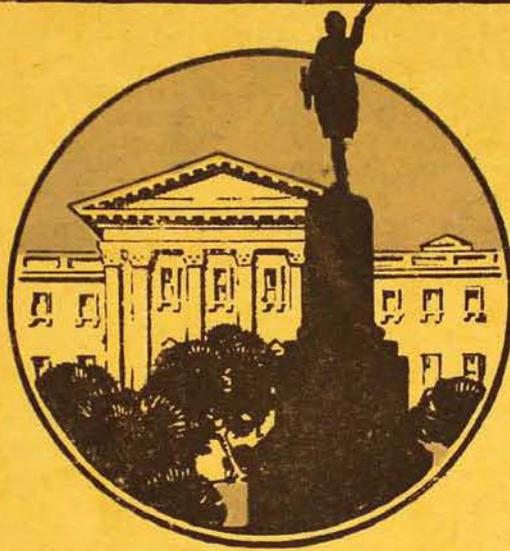


The
AUSTRALIAN
MUSEUM
MAGAZINE

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



Exploration of the Seas

Marine Animals from Low Isles, Queensland -

G. P. Whitley and W. Boardman

Aboriginal Adaptability . - - *W. W. Thorpe*

Life in a Mangrove Swamp - *Anthony Musgrave*

An Eel-Fare at Parramatta - - - *G. P. Whitley*

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Naturalists in Australia—The Frenchmen *Tom Iredale*

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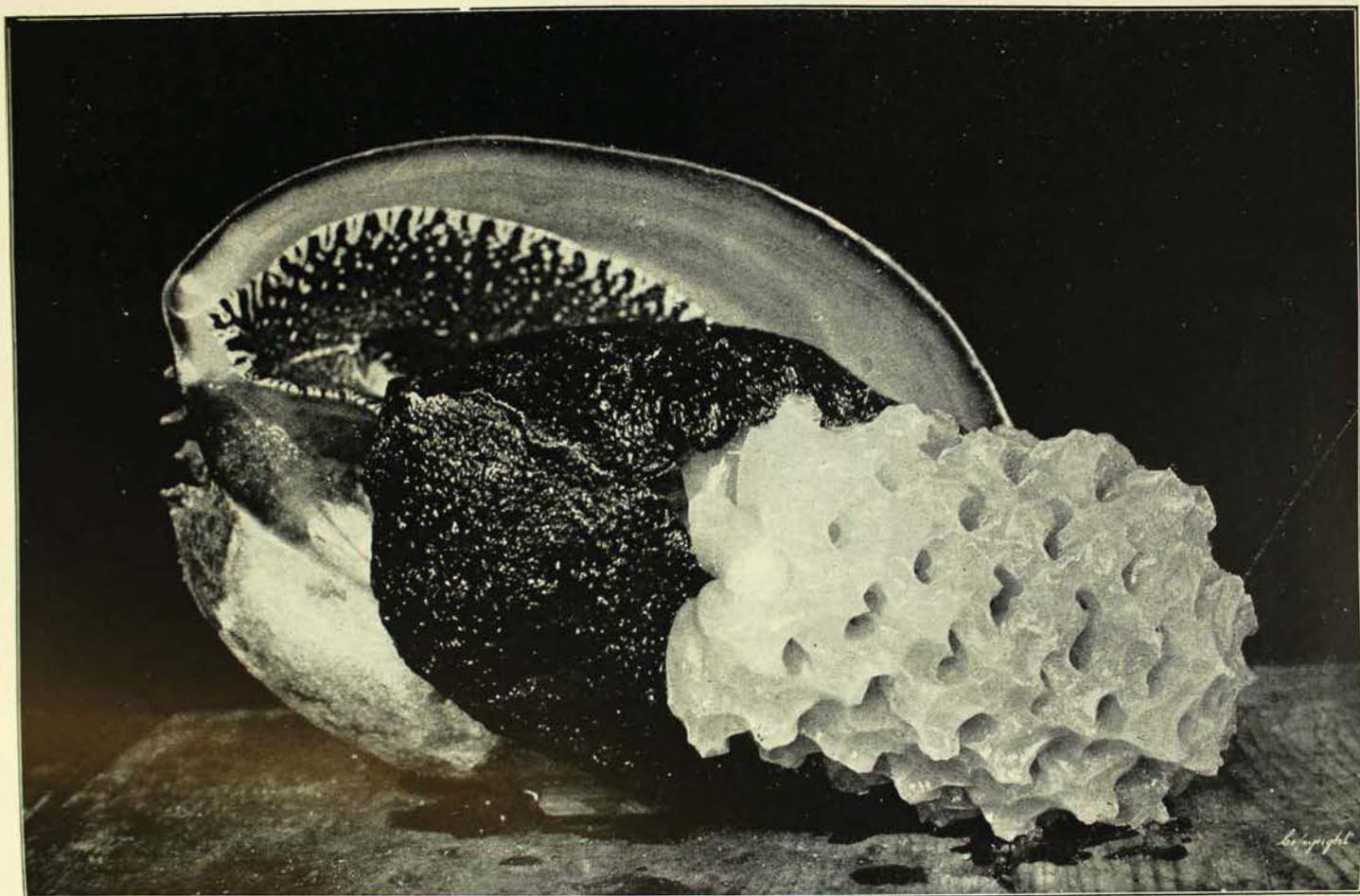
THE AUSTRALIAN MUSEUM MAGAZINE

VOL. III., No. 10. CONTENTS. April-June, 1929.

THE MELON OR BAILER SHELL, <i>Melo amphora</i> , <i>Frontispiece.</i>	
EDITORIAL—EXPLORATION OF THE SEAS	327
NOTES AND NEWS	329
MARINE ANIMALS FROM LOW ISLES, QUEENSLAND <i>G. P. Whitley and W. Boardman</i>	330
ABORIGINAL ADAPTABILITY— <i>W. W. Thorpe</i> ..	337
REVIEW	339
LIFE IN A MANGROVE SWAMP— <i>Anthony Musgrave</i>	341
AN EEL-FARE AT PARRAMATTA— <i>G. P. Whitley</i> ..	348
FOSSIL-HUNTING AT QUIDONG— <i>H. O. Fletcher</i> ..	349
PAGES FROM THE PAST— <i>G. P. Whitley</i>	355
NATURALISTS IN AUSTRALIA—THE FRENCHMEN— <i>Tom Iredale</i>	357

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The Melon or Bailer Shell (*Melo amphora*), depositing the large yellow capsule which guards its eggs. Specimen photographed from life at Masthead Island, Queensland.

[Photo.—Harry Burrell,



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VOL. III., No. 10.

APRIL-JUNE, 1929.

Editorial.

Exploration of the Seas.

IN 1874 H.M.S. *Challenger* was in Port Jackson¹ on a world cruise of scientific investigation. For three and a half years this famous vessel voyaged over the oceans, dredging and exploring the depths, and laying a broad foundation for the science of oceanography. In the magnitude of its operations and the value of its results the *Challenger* expedition has never been equalled, but oceanic exploration has been going on ever since and, as instruments and methods have been improved, observations which fifty years ago took hours in the making are now the work of minutes.

Britain has not neglected oceanographic research in the intervening years, but it is Germany, Norway, and, in particular, Denmark that have carried on the work initiated by the *Challenger*. The small country of Denmark, with a population considerably less than that of Australia, holds a proud place in the annals of marine investigation. Some weeks ago the Danish

research vessel *Dana* reached Sydney on a two years' round-the-globe cruise to study oceanography, which includes the investigation of depths, currents, temperatures, salinities, and the general physical and chemical conditions of ocean water, as well as research on the animals and plants which live in the sea. The leader of the expedition is Professor Johannes Schmidt, Director of the Carlsberg Laboratory, Copenhagen, a zoologist of renown, and a skilled investigator, best known as the world's chief student of, and foremost authority on, the natural history of the eel. For the past twenty-five years Professor Schmidt has been engaged in the elucidation of the breeding habits and migration of the fresh-water eels of the North Atlantic, and the wonderful story of the eel as we now know it has been written by him.² One of the objects of the *Dana* expedition is to discover if possible the breeding place or places of the fresh water

¹See Hargraves—The Australian Museum Magazine, Vol. 1, No. 7, p. 212, 1923.

²See Anderson and Whitley, The Australian Museum Magazine, Vol. II., No. 8, 1925, p. 266.

eels of the Pacific region, a subject on which we have no certain knowledge at present.

But that quest, interesting though it is, is not the only object of the expedition. It will be many years before our knowledge of oceanic waters and their inhabitants is even reasonably complete. The deeper waters in particular still hold many secrets, and it is the object of the *Dana* and similar expeditions to wrest some of these secrets from the gloomy depths. More important from a practical point of view is the investigation of food fishes, the nature and abundance of their food supply, their breeding habits and migrations. In the North Atlantic work of this kind has been proceeding for years and a rich store of information has been garnered, a work again which has been greatly advanced by investigations conducted by Danish vessels, and in which Professor Schmidt and his able associates on the *Dana* have played a leading part.

In Australia such investigations are only in their infancy. Prior to 1898 the only observations made in Australian waters for scientific purposes were the result of the visits of foreign expeditions. A few experiments in trawling for food fishes had been tried locally, and many dredgings had been made in Sydney Harbour; for many years it was a constant practice for The Australian Museum staff to dredge within the harbour, but these operations ceased in 1893 owing to the financial crisis which occurred then. In 1898 the New South Wales Government commissioned H.M.C.S. *Thetis* to conduct trawling operations along the New South Wales coast. For the inception and organization of this expedition we are indebted to Mr. Frank Farnell, who was appointed director. When all arrangements were virtually completed it was decided to ask the Trustees of this Museum to appoint one of their officers to join the expedition, chiefly to determine the fishes and report thereon. The late Edgar R. Waite accordingly joined the vessel and was aboard throughout the whole period of its operations. The collections made by the *Thetis* became the property of the Trustees of the Australian

Museum, and were reported upon by members of the scientific staff and others, their reports being published by this institution.³ The scientific results were of great value, and, moreover, the work of the *Thetis* demonstrated that with suitable vessels and proper gear our ocean fisheries could be successfully exploited.

In 1909 the Commonwealth Government built and equipped the *Endeavour* for general sea-fisheries investigations. Between that year and 1914 this vessel, under the charge of H. C. Dannevig, made experimental cruises along parts of the eastern, southern, and western coasts of Australia, and discovered trawling grounds of much potential value. In the course of this work valuable collections of fishes and invertebrates were made. These are now housed in the Australian Museum, and have been partly described in a series of reports issued by the Ministry for Trade and Customs, the preparation and printing of the reports being supervised by this Museum.⁴ Unfortunately the *Endeavour* was lost with all hands when returning from a trip to Macquarie Island, Subantarctica.

In 1915 State-owned steam trawlers commenced work off our coast and successfully landed large quantities of fish, but the venture was not a commercial success, and was ultimately abandoned. Trawling is still being conducted successfully by a number of privately owned vessels, and we may expect that the industry will expand in the future.

It will be observed that all these enterprises were undertaken essentially with the view of testing commercial possibilities; scientific investigation and results were merely a by-product. It is highly desirable, however, that something should be done in the systematic exploration of our ocean waters under adequate scientific control. With reference to this we may quote the remarks made by Professor Schmidt in replying to the toast "Our Visitors" at a reception given by the Government to welcome him and his colleagues. "I cannot disguise my surprise to find that, although there is ample evidence that Nature has

³Australian Museum Memoir IV. Scientific Results of the Trawling Expedition of H.M.C.S. "Thetis" off the Coast of New South Wales in February and March, 1898.

⁴Commonwealth of Australia. Department of Trade and Customs. Biological Results of the Fishing Experiments carried on by the F.I.S. "Endeavour," 1909-14.

endowed Australia with an abundance of good food fishes, you are importing more fish than you are catching. Can any greater evidence be found for the necessity for the systematic investigation of your waters? I hope to see in the near future an investigation vessel or vessels carrying out work of this nature, and I look forward with keen

anticipation to the time when you will have a marine biological station, conducting research into fisheries problems. I am sure you will find, as we have found, that such investigations pay handsome dividends."

Let us hope that before very long Professor Schmidt's anticipations will be realised.

Notes and News.

Mr. H. M. Hawkins has been elected a Trustee of this Museum. Mr. Hawkins, who is prominent in commercial circles, is well-known for his interest in philanthropic work and matters of public interest.

Mr. T. G. Campbell, assistant entomologist resigned on 4th January, having accepted an appointment in the Division of Economic Entomology, Canberra, F.C.T. Mr. Campbell, who joined the Museum staff as a cadet in 1920, was an efficient and zealous officer, and his resignation was accepted with great regret. We wish him every success in his new position and congratulate the Division on obtaining his services.

In the Museum Lecture Hall on February 6th, Professor Johannes Schmidt, Director of the Carlsberg Laboratory, Copenhagen, delivered a lecture on "Migration of Eels." The lecture was illustrated by lantern slides and a cinema film depicting oceanographic work on board the *Dana*.

The lecturer explained that for over two thousand years the problem of the breeding habits and migration of the common fresh water eels of the countries bordering the North Atlantic had been a subject of speculation and enquiry, and that only within recent years had the problem been solved.

In 1904 the lecturer was so fortunate as to discern a single glassy larva of the common eel west of the Faroe Islands. Up till then it had been supposed that the breeding grounds of the eel were somewhere in the Mediterranean, but this discovery opened up a new field of exploration, and, after years of patient research and the collection of many thousands of eel larvae from stations extending over the whole of the North Atlantic, Professor Schmidt and his assistants were able to establish the astonishing fact that the fresh water eels of Europe and North America breed in the Sargasso Sea. There, seemingly, the parents die, while the young travel back to their ancestral homes, becoming gradually transformed into elvers during the long journey, which in the case of the European eel occupies three years, of the American eel, which has a shorter distance to traverse, one year.

It is hoped that an article by Professor Schmidt himself, detailing the full story of the eel, one of the most fascinating romances of natural history, will appear in a subsequent issue of the MAGAZINE.

The executors of the late D. F. Cooksey have presented part of his extensive collection of aboriginal stone implements to the Museum.

Marine Animals from Low Isles, Queensland.

BY G. P. WHITLEY AND W. BOARDMAN.

AS the tide slowly retreated from the shore of our island home an expansive flat was gradually exposed between us and the neighbouring mangrove-covered isle some eight hundred yards distant. Its drab monotonous looking surface gave no indication of life. Here a patch of sand, there some



Small Clams (*Tridacna crocea*), burrowing in a block of coral-rock.

