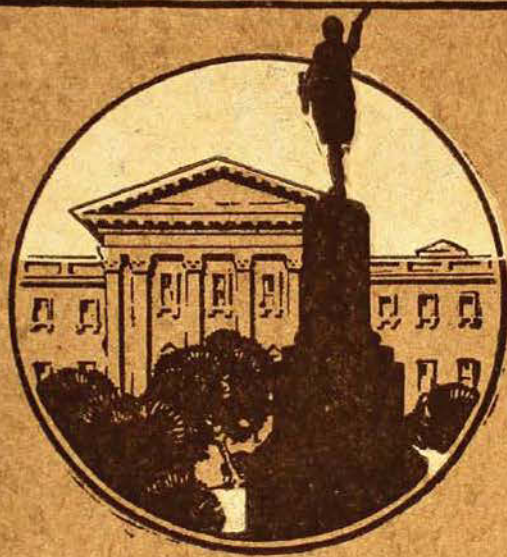


The
**AUSTRALIAN
MUSEUM
MAGAZINE**

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



- The Discovery of the Queensland Lungfish** - - -
G. P. Whitley
- A Permanent Method of Storing Valuable Natural
History Specimens** - - - - -
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- Quaint Creatures of a Coral Isle**
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K. A. Hindwood, R.A.O.U.
- Microscope Mites of the Sea** - - -
A. A. Livingstone
- Teeth of Mammals** - - - - -
C. Anderson, M.A., D.Sc.

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The Horseshoe Clam and some coral over a typical bottom of coral rock and detritus are the most prominent features of this picture, but closer inspection reveals the head and foreparts of a lurking Stonefish (*Synanceja horrida*), the most dreaded fish of the coral reefs. So closely does the Stonefish resemble its surroundings that it is well nigh invisible, but once touched it raises its deadly poisonous spines, which are capable of inflicting awful agony or even death. The fish may be located by cross-lines drawn from the indicators on the margins. (See page 369.)

{Photo.—W. Boardman.



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VOL. III., No. 11.

JULY-SEPTEMBER, 1929.

The Discovery of the Queensland Lungfish.

BY GILBERT P. WHITLEY.

IN the Mitchell Library, Sydney, there is a letter from Gerard Krefft, a past Curator and Secretary of the Australian Museum, to Dr. Richard Lydekker, of the Indian Geological Survey, referring, among other things, to the discovery of the Queensland Lungfish which Krefft called *Ceratodus forsteri*. As this matter will especially interest Queensland naturalists, I give here an abstract of Krefft's letter, which is dated December 18th, 1880:—

During 25 years I knew Mr. Wm. Forster the late Agent General for New South Wales. During ten years (at least) I dined with him at the Parsonage of St. Ann's, Ryde, once a week or so and every time William Forster tantalized me with his *fresh water salmon*.

Well when a thing of this kind is repeated too often a man requires proof, and peace reigned till the Honorable Gentleman, then Minister for Lands, sent me a message about 11 years ago that THE fish had come to hand.

I attended, and after some delay a messenger brought a box which I opened, and found two fishes in it.—

Said Mr. Forster "Well Krefft what are these fish?" Said I "[I] cannot tell till you allow me to examine them."

Said Forster "do so you are wellcome to them. I present them to you, if you will name them after me."—I replied "I will;" took my knife out, exposed the teeth & told Forster "never saw anything to equal this in my life."—

Are they new" said Forster? "no" I said "they are old as the mountains of Australia, and if you will let me alone we will make a fortune with these fishes." "Well (were his last words) "take them away do what you like with them but make the discovery known in to morrows "Herald." Of course I had to keep my word and other people earned the benefit.

I am indebted to Mr. H. A. Longman for calling my attention to a reference in Perry's *A Son of Australia—Memories of W. E. Parry-Okeden*, 1840-1926, p. 171, 1928, where the specimens of the Queensland Lungfish are noted as having been collected by Mr. W. F. M'Cord, a nephew of Forster.

In the *Sydney Morning Herald* for Tuesday, January 18th, 1870, p. 5, appeared a long letter to the Editor from Krefft, who announced the discovery of an "amphibious creature inhabiting northern streams and lagoons," and noted that it was not allied to

the Port Jackson Sharks as Agassiz and others had supposed. "In honour of the gentleman who presented this valuable specimen to the Museum," Krefft continued, "I have named this strange animal *Ceratodus Forsteri*." A few descriptive notes of a popular nature were also given in this letter, which is the first printed account of the Queensland Lungfish I have been able to discover.

I may add that Krefft's type specimen was apparently lost many years ago, although a photograph of it was published in this

MAGAZINE¹ in a more detailed article on this unique Australian fish.

Some doggerel by Krefft, written obviously for the amusement of his little boy, is still preserved in the Mitchell Library. Here is a verse, slightly modified, from a poem entitled *Ceratodus* :—

Lucullus ate Muraena rare
In Rome the daintiest dish
And Squatters on the Burnett dined
On geologic fish.

¹AUSTRALIAN MUSEUM MAGAZINE, Vol. iii, No. 2, 1927, p. 50.

A Permanent Method of Storing Valuable Natural History Specimens.

BY L. S. G. BUTLER.

THE safe storage of small type specimens is a matter of some importance. Sealing in corked bottles is not a good method, and even preserving in bottles plugged with cotton wool and then placing in a large jar does not afford permanent storage. The method now described, namely, hermetic sealing in a glass tube along with a preservative, will, apart from accident, serve to render the specimens safe for all time.

The preservative used is alcohol, which has abundantly proved its efficiency for this purpose; anatomical preparations, made as long ago as 150 years and preserved in alcohol, are still in good condition to-day.

The technique employed is familiar to chemists and mineralogists, but may be new to systematic zoologists. It can, however, be readily mastered by anyone of ordinary intelligence and dexterity, and the necessary materials are cheap and easily procured. They comprise chiefly some soft glass tubing, not too thick-walled, a bunsen burner, a three-cornered file, and some rubber tubing to connect with the gas supply.

If gas is not available a spirit lamp and blowpipe will suffice. Soft glass tubing is easily fusible, and, glass being a poor conductor of heat, a specimen contained in a tube will be uninjured, even though the glass an inch or so distant is heated to fusion.

Taking a length of glass tubing of a diameter suitable for the specimen, the operator procures a tube of the desired length (say five inches) by making with the file a tiny scratch round the circumference of the tubing five inches from the end. The tubing can then be easily broken where the scratch is, leaving a clean edge. The bunsen burner is then adjusted till it burns with a blue flame, in which the short length of tube is cautiously warmed until all moisture has been driven off. Next the tube is heated an inch or so from the end, and, when the glass softens, it can be quickly drawn out to form a slender thread-like tube. Snap this and apply heat to melt the thread down to the base, then cool slowly; the end of the tube is now sealed.

A label is then prepared and pushed down to the base of the tube. The label is all important and should contain all necessary

data, preferably printed on Whatman's hand-made paper, or legibly written with Higgin's water-proof ink. Cut a small extension on the top of the label before it is pushed into the tube and bend this over to prevent the specimen from slipping down to the end of the tube and concealing itself behind the label.

Examine and clean the specimen and slip it into the tube. With the flame turned down a little, again heat the tube two inches or less above the specimen, and carefully draw the glass out, forming a long thin neck (keeping the glass in the flame at first). The diameter of this neck should be about one thirty-second of an inch for easy sealing. Allow the tube to cool, then pour some alcohol into the open end by means of a pipette or small syringe. It will be noticed that the liquid will not pass the narrow neck, but on gently warming the sealed end (away from the flame) the enclosed air can be driven out and the alcohol will take its place. Repeat this operation until the tube is filled up to the narrow neck.

Next warm the open end of the tube until all moisture has disappeared, taking care to keep the open end away from the flame.

Heat the central zone of the neck and draw the open end away smartly. The thread-like termination can now be run down to a small globule of glass and the tube is sealed.

For convenience of handling pack each tube when sealed in a separate clear glass phial, or preferably in an "unbreakable" clear fused-silica test tube. If desired a wooden base can be made, and the phial or tube glued to this support, the end fitting into a hole bored in the centre of the support. Any movement of the sealed tube inside its container may be prevented by inserting each tapered end into a small cork fitting easily inside the container. Fill the container with liquid to increase visibility, cork it, and dip the cork into melted paraffin wax or a solution of glue and turpentine. This cement can be prepared by soaking four ounces of glue in water, melting by heat, and stirring in one and a quarter ounces of turpentine. Keep in a wide-mouthed jar and dissolve for use by immersing in boiling water.

If carried out with ordinary care this operation can be performed in perfect safety, though it must be remembered that alcohol is highly volatile and inflammable.

Notes and News.

Mr. Tom Iredale, Conchologist, returned on 1st June from a visit to Three Isles, Great Barrier Reef, where he was assisting the members of the Great Barrier Reef Expedition in zoological collecting and the making of a biological survey.

On Friday, June 28th, Mr. W. W. Thorpe, Ethnologist, left Sydney by the *Maheno* on a visit to New Zealand, where he will give assistance and advice in the installation of the ethnological collection in the new War Memorial Museum, Auckland.

On April 18th Mr. W. W. Thorpe lectured to the Maccabean Literary Institute on "Ancient Egypt." Lectures on the same subject were given by Mr. Thorpe to the Feminist Club on June 11th, and to the Sydney Bush Walkers' Club on June 14th.

A fine Queensland Groper (*Promicrops lanceolatus*) is being added to the museum collection as this MAGAZINE goes to press. It is seven feet two inches long, and weighed 441 lbs. when fresh, and is believed to be the largest specimen of this species in any museum. We are indebted to Messrs. G. Koutalis and P. Marvis for this fish, which was caught at Maclean, Clarence River, New South Wales. An account of a smaller Queensland Groper was given in an earlier number of this MAGAZINE.¹ Both giant fishes were mounted by the Museum taxidermists, Messrs. H. S. Grant, J. H. Wright, and W. Barnes, by the manikin method, and coloured by Miss E. A. King.

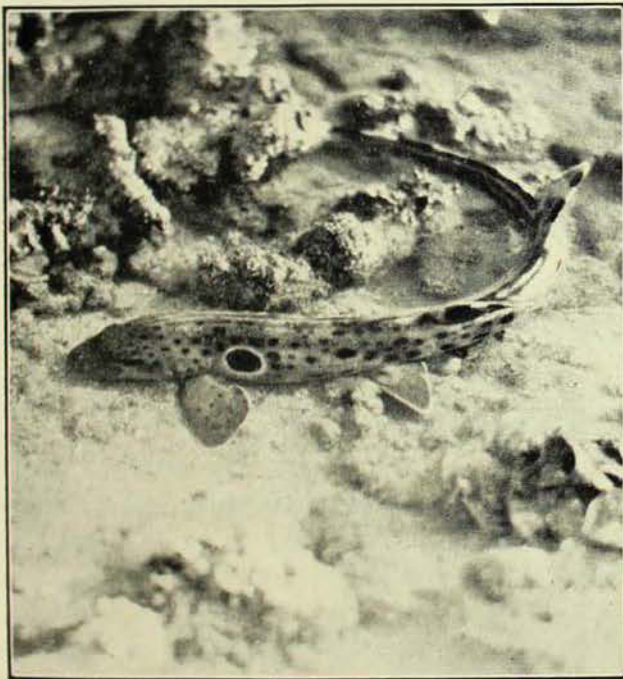
¹Whitley, "A Giant Fish," AUSTRALIAN MUSEUM MAGAZINE, Vol. ii., No. 10, 1926.

Quaint Creatures of a Coral Isle.*

BY G. P. WHITLEY AND W. BOARDMAN.

THERE must be thousands of different species of fishes in Queensland, and one can collect a hundred different kinds in a couple of months' stay on any coral island in the Great Barrier Reef. At Low Isles the reefs teemed with fish life, whilst the mangrove forest supported a distinctive fauna. There pygmy garfishes made rings on the water surface as they floated like little sticks near the mangrove roots, grey Silversides swam in groups near the sandy bottom, scooting away as quick as lightning when disturbed, Goggle-eyed Mangrove Fishes skipped across the mud or

forest, we waded to its source and noticed, just in time, a stingray in the shallow water amongst the tangled roots. One more step and we might have trodden on it and been



Cat Shark (*Chiloscyllium ocellatum*). This species, easily recognized by the large dark ocellus on the shoulder, is very common on the Great Barrier Reef and can easily be approached as it moves about in a blind fashion.

[Photo.—Melbourne Ward.]

climbed mangrove roots, little Blue Eyes kept the water free from mosquito larvae, and Rock Cods were sometimes found curled inside empty clam shells. Once, following a creek which penetrated the dense mangrove



A gaily ornamented Wobbegong or Carpet Shark (*Orectolobus devisi*), basking in a shallow coral pool. This species is harmless to man and grows to a length of at least six feet.

[Photo.—Melbourne Ward.]

gashed by the serrated spine on its tail. From a few paces this sombre-coloured animal was indistinguishable from the muddy water overshadowed by the trees. Subsequently we saw more of these rays and caught one for the Museum, after taking its photograph *in situ*. It proved to be a species (*Himantura granulata*) not hitherto known from Australia, and considered to be rare. We also caught a Spotted Cat Shark (*Chiloscyllium ocellatum*) about three feet long, amongst the mangrove roots. This is a harmless species which is common on the Barrier Reef; it gropes along the bottom in shallow water in a half blind fashion seeking

*This is the third and concluding article on the fauna of the Low Isles, North Queensland.

its food, and is easily recognised by the large dark eye-spot on each shoulder. It is sometimes called the Epaulette Shark. Another harmless ornate shark is the Wobbegong or

enter the anemone's mouth. The accompanying photograph, taken from life, shows the fish swimming amongst the tentacles of its adopted host.



Amongst the mangroves almost motionless stingrays (*Himantura granulata*), were sometimes seen. This species was not known from Australia until found at Low Isles. The long tail carries a serrated spine which can inflict an ugly wound.

[Photo.—Melbourne Ward.

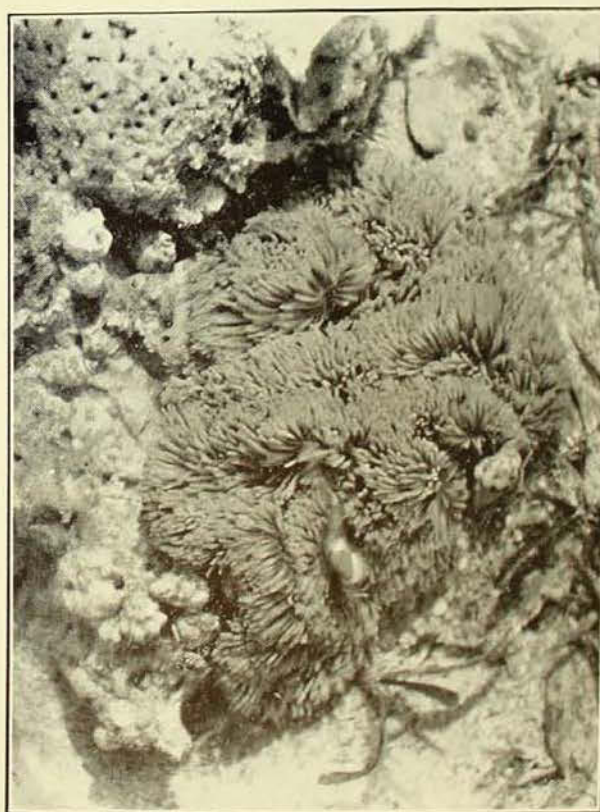
Carpet Shark (*Orectolobus devisi*). A photograph of one of these, which was taken in the Capricorn Islands by Mr. Melbourne Ward, is here reproduced. The photography of live fishes is not an easy matter, and there is a woeful absence of such pictures in ichthyological literature.

THE ANEMONE FISH.

