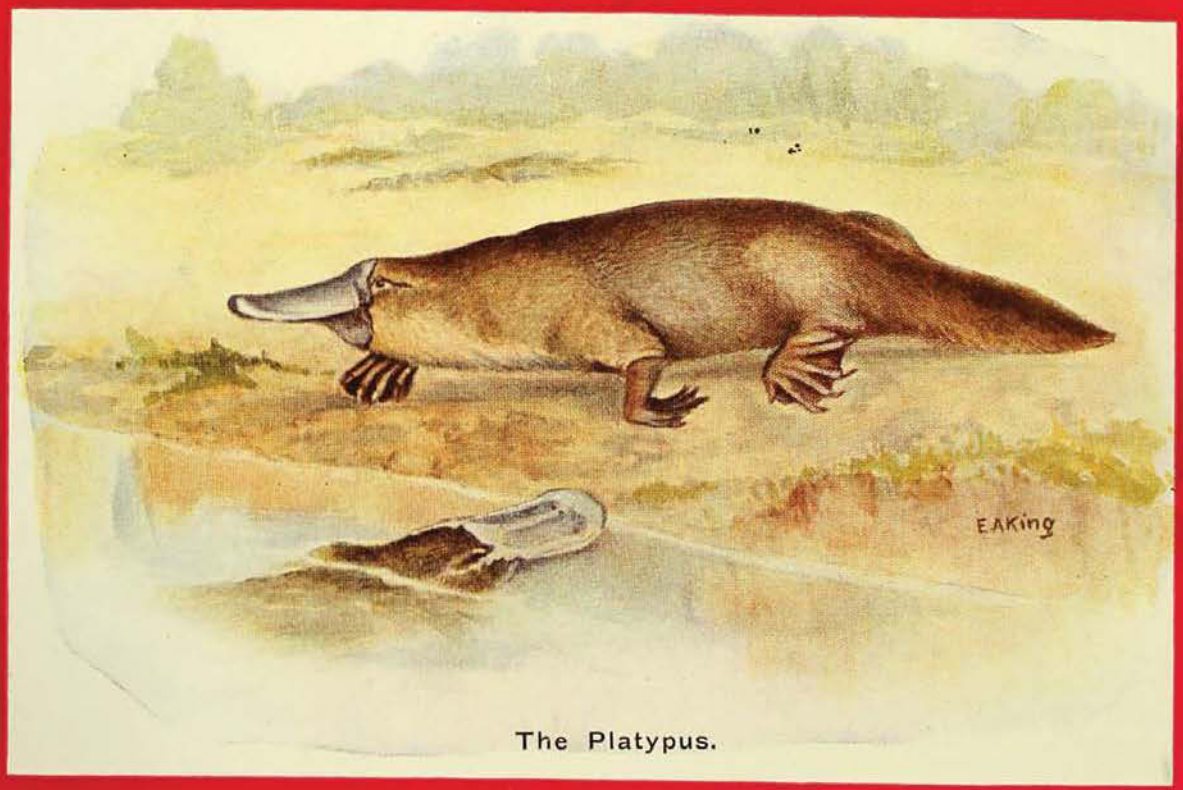
The AUSTRALIAN MUSEUM MAGAZINE

Vol. VI. No. 11. JULY-SEPTEMBER, 1938. Price—ONE SHILLING.



The Platypus.

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

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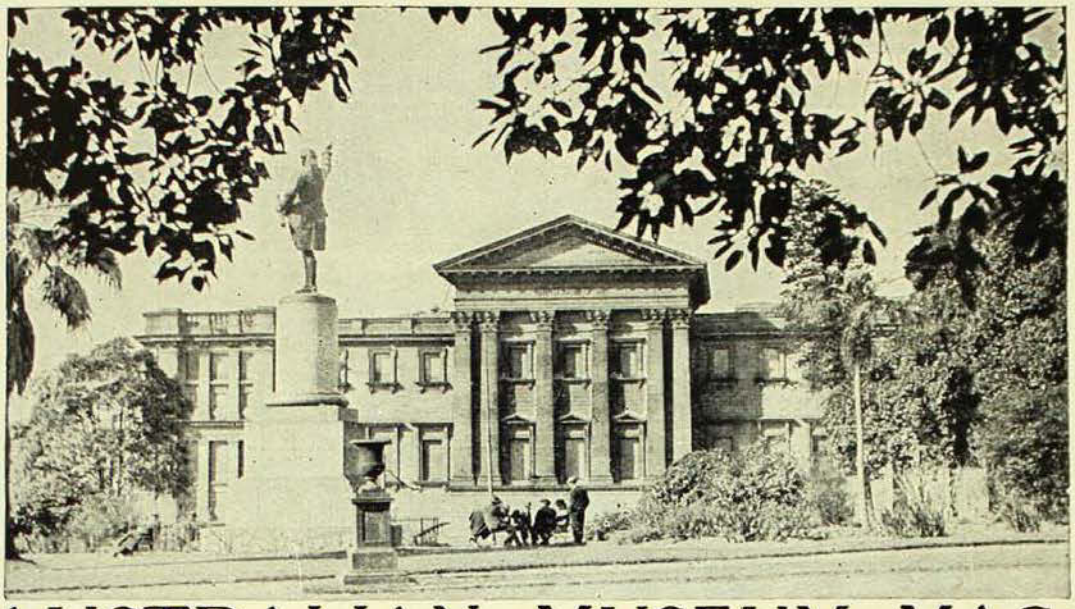

THE AUSTRALIAN MUSEUM MAGAZINE

Photography, unless otherwise stated, is by G. C. Clutton.

● OUR FRONT COVER. The Platypus (*Ornithorhynchus anatinus*) is by Edith A. King. It is one of a series of post cards issued by the Australian Museum.

Elsewhere in this issue is an account of the new Platypus group, a life history exhibit in the halls of the Australian Museum. To this article, and another, "The Egg-Laying Furred Animals of Australia", by E. Le G. Troughton, which appeared in THE AUSTRALIAN MUSEUM MAGAZINE, Vol. iv, No. 10, for April-June, 1932, the reader is referred for additional information.

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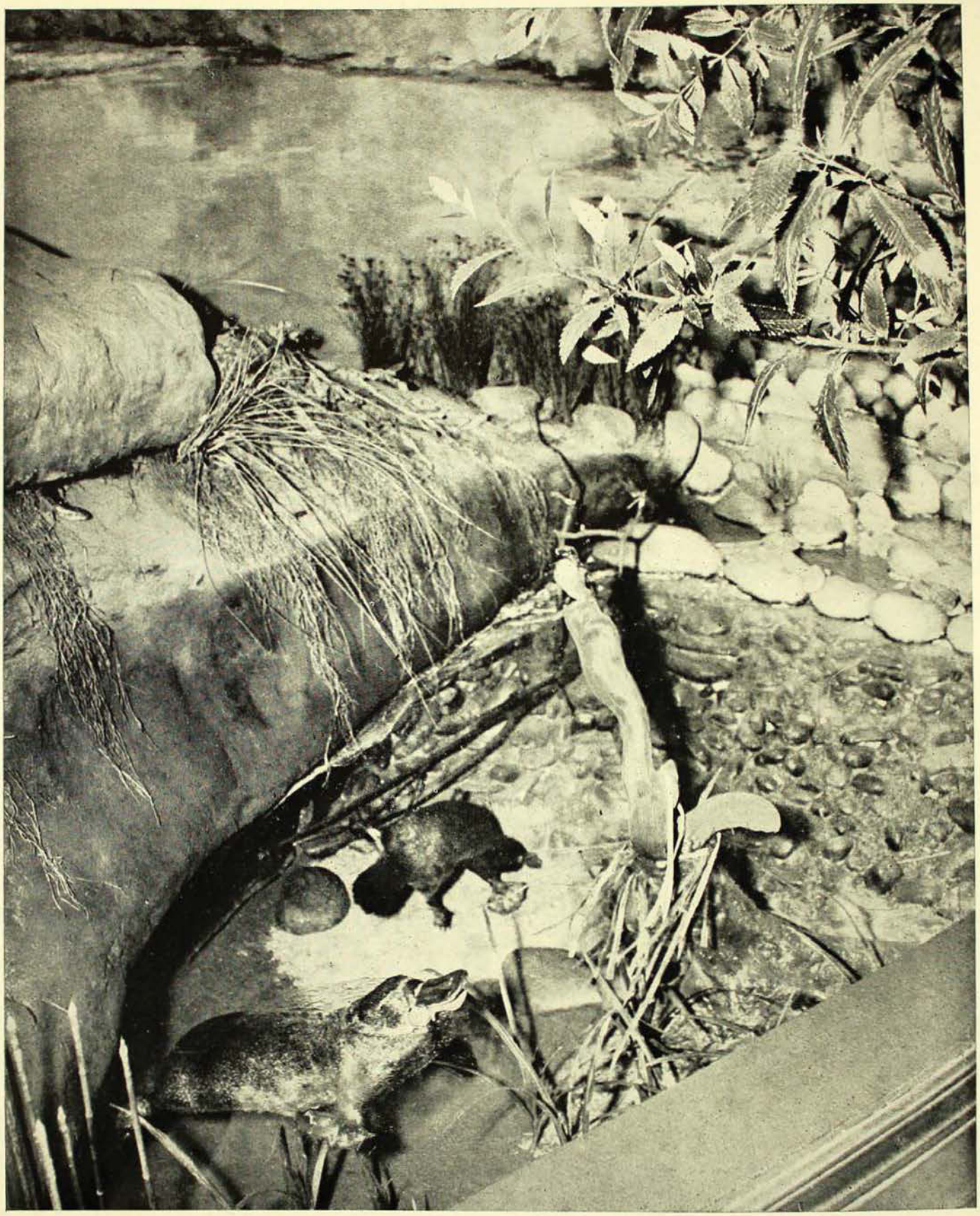


Two feeding platypus are shown in the pool on the right of the habitat group. The submerged animal is using the flattened snout or "bill" in dredging the bottom for aquatic food. The other has just broken the surface to masticate its catch, with facial groove opened, so that it can listen and scan the bank. The use of the swimming webs is clearly shown, while the watching Kingfisher, and aquatic effects impart a most realistic atmosphere.

THE AUSTRALIAN MUSEUM
MAGAZINE

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

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

VOL. VI, NO. 11. JULY–SEPTEMBER, 1938.

The Platypus Group

Life History Exhibit in the Australian Museum

By ELLIS TROUGHTON, C.M.Z.S.

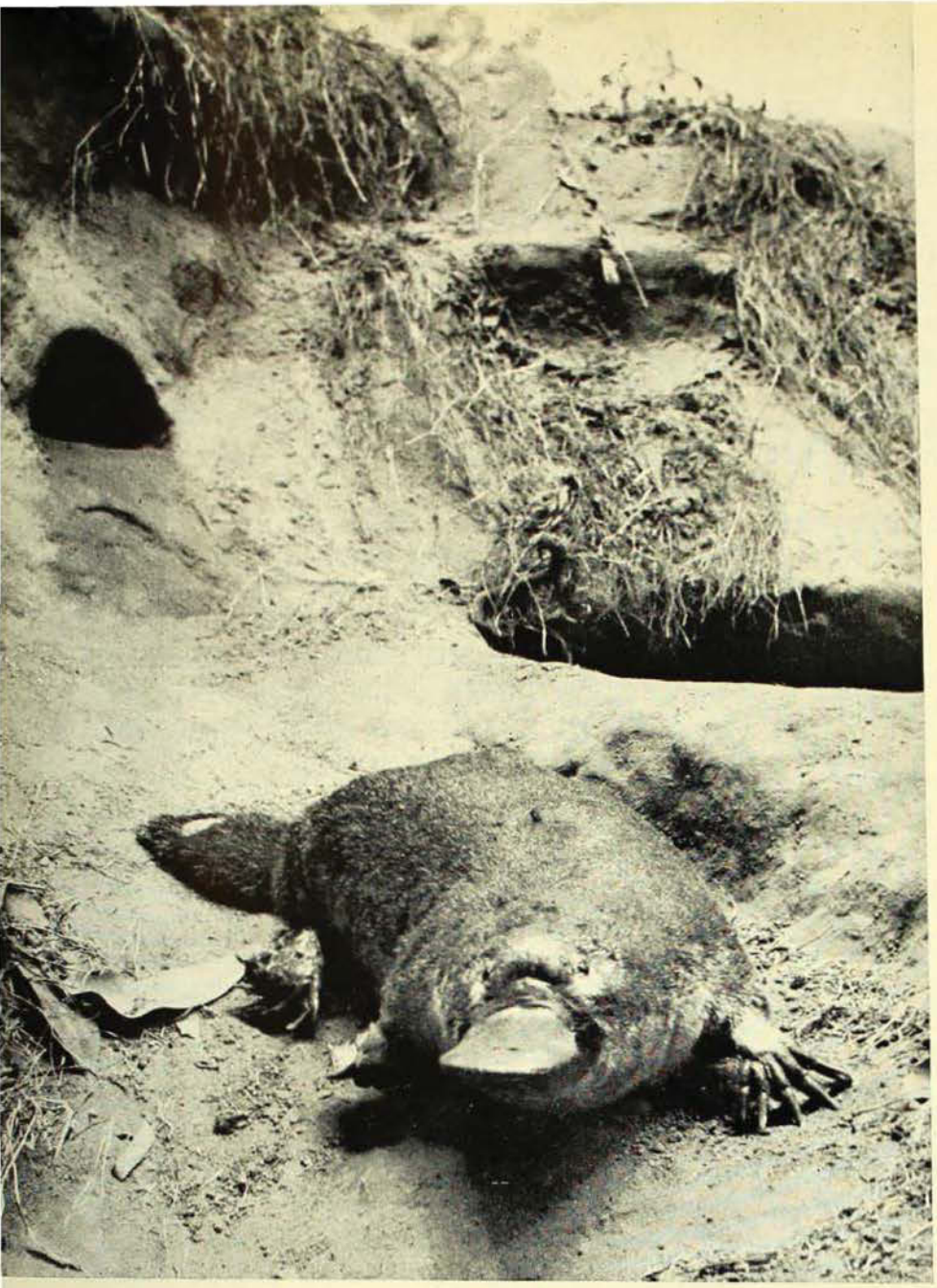
EVER since the platypus was discovered on the Hawkesbury River near Sydney in 1797, world-wide interest has been shown in the domestic life of the remarkable creature, which is displayed in detail for the first time in a new exhibit in the Australian Museum. Because of its peculiar adaptations for a semi-aquatic and burrowing existence, the platypus soon became known to the colonists as a "Duckbill" or "Duckmole", while the original Latin name of "*paradoxus*" referred to the contradiction of the supposed "bill", furred body, and reported egg-laying habit, not generally regarded as proven until 1884.

There is nothing bird-like, however, about the small, rounded egg shown in the nearby case, for it has a leathery and compressible instead of a brittle shell. As clearly shown in the group exhibit, the "bill" is not hard and duck-like, but is actually made up of the modified nose and lips. The beautiful coat is seal-like, and the body is "stream-lined" for swimming, while the beaver-like tail is specially adapted for diving operations. The remarkable hand-web is also very different to that of any bird's foot, consisting of an extension of the palm which makes a perfect swimming paddle, but can be folded under to free the fingers and nails when walking or digging.

