The AUSTRALIAN MUSEUM MAGAZINE

Vol. VI, No. 10. APRIL-JUNE, 1938. Price—ONE SHILLING.

Rosella.

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

THE AUSTRALIAN MUSEUM

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THE AUSTRALIAN MUSEUM MAGAZINE

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

● OUR FRONT COVER. The Rosella (*Platycercus eximius* Shaw) is by Lilian Medland. It is one of a series of post cards issued by the Australian Museum.

The Rosehill Parrakeet, the name has since been corrupted into Rosella, was so called because of its occurrence at Rose Hill near Parramatta. It belongs to the group of Broad-tailed Parrakeets, which is peculiar to Australia, and is one of the most beautiful members of the family. It ranges from New South Wales to Tasmania, and is a bird of the open country, its place in scrubs and mountains being taken by the even more beautiful Pennant's Parrakeet.

The Rosella, except during the breeding season, occurs in small flocks, and feeds chiefly upon the ground on seeds of grasses and other low plants. A flock of these birds rising from the ground has almost the appearance of a fireworks display. In addition to its harsh parrot squawk, it has a pretty whistling note. The average clutch of half a dozen white eggs is laid in a hollow spout.

The Parrots are peculiar in having a movable upper mandible to their hooked beaks. Both feet and beak are used in climbing, and the feet are also used for carrying food to the mouth. The feet have two toes directed forwards and two backwards.

VOLUME VI, NUMBER 10. APRIL–JUNE, 1938.

The Lower Hall of the Australian Museum. This hall, the oldest portion of the Australian Museum, which contains the palaeontological, or fossil, exhibits, and many fine groups, has been completely reorganized. Recent improvements to the Mineral Gallery, that above, may also be seen. See account opposite.

THE AUSTRALIAN MUSEUM
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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. 10. APRIL–JUNE, 1938.

A Footnote to History

THE first section of the Australian Museum building was erected in the forties of last century. It consisted of one hall (with gallery) and necessary accommodation for the staff. A second storey was added later, and this part of the building now forms the North or William Street Wing.

In 1852 the large hall was the scene of a ball in celebration of the arrival of the S.S. *Chusan*, inaugurating the steam mail service between the Old Country and Australia; and there was a sound of revelry by night in this abode of the Muses. A few years later the hall was for a time occupied by the exhibits collected for display by the colony of New South Wales at the Universal Exhibition for Agricultural and Industrial Products at Paris in 1855.

This, the oldest part of the Museum, has lately seen many changes. At one time it was fully occupied by the exhibited collection of fossils, but more recently it has been utilized in part for the display of habitat groups, a purpose for which it is well adapted. The old wooden floor, which was showing definite signs of its advanced age, has been covered with hygienic flooring composition, which gives an excellent surface and greatly improves the appearance of the hall as a whole. The old-fashioned wooden cases containing fossils have been replaced by more modern ones constructed of metal, and the exhibited series of fossils has been completely rearranged. The specimens now on view have been carefully selected to illustrate the evolution of life from ancient to modern times, and, generally, to make palaeontology more interesting to the average visitor.

About one-half of the floor space has been cleared of exhibition cases and provided with seating accommodation, so that visitors may be able to view the habitat groups in reasonable comfort.

The great improvements which have been brought about could not have been effected but for the generous and sympathetic assistance the Trustees have received from the Hon. E. S. Spooner, M.L.A., Minister for Works and Local Government, and his officers, especially those of the Government Architects' Branch. For this very helpful co-operation the Trustees have pleasure in expressing their grateful thanks.

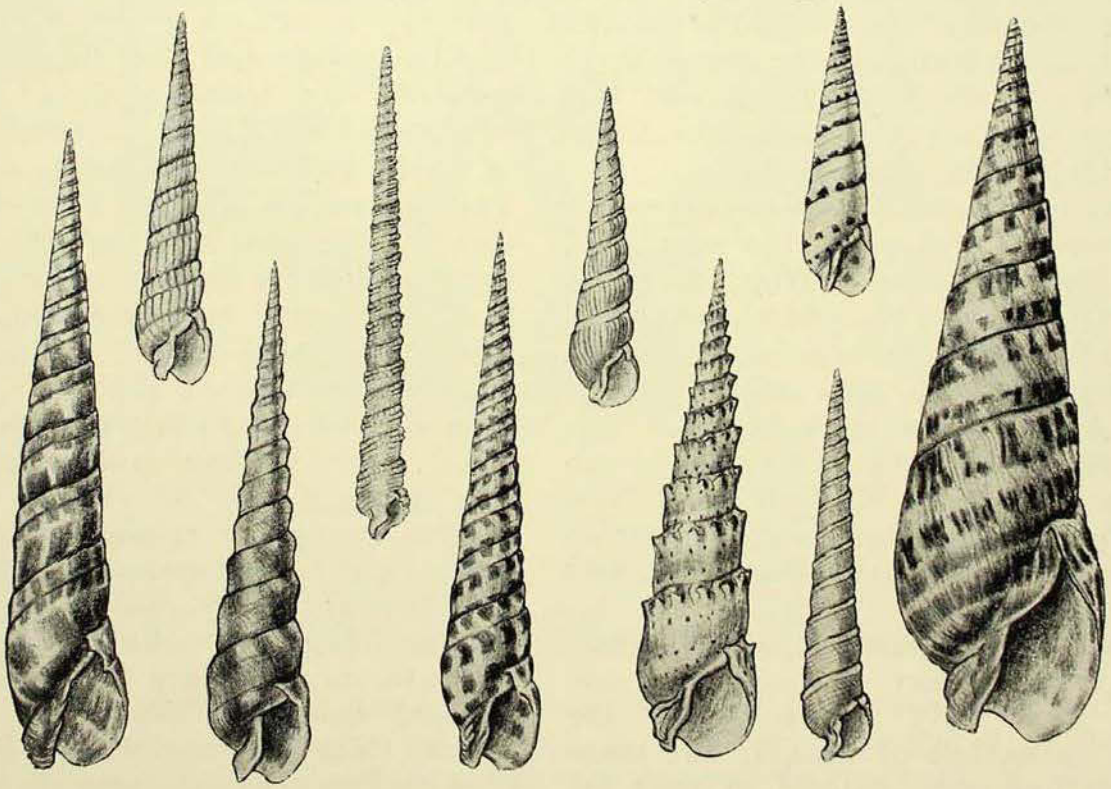
Australian Shells

Augur and Cone Shells

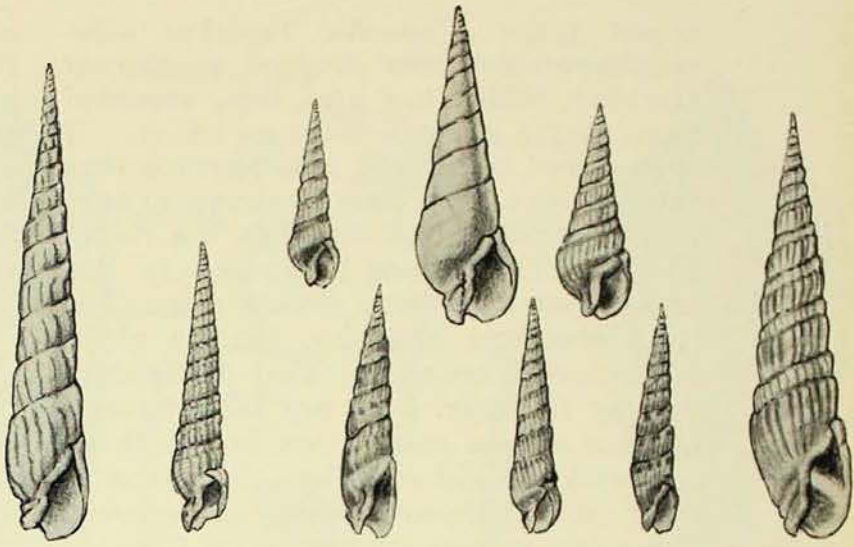
By JOYCE ALLAN*

IF the rule were adopted in these articles on Australian shells to follow strictly the correct position of each family in its classification, a very large group of minute shells, the Turrids, would be dealt with before the Auger and Cone shells. On several previous occasions it has been considered more practical to pass over some families of minute or little known shells and leave these until the larger or more easily obtained ones have been described. Such a practice is now being adopted regarding the Turrids, mainly because the different species are found only rarely by amateurs, as many come from difficult depths. If collected in any systematic manner, it is soon found that the family embraces such a bewildering wealth of species, small in size, variable in shape, and too often represented in a collection by only beach-worn specimens, rendering identification even more difficult, that only the stout-hearted conchologist indulges in serious collecting of Turrids. There are nearly four hundred different species already known from Australia alone, but there are possibly many more undescribed, and a scientific worker requiring a systematic account of the Australian Turrids is referred to an excellent account of the family prepared by the late Charles Hedley (*Records Australian Museum*, Vol. xiii, No. 6, 1922).

* Illustrations by the author.



Large Auger shells. In the top row, from left to right, are Diplomeriza duplicatoides, Triplostephanus triseriata, Terebra australis, and Terebra tigrina; in the bottom row, Terebra dimidiata, Terebra guttata, Terebra subulata, Terebra crenulata, Perirhoe albomarginata and Terebra maculata.



Smaller Auger shells. In the bottom row are Acuminia lanceata, Terebra bathyrhaphe, Terebra hastata, Acuminia brazieri, Hastula strigilata, Terebra bernardi. In the top row, from left to right, Terebra bicolor, Terebra albida, and Pervicacia ustulata.

AUGER SHELLS.

No one can mistake the Auger shells; their heavy build and long, regularly spiral, taper-pointed shape make them easily recognized. The family to which they belong, the Terebridae, has a tropical and subtropical geographical distribution, and is remarkable for the fact that on one hand it embraces large, often brilliantly marked species, readily distinguished from one another, and, on the other, has a number of small members which are sometimes difficult to separate without the aid of a lens. The species are mainly inhabitants of shallow water, though some of the small forms are found in the deeper waters of the continental shelf round the east and southern coast of Australia. In some species a poison gland is present, somewhat similar to that found in Cone shells, and which will be dealt with later. As with other types of shells, those found in the warmer waters, such as those of the Indo-Pacific and round north Australia, especially along the Great Barrier Reef, where coral reefs abound, are the largest and most brilliantly coloured.

Most of the large species, some of which grow to six inches or more in length, have a wide Indo-Pacific range. The most notable of these are the largest species of the family, *Terebra maculata,* the animal of which is eaten by native races and the shell used ornamentally; a nodulose species, *Terebra crenulata*; a white form with oblong, reddish-orange spots, *Terebra dimidiata*; a beautifully marked chocolate spotted shell, *Terebra subulata*; and *Terebra guttata,* with a conspicuous row of large white spots below the sutures and a second row below the middle of the body whorl. These five species, all or some of which are found in most private collections, are the best known Auger shells, and occur commonly in the South Pacific islands, as well as along the Great Barrier Reef of Australia. There is a species, *Terebra muscaria,* about the same size as these, that is from four to six inches long, which closely resembles *Terebra subulata*; but the spots are more chestnut than chocolate, and below the sutures is a pronounced sutural band, absent in the latter species. One of the most striking and interesting Auger shells is *Triplostephanus triseriata*, an extremely long, very narrow, heavily sculptured species, extending in its range from the Philippines to Queensland and north New South Wales.

A few slightly smaller species, two to four inches long, have a South Pacific distribution, and some are figured in this article. These are the white, chestnut-spotted *Terebra tigrina,* which comes down as far as Queensland; *Terebra australis,* from north and West Australia, and an Indo-Pacific species, *Diplomeriza duplicatoides,* which is also found in Western Australia. A smooth white shell, *Terebra albida,* comes from Victoria, South Australia, and Tasmania. In

recent years a species, *Perirhoe albomarginata,* has been dredged in Sydney Harbour, which has also been recorded from as far away a place as China. If such record is correct, it is possible that this species may in time be shown to have a fairly wide range through the South Pacific. The species is figured in this article, but two others closely resembling it in sculpture and size, that is about three inches long, and also dredged in Sydney Harbour, have not been figured, because a close comparison of the three, and with the aid of a lens, is necessary fully to appreciate their differences. These two species are known as *Perirhoe melamans* and *Perirhoe exulta,* and another species, *Perirhoe pertusa,* from Queensland and New South Wales, though broader in shape and having bolder sculpture, is close enough to be included in this group. These four species are deep honey colour.