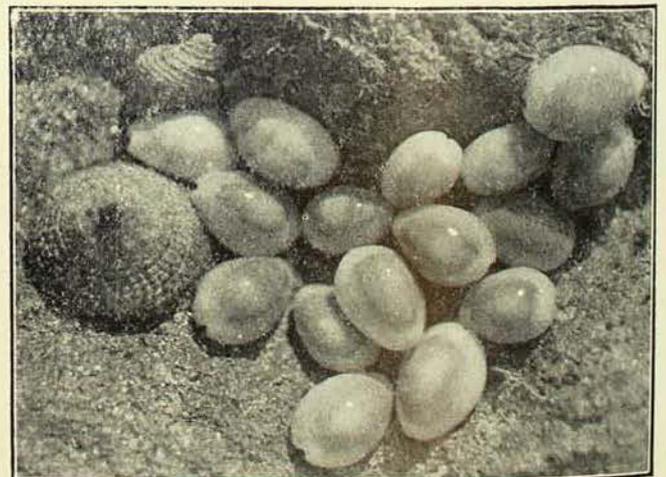
[Photo.—W. Boardman.]

weed lending colour to otherwise dull silted dead coral, and beyond stretches of shallow water in which flourished living coral.

Beneath every boulder, in every crevice, burrowing under the sand and into the coral, numerous denizens of the sea maintained an eventful, precarious existence. For brief instants the veil of mystery which invested the lives of these humble creatures would be drawn aside and a little of the joy, pathos, and grim humour of Nature revealed to the eyes of the curious.

CLAMS.

The most prominent shellfish on the reefs were Horseshoe Clams (*Hippopus hippopus*) which lay about in thousands, resting even in the shallowest water which was uncomfortably hot to the hand in the heat of a summer day. The Giant Clam (*Tridacna gigas*) with its huge cradle-like valves was rare at Low Isles, but on an unnamed coral patch of the Outer Barrier, we found many specimens agape, showing the gorgeously coloured animals, whose mantles were jewelled along their edges with little eyes. These mighty molluscs are the dread of divers for, if touched by leg or arm, their shells close and no amount of human force can separate them, and held in a vice-like grip the captive drowns. Small clams (*Tridacna crocea*), burrowing in rock or dead coral were superabundant, their richly dyed, multicoloured animals lying like velvet cushions between their wavy shells. Each clam, large or small, whenever affected by shadow or nearby motion, spouted a jet of water into the air,



A group of Money Cowries (*Cypraea moneta*), such as were commonly found under stones on the flat.

[Photo.—W. Boardman.]

and we would sometimes be drenched by one which had been thoughtlessly passed by. As the disturbed animal withdrew into its impregnable fortress, its shells locked and further investigations were frustrated.

“porcelain”—a little pig—in bygone days because of its shape, but this name has since been transferred to a Chinese ware of similar appearance.

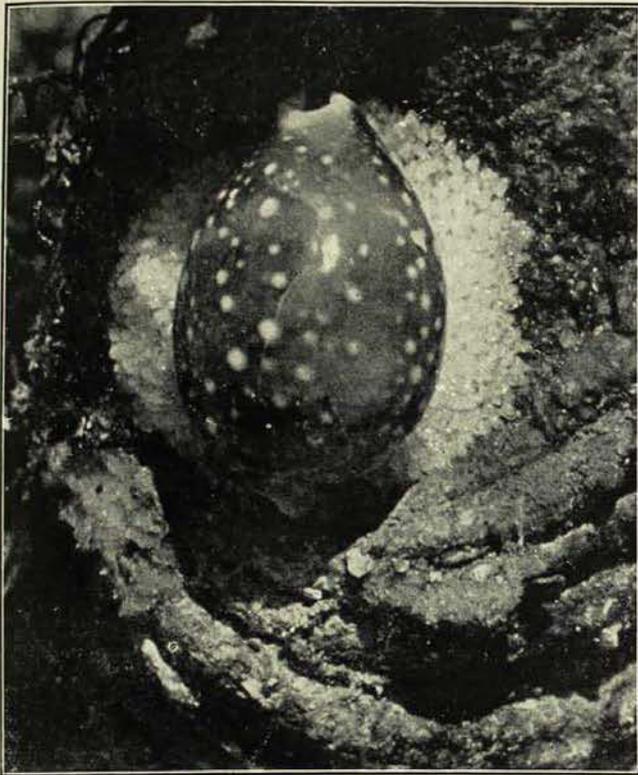
THE MELON SHELL.

A naturalist wading in a coral lagoon sometimes strikes his foot against a smooth, rather dirty, round-backed object and, picking it up, out of curiosity, removes it from the sand in which it had been partly submerged. Thus he encounters the Melon or Bailer Shell (*Melo amphora*), a large univalve attaining a length of fourteen inches and a breadth of about a foot, whose wide mouth makes it desirable as a bailer for small boats. Its shape and colour suggest a melon, but Queenslanders also call this shell the Boxing Glove. The animal is a thick leathery creature with a long siphon, like a miniature elephant's trunk, which it carries held forward as if to feel its way as it slides along. The flesh is edible, but, though not unpleasant to taste, is rather tough; the soup, however, has a most savoury aroma.

In the summer time, the Melon Shell lays its eggs, and each young one develops in a separate chamber of a long yellow capsule of elaborate structure, the formation of which takes considerable time on the part of this extraordinary mollusc. Through the courtesy of Mr. Harry Burrell, we are able to reproduce here his photograph, taken in the Capricorn Islands, of a Melon Shell in the act of depositing its egg-capsule (see frontispiece).

SPIDER SHELLS.

A large whelk, the shell of which is fringed with long, curved, finger-like spines, is common in shallow water at Low Isles, progressing in a series of leaps along the sandy bottom. The Spider Shell (*Lambis lambis*), as this is called, is white with brown mottlings, but, as in most molluscs which live in fairly exposed positions, the colours of its shell are generally obscured by a coating of marine growths. The animal which lives in the spider-shaped shell is like an elongated snail, but is much more active than the better known garden pest. If one holds a Spider



The beautiful brown-shelled Cowry (*Cypraea vitellus*), caught laying its eggs on the shell of a Horseshoe Clam.

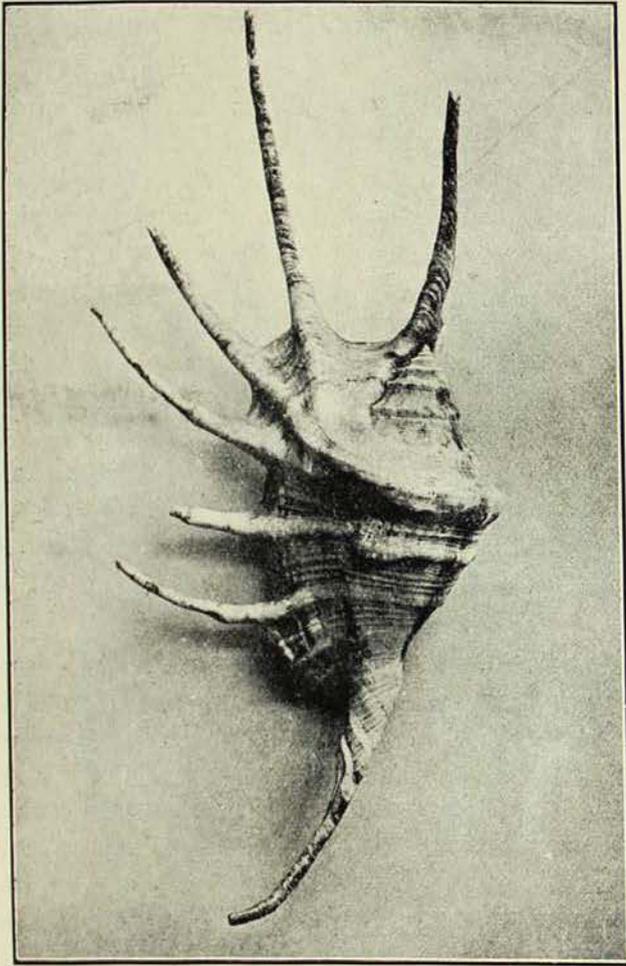
[Photo.—W. Boardman.]

COWRIES.

Undoubtedly the cowries are some of the most beautiful of coral-reef shells, and several may be seen if a stone be overturned. The soft animals, exquisitely coloured, cover their shiny shells until, frightened by the light, they contract into their dainty shelters, leaving an impassable toothed doorway grinning at those who would molest them. Once or twice we surprised a beautiful brown-shelled Cowry (*Cypraea vitellus*) laying its eggs under stones, and a photograph of such an incident is here reproduced.

On living coral, an unusual situation for a mollusc, there sometimes occurs a cousin of the cowries, the Egg Cowry (*Ovula ovum*) whose jet-black animal lives in a shiny pure white shell. The Egg Cowry was called

Shell, it makes slashing movements with its tail and tries to stab one's fingers with the spiked brown weapon into which its operculum has become modified. Then two long stalks protrude inquiringly from the head, and the eyes at their extremities look with apparent indignation at the intruder. These eyes are



The Spider shell (*Lambis lambis*), a curious whelk found in shallow water amongst coral.

[Photo.—G. C. Clutton.]

like tiny targets, having concentric rings of various colours, generally gaudy, but always strongly contrasted. Even this grotesque shellfish has its enemies, however, and fragments of spider shells and even clams may be found on many a lonely reef-crest. Evidently large Stingrays have crushed these with their strong grinding teeth, and shells which would have resisted the blows of a hammer doubtless cracked like nutshells in the jaws of the rays, which, as the tide flows, skim rapidly over the reef-crests in search of their food.

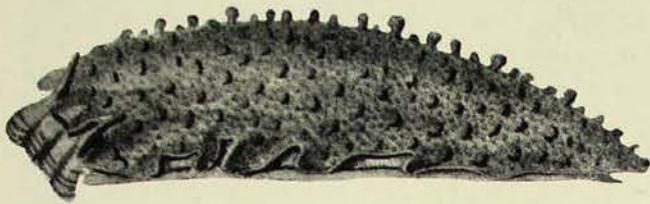
OTHER MOLLUSCS.

The mollusc upon which eyes, greedy for gold, are mainly turned is the Button Pearl Shell or Trochus (*Trochus niloticus*), a cone-shaped pink and white shellfish which lives amongst rocks and in moderately deep water. The crews of Japanese luggers, knowing more of the intricate mazes of the reefs than most Australians do, visit all parts of the Great Barrier Reef and despoil them of Trochus or other animals without hindrance. These they exploit commercially, while unenterprising white men ignore the golden harvest which merely awaits gathering. Tons of the Mother-of-Pearl Shells leave our waters annually and are later imported into their country of origin in the form of pearl buttons and other haberdashery which might profitably be manufactured by Queenslanders. It is, however, gratifying to note that an Australian scientist, Mr. F. W. Moorhouse, is investigating the biology of the species of *Trochus*, and laying a sound foundation upon which future developments of an Australian industry may be based.

Space will not permit mention to be made of the thousands of shells to be found on the smallest of islets on the Great Barrier Reef, and even such large forms from Low Isles as the oysters, Ass-ear Shell, Red-fingered Lima, and many shell-less molluscs of great beauty must be content with bare mention.

A large species of octopus attracted attention on account of its chameleon-like capacity for changing colour. At one moment blushing with rage, in a few seconds its colour-cells could be seen contracting until the livid object became mottled or of a pallid tone. Soon it became suffused with a yellowish and then a sickly whitish tinge and a brown eye-spot appeared in advance of each of its eyes, but the pigment-cells would again expand and a dark greyish-brown colour would spread all over the octopus as it sprawled along the sand to a convenient shelter.

Of the squids, those ten-armed relatives of the eight-armed octopus, we saw very few living examples, as they seemed to prefer deeper water. However, the characteristic "bones" of several different species were found from time to time stranded on the beach at Low Isles.



An air-breathing marine slug (*Onchidium tongana*), which feeds on algae at low water.

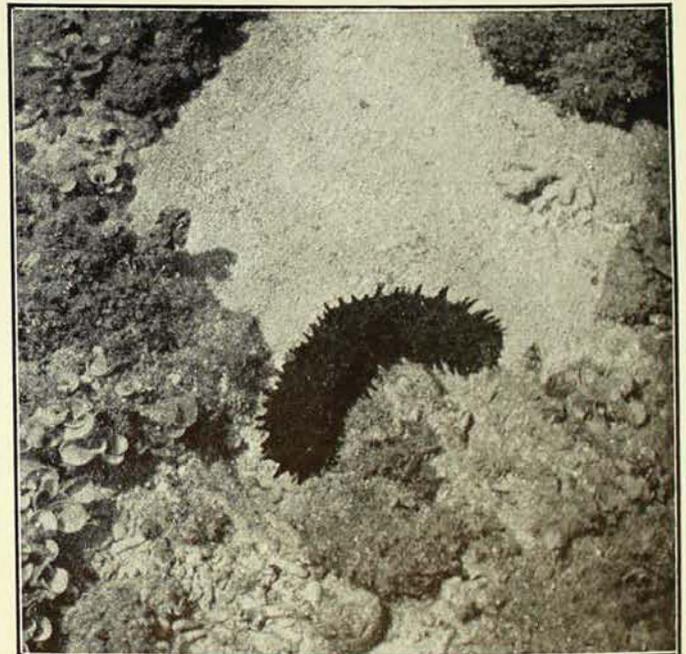
[After Quoy and Gaimard.]

Other molluscs seen were more bizarre than useful or beautiful. Eight-shelled loricates with spiny girdles clung tenaciously to eroded rocks and "niggerheads" cast on the reefs during storms. Air-breathing, slug-like creatures known as *Onchidium* crawled from their holes when the tide had ebbed and browsed upon seaweeds. A peculiar feature of these animals is the presence of little eyes on various parts of their backs. Altogether, the molluscan fauna of Low Isles proved a fascinating and absorbing study.

BÊCHE-DE-MER OR SEA SLUGS.

Bêche-de-mer, the delight of the Chinese epicure, at one time flourished on Low Isles, but the activities of luggers have left few of the commercial kinds to survive. Varieties unsuited for the market, however, thrive in

countless numbers. One species found commonly in shallow water on open coral sand is about six to eight inches long and about one and a half inches thick: the skin is of a black colour and secretes a red dye which will stain the fingers. When found, it is invariably camouflaged with a film of sand adhering evenly to its body, except for two rows of somewhat irregular patches on the dorsal surface. By looking casually one could often see dozens of these apparent sand sausages, each and all busily engaged upon the never-ending task of cramming their intestines with sand. In bêche-de-mer the alimentary canal is in the form of a loop, and

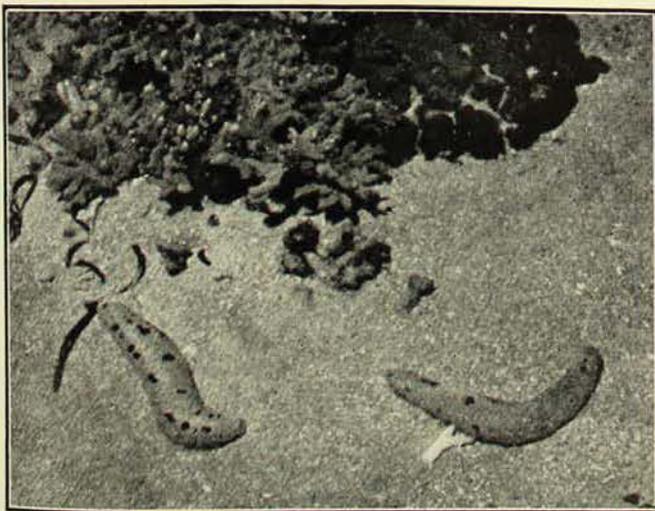


The "Prickly Fish" (*Stichopus chloronotus*), disdains concealment, but unpalatable flesh probably guarantees its tenure of life.