The platypus is actually one of the most primitive yet remarkably modified of furred animals, and, with the spiny ant-eaters or so-called "native porcupines", affords Australia the zoological distinction of harbouring the only egg-laying mammals living today. The ancient origin of these animals is shown by reptilian traces in the skeleton, but the suckling of young and the air-breathing habit, displayed by the exhibit, prove

* Photographs by courtesy of *The Sydney Morning Herald*.

The general setting of the Platypus Group, representing a scene in the Burragorang Valley, near Sydney, was chosen as closely resembling the place of original discovery by colonists on the Hawkesbury River in 1797. The animal on the left is a foraging female which has left furred young sealed in the burrow. The excavation shows the type of breeding burrows, made by the females only. The curled up animal is in the "brooding" position, with eggs enfolded against her breast, while the female nearer the tree has suckling twins.



An enlarged view of the walking animal, showing how the hand-webs are folded under when walking, or digging. The foraging female has left month-old, furred young in the burrow. Continued sealing of the nest, and barricading of the tunnel with "pugs" of earth, have worn the patch seen on the trowel-like tail.

the platypus to be a true mammal, representing the lowest order of man's class of the animal world.

Because of the general interest attaching to this unique Australian creature, special plans were made some time ago for the preparation of a group to display every phase of the life of the platypus from the egg to maturity. The animal inhabits the coastal and mountain waters of Australia and Tasmania, but, because of the local interest of its first discovery, an appropriate setting was chosen on a tributary of the Wollondilly River, in the Burragorang Valley near Sydney.

A considerable amount of field-work is entailed in the preparation of such groups, and Museum parties visited the location several times to make the necessary observations and obtain sketches, and such accessories as plants, reeds, and river pebbles to provide a faithful reproduction of the natural setting. The actual arrangement and construction of the habitat group was carried out by Mr. H. S. Grant (Chief Taxidermist), with the aid of his two assistants, Messrs. J. H. Wright and W. Barnes, and the completed work now open for inspection provides an instructive example of skilful preparation, worthy of any museum in the world.

The realistic effect of the setting was enhanced by the versatile work of Miss Ethel A. King, the well-known Australian artist, who painted the background from her field sketches, and also provided much

assistance in the coloration of various accessories, such as trees and foliage. The tedious and exacting nature of such group-work is indicated by the fact that one tree took three months of almost continuous work to reproduce, each leaf being handled twelve times. Throughout the work of installation the artistic advice and assistance of Miss King were invaluable, as on many past occasions when her efforts have earned the appreciation of the Museum authorities and staff.

Accuracy of detail in regard to the natural history of the strangely modified mammal was of paramount importance for the group, and this was assured by the willing co-operation of the world authority, Mr. Harry Burrell, O.B.E., C.M.Z.S., F.R.Z.S. Although many scientists have studied the internal anatomy of the platypus, no other naturalist had attempted the detailed research of its life history supplied by the author of *The Platypus*; and Mr. Grant considers himself fortunate indeed to have had the benefit of Mr. Burrell's exceptionally qualified advice during the final stages of preparation.

The excavated part of the group displays a plan of breeding burrows, constructed by females only, which may be from ten to sixty feet long, but are never more than fifteen inches below the surface, winding upwards to avoid flooding, which accounts for occasional unused under-water entrances. A curled-up female is shown in the "brooding" position of semi-hibernation, when the eggs are enfolded against the breast for the fortnight of incubation during which she remains sealed within the nesting chamber. Another female is supporting fortnight-old twins which have been suckling from the enlarged breast-pores, teats not being developed as in the marsupials and higher mammals.

Nests may be of leaves, willow-switches, or of reeds crushed by the animal's jaws, and the damp areas seen in front of the nesting chambers indicate the "pug" of specially kneaded soil which is pressed in to form a barrier in various parts of the burrow. The exposed burrows also demonstrate the remarkable instinct of the platypus for avoiding older tunnels as well as solid objects, aided by the sensitivity of the nerve-charged snout. On the extreme left a foraging female is descending from her burrow, in which month-old furred young remain within the nesting chamber, repeated sealing of which has worn the bare patch on the trowel-like tail. The walking action of the forelimb is also shown, in which the webbing is folded back under the palm as in digging, while the weight is actually supported on the knuckles.

In a realistic pool on the right the swimming and feeding habits are shown by two of the males, which actually live apart at greater distance during the breeding season, occupying roomy hollows beneath tree-roots, in which they are later joined by females and young. A submerged animal shows the use of the flattened "bill" in sorting out the diet of worms, shells, shrimps, and aquatic insects from the ooze and rocks of the river-bottom, and the sensitive nature of the snout may be gathered from the fact that the eye and ear remain closed within a facial groove while the platypus is digging, and feeding under water. The poison-spur, which is developed only in males, can be seen on the ankle of the feeding animal, while the actual poison system is shown in a nearby case. The animal at the surface is in the attitude adopted when masticating the catch, with the facial groove open so that it may listen and scan the banks. It also emphasizes the point that the platypus is not truly amphibious, as submersion averages little more than a minute.

Apart from the instructive nature of the exhibit, the typically Australian setting and atmosphere achieved by the Museum preparators and the artist have been the subject of much public admiration, especially of the water effects contrived with glass and artificial reeds,

with froth and debris from a small rapid caught along the bank. An inquisitive soldier bird watches from above, and a king-fisher from a river-snag, while a lizard, dragon-fly, and even bull-ants, complete a picture which must closely resemble the place of original discovery, on the Hawkesbury, about 140 years ago.

The entire display forms a most important addition to the hall of habitat groups, presenting the unique Australian platypus thoroughly at home in natural surroundings, and representing a high standard of museum achievement in which those concerned may justly take pride.

A Platypus Stamp

By K. N. ALLEN

Animals, if sufficiently striking, are very suitable for use on postage stamps, and Australia, with its quaint and interesting mammals and birds is fortunate in having a wide choice of such subjects. The

kangaroo, koala, lyre-bird, kookaburra, emu, and black swan have all graced issues of Australian stamps, and now a ninepenny stamp bearing an illustration of the platypus makes its bow to the public.

In 1880 Tasmania made use on its duty stamps of a characteristic study of a platypus, but only recently has it appeared on a postage stamp, although one was projected in 1931, 1933 and again in 1937. No more typically Australian subject could be chosen, no one of greater zoological interest. It is interesting, too, that its issue should occur in the year in which the platypus habitat group in the Australian Museum was completed.

The Postal Department states: "Although most Australians are familiar with the appearance and habits of this inoffensive and interesting creature, many people overseas are sceptical regarding the existence of an amphibious fur-bearing animal, which has a duck-like bill, webbed feet, lays eggs, and hibernates in a burrow". Perhaps the new stamp subject will still be viewed with incredulity abroad.

The chosen design shows, in oblong format, this strangest of all mammals entering a stream, one of its fore-feet resting on the surface of the water.

Sea-Squirts: Remarkable Marine Animals

By FREDK. CHAPMAN, A.L.S., Hon. F.R.M.S.

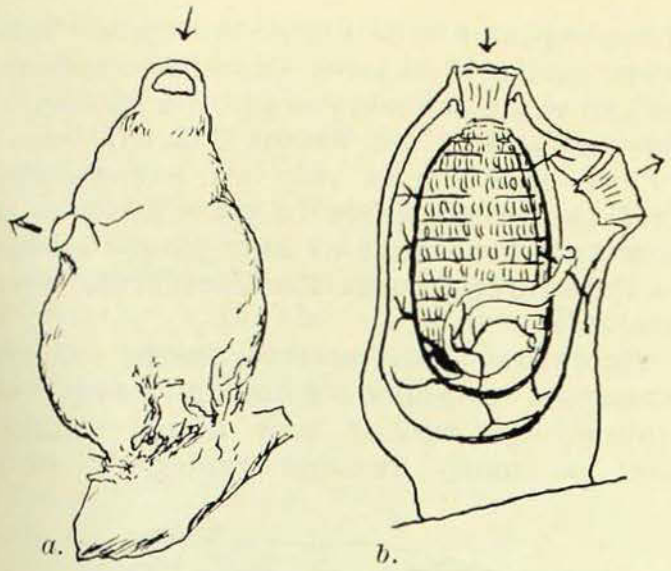
A FEW years ago two naturalists were "beachcombing" along the shore near Flinders, Victoria, when they came upon the amazing sight of myriads of sea-squirts piled up on the foreshore after heavy weather. The brownish-grey leathery bodies were strewn along the beach towards Point Leo for nearly a mile. The sea-squirts that one ordinarily meets with when walking on the shore at low tide are at first sight of so little interest that they might be passed over for lumps of badly preserved sponges but for their curious habit of squirting with considerable force a fine jet of water when irritated or stepped upon.

Colonies of an Ascidian (Cynthia) on Flinders foreshore.
Photo.—F. Chapman.

To discover that these almost inactive animals are still capable of obtaining their food, and that in the most efficient way, it is necessary to put them in a jar of seawater. We shall then see the tips of the two spout-like tubes protrude and a current of seawater being drawn into one, whilst from the other the same water, from which the food particles have been extracted, issues in a fine stream. This circulation is carried out by means of fine hair-like processes within the tubes. To see the movement more clearly one may drop a little carmine powder into the water to make the streams visible.

THEIR ROMANTIC LIFE-HISTORY.

In their earliest stages the sea-squirts resemble tadpoles, for they have a definite tail which in its structure compares closely with that of the primitive fishes. Later in life they rapidly degenerate from a free-swimming organism, able to explore the ocean from shore to shore, to



Ascidian. a, exterior. b, interior.

one where they lose their mobility. Becoming sedentary, they attach themselves to seaweed, shells, or even rocks, and it is in this stage that they are torn from their moorings and cast ashore.

Zoologists class the more familiar sea-squirts together as Ascidians, a name derived from "askos", the Greek for a leathern wine-skin. Their skin, indeed, is so tough that it is only with the greatest difficulty that it can be cut with a penknife. They are referred to the more comprehensive group Tunicata, on account of their leathery coat. The secret of this toughness is revealed by placing a thin slice of the skin under a microscope, when we see that it is studded throughout with tiny star-shaped spicules, rather like those seen in the outer covering of sponges. These beautiful little spicules are invariably composed of carbonate of lime and secreted from the seawater in much the same way as those of sponges, which, however, are often flinty in composition.

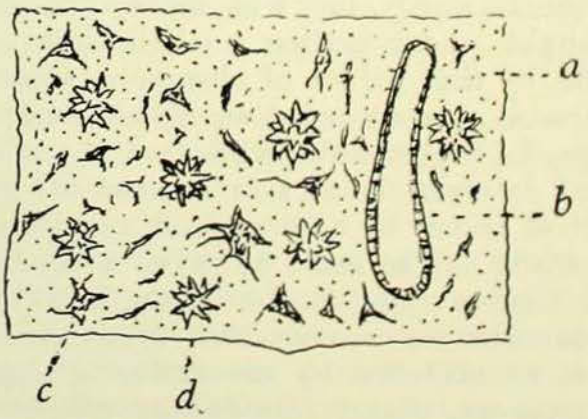
These limy spicules are left behind in the sea-mud when the sea-squirt decays and are sometimes abundant in deep-sea dredgings. Fossilized specimens of these stellate objects were lately found in profusion in the finer washings from the marl out of a well-boring in Gippsland at depths ranging from 61 to 142 feet.

It is no wonder that such "poor fish" as the degenerate sea-squirts require a strong protective skin, for they have no other external means of fending off enemies. These Tunicates were formerly classed either with Lamp-shells or even with Sea-mats or Polyzoa, but that was before their earlier tadpole existence was established.

THEIR WONDERFUL VARIATION AND DISTRIBUTION.

The common clustered kind found on our shores belongs to the genus *Cynthia*, which is allied to the "Red Currant Squirter" of the Devonshire coast, so well illustrated by Philip Henry Gosse in his book *A Year at the Shore*. The British species, however, is smaller and, resplendent with red instead of being large and drab, as is the Australian one, *Botryllus*, almost flower-like in its clustered symmetry, or like a cushion of jelly studded with bright orange stars on a warm brown background. Related kinds have been lately recorded by the McCoy Society from Julia Percy Island, where another genus, *Amaroucium*, also occurs, recalling a similar kind, the Orange-spotted Squirter from the Devonshire rocks.

The long-bodied ascidians, *Pyrosoma*, are amongst the most spectacular of marine animals and are not sedentary, but are part of the floating life or plankton of the sea. Clustered together in rings, they form a tube, closed at one



Structure of test or skin of Tunicate, Leptoclinum carpenteri, from recent dredgings by the "Porcupine". Highly magnified. a, matrix. b, vessel. c, cells. d, spicule.

end and open at the other. This floating cylinder rhythmically undulates near the surface of the sea, whilst at night it emits vivid flashes of light, like a glowing stick of fire. Other related kinds produce a pale greenish fluorescent light. Thus floating sea-squirts play an important part, together with marine worms, bivalved Crustacea (*Ostracoda*) and *Noctiluca* (a bag-like infusorian), in turning the otherwise inky-dark ocean into a flashing seascape. Through this many a vessel ploughs, leaving behind a trail of scintillating light, a revelation to the voyager of the teeming life in the ocean.

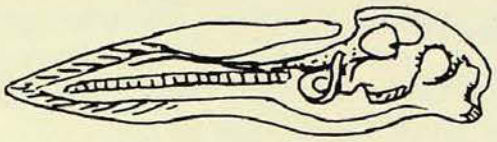
Not only do the sea-squirts dominate the shallow waters of the coast or float in the central seas, but they are found on the sea-bed itself. During the voyage of H.M.S. "Challenger", ascidians were found almost universally under marine conditions. Even at the enormous depth of 2,600 fathoms, or about three miles, they were found attached to manganese nodules and in company with species of lamp-shells lying on the bottom of the sea, where

> There is no sound, in the deserts of the deep,
> On the great grey level plains of ooze where
> the shell-burred cables creep.

DARWIN'S OBSERVATIONS ON EMBRYOLOGY.

The tadpole nature of the young of the sea-squirts was recorded in 1826, by Milne Edwards, but was more strikingly brought under notice a little later, in 1833, by that prince of observers, Charles Darwin. As recorded in his *Descent of Man,* he states how, whilst at the Falkland Islands, he saw a swarm of locomotive larvae of a compound ascidian in seawater. "The tail", he says, "was about five times as long as the oblong head, and terminated in a very fine filament. It was, as sketched by me under a simple microscope, plainly divided by transverse partitions, which I presume represent the great cells figured by Kovalesky." That famous Russian naturalist showed, in a memoir published in 1866, the analogy of this primitive vertebrate structure to the dorsal spine of the higher animals. This work by Kovalesky led Darwin to remark on the value of embryology to a zoologist. In the book cited above, Darwin says: "Thus, if we may rely on embryology, ever the safest guide in classification, it seems that we have at last gained a clue to the source whence the Vertebrata were derived."

Evolution still receives some of its strongest support from a study of embryology, and it now seems strange that so many famous zoologists were



Tadpole larva of Ascidian (Clavelina).

formerly opposed to its basic facts, and that in the face of the brilliant researches of Darwin, Wallace, and Huxley. Thus did Professors Richard Owen and Frederick McCoy repudiate the evidence of embryology and morphology which they must have continually encountered in the midst of their scientific work. One recalls the story of Professor McCoy, who, whilst lecturing on zoology, held before his students a bottled ascidian, facetiously dubbing it "Darwin's young man".

EARLY VERTEBRATES STILL DEGENERATE.