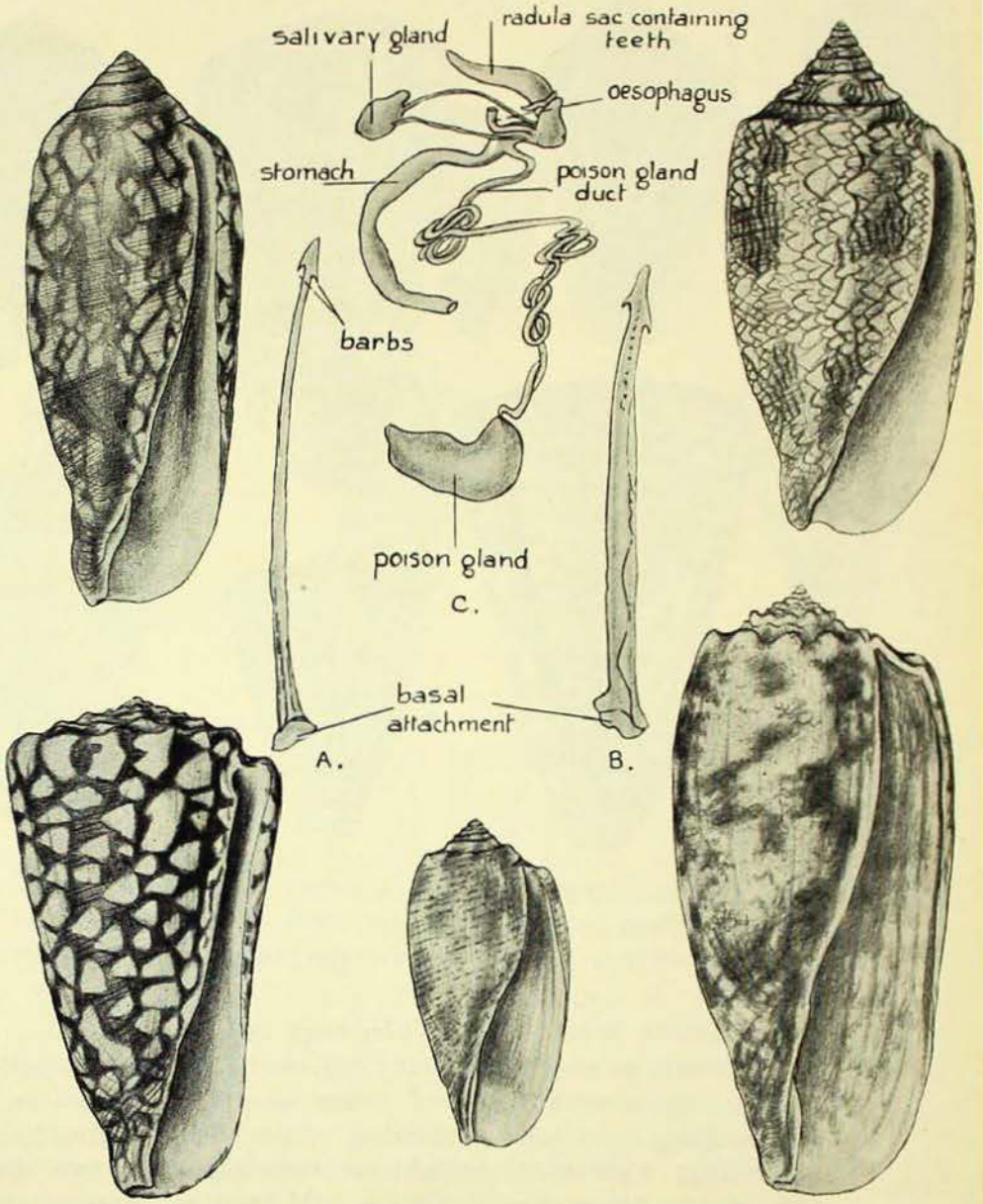
The small species of Auger shells, those round about an inch to an inch and a half long, are conspicuous more for their sculpture than outstanding colour pattern, so characteristic of most of the large ones. Exceptions to these are *Acuminia lanceata*, a South Pacific island species about two inches long, which has a number of vivid, chestnut, longitudinal lines running down the cream-coloured whorls, and *Hastula strigilata,* a highly polished, plicate shell, with white bands on its dark fawn colour and a row of squarish spots on those bands encircling the sutures. This species, sometimes very dark coloured, occurs in Queensland and the South Pacific islands. Most other small species are more uniform in colour. Only a few of these are figured, and include a highly polished, orange-brown, South Pacific island shell, *Terebra hastata,* with numerous close plicae appearing on the upper part of the whorls only; another heavily sculptured shell from the same habitat, *Terebra bathyrhaphe*; four species confined in their distribution to New South Wales, Victoria, South Australia and Tasmania, *Acuminia brazieri, Terebra bicolor, Pervicacia ustulata* and *Pervicacia assecla*; and a larger shell, *Terebra bernardi,* also from Queensland and the South Pacific islands, notable for its longitudinal sculpture. There are several small species of Auger shells found in the southern waters of Australia, but as these are not common, they have not been included in this account.

CONE SHELLS.

The family Conidae, to which the Cone shells belong, is also an easy one to recognize at sight. The heavy, porcellaneous, conical shells are unlike any others, and are considerably prized by collectors. It is a family of many hundreds of species, principally inhabitants of tropical seas, where they live in holes and fissures of rocks and coral reefs, boring into the shells of other molluscs and sucking out the juices from their bodies. They become more numerous and varied in their colouring as the waters become warmer, and, though the shells are covered with a thin epidermis when alive, hiding to a large extent their brilliant markings, when this is absent the shells form bright and beautiful ornaments. The arrangement of the colour pattern in many of the species is a wonderful example of the artistry displayed by Nature.

Poisonous Qualities of Cones.

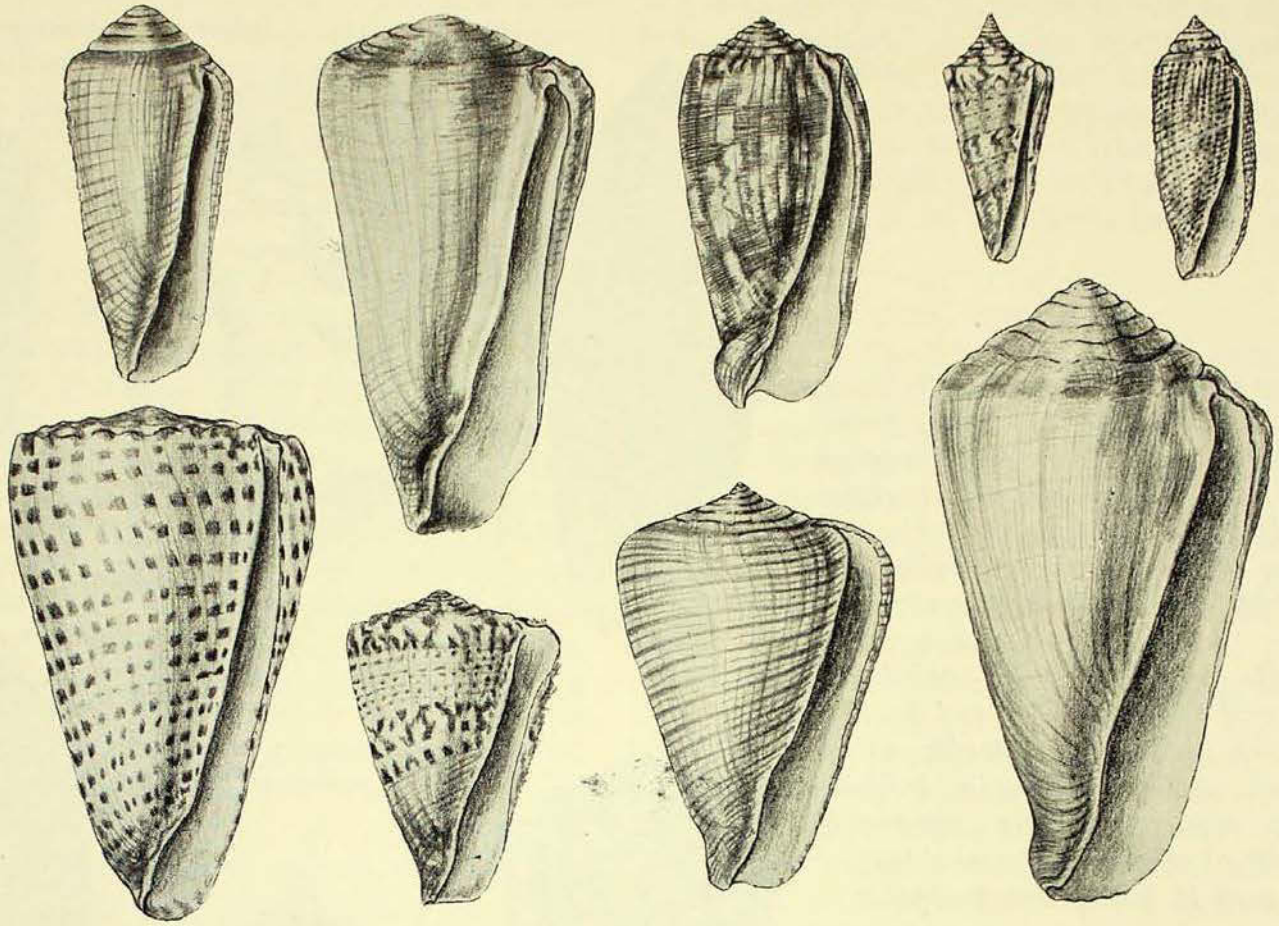
Though the Cones are said by observers to be timid animals, moving slowly and shrinking into their shells when danger approaches, yet the collector is strongly warned against handling them alive without taking the utmost care, for under their beautiful exterior the animals possess a poison gland, a defensive organ. When at bay, the Cone is able to lash out a protruding organ, the proboscis, through which sharp teeth carrying poison from the gland can extrude, and, after inflicting a deep wound, enable the poison to enter the blood stream of the victim. The poison is very virulent, and cases of poisoning by it have definitely been known to occur in New Guinea, New Hebrides, New Caledonia, Tonga, Samoa, Fiji, New



Five species of poisonous Cone shells. In the top row, from left to right, are Regiconus aulicus, Darioconus textile, and in the bottom row, Coronaxis marmoreus, Tuliparia tulipa, and Rollus geographus. The diagrams between the shells show—C, the relationship of the poison gland to the mouth parts and teeth of a Cone shell, Tuliparia tulipa, and also a single enlarged tooth of A, Darioconus textile, and B, Tuliparia tulipa.

Britain, Carolines, Society, Sandwich, Loyalty Islands, and at Hayman Island, Whitsunday Passage, Great Barrier Reef. Natives of the South Pacific are aware of the poisonous qualities of some at least of the Cones, and if by any chance "bitten" by one, they immediately cut incisions round the wound, allowing the blood to flow freely and so possibly saving their lives.

