdrawn into its thorax, after the Histerid fashion, till the ant stops abruptly, protrudes its tongue, and regurgitates a drop of food on its face. Then the beetle protrudes its head, opens its mouth, and works its jaws and rapidly absorbs the liquid, which some-

times floods the whole cavity in the fore part of the thorax. Thereupon the ant again falls to licking the beetle as if to wipe its face free from the moisture, and either leaves the creature to its own devices or regurgitates another drop. Again and again the licking and feeding may alternate, as if the ant were fascinated with its pet and could not feed and fondle it enough. I have rarely witnessed a more comical sight than the behaviour of these slender black ants while they are holding the chunky little red urchins in their paws and pouring liquid into them as if they were so many casks. Comical too is the behaviour of the beetle while it is waiting to be noticed, with its head and forelegs elevated. At such times it assumes a ridiculous cocky air.

Another small Staphylinid beetle (Lomechusa) is treated by the ants as one of themselves; they are cleaned, carried about, and fed from the mouths of the worker ants, which are attracted by tufts of hair on the sides of the body which are licked by them with evident satisfaction; the larvæ and pupæ are also cared for among the ants' own young. The larvæ of the beetles feed upon the eggs and grubs of their hosts, which in time brings about a degeneration of the members of the ant colony. There exists, however, a strange check upon the increase of the beetles. When they pupate the beetle larvæ bury themselves in the soil, where they must not be disturbed or they perish. The ants, knowing nothing of this, relentlessly unearth all the pupæ they can find, treating them like their own pupæ, which change into the pupal state above ground, so that it is only from such as may succeed in hiding themselves away out of reach of the ants that the beetle can depend for the continuance of the race. Should the ants remove their colony to a new situation the beetles are carried with them to the new home. It is a curious sight to see the ants carrying the beetles in their jaws, each held high above the surface of the ground, reminding one irresistibly of a human family moving house and taking its pets with it.

A word must be said about a mite (Antennophorus) which inhabits ants' nests. It is possible that this mite may suck the body juices of the ants, but it is also believed to carry out the duties of manicurist to its host, but the most remarkable feature about the habits of this creature is that if there is only one it attaches itself to the under surface of the ant's head; if there are two there will be one on each side of the abdomen, and so on. There seems to be an unwritten law among the mites that they must never upset their host's balance.

Many volumes have been written about ants, and many more could be written before a fraction of their curious habits could be recorded, so that it will be realized that it is impossible to do more here than merely pass rapidly over the subject, pausing here and there to draw attention to occasional "purple patches" in the life of the ants.

In April Dr. C. Anderson and Mr. H. O. Fletcher visited the shale quarry at Beacon Hill, Brookvale, and obtained an interesting collection of fossil fishes and insects of the Triassic period. A selection of the specimens was placed on view as a special exhibit and attracted much attention.

The Story of Money

By Frederick D. McCarthy.

An exhibit incorporating photographs and many of the specimens mentioned in this article, has been installed in Room 14, Ethnographical Galleries.

THE story of money is a fascinating one. It commences with the primitive peoples who barter their surplus tools, weapons, ornaments, food, and other products, for articles which they desire but cannot themselves produce. Barter is the most obvious method of trade. It is still carried on in Australia, New Guinea, Melanesia, and in many other parts of the world.

The Hiri trading expedition offers a good example of simple barter. The Motu and Koita natives live in houses raised on piles in the shallow water along the coast in the Port Moresby district of Papua. They depend mainly upon fishing and gardening for their food, but sago, which does not grow in their neighbourhood, is also a regular part of their diet. They obtain sago by bartering clay pots, which they manufacture for the purpose, with the people of the Purari delta in the Gulf of Papua. Special canoes, called lakatoi, are constructed for the long voyage ; these consist of several dugouts lashed together with a platform or shelter built over the hulls. The sail is of the well-known crab-claw shape. New hulls are also secured in exchange for the pots. A complex body of magic and taboos is connected with each of these voyages, and stringent restrictions are placed upon the behaviour and actions of the men participating to ensure success. Each voyager has a trading partner, and a tally of the pots and sago exchanged is kept with sticks to measure the quantities.

Preparing for the Voyage.
The pots being loaded into the canoe in the foreground are transferred to the Lakatoi nearby. The graceful set of the crab-claw sails adds a picturesque beauty to the ruggedness of the massive craft.

[*After* Lindt.

Likewise, the simple bartering of fish by coastal peoples for vegetables and forest products from the mountain and inland peoples is a regular practice on many Pacific islands.

Amongst the Australian aborigines barter is the only method of exchange, especially at tribal gatherings and ceremonies. Special parties are often sent to visit other local groups and tribes for the purpose. Each individual secures the products he desires, such as stone for making implements, weapons, and ochres for adornment. Usually it is what is termed silent trade, in which one group places a quantity of objects upon the ground, and retires; the other group then places beside the heap its equivalent offering, and also retires. If the first party is satisfied, it takes the latter's goods, and leaves its own in exchange. This type of barter took place between the natives of Africa and the Carthaginians, the latter procuring gold from the former.

Barter, however, is not possible in all cases where two communities desire to exchange goods. The relative values of commodities are not easy to adjust; there may be difficulty also in securing trading partners. The merchandise may be bulky and unwieldy; hostility, droughts, disease, storms, and other unavoidable circumstances often cause a shortage in the supplies of one group, with the consequence that it cannot barter for the time being. Thus there arises in all communities which barter or trade the need for a medium of exchange and a measure of value, in which the relative values of the goods exchanged can be expressed to facilitate the transactions. This step from simple barter to the use of a third element in exchange was of great importance in the evolution of money.

The fact that primitive peoples have a form of currency is of more than ordinary interest, for it demonstrates that, though lacking a knowledge of metal, they have achieved the same purpose as civilized peoples, but through a different medium.

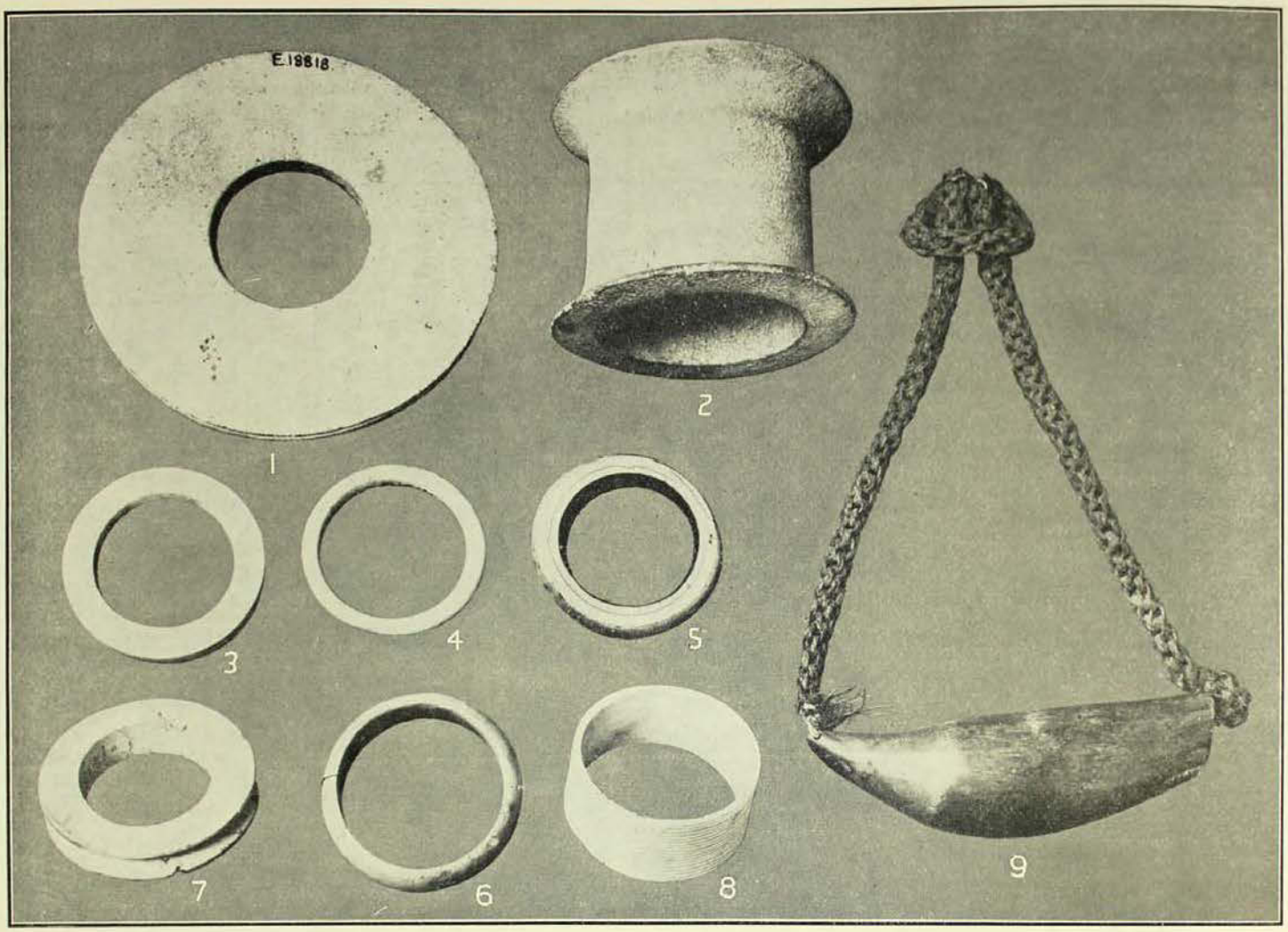
PACIFIC ISLAND CURRENCY.[1]