In their earliest or larval stage the degenerate sea-squirts show marvellous evidence of having been one of the lowliest, if not the lowest, of the animals possessing a vertebral column, before the fishes, reptiles, and the higher vertebrates came into being. In the ascidian larva there are no bones encasing this nervous column, but, in common with some other lowly forms of life, like the lancelet or Amphioxus, a fish-like animal, it possesses a series of connected nerves lying along the back, called the notochord.

Another curious example of a retrogressive primitive marine animal with a notochord is the worm-like Balanoglossus

that burrows into sand; in this the notochord is developed around the proboscis, whilst, by having supporting bars to the gill-slits, it resembles the fish-like lancelet.

Many zoologists now group the, at first sight, very diverse marine creatures with a soft spinal column in one phylum, the Chordata; with the worm-like Balanoglossus having the notochord developed in the forepart of the body only, as the Hemichordata; the ascidians and tunicates having the notochord in the tail, as the Urochordata; and the fish-like lancelet, with its notochord extending throughout the whole body, as the Cephalochordata. When this notochord became enlarged in the forepart of the body and encased in bone, as in the higher vertebrates, we have it representing the highest and largest division, the Craniata, culminating in Man.

New Ethnographical Exhibits

Near the entrance to the New Guinea Hall is a display of head-hunting trophies from New Guinea, featuring preserved skulls from Western Papua and the Sepik River district of the Mandated Territory. Grotesque caricatures of the human form, with long noses, protruding eyes or stretched skin, are the main features of the Papuan heads, while those from the Sepik area have the features restored with clay and paint. Inlaid work of seeds and shells frame the features which are made more life-like by the addition of fibre hair.

Three full-size native canoes have recently been placed in the galleries—a Tikopian outrigger in the Polynesian section, and in the Australian Hall a Melville Island dugout and a New South Wales tied bark canoe. All are fine specimens of their type; the last mentioned is particularly rare. It was made in the north coast district at the request of Mr. W. J. Enright by Albert Woodlands, a native who is skilful in the crafts of his forefathers, and faithfully followed out the old pattern in fashioning this vessel.

A colourful series of ceremonial and secular objects from Caledon Bay, Arnhem Land, has been received from the Rev. W. S. Chaseling, and includes paintings upon bark slabs, sacred poles and other ritualistic paraphernalia called "maraian".

Through the generosity of the Tourist and Trade Commissioner for New Zealand, sixteen coloured and enlarged photographs illustrating various aspects of Maori life have been placed on view. The subjects illustrated include a village scene, carved houses and gateway, haka and poi dancers, the "hongi" or greeting, tattooing, carving and canoeing, dress and ornament.

The recent acquisition of some unique pieces has resulted in the installation of an exhibit of prehistoric stone objects that have been collected in New Guinea, the Solomons and other islands in the Pacific. A long slate blade, mortars and carved birds' heads show a high degree of skill in stone working not typical of the work of modern natives.

Other newly arranged series are stone implements from Melanesia, Polynesia and Micronesia, to be found in the Melanesian Hall.

A set of casts of some of the subjects depicted in the aboriginal rock engravings in the Sydney district, together with casts obtained in exchange with the South Australian Museum of rock engravings in that State, have been set out in the Australian gallery. A series of reproductions of cave paintings by Mr. W. H. P. Kinsela, shows the range of subject and style portrayed by the aborigines.

The Eggs of Australian Sharks and Rays

By GILBERT P. WHITLEY

FIELD naturalists on the coasts of our extensive continent have a fine field for research open to them in the study of the egg-cases and young of our smaller sharks and rays.

In England and other countries these objects, found washed up on beaches, have been long known as Mermaids' or Sailors' Purses, Sea Cushions, or Barrows, and the species of small sharks and rays which lay them are known. But in Australia we have a greater variety of these objects, yet know very little concerning them.

A few facts and figures have been assembled for this article, and it is hoped that any fisherman or naturalist who finds a 'mermaid's purse' will send it to the nearest museum, if possible with its 'mother' shark or ray, for exact identification. If the amateur thus helps the professional, we shall soon gain some interesting scientific data, at present woefully lacking. It is important to note the locality, depth, and other details regarding any eggs found.

Drawings, for which I am indebted to the skill of Miss Joyce Allan, are given here of all the Australian and New Zealand shark and ray eggs so far known, all being original unless otherwise acknowledged.

Sharks and rays produce their young either alive and well developed, or in eggs enclosed in tough, horny envelopes. In some families both types of reproduction appear in closely allied genera. Most of the large and dangerous species are viviparous, the young being born as miniatures of their parents.

The external form of the egg-cases of different sharks and rays varies greatly, from the spirally flanged, pear-shaped type of the Port Jackson Sharks (*Heterodontus*) to the flattened quadrangular cases of the Dogfishes (*Scyliorhinus*) and the Rays. They all have a central chamber in which the actual egg lies and goes through its development, and from which the young later emerges through a slit at the top or sides. Many of the egg-cases are provided with tendrils of greater or less length which become entangled around sea-weeds and other marine growths and so secure the eggs in safe positions until the young within them have developed and escaped.

The egg-cases of sharks and rays are formed of a horny substance (keratin), and vary from brown to black in colour, but in some species are honey-coloured to pale yellowish. The more or less polished, oval, pear-, barrow- or stretcher-shaped egg-case is generally adorned with horns or tendrils to moor it to some submarine support, to save the embryo from being jarred by too much movement, or from being washed ashore.

Horns may stick in sand or mud and tendrils twine around weeds, or the egg-case may have sticky fibres to attach it to some support. Water soaks through the shell or enters narrow fissures in the egg-case or its horns, and bathes the embryo.

The young shark or ray feeds on the yolk in the egg for from five to about eight months, the period depending on water temperature.

It is difficult to say which end is which, especially as the young may wriggle within the egg and thus be head first or tail first, but in sharks' eggs the cervix, or fissure from which the young hatch, can usually be found at the wider end, and this is regarded as the front or anterior end. In rays' eggs this end is

usually flanked by the longer pair of horns (coronal horns) in distinction to the shorter posterior horns. The cervix is tightly clasped, so that, although the young can push their way out, sand or enemies cannot enter.

Sharks' and rays' eggs may be kept dry if empty, but if they contain yolk or young they should be preserved in alcohol. Formalin makes them too brittle, so that the tendrils are very liable to break off, and Blé's Fixative is not very successful.

Amongst the rays and small sharks there is nothing like the immense production of minute eggs such as in ordinary fishes. Only one shelled egg is usually developed at a time in each of the two oviducts, so that a pair is laid.

As in birds, so-called "wind-eggs" are also known, where the egg-case is formed when no egg is present within it. Also the phenomenon of twin ova in one egg-case has been observed in sharks.

PORT JACKSON SHARKS.

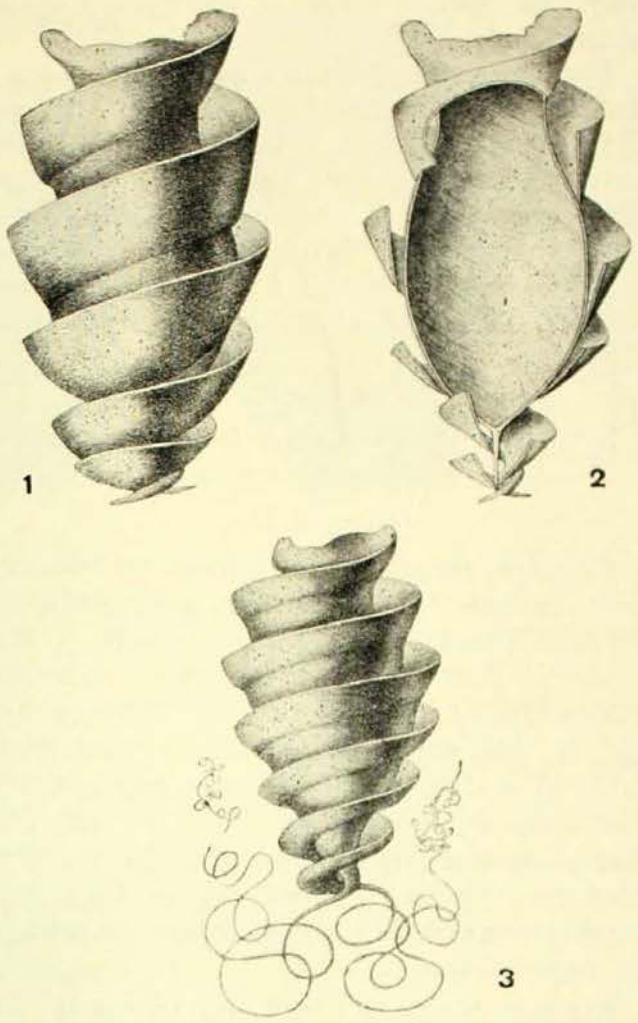
The eggs of the Port Jackson sharks are the most characteristic of our Australian forms. They are pear-shaped, brown, horny objects with the sides frilled with broad flexible flanges in a right-handed double spiral. Eggs containing living young are most abundant in spring (August and September), but are also to be found throughout the summer, whilst the empty egg-cases may be found washed up on beaches at any time of the year. There are two kinds.

The Common Port Jackson Shark (*Heterodontus portusjacksoni*).

(Figures 1 and 2.)

Length[1] about six inches. The spiral flanges (five or six in number) very broad, nearly hiding the body of the egg from a side view; they are sometimes frayed from friction with rocks, or coated with marine growths. At their base the spirals terminate bluntly and are not lengthened into tendrils.

[1] The length of an egg-case is expressed without including the projections of horns or tendrils.



Eggs of Port Jackson Sharks: Figure 1, Common Port Jackson Shark; 2, section through same; 3, Crested Port Jackson Shark. All from New South Wales. (After Waite.)

Range: New South Wales, round south-eastern Australia to the south-west. Found in moderately shallow water; wedged between rocks, so that it may be necessary to unscrew them.

Abundant in August and September. I have noted developing embryos in December and young hatching in May.

Crested Port Jackson Shark (*Molochophrys galeatus*).

(Figure 3.)

Length about 4½ inches. About seven or eight spiral flanges which do not hide the body of the egg; their ends are lengthened into tough tendrils, which

may be over seven feet long when unravelled.

Found amongst brown weeds in deeper water, about 50 feet; New South Wales.

In April, 1938, a baby of this species hatched in Taronga Aquarium, Sydney, after the egg had been five months in a tank there. The Museum also received a new born specimen from La Perouse, N.S.W., in April, 1932. Growth is slow.

CATSHARKS.

Brown-banded or Spotted Catshark (*Chiloscyllium punctatum*).

(Figure 4.)

Average measurements two by nearly four inches. Oval in shape. Shining purplish-black and very smooth. No tendrils, but a loop of two fibrous extensions on the dorsal edge fastens the egg to its support (weed, worm-tubes, etc.); it is said that, after the egg is laid, this loop is woven by the lips of the parent round the stem selected as the nursery. Or is it more likely that the shark swims round some object to which the eggs adhere?

Range: Moreton Bay northwards in Queensland, and northern Australia. The figured specimen is from Broome, Western Australia.

Concerning the allied Indian species, *Chiloscyllium griseum*, a note on breeding has been given by B. Sundara Raj.[2] In January, 1913, several specimens were in the Madras Aquarium, and every night from January 27th to 30th a pair of eggs was laid, also a single one on the night of February 1st. The egg-capsule was apparently like our Queensland ones, but with many silky threads (but no tendrils) for attachment. Length about 3 inches; breadth 1¼ to 1½ inches. Some of the threads were over seven inches long, but were much twisted and matted together. Smedley[3] described similar eggs from the Straits of Malacca, 2½ to 3 inches long by 1½ inches. Three eggs were joined by *continuous byssi*, so had probably been laid at one time. Hydroid colonies on each case suggested a lengthy period of incubation.

Zebra Shark (*Stegostoma tigrinum*).

(Figure 5.)

Egg 4 by 2½ inches. Oblong. No means of attachment. Deep purplish-black, the surface marked with distinct, but not prominent, longitudinal striae.

Eggs have been found in Queensland and further north, but may turn up in other Australian States. The one illustrated here came from the Aru Islands.

Smedley[4] described an egg from the Java Sea, 7 by nearly 4 inches.

Tawny Shark or Madame X (*Nebrodes concolor ogilbyi*).

(Figure 6.)

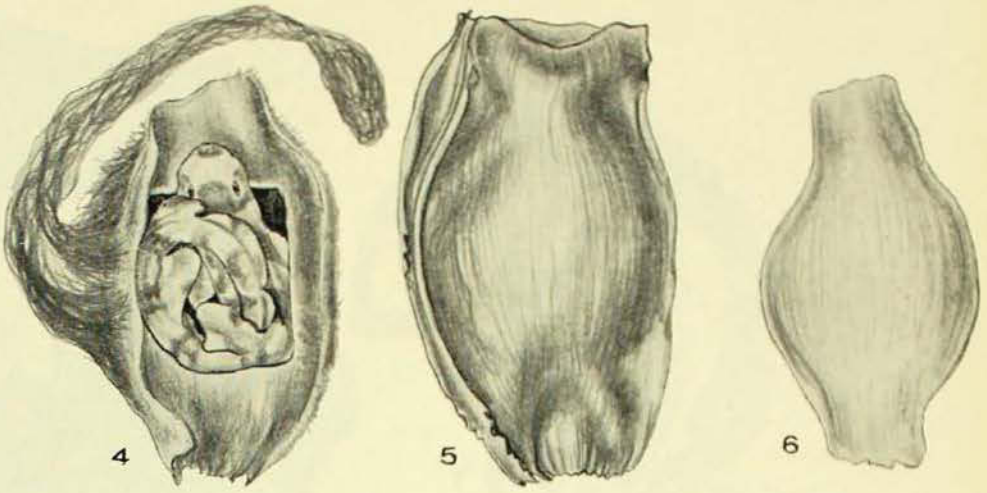
A curious north Queensland shark which spits water from its mouth and grunts when caught.

The egg is pale yellowish, rather onion-like, striated, and measures 3½ by 2 inches.

DOGFISHES.

"In the aquarium of the Zoological Gardens, in London, a novel race was staged: a race between dogfish as to which should be born first. For two months the horny egg envelopes had sheltered the developing embryos when visitors noticed that the eggs, which were suspended in a tank, began to move violently. There were about half a dozen of them and the wriggling of the embryos, some of which were larger than the others, could be seen through the egg-shells. In about another month, during which the embryos fed on the inner walls of their prison, they would be ready to burst free and those who wagered on the result would have a settling day."[5] I have seen such eggs and young in aquaria in London, Plymouth and Naples. There are similar species in Australia.

[2] *Rec. Indian Museum*, x, 1914, p. 318, fig.
[3] *Journ. Malay Branch Roy. Asiat. Soc.*, iv, 1926, p. 164.
[4] *Journ. Malay Branch Roy. Asiat. Soc.*, iv, 1926, p. 166; and v, 1927, p. 355, fig.
[5] *Southern Daily Echo* (Southampton, Eng.), Aug., 1927.



Eggs of Catsharks: Figure 4, Brown-banded Catshark from Broome, W. Australia; 5, Zebra Shark from Aru Islands; 6, Tawny Shark from North Queensland.

Spotted Dogfish (*Scyliorhinus analis*).

(Figure 11.)

This shark ranges from New South Wales to Tasmania.

The egg ascribed to this species is commonly found on some New South Wales beaches. It is rather spindle-shaped, generally less than three inches long and one inch wide. Colour brown, generally dark chocolate. There is a pair of tufts at the anterior end, and tendrils attach it to seaweeds, such as *Phyllospora*. Sometimes many of these eggs are attached to one base, or their tendrils intertwine, but in beach specimens the tendrils are often broken off.