Examination of a single tooth shows it to have a hollow tube running from tip to base. The teeth are situated in a sac, the radula sac, opening into the oesophagus, and are especially adapted to hold poison. They are attached to the radula sac by a swollen base, and below the tip have a backward-pointing sharp barb. Poison from the gland is conveyed, when needed, along a lengthy duct to an opening in the oesophagus, where it comes in contact with the teeth and travels up them. It is believed that the animal can shoot out and leave in the victim these dart-like poison-filled teeth, which are visible to the naked eye; this may account for the statement made by natives that the Cone "spits" poison. The relationship of the poison gland to the mouth-parts and teeth of the animal in a species of Cone shell, *Tuliparia tulipa*, and also a single, enlarged tooth of

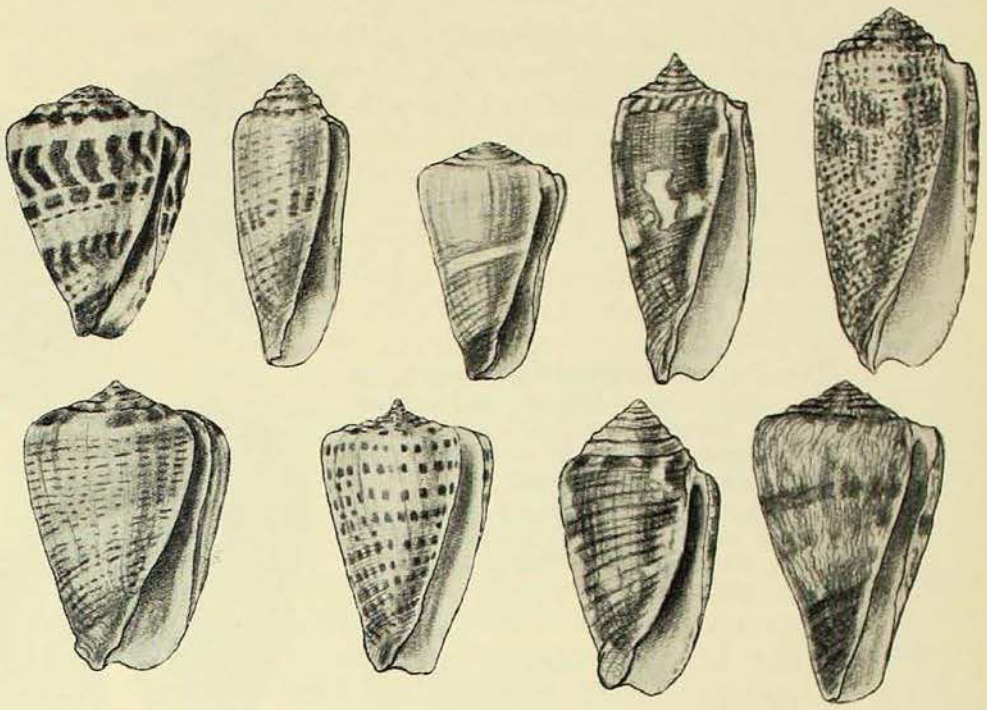


Large Cones. In the top row are Conus terebra, Conus virgo, Dendroconus striatus, Conus generalis, and Hermes nussatella. In the bottom row, Conus litteratus, Conus capitaneus, Cleobula figulinus, and Rhizoconus vexillum.

Darioconus textile and *Tuliparia tulipa,* are shown in the accompanying sketch.

The main symptoms of Cone shellfish poisoning are acute burning pain and swelling, with local numbness extending in severe cases to paralysis. Muscular control is lost, speech becomes thick and indistinct, and eyesight dim. It is not to be supposed that Cone shells are lying round just waiting to lash out at their victims, but it is natural that if the animal itself is touched, its first instinct would be a defensive one, and the possibility of a human being being struck by one in the aforementioned manner would arise through injudicious handling of a live specimen. Actually, the number of known cases of this poisoning is infinitesimal compared to the number of Cones encountered in tropical waters; but as to be forewarned is to be forearmed, it is again stressed that any live Cone shells should be handled with gloved hands, or, better still, with forceps or such-like instruments.

Five species of Cones, all living in Queensland as well as the Indo-Pacific, have been definitely known to inflict poisonous wounds on human beings. The colouring of these when alive is mainly obscured by epidermis, but when this has rubbed off their distinctive characters can be seen very easily. With the exception of *Tuliparia tulipa,* which is only about two and a half inches high, the four others are large, four to six inches long. They are *Coronaxis marmoreus, Darioconus textile, Regiconus aulicus,* and *Rollus geographus*—all very easy to recognize. The last species, *Rollus geographus,* was in 1935 responsible for the death of a young man, who, unfamiliar with the poisonous qualities of these shells, was scraping the epidermis from the outside of a live specimen he had picked up at Hayman Island, on the



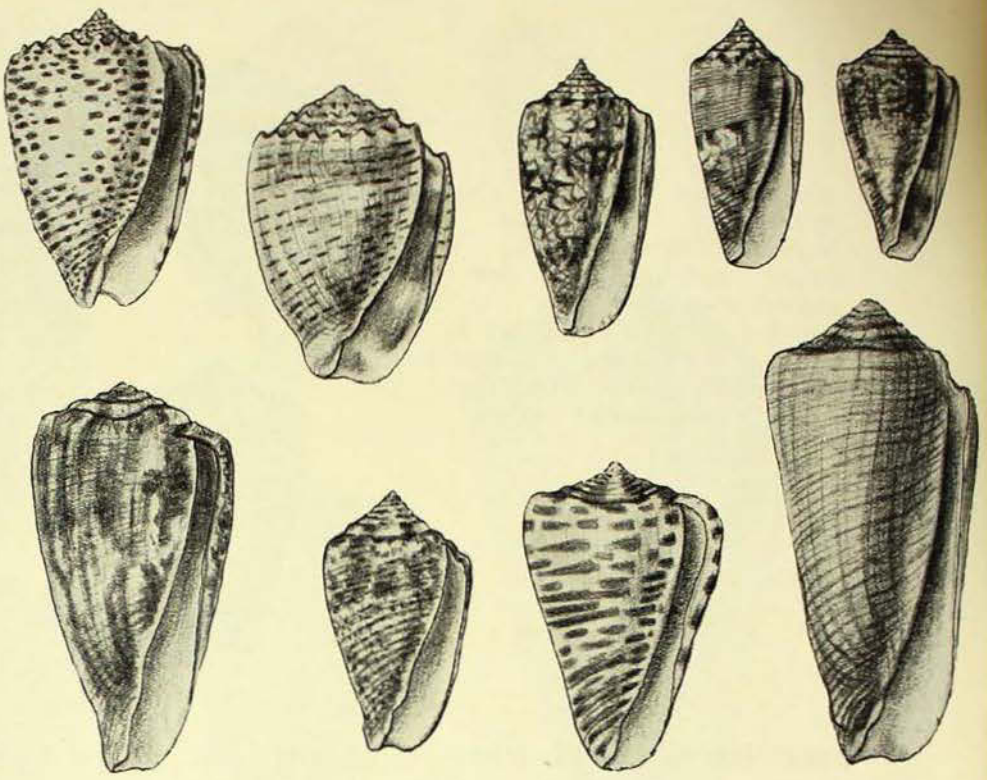
More Cones. The top row shows figures of Virroconus ebraeus, Hermes luteus, Conus flavidus, Conus epistomium, and Conus stercus-muscarum; in the bottom row are figured, from left to right, Conus glaucus, Puncticulis eburneus, Conus achatinus, and Rhizoconus miles.

Great Barrier Reef, when it pricked him. In a few hours serious symptoms developed; he was rushed to the mainland, but died before reaching hospital. An account of this case, the first known death from shellfish poisoning in Australia, was published in *The Medical Journal of Australia* (Allan, Joyce—*Medical Journ. Austr.*, Vol. ii, No. 16, 1935).

The largest Cone of the Indo-Pacific is *Rhizoconus vexillum,* which has been recorded from West Australia also, and is known by its close brown epidermis. But it almost has a rival for size in *Conus litteratus,* which, however, is a much heavier shell, and one used frequently by native races for ornamental purposes. This species comes into Queensland waters.

Other large Cones which are found in northern Australia, and are figured here, are *Hermes nussatella, Dendroconus striatus, Cleobula figulinus, Conus terebra,* and a pure white one with a patch of violet on the base, *Conus virgo.* These should be recognizable without description, and all are found throughout the islands of the Indo-Pacific. The majority of Cones are from round about one and a half to two and a half inches long, but as space permits only a few of these to be dealt with in this article, the commoner ones have been chosen. With these, as with the previous ones, their characters are in nearly all cases so distinct that a figure should be sufficient to make identification possible without difficulty. Outstanding ones are *Conus tessellatus,* with orange-pink spotting, *Puncticulis eburneus,* and a similarly black spotted but coronated shell, *Conus pulicarius, Conus stercus-muscarum, Phasmoconus radiatus, Conus catus, Conus coronatus, Conus epistomium, Rhizoconus miles, Conus achatinus, Conus glaucus, Hermes luteus, Conus flavidus, Conus capitaneus, Conus legatus* and *Conus generalis.* With the exception of *Hermes luteus,* which comes from the Northern Territory and has been recorded also from West Australia, and *Conus achatinus* and *Conus generalis,* which have not yet been recorded from Australia, the others extend in their range from the South Pacific islands into Queensland, where many are very common, *Conus capitaneus* and *Conus coronatus* even reaching New South Wales.

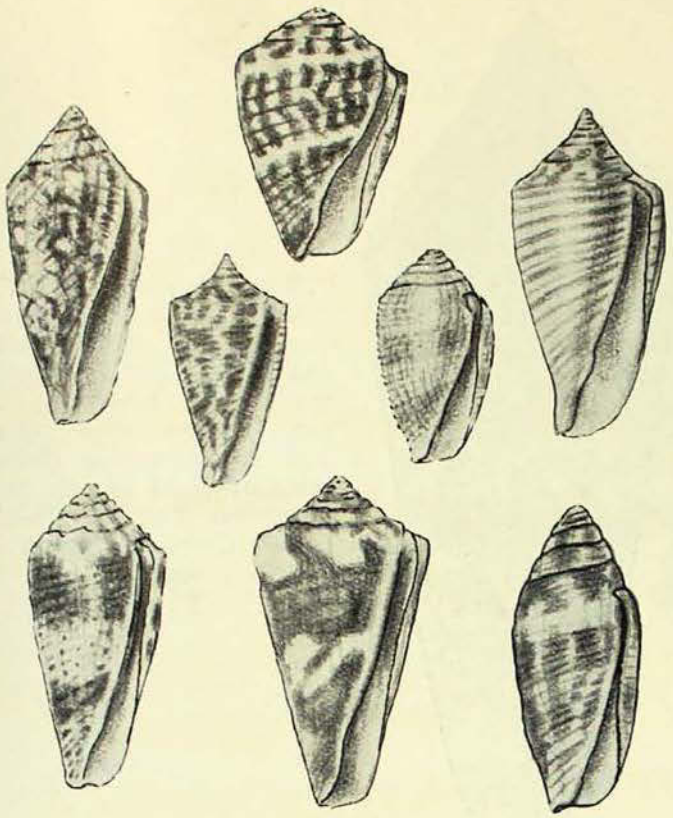
A few smaller Queensland and South Pacific island Cones are *Conus mucronatus,* a species unlike any other Cone on account of its spiral orange-coloured



The Cones illustrated here are, in the top row, Conus pulicarius, Conus coronatus, Darioconus victoriae and Floraconus anemone and Floraconus papilliferus; in the bottom row, Floraconus peronianus, Conus catus, Conus tessellatus, and Phasmoconus radiatus.

lines, *Leporiconus glans, Conus mitratus, Conus lithoglyphus, Conus lizardensis, Conus leucostictus,* and *Virroconus ebraeus.* The latter species is rather like *Virroconus chaedaeus,* better known as *vermiculatus,* from the South Pacific islands, but the latter is smaller and the markings are linear and wavy, rather than blocked. Two of the smallest Cones are *Lovellona atramentosa,* from Queensland, which is only one-quarter inch long, chocolate brown coloured, with a white base and white spots round the whorls, and *Parviconus rutilus*, a well-known pink Cone, about one-half inch in length, which ranges south from New South Wales to south-west Australia. Finally, the common north-west species, a figure of which is given, is *Darioconus victoriae,* the common southern Australian and Victorian species is *Floraconus anemone,* with its southern New South Wales relative *Floraconus papilliferus,* and the typical northern New South Wales species of this type is *Floraconus aplustre,* a figure of which, however, is not given. A larger form of these which has been dredged in Sydney Harbour in recent years differs sufficiently to warrant it being regarded as another species, *Floraconus peronianus.*

In identifying Cones, it must be taken into consideration that in some of them, especially those with complicated colour markings, variation will occur in different specimens of the same species. For instance, *Darioconus textile*, often called the Cloth-of-Gold Cone, with its very intricate markings of zigzag lines, triangular patches and bands of blotches, shows considerable variation in these throughout its wide distribution, extending from the Red Sea to Australia. In the species *Virroconus ebraeus,* the more typical form of marking is in rows of almost square black blocks, rather than that shown in the figure, but as the specimen illustrated was such a beautiful example of design in nature it was chosen in preference to the more common type. This species, incidentally, is one of the handsomest of the Cones, and when minus its epidermis shows out startingly clear as it lies on the sandy bottom of coral reefs. It is common at Lord Howe Island, where large specimens can be found. Also, from their habit of living wedged away in holes in rocks, the shape of Cones at times,



Some small Cone shells. On the extreme top left is Conus legatus and on the top right, Conus mucronatus. In the bottom row are, left to right, Conus leucostictus, Conus lithoglyphus, and Conus mitratus. Between these rows are, on the top, Virroconus chaedaeus, and bottom, Conus lizardensis and Leporiconus glans.

especially round the spire, becomes somewhat altered by wear or incrustation, and this must be taken into consideration when comparison of specimens is being made.