The communities of stone age natives living on the various islands of the Pacific, especially the Melanesians of the north-western region, employ numerous objects as currency. The best known and most widely distributed is the use of strings of small discs made of *Chama* and red-lipped *Spondylus* shells. The composition of the strings varies; some are of white discs, some are of red and white, and others entirely red. Coconut shell discs are also inserted. In the Solomons, groups of natives living on a number of the smaller islands collect the shells and make up the strings, which they trade to the villages on the bigger islands for vegetable food and other necessities. The red strings are usually kept in the possession of the chiefs and are reserved for important transactions.

At Blanche bay, New Britain, small whelk shells (*Nassa callosa* var. *camelus* Martens) are threaded upon strips of cane. These strips are used in small transactions and are measured by finger, elbow and arm lengths. The strips are also made up into wheel-like discs of varying size, being up to six feet in diameter. The very large wheels of diwarra are called Tambu Aloli, the latter word meaning chiefly; they are displayed by the chiefs and wealthy families at burials, feasts and ceremonies.

In the southern islands of the Solomon group rings of clam (*Tridacna*) shell are made in the form of armlets and used as currency. They are beautifully polished, and three different grades are recognized. Shell rings, fluted on the outside and rather thin, are made on Tanga Island; one ring will purchase five hundred pounds of sago. These rings are traded to the mainland of New Britain. The shell money of Rossel Island has been dealt with in Vol. v, No. 6, pp. 191-193 of this MAGAZINE to which readers are referred.

[1] It must be understood that the terms "money" and "currency" fail to describe adequately the nature of Pacific Island media of exchange. The wealth of social sentiment that surrounds the shell rings, whale's teeth, and so on, raises them above the mercenary plane of pure economics into a position of far-reaching significance in native life.



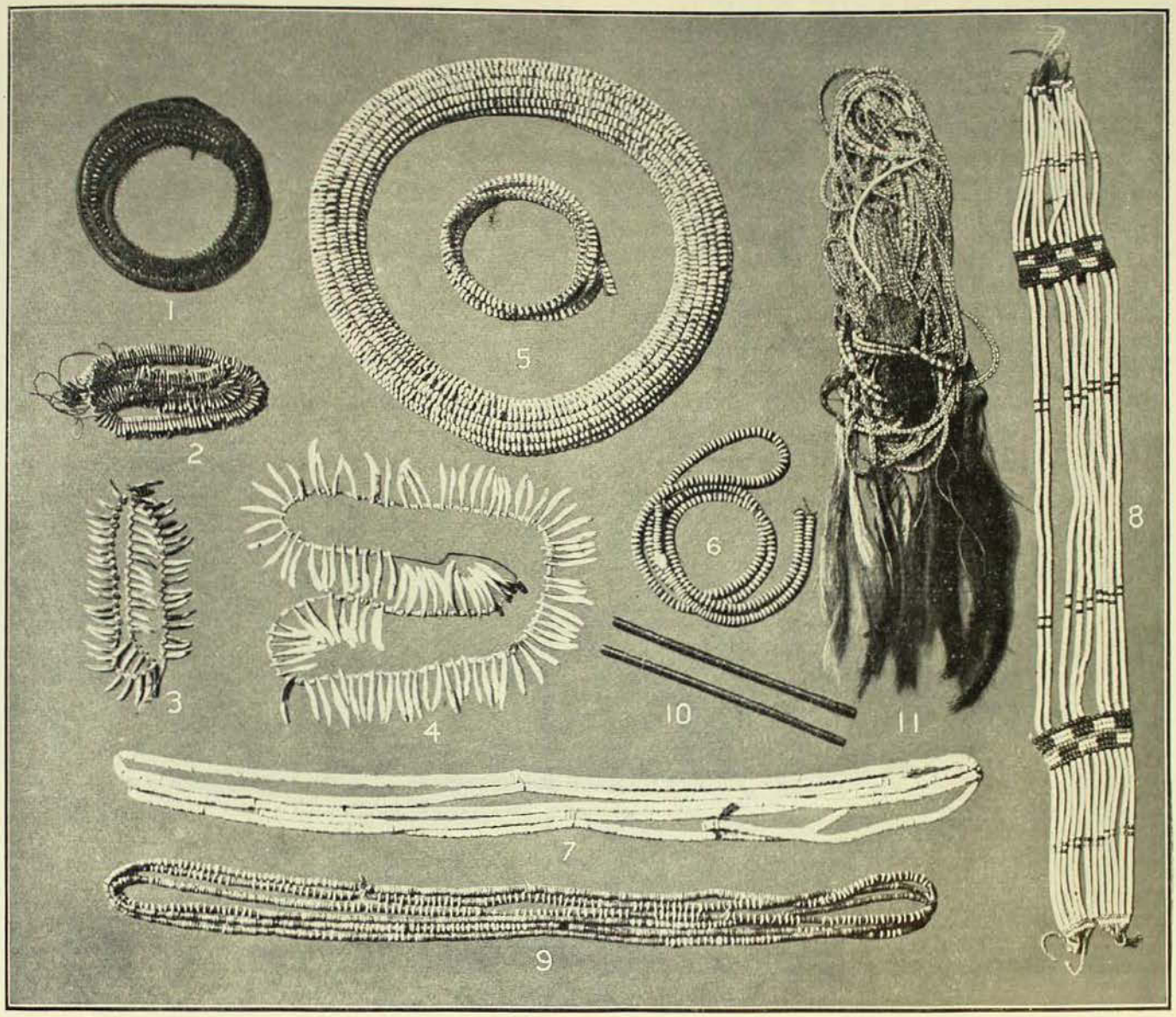
Various types of shell rings made from clam shell (Tridacna gigas) and used as media of exchange. Nos. 1-2 are exceptionally large and well-made specimens from the Solomons. 3-4—Roviana Lagoon, New Georgia Island. 5—Malaita Island. 6—New Britain. 7—Single-grooved ring from Feni Island, Bismarck Archipelago. 8—Multi-grooved ring from Tanga Island, Bismarck Archipelago. 9—Whale's tooth pendant, Fiji.
Shell rings are used as payment of compensation for crimes on the Sepik River, Mandated Territory of New Guinea.