At Low Isles we frequently found brightly coloured shrimps (*Periclimenes brevicarpalis*), and still brighter fishes (*Actinicola percula*) living amongst the stinging tentacles of the Giant Sea Anemone (*Stoichactis*). The fish is bright red with broad white bands bordered with black and is not only immune to the stings of the anemone but is unusually hardy for a reef fish as well. We kept one in a bottle for a couple of days, and watched it swimming with its broad ventral fins extended all the time; we afterwards placed it near another anemone, and, after swimming about for some time as if to get its bearings, the fish snuggled into the tentacles, gently waving its fins, or else sheltered in the folds of its host, but we could not induce it to

THE JUMPING JOEY.

On the rocky benches or coral debris ramparts of the Queensland reefs one is sure to see a curious little fish of the blenny family skipping from stone to stone or flopping into the water. This is the Jumping Joey, one of the many species of *Salarias*, and is reminiscent of the Goggle-eyed Mud-Skippers or Walking Fishes of the Mangroves, but the latter are cousins of the Gobies, and have very different ventral fins. A light-coloured Jumping Joey with spotted sides was common at Low Isles, and was easily seen when hopping about, although when it lay still it exactly resembled its rocky surroundings in colour.



The Giant Sea Anemone kills its prey by means of the stings on its numerous tentacles, but a little striped fish (*Actinicola percula*) is immune to its attack and can be seen in this picture swimming amongst the fronds of its host.

[Photo.—W. Boardman.

Under water it rested with little tentacles erected over its eyes like antennae, and with its gills working rapidly—one might almost say that the gill-openings twinkled. After a

few minutes' immobility, broken only by the movements of the gills and synchronised rolling of the eyes, the fish suddenly skipped away so rapidly that it was soon lost to sight in its new surroundings only a couple of feet away. The gills were not used when the fish was out of water, and we noticed that the colour varied from light olive almost to blackish, and that some specimens had a crest on the head. A flattened crab (*Petrolisthes*) was found under stones in the same places as the Jumping Joey, and often shed its claws as it escaped from us.

THE KINGFISH.

Some fishermen who had damaged the propeller of their launch on coral had to put in at Low Isles when we were there. They had twenty-six Kingfish or Barred Spanish Mackerel (*Scomberomorus commerson*) which they had caught by trolling. These fishes were about nine or ten pounds in weight when cleaned, and were almost mature. The fishermen informed us that they come up from the south in June or July, increasing in numbers and size until about November, when they spawn. They may be caught by trailing a "lily" or a piece of red or white rag behind a launch, until December, when they return to the south. The Kingfish bite ferociously, and are often caught in numbers, yet they do not stay long in one place, and may not be encountered the day after a good catch has been made. The Kingfish of Queensland is not related to the fishes called by that name in New South Wales or Victoria.

THE WALKING FISH.

So much has been written about the wonderful Walking Fish that we hesitate to inflict still more upon our long-suffering readers, nevertheless, this goggle-eyed marvel has such a perennial interest for all who visit our tropical mangrove swamps, that it is impossible to ignore it. The first account of an Australian specimen was given by Cook, and is thus described in Hawkesworth's Voyages:—

(Tuesday, 29th May, 1770. Near Thirsty Sound
[Queensland]).

We found here also a small fish of a singular kind; it was about the size of a minnow, and had

two very strong breast fins: we found it in places that were quite dry, where we supposed it might have been left by the tide; but it did not seem to have become languid by the want of water, for upon our approach it leaped away, by the help of the breast fins, as nimbly as a frog; neither indeed did it seem to prefer water to land, for when we found it in the water it frequently leaped out and pursued its way upon dry ground. We also observed that when it was in places where small stones were standing above the surface of the water at a little distance from each other, it chose rather to leap from stone to stone than to pass through the water, and we saw several of them pass entirely over puddles in this manner, till they came to dry ground, and then leap away.

At Low Isles we studied living Walking Fish (*Periophthalmus argentilineatus*), which were common enough in certain parts of the mangrove forest. They walked about near the water's edge, jumping at any living thing or munching little mouthfuls of sandy mud, which they later spat out or puffed through their rapidly-moving gills. Sometimes they rolled on their sides as if to moisten the membranes of their dorsal fins, which were erected like sails when, as often happened, two fishes snapped at each other. These fins were usually laid down when the fishes walked or swam across a puddle with a wriggling motion. On land, the tail fin was often carried tilted up at an angle, and the fish "rowed" itself along with the pectoral fins, obtaining a purchase with the ventrals or true breast fins at each stroke; a little groove was left in the mud as a trail caused by the body of the fish. When disturbed, the Walking Fishes skipped hurriedly out of the way, but when they thought nobody was about they employed the motion which resembled rowing.

Seen from above, the living fish was olivaceous in tone, but on the sides were strongly contrasted black and white marks; these not only served to break up the outline of the Mud-skipper, but resembled sunlit granules of sandy mud such as were to be seen around the fish.

THE DEADLY STONEFISH.

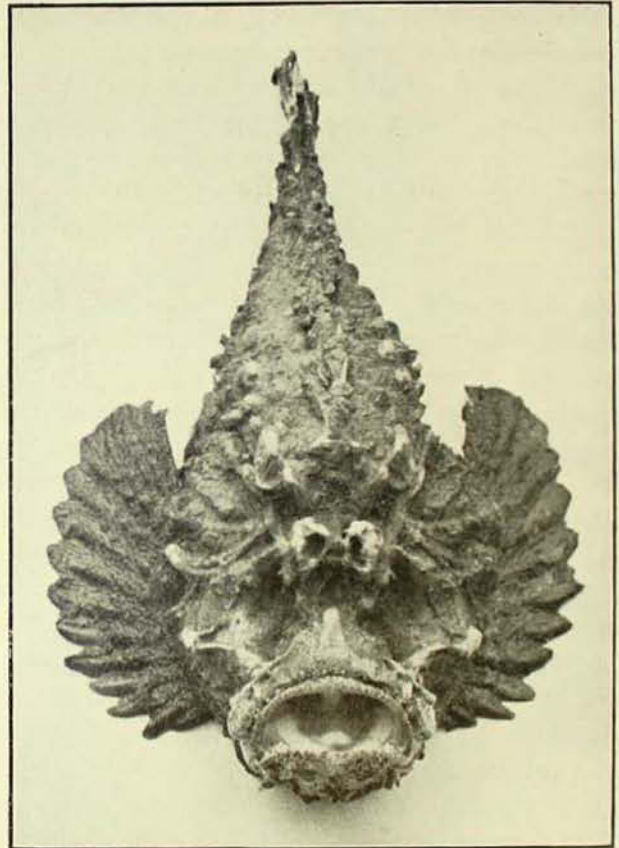
We were about to turn over a piece of coral when something between it and a gaping clam attracted our attention. We had to look at the intrusion very closely before we realized,

with an involuntary start of horror, that we were at last confronted by a Stonefish (*Synanceja horrida*). We touched it with a stick, and three poisonous spines rose instantly, and then only were we sure of the evidence of our own eyes, and we gazed upon the hideous fish with a feeling akin to admiration. Here was a vertebrate animal, a fish, a creature which should have darted away before we came anywhere near it according to all the accepted laws of Nature, yet this Stonefish lay absolutely motionless; it seemed part and parcel of the knobby coral or alga-coated stones in its vicinity. Its skull-like head was distorted into a series of bumps and hollows of a lemon yellow colour, and pock-marked with grey, so that it was extraordinarily like the yellowish madrepores from which the forepart of its body protruded. The spines, too, were yellowish, with their investing skin puckered into fronds and frills which completely disguised their poison bags and needle points. The eyes had tiny black pupils surrounded by a variegated iris whose very skin was pimpled to look like weed, whilst the hinder parts of the body and the broad, thick, pectoral fins were insinuated under the ledges of coral or the sides of the clam, and were brownish, with yellow or reddish warts. The fish lay somewhat on one side, and its symmetry was imperceptible except about the bony parts of the head, but these so resembled coral nodules that their equilateral nature seemed all the more appropriate. The mouth was kept tightly shut, but we pushed it open with a piece of coral and saw that it was white inside with blackish markings.

The immobility of the fish was uncanny. The Stonefish seemed as if conscious that its poison spines were a match for anything which should dare to flout its dignity. Surely, we thought, the creature must breathe, and in breathing move its bony gill-covers, but here again for some time we looked in vain for movement until we discovered a little aperture opening at intervals of about four seconds to eject a current of water. Molluscs crawled over the Stonefish's rock-like head and so did one or two prawns; some of them even walked over the fish's mouth, and we were quite disappointed when it did not gobble them up.

The specimen was photographed before being

in any way disturbed, and the result, reproduced as our frontispiece, is probably the only picture so far published of a living Stonefish *in situ*. Carefully, very carefully, we netted the Stonefish and carried it home at arm's length; it died in a bucket of sea water overnight, and is now preserved in the Australian Museum. In life its head, body, and fins were coated with a brown or dark greenish slime.



The same Stonefish as illustrated in the frontispiece, but removed from its surroundings to show its shape and the poison spines along its back.

[Photo.—W. Boardman.]

We met a fisherman who had had his finger scratched by a stonefish spine. He suffered intense agony for fifteen hours, and his finger became so stiff that he could not bend it, the poison seeming to affect the nerves rather than the blood. He felt at times as if someone were twisting each of his vertebrae, one after the other, right down the spine, and was unable to obtain relief from doctors or herbalists. At times the pain was so intense that only the thought of his wife and family restrained him from committing suicide. Eventually he recovered, but cases of death from stonefish poisoning are by no means uncommon.

SOME OF THE CRABS.

The tropic night has a peculiar charm and fascination. A light surf softly heaves and subsides on the beach, the agitation of the water often stimulating the minute phosphorescent organisms living in it so that the breaking waves become charged with small scintillating flashes of light. It is then that the beach community really awakens, and the principal inhabitant, a crab (*Ocypoda ceratophthalma*) ventures forth in numbers, all busily scouring the sand for food. In consideration of their agility one writer has called them Swift Sand-crabs, and has compared them to "foam blown before the gale." Our walking round the island with a hurricane lamp filled the feeders with consternation, and dozens of their shadowy forms could be seen frantically darting across the sand, seeking sanctuary in their burrows or the darkness beyond the circle of light. During the day they do not show themselves frequently but their presence is indicated by the numerous burrows constructed well above the high-water level. The Sand-crab is a carnivorous feeder, being very partial to the dead bodies of birds, fish, and other animals which are occasionally washed up. A feature of particular interest is that in the Sand-crab we have an example of an organism in process of evolution from a marine to a terrestrial existence. The conquest of the land is almost complete, for we find that the gills which normally serve for respiration in aquatic crustaceans have be-



Feigning death, these small crabs (*Actaea tomentosa*), permitted their picture to be taken and never by so much as a tremor gave indication of life.

[Photo.—W. Boardman.]

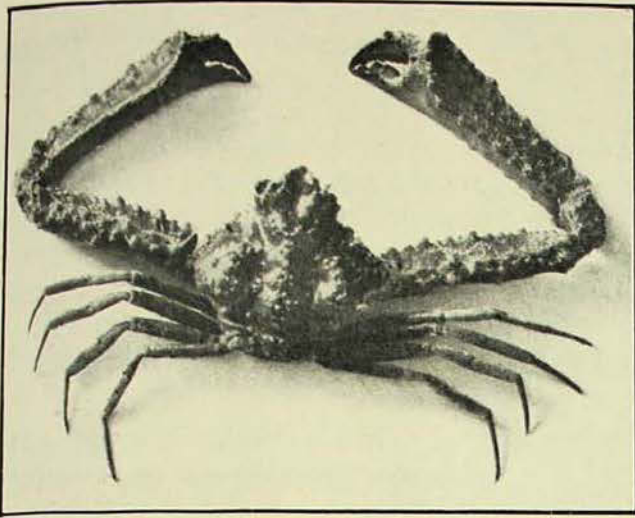


A Swift Sand-Crab's burrow, built in the sand well above high water mark. Note the pile of sand ejected during construction and the footprints radiating from the entrance.

[Photo.—W. Boardman.]

come transformed into primitive lungs to such an extent that the crabs drown if forcibly immersed in water. Sometimes when we were quietly sitting on the beach with ears alert to register the varied sounds of the night, a low intermittent grating sound could be heard, each time answered from another point a few feet away. The sound was readily recognised as that produced when the roughened surfaces, occurring on the inner side of the basal segment and its neighbour in the Sand-crab's large nipper, are rubbed together. Among other uses the sound is thought to be a mating signal.

Another crab (*Actaea tomentosa*) which lives under boulders on the flat has a peculiar habit of feigning death to escape detection; this phenomenon is not unusual in the animal kingdom. Most camouflaged animals appreciate to the full the necessity of remaining motionless when under observation, since movement would immediately betray them. A number, however, like the stick insects and this *Actaea*, actually pretend to be dead and will keep up the deception even if handled. If a coral block is overturned there is immediately a great commotion, as the numerous crabs and shrimps, fish and other creatures sheltering thereunder rush or flounder about in an endeavour to secure a new hiding place. Amongst them are probably several specimens of the dark brown *Actaea*, which almost immediately press the legs and nippers close to the undersurface of the body and then remain motionless like small brown pebbles. The crabs will permit themselves



An anomaly of the crustacean world, this weird crab (*Parthenope pelagica*) lives in the meadows of sea grass.

[Photo.—W. Boardman.]

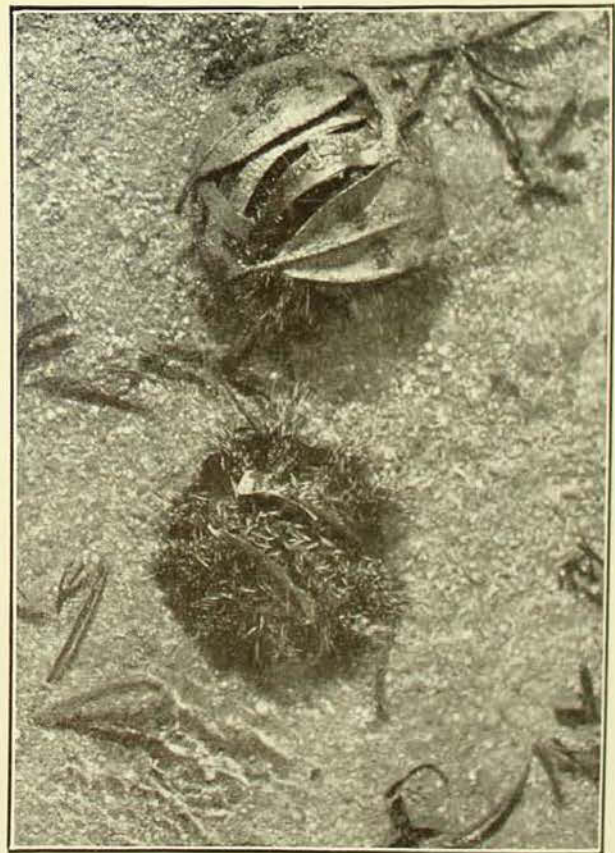
to be handled roughly and never by so much as a tremor give indication of the life pulsating through them. The individuals photographed remained dormant for some minutes on the hand, the heat of which probably made them restless before they would normally have commenced to move.

Yet another weird little crab (*Parthenope pelagica*) was discovered living in the sea-grass meadows on the flat adjacent to the mangroves. This anomaly of the crustacean world has a small body supported by four pairs of slender legs but the arms, bearing at their extremity a rather delicate nipper, are seemingly ridiculously large and cumbersome. The crab's progress, as might be surmised, is slow and ungainly, as the sea-grass often forms a considerable impediment to its movement. The surface of the body is pitted and scored and it has been suggested that this is to facilitate an accumulation of silt on the back, which would serve in no small measure to camouflage the creature; whether or no this is so we were unable to determine.

TWO CAMOUFLAGE EXPERTS.