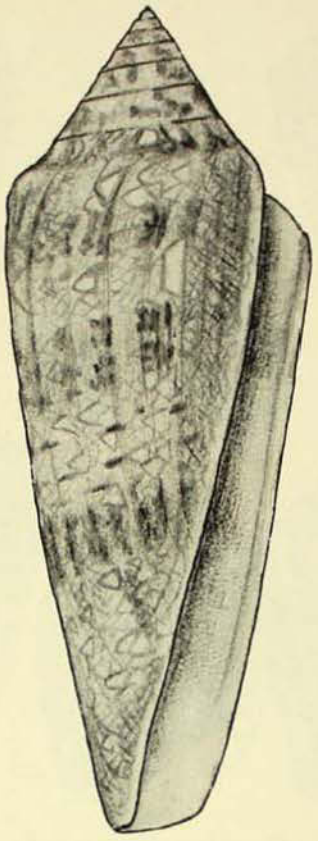
The "Glory of the Sea" Cone.

It will not, perhaps, be out of place to mention here the most valuable Cone in the world, and one of the most valuable shells, the famous "Glory of the Sea" Cone, *Conus gloria-maris,* even though this has not been found further south than the East Indies. In appearance it is like an unusually slender, very high-spired *Darioconus textile,* but with a much finer orange-brown reticulation over the surface. The shell was first known to collectors as early as 1758, and was naturally considered the most desirable of acquisitions. Later, in 1838, three specimens of this beautiful shell were found by Hugh Cuming, the great British conchologist, on a reef in the Philippine Island of Juena; but shortly afterwards an earthquake and tidal wave completely destroyed that particular reef, since when no more have been found in that region. The number of this much coveted species of Cone known at the present time barely exceeds twenty-two, only a percentage of which are perfect specimens. Most of these are, fortunately, now housed safely in museums, where they are likely to remain. It is unlikely that any private collector in the southern hemisphere unsuspectingly houses one among his material. A few specimens have been found in recent years at Ceram, East Indies, where it is believed the first specimens known were discovered. The "Glory of the Sea" is, therefore, still so extremely rare that a specimen found would still fetch a very high price, probably as high as, if not higher than, some of the prices paid by auction for those already known, and these have ranged up to nearly £50. There are at present five specimens of this Cone in museums in Holland, some of which changed hands several times in the last century before coming to their present location. As Holland has so many interests in the East Indies, it is only natural that that country should wish to have this rare shell represented in its museums. It is unfortunate for Australia that a very beautiful specimen of the "Glory of the Sea", for many years in a private shell collection in Sydney, should now be in America instead of in this country. The owner of this specimen, which is said to have come from Ceram, was Dr. James C. Cox, of Sydney, and the shell went from him to Hugh Fulton, a London shell dealer. From him it was purchased by an American woman, later acquired by an American shell dealer, Mr. Walter Webb, and from him purchased by the American Museum of Natural History about 1923. At least there is the satisfaction of knowing that this specimen is safe. Although Dr. Cox's collection, except for some rare shells, came on his death to the Australian Museum, Sydney, there is no record of

any mention of *"gloria-maris"* ever having been offered for sale in Sydney. Several times in recent years reference has been made in literature to the presence of a *"gloria-maris"* in the National Museum, Melbourne. Investigations have proved that no such shell exists there, and it is possibly a case of mistaken identification.

It is always the hope of every shell collector, knowing the wide distribution of the family of Cone shells, that some day specimens of the "Glory of the Sea" will be found in the islands of the South Pacific and even in north Australian waters, particularly along the Great Barrier Reef, where so many species of this family live. It has the appearance of a deeper water living shell, and it is therefore possible that specimens will be obtained by dredging. That may account for its rarity, even in the places where it has been found.

Before concluding, it may interest readers to know that among the many books on shells, usually heavily charged with moral, written for little children in the early part of the nineteenth century, was one entitled "The Glory of the Sea", the story dealing with the losing and finding again of one of these precious shells which had pride of place in the young heroine's shell collection.



"The Glory of the Sea" (Conus gloria-maris), one of the rarest and most coveted shells in the world. Compare its long spire and very slender, graceful shape with that of its nearest relative, the "Cloth-of-Gold" Cone, Darioconus textile.

THE LAND OF BYAMEE: AUSTRALIAN WILD LIFE IN LEGEND AND FACT. By Keith C. McKeown. (Angus and Robertson, Ltd., Sydney, 1938.) Pp. 229, with 11 full-page plates. Price: 6s.

In the mythology of the aborigines of south-western New South Wales, Byamee was a being with supernatural powers, but also with many human attributes, and his country was the whole universe, even to the distant stars, which were the camp-fires of the "Great One" and of the legendary heroes and ancestors of the tribe. This land of Byamee was inhabited by many strange creatures, which in form fluctuated between the shapes of men and of animals. Here also dwelt many spirits, both good and evil.

In this work the author, who is Assistant Entomologist in the Australian Museum, has gathered together a number of myths which for generations were retailed round the camp-fires and purported to explain how animals acquired their present form and habits. Thus Gayardaree, the platypus, strangest of living mammals, with its duck-bill and egg-laying habits, was the result of a mesalliance between Tharalkoo, a young and attractive but foolish duck, and Biggoon, the giant water rat. Driven away by the rest of the tribe, Tharalkoo and her strange offspring established themselves on the banks of a distant river and founded a new tribe.

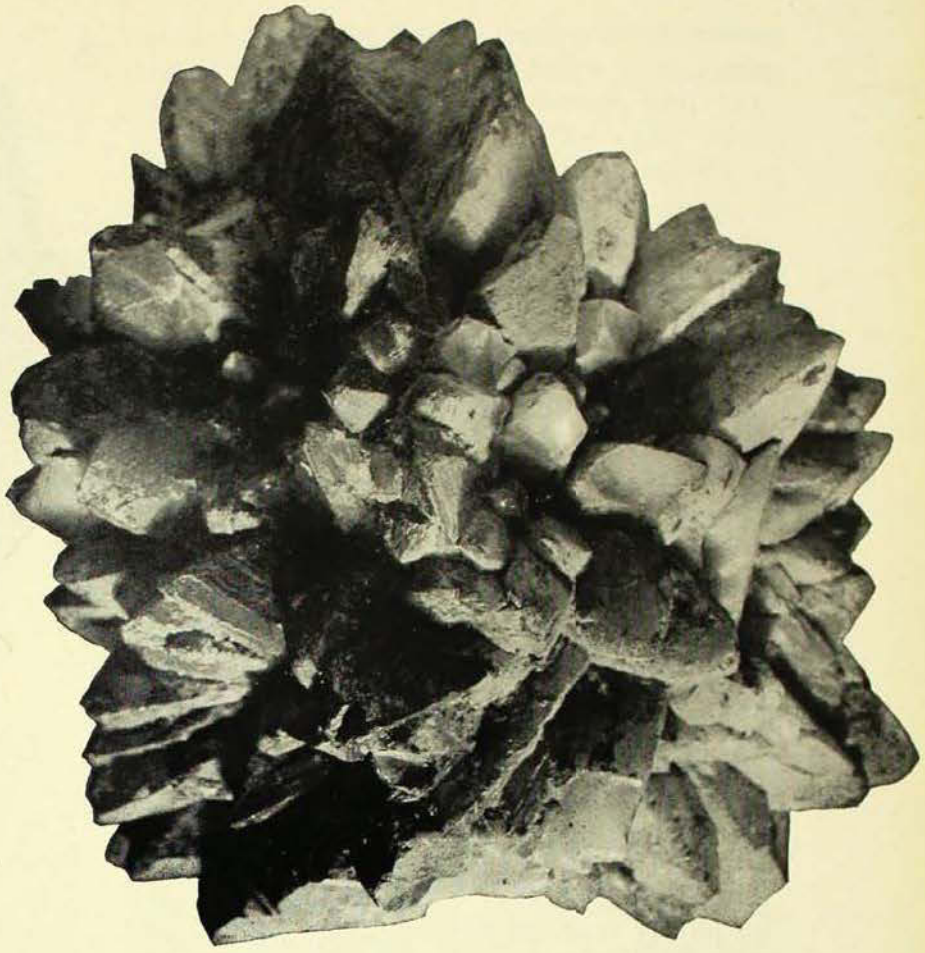
So Ouyen, the curlew, was once a lazy young blackfellow, with no skill as a hunter, who, unable to provide for his female dependants, used to cut chunks of flesh from his own legs, which are now thin, red and fleshless. Ouyen may have been lazy and inefficient, but he was game in more senses than one.

Interspersed among these legendary tales are notes on the natural history of the various animals, so skilfully caricatured in these fascinating tales.

C.A.

Glendonites and Other Fossil Crystals

By T. HODGE-SMITH



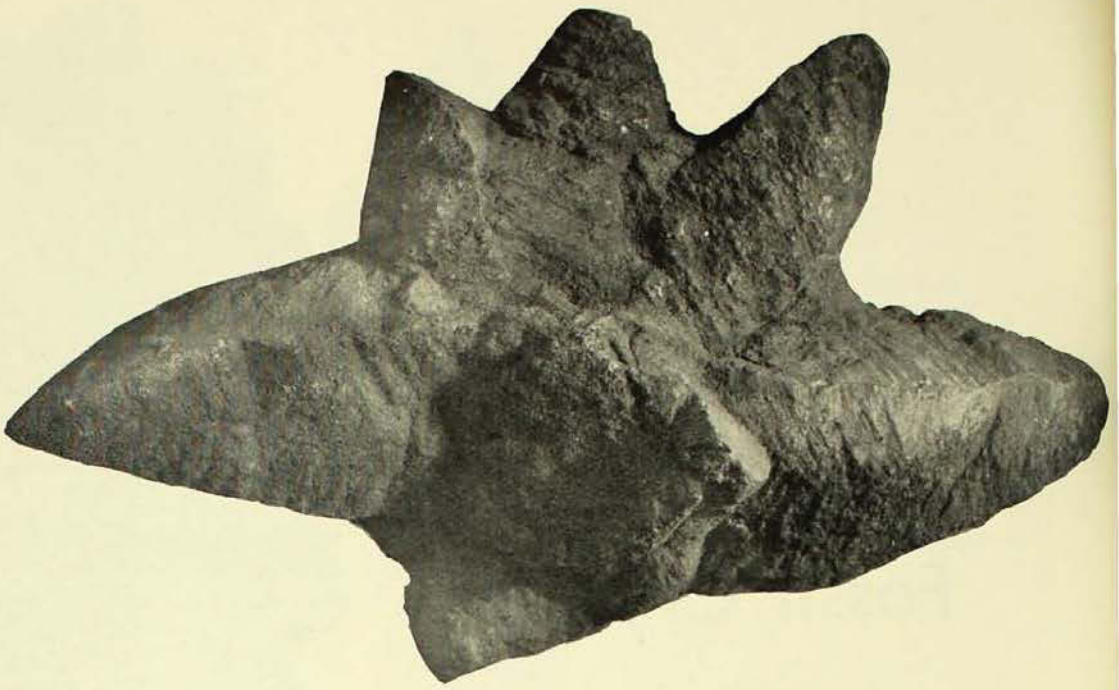
"Fossil Pineapple." A group of glauberite crystals replaced by opal. White Cliffs, New South Wales.

THE writing of an article on zeolites for the last issue of this MAGAZINE suggested the above title. It may seem a far cry from the zeolites forming in the still hot lava to the curious glendonites found in the mudstones around Singleton, New South Wales, or the opal pineapples from the arid region of White Cliffs, New South Wales.