[Photo.—*G. C. Clutton.*

Other types of currency include dogs' teeth in the Solomons and the Bismarck Archipelago, dolphin teeth in the Solomons, mats in Samoa, ear-sticks covered with plaited grass in the southern Solomons, red and yellow honey-eater feathers in Hawaii, feather ornaments in the New Hebrides, and flying-fox fur strings in New Caledonia. These media are used to settle innumerable transactions in the everyday life of the people. With them, weapons, implements, ornaments and food are purchased, and craftsmen paid for their services. The payments required for a young man's entry into a secret society, and the indemnity demanded of the bridegroom by his future wife's family, include large amounts of the currency used.

Cowries have circulated more widely than any other non-metallic medium. The great bulk of them were obtained from the Maldive Islands, Persian Gulf, Malabar coast, and from the East African coast. The Money-Cowry (*Cypræa moneta*) and the Ring-Cowry (*C. annulus*) were most commonly employed. The natural shape and abundance of these species make them ideal for the purpose. They were used in Asia, India and Africa as money. The Baganda of Tanganyika had the following scale of values: 2,500 cowries for one cow, 500 for one goat, 1,000 for one ivory tusk, 25 for one fowl and 50 for one rooster, and from 20 to 200 for cooking pots.

The great variety of utilitarian objects used as money is astounding. It is only



TYPES OF MONEY USED IN THE PACIFIC ISLANDS.

1—Fish-teeth money, Bougainville Island. 2—Dolphin-teeth money, Solomon Islands. 3—Opossum-teeth money, Kieta, Bougainville Island. 4—Dogs'-teeth money, New Britain and New Ireland, Bismarck Archipelago. 5—Short lengths of Nassa shells, strung on cane, and coils up to six feet in diameter, are used at Blanche Bay, New Britain. 6—Coconut and white shell discs strung alternately are used in the Gilbert, Caroline and Marshall Islands, and in the Bismarck Archipelago. 7—String of white shell discs, Solomon Islands. 8—Belt made of white and red shell discs, Kieta, Bougainville Island. 9—String of red and white shell discs, Malaita Island. 10—Short sticks encased in red and yellow grass plaited in geometrical patterns, Southern Solomons. 11—A string of tiny white shell discs, ninety-seven feet in length, used principally for the purchase of pigs. The tail of each pig is attached to the string. Mioko, Duke of York Island.

[Photo.—*G. C. Clutton.*

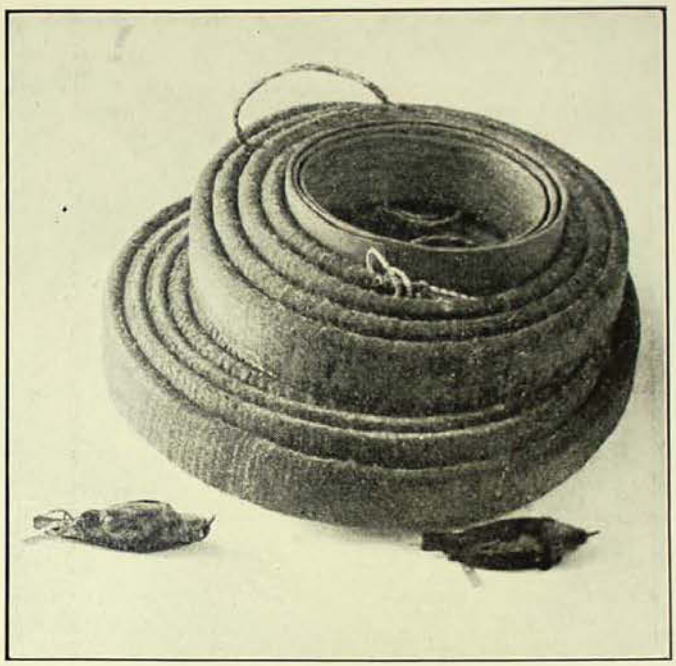
possible to mention a few in this article, such as moulded blocks of salt in Abyssinia, other parts of Africa and Asia, tea in brick form on the frontiers of Tibet, skins in Ancient Russia and North America, silk cloth, deer skins and gems in Ancient China. Many of these media represent the principal product of a community, such as pigs in Tibet, mulberries in Darwaz, Russia, and coconuts in the Nicobar Islands. Early British colonists furnish further examples in the temporary use of merchandise on account of a shortage of metal money. For example, dried codfish were used in Newfoundland in the eighteenth century, tobacco in Maryland in 1708, rum in Australia during the years 1792-93; cotton, corn, molasses and indigo have also been employed for the purpose.

WEALTH IN PRIMITIVE SOCIETY.

In the use of wealth, primitive man's passion for display has given rise to some interesting practices in regard to the form of money employed. Large numbers of mats are stored in the huts of the villagers of Samoa, the most valued being of the finest and softest texture, as a sign of wealth. Huge rolls of bark-cloth or tapa are similarly amassed in Fiji. Cane war shields, in bark covers, are accumulated as an indication of wealth on Guadalcanal Island. The large coral limestone wheels of the Yap Islanders (one of which, on exhibit in the Museum, was figured in Vol. v, Part 7, 1934, frontispiece, of this MAGAZINE) represent an extreme development of the display of wealth. The Kwakiutl Indians of the western coast of Canada possess copper plates which are a symbol of great riches. At a feast, called a Potlatch, given by a chief to one of his rivals, large quantities of food are eaten, given as presents, and wasted; this display of wealth and generosity is culminated by the host throwing one of the copper plates into a river or into the sea, for his resources are so great that he can afford to throw away his most treasured possessions. His reward is greater prestige and an enhanced reputation for generosity.

PRIMITIVE CONCEPT OF VALUE.

The institution of gift exchange in Melanesian and Polynesian communities illustrates well the reason why certain objects are highly valued by primitive peoples, even though they are not used as money. The Kula exchange of the Massim people of south-eastern New Guinea affords a splendid example. In this exchange two objects are used. One is an arm band made from Conus shell, the apex of which is broken off, and the basal portion smoothly ground and rasped. The other article is a necklace of tiny shell discs, made out of the Red-lipped *Spondylus* shell. Large white *Ovulum* shells are often attached to the necklaces. The oldest and finest specimens of each type are named and are circulated amongst the chiefs. Lists of the great ancestors who have handled these specimens are recited with pride by those who have them in their possession. These objects are exchanged throughout the islands of the archipelago along well defined routes. The necklaces are passed round from island to island or village to village on the same island in a clockwise direction, and the arm-shells in the opposite direction. Special canoes are built for the expeditions, which



FEATHER MONEY OR "TAVAU", SANTA CRUZ.

The feathers of a honey-eating bird (Myzomela cardinalis sanctæcrucis, Sarasin) are attached in layers with Parinarium nut gum to a padding of pigeon feathers, and then upon a thick, broad strap, composed of bark and tightly bound string. Seed and shell ornaments are then attached to the strap, which is coiled for convenience. Short pieces are used for minor transactions. This money is stored over the fireplace in the middle of the house to keep it dry and to protect it from insects. On festive occasions the dancing ground is decorated with lengths of uncoiled feather-money hung up by the givers of the feast. One or two red coils and perhaps fifty worn coils, the feathers of which are rubbed off, are given as indemnity for a wife. Feather money is made by the men.