The observation and study of camouflage tricks and protective devices generally in nature is always fascinating. Not granting lowly marine organisms the possession of intelligence, we can only believe that their habits and instincts in this direction are the product of ruthless and vigorous natural

selection. For countless generations a sifting process has been in continual action, only the better camouflaged individuals of a species living to carry on the race, so that ultimately a perfection in the art has been attained which at once amazes and delights the beholder. In a previous article a sea-cucumber was noted which invested itself with a film of sand to avoid the prying eyes of enemies. A sea-star living on the Low Isles flat has the same or a similar habit as it is usually found silted up in the sand. Apparently when the tide is receding the sea-star works its way into the surface and a shallow deposit of silt is smoothed over its form. Thus well hidden it awaits the return of the water and then, dragging itself from its resting place and still bearing its covering, it commences to move slowly away. Probably the water which so readily invested it just as readily washes the sand from its back, but the real danger period, when it might have been observed by the sharp eyes of some one of the numerous wading



Blades of sea grass are cunningly used as camouflage by this sea urchin (*Tripneustes gratilla*). The upper specimen has also pressed a couple of mangrove leaves into service; the lower one has been divested of most of its covering.

[Photo.—W. Boardman.]

birds frequenting the flat and reef at low water, has been safely passed over.

A sea urchin (*Tripneustes gratilla*) cunningly uses as a disguise the sea grass among which it lives. Lying among the weed, an unusual arrangement of detached blades, formed into a regular ball-like mass, prompts further investigation, and examination quickly reveals the urchin in its well-fitting dress. The animal is about three inches in diameter and is covered with short spines, the body and spines being marked with alternate sectors of orange and brown. The weed is held in place by numerous tube feet, which are slender contractile tubes protruding through the shell or test, each one having a sucker at its extremity. The system of tube feet is controlled by water pressure so that the hold of the suckers can be relinquished voluntarily. When the animal is handled and taken from the water the tubes are withdrawn and the camouflage falls away.

THE MANGROVE ISLE.

The larger of the two Low Isles is about three quarters of a mile long and somewhat less than half that distance across its greatest width, densely covered with a growth of tropical mangroves (mainly *Rhizophora mucronata*¹), individuals of which in the heart of the forest easily exceed forty feet in height. This mangrove area was to us a never-ending source of wonder. Entrance was effected through wide openings between the trees of the outskirts leading to avenues thickly carpeted with sea grass, which muffled the squeelch of heavy boots as we progressed. The silence of the place had an almost oppressive quality, being broken only by the distant rumble of the surf, the wild call of some brightly coloured kingfisher, or a mysterious sharp click from the shadows of

the mangrove roots. Hermit crabs bearing their shelly home lumbered heavily through the weed and small shoals of startled fish darted hither and thither. Was ever a stage set to induce such a sense of eeriness and mystery? As we entered further and further into the heart of the swamp the avenues gradually narrowed, till soon we walked in shady arbours with the sun's rays filtering through the lattice of branches and leaves above, to be reflected as a lace of light on the still water.

Naturally the life existing in a mangrove swamp is strictly limited, as few creatures are able to defy successfully the disadvantages of a mud habitat. The mangrove whelk (*Pyrazus palustris*) is a large mollusc, some three or four inches in length, which is very plentiful and usually lives on the surface of the mud between the mangrove roots. It is essentially a vegetarian feeder and seems to relish the mangrove seeds, numbers of which were seen lying about. These seeds are spindle-shaped, commonly about a foot in length, and hang among the leaves till ripe, when they fall onto the mud or water below. As many as a dozen or more whelks were often seen clustered round a fallen seed on which they were



The mangrove whelk (*Pyrazus palustris*), which occurs in great numbers on the surface of the mud between the mangrove roots. [Photo.—W. Boardman.]

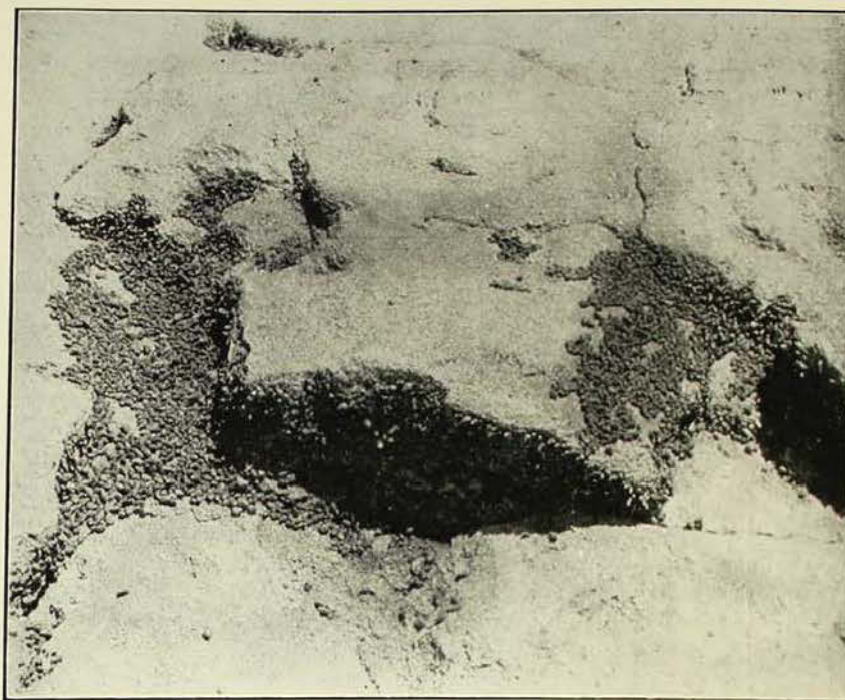
¹See also Musgrave, AUSTRALIAN MUSEUM MAGAZINE, Vol. III., No. 9, p. 318.

busily feeding. There is another mangrove whelk (*Telescopium telescopium*) equally plentiful, which also attains a length of three inches or more.

In the open shallow waters of the swamp a species of swimming crab (*Thalamita crenata*) was often observed. The swimming crabs have the last pair of walking legs modified to serve as paddles by which they are able to move through the water with extraordinary rapidity. Many of the species use their swimming powers to the full and are frequently captured in the surface waters of the sea, but we were able to observe *Thalamita crenata* only as they half ran, half swam, over the bottom. Scared by our approach, they would rapidly retire with a side-wise dart, the forward nipper folded against the body, the hinder trailing behind as though prepared to repel any attack from the rear. Though shy, surprising courage is displayed when it is cornered, and this pretty green crab will square the body to face an opponent, at the same time elevating gaping nippers in an attitude of

defence as though determined to sell life dearly.

The eastern side of the mangrove area is somewhat higher than the remainder owing to deposits of coral shingle forced among the trees by the heavy weather experienced on the Queensland coast. This shingle bank, much of it above high water level and with the other parts only covered at the highest tides, was the site of a number of large deep burrows. The

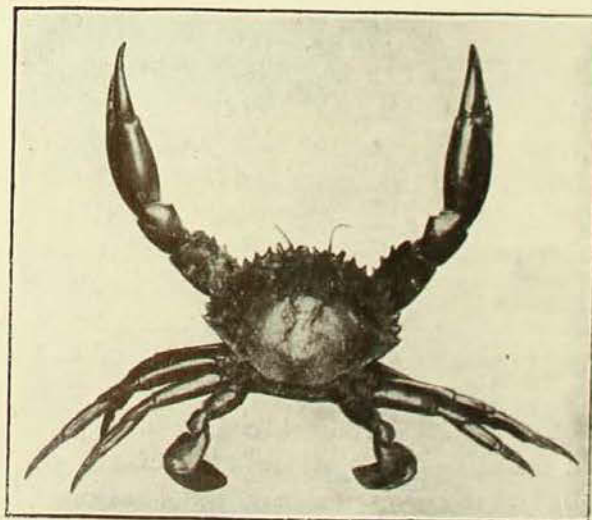


A gregarious winkle (*Planaxis sulcatus*), which lives on the exposed face of the outcropping beach rock unprotected against the fierce rays of the sun.

[Photo.—W. Boardman.]



One of the large burrows excavated in coral shingle by the mangrove swimming crab (*Scylla serrata*).
[Photo.—W. Boardman.]



The giant mangrove swimming crab (*Scylla serrata*), which may measure seven inches across the body. It is esteemed as an article of food.

[Photo.—T. C. Roughley.]

burrows were in some cases nearly a foot across but no sign of occupancy could be observed, so that for some time the identity of the burrower remained a mystery. Subsequently the work was credited to the Giant Mangrove Swimming Crab (*Scylla serrata*). Examples of this crab measure as much as seven inches across the body; the larger nipper is a formidable weapon five inches or so long. The species is widely distributed through the Indian and Pacific Oceans and is invariably found within the confines of a mangrove swamp. Not infrequently the crab is captured as far south as Port Jackson and is occasionally displayed for sale by local fish-mongers. The late A. R. McCulloch relates how the natives in the vicinity of Cooktown,

North Queensland, hunt for them with spears in the shallows, where great numbers are caught and used for food.

A HARDY BEACH WINKLE.

Huddled together in dense patches a small gregarious winkle (*Planaxis sulcatus*) lives on the exposed face of the conglomerate outcrops on the beach. These outcrops are submerged only at high water, so that necessarily the shells are for long periods unprotected against the merciless rays of the tropic sun. When picked off the rock the animal retracts within the shell, at the same time causing water to ooze from the mouth, the water undoubtedly serving to keep the body moist till the return of the tide.

Notes and News.

On May 6th, Mr. A. A. Livingstone, Assistant in the department of lower invertebrates, left Sydney for Darwin, where he joined Dr. H. Lyman Clark, of the Museum of Comparative Zoology, Harvard College, Mass., U.S. America. Dr. Clark proposes to investigate the marine life of the North and North-West Coast of Australia from Darwin round to Broome, paying particular attention to the Echinoderms, on which group he is a world's authority. This stretch of the Australian coast is sparsely populated, and has received but little attention from collectors and scientific investigators. Dr. Clark, with the assistance of Mr. Livingstone, intends to make a general survey of marine life, and it is expected that the expedition will result in large and valuable zoological collections, and a notable increase in our knowledge of the animal life of this part of Australia.

Part of the expenses of the Expedition is being met by a grant from the Australian National Research Council.

During the dinner hour on Wednesday, June 19th, Mr. J. R. Kinghorn, department of herpetology and ornithology, gave a short lecture on venomous snakes to members of the Public Medical Officers' Association. He described the methods used in the identification of snakes, their interrelations, the toxicity of their venoms, and the first aid treatment commonly in use. This was followed by a general discussion on the medical treatment of snake-bite, and particularly the use of antivenine. It was recognised that a first essential in the use of antivenine is the prompt identification of the species inflicting the bite.

On Thursday night, 23rd May, Mr. J. R. Kinghorn lectured to the teachers and children of the Burnside Presbyterian Orphans' Home. The subject was "A Ramble with Nature," and mammals, birds, reptiles and sea-shore animals were dealt with. The audience numbered about 450, and was most attentive and appreciative.

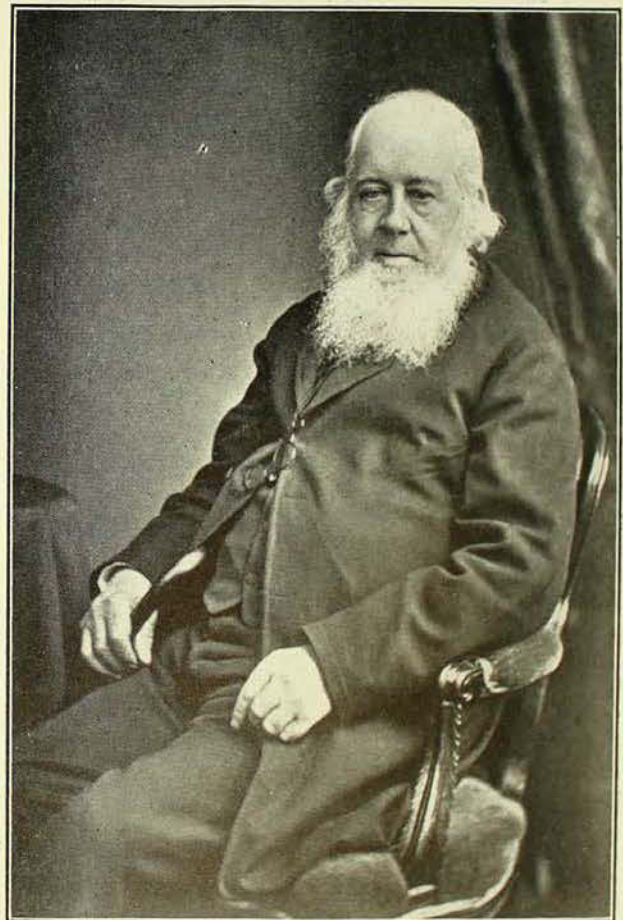
The Bird Man.

BY TOM IREDALE.

A FEW years before the day aeronautics dawned there lived a man who desired to go down to posterity simply as the "Bird Man." In his case he intended the name to be used in commemoration of his intense love of birds, not in connection with the age of flight. Such a wish was expressed by John Gould (1804-1881), one of the greatest pioneers of publicity who ever visited Australia's shores. He was born in the country in England, where most that the general public knew of Australia was summed up in the words "Botany Bay." Gould lived to see this country one of the best known and respected of nations, to which result his work paved a way.

Just about one hundred years ago, a young man, a country gardener's son, moved to London to follow his occupation in the employ of one of the aristocracy. There also he pursued his hobby, the stuffing of birds, a strange one for an unlearned man to choose, but great was the skill in his fingers. A man of few words and careless of future fame, Gould never troubled to explain how his love of birds was born, so that his secret died with him. All that is known is that his work in the taxidermy of birds attracted the attention of his employer, who, as was the wont in those days, at once took an interest in this novel workman. Gould's skill in setting up his trophies was brought to the notice of those able to judge and his ability was recognised. Just about this time the Zoological Society of London was formed, and the now very famous Zoological Gardens in Regent's Park began. Gould's patron secured for his protégé the post of assistant, and probably Gould then imagined that the height of his ambition had been reached. He courted and married a Kentish lass, and this marriage was the foundation of Gould's great fame. It is quite probable that at that time Gould had no great ambitions, but he was extraordinarily energetic and very persevering.

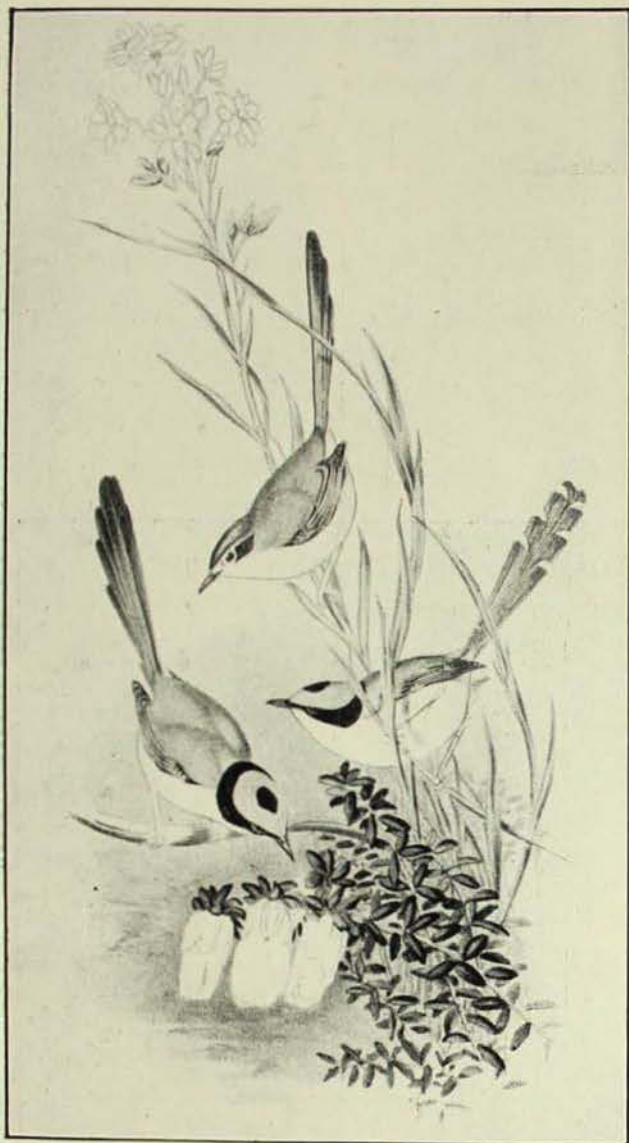
Attached to the Zoological Society was a museum, and Gould prepared the subjects, as, according to the custom, every object that came into the museum had to be set up and cased, named and labelled. The



John Gould at the age of 71.