Let us inquire how one suggests the other. One of the most famous zeolite localities of the world is to be found in the State of New Jersey, U.S.A. Here, in the Paterson district, an ancient (Triassic) lava flow has pushed its way into a lake, the waters of which were rich in sulphates and carbonates, mainly of calcium and sodium. The first action of these waters on the lava was to chill the surface to a glass and to form cracks and crevices. The lava, on the other hand, heated the water of the lake so that it would attack the glass and even dissolve it, finally filling the cavities and crevices of the almost completely consolidated rock. The hot waters would enrich their content of sulphates and carbonates by dissolving the solid sulphate and carbonate of sodium and lime contained in the muds of the immediate vicinity. As cooling proceeded, anhydrite (calcium sulphate) and glauberite (sulphate of sodium and calcium) were among the first minerals to crystallize out. Sometimes one or the other would form, and at other times they would form together.

This period was followed by the deposition of silica in the form of quartz, the silica being derived from the rock itself. Some of the quartz was deposited on and around the saline minerals, such as glauberite.

Then followed the deposition of such minerals as prehnite and pectolite. It was during this period that the saline



Glendonite. A group of glauberite crystals replaced by impure calcite. Singleton district, New South Wales.

minerals became unstable and were removed by solution. Later zeolites formed, and then finally calcite, but with these later stages we are not concerned. Thus the glauberite was formed, covered or partly covered with quartz, and finally dissolved away. All that is left today are the moulds of the glauberite crystals in the quartz. Some of these moulds, however, have subsequently become filled with quartz, which is easily separated from the "mould-quartz", producing casts of the erstwhile glauberite crystals. Mineralogists would describe this as quartz pseudomorphous after glauberite, and the quartz in the form of glauberite they would call pseudomorphs, as they generally do the hollow moulds. This latter use of the term is somewhat liberal, so I have used the term fossil crystals to indicate that the original crystals have gone, only casts or impressions remaining, exactly as in the case of fossils.

We have seen that glauberite had already accumulated in the muds of the lake into which the lava poured. As a matter of fact, a number of glauberite cavities are found in many horizons of the Triassic shales of this area, where apparently a number of these lakes existed.

In New South Wales glendonites occur in a number of places in the Upper Marine (Permian) mudstones. These beds are much older than the beds of New Jersey. During the Upper Marine times in New South Wales a large gulf, with a somewhat restricted connection with the ocean, occupied the area represented by these mudstones, which extends from just a little north of Bateman's Bay in the south, nearly as far west and north as Narrabri. The waters of this gulf were shallow and icebergs floating on its surface were no uncommon feature. Probably, too, the surface of the gulf was at times frozen or partly frozen over.

It is difficult to conceive a greater contrast in conditions between the ice-bound gulf of New South Wales and the sizzling, steaming conflict between water and molten rock in New Jersey. Yet the one mineral, glauberite, is formed under these two sets of conditions, and the process is not so very different in the two cases.

Local freezing of a shallow gulf will produce a greater concentration of saline material in the underlying sea water. The low temperature of this underlying water lessens its capacity to hold in solution this saline material. We remember in the case of New Jersey that the sulphates

of calcium and sodium are the first to crystallize out. Applying this fact to the sea water of our gulf, we see that conditions for crystallization of glauberite are all present.

Today the glauberite no longer exists. In some cases only the moulds of these crystals in calcareous concretions in the solidified muds of this ancient gulf remain; in other cases the hollow moulds have been filled by impure calcite, forming a cast of original glauberite crystals. The name glendonite has been given to these calcite pseudomorphs.

In the north-western division of the State at the famous White Cliffs opal field is found another occurrence of these fossil crystals of glauberite. These occur in the Upper Cretaceous or "Desert Sandstone" series, and are therefore younger than those of the other two examples. Just what were the conditions when the beds containing the opal were laid down is not known, but it is probable that here an inland sea or a series of lakes existed. In either case, shallow water conditions prevailed. The opal-bearing rocks consist of a very fine-grained kaolin-like siliceous material and conglomerates containing marine shells, reptilian bones, and fragments of fossil wood. The opal which replaces the material of these fossils, or occurs as patches and thin veins, is secondary. That is to say, after the formation of the rocks the action of siliceous waters percolating through them has replaced some of the material by silica in the form of opal.

Just how did the gypsum and glauberite form in these conglomerates and fine-grained siliceous rocks? The answer to this question has not yet been found, but we do know from the other occurrences that the shallow-water conditions would be ideal in certain cases for the formation of both gypsum and glauberite. Here the evidence of glacial conditions is not conclusive, and maybe the drying up of the land-locked waters produced the separating out of these two minerals. Because of the resemblance of the groups of opalized glauberite crystals to a pineapple they are known locally as fossil pineapples, though, of course, they are fossil crystals.

AUSTRALIAN ABORIGINAL DECORATIVE ART. By Frederick D. McCarthy, Dip. Anthr. (Syd.). Foreword by Professor A. P. Elkin, M.A., Ph.D. Pp. 48, with coloured frontispiece and 33 half-tone illustrations. Price: 2s. 6d.

This publication, issued by the Trustees of the Australian Museum, gives a comprehensive account of the decorative art of the Australian aboriginal.

Frequently regarded in the past as a rather lowly member of the human family, the Australian blackfellow has of recent years been the subject of intensive study. The subject of aboriginal art has, however, been largely neglected, and this contribution to this phase of native culture will be welcomed both by anthropologists and artists. The painting and engraving of weapons, articles of adornment, and ceremonial objects, expresses the aesthetic feeling of the aborigine, and, like the cave paintings, rock carvings, and patterns painted or engraved on the sacred objects used in totemic or initiation ceremonies, have a definite relation to the world of mythology. Apart from their significance in relation to the secret life of the native, the designs figured in this contribution will be of distinct value to architects, designers, and artists who are seeking distinctive Australian motifs in architectural and art designs.

The Habits of *Sidyma longipes*, an Australian Spider

By V. C. LEVITT

Despite the fact that some twelve hundred spiders have been described from Australia, the great majority remain merely specimens in our collections: they bear names, but of their lives we know nothing. The biology of our spiders has hitherto been a neglected field of observation in spite of its obvious richness, and there are but few species of which we have even a little information on their life histories and habits. Miss V. C. Levitt's observations are, therefore, all the more welcome, for they lift the curtain to permit us to see a little of the strangeness of spider life. Her patience and the detail with which she records what she sees of the doings of this little people, will be evident to readers of the accompanying article. More of Miss Levitt's fascinating notes will appear in future issues of THE AUSTRALIAN MUSEUM MAGAZINE.—EDITOR.

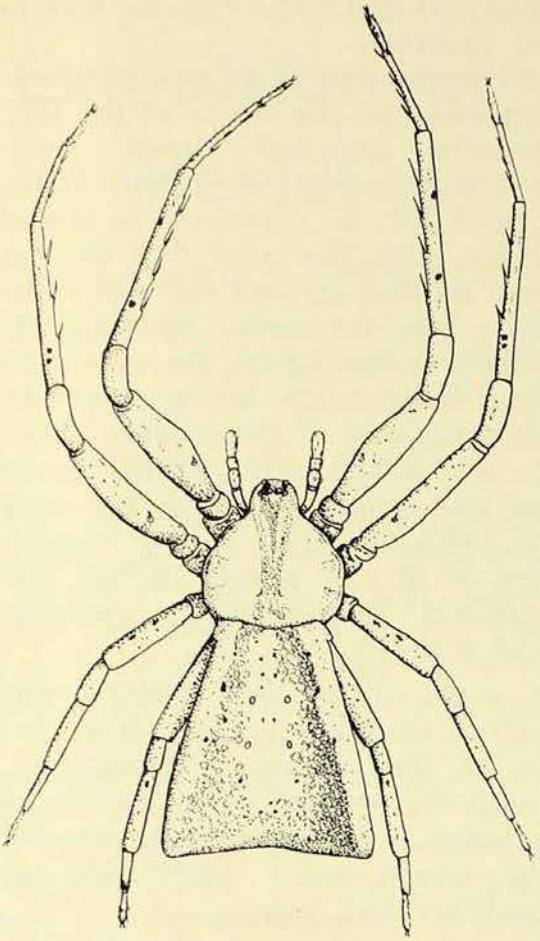
THE subject of these notes is a curious but little known spider, known to scientists as *Sidyma longipes*. So far, perhaps on account of its somewhat retiring ways, it has not attracted sufficient attention to warrant its receiving a popular name. It is a little elongated creature with a rather bifid abdomen, and long, slender, spiny legs. Its colour is subdued, being a pale buffy-brown mottled with spots of a darker shade. It measures under a quarter of an inch in length.

The first of these spiders to come under observation was captured in company with her mate as they rested upon the leaf of a lilac tree. Both spiders strongly resemble small sticks, and, when clinging to the leaf-stalk, the male especially was almost indistinguishable. The two captives were soon established in an observation jar, with a few twigs upon which they could climb and spin, if they so desired. Both spiders were of about the same size, the male being readily distinguished by his swollen palps, and he was far more active than his companion.

On 11 April, 1937, the female cast her skin, taking about an hour to effect the delicate operation. She was now noticeably larger than the male. After moulting the lady took interest in food, and the next day captured and devoured a moth provided for her refreshment. The male also showed an interest in the meal, and attempted to secure it for himself, but surrendered his claims to his mate—indeed, his surrender was somewhat precipitate: he fled in haste from the scene! Shortly after this episode, it was noticed that he had lost one of his hind legs, possibly as the result of domestic differences. On 12 May the male was seen to be feeding upon a moth which he held firmly gripped by the head, but the meal proved too much for him, and two days later he was found dead at the bottom of the jar, still clutching his prey.

A few days after her bereavement the widow was removed to more palatial quarters on a glass-fronted box furnished with a branch of vine. She had seemed dull and apathetic during the preceding fortnight, but, within half an hour of the vine being placed in the box, she explored her surroundings and spent the following days among the leaves. The vine did not seem wholly suited to her purpose, for after a time she occupied herself in wandering about on the floor or the walls of the box. The plant was, therefore, removed and replaced by "Chinese Fuchsia", a plant which she seemed to prefer.

On 11 July the spider was noticed busily tugging at a small withered leaf



Sidyma longipes.
N. B. Adams, *del.*

with her forelegs. Four days later this leaf dropped off, but she retrieved it and suspended it by a few threads to the fuchsia. Other dead leaves were then dropped into the box, but they were not to her ladyship's taste, for she cut them adrift from the threads where they clung. The remaining fuchsia leaves seemed to be too large to be handled readily by the spider, so a small dead honeysuckle leaf was dropped in; it lodged among some sticks on the other side of the box. On 18 July it was found that she had lifted the honeysuckle leaf out from among the sticks, and had it hanging by several threads between the back of the box and the sticks. She was on it, and I also noticed that she had begun to lift one of the fuchsia leaves by means of several strands of silk twisted together to form a very strong thread, which she attached to the side of the box.

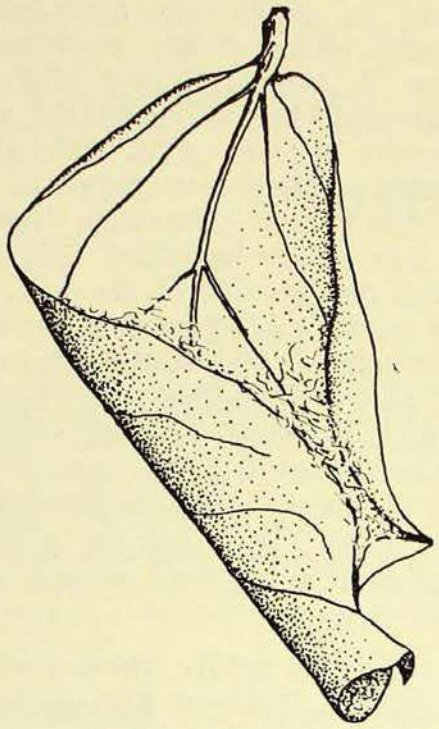
For the next twenty days the spider remained clinging to the leaf; she was not seen to leave it, although she occasionally changed her position. At 8 a.m. on 7 August, however, I found the honeysuckle leaf lying on the ground with a white egg-sac on it, covered with a very thin transparent layer of white threads, the whole glistening like spun silk. It was a very beautiful object. The spider was on the side of the leaf, which had been partly curled so that the egg-sac lay in the hollow. The mother had shrunk to about half her original size. By 9 a.m. the spider had moved the leaf containing the egg-sac over behind the sticks, a distance of about an inch, raising it at the same time. She took up a position with her forelegs spread widely on the top of the egg-sac.