[Photo.—W. Boardman.]

runs from end to end of the body, the mouth being surrounded by a circlet of tentacles which are capable of being withdrawn into the body. As in many other sand-inhabiting animals, food is extracted from the sand which is taken into the intestine.

Another larger species lives in the same situation as the form described above, and similarly covers itself with sand. Examples of this form may be well over a foot in length, proportionately thick, and are generally of a yellowish colour. Numerous small black papillae are seen scattered over the surface



A small, well-camouflaged "sand sausage," (*Holothuria* sp.), whose skin secretes a red dye which stains the fingers.

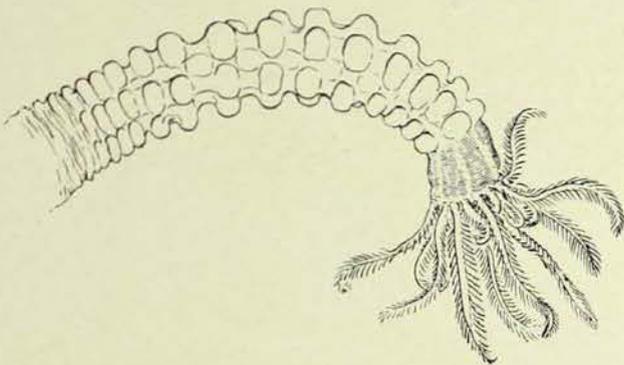
[Photo.—W. Boardman.]

when the complete sandy covering is removed. Care is necessary when handling these animals owing to their unpleasant habit of ejecting long, opalescent, faintly blue threads, which are extremely sticky and cause much annoyance if they become attached to one's skin or clothes. Scientifically these threads are known as Cuvierian organs, and undoubtedly their function is mainly protective, serving to entangle and disconcert enemies; it is interesting to note that the animal itself seems to be immune to their stickiness. In those forms which possess the organs regeneration takes place very quickly after they are discharged. Some *bêches-de-mer*, if irritated sufficiently, eject not only the Cuvierian organs, but also nearly the whole of the viscera. Under favourable circumstances, however, these losses are replaced by regeneration.



This sea-cucumber, whose tentacles are actively pushing sand into its mouth, stubbornly resists attempts to pull it from its stronghold.

[Photo.—W. Boardman.



Synapta, a snake-like sea-slug with a nodulated body which shows remarkable individual colour variation.

G. P. Whitley.

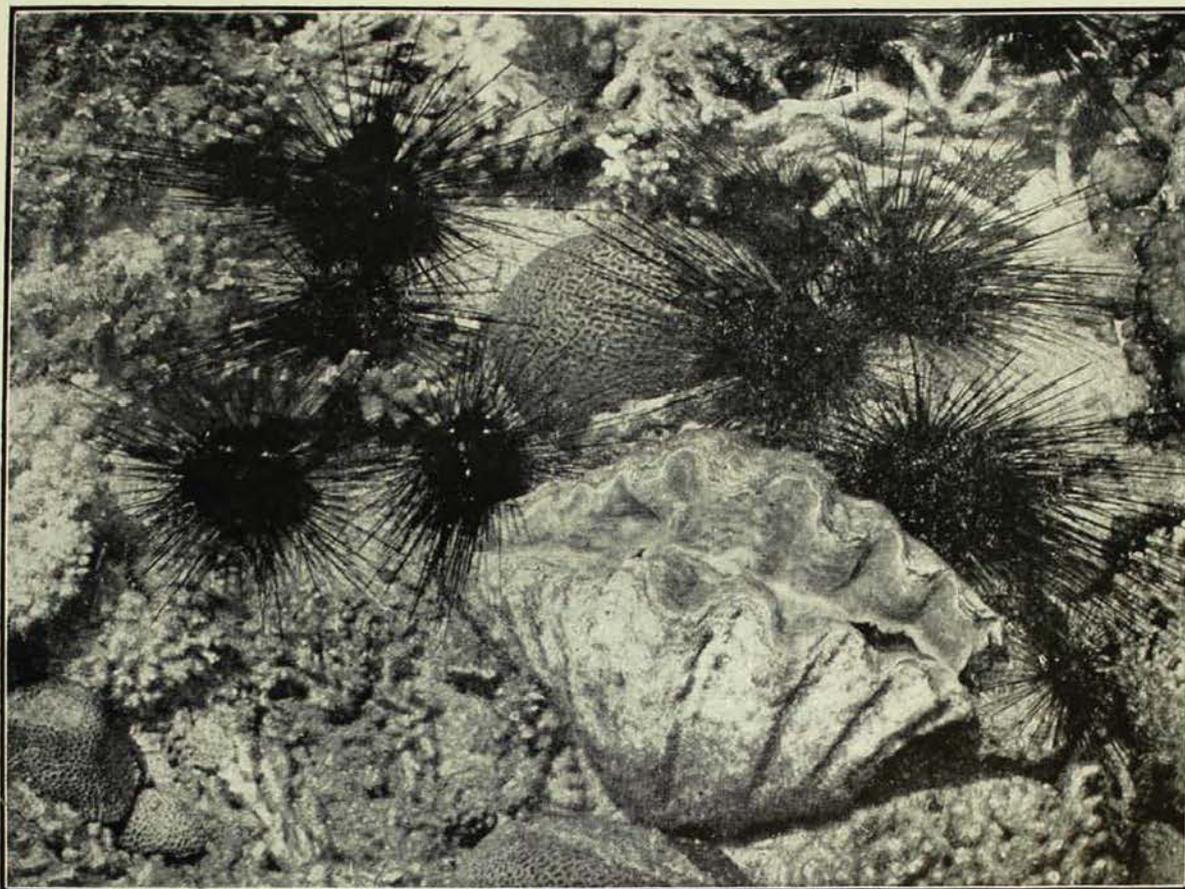
The Prickly Fish (*Stichopus chloronotus*) is another *bêche-de-mer* living on the open sand flat, but it does not adopt any mode of concealment. The body is somewhat squarish in cross section, and on each edge is a row of fleshy serrations running from one end of the body to the other. A deep blackish green colour makes the animal very conspicuous against its background of coral sand, and one is led to the surmise that its flesh must be unpalatable, or else there is some other unpleasant property present which guarantees its tenure of life. When handled the body is noticed to be soft and plastic, in fact, almost gelatinous in consistency, and resting snugly in a shallow depression on the ventral surface one often sees a pretty flattened annelid worm. The

worm is usually an inch in length and is bright red in colour, probably due to the blood showing through the transparent body-wall; some small white marks on the red ground suggest grains of sand. If disturbed the worm moves rapidly in search of new quarters on another part of the "slug." Just what connection exists between the two organisms was not apparent to us, but it seems to be a case of commensalism wherein each is helping the other in a most subtle manner.



The sea urchin (*Salmacis*), a most inoffensive sand-burrower.

[Photo.—W. Boardman.



A menace of the reef, poisonous-spined sea urchins (*Centrechinus setosus*). In the foreground is a Horseshoe Clam (*Hippopus hippopus*).

[Photo.—W. Boardman.

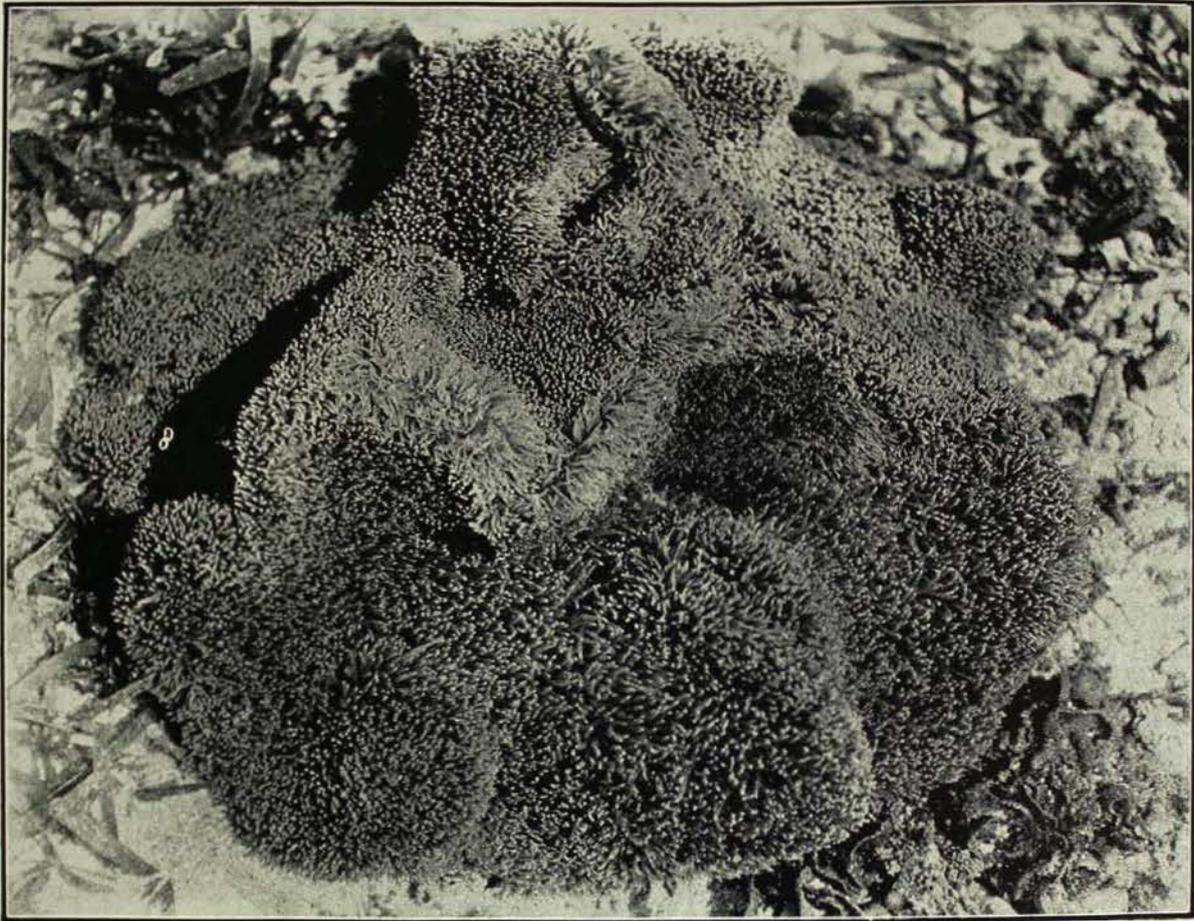
Still another "sea slug" which is plentiful lives beneath the dead coral boulders on the flat. Its colour is black, and large specimens are a yard in length. They are usually seen with the anterior portion of the body protruding from beneath the boulder, with the circlet of tentacles expanded and actively occupied in pushing sand into the mouth cavity. Attempts to extract individuals from their strongholds are stubbornly resisted; powerful muscles are responsible for the contraction of the body, and thus serve to withdraw the exposed portion of an animal beneath its cover.

Probably the most interesting of the Low Isles beches-de-mer is an inhabitant of the weedy flats, which are fairly extensive in the vicinity of the mangroves. This is the form technically regarded as a member of the genus *Synapta*, whose snake-like body may attain a length of six feet. The colour scheme

is quite rich and variegated, being composed of numerous different combinations of brown and dull yellow to greenish tints; in fact, no two individuals seem to possess the same colouration. The skin is quite thin and delicate, though scarcely transparent, and numerous minute anchor-like spicules in its substance enable it to cling to one's fingers when handled.

SEA URCHINS.

Various kinds of sea urchins were much in evidence. On the sand exposed at very low tides one would find the quaint little *Salmacis* boring an inoffensive way. Like the beche-de-mer it is a "sand feeder," and the manner in which the spines are directed backwards does not lessen their protective value, while contributing greatly to the ease with which movement through the sand is effected.



The Giant anemone (*Stoichactis*). These are really two examples growing close together, the whole having a diameter of fourteen inches.

[Photo.—W. Boardman.]

Sometimes when walking through the coral in the lagoon progress would be suddenly checked by a barrage of the Needle-Spined Urchin (*Centrechinus*). Closely congregated over an area of several square yards the long spines of neighbours would engage and wave slowly with seeming anticipation; they formed an obstacle to be treated with respect. The greatest care was necessary even in the examination of single individuals because of the foot-long spines which radiated from the dorsal surface, each armed with a needle-like point. Should the observer be so unfortunate as to be pierced by any of these poisonous spines, the wound is aggravated by the brittle points breaking off within the flesh. This urchin is coloured deep purple and a patch interspersed with coral growth and brightly hued clams makes a striking picture, which indelibly impresses itself on the mind. Indeed, such a scene was depicted on the artistic Christmas cards of the Great Barrier Reef Expedition.

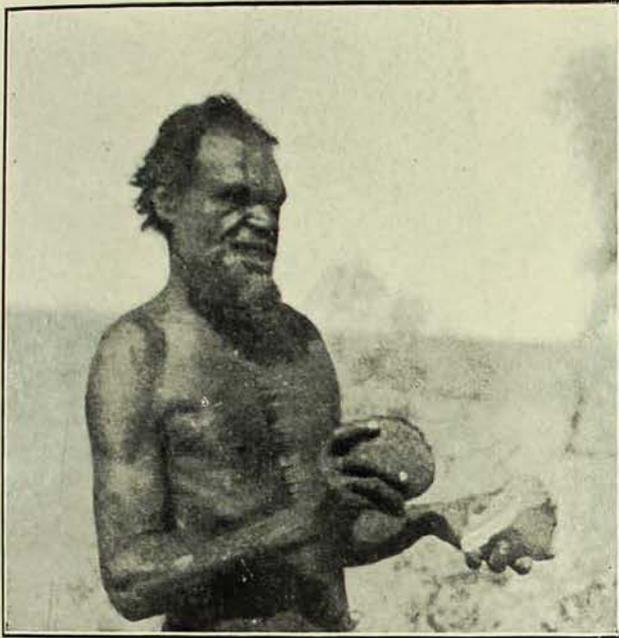
ANEMONES.

Some of the tropical anemones attain a size unheard of among their brethren of the temperate seas. Whereas a large specimen of a common Port Jackson species rarely exceeds a diameter of three inches, one of the best known of the Low Isles forms was frequently as much as a foot or more across. Generally this monster is a fine emerald green in colour, and usually lives attached to submerged boulders in open situations on the lagoon flat. An example living in a shallow pool presented a fine sight with its hundreds of short tentacles gently swaying in their eagerness to come into contact with minute floating food. Sometimes we came across a similar giant, probably of the same species, but coloured a brilliant electric blue. Swimming unharmed amongst their sting-laden tentacles we sometimes found gaily coloured prawns or fishes, which were quite impervious to attack from their hosts.

Aboriginal Adaptability.