[Photo.—Maull and Fox.]

lack of names troubled Gould, and he applied to Vigors, who was the Secretary of the Society, and the foremost ornithologist in England, for advice. A large series of birds then arrived from the Himalayan Mountains, and Gould pointed out that all these were undescribed species, at the same time indicating that they would make fine pictures. Mrs. Gould was a natural painter, and had painted some botanical pictures which Vigors had seen and he immediately seized a great



Lilac-Crowned Fairy-Wren (*Rosina coronata*), one of Australia's most lovely birds.
[From *Gould's Birds of Australia*.]

opportunity to kill half a dozen birds with one stone. Just previously an Englishman, William Swainson, had published some paintings which excelled even those of the French artists, who up to then had reigned supreme in this branch of art. Vigors saw that Mrs. Gould's paintings were at least as good as Swainson's, and better than the French ones and he put all his power into the project of publishing paintings of these Indian birds by Mrs. Gould, while he himself kept in the background, though he described the birds and assisted Gould in every way to make the project a success. By this means he was revenged upon Swainson, with whom he had had a bitter quarrel, and also upon the French ornithologists as a whole, with whom he had also fallen out.

Thus the fortune of Gould began through the vagaries of a clever and erratic scientist. The paintings created a furore and made history in that they have never been excelled. Gould's energy may be gauged by the fact that the series of paintings, eighty in number, were prepared and issued before the few lines of description written by Vigors appeared in print. So successful was the issue of this work that with the money accruing therefrom Gould attempted a most ambitious work, nothing less than a pictorial representation of the birds of Europe. The plan of the work was such that it could scarcely be carried out with success to-day. His prospectus promised a part containing twenty plates to be published quarterly, and he fulfilled his promise, completing the work in twenty-two parts. The plates, like those of his previous work, are of large folio size, produced by the lithographic process and hand coloured. Thus, first a painting was made and transferred to a lithographic stone. From the stone the prints were taken and then each print was coloured by hand to the pattern of the first painting. Such detailed work did not favour rapidity of execution, yet so industrious was Gould that, while he was overseeing all this work, he prepared letterpress to accompany it, and, not content with this, he initiated and carried out some minor works of the same nature.

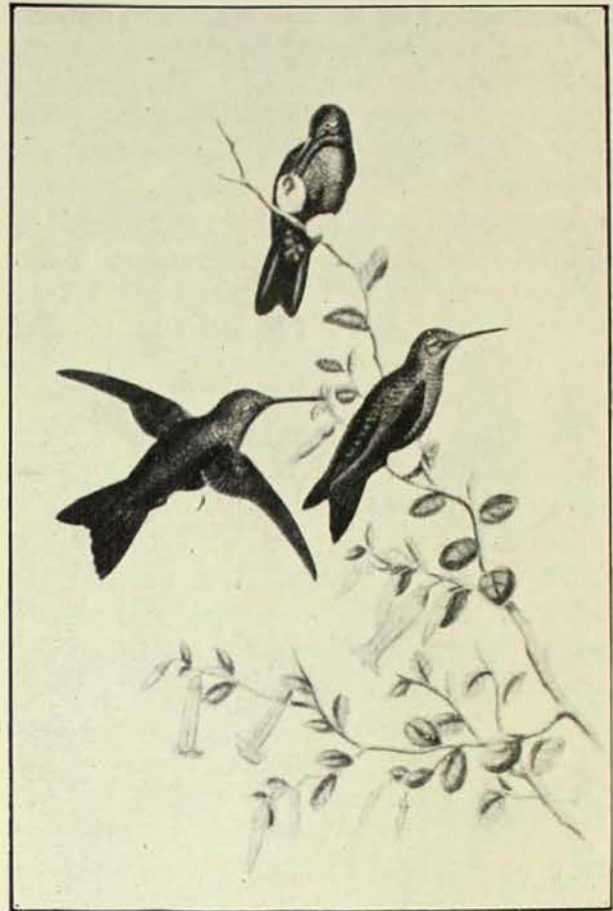
Up to this stage Gould might be regarded simply as a master craftsman, but now his opportunity came. While he was working at this huge project his friend Vigors intimated to him that even a bigger field than either India or Europe awaited him in the birds of Australia. Banks' protégé, Caley, had some years before sent many birds from the new colony, New South Wales, and these Vigors had found to present great novelty. Gould proposed to follow up Vigors' work by figuring all the birds of Australia. He published a small synopsis and then issued two parts of a large folio work. His studies showed the great opportunity and the genius of Gould now asserted itself. He stopped his work and made up his mind to go to Australia and collect all the wonderful birds there himself. Such an enterprise marks Gould as no ordinary person, as the consideration of the

expense and the perils involved would have outweighed many times the probable results save to an enthusiast endowed with extraordinary optimism. All his fortune was bound up in the success of the scheme, and that is why, though Gould figured most of the birds of the world, his name is forever associated most intimately with those of Australia. Outside this country his name recalls Australia to everyone interested in birds and bird life, and here we have immortalized it in the Gould League of Bird Lovers, a league that is doing great work, the results of which are noticeable every day.

Before he ventured on this self-imposed task he had sent out two of his brothers-in-law to collect specimens on account of the Zoological Society, and their reports may have influenced him. After his return one of these brothers-in-law, Charles Coxon (1809-1876), settled in Queensland and became one of the pioneers of that State.

Gould with his indomitable energy associated with himself excellent collectors, and also induced almost everyone to assist him in his work. Thus he brought out letters to the young colonies which so influenced those in charge that his path was made comparatively easy. In the long and tedious voyage out the captain gave him every opportunity to capture seabirds, and he made such good use of this that his results became the basis of all future work. His wife accompanied him and made sketches of all these birds, so that the published paintings are much more natural than many which have been done since.

When he arrived in Van Diemen's Land he became the guest of the later famous but ill-fated Sir John Franklin, at that time Governor of the colony. Mrs. Gould stayed there while Gould energetically pursued the bird life he had travelled so far to see. Their son, Charles, was born in Tasmania, of which he subsequently became Government Geologist. Gould collected in Van Diemen's Land, Victoria, South Australia, and New South Wales, and in addition had assistants collecting in Western Australia and Queensland. As before indicated his enthusiasm infected all who came in contact with him, and after he returned to England laden with spoils, collections came steadily



Humming Birds. These dainty miniature creatures were favourites of Gould throughout his long life. [From Gould's *Monograph of the Trochilidae*.

to hand, completing the task he had so well begun.

The success of this expedition set the hallmark on Gould's reputation, but unfortunately, his partner, who had been so largely responsible for his fame, was denied the pleasure of further participation, as soon after their return she passed away at a comparatively early age. It must always be remembered that Gould's works were pictorial, and these pictures were at first all made by Mrs. Gould, and Gould's fame is based entirely on the illustrations, though after Mrs. Gould's death, through strict devotion, Gould became authoritative in connection with the scientific pursuit of ornithology. As another instance of his adaptability Gould picked up from Mrs. Gould the elements of sketching, and was thus able to provide natural sketches for the artists who later illustrated his works.

The publication of *The Birds of Australia* was accomplished in the allotted time, and while it was in progress Gould published

other monographs in the same magnificent style, one of them being of the kangaroos, followed by another, *The Mammals of Australia*, a subject outside his usual scope, but one admitting of fine illustrations and previously untouched.

Gould then began *The Monograph of The Trochilidae or Family of Humming Birds*, subjects particularly well suited for colored treatment in pictures, on account of their grace, daintiness, and design. While he was investigating this group his first love of taxidermy again manifested itself, and he amused himself by setting up groups of these delicate little birds in attitudes of flight and in natural positions. The Great Exhibition of 1851 then loomed in sight, and Gould hastened to complete a lovely series of these attractive groups and showed them at the exhibition. These created a sensation and the hall in which he had arranged them was packed day after day, so that when the exhibition closed Gould had added another large sum of money to his steadily increasing fortune. The cases of Humming Birds were afterwards presented to the British Museum, where they are a great source of attraction to visitors to this day.

Thus from success to success Gould continued with his huge folios of bird pictures, simultaneously with the Humming Birds issuing *The Birds of Asia*. The *Humming Birds* completed, he began on the

Birds of Great Britain, and, finishing these in his seventieth year, he started on the *Birds of New Guinea*, which he did not live to complete.

Such a career stands alone in the history of natural science as regards amount and quality of output, and his works are sources of reference and inspiration to-day, the wonderful illustrations being unsurpassed. Gould's life is worthy of being classed with any of the great lives commonly quoted, for no one ever worked harder nor lived more simply, his last wish, to be known hereafter as The Bird Man, expressing grandly the single purpose of his life. Figures are sometimes illuminating, so that they may here be used to emphasize the industry of Gould. The series of large folio works that bear his name total over 3000 illustrations, giving an average of more than one published each week of his fifty years of working life. To-day an artist would regard himself as doing good work on the same scale who did *two* such pictures each week. Gould did not do the pictures himself but he drew the sketches, supervised the plates, prepared the letterpress, and managed their publication. It may be truly said that his only love was "Birds," and that is why his name is perpetuated in the Gould League of Bird Lovers, to which everyone belongs who loves to see our birds still living undisturbed in their own land.

The Rock Warbler.

BY K. A. HINDWOOD. R.A.O.U.

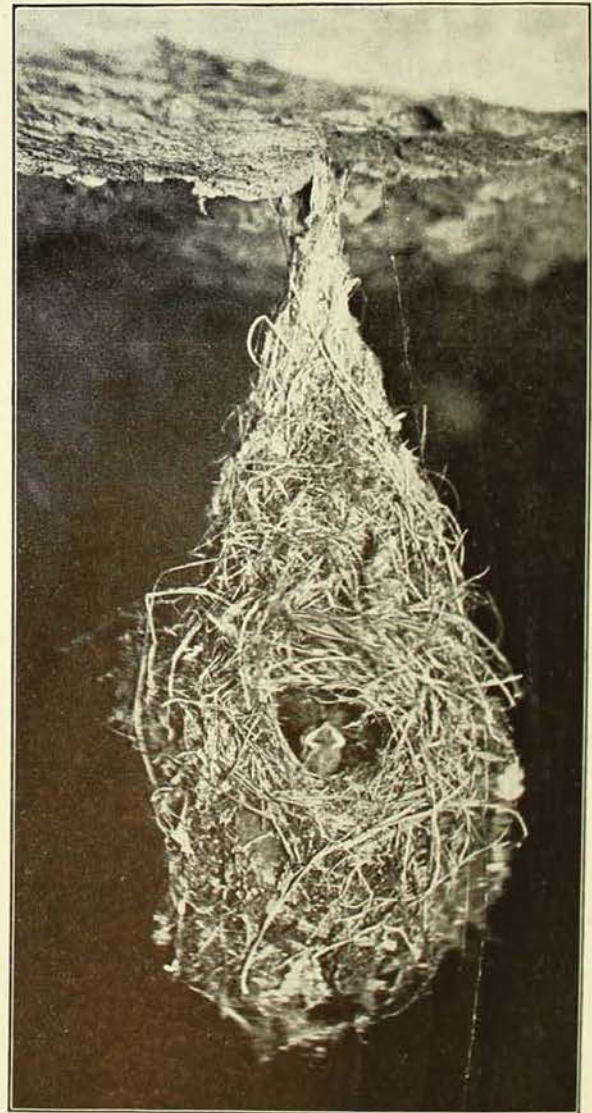
AMONG the many notable birds inhabiting New South Wales, the Rock Warbler, *Origma rubricata*, retains an eminent place; its remarkable nesting habits and restricted distribution mark it as a *rara avis* indeed. The relation of this distinctive bird to its environment is so close that unhesitatingly one considers it as contemporary with the oldest existing forms of the Australian fauna. To many bush lovers it is known as the "Rock Robin"; few of our birds are more aptly named, for bodily it resembles the true robins, Muscicapidae, and in coloration the age old weather-worn sandstone boulders that form its true habitat. Scarcely six inches in length, it is blackish-brown above, russet beneath, with a throat flecked with grey. Surely Nature has here given life to stone, and Mother Earth has not a more faithful offspring than the Rock Warbler, for rarely does it perch in trees.

THE TERRITORY OF THE ROCK WARBLER.

The range of birds is mainly controlled by the food values of different types of country, and it is seldom that a particular geological formation inexorably confines a bird to a limited area. It is in this direction, however, that we shall seek the explanation of an interesting ecological problem.

A characteristic of exposed sandstone is the peculiar way in which it is fretted by wind and weather, forming deep though not extensive caverns. In such situations the Rock Warbler builds its wonderful pendant nest. Sometimes through subsidence suitable rock shelters are formed, whilst the formation of limestone caves by water filtration affords favorable nesting sites for this unique bird. A consequence of the peculiar nesting habit of the Rock Warbler is that it can breed only in sandstone or limestone country, and consequently it is not found elsewhere.

A geological map of New South Wales shows the occurrence of sandstone and limestone formations extending westwardly from Newcastle to Mudgee, thence in a southerly direction along the western slopes of the Blue Mountains, gradually converging on the coast line at a point somewhat below Nowra. As no suitable nesting country exists outside this area any



Nest of the Rock Warbler, showing the method by which it is attached to the ceiling of the cave. Its occupant is a young bird, open-mouthed in anticipation of food.

[Flashlight Photo.—K. A. Hindwood.]



Rock Warbler (*Origma rubricata*). From Lewin's "Birds of New South Wales," 1813, Sydney.

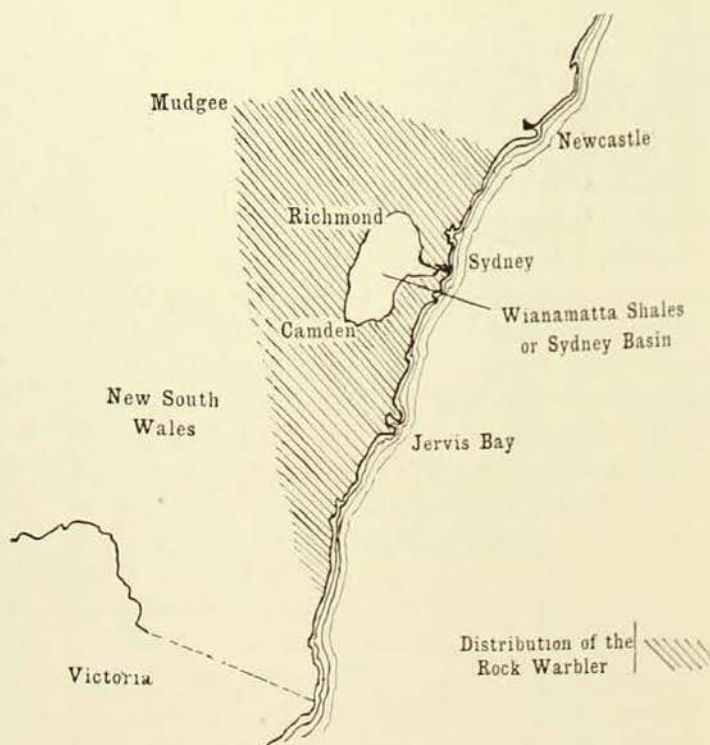


A typical haunt of the Rock Warbler—Upper Middle Harbour, Sydney. The entrance to the nesting cave is slightly to left of cross.