That night the spider again moved the egg-sac, lifting it about two inches, and turning the leaf so that her brood was on the side away from the light. This work completed, the mother remained on the egg-sac, apparently guarding it. For the next seventeen days she did not seem to move, although it is possible that she may have done so in darkness, and remained motionless upon her cherished sac; even when the leaf was touched she did not respond in any way. On the twenty-sixth day she showed signs of activity, and moved in a lively manner about the egg-sac.

On October the spider again moved her egg-sac, this time to the front of the box, and attached it to the glass up near the top.

The following morning the spiderlings emerged, but, unfortunately, I was away on my annual holidays, so did not see them myself, for they had dispersed on my return. A note was, however, made of the date on which they emerged, and they were described as resembling their parents, the forelegs being about one-fifth of an inch long, and the body of the size of a large pin-head.

The discovery of another female on 25 August made it possible to make some further observations. She was placed among some dead sticks and leaves in a large jar, with about half an inch of



Egg-sac of Sidyma longipes in a curled leaf.
N. B. Adams, *del.*

earth at the bottom. Once established, she accepted and fed upon a moth.

Six days later I found the spider upon a leaf which had been rolled into a shape resembling that of leaves containing egg-sacs of the Leaf-curling Spider (*Syngatypa wagneri*), so concluded that she had laid her eggs in the night. The leaf was attached to the gauze covering of the jar. Like the other spider, she had shrunk to about half her former size.

After laying her eggs, the spider continually shifted her egg-sac, occasionally cutting it free altogether and letting it fall to the ground while she clung tightly to it to avoid being dislodged by the sudden descent. Her method of lifting the egg-sac in its enclosing leaf was similar to that used by the Leaf-Curling Spider. She fixed a thread to it, climbed several inches up a stick and attached the thread to the support, at the same time raising the egg-sac very slightly by shortening the line, and then climbed back along the thread to the egg-sac. Then, with all her legs clasping the sac, she appeared to give a quick jerk, lifting her burden about half an inch. The process was repeated until the egg-sac was in the desired position.

On 25 September the egg-sac, which had been attached to the cover of the jar, was accidentally knocked down, but the spider immediately set about lifting it again, and left it attached to the sticks in the jar. By the next day the egg-sac had been hauled up and secured in its old position; but the next morning it had apparently fallen again, for it was nearly touching the ground, being suspended by threads from one of the sticks. Two days later it was lifted half-way up the side of the jar, and was secured to the sticks by several threads. The spider, apparently satisfied with the result of her labours, was several inches away sucking the juices of a moth.

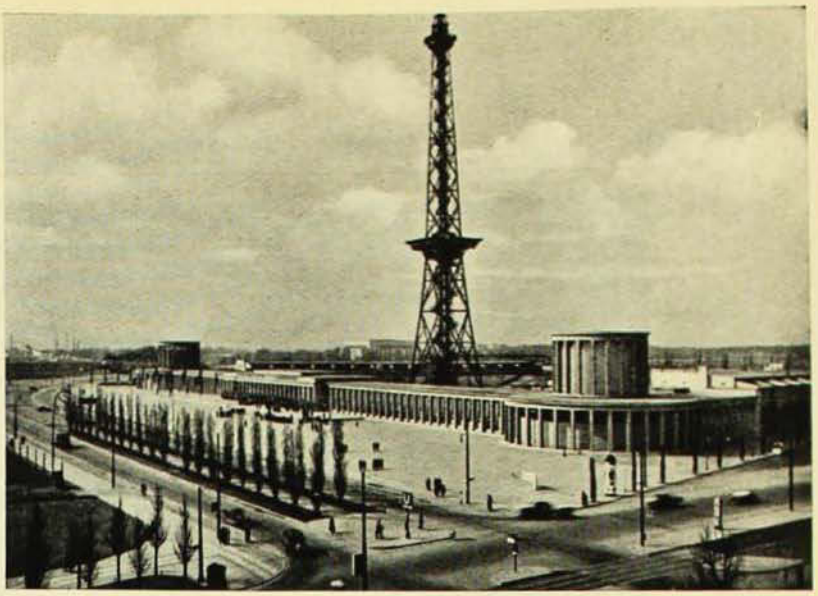
For some days the spider remained away from the egg-sac, revisiting it for a couple of hours on 1 December, but generally she seemed quite indifferent to its presence. She seemed to be growing rapidly again, and had now almost regained her full size.

About a week later the spider resumed her activities, and she lifted a dead leaf and hung it up by threads to a stick; but, apparently dissatisfied, a week later she abandoned the first leaf and hauled up another. This, too, did not seem to suit her, so a few fresh leaves were placed in the jar. These proved to be what she sought, for the following day she had raised one of these fresh leaves and partly bent it to form a semicircle. By her efforts during the next couple of days she formed the leaf into a pouch, like that of the Leaf-curling Spider, and in the cavity formed a second egg-sac. After egg-laying was completed, the mother was not so large as formerly, although she was still of a fair size. The next day she raised the sac to the top of the jar, and took up her position on it, as she had done with the former egg-sac.

It was noticed that throughout the whole of the time she was guarding her egg-sac the mother appeared to undergo a voluntary fast, although suitable food was provided in case she desired to make a meal.

The International Hunting Exhibition at Berlin

By GILBERT P. WHITLEY



Portion of the great Exhibition Buildings near Berlin, also the Radio Tower.

THE International Hunting Exhibition was one of the sights of Berlin when I was there last November, and will be remembered as the meeting-place of Lord Halifax and Herr Hitler. My own visit was non-political, and, as I am no hunter, my interest was in the animals and their display. The exhibition, the greatest of its kind ever held, was under the presidency of Schirmherr Reichsjägermeister [State Hunting Master] Generaloberst Protector Hermann Göring, himself a noted hunter. The gigantic set of buildings which housed this *Internationale Jagdaustellung* was in a suburb of Berlin, not very far from the Olympic Sports-ground. A huge golden statue of a stag and waving flags and banners of many contributing nations formed an imposing introduction. I paid a mark, bought an excellent illustrated official guide with hundreds of pages, and passed into the main hall along with bearded Austrian hunters in green suits, contentedly puffing at their pipes.

The entrance "hall of honour" (*Ehrenhalle*) was surrounded by the choicest pieces: world's record heads, great antlers, and skulls decorated with the crests of those who shot them, and the first prize exhibits. But all was not concentrated here, for in the vast halls were staged displays from scores of countries and peoples, including some from the Royal Family of England. The whole was a monument to German thoroughness; hundreds of horns were ranged to show their changes with growth, the effect upon them of climate or locality, and, in one case, the horns of fighting stags which had been locked in death.

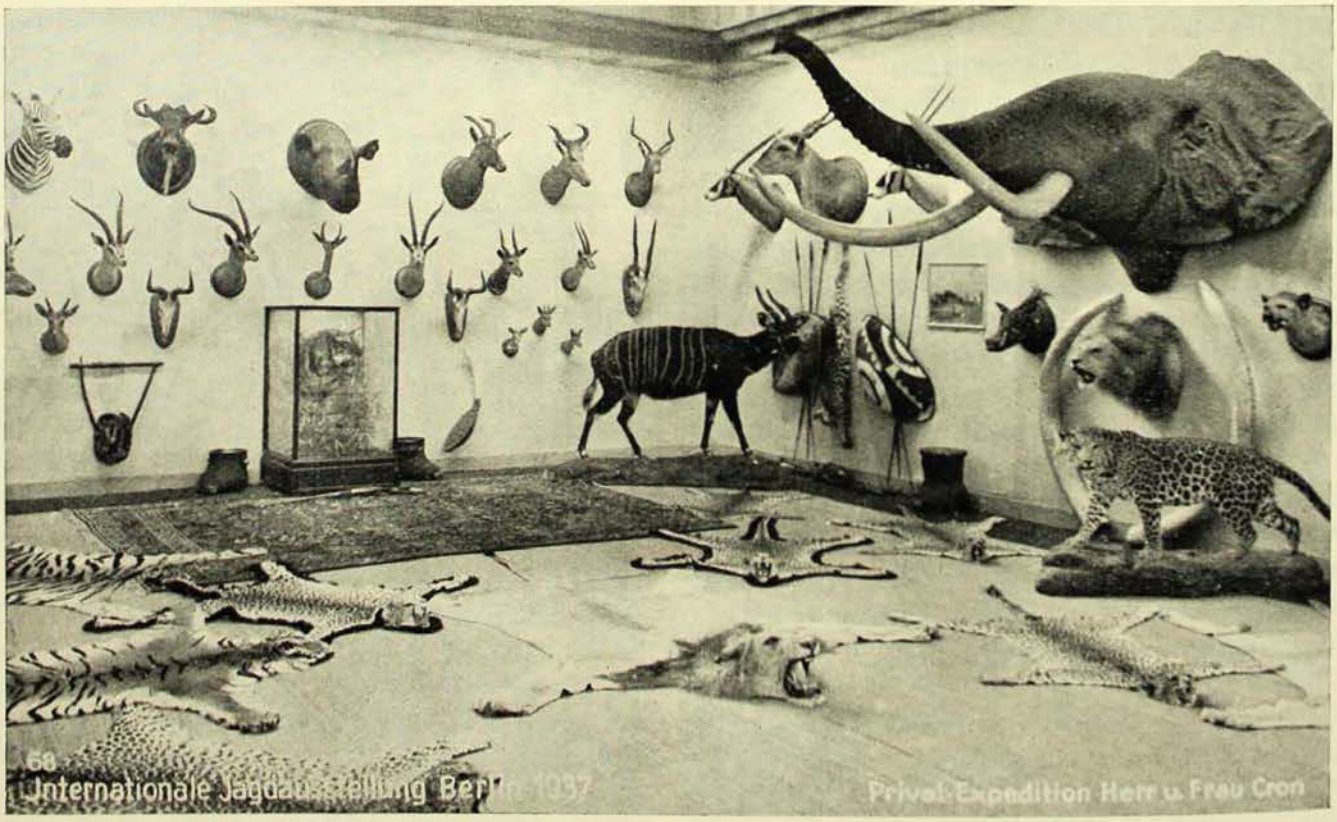
Mammals *en masse* ranged the salons, from smaller game to large carnivora, from bears, walrus, and elks to the elegantly horned moufflon.

In another part of the buildings there was an entire wood with real trees and mounted animals in it. Smaller cases showed animals' tracks, excrement, and drops of blood upon the ground, useful to stalkers. Even parasites of game were shown. A living Elbe Beaver occupied one section, and there were fossil animals from the Naturhistorisches Museum, Mainz; also models and old drawings of rare or extinct animals: wisent (*Bison priscus*), aurochs, etc., with mounted specimens of the last wolf or other large mammals from certain districts.

Cartoons and posters warned persons not to leave litter about and to guard against forest fires and careless shooting, whilst maps showed game preserves and protected areas. The natural history books were modern editions of the Brehm school, but not as up to date as their subjects warranted or as the exhibition itself.

Graphs and maps and rows of statistics gave information upon every conceivable subject connected with game. As I tried to inspect a large wall map, a vaguely familiar face looked up between me and Australia; then I remembered some wartime cartoons and realized that here, without any ceremony, was the ex-Crown

A large and striking diorama of Geese flying over the vast plains of Hungary at the International Hunting Exhibition.



A big game exhibit from Mr. and Mrs. Cron's African expedition.

The hall of falconry, with live birds in the central plot, an Austrian display in the background, and, on the right, portion of the winning exhibition of British falconry. The statue illustrates the motto, "Der wilde Falk ist mein Gesell" (The wild falcon is my comrade).

Prince Wilhelm, greyer haired, but looking extremely well.

'Shooting with a camera' was to the fore in a collection of Nature photographs, amongst which the Italian contribution was particularly good. Films of wild life were also screened in a special projection department. There was quite an art gallery of paintings of animals, besides murals, and backgrounds. Some of Johannes Deiker's paintings of stags were photographic in their detail.

Group exhibits and dioramas were devoted to many kinds of animals, one, showing geese flying over the vast plains of Hungary, being very striking.