Ogilby[6] says that "these cases are produced in pairs at intervals, and incubation lasts about six months". But the Australian Museum has a group of capsules, shown here (Figure 11), from near Sydney, and five others attached to one base from Austinmer, New South Wales, which suggest that these little sharks (like the similar ones known as Hounds or Dogfishes in England, because they travel in packs), may get together in a single favoured spot for breeding purposes.

Smaller Dogfish (*Scyliorhinus* sp.).

(Figure 7.)

An egg-case, figured here, is ascribed to an unknown species of *Scyliorhinus*. It was collected by me on Maroubra Beach, near Sydney, where it had evidently been washed ashore, in November, 1926. I found a second specimen on the same beach a week later. In general form these eggs resemble those of *Scyliorhinus analis*, but my specimens are only half the size and have no terminal tendrils.

Then the Museum has a more slender little egg from Tasmanian waters, which probably belongs to another related species.

St. Vincent's Gulf Dogfish (*Scyliorhinus vincenti*).

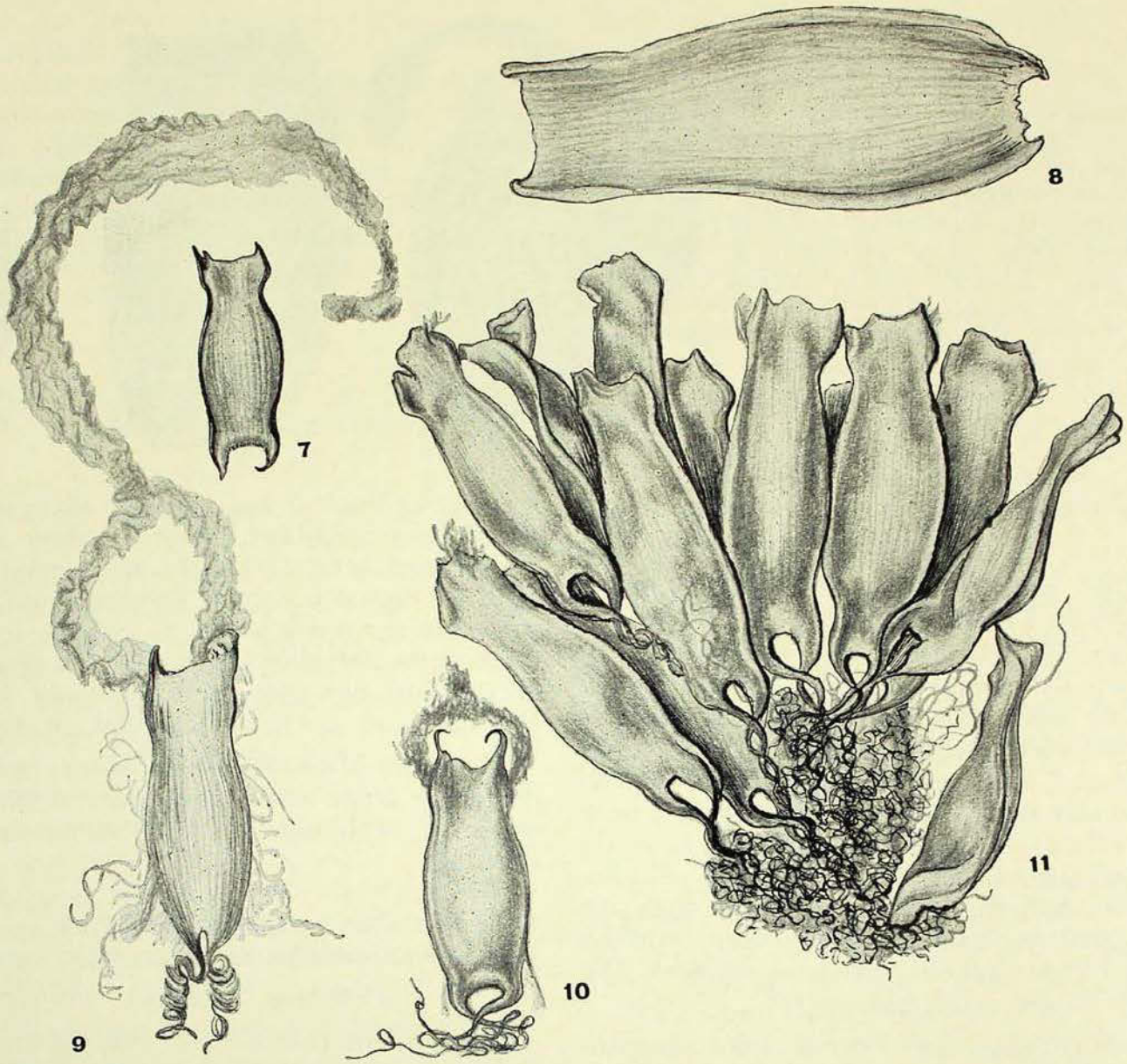
(Figures 9 and 10.)

A female of this species, over 16 inches in length, was caught on September 11th, 1928, in St. Vincent Gulf, South Australia; in the oviducts, ready for deposition, were two eggs. Each of these, including the shell, weighed 0·2 oz.

The egg-case was described by Mr. H. M. Hale as subquadrangular in shape, flattened, two inches in length and half an inch in depth. At the posterior end each corner tapered rapidly to form a single filament, ten inches in length. When the eggs were placed in a saline solution these filaments rapidly "corkscrewed", as shown in Figure 9.

Both faces of the eggshell had a striated appearance owing to the presence of bundles of silk-like threads, laid from end to end, and covering practically the whole of the eggshell. From the sides

[6] *Catalogue Royal Aquarium Bondi*, 1887, p. 3.



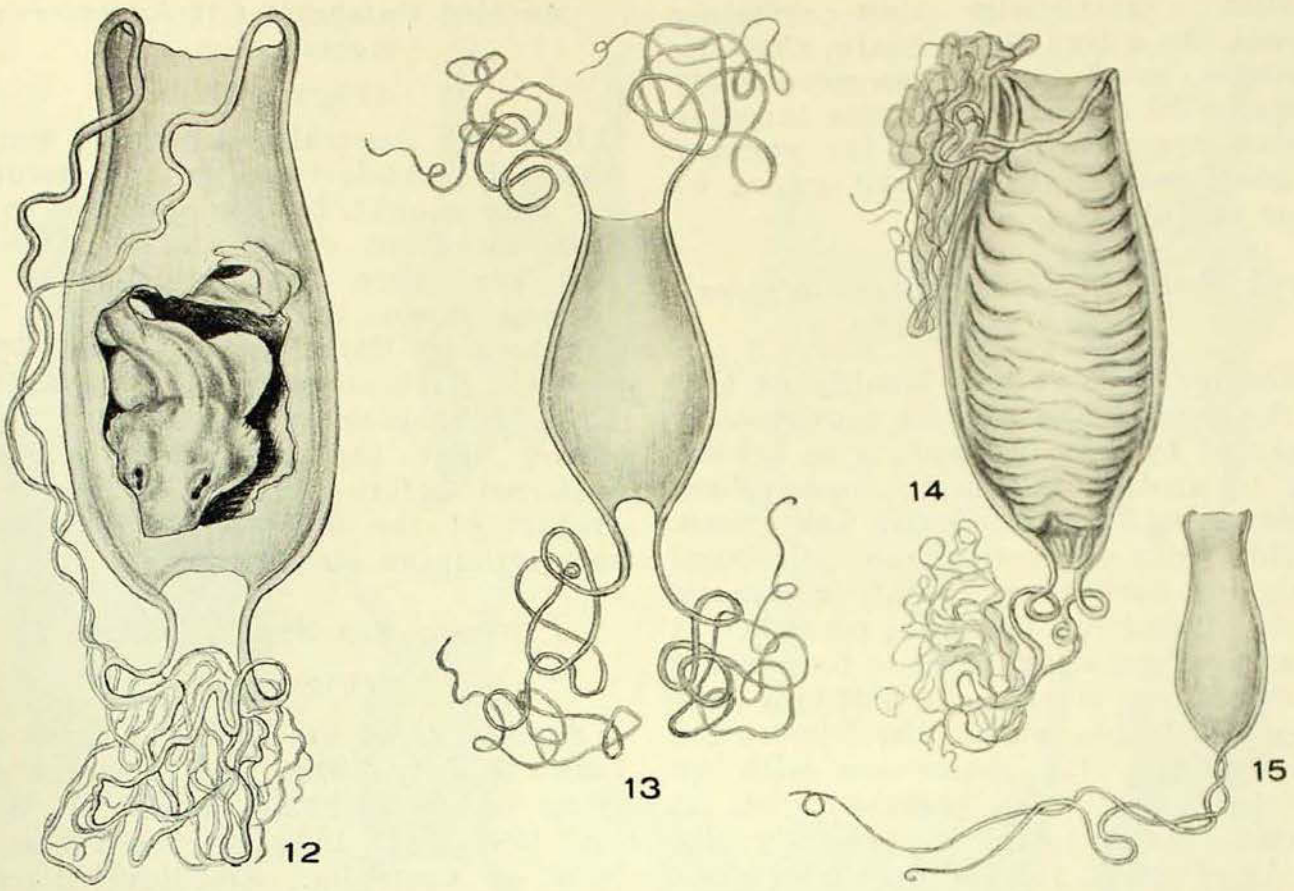
Eggs of Dogfishes: Figure 7, Scyliorhinus from Maroubra, N. S. Wales; 8, Cephaloscyllium, from Tasmania; 9, Scyliorhinus vincenti from St. Vincent's Gulf, S. Australia (after Hale); 10, S. vincenti ? from Portland Bay, Victoria; 11, S. analis from Sydney, clustered around one base.

emanated silky filaments $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length, forming a fringe; at the anterior portion of the case these filaments became very long and formed a pair of wavy byssi. Each byssus was 14 inches in length and was composed of a great number of separate fine threads. In the oviduct the byssi appeared as slender and extremely flexible tendrils, and their structure and purpose were apparent only when the eggs were placed in fluid.

"Evidently, when the egg is extruded the posterior tendrils rapidly twist to a spiral and thus anchor the egg to weed or some other support; also, the long byssi, once they have floated free, cling to and entangle around every rough object they come into contact with, like threads of wet silk, and doubtless serve as an excellent secondary means of attachment."[7]

The little egg shown in Miss Allan's Figure 10 probably belongs to *S. vincenti*. It is $1\frac{1}{2}$ by $\frac{3}{4}$ in., has tufts 'fore and aft',

[7] Hale.—*Rec. S. Austr. Mus.*, v, 1935, p. 367, fig. 1; reproduced here as Fig. 9.



Four curious Catshark eggs: Figure 12, Cephaloscyllium laticeps from Victoria; 13, Atelomycterus from the China Sea; 14, a "laminated egg" (Parascyllium ?) from Victoria; and 15, an unknown species from the Timor Sea. (Figures 13 and 15 after Smedley.)

and comes from Portland Bay, Victoria, whence the Gulf Dogfish is so far unrecorded.

Sawtail Shark (*Figaro boardmani*).

The egg of this species, which is known only from a few specimens trawled in New South Wales, has yet to be discovered. Possibly it will resemble the very dark brown, bomb-shaped eggs of the European *Pristiurus*.

FOUR CURIOUS CATSHARKS.

The "Laminated Egg" (*Parascyllium* ?). (Figure 14.)

In 1865 the French naturalist Duméril[8] figured a shark's egg from Tasmania like the one shown in Miss Allan's Figure 14, characterized by the ridges or laminae which reinforce the sides.

From then to now, the shark responsible has not been identified. The Australian Museum has numerous specimens of this egg, which is unlike that of any foreign shark. Some examples are more "bottle-necked" than others. The laminae number nineteen or twenty as a rule, but occasionally they may fuse or branch to count as low as sixteen or as high as twenty-seven. The egg is a beautiful treacle-yellow in colour, has a thick, hard shell, and measures from $3\frac{1}{2}$ to 5 inches long and $1\frac{3}{4}$ to 2 inches wide. It is taken by the trawlers, in depths of 20 to 80 fathoms, between southernmost New South Wales and Tasmania, and is often attached by its tendrils to large worm tubes. The one shown here is from off Cape Everard, Victoria.

Only one or two specimens seen by me contained embryos, little Catsharks of sorts, but too young for positive identi-

[8] *Hist. Nat. Poiss.*, i, 1865, p. 248, pl. viii, fig. 1.

fication; superficially they certainly looked like a tiny Swell Shark, *Cephaloscyllium*, but I think them more likely a species of *Parascyllium*. The breeding season appears to be in the summer months, as embryos are well grown by June or July.

Swell Shark (*Cephaloscyllium laticeps*).

(Figures 8 and 12.)

The egg which I now identify as that of the Swell Shark has been provisionally regarded by some naturalists as belonging to another Catshark, *Parascyllium collare*, and much confusion has arisen.

This bulky egg varies from pale horn-yellow to dark honey colour, is *smooth*-surfaced, and has the usual tendrils. It measures from about three to four inches in length, and is one and a half to a little over two inches wide. The illustration here (Figure 12) shows one with an embryo inside. This sharklet, with its flattened head, looked superficially like an Angel Shark, and had been labelled as such. But the Angel Shark (*Squatina*) is viviparous and, besides, this little specimen had an undershot mouth, an anal fin, and other characters which link it with the Swell Shark, in spite of its curious flat head and broad body. The "Endeavour" caught it in December, 1912, south from Gabo Island, Victoria, in 100 to 150 fathoms depth. It is generally in deep water that such eggs have been trawled in New South Wales, Victoria, the Great Australian Bight, and Tasmania, clinging to seafans, hydroids and other plant-like growths. Southern specimens are slightly larger than northern ones, and are found in the summer months in various stages of development. Figure 8 shows a specimen in the Tasmanian Museum, Hobart.

Marbled Catshark (*Atelomycterus marmoratus*).

(Figure 13.)

In North Australia a prettily marked Catshark (*Atelomycterus marmoratus*) has been caught, but its eggs are so far unknown from our waters. However, they have been found on cables, 115 fathoms down, in the China Sea, and described by Smedley:[9] 3½ inches by 1½ inches. Each corner with long tendrils which, "engaging with some fixed object, ensure that the egg shall be safely anchored before it actually leaves the oviduct of the mother". [A deduction rather than an observation.]

Timor Sea Shark, *species* ?

(Figure 15.)