[Photo.—*G. C. Clutton.*

are reciprocal between trading groups. A wealth of magic and ritual surrounds every phase of the exchange. Each man has a number of trading partners, and great feasts are held when the exchange takes place. An arm-shell is received from one partner, and a necklace is given in return at a later date. The object is retained for some time, and is then passed

on. The value lies in possession, and in the renown and fame it brings. Tremendous social, historical and ceremonial significance is symbolized by each arm-shell and necklace. They are insignia of rank, of wealth and prestige, and symbols of tribal ancestors and traditions. Side by side with the Kula there exists a system of barter which enables communities of natives living on the small islands to secure a great many of the necessities of life. There is, however, no monetary system connected with it. The Kula, then, is of great economic value in addition to its principal function, that of a living social and religious institution which binds scattered communities together in a common interest. The greenstone Hei-Tiki and exceptionally fine and large adzes are handed down from generation to generation by the Maori; they also are not used as currency, and their value is derived from their historical associations.

In Fiji whale's teeth are of importance in gift exchange, and are worn as necklaces and breast-pendants only by those of chiefly rank. A few are named and greatly revered. As currency they are reserved for important transactions, such as payment for the building of a canoe or house. This dual function is also characteristic of cattle in East Africa. They are considered to be divine, and to possess a spirit, like their owners. They are regarded as members of the clan, and the progeny of the sacred herd is added to the wealth of the clan. They are not killed for ordinary purposes, for their milk only is used for food. Cattle, however, form the main portion of the payment made by a young man's family to his future wife's family prior to their marriage. Other articles, such as cowries and weapons, are used in ordinary transactions. Cattle were also used as currency by the ancient Greeks and Egyptians.

ADOPTION OF METAL.

Another vital step in the progress of economic life was the adoption of metal in the monetary system. The change was slow, and the more primitive media remained in circulation for some time afterwards, until the new medium was accepted by the traders and the people as a whole. Metal is particularly suitable for coinage and is superior to all other media. It is durable and easily carried, it is homogeneous but easily divisible, and it is not bulky. The more precious metals, such as gold and silver, are universally esteemed and recognized, so that their value is fairly stable.

The innumerable forms in which metal was cast and shaped to serve as a measure of value are of great interest. Metal at first circulated by weight in the forms of bars, lumps and as beads, and rings of bronze and iron were used by the Neolithic traders. In the Bible it is recorded that gold and silver were used in lieu of barter in the time of Shem, in about 1918 B.C. Abraham returned from Egypt very rich in cattle, silver and gold. The use of gold and silver money, in the form of rings, is also recorded in the painted sculptures of Egypt. A modern survival of this practice exists in the brass and copper ring money of the Congo region. It was in circulation in the north and west of Europe prior to, and a little later than, the time of Julius Cæsar. The ancient Celts and Teutons at first used ring money. The Gaelic warriors carried their wealth in the form of a gold or silver torque round their neck, and examples of gold up to five pounds in weight have been found. Great quantities of brass rings have been found. Lacouperie states that from the seventeenth century B.C. the currency of western Asia consisted chiefly of armlets and rings, uninscribed, and of various sizes, in gold, silver and bronze. In China it was in the form of small implements of daily use in bronze, such as hoes, spades and sickles, uninscribed, and exchanged by weight.

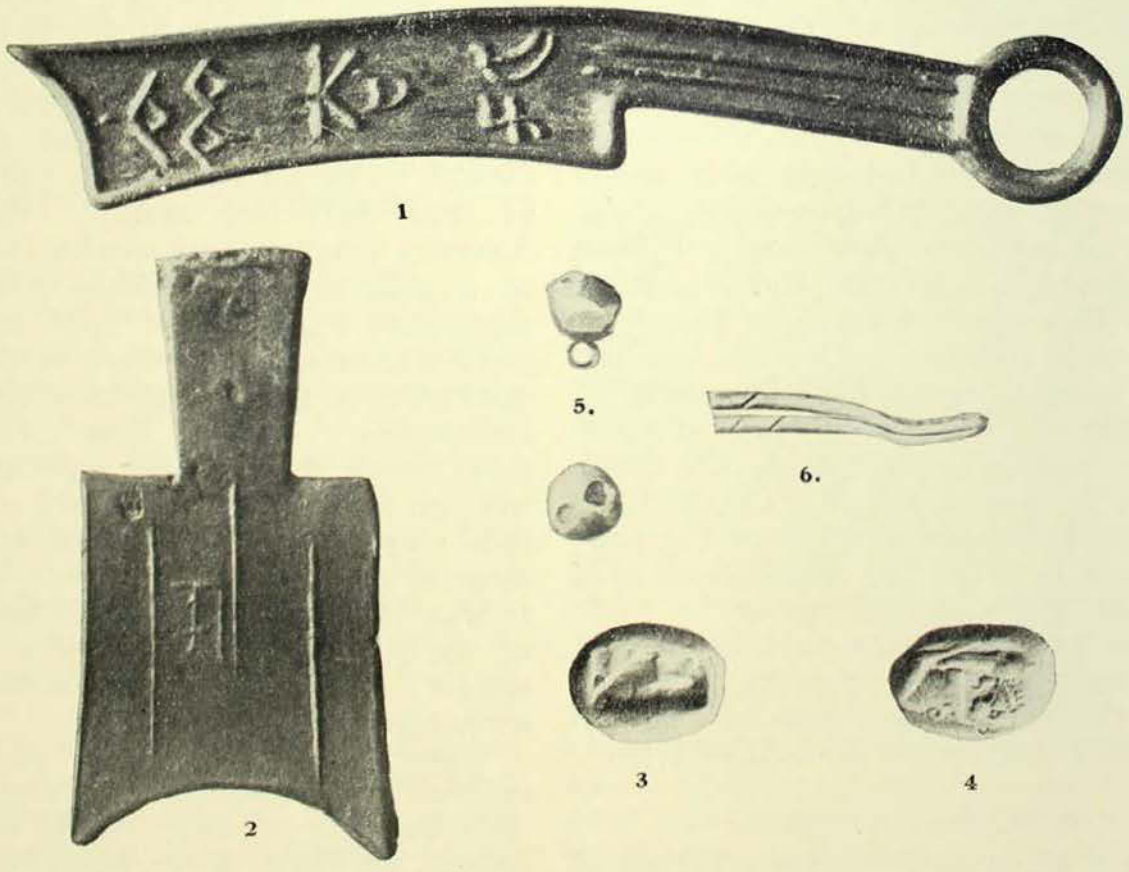
When metal replaces a non-metallic medium it is often cast as a replica of it. This was true of many of the very early forms. In Siam, silver replicas of shells were made. In China, in 600 B.C., the King of T'Su issued bronze replicas of cowries, which had become scarce. There

were two sizes, and they are known as Dragon's Eyes. In Egypt replicas of cowries were made in clay, stone and gold. The latter type was coveted, and as a result an interesting transition in the value of that metal took place. Cowry shells were symbols of Hathor, the goddess of life, and her attributes were transferred to the gold replicas. She became known as the Golden, and identified with Nub, the word for gold, and Nubia, the gold country. Gold was the liquid of Ra, the Sun, which was believed to be a ball of gold. Thus gold symbolized divine life, and for this reason golden ornaments, utensils, food containers, even chairs and beds, were placed in the tombs —it was not so much a display of wealth as a provision for a future life.

In more modern times, fish hooks were used as currency by the fishermen of the Persian Gulf and of Alaska, metal bells (from China) in the Philippines, large copper cylinders up to two feet long by the Karens of India, and a bunch of copper plates by the Nimkish Indians of North America. In Africa the natives employed miniature iron hoes, axes, spear and arrow points, and copper plates. An ingot cross was used in Central Africa. In 1900 iron bars were employed on the west coast of Africa, and were valued at two shillings each, to facilitate trading between the white people and the natives.

FIRST ISSUE OF COINS.