The statue of a boy with a falcon as his comrade adorned a salon wherein were real live falcons and eagles, and wonderful exhibits concerning falconry from the oldest times to the present, which seemed to me the most interesting display in the great exhibition.

How the chase had contributed to art was demonstrated in pictures, sculpture, tapestries, hunting-lodge furniture, and ceramics. Hunting wagons and sleighs were shown; one beautiful example of Frederick I was fashioned like a stag, as were other objects of art, such as an impressive Cup of Welcome, dating from the sixteenth century.

The hunting clothes of the Emperor Franz Josef, hunting equipment, weapons, ammunition, optical instruments . . . . Was anything concerning hunting omitted? Probably not, for here were cooking recipes, exhibits concerning angling, the effect of oil on seabirds, medals, permits, even curious playing-cards.

The literature and poetry of the chase were freely quoted, even including German translations of Japanese hunting-poems, but, pleasantly tired at the end of hours of tramping around the galleries, I could not help recalling one quotation I had not seen anywhere. It comes from Omar Khayyám:

> And Bahram, that great Hunter—the Wild Ass Stamps o'er his Head, but cannot break his Sleep.

Birds and a Cuckoo

Mysteries of Bird Behaviour

By M. S. R. SHARLAND*

THE way of a bird with a cuckoo will never cease to be a mystery. Through the years since the cuckoo first was known to be a parasite, the sight of a diminutive foster-parent attending a fledgling cuckoo nearly twice its size has never failed to excite interest; and all the wonderment, all the observation by patient naturalists, have not assigned a convincing reason for the cuckoo's strange behaviour or the gullibility of the birds which it deceives.

The wise ignorance, the clear-seeing instinct of our forefathers, gave utterance to this oracle: "Everything springs from the egg; it is the world's cradle." Many birds, however, find that some eggs may produce more than they bargain for; but, doubtless, it is something of ignorance and instinct combined—the all-pervading parental instinct, especially—that enables them to accept a bad bargain without complaint, and, at the same time, permits the cuckoo to continue its nefarious ways.

While I was walking along a lane last spring, where the old-fashioned sweet briar filled the air with fragrant perfume, and yellow stars of the cape-weed made colourful patterns in the grass, my attention was attracted by the plaintive notes of a young bird sitting on a dry wattle twig. It was a Pallid Cuckoo, apparently fresh from the nest, and about it a number of small birds were flying,

* Illustrations by the author.

A Pallid Cuckoo that sat alongside a nest of the Willie Wagtail and intercepted the food which the male brought for his sitting mate.

some scolding it and others pausing for a moment in their flight to push an insect into its gaping mouth.

From a patch of trees in a paddock beyond the hedge a bird, slightly smaller than a kestrel and with characters not unhawk-like, flew above my head and turned its eye in the direction of the wattle tree, as if it recognized the fledgling for the product of its egg which it had deposited in a nest of a Black-capped Honeyeater a few weeks earlier. At any rate, it hovered above the tree for a moment, attracted either by the young bird's cries or the sight of the honeybirds (the foster-parents), two robins, a flycatcher and a few wood swallows gathered about the wailing object on the twig. Then, in a series of long undulations, it disappeared down the lane, pursued by a pair of wood-swallows, which had recognized it as a Pallid Cuckoo in spite of its hawk-like guise, and were not content until it had quit the neighbourhood.

Why is it that birds are duped so easily by cuckoos? One seemed to see in the actions of some of these birds in the lane something far removed from sympathy for their fellow-creatures who had been saddled with a hungry, wailing baby, whose appetite was most exacting, and who, in infancy, had probably destroyed their rightful young ones with whom it had shared the nest.

These small honeyeaters were striving to satisfy the material needs of their over-grown baby, fussing about it tenderly, stuffing tasty insects into its throat as quickly as they could catch them, and protecting it from the assaults of ill-mannered neighbours, as if it were an offspring of their own blood. Their neighbours, meanwhile, made fun of them (or so it seemed) for their failure to see through the trick that had been played them. The wood-swallows sat close together on a high branch, and one could well believe that they wore broad smiles and remarked to one another: "What fools these honeybirds must be!"

And yet, if any of these unsympathetic birds had been similarly placed (as some-

Cuckoo and Willie Wagtail. An unusual bush snap of a Pallid Cuckoo fledgling and a Willie Wagtail. Although the Wagtail was not the foster-parent, it persisted in feeding the Cuckoo.

times they are), they would, I suppose, have reacted to the imposition in precisely the same way. It may be that the impulses aroused by parental love are sufficiently strong to cause birds to lose their sense of proportion to the extent that they will bestow as much care on a young one foisted on them as on one of their own breeding. As far as we can determine, they fail to recognize anything unusual in the size and colouring of the cuckoo's egg when deposited in their nest, nor in the early disappearance of their own young ones soon after the infant cuckoo has hatched, nor in the rapid growth of the now sole occupant of the nest, and, finally, in the fact that the bird

A Bronze Cuckoo being fed. The baby cuckoo opens its mouth so wide that its foster parent—a Brown Thornbill—is almost swallowed with the food.

they are rearing grows to sometimes twice their size before their task is finished. These are features that we cannot understand.

In the fork of a gum sapling a pair of robins built a nest, and in due time three greenish-white eggs were laid. Before the hen began to sit, a Narrow-billed Bronze Cuckoo visited the area, found the nest, and while the robins were absent for a few minutes, destroyed one of their eggs and replaced it with one of its own.

This was pinkish-white in colour, finely freckled all over with reddish spots. It needed but "half an eye" to see the difference, but, apparently, this was not detected by the hen robin, who sat on them all for a couple of weeks, blissfully unaware of what was stirring beneath her. At the end of the incubation period, the robin's eggs were the first to hatch, and although two days elapsed before the young cuckoo appeared, she made no attempt to throw this egg out, as birds will when one of their own eggs fails to hatch within a day or so after the others. The tiny bird which emerged was black in colour, and possessed a skin of leathery texture, much like that of a young reptile, while the robin's young ones were a delicate shade of pink. Here again the bird evidently failed to see anything unusual.

Four days passed before I could visit the nest again, and this time it was occupied by the baby cuckoo alone. No doubt, the robin's nestlings had gone the way of all young birds unfortunate enough to be born into a nest with a cuckoo. Though less than a week old, the infant parasite had thrown them over the side, where they had died and been eaten by ants. The cuckoo, now getting all the food and the concentrated attention of two foster-parents, grew apace, and within a fortnight was sitting on the rim of the nest, and all day whined for food. And while the robins, no doubt, welcomed the coming of each night as a respite from their food-gathering labours, other birds in the area mocked them for their blind foolishness in tending to the wants of an interloper.

The nature of an average bird is one of strange contrasts. In studying birds with a cuckoo we may see malevolence and compassion, charity and enmity, in

A young Fantail Cuckoo just out of the nest.

quick succession. Some birds, evidently by instinct, feed young cuckoos, whether they be the rightful foster-parents or not.

I was once watching the reaction of several birds to the appearance of a fully-grown Pallid Cuckoo in a patch of bush along a creek. This cuckoo, I must state, had been reared by a pair of White-plumed Honeyeaters, who were still feeding it, although it had reached an age when it should have been able to fend for itself; but, as if not content with the food received from this source, it had attached itself to a pair of Willie-Wagtails, which were busy incubating a clutch of eggs! It sat on a branch close to the Willie-Wagtails' nest and intercepted all the food which the male wagtail brought for his sitting mate, so she, when she wanted food, had to leave the nest to find it for herself. And, in her absence, the cuckoo amused itself by trying to tear the nest to pieces and dislodge the eggs, and it would have succeeded had I not intervened.

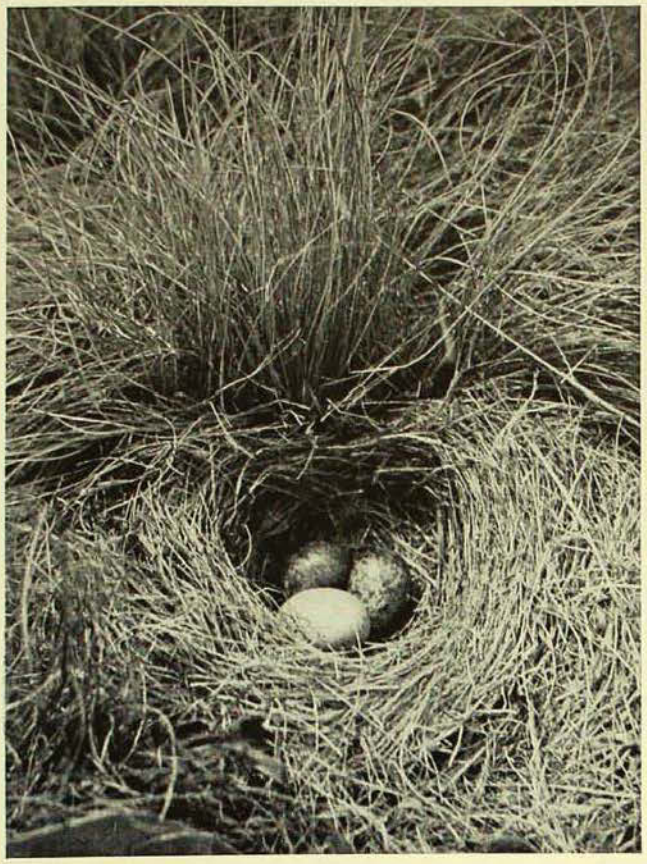
There was a wood-swallow nesting in a gum tree some thirty yards away. It had three small young ones. In the intervals of finding food for its brood, the wood-swallow tormented the cuckoo by darting at it, dislodging it from its perch, and chasing it through the trees. But, when the excitement had died down, the cuckoo would always return to its perch beside the wagtails' nest.

Here is the interesting part of the story. After watching the wood-swallow's hostile demonstration for an hour or more, and noting how viciously it flew at the larger bird, you can imagine my astonishment to see it catch a butterfly, then suddenly dive in its return flight to its tree, alight alongside the cuckoo, and push into its throat the food that was intended for its own offspring!

The plaintive cry of a young cuckoo seems to strike a responsive note in the breasts of most birds; it plays upon an instinctive maternal chord, and the most hostile enemies at times will divert their flight, or forget their enmity, to feed it. And the cuckoo never hesitates to accept food from all and sundry who may offer it.

Sometimes adult cuckoos have been noted feeding young cuckoos fresh from the nest, and this had led to the suggestion that parent cuckoos are not so neglectful of their offspring as has been supposed, but watch over them from a distance, as it were, and feed them when opportunity presents itself. But there is nothing to show that these birds really are the rightful parents, or whether they are total strangers, responding to instinctive prompting, as many other birds do.

Now and then one comes across nests where a cuckoo's egg has been buried in the lining, as though the owner of the nest had been somewhat more discerning



Egg Contrasts. A Pallid Cuckoo's egg (front) in a Pipit's nest. The contrast was most marked between the Cuckoo's pink egg and the Pipit's chocolate-brown pair, but apparently the Pipit accepted the strange egg without question.

than the average and detected the difference from its own eggs. The more probable explanation is that the cuckoo misjudged its time and laid the egg before other eggs were there, whereupon the owner of the nest, without realizing how it got there, pushed it down through the lining and disregarded it, or deserted the nest. Once I found a Scrub Wren's nest containing one egg of a cuckoo and one of the rightful owner. The next day the Scrub Wren's only egg was removed and another cuckoo's egg inserted, and she was sitting on two eggs that did not belong to her. You could find no greater contrast in egg-colouring than the pink of a Pallid Cuckoo's egg and the chocolate-brown eggs of a pipit; yet I have seen such a combination in the pipit's nest, and the bird protecting them as if they were all her own. There is no explanation for this sort of thing.

It might be mentioned that all cuckoos are not parasites. The American cuckoos, for example, still manage to build a nest and face the responsibility of rearing young. The same parasitical habits of cuckoos are common in America to the family known as Cow-birds, which are polygamous, living in roving flocks, making no nests and providing in no way for their young. They feed in the pastures on insects disturbed by grazing stock. Then, in the so-called swamp-pheasant (Pheasant Coucal) of Australia, we have a large ground cuckoo that builds its own nest and rears its young, like any normal bird.

THE W. D. K. MacGILLIVRAY EGG COLLECTION.