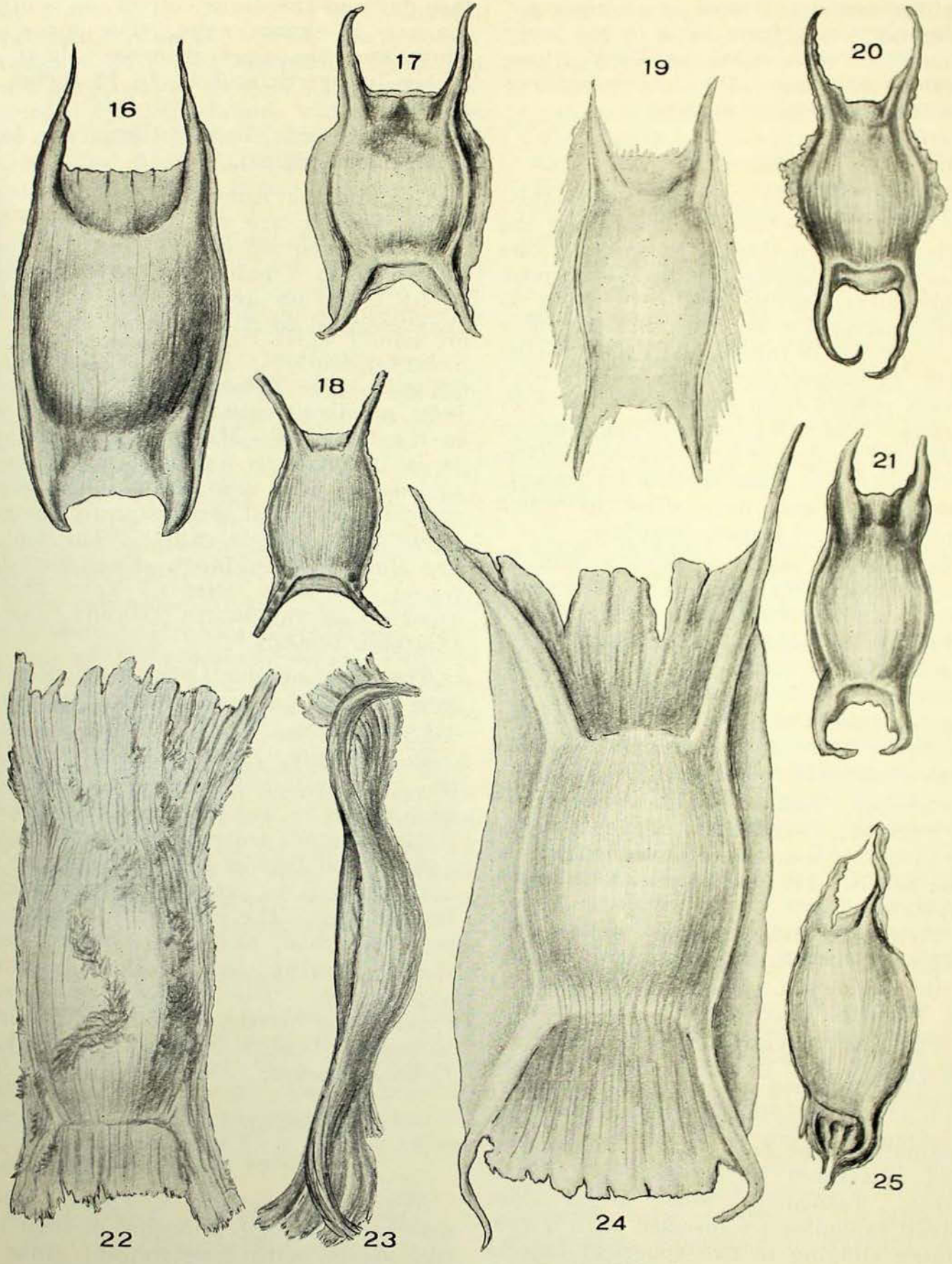
Some eggs of an unnamed shark were found in July, 1913, on a telegraph cable lying in 300 fathoms at 10° 27′ S. lat. and 126° 4′ E. long., in the Timor Sea, N.W. of Australia. Smedley[10] described the specimens, which are preserved at Singapore. The egg is about two inches long by a little over three-quarters of an inch in depth. The anterior end has no tendrils, but at the posterior end the case is contracted almost to a point, and has two tendrils about five inches long. The parent is quite unknown at present.

OVO-VIVIPARITY.

The Shovel-nosed Rays and their allies, such as the Fiddler Ray, produce beautiful golden pillow-shaped eggs; these are not laid, but hatch within the body of the parent, wherein the rolled-up "temporary egg-shell" may sometimes be found.

[9] *Journ. Malay Branch Roy. Asiat. Soc.*, v, 1927, p. 355.
[10] *Bull. Raffles Mus.*, v, 1931, p. 63, fig.

Mermaids' purses or Skates' eggs: Figure 16, Raja nasuta from New Zealand (after Waite); 17, R. nitida from Flinders Island, Bass Strait; 18, R. lemprieri from Tasmania; 19, White-spotted Skate (Raja sp.) from off Babel Island, Bass Strait; 20, R. dentata from Port Phillip, Victoria; 21, R. australis from off Botany Bay, New South Wales; 22, "Stringybark egg" of R. scabra ? from Tasmania; 23, side view of a similar egg from Flinders Island; 24, egg from Tinder Box Bay, Tasmania; 25, Irolita ? from Portland Bay, Victoria.



"Mermaids' purses" or Skates' eggs.

Sharks and Rays whose eggs hatch in this manner are termed *ovo-viviparous*. It is only a step from these to the truly viviparous forms, like the Grey Nurse (*Carcharias arenarius*), which sometimes becomes egg-bound in captivity.

SKATES.

Skates' eggs are the true "mermaids' purses" or "skate-barrows", and there are various forms of them. So far only one or two Australian species have been positively identified, but an assortment is here illustrated in the hope that they may be recognized in future, and I have sorted them geographically, associating each with a species from its locality. A very curious Tasmanian type of egg has a covering like that of a "stringybark" tree, but most of the other species are smooth, though they may have slime to which sand and debris become attached.

In England, skates' eggs vary from $2\frac{1}{2}$ by $1\frac{1}{2}$ inches (Cuckoo Ray) to over seven by five in the Bottlenose Skate, which takes over 14 months to incubate, whereas the Thornback Ray develops in $4\frac{1}{2}$ to $5\frac{1}{2}$ months. We know nothing about the development of the Australian ones. The European Skate (*Raja clavata*) first lays eggs when it is about nine years old.

Common Skate, *Raja australis* ? (Figure 21).—Dark brown eggs, about $2\frac{1}{4}$ by $1\frac{1}{4}$ inches, sometimes coated with slime and debris. Trawled off the New South Wales coast.

Victorian Skate, *Raja dentata* ? (Figure 20).—Black eggs, $1\frac{3}{4}$ by $1\frac{1}{4}$ inches, with long horns. Sides woolly. Found on Victorian beaches.

Thornback Skate, *Raja lemprieri* ? (Figure 18).—Dark brown, almost blackish eggs, $1\frac{3}{4}$ by $1\frac{1}{4}$ inches to about $2\frac{1}{2}$ by $1\frac{1}{2}$ inches, closely striated longitudinally. The horns are spread-eagled and sometimes have squarish sunken areas. Tasmania. Some larger Bass Strait examples are invested with a substance clinging to two spherical objects near the posterior sides of the egg.

Rough-backed Skate, *Raja nitida* ? (Figure 17).—Rather squat, broad-flanged, blackish to brown eggs, with one face flat and the other convex, as is often the case in skates' eggs. The horns are short and the eggs measure about $2\frac{1}{4}$ inches in length and $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in width.

The trawlers bring them up from eastern Bass Strait.

Also, in the same waters, 70 to 100 fathoms deep, are the eggs (Figure 19) of a white-spotted skate (*Raja* sp.) only known from a baby taken from an egg $2\frac{3}{4}$ by $1\frac{1}{2}$ inches and similar in shape to that ascribed to *R. australis*.

New Zealand Skate, *Raja nasuta* (Figure 16).—The egg of this species has been positively identified from material in the Portobello Marine Fish Hatchery. It is large, 4 to 5 inches by $2\frac{1}{2}$ to $3\frac{1}{4}$ inches, brown, and has long slender coronal horns and short stumpy posterior ones. The adult is called *Whai*, and the egg *Hau*, by the Maori. Eggs have been found in Bass Strait, New Zealand (mostly off the South Island), and the Chatham Islands.

The eggs of the Long-tailed Skate of New Zealand (*Arhynchobatis asperrimus*) are unknown.

Round Ray, *Irolita waitii* ? (Figure 25).—An unusual kind of egg, which I have found in numbers on the beaches of Phillip Island, and which is also common at Portland Bay in Victoria, may, or may not, belong to the South Australian Round Ray. The capsule is smooth and polished, thin, and not symmetrical in shape, having a swollen, contorted appearance. The horns are lopsided, twisted and brittle. Colour golden brown to black. Length 2 to 3 inches, breadth $1\frac{1}{4}$ to $1\frac{1}{2}$ inches.

"Stringybark" Eggs.

(Figures 22, 23 and 24.)

We now come to a curious set of quadrangular eggs; because of their bark-like shells, with longitudinal grain and woody character, I call them "stringybarks", but the rays or skates which lay them are quite unknown at present.

Figure 22 is from a sketch I made in the Museum at Hobart of a Tasmanian specimen, dusty brown in colour. Attached to it are anchorage-fibres like dark purplish-brown wool. The exit end is guarded by split flanges which curl over the cervix, as shown in Figure 23, which is from an Australian Museum example trawled in Bass Strait. These eggs measure from 6 by 2 inches up to 8 by 3½ inches, and the actual egg-chamber is lens-shaped, smooth and black inside. Thirdly, there is the Tinder Box Egg, shown in Figure 24, from a specimen in the Museum at Hobart from Tinder Box Bay, Tasmania. It is 7 by 3¼ inches, straw yellow in colour, fairly smooth, with fine grain. Egg-cavity well rounded. The Australian Museum has an even larger one, 9 by 4¾ inches, the largest Australian skate's egg known, in which the egg-cavity is 4 by 2¾ inches. It was trawled off southern New South Wales, and is brown and wood-like.

If we can associate this great egg with the largest Australian skate, then it may be that of *Raja scabra,* which grows to 5½ feet in length and is trawled off New South Wales and Victoria, though it has not yet been recorded from Tasmania.

But then we know so little of our deep-sea animals that it is possible that the only record we may have of a species in a given locality may be its egg-shells. In Antarctica there is a species of Skate (*Raja arctowskii*) whose very existence is deduced only from its egg-shells.

GHOST AND ELEPHANT SHARKS.

We now come to the very distinctive eggs of the extraordinary Ghost Shark and Elephant Fish, which are deep-sea sharks with only one gill-opening on each side, curious dental plates in the mouth, and a dorsal spine which can be raised and lowered.

Ghost Shark (*Chimaera ogilbyi*). (Figure 26.)

The eggs are somewhat tadpole- or skittle-shaped (rather like the 'pen' of a squid), light brown, thin, papery, brittle, and minutely sculptured. There is a flap at the broader end, and water is filtered through apertures with saw-like guards, which later burst open for the young to hatch. There are narrow webs, keels, and perhaps a terminal filament, outside the main sheath of the eggs, which measure nearly 10 by 1¾ inches. The female carries a pair of these eggs protruding from the body for some time before laying them.

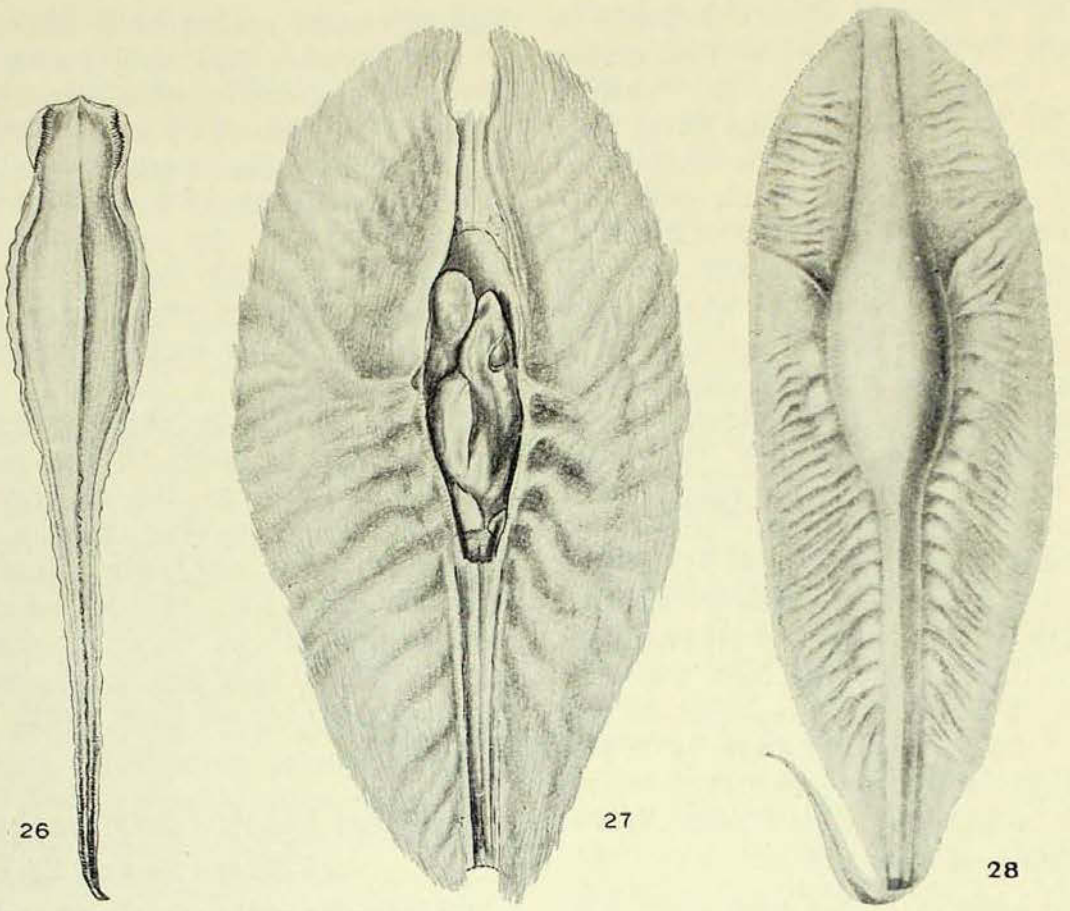
Ghost Sharks in other countries have been known to breed in any month, soon spawn again, and the embryo probably spends nine to twelve months in its egg-capsule. The egg here illustrated was trawled by the "Endeavour" in 230 fathoms, south of Cape Everard, in Victoria. The Ghost Shark is also found in very deep water off New South Wales and Tasmania.

Elephant Shark (*Callorynchus milii*). (Figures 27 and 28.)

This extraordinary shark, which has a boot-shaped proboscis, lays a dark brown, leathery egg of unusual snow-shoe or racket shape and with frayed edges. The egg-capsule is long and tadpole-shaped, but the webs are broad and waved into ridges (rugae) with whiskery surfaces. Slits act as entrances for the water, there being no saw-edged guards (serrulae) as in Ghost Shark eggs. The Australian Museum has eggs from Tasmania and New Zealand, and one measuring 10½ by 5½ inches from that Dominion, and containing a baby shark, is here illustrated (Figure 27).

An Australian Elephant Shark egg (Figure 28), about fifteen inches long by a little over two inches wide, long and narrow, and with a pointed 'tail', was collected at the beginning of the nineteenth century by Péron and figured by Dean,[11] who had studied several specimens of Australian capsules, probably referable to two species, in the Museums of London, Copenhagen, Harvard, and New Zealand.

[11] *Carnegie Inst. Washington Public.* 32: Chimaeroid Fishes, 1906, p. 33, fig. 15*c*, and, probably, the unlocalized 15*a*.



Eggs of Ghost and Elephant Sharks: Figure 26, Ghost Shark from off Cape Everard, Victoria; 27, Elephant Shark from New Zealand, showing young in egg; 28, Elephant Shark from Australia. (Figure 28 after Bashford Dean.)

Fossil Elephant Shark eggs have been found in other countries.