The issue of actual coins, *i.e.*, stamped with a private or public seal, guaranteed in weight and purity, and of a recognized value, was the next great step forward in the evolution of coinage. Between 750 and 700 B.C. silver coins were struck at Ægina, Greece, by Pheidon, King of Argos, and electrum coins (23% silver, 73% gold) were issued by King Gygas at Lydia, Asia Minor. It is not known which type was the first issued. Both, however, were oval or bean-shaped lumps



UNUSUAL FORMS OF METALLIC MONEY.
1—Bronze knife-money, China. 2—Bronze spade-money, China. 3-4—Early Lydian coin. 5—Silver Bullet money, Siam. 6—Silver Larin, India.
[Photo.—*G. C. Clutton.*

of metal bearing a seal on one side, and an anvil mark on the other side. As the practice spread, coins came to be issued by the cities and states. Between 675 and 670 B.C. the sea-traders of the Indian Ocean, at a colony established by them in the Gulf of Kiaotchou, southern Shantung, issued large bronze knives for currency, and inscribed upon them a Chinese symbol for the name of their place.

THE FUNCTION OF COINS.

The earliest types of Greek coins were often replicas of the principal product of the place of issue, or had images of it stamped upon them as, *e.g.*, at Olbia and Cyzicus, on the Black Sea, as a miniature replica of the tunny fish, the measure of wine on the coins of Thasos, the olive on those of Attica, cuttle fish on those of Croton, and the ear of wheat on the coins of Metaportum. Some of these commodities were used as currency in conjunction with oxen prior to the introduction of metal coins. The coins issued by the city and state were made in the temples, under the supervision of the priests, who were the representatives of the gods. Upon these coins were representations of gods and goddesses, of symbols sacred to these beings, and records of the myths and legends, of the migrations of the people and of their everyday life. Thus, from the earliest times, the history of the Greeks and Romans is portrayed upon their coins. The designs upon the latter illustrate how deeply religion influenced the daily life of the people, and many of the devices served to keep the religious beliefs always before the people.

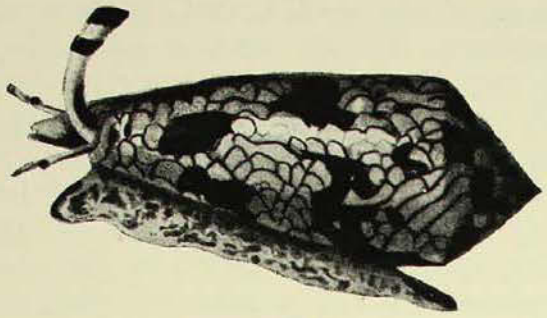
The function of coins in a religious sense has been almost completely severed in modern times in accordance with the more restricted application of religion in everyday life. The monetary systems of modern nations are governed by temporal leaders, for the religious authorities have no control over their issue. On the British coinage *Dei Gratia*—by the Grace of God—is included in the title on the obverse. To a large extent, the weath of a family governs its social position, merely on account of the total amount possessed. In contrast to primitive peoples, amongst whom the higher denominations are of more than materialistic significance, all of our denominations are of economic importance only. Gold coins have been substituted by paper money, while credit and book entries are sufficient in many transactions involving large amounts of money.

Shellfish Poisoning

THE first case of death, or even poisoning, from the sting or bite of a shellfish in Australia has occurred quite recently. A young man, while cruising on the Great Barrier Reef, was examining a prettily marked cone-shaped shell, when he felt it prick him. Sometime after he complained that his sight was dim. He was hurried to the mainland, by which time he was unconscious, and died before he reached hospital.

In the South Pacific Islands, such as New Caledonia, the Loyalties, Solomons, Hawaii, Fiji, New Guinea, the natives are well aware of the poisonous qualities of many of the shellfish, and warn people handling them. There are many records of poisoning, one severe case, that of a European woman at Fiji, who recovered only after serious complications, and one death.

In the Islands the shells responsible are Cones, strong, prettily marked shells which are found on reefs. Cases of poisoning have been traced to five different species of these Cones, namely, *Conus tulipa*, *geographus*, *marmoreus*, *textile*, and *aulicus*. As these species occur on the Great Barrier Reef, and as it was reported that the shellfish responsible for the death



Conus textile.
[From *Voyage de l'Astrolabe.*

in Queensland was a cone-shaped shell, it is almost certain that a Cone shell did the damage, and the species was probably *Conus textile.*

At the narrow end of the shells, Cones, when crawling about, protrude a long fleshy tube or *proboscis.* Within this tube are numbers of sharp-pointed teeth, hollow within, and with a poison gland at the base of each. When the animal is hunting for food (it is carnivorous) it probably first stuns its prey by pricking it with these sharp teeth, and then eats the animal. It is these teeth in the long proboscis which are responsible for the poisonous stings amongst human beings. Therefore readers are warned against handling Cones or any similar shellfish without gloves, or are advised to hold them by their broadened end, away from the proboscis.

J.A.

The Rat Problem of the Canefields

The importance of our rat population which exceeds fifty known species, was recently shown by the submission of over a hundred and fifty specimens from the cane fields of northern Queensland for identification and report by the Museum Mammalogist, Mr. E. le G. Troughton. Most of the rats were received from the public health authorities of the Queensland Government and Sydney University, and specimens of various species were subsequently mounted by the Museum taxidermists for exhibition at the recent health conference in Brisbane. This work was carried out in regard to the outbreak of Weil's Disease which is conveyed by rats to man, usually with fatal results, so that recognition of the species and their relative numbers becomes of great importance in the cane fields, which naturally attract hordes of the rodents.

The assistance afforded by the Australian Museum in this matter has been warmly acknowledged by Sir Raphael Cilento, Director-General of Public Health in Queensland, and Professor Harvey Sutton, Director of the School of Public Health, and Tropical Medicine in the University of Sydney, who stated that the results from the examinations were of much importance in respect to the outbreak of Weil's Disease.

A further small collection of rats from the Ingham district was submitted by officers of the Colonial Sugar Refining Company regarding economic damage caused by the chewing of cane. It is interesting to note that the greatest damage individually is said to be caused by the smallest of the three species, which has a hairless tail with scales set in a mosaic instead of rings. This small species, which was made known to science from a single specimen from the Cairns district in 1916, and the validity of which was rather doubted until Mr. Troughton's recent discovery of several specimens, has been observed to use the scaly tail in a semi-prehensile way in climbing the standing cane. It is thus able to chew the cane higher up and more deeply than the larger species, resulting in the breaking down of a much larger proportion of stalks.

Australian Shells

THE LIOTIAS, WHEEL SHELLS, NERITES, CAP, SUGAR AND TRUE LIMPETS.

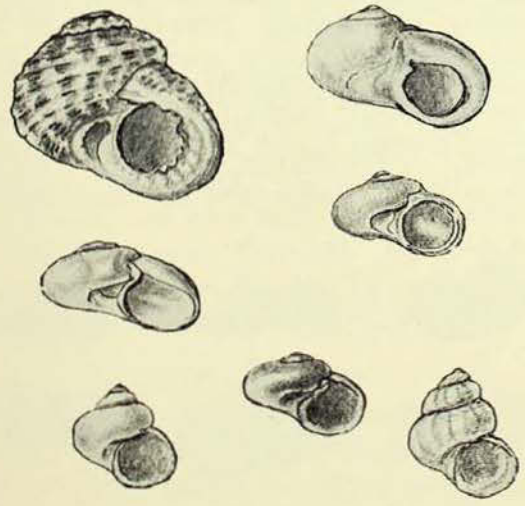
By JOYCE ALLAN.

THE present article is the fourth of a series appearing in THE AUSTRALIAN MUSEUM MAGAZINE on Australian shells. Where certain species occurring in the South Pacific Islands have been found, or are likely to be found, in northern Australia, they are included.

Previous articles have dealt with Slit Shells and False Limpets, Ear Shells and Wide-mouthed Shells, and Top, Turban, Pheasant, and Dolphin Shells.