BY W. W. THORPE.

THE Australian aborigines often show remarkable ingenuity in using for their own purposes the products of civilization. In many native camps, and in most museums, objects may be seen which have



Old aboriginal man flaking stone, Avon Downs, Cameroonal, western Queensland.

[Photo.—Dr. W. E. Roth.

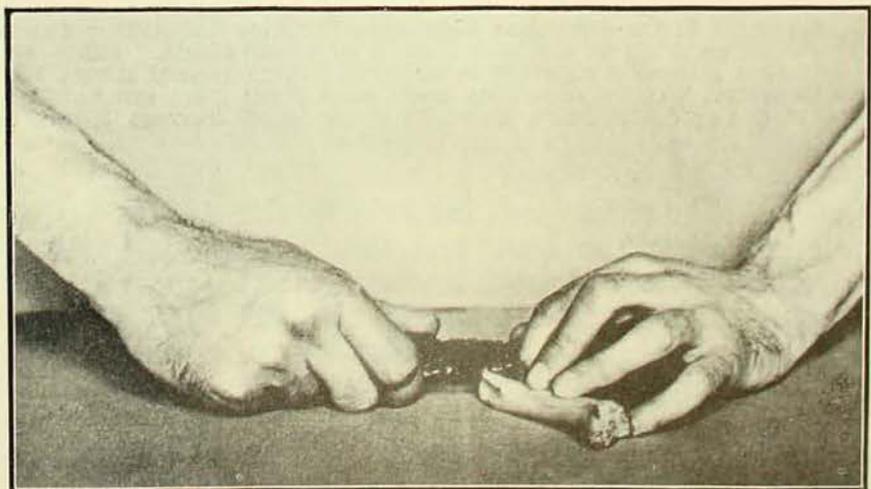
been made from iron, glass, or porcelain. These take the form of spear heads, surgical appliances, and various implements used in the manufacture of weapons.

One cannot admire a boomerang made with metal tools and finished with sandpaper, yet on the other hand the glass spear heads of North-West Australia make one marvel at the symmetry and finish attained. Our admiration is greater when we remember that, after all the time spent on this delicate work, one throw of the spear might destroy that which has taken many hours to prepare. The aborigines were not long in learning that porcelain obtained from telegraph insula-

tors, and bottle glass were workable like the stony material they and their forefathers formerly utilized. The primitive materials were quartzite, chert, chalcedony, and jasper, and here was convenient "stone" provided by the white man!

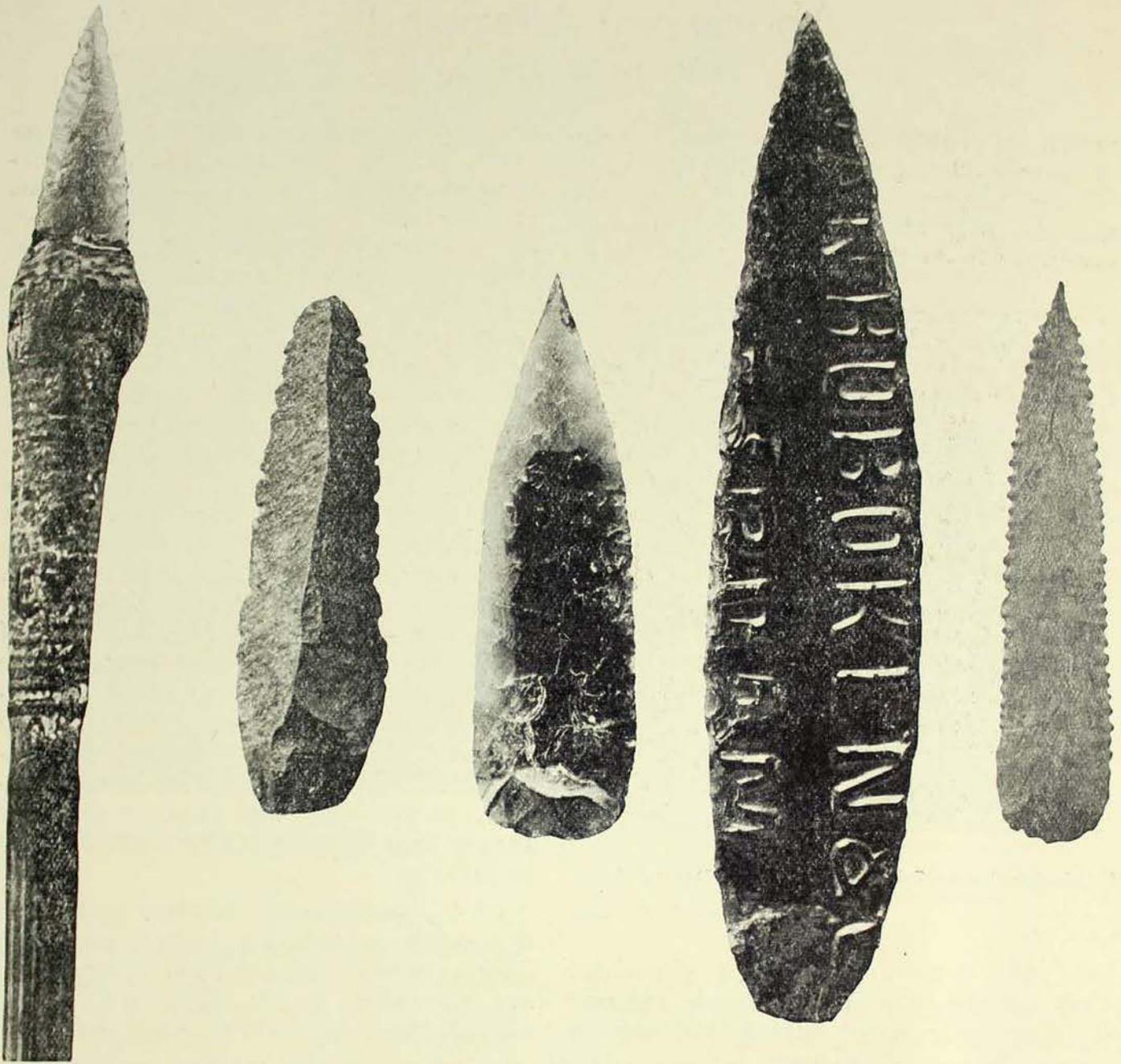
That flake work in general may be understood it is necessary to explain briefly the two incidental operations. One is called "flaking," and the other "chipping." The first process is the operation of skilfully striking one stone against another, the resultant removed piece being known as a flake. The blow is usually delivered with a rounded pebble of very compact rock while the mass to be flaked is embedded in the palm of the left hand. This process invariably applies to the manufacture of the smaller varieties of flake work, but the reduction of larger masses might be performed on the ground, in which case it is termed "bruising." The process of "chipping" constitutes that fine secondary treatment to give edge and finish to the flake. This is usually done not by concussion but by pressure.

In the manufacture of glass spear-heads the bottle is carefully broken, and likely pieces, selected as potential spear points, are set aside. A flat stone anvil is next requisitioned, on which some soft bark



Pressing off the chips against the bone implement, as practised at Kimberley, W.A.

[After Balfour.



Specimens in the Australian Museum collection, illustrating the skill of the aboriginal in utilizing various materials in the manufacture of spear heads. Glass spear head in foreshaft, Kimberley, Western Australia; quartzite spear head, Prince Regent River, Western Australia; glass spear head, Kimberley, Western Australia; spear head made from gin bottle fragment, with brand, "Van Hoboken & Co., Amsterdam"; quartzite spear head, Forrest River, Exmouth Gulf, Western Australia.

is placed. The stone gives firmness to the operation, while the bark bed minimizes the shock to such brittle material. The spear-head-to-be is then taken in the left hand, embedded in the bark, and progressively chipped by pressing upon the edge with a piece of bone held in the right hand. The process calls for careful adjustment each time the pressure is applied. Patience, skill, and concentration are necessary. The first is often tried by a fracture in the wrong direction, or the breaking of the

point just as the work is nearing completion. An accident of this nature necessitates the formation of a new point, and more chipping of the sides to make them correspond. One would think that glass splinters would cause considerable annoyance by entering the points of the fingers, but observers say this causes the aborigine very little concern. He just runs his fingers through his hair to remove the blood, and carries on with the work.

In the northern parts of Australia, glass is used to-day for surgical purposes such

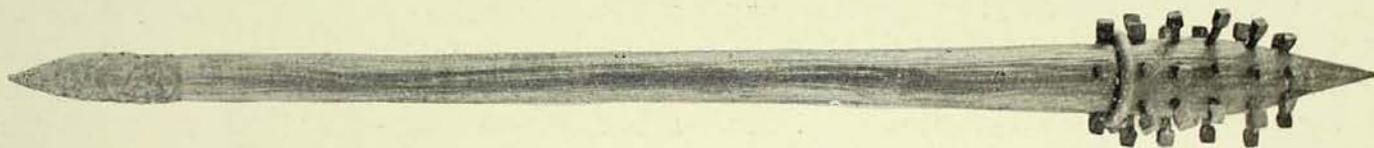
as blood-letting, scar-producing, and initiatory rites. When digging in rock shelters around Sydney one frequently discovers amidst the shells and ashes, pieces of bottle glass which have been used as knives and scrapers by the aborigines in the early days of white settlement.

Iron also is largely used by the aborigines. A shear blade makes an excellent spear point. So also does a piece of fencing wire, while pieces of cartwheel tyre sometimes takes the place of stone as chisel blades. Horse-shoe nails placed in rows in the head of a club add weight to the blow, and give the owner more importance amongst his fellows. In tropical Australia nails are taking the place of bent turtle-shell as fish hooks, and nothing pleases the turtle fisher-

man more than to know that his harpoon is provided with an iron point.

Native cords were formerly and invariably composed of bark fibre, human hair, animal fur or sinew. Now the string of civilization is much utilized by the aborigines. Very neat bags and efficient nets are made with this material. The rabbit is slowly replacing the native animals in providing decorative pelts for ceremonial dances.

All these changes and innovations are inevitable. What with adaptation on the one hand, and decimation on the other, the time is not far distant when the handiwork of these interesting people will be no longer produced with native material in the primitive way.



Nulla Nulla, embellished with horse-shoe nails and iron ring, Rockhampton, Queensland.

[Photo.—G. C. Clutton.

Review.

Wanderings in Wild Australia. By Sir BALDWIN SPENCER, K.C.M.G., F.R.S. Two Volumes, MacMillan and Co., Ltd., 1928. From Angus and Robertson, Ltd.

Few men are better acquainted with Central and North Australia and its human and animal inhabitants than the author of these two handsome volumes. In 1894 he was a member of the celebrated Horn Expedition, organized to carry out investigations in the central wilds, which at that time were, in a scientific sense, practically unknown. Since then he has wandered over much of the great stretch of country occupying the central and northern central part of the Australian continent, and has gleaned a wealth of information regarding the aborigines, the

animals, the plants, and the geology of this great lone land. In these volumes he has summed up his experiences and observations, and the result is an eminently readable and informative account of a rather inhospitable, yet intensely interesting region, of which few Australians have any first hand knowledge. His narrative is vivid and full of interest. In fancy we accompany him in toilsome treks over the gibber country, through the Giddea and mulga scrubs and the salt-bush plains, over arid stretches, where the distance to and the condition of the next waterhole may be a matter even of life or death. On his first expedition the author and his companions had to rely largely on camel transport, and one can gather that Sir Baldwin has no great admiration for

that cross-grained but useful "ship of the desert," with its perplexing fore-and-aft and sideways motion. But there are oases in the desert, at any rate in good seasons, and the party spent a few pleasant days at Palm Creek, where grows the *Livistonia* palm, a relic of better days before dessication had laid its paralysing hand on the pulsing heart of central Australia. And there are compensations even on the desolate plains and gibber fields, which for just a short time at dusk are fascinating in their beauty, when "one after another the stars rise in the east and mount higher and higher in the sky, and then, with a feeling of perfect freedom and a delicious sense of absolutely fresh air, as the night wind rises and blows over you, gently rustling the leaves of some old gnarled gum tree, you fall asleep."

The author remarks on the contradictory character of the reports regarding this region. One traveller describes it as a fertile country, another, following the same route, "finds nothing but sand and flies, withered shrubs and dried-up water-holes, with here and there the bleached bones of some poor beast that has perished in the drought." It depends on the season, and there is no regularity of season in the centre, the rainfall varying from a maximum of perhaps twelve inches to a minimum of two or even less.

In this trying environment existence both for man and beast is precarious indeed, and Sir Baldwin frequently remarks on the poorness of the country from a collector's point of view. Yet on the Horn Expedition and on later journeys he was able to make valuable additions to Australian zoology, and his observations on the habits of the animals and their adaptations for the severe conditions under which they exist, are full of interest. The major part of the work is concerned with

the natives of Central and North Australia, their ceremonies and customs, a subject on which Sir Baldwin speaks with an authority based on long experience and intimate knowledge.

The greater part of the second volume is taken up with a description of travel and investigation in the northern part of Central Australia, including Bathurst and Melville Islands, the east Alligator River, and the shores of the Gulf of Carpentaria. For twelve months the author acted as a Special Commissioner for Aboriginals and Chief Protector in charge of the department instituted to safeguard the interests of the aboriginal population. While acting in this capacity he was concerned with the relations between the aborigines and other inhabitants of the Territory, white and coloured, and with the administration of justice. He relates some humorous incidents associated with the trials of natives for various offences, from stealing potatoes—for which the punishment was to "sit down two fellow moon longa gaol, work 'em"—to murder. It is amusing to learn that in two murder cases, where the actual killing was not denied, the verdict was "not guilty." When the last boy was acquitted, much to his own surprise, he turned to Sir Baldwin, and said, in a very audible voice of mingled reproach and disappointment, "What for me no go along Fanny Bay [the gaol]? Me been spear 'em that one boy all right." A difficulty with native prisoners and witnesses is that they have a liking for telling the truth in a way that disconcerts sometimes the defending and sometimes the prosecuting counsel.

The work is well illustrated with photographs and black and white and coloured drawings, most of them the work of the gifted author himself.

Life in a Mangrove Swamp.

BY ANTHONY MUSGRAVE.



As the tide recedes, numbers of Semaphore Crabs (*Heloecius cordiformis*), follow, feeding as they progress, later to return to their burrows.

[Photo.—A. Musgrave.]

TO the zoologist the mangrove swamps offer an inexhaustible field for research, and to the artist innumerable charming subjects for paint and pencil. Saville Kent has pointed out that endless recreation may be afforded by a mangrove swamp, apart from the wealth of material to be secured. But the mangroves do not part with their secrets very readily, and those who would penetrate into a mangrove swamp, whether it be on the shores of Port Jackson or along some tropical water-way, must be prepared to do battle with clouds of mosquitoes or the less conspicuous but no less annoying sand-flies. The residents along the banks of the

Parramatta River and the upper reaches of Sydney Harbour are plagued during the summer by numbers of the Salt-water Mosquito (*Aedes vigilax*), which breed in saline pools left by receding tides; the mangrove swamps which here line the foreshores are stated to be a contributing factor in the dispersal of these insects. This insect may be identified by the very black thorax and the transverse black and white stripes on the abdomen, and the somewhat similarly banded tarsi. It is a vicious biter. The very large "Scotch" or "Hexham" Grey (*Mucidus alternans*) is also a salt water breeder, and is annoying during summer evenings.