However tentative my identifications may be, it is hoped that they are not as erratic as that of a Sydney journalist who ascribed a Port Jackson Shark's egg in Taronga Aquarium to "Skipper", the large Grey Nurse (a viviparous species), swimming there. But his remarks were amusing: ". . . . People used to talk about 'Skipper' as one of those he-sharks. They'll only regard her as a kipper now. Thousands of sightseers who saw 'Skipper' on Eight-Hour Day never dreamed that such an event was imminent. 'Skipper' didn't raise so much as a cackle. . . ."

The preparation of this article, over the last twelve years, has involved study of some dozens of eggs in museums as far apart as Europe and New Zealand, in English and Italian aquaria, and in the field from Queensland to Tasmania, also a good deal of study of considerable technical literature, and now I feel we are only on the threshold of the subject.

* * * * *

Postscript.—Since this article was written, Mr. Melbourne Ward has collected a female Marbled Catshark (*Atelomycterus marmoratus*) at Melville Island, Northern Territory. Its egg is $2\frac{3}{4}$ by 1 in., and resembles Figure 15 rather than Figure 13. But the tendrils are short, and the posterior end of the egg, which alone bears them, is preceded by a constricted "waist".

The R. H. Phillips Collection of Fijian Moths

By A. MUSGRAVE

THROUGH the generosity of Mr. R. H. Phillips, the Australian Museum has recently acquired a large collection of Fijian moths secured by him during a residence of thirty years in the Fijian Group.

Mr. Phillips began his collecting in Fiji whilst in the service of the Fijian Government, which he entered in 1908; in 1915 he was an Inspector of Plants, and in 1928, upon retiring from the Government service, he joined the Colonial Sugar Refining Co., and was in their employ for three years.

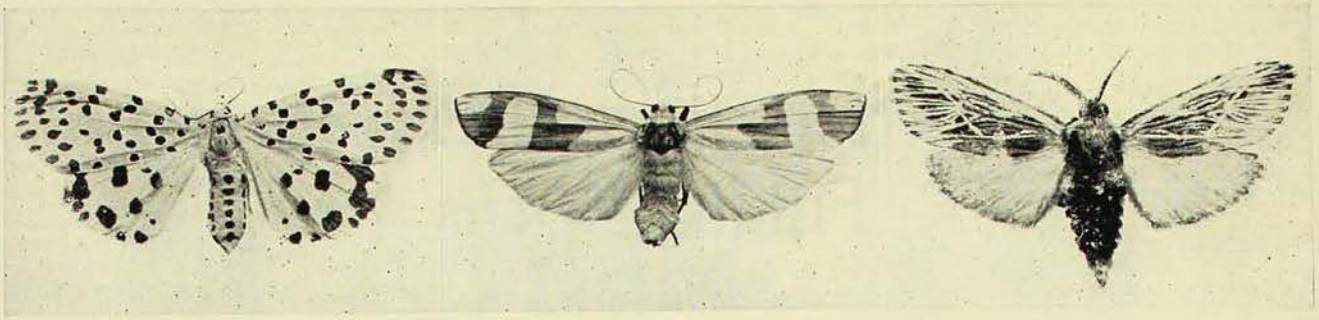
The collection, which consists of some 873 specimens, includes about 400 named species and 455 unidentified specimens, and is set and properly labelled, and two field registers which accompany the collection give additional data as to the food plants of the larvae and other particulars. The identification of the specimens has been undertaken for the most part by specialists in England, where many families have received the attention of Mr. Edward Meyrick (whose death was reported from London in April of this year). In his serial work, *Exotic Microlepidoptera*, appear the descriptions of the new species collected by Mr. Phillips and other Fijian entomologists, and on looking through this work from 1930 onwards, one is struck by the constant recurrence of Mr. Phillips' name in connection with Fijian moths. Mr. Louis B. Prout,[1] of Tring Park Museum, has also described a number of species of Geometridae collected by Mr. Phillips. Mr. W. H. Tams,[2] of the British Museum (Natural History), has also described and figured an Agaristid Moth, *Scudyra bostrychonota*, from Lautoka, Fiji, collected by Mr. Phillips, specimens of which are in his collection.

Mr. R. H. Phillips.
Photo. Howard Harris Studios, Sydney.

Mr. Phillips has kindly furnished me with a few remarks on the conditions of insect life in the Fiji Islands, which might perhaps help to influence anyone who was possibly considering a trip there.

The main island, Viti Levu, although no more than about 100 miles in diameter, has a very great range of climate. The north-east, north, and north-west coast is dry and hot, and has variations as it rises from sea-level to 4,000 feet. There is a great change in plant life at these varying levels, and con-

[1] Prout: *Stylops*, 3 (11), 1934.
[2] Tams: *Entomologist*, 62: 1929.



Rhodogastria astraeus Drury, 1773 (Arctiidae).

Oeonistis entella Cramer, 1779 (Arctiidae).

Acritocera negligens Butler, 1886 (Cossidae).

Asota woodfordi Druce, 1888 (Hypsidae).

Hypargyria metallifera Raginot, 1888 (Crambidae).

Dasychira fidjiensis Mabille and Vuillot, 1890 (Lymantriidae).

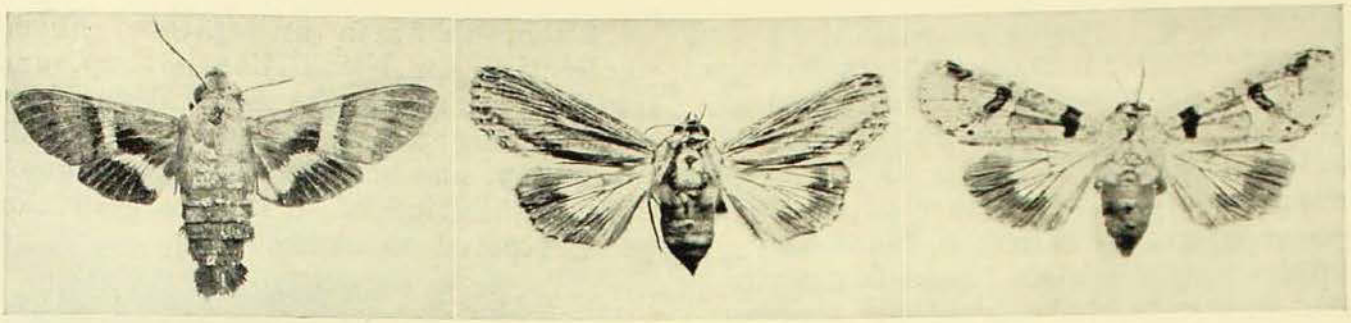
Photo.—A. Musgrave.

sequently in the insects that feed on them. After 3,000 feet insect life in this zone becomes scanty. Travelling in either east or west directions towards the south, conditions become gradually more tropical, until dense jungle is met with, and this teems with insect life. Making into the interior, the jungle persists to the highest levels, though a great variation of plant and tree life is met with, and insects are taken which are rarely met with on the lower levels or on the dry side. This is the country of almost incessant rain. To a certain extent these conditions of wet and dry zones are met with on the other large islands; there are over 200 islands in the Group. The larger outlying ones could be visited at small expense, and in the farthest out, where perhaps the destructive bulbul and mynah have not penetrated, there may be treasures worth the pains of collecting. The insect life on Rotumah, a well isolated group some 200 miles to the north-west, might well be interesting. A cargo and passenger boat goes occasionally, and it is probable that a passage on the Government steamer could be arranged through the Travel Bureau. There are excellent rest houses provided by the Government at various centres, at which the charges are moderate, and stores always available. There is a very efficient Tourist Bureau in Suva, where all information and assistance are obtainable. The C.S.R. Company at Lautoka have a very comprehensive collection of general insects of Fiji, and there is another at the Agricultural Department at Suva. The Department will always be found ready to advise on the districts proposed to be worked. There is a motor road right round the island, and there is a daily bus service; the fares are reasonable. Travel between the smaller islands is chiefly by native cutters, and would best be undertaken as advised by the Travel Bureau, who would instruct as to what stores would be necessary. Lodgings on these trips would be in native villages, and, though doubtless the visitor would go armed with net and cyanide bottle, still it would be as well to add a tin of Keating's powder to the list, or insects that were not needed might be inadvertently collected.

THE HISTORY OF MOTH-COLLECTING IN FIJI.

In dealing with Mr. Phillips' collection a few words might not be out of place on the history of moth-collecting in Fiji, so as to place Mr. Phillips in a proper perspective among his confrères of the butterfly net and killing bottle.

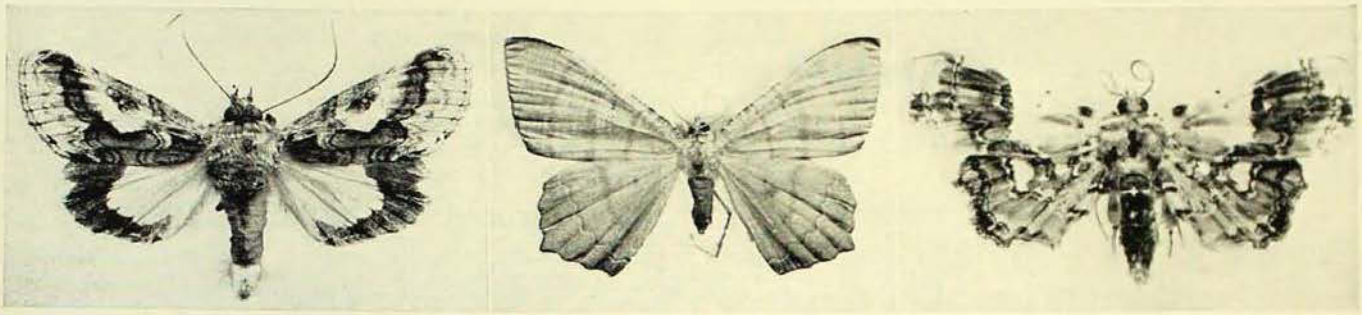
Among the first collectors to visit the Group were the early French explorers in their quest for the missing vessels of La Perouse. In 1824 the *Coquille*, under L. I. Duperrey, visited the Group and neighbouring islands, but apparently no



Macroglossum hirundo vitiensis Rothschild, 1903 (Sphingidae).

Stictoptera vitiensis Hampson, 1912 (Noctuidae).

Stictoptera vitiensis Hampson, 1912 (Noctuidae).



Seudyna bostrychonota Tams, 1929 (Agaristidae).

Bulonga philippsi Prout, 1930 (Geometridae).

Aeolopetra palaeanthes Meyrick, 1934 (Pyraustidae).

Photo.—A. Musgrave.

records of moth captures exist. From May 25 to June 8, 1827, the French corvette *Astrolabe*, under the leadership of Dumont D'Urville, was in Fijian waters, and accompanying the vessel were such well-known collectors as Lieut. C. H. Jacquinot and the surgeons J. R. C. Quoy and J. P. Gaimard and P. A. Lesson. In 1838 the corvettes *Astrolabe* and *Zélée*, also commanded by Dumont D'Urville, touched at Fiji during October of that year. Despite the fact that six members of the expedition, including the leader, made collections of insects, no Fijian moths appear among the insects described in the scientific results of the expedition.

European settlement did not take place until 1835, when the first missionaries became established there. Thus collecting may be said to date from about 1860, when the great Museum of Godeffroy in Hamburg sent its collectors far and wide into the Pacific. Of these may be mentioned Dr. Eduard Graeffe, Captain Theodor Kleinschmidt, Franz Hübner, Mr. Andrew Garrett; papers on the material collected by them appeared in the journal of the Godeffroy Museum and lists of specimens in the catalogues of the Museum. Among these latter we note Fijian moths, mostly species with a wide range and not native to the Group.

Fiji was ceded to Britain in 1875, and in the previous year H.M.S. *Challenger*, while on her voyage round the world, spent some time there. Collectors now began to pay more and more attention to these islands, and the names of Fijian insects appeared more often in scientific journals. Those who are interested in the literature of Fijian entomology will find the more important papers on the subject listed at the end of this article.

Mr. M. Bezzi has pointed out in his work, "The Diptera of the Fiji Islands", with regard to the flies of Fiji, that a careful study of the literature to the end of the year 1925 shows that only a few species had been recorded up to that year. As I have shown, the moths have received somewhat better consideration; nevertheless, it is only during the past decade or so that the study of the moth

fauna of the Group has received any serious attention. With the establishment of the sugar-cane industry, and the growth of such organizations as the Colonial Sugar Refining Co., and the Department of Agriculture of the Fijian Government, it became necessary to employ entomologists to combat pests, so that the study of the Lepidopterous fauna of the Fijian Group was inevitable. Thus we find in literature relating to the entomology of these islands the names of such contemporaries of Mr. Phillips as Dr. Guthrie, R. Veitch, R. J. A. W. Lever, W. Greenwood, H. W. Simmonds (the last-named being the present Government Entomologist) and the donor's son, Mr. C. S. Phillips.

Such, then, is an epitome of moth-collecting in the Fijian Group, and it will be seen that the Australian Museum, in reaping the benefits of Mr. Phillips' industry, has been extremely fortunate in the acquisition of so large a collection of so neglected an order.

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THE MAKING OF A SCIENTIST. By Raymond L. Ditmars. (Angus and Robertson Ltd., Sydney, 1938.) Pp. 223, with twenty-three full-page plates. Price 7s. 6d.

Dr. Ditmars is Curator of Mammals and Reptiles in the Zoological Park, New York, but, as this book indicates, he has a "variety of enthusiasms", including weather lore, volcanoes, fire engines, and the like. It was intended by his family that he should follow a military career, but, fortunately, he obtained employment as a junior assistant in the great American Museum of Natural History, where his first task was the mounting of moths and butterflies. Thus was his future determined.

Most healthy and intelligent youngsters have a lively curiosity concerning the world around them and a natural propensity for keeping pets of various kinds. These admirable traits often disappear in their maturer years, partly because of the discouraging attitude of their elders, partly because life becomes too complicated and exacting. Ditmars has been fortunate in that his youthful hobbies have become his life work. This inspiring and fascinating book tells the story of his struggles and achievements from his first disastrous attempt to keep live snakes in a New York apartment house to the present time when he is recognized as one of the leading authorities on reptiles. He describes his various journeys in search of snakes, lizards, frogs, bats and other creatures; he has thirsted in the deserts of the south-west and struggled through Panama jungles and the hot, steamy forests of Trinidad. The book, which is well illustrated and produced, is written with gusto and a sense of fun, even though the joke is sometimes against the author.

The naturalist will find much in the work to interest and instruct him, for the author is a keen observer, learned in the habits of animals and the whys of things generally. Amongst the most interesting passages are those dealing with the strange frog, found in Venezuela and Trinidad, which as a tadpole grows to a length of fourteen inches, but as an air-breathing frog is only two inches long. No less absorbing is the account of the giant bat of Trinidad, a savage killer in its wild state, but a cleanly and well-behaved creature in captivity.

Chalcedonic Quartz

By T. HODGE-SMITH

IN a previous article the varieties of crystallized quartz were described,[1] and it yet remains to describe the principal varieties of chalcedonic quartz, which differs essentially from crystallized quartz in that it never possesses a regular external form. Further, instead of being a homogeneous mass, it is made up of an aggregate of very small crystalline particles or fibres. The mineralogist describes this structure as cryptocrystalline (*κρυπτός*, hidden) as distinct from phenocrystalline, which applies to ordinary quartz. Its lustre resembles somewhat that of wax, as distinct from the characteristic glassy lustre of quartz. Also it is not quite so hard. The varieties of chalcedonic quartz described here are: chalcedony, sard and carnelian, plasma and bloodstone, agate, and onyx, flint, and jasper.