THE LIOTIAS.

The Liotias belong to the family Liotiidæ, a group of very small, solid, turban-shaped shells with many whorled

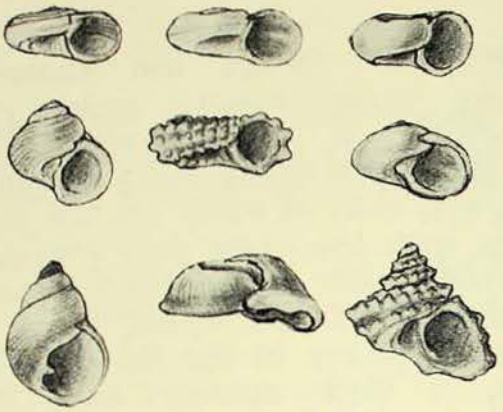


With the exception of the first figure, these minute shells are Liotias. In the upper row, from left to right, are Collonista costulosa and Callomphala lucida, in the middle row Starkeyna starkeyæ and Cirsonella weldii, and in the lowest row Lissotesta micra, Zalipais bruniense, and Brookula angeli. [Joyce Allan, *del.*

horny opercula, some of which have a limy layer formed of pearly particles. Very little is known of any of the animals of this family, but several of the opercula are known and these help in the classification of the species in this interesting group. The Liotias are shore-living molluscs, found mostly under stones, and chiefly in tropical seas. Though small they have strong easily recognizable characters, chief of which are the rounded mouth, with the outer part considerably thickened, and a sculpture composed of longitudinal and spiral ribs. There are many genera in the family, some of which, if their animals were known, would probably be elevated into separate families. It is not intended to give a detailed account of the characters of the different genera in this article, as, being so small, the shells do not often come into the hands of the amateur collector. A representative of each Australian genus in the family is figured from an actual specimen, and, as the shells are all whitish coloured, the drawings will in all probability be sufficient for identification of any specimens.

The chief Australian genera are *Callomphala*, smooth rounded shells with a pad covering the lower portion of the larger main whorl of the shell, and represented here by *Callomphala lucida*, from New South Wales, Victoria, Tasmania, and Queensland; *Starkeyna*, thin, very glassy, rather flattened shells through which can be seen the inside structure, and shown here by the species *Starkeyna starkeyæ* from New South Wales. Small, stout, but also shiny shells form the genus *Cirsonella*, a good example of which is *Cirsonella weldii* from New South Wales, Tasmania, Victoria, South Australia, and southern Queensland, and a somewhat similar, but more elevated shell from the southern States of Australia is *Lissotesta micra*. Both of these are found in shallow water to one hundred fathoms. Another genus, in which the shells are flattened, is *Zalipais*, a small, brown, shallow water

species (*Zalipais bruniense*) of which is found in shallow water in Tasmania, Victoria, and South Australia. The more elevated *Brookula angeli* from the southern states of Australia is chalky white, with longitudinal ribs crossed by striæ, and in the genus *Teinostoma*, the representative figured here being



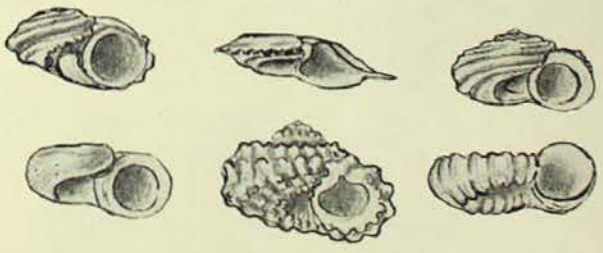
More Liotias. From left to right in each row these read, Elachorbis harriettæ, Microdiscula charopa, Daronia jaffaensis, Charisma josepha, Orbitestella bastowi (Wheel Shell), Teinostoma brazieri, Aleyna australis (Turban Shell), Morchia introspecta, and Mecoliotia spinosa.

[Joyce Allan, *del.*

Teinostoma brazieri from New South Wales, the shells are depressed, polished, or spirally striated, and the lower part or umbilical region is covered by a flat callosity.

Two other flattened forms are *Daronia jaffaensis*, from Tasmania, Victoria, and South Australia, and *Elachorbis harriettæ* from the same region. Both these species are found from twenty to thirty fathoms, and the latter is quaintly marked with two series of close-set, raised, revolving ribs, one lot on the body whorl near the suture, and the other within the umbilicus. Found commonly in Tasmania, *Microdiscula charopa* is a minute flat shell, and in that State also occurs a thick, heavy, semi-elevated small species, *Charisma josepha*. This species also comes from south-west Australia, South Australia, and Victoria; it ranges from ten to one hundred fathoms, and is commoner in the deeper water. A peculiar flattened shell with the last whorl ascending and at the same time embracing within it the earlier whorls of the shell is *Morchia introspecta*, a Queensland species. The mouth of the shell also faces downwards in an extraordinary manner, making the species easily recognizable. A tiny shell which also comes from Queensland, when magnified shows beautiful sculpture, most elaborate for such a minute specimen. This is *Mecoliotia spinosa*, an elevated species with a heavy mouth, the sculpture forming strong pustulose ridges. All of the species mentioned so far range from one to a few millimetres in size.

Two small strongly characterized shells from Queensland are *Leucorhynchia tricarinata* and *Laciniorbis hedleyi*, both of which should be identifiable from the illustrations. Of the true Liotid forms, those in which the rounded mouth is very thickened and the sculpture strongly marked, there are many species closely related in Australia, and only the better known ones are figured in this article. Briefly, these are *Lodderia loddera*, from shallow water in New South Wales, South Australia, Tasmania, and Victoria; *Lodderena minima*, the smallest of the series, a very flattened solid form from the southern States, *Pseudoliotia micans*, an extremely heavily sculptured species from southern Australia, extending round to Western Australia, and *Liotella annulata*, a pretty little species like a small ammonite, which occurs in New South Wales, South Australia, Tasmania, and Victoria. Together with these are *Liotina botanica*,



Six Liotias. Reading from left to right these are Leucorhynchia tricarinata, Laciniorbis hedleyi, Lodderia loddera, Lodderena minima, Pseudoliotia micans, and Liotella annulata.

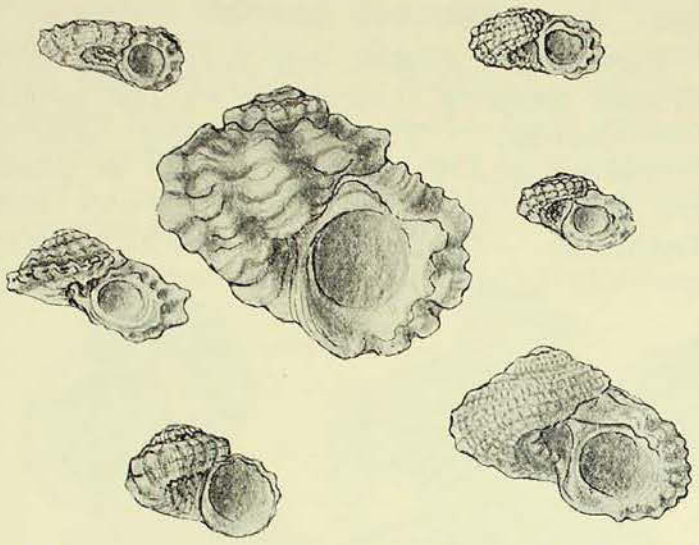
[Joyce Allan, *del.*

occurring in all the southern states, *Liotina subquadrata* from shallow water in Tasmania, and *Liotina mayana* from deeper water in the same state, *australis* from Victoria and Tasmania, and three North Australian forms, *Liotina discoidea*, *L. peronii*, and *Dentarene sarcina*. Of these, *peronii* is the largest of all the

Liotid shells, being a little less than an inch in size.

WHEEL SHELLS.