The Goggle-eyed Mangrove Fish or Mud Skipper (*Periophthalmus argentilineatus*), which resides in the mangrove areas of tropical Australia. As may be seen the fish spends a considerable amount of time out of the water, hence it breathes with a specially adapted tail.

[Photo.—Allan R. McCulloch.]

The sand-fly (*Ceratopogon molestus*) is an insect which is execrated even more than the mosquito, so far as Sydney is concerned, as its bite soon causes large and itchy hives to appear, which may persist for about a week.

In the winter months about Port Jackson the sand-flies and mosquitoes disappear, but the mangroves still retain their conservative attitude, for the liquid black mud in which they flourish becomes so icy cold that one's bare feet become insensible to the piercing of the pneumatophores and the cuts

from oyster shells. While the investigator of the mangrove swamps of New South Wales has little to fear beyond sand-fly bites or the risk of catching a chill, in the mangrove-fringed streams of northern Australia crocodiles occur, and it is necessary to be on the alert.

A small but extremely interesting inhabitant of the mangroves in the tropical parts of Australia is the Goggle-eyed Mangrove Fish or Mud Skipper, a small fish with well developed front fins, which it uses to assist it in hopping over the mud or climbing the arching roots of the *Rhizophora* mangroves. A great portion of its time is spent out of the sea, only its tail remaining in the water. It does not use its gills therefore, but the tail is provided with a very thin skin and minute blood vessels which enable the fish to extract oxygen from the sea.

SOME MANGROVE CRABS.

At Port Curtis, Yeppoon, and other places in tropical Queensland, the mud in which the *Rhizophora* mangroves occur is the home of innumerable Beckoning Crabs, such as *Uca dussumieri*, *U. marionis*, and *U. lactaea*. The species of the genus *Uca* here occupy a position analogous to that of the Semaphore Crab of Sydney latitudes, the

northern range of that species terminating just beyond the New South Wales border. At least two species of *Uca* occur at Trial Bay, New South Wales, the most southerly station for any species of *Uca*. This discovery we owe to Mr. J. R. Kinghorn,¹ of the Australian Museum, who visited the spot in 1921, and, as a result of his investigations, Mr. F. A. McNeill, who has supplied me with

¹ Kinghorn, Crab Hunting on the North Coast. THE AUSTRALIAN MUSEUM MAGAZINE, ii, 1924, p. 32.



The Spider Crab (*Halicarcinus australis*), occurs abundantly among the *Zostera* blades in the black mud at Middle Harbour, Port Jackson.

[Photo.—A. Musgrave.]

the facts, was able to record for the first time in New South Wales the presence of *Uca marionis* and has also observed the occurrence of *Uca lactaea*. These crabs are remarkable for having either the right or left claw of the male developed out of all proportion to the rest of the body. It has a black or brownish back, but the huge nipper and the rest of the body are a most brilliant scarlet and orange. The nippers of the female resemble the undeveloped claw of the male. To see these crabs dotted over the mud among the mangroves was a sight which my friend, Mr. Whitley, and I enjoyed one November morning at Gladstone in 1925, before we set sail with a party for the Capricorn Islets. For further information about these interesting crabs the reader is referred to Mr. Melbourne Ward's article in this MAGAZINE.²

Among the *Avicennia* mangroves at Middle Harbour, Port Jackson, the Semaphore Crab occurs in numbers. It is a small crab with a purple back and whitish claws. It is very agile, and scuttles away over the mud or among the *Salicornia* with great rapidity. The surface of the mud flats are often covered with their burrows and mud pellets. The species occurs in New Zealand, Tasmania, New South Wales, and as far north as Brisbane.

On landing on a sandy flat above Roseville Bridge about 11 o'clock one Sunday in March, accompanied by some Museum friends, I noticed numerous Semaphore Crabs moving towards the water's edge and sifting the sand for food particles as they progressed. The

tide was on the ebb, and the crabs scattered over the flat followed the receding water. On being approached, they shuffled off, extending their chelae in threatening attitudes. The other members of the party later drove them all down to the water's edge, where they huddled together, not daring to go into the shallow water where toadfish and other fish awaited them. The sandy silt here was evidently too firm to permit their burrowing in, as they do when caught on the black mud of a mangrove formation.

About 3 p.m. there was not a crab to be seen on the sandy flat near the mangroves, and all had returned to their burrows in the black mud, which they could be seen in abundance excavating for fresh wet mud lay on top of the sun-dried mud at the entrances.

The late Charles Hedley has likened the heaps of mud pellets brought out of the burrows to worm castings on a lawn, and Mr. A. A. Hamilton³ has pointed out that this "analogy may be advanced a step further, as the crabs perform a similar beneficent service in the aeration of the marsh mud to that undertaken by the earthworms in ordinary garden soil."

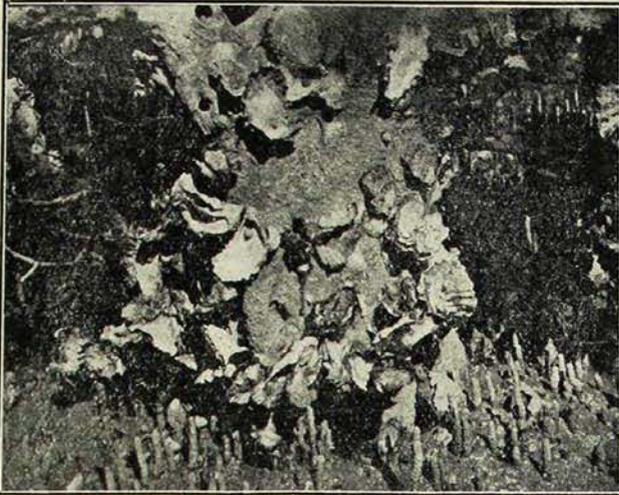
Just below the lowest ebb of the tide in the black mud near the mangroves at Middle Harbour grew a meadow of the Grass-wrack, *Zostera nana*, forming what is termed a zosteretum. By delving deeply down among the silt, my friend, Mr. Mel. Ward, secured numbers of a Spider Crab among the blades of the *Zostera*. The flat backs of the crabs and their moving legs could be seen plainly among the strands of *Zostera* and the mud which covered their bodies. The species is distributed along the New South Wales coast.

The most beautifully marked crab of our Sydney mangrove formation is the brownish-backed *Sesarma erythrodractyla*, which hides under stones, dead mangrove branches, or other objects in the marsh. Its nippers are orange red. Sometimes we find males with bright iridescent-green carapaces. The species has a wide range from Zanzibar, through the Indo-Pacific to Japan and Australia.

On the trunks and pneumatophores of the *Avicennia* mangroves barnacles occur in

² Ward, The Habits of our Common Shore Crabs. THE AUSTRALIAN MUSEUM MAGAZINE, iii, 1928 p. 243.

³ Hamilton, Oecological Study of the Salt Marsh Vegetation in the Port Jackson District. Proc. Linn. Soc. N.S. Wales, xlv., 1919, p. 464.



Oysters (*Ostrea cucullata*), and Mangrove Limpets (*Notoacmea mixta*), attached to Grey Mangrove trunk growing at Botany Bay.

[Photo.—A. Musgrave.]

numbers, clustering in masses in their efforts to seek sanctuary from the mud. Once established, they develop hard plates or valves behind which they rest when the tide is down, but, when once they are covered with the water, tiny feathery foot-jaws appear and, waving furiously, comb it for food particles.

SOME MANGROVE MOLLUSCS.

The Mollusca of the Mangroves are very remarkable for their wide distribution. Mr. Tom Iredale tells me that if a number of shells were collected from a mangrove swamp at Zanzibar and compared with a collection from the mangroves of Port Jackson, the differences between them would be difficult to detect. Such a shell is "the oyster which grows on trees," *Ostrea cucullata* var. *glomerata*, which occurs on the roots, trunk, and branches of the mangroves when they happen to lie on the mud.

The Mangrove Limpet, may often be found attached to the trunks of the mangroves or inside oyster shells adhering to the tree. It is restricted in its range to the mangrove formation, and, though it has been recorded only from New South Wales, it may occur in Queensland.

On the trunks of the Grey Mangroves or their pneumatophores, in fact on every solid object in the mangrove formation about Sydney, one meets with the Mangrove Winkle, *Bembicium*

nodulosum. It is elevated and nodulose, as its specific name suggests, while an ally, *Bembicium melanostoma*, which occurs on the sea shore in the open surf, is smooth and depressed. The species is confined to Australia.

In association with the Semaphore Crab is the Sydney Whelk or Hercules Club Shell, a large knobbed shell which may measure three inches in length, and which at low water lies scattered over the mud flats. This shell was secured first at Botany Bay by Banks and Solander, the naturalists of Captain Cook's party, and was the first shell from New South Wales to be illustrated in scientific literature. The shell is very thick and solid, and, according to the late Charles Hedley,⁴ "is armour proof against the jaws of fish, the beaks of gulls, the teeth of rats, or the rays of the sun." In company with the Hercules Club Shell is another and smaller species, *Pyrazus australis*, which one might believe to be merely the young form of the larger species. It differs, however, from the Hercules Club Shell in being more nodulose, and opposite the aperture it is not broadened into a varix.



Barnacles (*Balanus* sp.) and Mangrove Winkles (*Bembicium nodulosum*), growing on Grey Mangrove, Parramatta, Port Jackson.

[Photo.—A. Musgrave.]

⁴ Hedley, Presidential Address. Ecological Sketch of the Sydney Beaches. *Journal Proc. Roy. Soc. N.S.Wales*, xlix., 1915, p. 48.



The Sydney Whelk or Hercules Club Shell (*Pyrazus herculeus*), which at low water lies scattered in numbers over the mud flats.

[Photo.—A. Musgrave.

In a mangrove swamp we find many animals in a state of transition from a marine to a terrestrial environment. To escape suffocation these forms have had to climb above the mud or perish. As we sink to our knees in our progress through the oozy mud, we find that everything about us is also endeavouring to keep above it. Periwinkles, oysters, barnacles, cling to the mangroves or the pneumatophores. The Hercules Club shell has, at the rim of the opening, a broadening or varix, which serves to support the shell and prevent it from sinking too deeply into the mud.

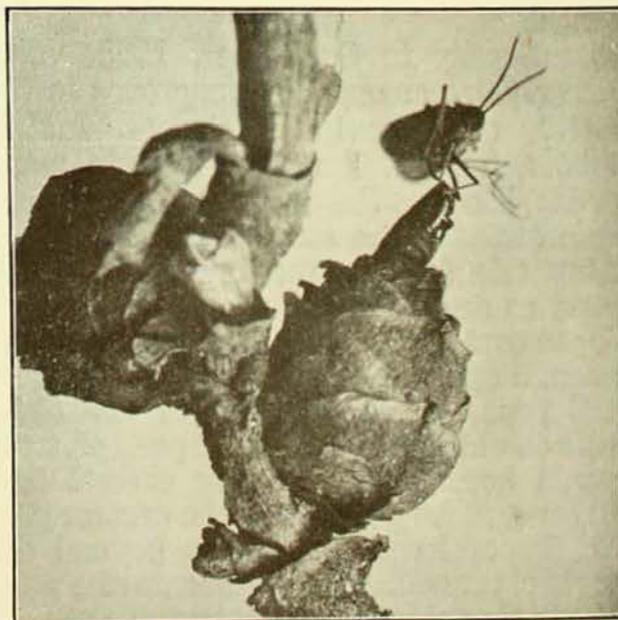
Of the molluscs which have climbed to escape the mud, the Sea Snail, *Melaraphe luteola* has climbed so high that it has entirely forsaken the sea, and spends its time on the leaves of the mangroves. It is able to lower itself from leaf to leaf by a thread of mucus. The species was first collected in December, 1826, by Quoy and Gaimard, the naturalists on board the *Astrolabe*, at Sydney. The Sydney form *luteola* is a degenerate form, others occurring at Port Curtis and more northern localities being much larger.

INSECTS OF THE MANGROVES.

A mangrove swamp possesses many insects other than mosquitoes and sand flies. When the mangroves are in bloom many butter-

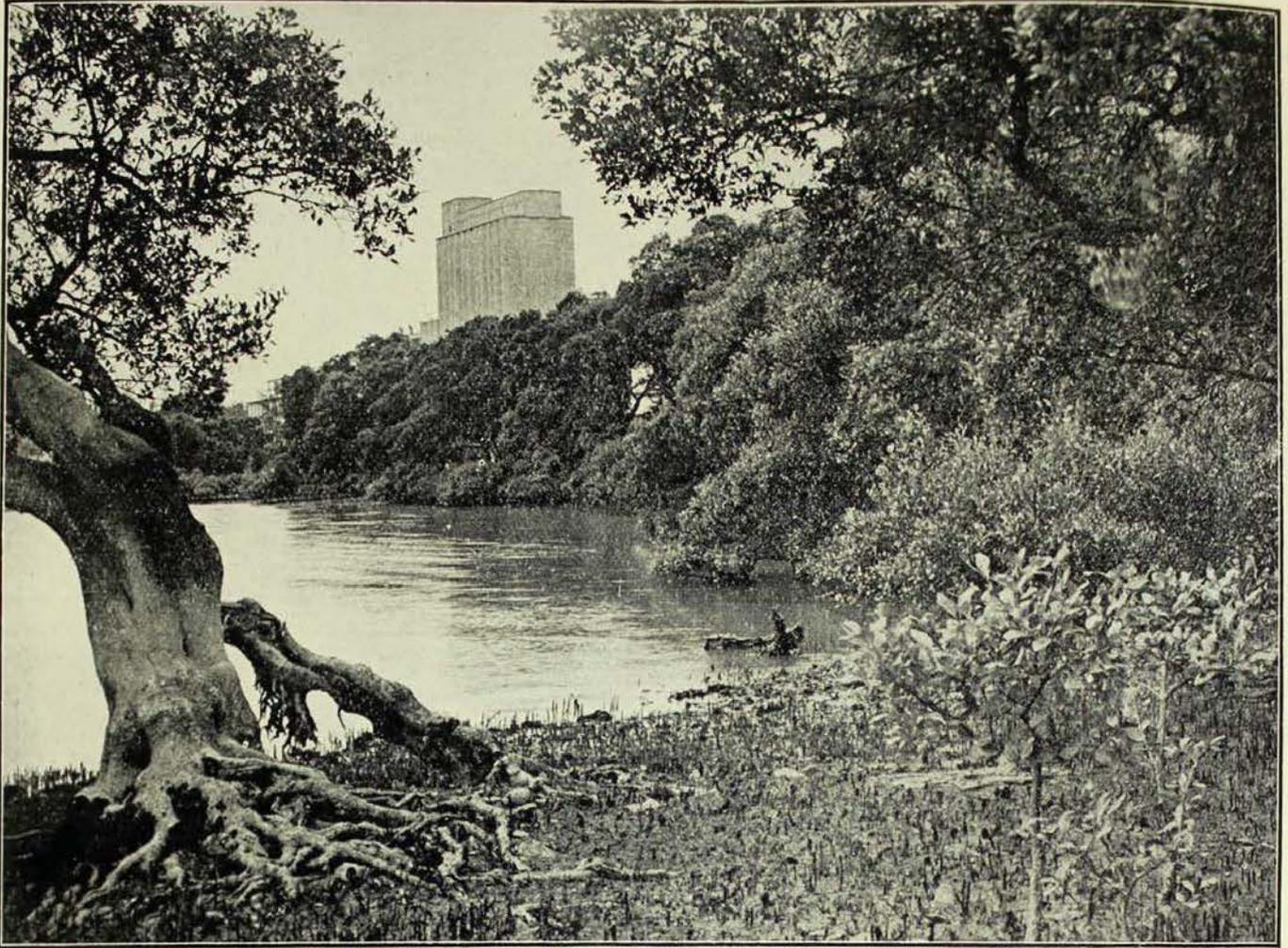
flies, attracted by the honey, visit them. Longicorn beetles burrow in the wood, and in the late summer numbers of an aquatic bug called *Halobates whiteleggei*, skim over the surface of the water among the pneumatophores.