CHALCEDONY.

The origin of the name is uncertain. The *chalcedonius* of Pliny was certainly not the chalcedony that we know today. It was a green mineral that may have been the modern chrysocolla, a hydrous silicate of copper, which was obtained from the copper mines of Chalcedon, from which it derived its name. Just how the name became transferred from chrysocolla to a substance that is so different in every way is difficult to explain.

Chalcedony is mostly translucent, but may be sometimes almost transparent, while the colour varies from white or grey to various shades of brown. Generally the colour is uniform, but occasionally it may be cloudy or indistinctly banded. It is only exceptionally large translucent stones of uniform colour that are of any value.

It is found as nodules, of more or less spherical shape, or stalactites, either lining or filling cavities in rocks. It is also found as nodules in the soil derived from the weathering of rocks which contained the more resistant chalcedony.

Busts and heads in full and bas-relief were executed by the Romans in chalcedony, and in no other substance do antique works in full relief occur in such magnitude as in this mineral.

SARD AND CARNELIAN.

Sard was the first name to be applied to the reddish or brownish variety of chalcedony. There are several versions as to the origin of the name. One is that it is derived from Sardis, where it was first known; another from the colour of a salted sardine; a third (which is probably correct) that it is derived from the Persian word *sered*, meaning yellowish-red.

Later came the word carnelian, probably derived from the deep flesh-red colour of some of the stones. In modern nomenclature it is usual to use sard for the reddish-brown stones and carnelian for the flesh-red varieties, although it is sometimes difficult to determine which name should be used for a particular stone.

The colour of carnelian is due to an oxide of iron, while that of the sard is due to a hydroxide of the same metal, both of which are present as impurities. It is possible to convert a sard into a carnelian by the simple process of heating, thereby converting the hydroxide into an oxide by driving off water. Carnelian that is pale in colour, due to a deficiency of iron oxide, may be given the proper colour by immersing it in a solution of iron nitrate and subsequently heating. Ordinary chalcedony may be artificially coloured a uniform brown,

[1] "Quartz", AUSTRALIAN MUSEUM MAGAZINE, Vol. vi, No. 5, pp. 176-180

when it is in no way inferior to the natural sard.

The ancients believed that this stone would drive away evil spirits, and, probably because of its colour, it would stanch haemorrhages. Later more virtues were attributed to it, when it was said to baffle witchcraft, drive away fear, and exhilarate the soul, whatever that may mean.

PLASMA AND BLOODSTONE.

Plasma is the green variety of chalcedony, and the colour is probably due to the presence of minute inclusions of a green chloritic mineral evenly distributed throughout the mass.

The ancient name was *prasius*, which was derived from the similarity of the colour to the green of the leek. Later the term prasma appeared, but this included a number of other stones of a green colour.

Of plasma, Orpheus sings: "Hence was I taught thy powerful virtue as a remedy against the sable asp, thou life-saving divine stone."

Bloodstone, sometimes referred to as heliotrope, is really a variety of plasma, but the green is spotted or streaked a blood-red colour. In the National Library, Paris, is a famous statuette in this material representing the scourging of Christ. The carving was so arranged that the red spots represented drops of blood on His garment.

AGATE.

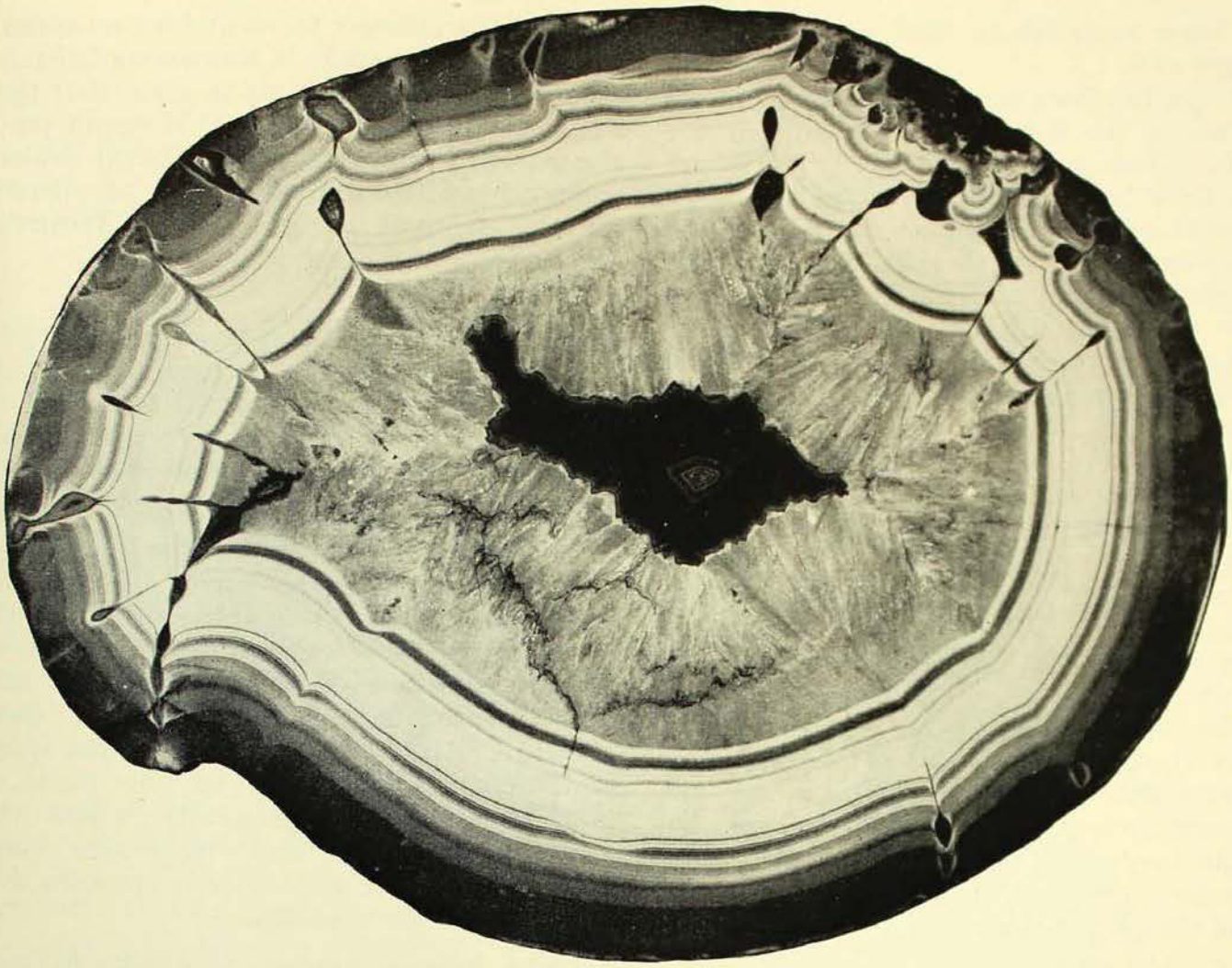
Agate is the most important and best known variety of chalcedonic quartz. It differs from chalcedony only in that it is banded. In typical agate the banding is sharply contrasted both as to colour and transparency. When these become similar the banded structure becomes less distinct and the mineral grades into chalcedony.

The width of any one band is usually uniform throughout its length, but the width of the bands may vary considerably, though mostly they are quite narrow, sometimes exceedingly so. As many as 17,000 definite bands to the inch have been recorded. If a thin plate of such finely banded agate, cut at right angles to the banding, is held to the light it will show a play of colours like a rainbow. These are known as rainbow agates. They are not of much value, this depending almost entirely on the contrast of colour and transparency of the different bands.

As agates are formed by the deposition of silica, from solutions intermittently supplied, on the walls of irregular cavities in rocks, the concentric waving course of the bands coincides with the irregularities of the cavities. If the cavities happen to be spherical, then the banding will be concentric circular. Occasionally the banding is arranged in an angular pattern like the plan of an old fortress, when the stone is known as Fortification Agate.

Agates were highly prized in very ancient times. Theophrastus described it as "a handsome stone from the River Achates in Sicily, and sold for a high price". This is the first locality from which agates were obtained, and doubtless the name is a corruption of Achates. It was not until the fifteenth century that agates were found to occur in large quantities near Oberstein and Idar on the banks of the River Nahe, Germany. The industry of cutting and polishing agates was established at Oberstein, where it has remained ever since. The supply of agates in these areas becoming depleted, it became necessary to look for other fields. In 1827 came the discovery in the Province of Rio Grande do Sul in southern Brazil of agates which for size and beauty excelled anything hitherto known.

Just prior to the discovery of agates in Brazil the German agate-cutters found that agate was porous, in spite of its compact appearance, and could be made to absorb colouring agents. Further, the different layers comprising the mineral possessed differences in porosity and therefore differences in absorption of the colouring matter. The colours are permanent, and more pleasing contrasts may



Agate from Serra do Mai, Brazil, measuring 10 inches on the longer diameter. The dark bands have been artificially coloured blue. Crystals of quartz can be seen radiating from the agate toward the centre, which is composed of chalcedony. Australian Museum exhibit.

be obtained in this way than is found in the natural stone. Probably the majority of agate ornaments of modern times have been coloured in this way.

Agates were once used extensively as ornamental stones, and in the middle of the nineteenth century agate jewellery was most fashionable. With the advent of so many artificial products suitable for ornamental work, the agate has largely been displaced, though it is doubtful whether there is anything to equal the genuine agate ornaments produced by the Oberstein workmen.

Moss Agate differs from ordinary agate in that its variegated nature is not due to banding, but to visible inclusions which have a moss-like or dendritic form. It would be described more correctly as chalcedony with dendritic inclusions.

ONYX.

Onyx is a variety of agate in which the various layers are in even planes and the banding is straight. The principal colour variations are black and white, and red or brown and white, the latter being known as sardonyx.

The origin of the stone, according to Greek mythology, is as follows: "Cupid with the sharp of his arrow, cut the nails of the sleeping Venus, which fell into the Indus; but as they were of heavenly origin they sank, and became metamorphosed into onyx." The name is derived from the similarity of the colour

of some varieties to that of the human finger-nail.

Onyx has been used chiefly for cameos, in which the figure is carved out of the light colour and stands out in relief on the dark background. Perhaps the most famous of antique cameos is that on the Mantuan vase, which was made from a single stone and is seven inches high and two and a half inches wide. The base is brown and on it in relief are carved several groups of white and yellow figures.

The term onyx is sometimes used to describe a variety of limestone with similar colour bands to that of true onyx. The ancient writers seem to have used the term to describe any banded stone, and a good deal of confusion has thus arisen. For instance, it has been recorded that Mithridates, King of Pontus, possessed 2,000 cups of onyx. It is almost certain that these were not the true onyx, but onyx-marble or Mexican Onyx, as the banded variety of limestone is known. To avoid confusion, some writers have used the term Oriental Onyx to designate the true chalcedonic onyx.

JASPER.

Jasper is an impure almost opaque variety of chalcedonic quartz, usually of red colour, but yellows, greens, and greys are not uncommon. The jasper of the ancients was apparently quite a different stone, as it is usually described as a translucent green mineral. The Greek name Ἰασπις, according to Isodore, "signifieth green, and such a green as doth illustriously shine forth with a very supreme viridity or greenness of glory". As it was supposed to benefit the mouth and chest of the wearer, one is tempted to wonder if Isodore wore a jasper when he spoke of the stone as above.

Often the colours form stripes or zones in the stone, when it is known as Riband Jasper. It is interesting to note that the Trustees of the Australian Museum purchased from an American mineral dealer a very beautiful polished slab of riband jasper from Marble Bar, Western Australia.

FLINT.

Flint is allied to chalcedony, but is much more opaque, with a dark grey or brown to almost black colour. Often the exterior of nodules is coloured white.

In eastern England and western Europe it occurs in the Middle and Upper Chalk Formations, where it forms irregular nodules and veins. The chalk, which consists of carbonate of lime, contains a number of sponge spicules and tests of other organisms, both composed of silica. Water dissolves this silica and deposits it again in the form of nodules or veins, generally where the siliceous spicules and tests are most abundant. Often undissolved spicules will be found in the nodules.

Flint breaks with a shell-like or conchoidal fracture, producing very sharp cutting-edges. Palaeolithic man thus learned to use flint in the manufacture of his cutting tools long before man discovered the use of metals for this purpose.

The discovery that sparks were produced when iron pyrites was struck by flint is said to have brought about the percussion method of fire-making. In the flint-lock musket, the standard equipment of the British army until 1840, the charge was fired by sparks produced by the striking of a piece of flint by a steel hammer.

Miss Joyce Allan's contribution on Australian shells was unavoidably held over. It will appear in the next issue.

Australian Insects

III. The Collembola or Springtails

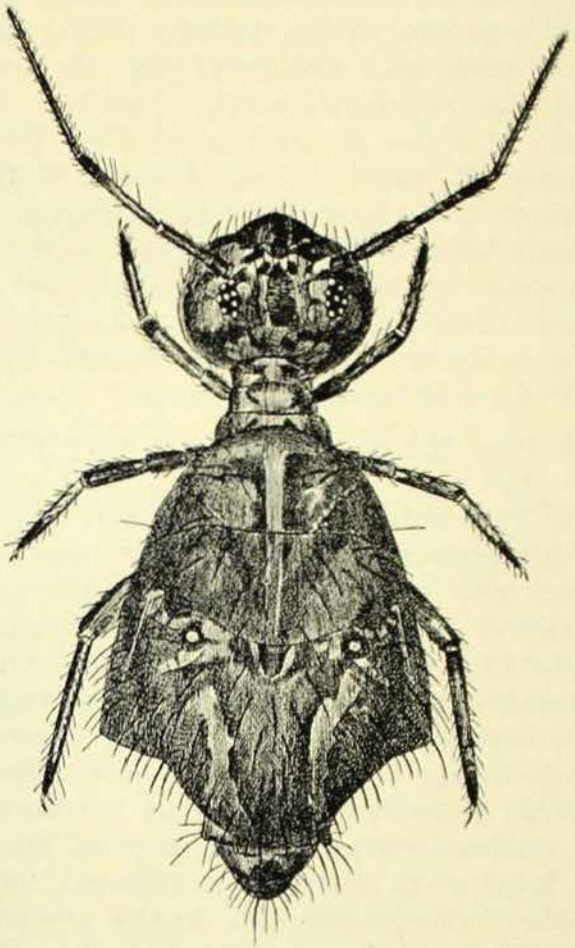
By KEITH C. McKEOWN

THE insects comprised in the order Collembola are of very small size, and like those of the preceding order, the Thysanura, primitive. They have been found preserved in the amber-beds of Europe, and, truly remarkable with such fragile and soft-bodied insects, they have been definitely identified as fossils from the Rhynie chert-beds of Scotland of Middle Devonian age, and are thus amongst the oldest insects known. It will be seen, therefore, that they are of ancient lineage.

On account of their insignificance and retiring habits, the Springtails usually escape observation by the average nature-lover, or at most attract but a casual glance. Until recent years the same was largely true of the attention they had received from the scientist, but since Mr. H. Womersley, Entomologist, South Australian Museum, has devoted himself to their detailed study, many species, both indigenous and introduced, have been added to the Australian fauna. In 1934 the total species recorded from Australia was about 170, but since that date a number of species have been added to the list, so that possibly some two hundred of the insects are now known from our continent. There is little doubt that many more await description; the insects should be carefully collected and preserved in 70% alcohol, so that they may be submitted to a specialist for examination.