These are very small shells, less than two millimetres in breadth, which are found, sometimes amongst kelp weed, in shallow to deeper water in southern Australia, particularly New South Wales



The large Liotia in the centre is Liotia peronii, the two top ones are Liotina discoidea and Liotina botanica, the next two are Dentarene sarcina and L. subquadrata, and the two lower ones Liotina mayana and L. australis.
[Joyce Allan, *del.*

and Tasmania. The very flattened shells have a peculiar sculpture on their surface, which when viewed from above gives the suggestion of spokes in a wheel. Wheel shells belong to the family Orbitestellidæ, and the species figured is *Orbitestella bastowi* from New South Wales, Victoria, South Australia, and Tasmania.

THE NERITES.

The Nerites are sometimes called Bleeding Tooth shells because of the blood-coloured teeth found on some species. They are a large family of solid shells, with the main whorl very large and a columellar deck possessing teeth of variable strength and size. The deck-like structure is either smooth, or is ornamented with pustules or ridges. The shells also have a calcareous spiral or non-spiral operculum, with teeth on the inner face, one of which locks into the columellar teeth, thus increasing the security of the operculum.

Nerites belong chiefly to tropical and sub-tropical seas, and although the animals are aquatic a few can live out of the water. They are therefore found at varying depths ranging from above the water line to shallow water. There are no deep water forms. They are vegetable feeders and move above, possibly at night, feeding on the weeds near rocks and stones.

The main genera of Nerites are *Nerita*, a gregarious, littoral genus containing about two hundred different species, and *Clithon*, *Smaragdella* and *Dostia*, sometimes known collectively as Neritina, like small polished replicas of the genus *Nerita*. These are ornamented with a great variety of black and purple, or variegated bands and spots arranged in an attractive design ; some species have spines on the shell. Though they are mostly fluviatile, a few inhabit marine or brackish water, and others cling to roots of trees on the banks of rivers or inhabit the foliage of trees that overhang the water. Another genus, *Navicella*, contains oblong, limpet-like shells somewhat resembling the Slipper Limpets in shape. It is a South Pacific Island genus, and specimens have not yet been recorded from Australia. The species are usually found adhering to floating sticks and roots of trees near the water.

Only the well-known species of Nerites are figured in this article. These are *Nerita polita*, the " bleeding tooth ", a thick, smooth, polished shell with faint growth lines, and varied colour. It may be grey, flecked, spotted or banded with white, yellow, orange, red, or black. Some specimens have the aperture and columellar teeth tinted orange-red. Owing to the great variation of colour the species has been frequently divided into numerous varieties. A smaller species, *Nerita chamæleon*, with a few granules on the columella and plications on the raised outer lip, is noteworthy because of the great variation in its colouring and the low spiral ribs on the shell. The best known of all the Nerites is possibly *Nerita albicilla*, easily recognizable by the rows of conspicuous tubercles on the columellar shelf. *Nerita plicata*, as its name suggests, is strongly plicate, both on the columellar and outer lips, with tooth-like folds, making the entrance to the shell very narrow. Strong spiral ribs also ornament

this species, which is whitish or brown, spotted and streaked with black. A somewhat similar species is *Nerita costata*. The Black Periwinkle, *Nerita melanotragus*, is one of the commonest shells on the rocks in southern Australia, where it occurs in all the States, but especially in New South Wales. It is a black shell, white within, but having the edge of the mouth black-margined. A black patch is also on the columellar shelf. Numerous threadlike, purplish, spiral lines, sometimes speckled with white, traverse the greyish shell of *Nerita lineata*, and almost similar raised lines ornament a more flattened species with an obtuse shoulder angle, *Nerita planospira*.

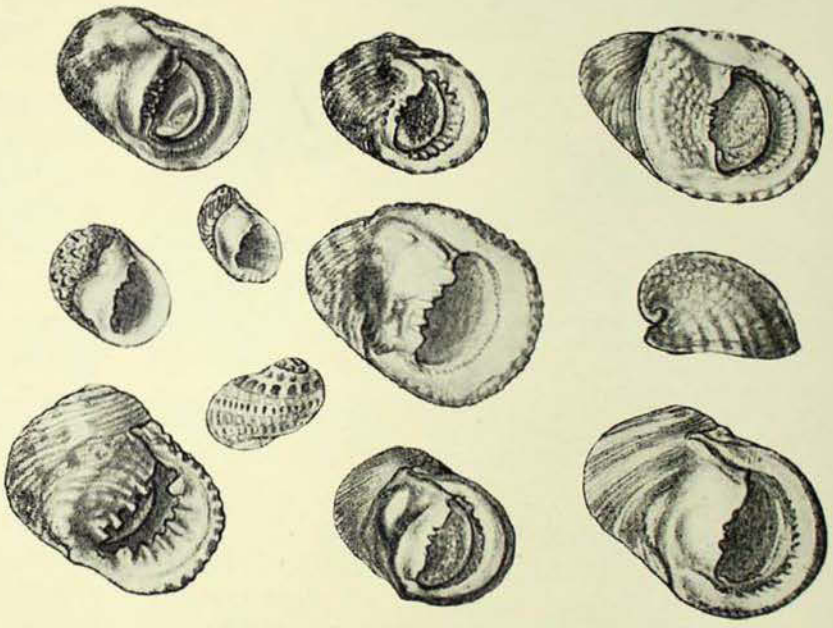
With the exception of the Black Periwinkle, all the above Nerites are found in northern Australia, ranging from north New South Wales round to Western Australia, and measure from less than an inch to almost two.

The Neritines are much smaller in size, and very pretty. Three chosen for illustrating the genus are *Smaragdella pulcherrima*, smooth shining shells, beautifully marked with longitudinal or reticulated black lines on a yellowish ground, *Smaragdella rangiana*, which varies from green to yellow or rose, and has white flames and reddish spots arranged in spiral series round the shell, and *Clithon oualaniensis*, smooth, shining, with reticulated or longitudinal purple-black or reddish lines over the whole surface, which is generally yellow in colour. This is a littoral species, inhabiting fresh-water and mangrove swamps in Queensland and South Pacific Islands. The other two, *pulcherrima* and *rangiana*, both wander into the sea from a fresh-water habitat, where they are dredged in New South Wales, the former more rarely in Queensland. An entirely different looking Neritine, *Dostia crepidularia*, from Queensland, is very convex and exhibits considerable variation in its colouring.

Close to the Nerites in classification is a family of small white shells, reticulated by spiral and longitudinal ribs and striæ, which is represented in the South Pacific Islands by one species, *Neritopsis radula*. The family is *Neritopsidæ*, and so far very few specimens have been found in Australia.

THE CAP LIMPETS.

The Cap Limpets are very small cap-shaped limpets, belonging to the family Cocculinidæ. There are two genera, *Cocculina* and *Cocculinella*, both of which are found in New South Wales and Tasmania. The species, of which there are only a few known, are found in deep water, sometimes on heavy kelp weed, and are only a few millimetres long. The more conical shape is exhibited in the species, *Cocculina tasmanica*, and a longer, flatter and very narrow form is *Cocculinella coercita*. They are both thin, rare species, and are obtained by dredging.



Some familiar Nerites. In the top row are Nerita polita, N. chamæleon, and N. albicilla. In the middle row, the three small ones are Clithon oualaniensis, Smaragdella pulcherrima and S. rangiana. The larger one to the right of these is Nerita planospira, and the last one Dostia crepidularia. In the bottom row are Nerita plicata, N. melanotragus and N. lineata.
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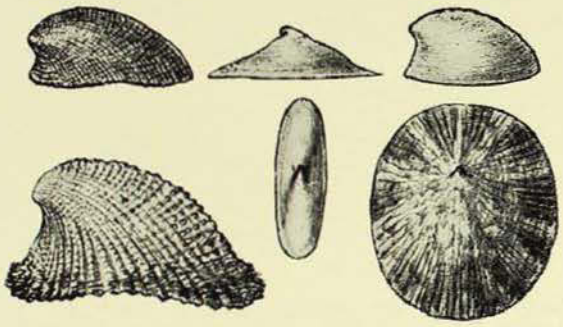
SUGAR LIMPETS.