The Lycaenid Butterfly (*Miletus apelles*) occurs among the mangroves in Queensland, and feeds on the foliage of the River Mangrove. It has been found at Yeppoon, and like other members of the family, the caterpillar is attended by ants, which feed on the sweet fluids it secretes from certain glands. The butterfly is reddish-orange at the bases of the wings, the extremities being a dull brown; on the underside the wings are greyish, with turquoise and red markings. Other species of butterflies occur only in the mangroves, though many species visit the flowers. Spiders, such as the large yellow heavy-bodied species of the genus *Nephila*, construct their orb webs among the branches, take up their position in the centre of the web hanging head downwards, and there await their insect prey. At Yeppoon I once captured a large Huntsman Spider of the family Clubionidae concealed among the blossoms of a mangrove, its position being betrayed by the fact that it had just caught a brilliant-winged Lycaenid butterfly. When the quaint fauna of the mangrove swamp comes to be better known many interesting



A Cecidomyiid midge emerging from its gall on the samphire weed, (*Salicornia australis*), collected at Middle Harbour, Port Jackson.

[Photo.—A. Musgrave.



Mangroves and Mammon. Along the banks on the upper reaches of the Parramatta River, Grey Mangroves flourish, but, with the advance of settlement, their days are numbered.

[Photo.—A. Musgrave.]

forms of insect and spider life will be revealed.

One Sunday in September, 1923, while photographing among the mangroves in the vicinity of Roseville Reserve, Middle Harbour, Sydney, I noticed certain small rose-bud-like growths on the stems of *Salicornia australis*, the samphire weed, which at low tide forms a meadow-like expanse known as a salicornietum.

Upon examination each bud was found to contain a cavity in which was an extremely small pupa. Some branches of the *Salicornia* on which these galls were present, were brought home, and next day several flies had emerged from the galls, the greater part of their pupal cases projecting beyond the margin of the gall. The movements of a pupa while in the gall are the quintessence of liveliness. One expects an insect in its pupal or chrysalis stage to be practically inert, but I found that I was unable to photograph a

pupa *in situ*, as its movements always caused it to jump out of the cell in which it had been confined.

Each pupa examined measured four millimetres in length and about one and a half in breadth; the colour of the head and thorax was dark brown, while the abdominal segments were light brown. From the head end sprang a pair of horns, which undoubtedly are used to assist the pupa to cut its way out of its cell preparatory to its emergence as an adult.

Under a microscope these horns are seen to consist of hard chitin, flat towards their free extremities, though somewhat rounded at their bases. Their innermost edges are convexly curved and serrated, the outer edges being straight and free from any armature. Just in front of the large anterior horns and situated on the face, is a small spine, while in front of these again are three sharp tubercles. Just what function these per-

form I am unable to state, but probably they assist the pupa in its work of excavation. Fortunately I was able to photograph a fly emerging from its pupal case, and this is reproduced here. The fly which constructs these galls is a member of the family Cecidomyiidae, which includes a number of species popularly known as gall gnats or midges. The species appears to be undescribed, and the complete account of its life-history remains yet to be given. It is remarkable that an insect should live in a plant which is submerged by the sea for considerable periods during the day and yet should know when the time is propitious for its emergence.

BIRDS AND MAMMALS.

Many kinds of birds shelter and nest among the mangroves. About Sydney the Mangrove Bittern nests in the Grey Mangroves, and the Blue Crane or White-fronted Heron patrols the edges of the mangrove swamps. In the north of Australia, an interesting bird fauna exists among the mangroves; an account by Dr. W. Macgillivray of the bird life in the mangroves at Night Island will be found in *The Emu* for December, 1910.

Man, as well as the lower animals, has found the mangrove marsh to furnish many things for his well-being. Before the advent of the European the aborigines of the Sydney district found the mangrove swamps and the zosteria flats in their vicinity to yield a variety of foods. The viviparous fruits of the former were roasted and eaten, and, when the tide

was in, Mangrove Mullet were speared from canoes. The dugong, too, once browsed on the zosteria flats of Botany Bay and was sought after, as it still is in more northern latitudes.

At Port Hacking the rock-shelters are filled with mussel, oyster, and Hercules Club Shell debris, remains of shells once garnered from adjacent rocks, zosteria beds, or mangroves, though their collectors long since have disappeared, like the dugong, into the limbo of the past. In northern Australia the mangroves still provide food for the aborigine, whether it be their fruit or the large Mangrove Crabs which hide in their hollow trunks or in pits nearby.

Even the mangroves themselves have not escaped the baneful effects of our civilization. At Port Stephens all the Black Mangroves have been cut out to provide sticks to catch oyster spat, and oyster-growers are obliged to get their sticks from the Manning and other rivers. Along the banks of the Parramatta River the rock shelter of the aborigine has given place to the factory and the grain silo, and it appears that the Grey Mangrove there must inevitably disappear, for a movement is afoot to reclaim the land upon which they grow. This is stated to be an economic necessity but, to my mind, it is unfortunate that this interesting and beautiful tree should be doomed to disappear from our midst.

In conclusion I desire to express my indebtedness to those members of the staff who have assisted me in the preparation of these notes, and also to Mr. C. T. White, Government Botanist, Queensland, and Mr. E. Cheel, of the Herbarium, Sydney Botanic Gardens.

Three lectures have been delivered to students of the Kindergarten College. Mr. W. W. Thorpe dealt with the subjects "Ancient Egypt," 21st February, and "Primitive Man," 28th February, and Dr. C. Anderson lectured on "Fossils and Pre-historic Animals," 7th March.

An exchange of reptiles and batrachians with the University of Michigan has just been completed; this is the outcome of the visit last year of Dr. F. N. Blanchard, Zoology Department, University of Michigan.

An Eel-fare at Parramatta.

BY G. P. WHITLEY.

MR. FRANK WALFORD, a keen naturalist and correspondent of the Museum, recently drew attention to a migration of elvers or young specimens of the Long-finned Eel (*Anguilla reinhardti*). These fishes were ascending the Marsden Street weir of the Parramatta River in numbers, forming a regular "eel-fare," which began late in the afternoons for several days, beginning with the 15th of February. The migration was at its height at night, thousands of specimens travelling between 8 p.m. and midnight on one occasion. Mr. Walford made very full and interesting notes on the phenomenon, and his patient observations form the subject of this record. On the 22nd of February, the migration suddenly ceased and no more elvers were seen until March 19th, when a fresh invasion took place. One night, Mr. Walford, assisted by Mr. W. D. Gates, secured some seven thousand specimens for scientific study by Dr. Schmidt and his colleagues in Copenhagen.

At the invitation of Mr. Walford, I visited Parramatta on March 23rd and witnessed this wonderful phenomenon taking place actually within the historic town. At 5.22 p.m., when the sun was setting, the pioneers of the eel expedition began to make a move to circumvent a rapid current extending right across their waterway. They could not swim against it but had to leave the stream and climb a vertical face of stone to

reach the outlet of a pipe, through which they must travel to reach the upper waters. One would leap from the water's edge for about an inch and press itself against the wet rock, then, by twisting its tail into the shape of an S, push itself along the steep surface with a wriggling movement. Another would follow, and soon two or three were progressing favourably, until, venturing too near the current, they would be swept back to their starting-point, there to begin again. After a while, they seemed to climb higher, following the flowing water with wonderful accuracy, until at last a definite trail over the slippery stone was established and more and more elvers emerged from rocky shelters and joined in the movement. As darkness fell, the water where the current was weakest was full of little eels and the wet faces of the weir supported chains of them, actively wriggling as they struggled onward. I was unable to stay longer, but Mr. Walford assured me that later in the night, they would be ascending in thousands. In the daytime, they are eaten by kingfishers and a peewee, and even larger eels feed upon them. The migration is still in progress at the time of going to press (29th. April).

This is, so far as I know, the first definite record of a migration of the Long-finned Eel, though it should be noted that our aboriginal predecessors long ago called this locality "Parramatta," which means the place where the eels lie down.

Mr. Melbourne Ward, Honorary Correspondent of this Museum, who recently returned from a trip to the islands of Torres Strait, brought back a fine zoological collection. Some of the snakes and lizards constitute new records.

Rare birds are often found washed up on our beaches after storms and during the last few months some interesting specimens have been acquired from this source. Should any reader come across any recently dead beach specimens we should be glad to see them.

Fossil-Hunting at Quidong.

BY H. O. FLETCHER.



Looking up the Quidong River towards the old smelting works (on left of picture). Basket willows are to be seen in the middle distance.

[Photo.—A. Musgrave.]

EARLY this year a party consisting of three members of the Museum staff, of which I was a member, who had been investigating the insect fauna at different altitudes on Mount Kosciusko, decided to spend a few weeks at Quidong in order to examine and collect specimens from the rich fossiliferous beds, which, on account of their inaccessibility, have not received the attention they deserve.

Quidong is not a town, or even a village, but a parish, and is situated far south in New South Wales, about eighteen miles from the Victorian border in a northerly direction from Delegate.

To the geologist the locality is full of interest, for it is mineral-bearing, has a rich fossil fauna, and its scenic attractions are a revelation to all who are so fortunate as to visit this remote district.

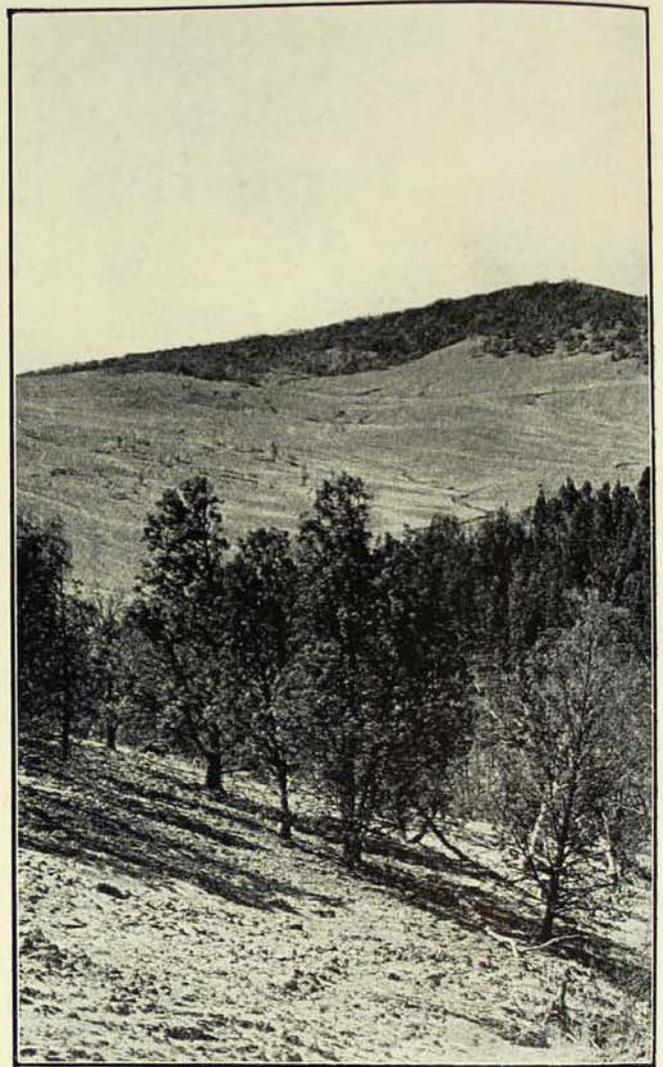
The highest point in Australia was soon left behind us as we descended by car to the plains of the Monaro, which had to be crossed before the town of Bombala could be reached. Bombala was made our headquarters for several days, while enquiries were made regarding the conditions of the roads and the best manner of getting to the beds. Excellent advice and instruction was received from Mr. Harold Ellis, and from Mr. Tweedie of the *Bombala Times*. The former was one of the original discoverers of the fossil field, and accompanied the Government Geologist, Mr. Carne, on his first official visit. We were indeed fortunate in having such a keen observer and naturalist to refer to, and the information gladly given by him as to the situation of the various types of fossils proved of great value.

From these gentlemen we learnt for the first time that Quidong was renowned not only for its fossil fauna, but also for its mining activities, which began as far back as 1864; we were told that possibly signs of the old mining days would be seen by us in the shape of chimneys and retorts. These are the only remains of what was once a flourishing settlement, with carefully laid-out streets and stone huts. Nature and the ravages of time have, however, played havoc, and little now remains to be seen.

Doubt was expressed whether we should be able to cross the Delegate River in the car, and we were advised to acquire in some way a horse-drawn vehicle. This was found to be an impossibility, for, after scouring the township and many stations in the vicinity without success, we discovered that certainly the day of the horse is over.

THE QUIDONG DISTRICT.

The following morning an early start was made, and, leaving the township of Bombala, we proceeded along the main Delegate Road for some miles until we reached a very warped finger post pointing in the direction of Quidong, and informing us that the distance was eight and a half miles. From here we followed a very rough track with numerous gates. The first doubtful point on the road was Two-eyed Creek, but this was safely negotiated as the creek bed was dry. From



Over the naturally cleared hills of Quidong, we walked to our camp on the Quidong River.

[Photo.—A. Musgrave.]

here the distance to the Delegate River was soon covered.

Since leaving the main road we had been on the property of Mr. W. Stephenson, of "Coorong," whom we had previously met in Bombala, and who had signified his intention of assisting us as much as time allowed him to. Bush fires and other contingencies were taking up most of his time, but permission was gladly given by him to take whatever we wanted from the fossil beds at Quidong.

The crossing at the Delegate River, however, was a different proposition, for the water was running deep and strong, and the bed consisted of huge boulders which looked as if they spelled disaster to any unwary motorist who attempted to make the crossing



Callitris pines clothe the limestone cliffs along the Quidong River, and Scotch thistles line the banks. [Photo.—A. Musgrave.]