[Photo.—K. A. Hindwood.]

extension of the range of the Rock Warbler does not seem possible.

The stronghold of the species appears to be the broken and precipitous country surrounding the Wianamatta Shale beds. Its favourite haunts are rocky hillsides contiguous to water and mountainous country, preferably covered with an open growth of big timber, though somewhat barren in aspect and devoid of excessive underscrub. The Wianamatta Shale of the Sydney basin occupies a depressed area consisting of undulating country with scant, forest growths; it is oval in shape and extends from Sydney westward to the footholds of the Dividing Range, north to Richmond and south to Picton. For apparent reasons it is forbidden territory to the Rock Warbler.



THE ROCK WARBLER'S NEST.

The nest of *Origma* presents an outstanding example of bird architecture. The method by which, under natural conditions, it attaches its globular home to the ceiling of a rock shelter or cave is full of interest. When commencing to build, usually early in spring, the birds select a small protruding ledge, showing preference for positions that afford a measure of protection both from natural enemies and from the rigours of the elements, whilst dismal situations almost entirely devoid of light are favoured.

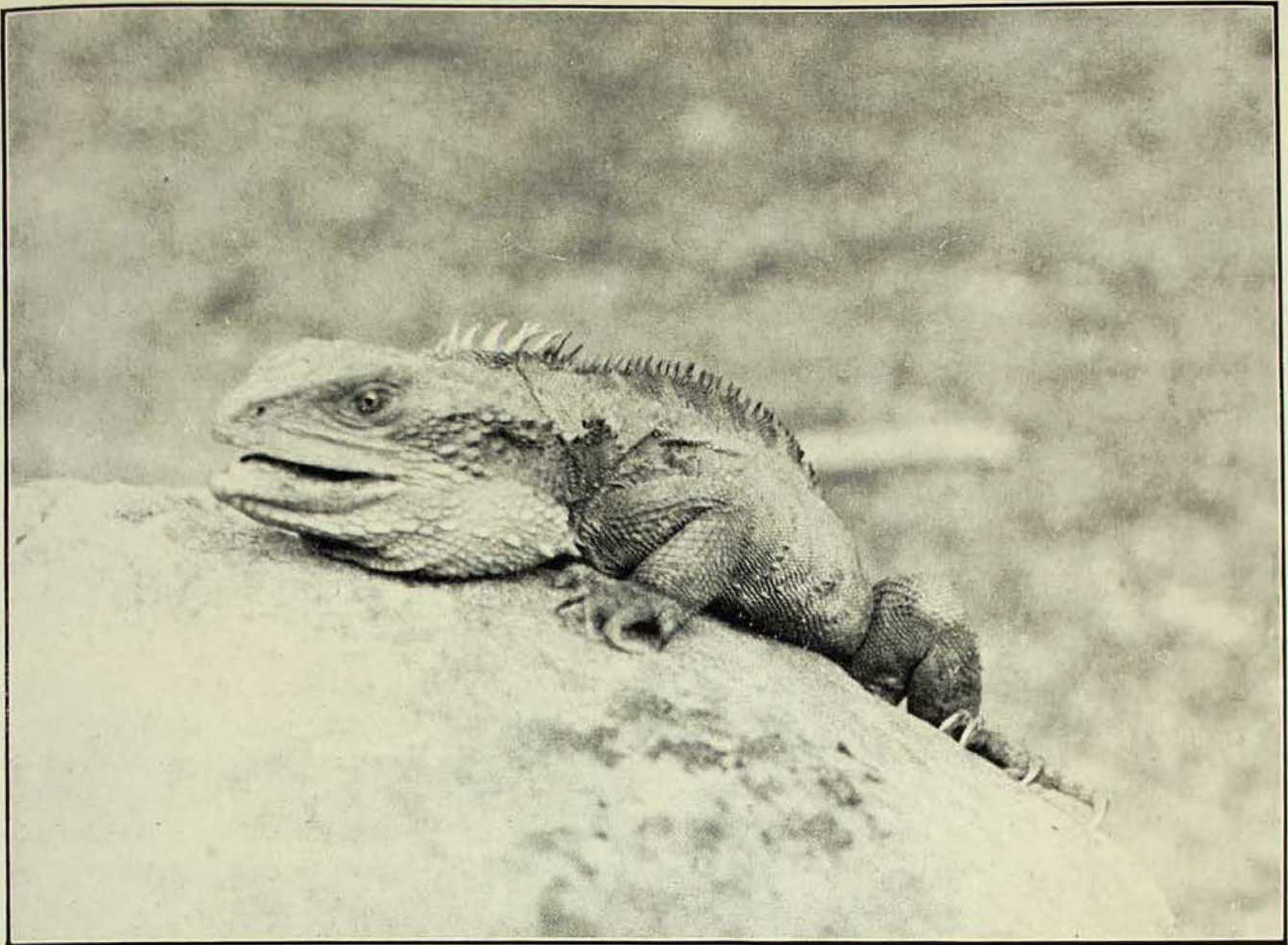
Collecting silky spider's web of a glutinous nature, they affix it to the rock with their bills. This mass of silken cords, which is destined to support the nest, appears to be covered with saliva where it joins the rock; moreover it is apparent that the weight of the nest is not borne directly by the suspensory material but is broken at the angle where it overlaps the ledge; thus is its holding strength greatly increased. This foundation extends downwards for two or three inches, after which the main structure of root fibres, moss, bark shreds, and grass is gradually built in. The exterior of the nest is invariably covered with moss and the webs and egg bags of spiders, the interior being composed mostly of grass. The nesting cavity is not made until the nest is almost completed, when it is lined with fine grass stalks, shreds of bark, the seed cases of Scotch thistles or feathers. An average nest measures about ten inches in length and not above five inches in diameter at its widest part. It will be readily understood that the spider's web could not support any considerable weight, so with commendable economy the Rock Warbler utilizes materials that are dry and light and which knit moderately well, though a vigorous shake will destroy a delightfully sheltered home that has taken perhaps two or even four weeks to construct. Both sexes are occupied in the building of the nest, and after they have reared their offspring they close the entrance to their home; this seems to indicate intelligent thought, for if undisturbed they will return to their old home site year after year, though seldom does the nest remain intact, for during the winter months it generally falls

asunder. Not always does the Rock Warbler resort to natural caves to nest; here again it shows exceptional adaptability. Desirable situations are by no means common, hence there are records of many unusual nesting sites. J. C. Wiburd, Superintendent of Caves, and a lover of bird life, has kindly sent me the following notes from Jenolan: "...to get the foundation of their nest on the point of a stalactite or from a crevice in the roof, they do their work upside down ... a pair built over the dynamo in the engine shed here, and would rest on the engineer and eat from his hand ... one pair built their nest in the carpenter's shop, suspended from a whitewash brush."

Personally I have known these charming and trustful birds to hang their nest from a broken ceiling board in a cottage at Fisherman's Point, Hawkesbury River, and also from a lamp bracket in an old stone house at Roseville. An unusual instance is recorded of a pair of Rock Warblers successfully nesting in an occupied tent at Freshwater, near Sydney. They attached their nest to a hanging rope end; this means of suspending the nest is often used and must eliminate much that is arduous in nidification under natural conditions. The three eggs which constitute a clutch are laid on consecutive days; their colour is pearly white and they possess a slight sheen. When incubation is well advanced they become dull. The duration of incubation varies slightly, but it is generally twenty-three days, whilst a similar period elapses before the young birds leave the nest. The nesting season extends from early in August to November or December, and, should conditions be favourable, two broods are reared, though I have never known these birds to undertake the responsibility of a second family in the same year in the neighbourhood of Sydney.

CALL NOTES AND HABITS.

The melancholy call notes of the Rock Warbler seem to express its solitary nature. The call most frequently used can be likened to "good-bye"; Another note sometimes uttered is a succession of rasping though slightly liquid notes. Seldom does one observe more than a pair or family of birds



An enemy of the Rock Warbler, the Water Dragon (*Physignathus lesueri*).

[Photo.—K. A. Hindwood.]

in the same locality. Even early Australian ornithologists, in naming the Rock Warbler, were influenced by this trait. Lewin states "inhabits rocks. Frequents caverns inaccessible to mankind, and deep rocky gullies, creeping in the cavities and chasms. This is a shy and wary bird; its note is sharp and shrill. Does not migrate."*

**Birds of New South Wales*. Imp. 4to., 18 pp., 18 pl., J. W. Lewin, Sydney, 1813. A rare and interesting book, representing the early efforts of printing and engraving in Australia; actually it is a re-issue of Lewin's *Birds of New Holland*, 1808 (the rarest book dealing with Australian birds), the letterpress for which was set up and the book published in London, though the plates were engraved and coloured by the author in Sydney. The earliest examples of engraving ever done in the Colony were drawn and engraved by Lewin during the years 1803-4, and appeared in *A Natural History of the Lepidopterous Insects of New South Wales*, 18 plates and text, published in London in 1805.

Another edition of Lewin's *Birds of New South Wales* was issued in 1822, and, later, a reprint of this edition appeared, the date on the title page being 1822, the paper, however, bearing the water mark of the year 1875.

In moving over the ground the Rock Warbler restlessly flits from boulder to boulder; indeed it is never still, as it explores crevices and cavities in search of small insects and spiders. Occasionally a bird will hover in the air and secure an insect from beneath a jutting rock, also it will enter under low shelving rocks, where, because of the confined space, it is unable to hop; it then creeps about keeping its body low down in the attitude of a rodent. Often a bird will fly to the summit of a boulder, utter a few notes and then, suddenly, will seemingly fall backwards and, as though drawn by some magnetic force, will alight on the vertical face of the same or a nearby rock. One commonly sees *Origma* hopping over the upright faces of cliffs with the greatest ease.

ITS FOES.

The Rock Warbler has many enemies, foremost among them, perhaps, being the voracious Goanna (*Varanus varius*). It is

an easy matter for these detestable reptiles to rob a low-lying nest of either eggs or young. The late A. J. North records having seen a large Water Dragon (*Physignathus lesueri*) feasting on the eggs from a Rock Warbler's nest. Despite the fact that nests are usually well hidden the Fan-tailed Cuckoo (*Cacomantis flabelliformis*) has developed a penchant for the Rock Warbler as a foster parent, and foists its eggs upon *Origma* more

commonly than is supposed. Fortunately Rock Warblers are not uncommon a few miles from Sydney; a keen observer will always find them at Middle Harbour and Port Hacking. A study of their habits will give the naturalist a fuller understanding of life, for there is at least one philosophic moral we can well consider from this sprite of the sandstone, namely harmony with environment.

Notes and News.

The British Great Barrier Reef Expedition, having completed an ecological survey of Low Island, the coral reef upon which they were stationed, determined to make rapid surveys of other reefs for comparison, and Three Isles, one hundred miles north of Low Island, was one of those selected. Mr. Iredale, of our staff, was invited to accompany the party, as he had already investigated the molluscan ecology of Low Island last year, and of Michaelmas Reef three years ago. Mr. Iredale left Sydney on April 24th and arrived back on May 31st. The fauna and flora of Three Isles were quickly surveyed and were found to agree in great detail with those of Low Island, while the formation of the reef was found to be essentially the same. A series of over five hundred species of molluscs

collected at Three Isles showed scarcely half a dozen kinds different from those previously secured at Low Island. Through bad weather, shelter had to be sought behind Cape Bedford, and collections were there made, which are of great interest as showing the great difference between the molluscan fauna of mainland littoral and that of the coral reefs adjacent.

Amongst recent visitors to the Australian Museum was Mr. Henry Weed Fowler of the Academy of Natural Sciences, Philadelphia, who was returning from the Pan-Pacific Science Congress in Java. He was most interested in our fish collections and has proposed an exchange of Hawaiian and Melanesian fishes for Australian species.

Microscopic Mites of the Sea.

BY ARTHUR A. LIVINGSTONE.

THE microscopic world of animals is perhaps looked upon by many as a mysterious region, unexplored, and open only to those surrounded by glass phials and slides, costly apparatus and shelves of leather-bound volumes. Nothing, however, is farther from the truth. To those who foster a desire to look into this fascinating side of Nature nothing is necessary but an ordinary low-powered microscope which is sufficient to enable the enthusiast to indulge in a pastime not only interesting but instructive and useful.

be made up of a number of minute cells, and such is commonly termed a colony. Drift weed is particularly suited for the growth of some types of colonies, and after storms, when the sea-shores are dotted with weeds dragged from their moorings, is without doubt the most profitable time to explore for sea-mats. On the roots of nearly every specimen of the brown-leaved kelp (*Eklonia radiata* var. *exasperata*) found on the beach there will occur glistening white patches, or dull yellow nodular growths of sea mat which can be easily removed with the point of a knife.

Most specimens of sea-mat can be examined quite well without treatment, but there are some, particularly dark yellow kinds, which need to be burnt over a blue gas flame until they turn white before a clear view of them can be obtained. If placed upon black cardboard, preferably gummed, the colony will present no difficulty so far as examination is concerned, but a good light is necessary to gain the best results.

HABITS AND GENERAL DESCRIPTION.

The young sea-mat, after its early embryonic and free-swimming phase, settles on some submerged object in the form of a single cell or chamber. As time goes on other cells of a similar kind are formed from this primary or original cell and become cemented together side by side in an amazingly regular manner. Each cell as it forms also develops an animal, and when the cell or house is complete the animal claims it as its own and becomes entirely independent of its neighbour. In this way there arises an accumulation of cells or chambers all alike in structure, and each with its own tenant, which is destined to live the life of a hermit and carry on the arduous and often precarious process of existing, reproducing its kind, and dying, without knowing how its immediate neighbours are faring.

Not all types of sea-mat are wholly encrusting. Some assume a free and erect



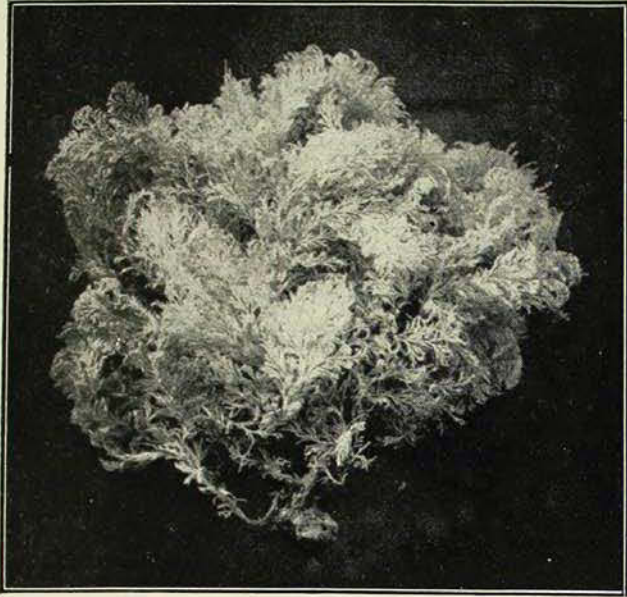
Retepora hirsuta. This and allied species of sea lace abound in the waters off our coast, and colonies are often to be found washed up on beaches after heavy storms. This particular type admirably illustrates the lacy appearance of the colony.

[Photo.—G. C. Clutton.

The field is unlimited, for the sea, the land, and the air abound in tiny creatures, so that the collection of material for scrutiny is extremely easy.

A group here suggested for study is marine, and is known under the common name of sea-mats or lace-corals. A casual examination of the debris washed up on the beaches seldom fails to reveal a small encrusting and usually flat mass of the most delicate appearance attached to some piece of jetsam. This mass, if examined closely, will be found to

habit, either single or double layered; some are loosely attached to the undersurface of rocks by means of tube-like rootlets, while others grow tuft-like and resemble strings of semi-transparent beads. Some of the erect



Sea Flower (*Scuticella margaritacea*). The species depicted is of the weed-like variety. Microscopical examination shows the colony to be made up of flexible bead-like branches, the beads, so to speak, being the cells in which the animals live.