Sugar Limpets are limpet-like shells with their surface sculptured with radiating lines or cancellations. The species usually

have a brownish, sometimes very dark brown, epidermis, which may be very close, or prolonged into close-set long hairy growths, especially conspicuous along the margin of the shell. These limpets form the family Phenacolepadidæ, and are distinguished from the true limpets by the position of the apex.

Figured in this article are *Phenacolepas cinnamomea*, half an inch in length and found in New South Wales and Queensland, and *Phenacolepas crenulata*, cream-coloured with strong, hair-like light brown epidermis round the edge, and conspicuous ribbing. This species comes from Queensland.



The first shell in the upper and lower row respectively is Cinnalepeta cinnamomea and Phenacolepas crenulata, both Sugar Limpets. In the upper row, the second shell, with its upper view immediately below it, is the Cap Limpet Cocculinella coercita, and by its side another Cap Limpet, Cocculina tasmanica. The remaining Limpet is Chiazacmea diminuta.
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TRUE LIMPETS.

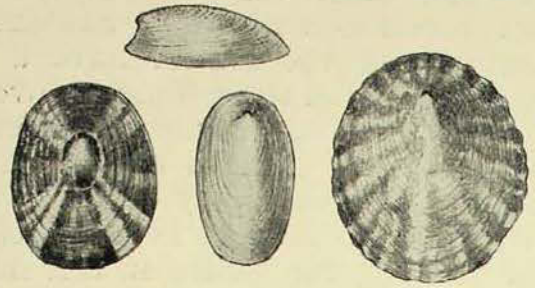
The Limpets are bowl-shaped and conical shells which vary considerably in shape and height according to their age and environment. For this reason they are a particularly difficult group for the scientific worker to identify. When the animals are crawling about it is quite easy to see the head with its mouth and pair of tentacles and the mantle lining the shell. Limpets live on rocks between tides and higher, where they are sedentary, moving only in search of vegetable food, which they rasp from the rocks with their toothed radula. Some are even found on seaweed, but wherever they are they can cling so firmly to their base that it is extremely difficult to move them.

Several families compose the limpets, the chief of which in Australia are the Patelloididæ and Patellidæ, and in these are many species. Only a few of the common ones are figured.

The chief difference between the two families mentioned above is anatomical. The animals of the former have a free branchial plume on the left side above the neck. The shells can be distinguished by the more or less distinct border on the inside of the aperture, by their texture, and the fact that they are never iridescent within. Among the genera in this family are *Patelloida*, thick porcellaneous shells with radiating ridges having a tendency to develop seven larger than the others, examples of which are *Patelloida alticostata*, ranging in its distribution from Tasmania, south Western Australia to southern Queensland, and *Patelloida* (*Collisellina*) *saccharina*, from tropical northern Australia, a form with high ribs and an entirely white interior with a black and yellow margin, or variously marked; *Asteracmea*, minute translucent shells, often with radiating pink bands. Two New South Wales species of *Chiazacmea* are figured here, namely *inradiata*, a very common form recognized by the cross pattern of brownish rays, and *diminuta*. *Naccula*, a genus introduced for a small, hyaline shell with an anterior apex, is represented by the species *parva* from South Australia. *Notoacmea* is distinguished from the other genera by the shells having the inner layer thin and transparent and the outer, when present, more shelly; the radular teeth are also different. The species of *Notoacmea* figured is *petterdi*, from southern Australia ranging up to southern Queensland.

In the other family of Limpets, Patellidæ, the shells are also cone-shaped, but have no distinct internal border, and the gills are replaced by a row of branchiæ set in a ring between the mantle and the foot of the animal. The lining of the shell is sometimes almost translucent and iridescent. To this family belong the commonest limpets found round Sydney, notably *Cellana tramoserica*, the colour of which varies from reddish-brown with white rays to yellow with blackish-brown rays and the interior yellow. It also occurs in other southern states of Australia.

Patellanax perplexa, a very well known and easily identified species from all southern Australia, has eight conspicuous



The very minute Limpet in the middle of the row, with its side view above, is Naccula parva. On the left of it the cross-marked Limpet is Chiazacmea inradiata, and to the right of it, Notoacmea petterdi.
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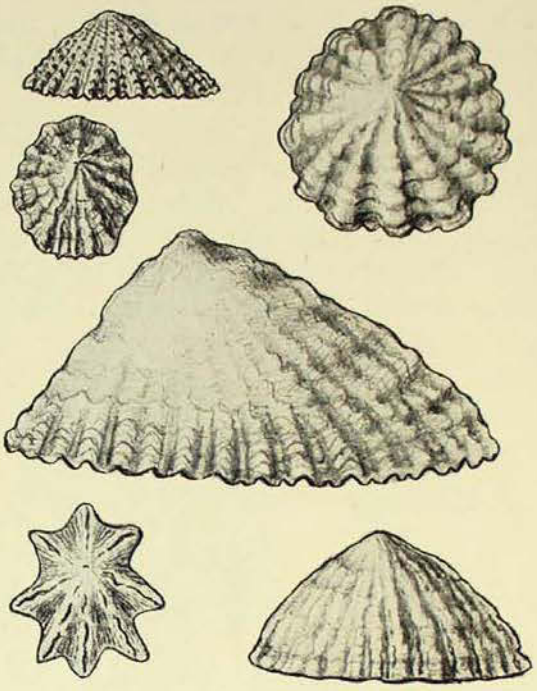
star-like rays with a reddish line running down the centre of each. A more thickened species, *Patellanax squamifera*, is radiately ribbed and ridged, the ridges scaled. The shell is whitish, tinged with grey-black, and the interior is bluish-white. The species occurs in southern Australia generally. The largest of all the Australian limpets is *Patella laticostata* from south-west Australia, which is almost four inches long.

Two small shells are included here, though they belong more properly to the group treated in the previous article. These are *Alcyna australis*, a small shell like a *Phasianella*, but with a tooth on the inner lip, and a horny instead of a stony operculum, which belongs to the family Trochidæ. It is dredged in Queensland. The other species is *Collonista costulosa*, a small heavily sculptured shell



Limpets. The very large one in the centre is Patella laticostata, and the small one to the left of it is Patelloida saccharina. In the top row are Patellanax squamifera and Patelloida alticostata. The two bottom Limpets are very well known forms, Patellanax perplexa and Cellana tramoserica.
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which lives in numbers under stones on coral reefs in Queensland. This species is placed in the *Turbinidæ* on account of the stony operuclum.

Among recent visitors to the Museum was His Imperial Highness Prince Kuni of Japan, accompanied by Lieutenant-Commander S. Asamo and Mr. K. Murai, Japanese Consul-General. Prince Kuni is particularly interested in fishes and shells. He inspected some of our exhibits and was provided with literature on Australian mollusca.

Dr. Jiri Baum of the National Museum, Prague, Czechoslovakia, who, accompanied by Madame Baum, is making a caravan trip in Australia in order to collect insects, spiders, and other specimens, spent some time at the Museum identifying his specimens by comparison with types and named material.

Dr. Cecil J. Hackett, University of Adelaide, who is studying certain diseases of the bone from which Australian aborigines suffer, has recently examined our collection of aboriginal skeletons in connection with his researches.

Sir Edward Samuel, Baronet, of London has recently paid several visits to the Museum.

Other visitors include Professor J. L. Shellshear, of the Chair of Anatomy, University of Hongkong, and Mr. M. S. Curtler, University of Virginia, who is specially interested in ornithology.