At this stage discretion seemed the better part of valour, and it was decided to leave the car at this spot and continue to Quidong on foot, carrying only essential gear. This setback in our plans was not altogether a surprise, as we had been suspecting since leaving Bombala that this course would have to be adopted. A friendly farmer, noticing our plight, kindly offered us the use of a pack-horse to carry the heaviest of the gear, and himself to guide us to fossil cliffs which were known to him as "The Cliffs" or "The Bluff."

The three and a half miles which constituted the distance from the Delegate River to the Quidong River was one of the finest walks of my life. The country is typically Silurian, consisting of undulating hills all naturally cleared and used extensively for the grazing of sheep. In the foreground as far

as the eye could see were precipitous limestone cliffs, through which the river had cut its way to reach the open country and the Snowy River.

One imagines one is stepping over the threshold of another country, as the scenery is so unlike anything Australian. North America instantly flies to one's thoughts, and, to heighten this resemblance, the flora of Quidong in this vicinity consists of forests of Cypress Pine (*Callitris propinqua*). These pines are very distinctive, and, to my knowledge, occur only at this locality, at Bibbenluka, a nearby town, and in South Australia. It is a tree natural to Australia and has not been introduced, but the change from the typical Australian gums to the pines imparts to the scene a vastly different appearance from that to which the average Australian is accustomed in his bush wanderings.

Continuing on amid this enchanting scenery our guide soon introduced us to our home for the following week. A position was chosen close to the Bluff and the river, and here camp was immediately made by the simple process of lowering our gear to the ground. Dusk was gathering by this time, and time remained only to make a hasty survey of the limestone beds in our immediate vicinity. We discovered that our camp was made on some highly fossiliferous rock, while the cliff face and the debris at the base offered prospects of very pleasant collecting during our stay.

The night was spent in the open, in company with myriads of mosquitoes, which apparently had congregated to bid us welcome to their domain. Needless to say little sleep came our way, and at break of day three badly bitten and bone-weary scientists arose and surveyed the beauties of the morning in a very sad and disconsolate manner. In a minor key our entomologist remarked, "the blighters are much larger in size than the Hexham Greys, and even more savage and persistent."

We were thus being introduced to the serpents in our newly-discovered Eden, and before long a nestful had assisted in lowering our estimation of Quidong as far as comfort was concerned.

THE SILURIAN PERIOD.

In the throes of fossil-hunting, however, we had no thoughts of our previous night's discomforts, and all cares were banished from our minds. It was found that there were two main limestone outcrops of considerable magnitude, separated by beds of shale or claystone. The texture of these was very fine, and therefore indicative of deep water deposition. No doubt during Silurian times two enormous coral reefs had originated about a mile apart, separated by a deep channel, on the floor of which material brought down from a distant land surface had slowly accumulated. The limestone rocks are strongly folded into acute anticlines and synclines, the pressure apparently having been exerted in an eastward direction as the beds have a north and south strike. The shales also suffered slightly by deformative movements, which had caused them to harden and break into small cubical fragments. Silurian movements were invariably accompanied by

igneous intrusions, and Quidong is no exception, as away to the west large masses of granitic rocks occur.

The abundance so far south of reef-building corals during the Silurian period indicates that the water of the sea must have been considerably warmer than it is in that latitude at the present day. Coral reefs to-day are restricted to tropical and sub-tropical seas where the temperature of the water does not drop below 68 degrees Fahr., and the closest occurrence to Quidong are the reefs of the Great Barrier Reef off the coast of northern Queensland.

Many of these Silurian coral reefs were of great magnitude, and the strata deposited often exceeded 10,000 feet in thickness. Shales, however, alternate occasionally with the limestone, sure evidence that the subsidence of the sea floor, which must have been taking place to allow such huge deposits to be formed, was intermittent. Deformative movements occurred at the close of the Silurian period and caused the folding and tilting already mentioned, and at the same time uplifted considerable areas above sea level.

In the limestone at Quidong a characteristic marine fauna has been preserved, and a variety of corals of all types was exposed, together with many shells, of which the most characteristic was *Pentamerus knightii*.

It was interesting to reflect that one was actually walking and sleeping on an ancient sea-bed which, in Silurian times, many millions of years ago, was covered by the water of a great sea, and now, by the kind graces of Nature, was open to inspection. Such areas as these are the open pages of Nature's book, and from them only can the many problems which crop up before the palaeontologist be elucidated and revealed.

All the great caves of New South Wales, including the Wombeyan, Yarrangobilly, Wellington, and the world-famed Jenolan Caves, occur in the limestone belt, where stream channels cross the limestone. The water with its contained carbon dioxide creates a wonderful series of caverns which must be seen to be believed. At Quidong a cave was discovered which from all accounts is quite majestic in proportion, and extends for some distance underground. The entrance is exceedingly small, and is situated in

the northern limestone cliff overlooking the Quidong River. Owing to the lack of lights and suitable cave-exploring equipment we did not venture any distance into its depths, but from all appearances it would be well worthy of exploration.

ANIMAL LIFE.

On returning to our camp we invariably found all our provisions literally covered with ants, and for the remainder of the trip much time was spent in cleansing the larder. Other irritants of Quidong were plagues of grasshoppers and Scotch thistles, which frequently proved to be a "thorn in the flesh."

Every morning our many feathered friends used to herald the approach of day with their song, and it was then that the full beauty of the place was revealed. The call of wild duck was heard overhead, and before long many Black Duck (*Anas superciliosa*), Grey Teal (*Querquedula gibberifrons*), and Wood Duck (*Chenonetta jubata*) would swoop down and alight in their inimitable way on the still waters of the river. Small heads had often been seen above the water level, propelled at fast speed by an unseen body, and many were the conjectures as to the identity of the swimmers. A fortunate close view enabled one of us to determine that they were platypuses. This remarkable and world-renowned egg-laying mammal was fairly plentiful, and this was the first time that I had seen this anomalous creature in its wild state.

Swallows and swifts of many species had utilized the myriads of weathered apertures in the limestone cliff for their small mud houses; one of these, the large Spine-tailed Swift (*Hirundapus caudacutus*), appeared to take a keen delight in ruining our nerves by swooping down from tremendous heights and passing our ears at an incredible speed, causing a terrific displacement of air. Hawks and Wedge-tailed Eagles (*Uroaetus audax*) patrolled the sky and levied their toll on the rabbits and water-rats with which the place seemed to be infested.

To make the picture of Quidong complete one must not forget the deer, which were running wild in the pine forests on the opposite side of the river. These had originally been imported from England and kept in captivity on a nearby station, but, after a change of ownership, they were liberated on this natural park land and had multiplied and thrived.



Portion of a *Favosites* coral in situ, at the base of the limestone cliffs near our camp.

[Photo.—A. Musgrave.]

FOSSILS.

During this period we had not been neglecting the fossil fauna and had secured an excellent series, including corals of infinite variety and form from the limestone. These included simple and multiple types practically as complete in form and structure as when they were living. One excellent example of a *Favosites* coral was photographed *in situ*.

Small brachiopod and pelecypod shells were found in the shales, but these were badly preserved and showed little structure. A keen lookout had been kept during the whole of our stay at this locality for trilobite remains, and, although a few had been collected, they were found to be by no means plentiful. It is the exception and not the rule

to find a complete trilobite, and at Quidong we did not break the rule, as only the tail pieces or pygidia were collected, in isolated instances with portions of the thorax still attached.

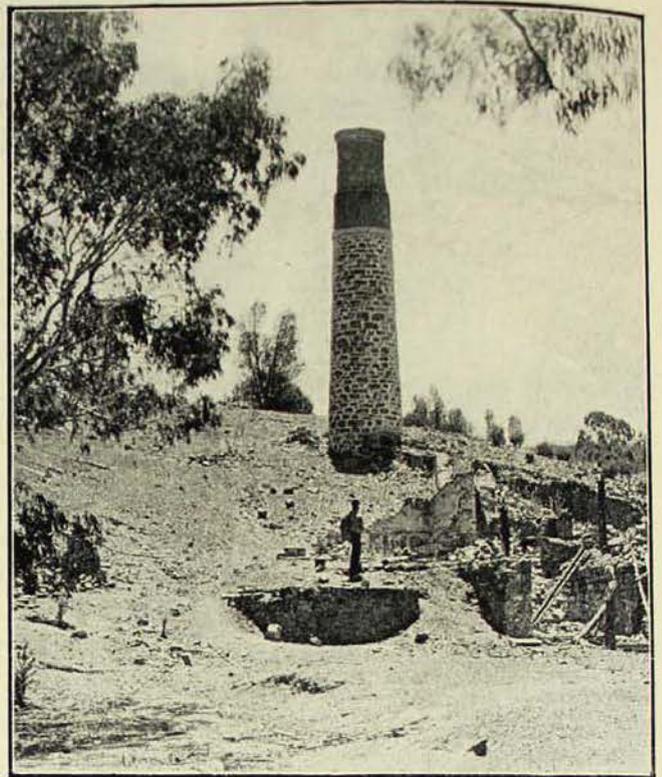
MINING.

The Silurian period is economically important so far as the metalliferous wealth is concerned. Many important gold and copper mining fields are associated with rocks of this age, and at Quidong many shafts are seen where prospectors have left evidence of their work. The mineral deposits are, of course, later in age than the Silurian rocks, and the deposits occur as true "fissure veins"; the larger deposits of copper are, however, in most cases metasomatic replacements of the shale and claystones.

During our search for fossils we had come across traces of gold in a shale carrying pyrites, but in each case the rock was not *in situ*, but had been carried to its resting position by flood waters. Traces of copper were everywhere, and in search for this mineral extensive mining operations had been carried out. The retorts and smoke stacks of one of these ill-fated mining ventures are still standing after the many years since operations ceased.

The history of this mining venture is a particularly interesting one, extending back as it does to the year 1864, and I cannot do better than refer readers to an interesting article in the *Bombala Times* by Mr. C. A. Harper, from which the following account is quoted :

"Some time ago, in the year 1864, two gentlemen were engaged on the geological survey of north-east Gippsland to the border of New South Wales, one as geological surveyor (the late Norman Taylor), the other as topographical surveyor. They both visited Bombala, and while there were induced to visit and inspect Quidong. The topographical surveyor was a German, trained in the mining schools of that country, and well versed in scientific and practical mining. They were both very much impressed by the apparent mineral indications, especially copper, so much so that the German, after he had arranged for a three years' lease from the



Old smelting works, once the scene of the Belmore Silver and Lead Mining Company's operations at Quidong.

[Phoo.—A. Musgrave.]

owner, resigned his appointment under the Victorian Department of Mines and devoted his time to the formation of an 'adventure' company of eighty members, who applied in eighty different names for eighty blocks of leasehold mining land, which was surveyed and the leases issued. Three-fourths of these lease areas had no surface indications of any kind, but a large area 'looked well' for the purpose they were required for. After this was completed the 'adventure company' was converted and reorganised into a limited liability company, with a large capital, out of which the 'adventurers' did very well indeed. This was formed altogether of Melbourne people, and was known as 'The Quidong Copper Mining Co., Ltd.' Time was flying since the date of the lease, and little or no development was done. Several other leases were taken up for copper by Sydney people, chiefly embracing the numerous cupriferous ironstone lodes, which abound in the locality, but on these leases nothing in the form of exploration was done by the lessees. They ultimately lapsed and reverted to the Crown, and were sold as pastoral land.

"The Quidong Company spent many thousands of pounds, not all on the development work, but in rooting out all the rich ore along the line of the lode near the surface, and sending it to South Australia to be smelted, a very costly undertaking at the time. Most of the ore sent away was extremely rich, some of the red oxides on analysis going as high as 80 per cent. pure copper. The result was that the shares became inflated in Melbourne to an unheard of extent. About this time it was made manifest to the knowing ones that the lease would not be renewed at the expiration, so the mine was boomed for all it was worth—and more, too—the original shareholders unloading their stock quietly and successfully, with great profits to themselves, but disastrous to their victims. There is not the slightest doubt that, had the lease been renewed, and had there not been such a heavy drop in copper values, Quidong would have developed into one of the best copper-producing localities in Australia.

"Some few years after the collapse of the Quidong Copper Company's operations

another company was formed in Melbourne known as 'The Belmore Silver and Lead Mining Company.' Its operations were confined solely to the development of the galena indications showing on the faces of the various limestone cliffs on the north side of the river bank, on some of the abandoned Quidong leases which the Belmore people had secured. The mineral was found mixed up in the limestone, as if a part of its natural composition, like hornblende or mica in granite rocks, with not the slightest sign of any lode or fracture in the strata. The Company spent a lot of money in the necessary recovery plant, crusher, furnace, etc. but with no success, the galena not being rich enough in silver, and the lead of little economic value at that time. Instead of calcining the ore in the open to drive off the sulphur it was crushed and fed to the furnace in its raw state, and for every pound of silver-lead recovered half a ton of slag would result. The bricks used in the furnace were imported 'Stourbridge' fire bricks, and by the time they were built in must have cost a shilling each. Of course, the end was disastrous."

Pages from Our Past.

BY G. P. WHITLEY.

THE minutes of the last meeting were read and confirmed." How often have we heard that statement at gatherings of every description. "Read and confirmed"—and promptly forgotten.

Recently, I was privileged to delve into the minute-books of our century-old Australian Museum in search of certain historical data, and, in so doing, discovered a number of quaint entries which may fittingly be disinterred from their present resting place in a seldom opened safe to see the light of day in the pages of this MAGAZINE.

SOME REQUESTS.

In December, 1876, "A. B. Weigall, Esq., of the Grammar School requested permission to run a cow in the Museum grounds, but as the paddock had been reserved for the use of the Curator the Trustees were unable to accede to his request."

A public meeting was held on 1st April, 1878, to protest against the opening of the Museum on Sundays. Several eminent clergy concurred with the general feeling and it was arranged that the Museum should be opened on Sundays, but "that the Curator be instructed to make such arrangements for cleaning the specimens and cases as will not interfere with the power of the servants to attend Divine Service in the morning." This ruling still holds, the Museum being closed on Sunday mornings, and opening from 2 to 5 p.m. in the afternoons.

The recent agitation for a much needed Marine Biological Station, where our local marine animals may be studied, is no new movement, as an entry of November, 1878, states: "The Curator's requisition for £12 towards making a collection of the Marine Fauna of Port Jackson and £5 towards fitting up the Spirit Room as a laboratory, was approved."

Earlier still, in 1858, a proposal was made to start an aquarium in the Museum, but was subsequently withdrawn.

DONATIONS.