Those species which may be classed as immigrants from overseas have, in all probability, entered the country in soil about the roots of plants, or similar media.

The popular name for the Collembola is "Springtails", and one has only to watch the little creatures for a very short while to realize how apt the term is, for, as they move about, they are continually leaping up into the air in an apparently effortless manner. On a superficial examination the source of their ability is not apparent, for the legs are short, although well developed. Here are no long, specialized jumping legs with thickened thighs, such as we find in the grasshoppers and their allies, or in the elusive



Sminthurus viridis, an introduced species of Springtail destructive to lucerne and clovers.
After Lubbock.

flea. How, then, do they leap so nimbly? From the fourth or fifth segment of the abdomen springs a slender, tail-like appendage terminating in a forked process. This is the *furca* or spring. When the insect is at rest, this furca is folded down under the body with its tip pointing forwards. It is held in this position by a curious catch or *hamula*, placed on the third segment. When the little creature wishes to leap, the catch is released, and the furca, by its own elasticity, springs erect, hurling its owner into the air as though shot from a catapult. On the first segment of the abdomen there is another appendage like a short tube, from which a pair of long filaments can be protruded; this tube is called the *collophore*. Its purpose appears to be unknown, but it is surmised that it is of an adhesive nature.

In form the Springtails are very variable, and their appearance is best conveyed by the accompanying illustrations. As already mentioned, many are of minute size, ranging from about 0·2 mm. to some 6 mm. in length. They live in all sorts of situations, and usually occur in immense numbers in soil, rotting vegetable matter, and fungi. Some species attack living plants; others have been recorded as feeding in decaying barnacles and molluscs. Ranging as they do from the tropics to the polar regions, the insects are very adaptable to the prevailing conditions. One species, living in the Antarctic, provides a wonderful example of an insect which has adjusted itself to life in a climate which would prove fatal to most creatures. For the greater part of the year the Springtails are frozen in the ice, but when the summer sun, shining on the dark rocks, melts their prison, they take up their life once more. It may be only a couple of days, or possibly only an hour or two, before they are again gripped by the cold and immured for a further prolonged period. During their short interval of liberty, life is carried on at a furious pace, for the insects must feed, mate, and deposit their eggs within the short space of time at their disposal, for who knows when a further period of activity will be granted to them. Few insects can live in such a remarkable manner! Collembola have also been recorded as swarming in immense numbers over the surface of snow at high altitudes.

The late Dr. R. J. Tillyard has written of the Collembola, and he says:[1]

> During the past twenty years or more, there has been a growing realization of their great importance economically. Researches by forest entomologists have shown that the preparation of the primeval forest floor out of the bare original elements of disintegrated rock and unconverted plant humus has been, through countless ages, the task designed by Nature for these tiny insects and another important soil group, the Mites. Some thousands of species are now known, of which the great majority are ceaselessly engaged upon the work of preparing minute particles of humus and incorporating them in the soil.
>
> But, as in almost all cases of insect groups, there are specialized forms which have broken away from the original rôle and have taken on a new line of evolution. Among these are the Globular Springtails, or family Sminthuridae. . . . These insects have departed from the original habit of feeding on rotting or decayed vegetable material, and have adopted instead the habit of attacking the delicate tissues of living plants. In their natural surroundings, owing to their small size and to the delicacy of their mouth-parts, the damage which they do is generally (though not by any means always) too slight to be considered an economic loss. But, through his manifold activities, Man has provided two means by which these insects are enabled to increase their activities so as to become definite economic pests: (1) by introducing into new countries richer and more tempting pasturage, so that native species tend to transfer their activities from the native flora to the introduced plants, and (2) by the accidental introduction of dangerous species into new environments, where the more suitable climatic conditions enable them to leap ahead and to become formidable as pests.

The life-history of the Springtails is simple. The eggs are laid with apparent casualness in the soil or among the decaying vegetable matter on which the parents feed. Once the eggs are laid they are left to their fate, and the young, on hatching, to their own devices. The tiny nymph is a minute replica of its

[1] Commonwealth of Australia Council for Scientific and Industrial Research, Pamphlet No. 34, 1932, p. 5.

parents, from which it presents no structural differences, but is usually somewhat lighter in colour. As the little creature grows, it moults its skin some seven or eight times. After moulting the insect is pale in tint, but with exposure to air and sun it soon resumes its normal coloration. At no time in its life does the Springtail develop wings; like the other primitive insects, it can never enjoy the pleasures of flight, but perhaps its power of jumping is some compensation. No details are available concerning the duration of life in these strange little insects. An almost unexplored field lies before the investigator who devotes his time to the observation of the habits of the Springtails, and his patience should be amply rewarded.

Sir John Lubbock has described the courtship of a European species of Springtail in a very entertaining manner. He says:

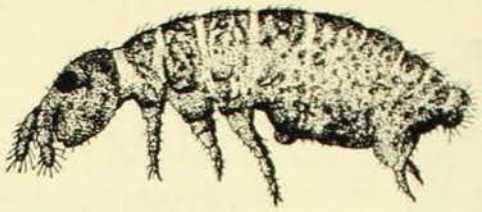
> It is very amusing to see these little creatures coquetting together. The male, which is much smaller than the female, runs round her, and they butt one another, standing face to face, and moving backwards and forwards like two playful lambs. Then the female pretends to run away and the male runs after her with a queer appearance of anger; gets in front and stands facing her again; then she turns coyly round, but he, quicker and more active, scuttles round too, and seems to whip her with his antennae; then for a bit they stand face to face, play with their antennae, and seem to be all in all to one another.[1]

The order Collembola is divided into two sub-orders:

> Elongate insects with thorax and abdomen clearly segmented ..... Arthropleona
> Globular insects with ill-defined segmentation ..... Symphypleona

One of the commonest species is *Hypogastrura armata* (Nic.), which frequently attacks mushrooms, eating out large areas of the soft tissue and filling them with galleries and tunnels, and rendering them quite unfit for human consumption. This, together with another species (*Brachystomella parvula* Schäffer), is often washed out of the soil by heavy rains, when it covers the surface of small pools of casual water with a blue scum.

[1] Monograph of the Collembola and Thysanura, Ray Society, London, 1873, p. 109.

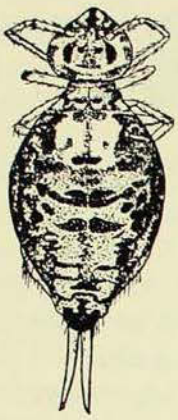


Brachystomella parvula, one of the Springtails which attacks mushrooms. When washed from the soil by rain, these insects form a blue scum on the water in pools.
After Womersley.

Under the lens this scum will be seen to be composed of hundreds of thousands of the tiny dark purplish-blue insects ceaselessly springing up and down upon the surface film of the water, from which they seem unable to crawl away and must remain floating about until the wind blows them to the edge, or the water dries up. When fungi are absent, I believe that this insect lives on the humus in the soil.

Sminthurus viridis L., an introduced species, the so-called Lucerne Flea, is an important economic pest attacking the foliage of lucerne and clover. The Clover Springtail would be preferable as a popular name. In South Australia and Victoria this species is responsible for enormous losses in these crops. It is a striking example of an insect which has been brought accidentally from its native land to a new country, where, free from its enemies, it has been able to increase without restraint. It is possible that certain of our native mites prey upon their soft bodies, but otherwise, beyond the control exercised by climatic conditions, there is little to retard their increase.

A comparatively large species of Globular Springtail was discovered by the writer at Leeton, New South Wales, some years ago. In the early morning hours, when the dew was still wet upon the foliage, one would find these curiously marked slate-grey or greenish insects resting singly upon the extreme tip of the leaves of the orange trees. Here they would sit motionless, often completely



A curious native Springtail, Parakatianna obscura, which rests in drops of dew collected on the foliage of orange trees.
After Womersley.

immersed in the drop of moisture that clung to the leaf. When disturbed they would make all haste to spring away into the depths of the foliage. As the sun climbed higher in the sky and the moisture dried up, these strange little insects would disappear, possibly hiding themselves in the tangled branches in the centre of the tree. Although I studied the insects carefully over a considerable period, I was unable to discover anything regarding their life-history, or even upon what they fed. This species has been named *Parakatianna obscura* by Mr. Womersley.

HARPOONS AHOY! FIGHTING THE GREAT SPERM WHALES. By Will Lawson. (Angus and Robertson Ltd., Sydney, 1938.) Pp. 219. Price 7s. 6d.

This is an enthralling and full-blooded story of the whaling days of the eighties, when the great sperm whale was hunted in the South Seas by ships of many nations. The tale is based on the experiences of the late Captain Bill McKillop, the last of the old whalers, who, apparently, figures in the book as Dave McKinnon, boat-steerer of the *Water-witch*.

Hobart Town was the most important base of the colonial whalers, and, after exciting battles with big bulls, and exhausting struggles with storms that came roaring up from the Antarctic, the ships, with their casks of oil, would make for the bright lights, the girls of Hobart Town "pulling hard on the tow-lines". These were the days when the whales were pursued in row-boats, harpooned by hand, lanced to death, and flensed alongside. How different is present-day practice, when the harpoon gun hurtles the deadly weapon, a bomb in its head, from the bows of a "chaser". "That ain't whalin', that's murder", says the old hand.

These were lively times in Hobart Town, and broken heads were not uncommon when the bay was full of whaling ships. For the whalers loved a fight. "P'raps we'll meet some man-o'-war's men there. Then we'll have a real fight", says Porky Sullivan. And they were a tough lot, these old whalemen, hardened by bitter toil and bitter weather. When Porky was hit on the head with a three-pound hammer he rubbed the injured part and remarked, "Begob! I believe the poor bloke is silly". Sometimes a harpooned whale would turn on its pursuers and with teeth and tail inflict serious damage on boat and men. But whale wounds seldom mortify, as old Jim Falconer consolingly told Mac, who had sustained a broken arm in one of these encounters.

"Once in the *Wallaby* with Captain Wishart I seen a cove almost cut in two. But he got over it. It's the salt an' the oil, I suppose—an' the rum."

This lively tale is not without interest for the zoologist. There is a fine description of the habits and haunts of the sperm whale and brief accounts of the animal inhabitants of the sub-Antarctic islands. But it is doubtful whether any breeder will credit the story of the strange sheep of the Campbells, which, after generations of foot-rot, are *born* without hoofs.

The New Meteorite Exhibit in the Australian Museum

IN accordance with the policy of the Trustees that the exhibits in the galleries of the Museum should be made equally as instructive to the ordinary visitor as they are to the student of a particular subject, the meteorite exhibit has been removed to a new location in the wall cases at the western end of the mineral gallery, and completely reorganized.

A space of twenty-one feet by seven feet is given up entirely to an introductory series. This has as its first label "Falling Stars or Meteors", accompanied by a painting of a meteor shooting across the sky with a typical Sydney Harbour background. The painting was done by a student of the art class of the East Sydney Technical College, under the direction of the Acting Lecturer-in-Charge, Mr. E. C. Walters.

Then follows a number of large labels which are headed by questions which experience has shown are repeatedly asked by the ordinary visitor. These questions are answered on the labels in non-technical language. The final label of this series is headed by the question: "Do they ever reach the earth?" The answer given to this question is: "Yes! Many must be lost in the depths of the ocean. Only a relatively few have been seen to fall on the ground. Up to date about a thousand have been found. The captured stars are called *meteorites*." Thus the definition of a meteorite is given.

The varying size of meteorites is illustrated by a cast of the Gladstone meteorite (Queensland), which weighed fourteen and a half hundredweight, and a cast of the four-and-a-half-ounce Emmaville meteorite (New South Wales).

The next exhibit illustrates the composition of meteorites by examples of an iron (siderite), iron and stone (siderolite), stone (aerolite), and a glass (tektite) meteorite. The various minerals found in meteorites are then shown. The structure of the irons is illustrated by an etched slice of the Henbury (Central Australia) meteorite showing the octahedral arrangement of the nickel-iron alloys constituting the well-known Widmanstätten figures. The cubic pattern so characteristic of the hexahedrites is shown by an etched slice of the Bingara iron (New South Wales), while the structureless ataxite is shown by a polished surface of the Santa Catharina iron (Mexico). The chondritic structure of many of the stone meteorites is illustrated by a microphotograph of the Barratta stone.

Next comes the question of the speed at which they reach the ground. This is illustrated by a diagram of the position of the three-and-a-half-ton Cranbourne meteorite (Victoria), which was almost entirely buried under the ground when found. Another label tells of others which barely make an impression on the ground. The manner in which some large meteorites explode, forming huge craters, is illustrated by diagrams and photographs of the famous Henbury craters. A mass of iron weighing 105 lb. and a cast of another weighing 96 lb. are exhibited. An etched section showing normal Widmanstätten figures is exhibited with one showing a distorted pattern due to the mass having been torn and bent by the force of the explosion. Specimens are shown of the crater rock fused by the heat of the explosion either to little black blebs or to a sponge-like mass.

This completes the introductory series, and an exhibition of Australian meteorites follows. Of the 78 known Australian meteorites, 50 are included in the collection. Where possible, a cast of the meteorite is shown along with the specimen. The Baratta fall is represented by specimens of four separate masses, the Gilgoin by five, the Bingara by four, and the Cranbourne by three. Owing to the presence of much lawrencite (chloride of iron), which readily decomposes under atmospheric conditions, the Molong meteorite (New South Wales) has to be kept in a glass vat filled with paraffin.

Lastly, seventy-four foreign falls are represented, making in all a collection of one hundred and twenty-four meteorite falls, which is the largest collection of meteorites in the southern hemisphere.

T. Hodge-Smith.

Australian Parrots: Their Habits in the Field and Aviary, by Neville W. Cayley. (Angus and Robertson, Ltd., Sydney, 1938.) Pp. 332, 11 coloured and 15 half-tone plates. Price 12/6.

This, the fourth of Mr. Cayley's books about Australian birds, must be regarded as the best of the series. The subject lends itself peculiarly to pictorial representation, and the paintings are some of the best the author has made. However, the matter of the book is also of a high standard, the plan adopted being excellent. The technical name, with original references, is given, and here Mr. Cayley has wisely followed the best authorities, discarding many names incorrectly accepted elsewhere. Then follows a description of the bird in all stages of plumage, and, as usual in Mr. Cayley's works, a drawing indicating all the technical terms as added, so that everyone can understand the descriptions. The history of each species is given, with map showing its distribution, and, as these birds attracted the attention of all the early voyagers and settlers, an insight into Australian development is gathered from a study of this book, a rather unexpected place for instruction in Australian history. A special feature in this connection is the reproduction of early sketches and illustrations, a novel item of the greatest value and establishing this volume as a memorable work of reference. The field habits are detailed from the fullest information available, and then to complete the review excellent aviary notes are included. These birds have from the earliest times been favourites as cage birds, but now we find aviculturists coming to the assistance of science by preserving almost extinct forms and inducing them to breed. For this purpose these aviculturists, who deserve great praise, have built huge aviaries so that the birds are being kept under almost natural conditions. The near extinction of such birds was due more to the cultivation of their haunts than to any attack upon the bird life, and the reproduction of these conditions in these aviaries has definitely saved some species. Altogether the book can be recommended to everyone interested in Australian birds, and the publishers must also be congratulated upon this fine production, which is a credit to Australian workmanship. The reproduction of the plates, the clear printing, and the whole get-up cannot be criticized.