[Photo.—G. C. Clutton.

and branching types present such a delicate formation in their mode of growth that they have earned for themselves the particularly applicable name of lace-coral, while others, composed of a chitinous material, are called sea-flowers, on account of their plant-like external appearance.

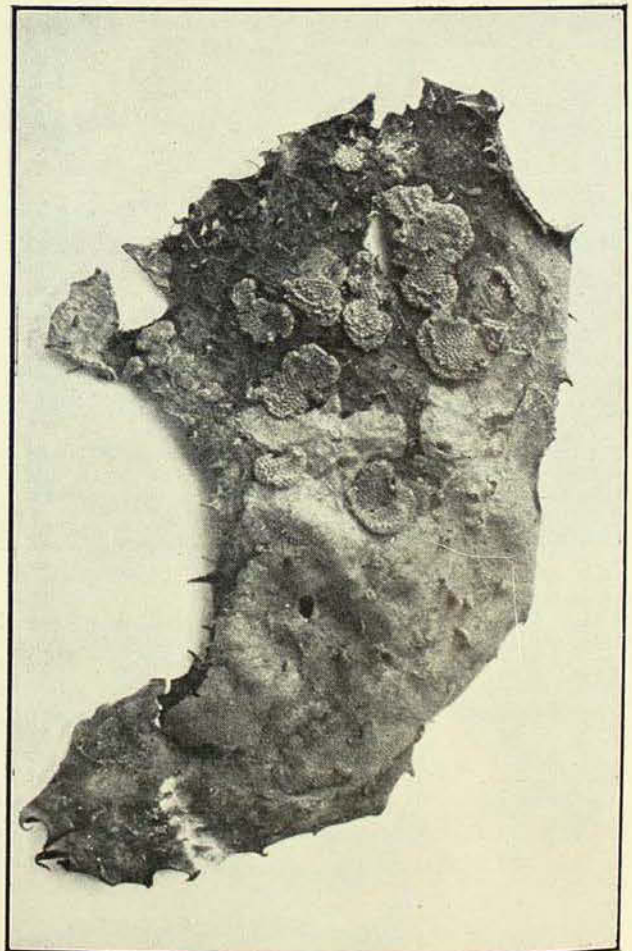
In most kinds the cells present upon examination a magnificently sculptured surface, and, as the cells are all the same in appearance, the whole field of vision reminds one of some beautifully designed art carpet. Other colonies are composed of bundles of small delicate tubes of a frosted white or slightly tinted hue, with a diamond-like glistening surface, which in many species is responsible for a picture of handsome microscopic ornament.

In the prevalent types the cell is like a rectangular box with four sides, a top, and a bottom. In the top or front wall of each cell there occurs at one end a small hole or aperture varying somewhat in shape in the different families, and through which the animal can thrust its feeding apparatus. Usually

this hole is covered when the colony is removed from the water, but its position can be determined by the little chitinous lid which lies over it when the animal is totally within its chamber.

Owing to the thickness and density of the chamber or cell in the chalk-like calcareous forms, the contained animal is never seen in its entirety. If a living colony, however, is placed in a small dish and covered with seawater the tentacles at least will be seen to issue slowly from the special aperture at one end of the cell, then with lightning-like rapidity vanish again into the depths of the chamber when the animal is disturbed.

The Sea Flowers are the best types for examination when a full view of the animal *in situ* is desired. These can always be found in considerable abundance attached to wharf piles or such like submerged structures, where



Sea Mats (*Gephyrophora biturrita*, and *Membranipora membranacea*). The former species is recognized by its habit of forming irregularly circular colonies on weed, while the latter usually encrusts a weed in such a manner as to clothe it almost entirely in a clustering white mantle. Both the species are common in Port Jackson, and, as shown here, are often found growing together.

[Photo.—G. C. Clutton.

they appear like weeds swaying to and fro at the will of the currents and eddies. A small branched fragment of such a form when placed in water under the microscope will be found to possess almost transparent cells, through which the contained animal can be detected and watched with ease. Firstly, it is the conspicuous "U" shaped alimentary canal or digestive system which attracts attention, and at one end will be seen the circlet of tentacles surrounding the mouth-opening. This end is capable of being thrust out through the small aperture in the front wall to the exterior, where food is attracted to the tentacles by means of water currents created by the rapid movements of myriads of minute hair-like structures called cilia. The opposite end of the alimentary canal will be seen to lie very close to the mouth, and it is largely due to this curling round of the canal that this type of animal, and the other classes of the phylum Molluscoidea are distinctly and sharply separated from all others, whether big or small.

Should a close examination be made under the microscope, the alimentary canal will be seen to be supported by numerous bundles of delicate muscles which connect with it and the opposite walls of the cell. Certain of these muscles are responsible for the operation of protruding and withdrawing the mouth and tentacles during mealtime. When the polypide or animal is withdrawn and fully within its cell, a special cover or lid, yellow in colour and called the operculum, lies over the aperture in the front wall so as to afford protection to the inmate, as do the doors on houses and the flap at the entrance to the burrow of the trap-door spider. Usually the muscular system operating the lid or operculum is very elaborate, especially in many of the calcareous types, where it can be quite easily seen when the operculum is lifted with the point of a needle, or the bottom or basal wall broken or ground away.

Little bristle-like spines are very often found arranged in a semi-circular row around the outside of the cell aperture, and the presence of such structures, it is assumed, gives protection to the tentacles when protruded, and assists in keeping sand-grains and such foreign matter from accidentally entering the cell.

In many colonies found around our shores

special cells, differing considerably from those comprising the colony, will be seen even with the naked eye, superimposed upon their brethren in such a manner as to give the entire mass a conspicuously nodulated appearance. When examined microscopically this second type of cell, or oecium, will be seen to be usually dome-shaped and situated immediately above the aperture of the ordinary cell, or zoecium, as it is called. In such a position the oecium naturally encroaches upon the front wall of the zoecium situated immediately in front of the one which gave rise to the dome-shaped structure. To explain the presence and function of this dome-like cell it is necessary to refer briefly to the mode of reproduction habitual to the bryozoan animal. In the first place the animal is hermaphrodite, that is the sexes are not separated, both being united in the one animal. Such being the case both male and



Fenestrulina malusii. This species of sea mat, may be found either encrusting rocks or forming flat and free leaf-like colonies. This photo-micrograph shows the external appearance of the colony as it would appear under the microscope. The largest holes are the cell apertures through which the animals of the colony communicate with the exterior. The globular cells situated on top of the zoecia are the oecia, in which the embryos undergo a stage of their development.

[Photo.—G. C. Clutton.

female elements, sperms and ova respectively, are developed by the one animal, and are sometimes to be found on the funiculus, a contractile cord connecting the base of the "U"-shaped alimentary canal to one of the cell walls. When the "eggs" or ova are fertilised they are transferred to the dome-shaped cell or oecium referred to above to undergo segmentation and development until

they are old enough to be discharged into the surrounding sea water. When liberated the embryo is ciliated and capable of swimming from place to place, but finally settles down and develops as described in the earlier pages of this article.

In a vast number of species there are structures called avicularia, which vary considerably in shape and size, and are usually external in position. In some species they are moderately chitinised triangular appendages divisible into two sections, the mandible and the mandibular or avicularian cavity. The mandible is usually chitinous, and is capable of an up and down movement brought about by a muscle system lodged within the mandibular cavity. The cavity itself is of the same shape as the mandible, whether triangular, semi-circular, or spoon-shaped. Within the slight, or sometimes deep depression, which conforms in shape to the mandible, is an opening leading to a special cell

which houses and protects the delicate muscles which operate the mandible.

Sometimes the avicularium is erect and free and not embedded in the front wall of the cell, and such types occur mostly among the branched and weed-like Bryozoans. One particular species, well known to many on account of its peculiar avicularia, possesses these curious avicularia in the form of a bird's head. The opening and shutting of the mandible is remarkably like the operation of a bird's beak, and for this reason the form is known popularly as the Bird's Head Coraline. This species (*Bugula avicularia*) is not only remarkable in appearance but extremely common in the waters of Port Jackson, and, being one of the transparent kind, lends itself admirably to the study of the animal in detail. Like the other types the mandible of *Bugula avicularia* is operated by a system of muscles, and to see the working of these fan-like muscles in living material is well worth the time spent on preliminary work.

Review.

The Papuan Villager, Vol. I., No. 1. 15th February, 1929. Price 3d. Department of the Government Secretary, Port Moresby, Papua.

His Excellency, Sir Hubert Murray, Lieutenant-Governor of Papua, has done much during his term towards the enlightening of the Papuans, and, we feel sure, with a considerable degree of success. Measures have been taken for their protection and education and to make them self reliant and self supporting, a policy which has placed this administration in the forefront of those directing primitive peoples.

The most recent activity in this direction is a pictorial monthly journal, *The Papuan Villager*, edited by Mr. F. E. Williams, the well-known anthropologist, the first number of which was issued last February. The object of this journal is to provide the natives with a paper of their own, and perhaps the best description we can give of it is that afforded by the following extracts from its columns.

"This paper is for the people of Papua. It is not for the white men (they have a paper of their own). It is for the brown men, and it will tell you about the things that belong to you. It is called *The Papuan Villager* because it tells about the Papuans and the things they do in their villages."

"We want Papuans to help to write their own paper. We want them to write 'articles.' An article may be one of your old-time stories; or it may tell about some of your village fashions; or it may tell about something you have done in the village, or on the Government station, or at the Mission, or on the plantation."

The issue under notice, the first, contains an article by Nansen K., a native clerk in the Magistrate's Office at Rigo, on dugong-catching. The other articles comprise, amongst other things, legends, accounts of trading operations, technology, and general news items. That the *Villager* will be successful there can be little doubt.

Teeth of Mammals.

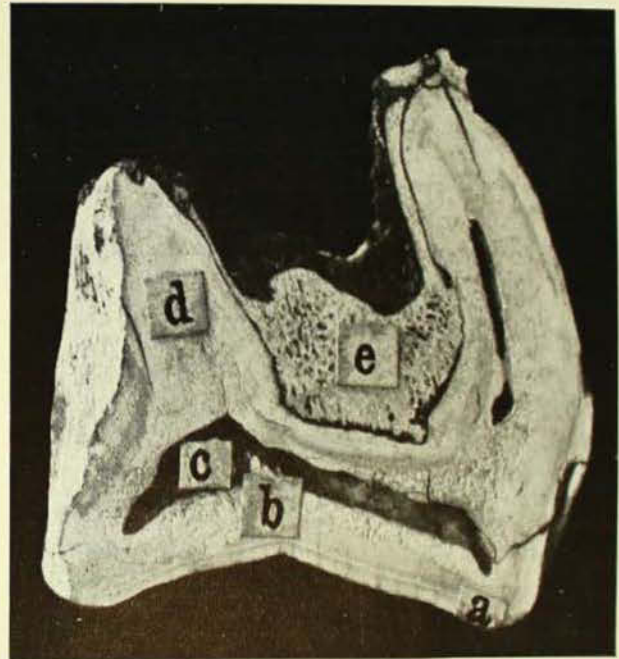
BY C. ANDERSON, M.A., D.Sc.

TEETH are important and interesting structures on account of their usefulness in the prehension and mastication of food, the great variation they exhibit in the different groups of vertebrate (backboned) animals and the wonderful examples they afford for the study of adaptation. As they are the hardest of the animal tissues teeth are frequently preserved in the fossil state when the rest of the skeleton has crumbled into dust, and on this account the study of teeth is of great importance to the palaeontologist, whose task it is to describe and reconstruct for us the animals of the past.

It must not be supposed that the teeth of a modern mammal such as the horse have always had the complicated structure they present to-day. Teeth, like every other part of the animal body, have had a long period of evolution, and the teeth of recent mammals have attained their form and structure as the result of many modifications and adaptations extending over millions of years, the general course of evolution being from the simple to the more complex.

The teeth of even the highest mammals are comparable with the placoid scales which cover the bodies of the selachian fishes, of which the sharks and rays are familiar examples. These placoid scales or dermal denticles (skin teeth) consist of a flattened base embedded in the skin and a projecting point; in shape they somewhat resemble a drawing pin, or what Americans call a thumb-tack. They are composed of a bony substance called dentine or ivory, and are capped with a harder substance which is called enamel; as we shall see a typical mammalian tooth has exactly the same structure and composition as a placoid scale. In the selachian fishes the placoid scales are continued over the jaws into the mouth, which is but an enfolding or invagination of the anterior end of a developing vertebrate, and on the rounded surface of the jaws they become larger and appear as (usually) triangular teeth in successive rows.

The teeth of vertebrates, then, are essentially dermal structure, and were originally simple placoid scales, which differ from those which cover the bodies of selachian fishes only in that they have been modified through change of function owing to their position in and about the mouth cavity, the gateway to the digestive system.



Premolar of *Thylacoleo carnifex*, an extinct marsupial. The tooth has been sectioned to show its structure. a, enamel; b, dentine; c pulp cavity; d, fang or root; e, portion of the jaw bone. The cement which in life covered the embedded portion of the root has been removed during fossilization. Australian Museum specimen.

[Photo.—G. C. Clutton.

In fishes and amphibians teeth are not confined to the edges of the jaws but may also occur in patches on the roof and floor of the mouth cavity. In reptiles and mammals it is usual for the teeth to be restricted to a single row in each jaw. Again, in a lower vertebrate as a general rule all the teeth are more or less alike (homodont), and, moreover, these animals possess a constant reservoir of teeth, so that when one set is worn out or lost it is replaced by a reserve set. In mammals, however, the dentition is typically heterodont, that is, not all teeth are alike,

but differ materially in form according to their position in the jaw. Moreover, the succession of teeth is very much reduced in mammals, and, generally, they have only two sets, the milk and the permanent dentition, and only a certain number of the permanent teeth have milk predecessors.

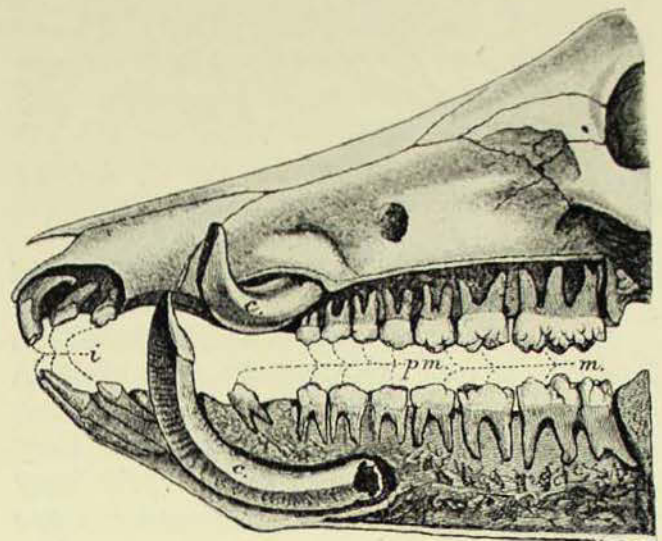
The teeth of reptiles (from which the mammals are generally supposed to be derived) are usually simple in form, generally consisting of a single pointed cone. In mammals the most characteristic teeth are much more complicated, the working surface presenting a number of tubercles, crests, or folds, though certain mammalian teeth are essentially similar to the simple reptilian cone.

STRUCTURE OF A MAMMALIAN TOOTH.

A typical mammalian tooth consists of a crown (the part exposed above the jaw bone) and the embedded root or roots. The crown is covered with a hard bluish substance, the *enamel*, which forms a thin outer layer covering a much softer, somewhat yellowish material called the ivory or *dentine*. The root or embedded portion is overlain by a rough bony substance, the *cement*, which is in direct contact with the dentine. In human teeth the cement is confined to the root, but in some mammals it extends on to the crown, where it overlies the enamel. A hollow space in the crown and root is occupied by the *pulp*, containing blood vessels and nerves, which enter the tooth through the canals of the root. In young animals the pulp-cavity is large, and the openings at the base of each tooth are wide, but, as the animal grows older, the cavity becomes contracted and these openings become narrowed, though in certain mammals the pulp-cavity remains widely open below, the teeth grow continuously, and are said to be rootless, or to have *persistent pulps*.