Lists of donations to the Museum were printed monthly in the *Sydney Morning Herald* and tabled at the Board Meetings. These contain occasional items of a curious nature, such as freak chickens with four legs, "a living pig with six legs from Tonga," and "a piece of bone grown out of a human head." Two amusing misprints are "The milk of a *Ceratodus*" and "Two white-winged Coughs." Relics and articles which would be regarded as of doubtful value nowadays are also listed, and one sees such diversities as "portion of the stone desk upon which Martin Luther translated the Bible in the Castle of Eisenach, Wartburg," a Russian policeman's cap and jacket, a piece of iron gaspipe struck by lightning, specimen of wood from old pier at Southampton destroyed by *Limnoria terebrans* (a crustacean known as the Gribble), a Seal-gut jacket, and a new fossil marsupial (*Zygomaturus*); the latter being the first animal to be moulded and cast for exhibition in the Australian Museum. Human skulls were frequently added to the collections, abnormal ones and those of executed malefactors claiming special mention. One cranium, presented in 1857, is said to have belonged to one of Oliver Cromwell's soldiers.

Such vicissitudes have been suffered by the old collections of the Museum, however, that few or none of these quaint donations have been preserved.

A WHALE FEAST.

"A whale's tooth and two native fishhooks cut out of the shell of a turbo from South Head of Botany" presented in July, 1857, are objects not likely to be encountered in that locality now. They are rather more reminiscent of the days of Governor Phillip who, in September, 1788, went to examine the coast between Sydney Harbour and Botany Bay and noticed that a young whale had been driven ashore. The natives carried large pieces of the flesh which they had ap-

parently placed on a fire until the outside was scorched, in which state they ate it. In kitchen middens at Maroubra, I have found a few charred whale's vertebrae amongst the mounds of shells left behind by a now extinct tribe of aboriginals.

A sample of tanned shark skin was presented to the Australian Museum by a Mr. Horatio Tozer in December, 1858. Now, seventy years later, the capture of sharks for leather is regarded as an infant industry.

THE QUEENSLAND LUNGFISH.

The first notice of the Queensland Lungfish (*Neoceratodus forsteri*) which appears in the Museum minute-books records that on February 3rd, 1870, the Curator (Mr. Gerhard Krefft) applied for leave for Mr. (George) Masters to visit the Burnett River and, if possible, the Dawson in the Wide Bay district for the purpose of collecting specimens and in particular for the capture of some of the new Amphibians found in those rivers.

At the November meeting, a series of specimens caught by Masters was exhibited, when the rare "amphibians" were diagnosed as fresh water fishes. Three years later, Queensland Lungfishes were sent to London to be "sold by auction for the benefit of the Institution."

THE LLAMA.

It is not generally known that attempts were made in the forties and fifties of last century to introduce Llamas, Alpacas, and Vicunas into Australia from South America, following their "naturalisation" in France and Algeria. Numerous specimens were safely transported here though not without considerable trouble both in South America and at sea.

A young Alpaca (*Auchenia llama*), one of the first born in New South Wales from the flock imported by Mr. (Charles) Ledger was presented to the Australian Museum in February, 1859.

Mr. Ledger gave "An Account of the Llama and Alpaca . . ." which contains much interesting detail, in the second volume of *The Sydney Magazine of Science and Art*, published in 1859, which I have consulted in the Mitchell Library, Sydney.

Naturalists in Australia—The Frenchmen.

By TOM IREDALE.

IN the history of zoology in Australia there are many pages inscribed in red, while others are margined with black in respect of those investigators who made the supreme sacrifice in pursuit of the mysteries of nature.



Francois Peron, the indomitable.

[After *Peron et Freycinet*.]

Some of the most interesting of those pages relate to the records of the naturalists accompanying the many French exploring expeditions which visited Australia about a century or so ago. The names of these naturalists are inscribed in gold in a scroll of fame, a scroll honoured only by a small, but world-wide, band of scientific workers. Careless of disease and every other hazard, these intrepid Frenchmen ventured into every kind of danger to wrest from nature its hitherto unknown secrets. Their reward was in posterity, as, owing to the troubled

state of their motherland, they failed to reap any adequate reward in their lifetimes. Such names as Quoy, Gaimard, Lesson, Hombron, Péron, and Lesueur are revered to-day whenever met with, and that is not seldom, by the Australian zoologist. Yet none of these gained much worldly benefit from their great discoveries, which practically control the study of Australian natural history.

Foremost in the field, superb in his enthusiasm and unequalled in lustre, shines the small figure of the puny Péron. Like Nelson he had lost an eye in warfare and was similarly small in stature; he had an unbreakable spirit, though his body was frail. Undismayed by any difficulty, he overcame every obstacle and achieved a great ambition, when, at the moment of sailing, he was attached as zoologist to the expedition into southern seas commanded by Baudin. The official savants, four in number, had been selected and were on board when Péron was added to the list. Of these five Péron alone arrived home after three and a half years' work: two had left the vessels in the first six months, and two others had died on duty. The leader, Baudin, having also succumbed, the expedition had become disorganized, and upon their return rumour discredited the results, and the voyage was stigmatized in the capital as a failure. Such undeserved criticism stung Péron, so that he abandoned his attempt at rest in the country and hastened to Paris. His personality was magnetic, and his account of the dangers and difficulties encountered, and the unparalleled results in every branch of natural history, so stirred his aforetime antagonistic listeners, that, not only was the rumour killed, but Péron himself was commissioned by the government to write the historical as well as the zoological accounts of the voyage. But, though the spirit was willing, the body was not strong enough to carry out all the brilliant ideas of this wonderful worker. A few articles were published,



Aboriginal burying place at the spot where Mauge was interred, Oyster Bay, Tasmania.

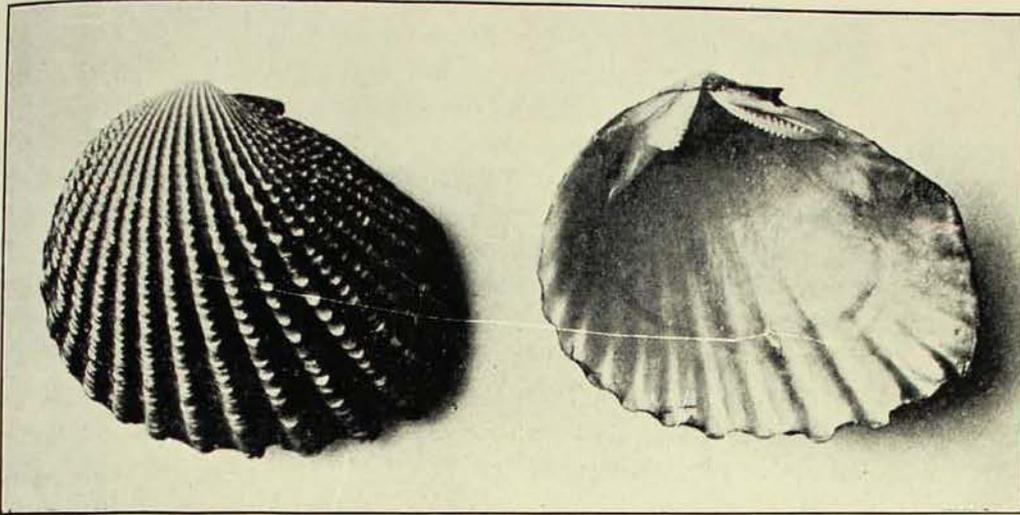
[After Peron et Freycinet.]

showing his ability, and then the first volume of the history appeared. Before he had prepared half the second volume Péron had gone to rest, and, at the early age of thirty-five, this genius passed away, leaving a record of work probably unsurpassable in extent and thoroughness. The report of the French Academy appointed to inquire into the results stated that over 100,000 specimens had been collected, including many new genera; that over 2,500 species were new to science; that all of these had been described on a uniform plan by Péron at the time of collection; that over one thousand of these had been painted from living specimens by Lesueur before they were preserved in spirit.

Lesueur was the artist, and the enthusiasm of Péron so attracted him that the two worked in complete unison, and the two names have become linked together as indissolubly as those of Castor and Pollux, David and Jonathan, or Johnson and Boswell. In most places the two names occur together

as the collectors, and Lesueur to-day basks in the recognition of Péron's work. Lesueur assisted Péron in preparing the published account, and, when Péron died, hoped to continue the work. The authorities decreed otherwise, and Lesueur in disgust left France altogether for the new land of the free, the young United States of America.

Although all the material collected by Péron and Lesueur was described and figured on the spot, through the vicissitudes of the expedition, and perhaps the carelessness of someone else, the locality labels became in many cases transferred. Through the regrettable death of Péron the recording of the collection was perforce done by others, who did not refer to the wonderful manuscript, but simply promulgated the erroneous habitats. Ignorance of the Australian fauna, coupled with the fact that some of the places visited by the Frenchmen were not easily accessible, was responsible for the persistence of these errors for nearly a hundred years. To-day we are engaged



Trigonia margaritacea, Lamarck, regarded by Peron as his most remarkable find. This shell occurs commonly as a fossil, but living specimens are found only in Australian seas.

[Photo.—G. C. Clutton.]

in rectification through intensive collecting at the exact places where the collections were made. Thus, Péron wrote that, at Kangaroo Island, South Australia, he made a very large collection amounting to eight hundred species. Yet comparatively little mention is made of this locality in published records, the species being credited to other places or no habitat given at all. Recent collections made at Kangaroo Island have been the means of rehabilitating some species, and of recognising others, previously indeterminate. It is possible that one of the dead naturalists, Mauge, was responsible to some extent for Péron's delight in conchology. Péron has related how, sick to death, Mauge was confined to his bunk when the vessel anchored in Oyster Bay, east Tasmania. Péron went ashore and found the beach littered with shells of unknown sorts, handsome and even bizarre. Upon his return to the ship to cheer the dying man Péron spread out in the cabin all the treasures he had secured. Instead of gladdening, the sight so distressed poor Mauge that he burst into tears at his unhappy fate, and, to soothe him, Péron promised to take him ashore the next day. The promise was kept, but, upon landing, Mauge fainted on the beach, and sorrowfully he was rowed back. A few days later Mauge's body was buried at this same spot, and we can picture Péron decorating the simple grave with some of the shells Mauge had loved so much.

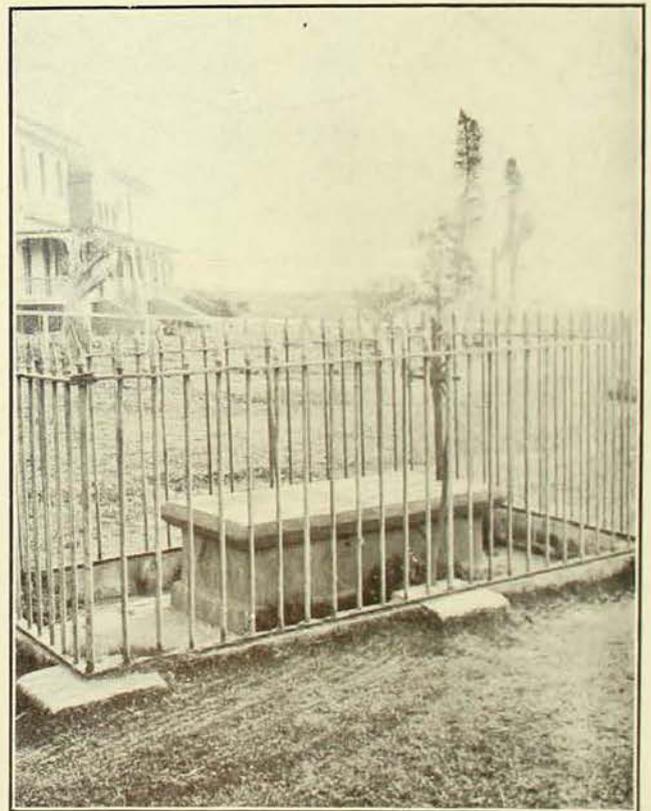
Prior to this event another French

naturalist had been buried on Australian soil, Father Réceveur the friend of La Pérouse, succumbing at Botany Bay, to injuries received at Tutuila. In 1825 a tomb was erected over his grave at the place now known as La Perouse.

QUOY AND GAIMARD.

Succeeding Péron and Lesueur, other naturalists, whose names are scarcely less famed than these, visited Australia,

and curiously enough, these ran in couples, Quoy and Gaimard, Lesson and Garnot, Hombron and Jacquinot; most of these were surgeons.



The Tomb of Father Réceveur, La Perouse, near Sydney. In the background may be seen the monument, erected in the name of France by MM. de Bougainville and Ducampier, in the year 1825, to perpetuate the name of La Perouse, who visited this place in 1788. Appropriately this locality bears the explorer's name and a few years ago the plot bearing the monument was ceded to the Republic of France in memory of her son's zeal.

[Photo.—G. C. Clutton.]

Quoy and Gaimard made fine collections and magnificent paintings of the objects secured, including many splendid drawings of dissections. These men had the good fortune to put through the press their own descriptions, and to see all their beautiful work reproduced in an inimitable style. To-day it is a pleasure to refer to the unsurpassable volumes containing the results of their second trip. Their first attempt was even more unfortunate than those of their predecessors, as, owing to shipwreck, all their collections were lost, and their only natural history records were due to the salvage of a few paintings made by the official artist, whose duties lay in another direction. As noted above, these men were surgeons first, and, after having published a few notes on various subjects that particularly attracted their attention, and having completed the account of their second voyage, they pass out of ken in connection with Australia, though both lived for a long time after their return.

LESSON AND GARNOT.

A brighter zoological star arose in the person of Lesson, also a surgeon, who, attached to one of the exploring vessels, developed into one of the world's great systematic zoologists. His confrère was another surgeon, Garnot, and these two collaborated on many natural history subjects relating to the voyage, but afterward Garnot passed out of the picture while Lesson loomed larger every day. Manuals dealing with mammals and birds were published by Lesson, followed by a larger treatise on birds. These books show his breadth of view gained through his experiences on the voyages, associated with detail in technique acquired through his professional duties. Some fine pictorial zoological works were prepared by him, and then he compiled a complement to Buffon's Natural History, indicating in an accurate and well written manner the notable additions to ornithology and mammalogy that had been made, chiefly by French exploring naturalists, since Buffon's day.

HOMBRON AND JACQUINOT.

Another pair of names commonly met with are those of Hombron and Jacquinet, the former the surgeon-naturalist again, the latter the captain, who, like some others of the captains, was interested in zoology.

These two became associated, studying the sea birds of the Antarctic seas, and together they wrote a short synopsis of their investigations preliminary to the detailed account to appear in the complete publication of the zoology of the voyage. The plates were prepared and distributed, but Hombron died, and a scant report to elucidate these pictures was issued under the care of the officers of the Paris Museum, with whose names that of Jacquinet was sometimes joined in compliment. Again, through Hombron's death, confusion occurred in connection with the localities whence the specimens had been procured, a vague term such as "l'Océanie" successfully concealing Raffles Bay in the north of Australia.



Rene Primevere Lesson, a great admirer of Sydney.
[After Lesson.]

The names of the exploring vessels, their commanders, and sometimes those of the naturalists, are permanently fixed in the geography of Australia. In this connection may be noted D'Entrecasteaux Channel and Bruny Island in south Tasmania, named after Bruny D'Entrecasteaux, who commanded an expedition in search of La Perouse, which visited there, and whose naturalist, Labillardière, was apparently more interested in botany than zoology, and hence is little heard of in the history of the latter science.