VARIATIONS IN THE TEETH OF MAMMALS.

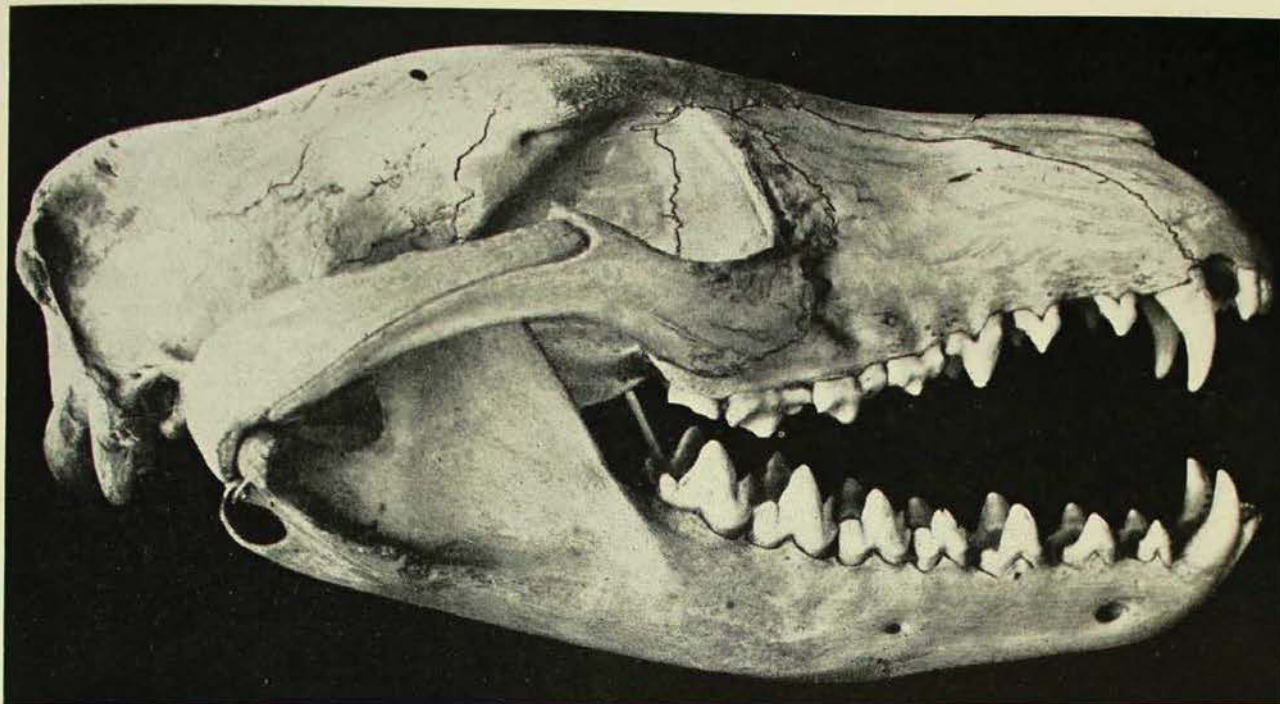
Mammals exhibit an extraordinary range of variation in their dentition, the teeth having a close relation to food habits and general skeletal structure. For this reason the teeth of mammals have always been regarded as of special value for purposes of classification, and as important indices to life habits.



Teeth of boar (*Sus scrofa*), to show typical dentition; the bone has been cut away to expose the roots of the teeth. i, incisors; c, canines; pm, premolars; m, molars. It will be observed that the incisors have but one root, that the canine is rootless and that the premolars and molars, which are of the bunodont type, have two or more roots.

[From Flower and Lydekker's *Mammalia*.

The form of mammalian teeth is largely determined by their function. For grasping and holding prey, simple conical teeth resembling those of reptiles such as the crocodile are the most useful. If they are to be used as weapons of defence, or to remove obstacles, they become elongated and project, like the tusks of the boar or of the elephant. If the food is varied the teeth are specialized. Certain of them become adapted for seizing, others for cutting, others again for crushing and grinding. These operations generally take place in different parts of the mouth, and we find, therefore, that the front teeth are differently shaped from those situated farther back in the jaws. The front or incisor teeth are typically chisel-shaped, their cutting edges placed transversely. Incisors are commonly three in number in each half of the jaw, above and below, and are usually simple in form and single-rooted. Behind the incisors is a single *canine*, usually of a pointed piercing type, showing little departure from the reptilian cone, and also single rooted, though rarely it has two roots. The canine is succeeded by the *cheek teeth*, typically seven in number, of which the foremost three or four are called *premolars*, the others being known as *molars*; cheek teeth usually have more than one root. Usually the teeth in the upper and the lower jaws



Skull and lower jaw of the Tasmanian Wolf (*Thylacinus cynocephalus*), illustrating carnivorous dentition. The canines are long and sharp and the cheek teeth pointed and compressed. Australian Museum specimen.

[Photo.—G. C. Clutton.

correspond in number and kind, though there are many exceptions to this rule. In the higher (placental) mammals it is usual for the incisors, canines, and premolars to have milk predecessors; in marsupials, however, only one tooth, a premolar, has a predecessor.

In a typical mammal, then, there are usually three incisors, one canine, and seven cheek teeth in each half of each jaw, making a total of forty-four teeth, but there are many departures from this rule. Thus certain mammals, such as the great ant-eater (*Myrmecophaga jubata*), and the Australian Ant-eater or Echidna are toothless. The platypus has true teeth in its youth, but these soon disappear and are replaced by horny plates. The Whalebone Whales have no teeth in the adult, the small teeth of the young being absorbed before birth. On the other hand, some of the dolphins have a large number of teeth (as many as two hundred), and these are also peculiar in that they are all similar to one another, and resemble the simple conical teeth of reptiles.

CARNIVOROUS DENTITION.

The teeth of flesh-eating animals, such as the cats and dogs among placental mammals,

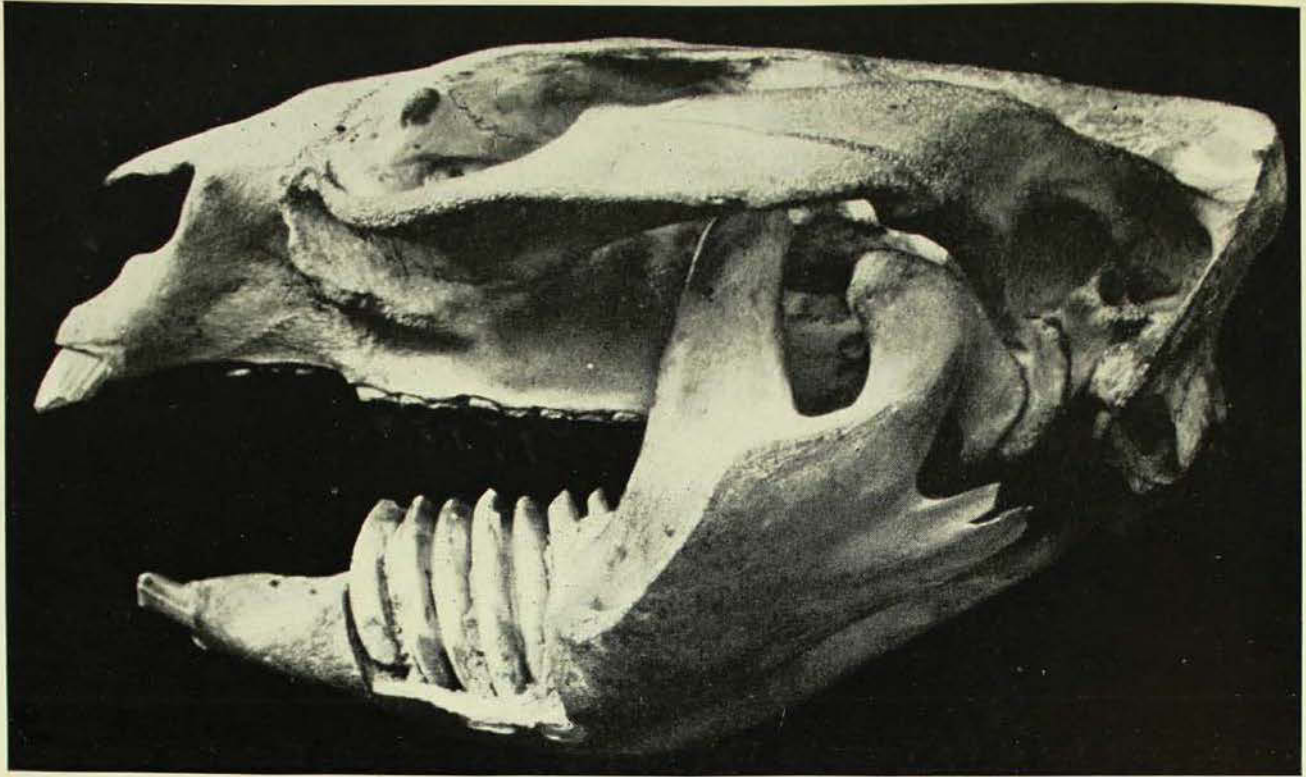
and the Tasmanian Wolf, Tasmanian Devil, and Native Cats among marsupials, present a more or less uniform type. The incisors are close set, and adapted for tearing the flesh from their victims, the canines are long and sharp, and those of the lower jaw interlock with those of the upper in order to give the animal a firm and deadly grip on its prey. The cheek teeth are adapted for cutting, not grinding, and are therefore in general compressed and sharp-edged. In each jaw there is generally one large specially modified tooth, called the carnassial or flesh-tooth, with a long cutting blade. The teeth in front of the carnassial are more or less pointed and compressed, while those behind it are broader and tuberculated.

TEETH OF INSECTIVORES.

Insectivorous animals usually have pointed incisors, the upper and lower teeth meeting like a pair of forceps. The canines are generally not well developed, while the crowns of the molars are characteristically studded with numerous short sharp cusps.

RODENT DENTITION.

The teeth of gnawing animals are very characteristic. On account of the great



Skull and lower jaw of Wombat (*Phascolomys mitchelli*). The roots of the lower molars have been exposed to show the length and curvature of these constantly growing teeth.
[Photo.—G. C. Clutton.]

amount of wear to which they are subjected the teeth are rootless and continue to grow throughout life. The incisors are well developed, and usually have enamel only on the front of the crown. As a result the working of the upper and lower incisors against one another develops and maintains a sharp chisel edge on the front incisors, which are said to be scalpriform. Among the marsupials the Wombat (*Phascolomys*) has a typically gnawing dentition, strongly resembling that of the true placental rodents. Its incisors are reduced to a single pair above and below, and these teeth have long deeply embedded bases, widely open below. It has no canines, there being a wide space or diastema between the incisors and the cheek teeth. The latter have long roots, which are strongly curved, the concavity of the upper teeth directed outward, of the lower teeth inward. By this device the grinding pressure does not fall on the growing root, but is supported upon the side of an arch.

Teeth which are rootless and constantly growing are restrained from over-growth by mutual attrition of the lower and upper teeth. When, however, one of these teeth is lost the opposite tooth continues to grow and may

reach abnormal dimensions. Or perhaps two opposite teeth do not meet accurately and grow past one another. There is then no check on their growth, the teeth become very long and may twist and curve in a manner which must be very inconvenient for the animal, and may actually cause its death. This misfortune seems to be not uncommon among rabbits.

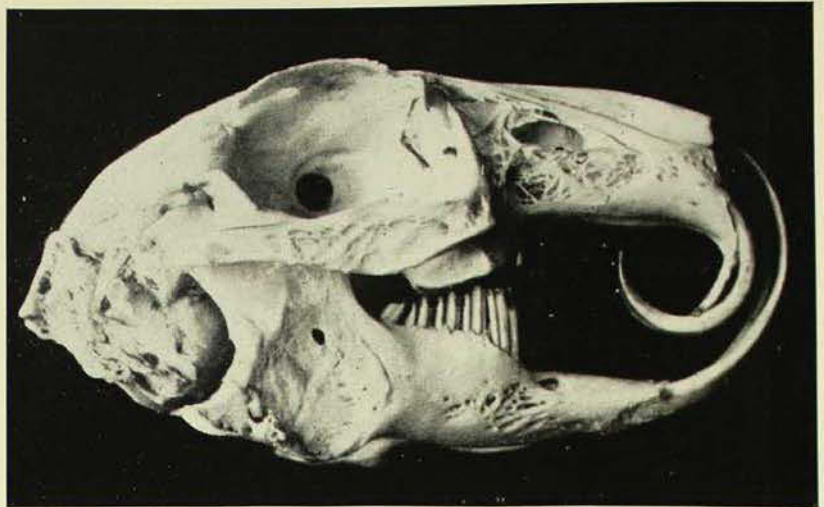
TEETH OF UNGULATE ANIMALS.

Perhaps the hoofed or ungulate animals are the most interesting of all the mammalian groups as regards their teeth, particularly the cheek series. This great order includes the Even-toed Ungulates (pigs, deer, antelopes, cattle), Odd-toed Ungulates (tapirs, rhinoceroses, horses), and thirdly, the elephants.

Of these the pigs and their allies have the simplest form of cheek teeth, the crowns having a number of cone-like prominences which somewhat resemble small hillocks; for this reason teeth of this type are called *bunodont* (Greek *bounos*, hillock). Other forms now extinct show a transition to a type of tooth in which the cones are compressed and are

ranged to form a pattern such that a worn tooth shows a number of crescentic bands of dentine. This type of tooth is said to be *selenodont* (Greek *selene*, the moon). The cheek teeth of modern deer and cattle are still more complex. The teeth are *hypsodont*, namely, long from the working surface to the point where they emerge from the jaw bone, as opposed to the *brachydont* (short-crowned) teeth of their predecessors, and the grinding surfaces are much more complex. The crescents are higher and there are intervening pockets filled with cement. Such teeth are well adapted to the needs of animals which "chew the cud," a process which subjects the teeth to excessive wear, which is counter balanced by the increased height of the crowns. The complex grinding surfaces form an efficient mill by which the fibres of grass are reduced to a fine pulp.

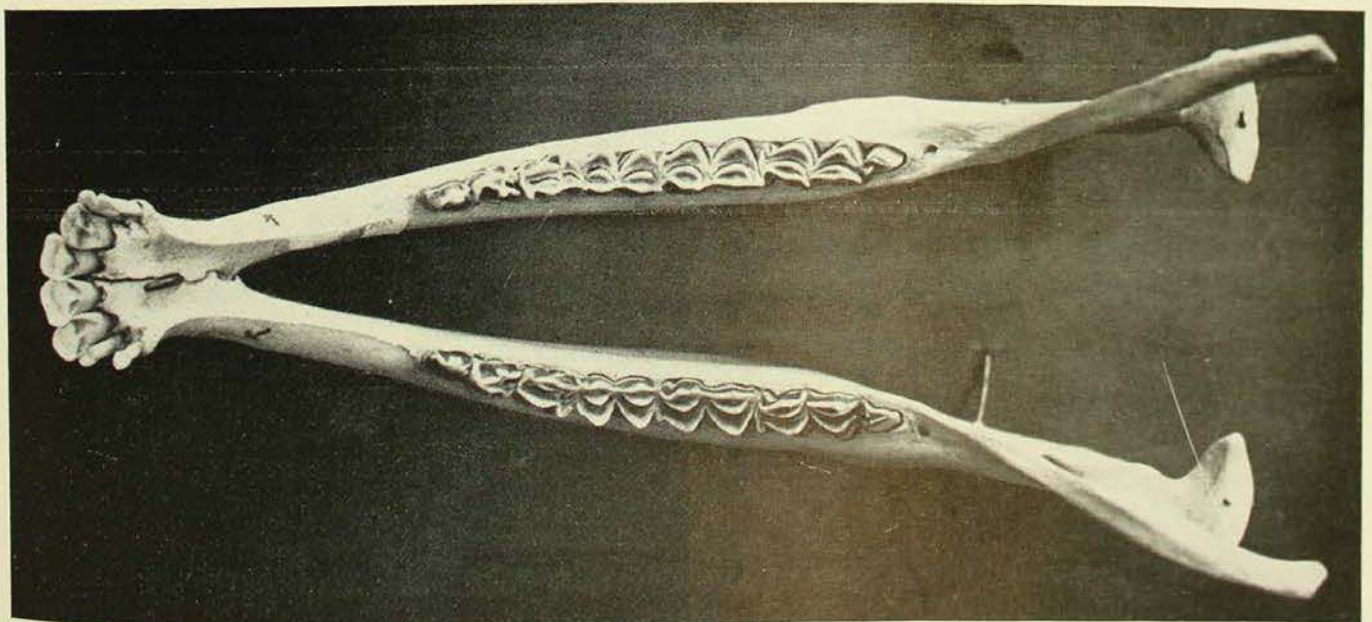
The second group of ungulates, the tapirs, rhinoceroses, and horses, exhibits a similar series of changes in the cheek teeth, leading from a comparatively simple type in the tapir, with two transverse folds, to the wonderful grinders of the horse and its allies.



Skull and lower jaw of rabbit. The rootless constantly growing incisors do not meet, and, their growth being unrestricted by mutual wear, they have become abnormally long and curved. Australian Museum specimen.

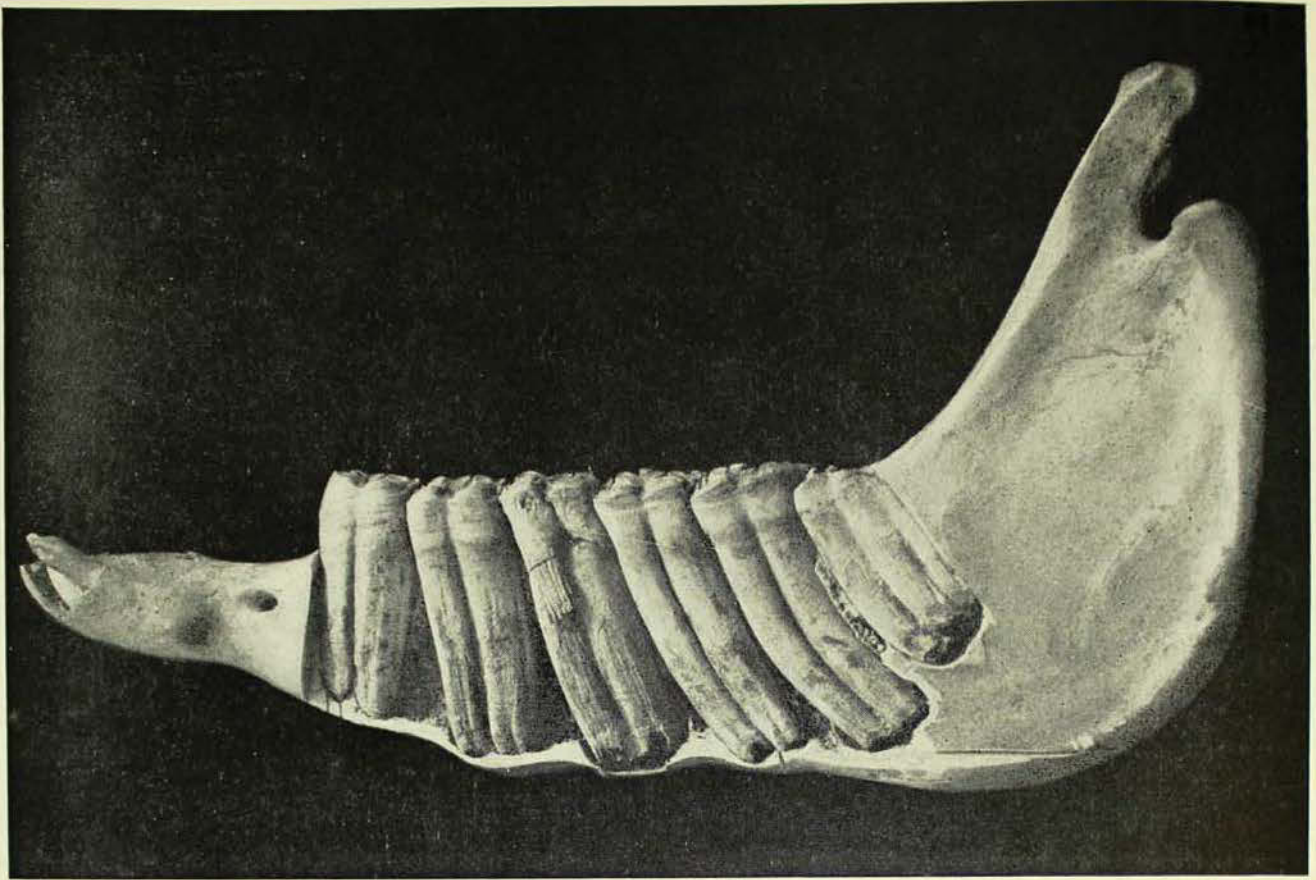
[Photo.—G. C. Clutton.

These are very high crowned and resemble square pillars with fluted sides. The grinding surface has attained great complexity, the ridges elevated, curved and contorted, the intervening valleys and cavities deep and filled up to the top with cement. When such a tooth wears it presents a surface consisting of islands and patches of the two softer substances, dentine and cement, separated by narrow ridges of the much harder enamel. The grinder of the horse continues to grow until the animal is four or five years old, the



Lower jaw of sheep. The cheek teeth exhibit the crescentic (*selenodont*) pattern characteristic of ruminating animals. Australian Museum specimen.

[Photo.—G. C. Clutton.



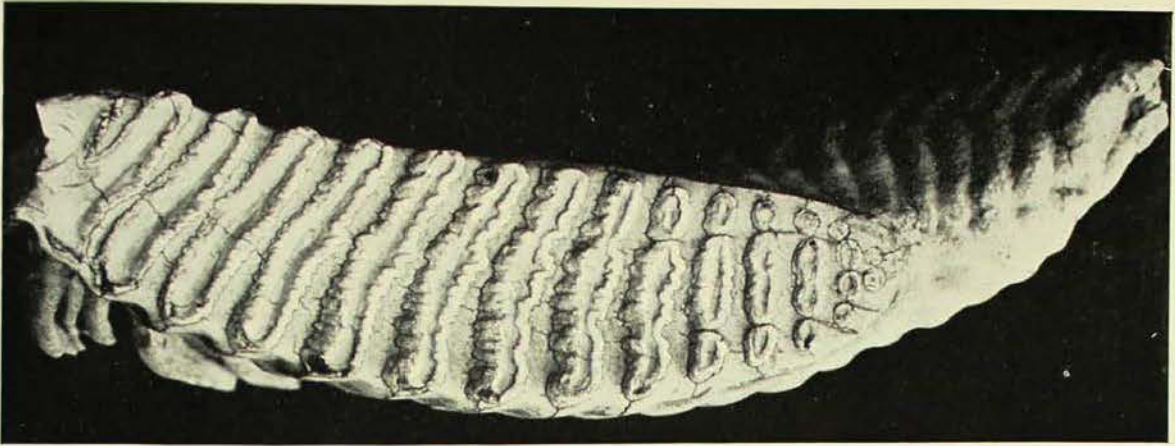
Lower jaw of horse about four years old, the bone cut away to show the embedded portions of the grinding teeth. These are still open below, the root being as yet unformed. The long pillar-like teeth extend downward the full depth of the jaw. The third permanent cheek tooth has not yet replaced its "milk" predecessor and the last molar is just erupting. Australian Museum specimen. [Photo.—G. C. Clutton.

base extending deep into the jaw bones. The roots then form and the tooth ceases to grow, but as the surface wears away by use the whole tooth moves upwards in its socket, so that its usefulness as an organ of mastication is maintained until old age. The dry, harsh herbage of the plains, the natural food of the horse family, often contains hard mineral matter such as grains of sand, so that the teeth of the animal are subjected to wear which would quickly reduce the brachydont molars of primitive ungulates to useless stumps. These ancestral forms, like the modern tapirs, dwelt in the forests and marsh lands, and their food consisted of soft and succulent vegetation which exerted no great wear on the molar teeth.

The Proboscidea, of which the African and Indian Elephants are the only living representatives, have a very specialized dentition. The two upper incisors attain a great size and weight, and furnish the bulk of the ivory

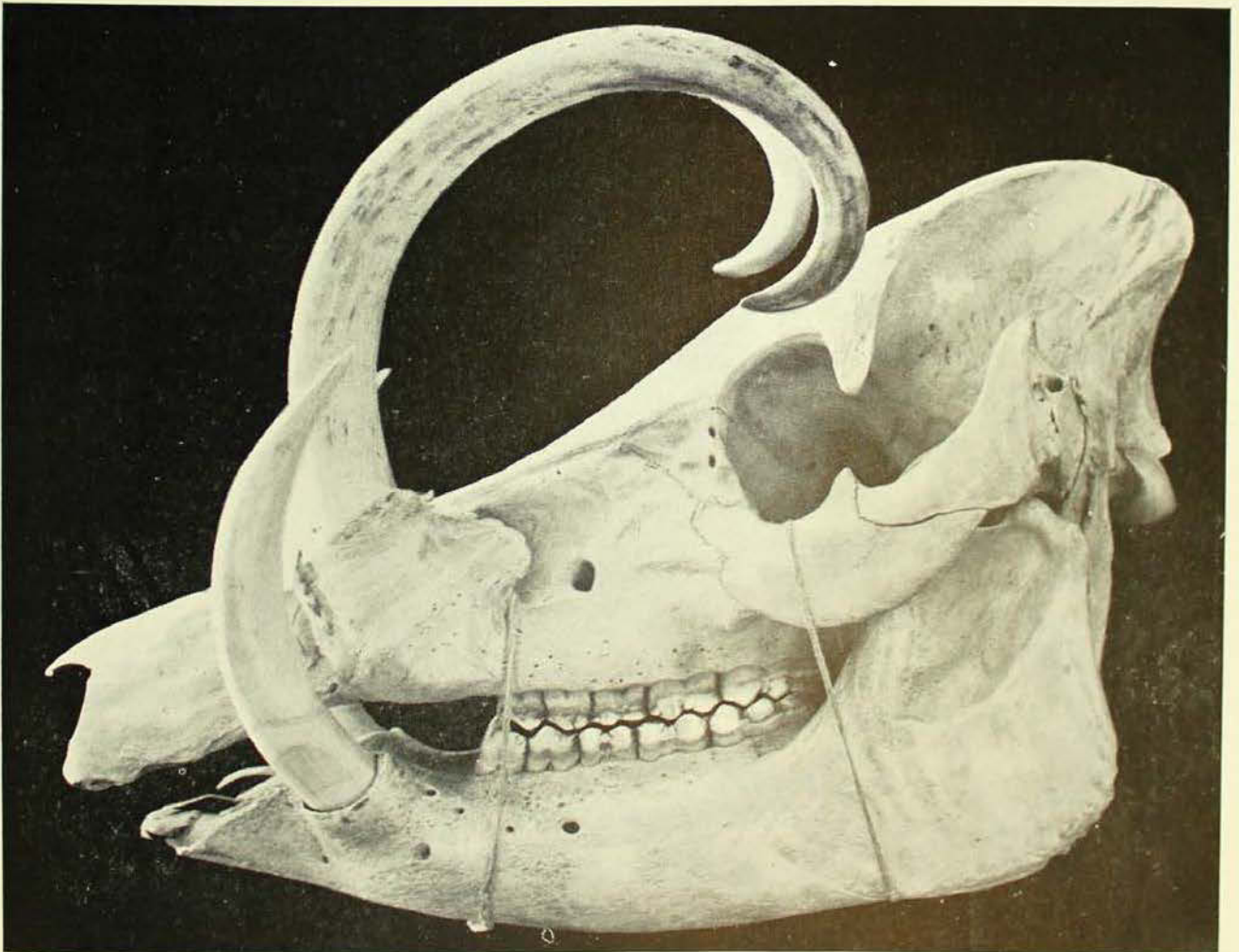
of commerce. These teeth are almost wholly composed of dentine, the enamel being restricted to a small area on the tip of a young tooth, removed by wear at an early age. There are no canines and the cheek teeth are massive structures consisting of numerous enamel-covered plates of dentine surrounded and bound together by cement.

During its lifetime an elephant has six cheek teeth, with occasionally an additional rudimentary tooth in front. Only one tooth and portion of another are in place and in use on either side of each jaw at one time, but the whole series moves forward, and, as the foremost teeth become worn away and shed, the others take their place, the series of changes coinciding with the duration of the animal's life. A somewhat analogous forward movement of the cheek teeth takes place in the dugong and the manatee, and also in the kangaroos, but in none of the mammals is it so pronounced as in the elephants.



Partly worn molar tooth of Indian elephant. The tooth, which is a very massive structure, consists of a number of parallel laminae with a core of dentine surrounded by enamel, the whole bound together by cement. Australian Museum specimen.

[Photo.—G. C. Clutton.



Skull and lower jaw of the Babirusa. The upper canines never enter the mouth, but grow upwards and curl back over the forehead like horns. Australian Museum specimen.

[Photo.—G. C. Clutton.

ABNORMAL DENTITION.

The Narwhal, one of the dolphins, has a very aberrant dentition. Except for some irregular rudimentary teeth the entire dentition is reduced to a single pair, one on each side of the upper jaw. In the female these remain permanently concealed in the jaw bone; in the male the right tooth also usually remains embedded and useless, but the left develops into a slender cylindrical tusk, sometimes seven or eight feet long (more than half the length of the entire animal), its surface marked with spiral grooves and ridges. The use of this peculiar tooth or "horn" is unknown. In the female dugong the pair of upper incisors are retained through life, but like the teeth of the female narwhal they never cut the gums, although in the male they have persistent pulps and project as short tusks.

In the deer family there is usually a small

canine in the upper jaw, but in some of the smaller and more primitive members, such as the Musk Deer, the Muntjac, and the Chinese Water Deer, this tooth attains a considerable size. In the Chinese Water Deer in particular it has the form of a long curving scimitar-like tusk. Deer with well developed canines have the antlers either absent or small, and in this respect they resemble the older members of the family, which had no antlers, and apparently relied on their canines as weapons of defence and combat.

In the male Babirusa, a wild pig of Celebes and Buru in the East Indies, the canine teeth are ever growing, and develop into long, slender, curved tusks resembling horns. The upper canines are directed upwards and never enter the mouth, but pierce the skin of the face and curve backwards over the forehead.

PERRY'S "ARCANA."

The Australian Museum has recently acquired a copy of George Perry's *Arcana, or the Museum of Natural History*, a work issued in twenty-one monthly parts during the years 1810 and 1811. This is an extremely rare publication, only four other copies being known, one in the British Museum (Natural History), one in the library of the Zoological Society of London, one in the library of Gregory M. Mathews, the well-known ornithologist, and one in the Royal Swedish Academy at Stockholm. The Museum endeavoured to secure the latter copy when it was offered for sale in London in 1909, but, unfortunately, the great distance between Australia and Britain placed us at a disadvantage for the Stockholm library had secured it before we were even aware of its existence. In the intervening

twenty years no other copy had come to light until the one we were so fortunate to procure. This copy is in perfect condition, save the binding, the plates and pages being in an excellent state of preservation.

The publication is of peculiar interest to Australia for many of the plates illustrate examples of our fauna and, in some instances, these are the first issued, the well-known native companion, the brolga, being a striking instance. Australian zoologists have long deplored the absence of this work in local libraries. Messrs. G. M. Mathews and Tom Iredale published a complete resume of the *Arcana* in the *Victorian Naturalist* for May, 1912, which, condensed as it necessarily was, has been of great assistance to local workers.

W.A.R.