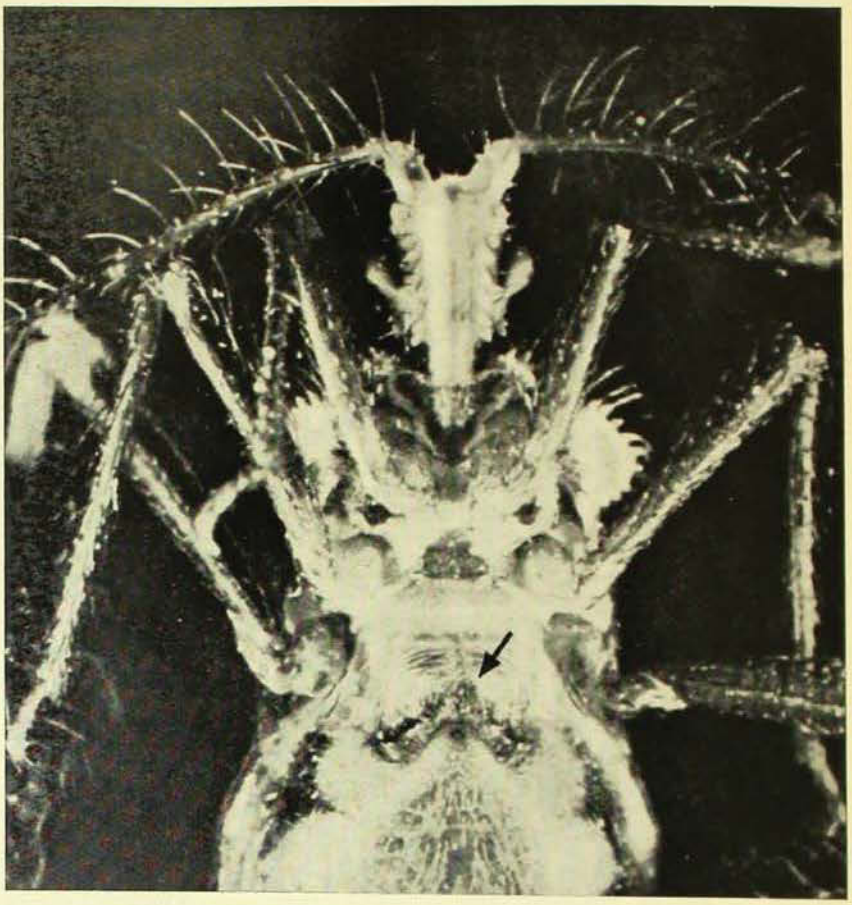
Over thirty years ago, the late Dr. W. D. K. MacGillivray, of Broken Hill, New South Wales, commenced to form a collection of birds' eggs. Dr. MacGillivray travelled extensively in the inland districts of Australia, and made several visits to the Great Barrier Reef, and was thus enabled to form a very large and valuable collection of specimens from western New South Wales, western Queensland, Central and North Australia, and the islands of the Great Barrier Reef. In this work he was aided by his son, Dr. I. H. MacGillivray, and several others, including the late W. MacLennan, a well-known and experienced collector.

This collection, containing several thousands of eggs and many rare and interesting clutches, has now been presented to the Australian Museum by Dr. I. H. MacGillivray, and is one of the most valuable donations ever received by the Trustees, by whom the generous action of the donor is very highly appreciated.

Some Habits of an Assassin Bug

(Ptilocnemus femoralis)

By N. GEARY



Underside of Ptilocnemus, showing position of gland which secretes the narcotizing fluid which paralyses the Green-head Ants.

Photo.—N. Geary.

AS little or nothing of an authentic nature has been recorded about the habits of, or the method employed in the capture of its prey by, one of Australia's little known and most interesting insects, the following observations recorded by the author during March, 1937, on the Condamine River near Condamine township, Queensland, should prove of interest.

This bug has a unique method of capturing its prey, which by experiment I have proved beyond any doubt. It "chloroforms" its victims (ants) before attempting to seize them.

In my first experiment, which took place on the 9th March, I placed five specimens of the bugs in a jar with twenty-two specimens of the Green-head Ant (*Chalcoponera metallica*). After two days, only five ants were alive, the rest having been killed by the bugs. Although I kept a careful watch, I did not see a bug capture an ant. On the 12th another batch of twenty-one ants was placed in the jar, and after two days the majority of the ants (fifteen) had been killed; but though I saw the bugs fastened to the ants and feeding on them, I did not actually see any caught. On the 15th another fresh batch of fifteen ants was put into the jar, and on the 17th five ants were alive.

Up to this period I had not seen the capture of an ant, so I removed all the surviving ants and left the bugs for thirty-six hours without food. I then put in nineteen ants, and on this occasion my patience was rewarded. It might be well to mention here that on each occasion when ants were freshly put into the jar they molested the bugs quite considerably, mostly by grasping the tarsus of a hind leg and pulling the bug about,

Ptilocnemus with rostrum extended to extract the juices of Green-head Ant.
Photo.—N. Geary.

the latter all the time struggling to get free. On each occasion this molestation lasted for about fifteen to twenty minutes, after which they would not interfere with the bugs.

The method employed by the bug in capturing the ant is as follows. The bug crouches down flat on its body, with its two hairy hind legs pressed tightly to its side; the ant meanwhile stands off a short distance (about two inches) and, raising its head, works its antennae backwards and forwards as if smelling the air. At other times the ant went straight to the bug, which remained in the same crouching position until the ant was almost up to it, whereupon the bug would raise itself upon its front legs, enabling the ant to go straight to the gland situated on the second segment of the ventral side of the abdomen. Here the ant immediately seizes with its mandible the bristles which protrude from the opening on the top of the gland and proceeds to suck the fluid, a minute drop of which is at the base of the bristles. The first ant sucked (as far as I could estimate) for five seconds, the second for six seconds, and the third for eight seconds. This makes the duration of sucking about six seconds. Immediately upon the expiration of this period the bug springs backwards for about one-eighth of an inch, and, with its front and middle legs working rapidly backwards and forwards on each side of the ant's head and shoulders, keeps the now doped or dying ant on its feet. The ant's head meanwhile hangs downwards, thus exposing the nape of the neck (the only vital spot the bug can reach), into which the bug incontinently thrusts its beak, the rapid movements of the legs on each side of the ant ceasing once this action has been performed. Without the support of the bug's legs the ant would assuredly fall on its side. Proof of this was obtained when an ant approached a bug, which acted in precisely the same way as in the account just described up to the point where the ant seizes the bristles on the gland, but, instead of springing backwards and holding up the ant with its legs, it simply walked away and the ant fell on its side and died.

The bugs mostly suck the juices of the ant from the nape of the neck, usually taking about half an hour. On one occasion I saw a bug, after sucking at the nape of the ant's neck for some time, turn it round by manoeuvring it about with its legs, and then fasten its beak at the end of the ant's abdomen and proceed to suck from this part. I am quite satisfied that this particular bug (*Ptilocnemus femoralis*) eats only Green-head Ants, as other ants put into the jar were never touched. I am also of the opinion that it is at the will of the bug that the ants are attracted, and it has not a constant scent or lure. When the bug is not hungry or does not want to attract the ants, the ants run all about the bugs and very often over them, but do not seem to take any notice whatever of their enemies.

The spring back of the bug when it considers the ant has had sufficient of the "narcotic" is necessary, otherwise the nape of the neck of the ant would be too far under the bug to be reached. When the beak is attached to the ant's neck the latter is almost directly under the bug's head. Without the extraordinary power of being able to drug the ant, this bug would not be able to overcome it, for the ant is encased in a very hard covering, is very active, and is capable of inflicting a sting which I feel sure would be sufficiently severe to kill the bug. The bug is a very slow-moving insect, but is a strong flyer. Its usual habitat is in dark places, such as under bark on trees and logs, and under stones on the ground.

Notes on the Assassin Bugs

By A. MUSGRAVE

THE following notes are to amplify those of Mr. Geary made in the field, as it is felt that additional information of a preliminary nature may assist readers in knowing something of the classification of the species.

The Assassin Bugs (family Reduviidae) constitute a large group of carnivorous bugs which feed on the juices of other insects killed by means of their sharp curved beaks.

Australia is rich in species, some 130 forms being so far recorded from this continent. Included in the family is the subfamily Holoptilinae, a small group represented by four genera in Australia, and of which the genus *Ptilocnemus* is one. The bugs of this genus are yellow and black in coloration, about a quarter of an inch in length, and structurally remarkable for the somewhat feathery appearance of the hind legs, thick tufts of hair on the tibiae recalling the "chaps" of a cowboy. In addition, there are on the under-surface of the body certain structures called "trichomes" on the second segment of the abdomen. The opening of the trichome is concealed in a tuft of hairs, the opening leading from the gland which secretes the "drug" prized by the ants. This gland is different from the usual "stink glands" of bugs.[1] These glands exist in other genera, and their secretion is evidently attractive to ants.

A Javanese species, *Ptilocerus ochraceus*, has been described by Jacobson in a Dutch entomological journal for 1911,[2] as capturing and killing a species of ant, *Dolichoderus bituberculatus*. Mr. W. E. China, of the staff of the British Museum (Natural History), in 1928 drew attention to Jacobson's paper in the *Natural History Magazine*, issued by the British Museum, and these appear to be the only biological notes so far published concerning the habits of these insects. As so little is known about these tiny bugs, it may not be out of place to quote from Jacobson's paper such portions as may be compared with Mr. Geary's field experiences.

The way in which the bugs proceed to entice the ants is as follows. They take up a position in an ant-path or ants find out the abodes of the bugs, and attracted by their secretion visit them in great numbers.

On the approach of an ant of the species *Dolichoderus bituberculatus* the bug is at once on the alert; it raises half-way the front of the body, so as to put the trichome in evidence. As far as my observation goes the bugs only show a liking for *Dolichoderus bituberculatus*; several other species of ants, e.g. *Cremastogaster difformis* Smith and others, which were brought together with them, were not accepted; on the contrary, on the approach of such a stranger, the bug inclined its body forwards, pressing down its head; the reverse therefore of the inviting attitude taken up towards *Dolichoderus bituberculatus*. In meeting the latter the bug lifts up its front legs, folding them in such a manner that the tarsi nearly meet below the head. The ant at once proceeds to lick the trichome, pulling all the while with its mandibles at the tuft of hairs, as if milking the creature, and by this manipulation the body of the bug is continually moved up and down.

At this stage of the proceedings the bug does not yet attack the ant; it only takes the head and thorax of its victim between its front legs, as if to make sure of it; very often the point of the bug's beak is put behind the ant's head, where this is jointed to the body, without, however, doing any injury to the ant.

It is surprising to see how the bug can restrain its murderous intention as if it was knowing that the right moment had not yet arrived.

After the ant has indulged in licking the tuft of hair for some minutes the exudation commences to exercise its paralysing effect. That this is only brought about by the substance which the ants extract from the trichome, and not by some thrust from the

[1] G. W. Kirkaldy: Some Remarks on the Reduviid Subfamily Holoptilinae, and on the Species *Ptilocerus ochraceus* Montandon. *Tijds. v. Ent.*, liv, 1911, 170-174, pl. 15.

[2] Edw. Jacobson: Biological Notes on the Hemipteron *Ptilocerus ochraceus*. *Tijds. v. Ent.*, liv, 1911, 175-179.

bug, is proved by the fact, that a great number of ants, after having licked for some time the secretion from the trichome, leave the bug to retire to some distance. But very soon they are overtaken by the paralysis, even if they have not been touched at all by the bug's proboscis. In this way a much larger number of ants is destroyed than actually serves as food to the bugs, and one must wonder at the great prolificacy of the ants, which enables them to stand such a heavy draft on the population of one community.

As soon as the ant shows signs of paralysis by curling itself up and drawing in its legs, the bug at once seizes it with its front legs, and very soon it is pierced and sucked dry.

The chitinised parts of the ant's body seem to be too hard for the bug to penetrate, and it therefore attacks the joints of the armour. The neck, the different sutures on the thorax and especially the base of the antennae are chosen as points of attack.

Nymphs and adults of the bug act in exactly the same manner to lure the ants to their destruction, after having rendered them helpless by treating them to a tempting delicacy.

This account of a Javanese insect resembles very closely that given by Mr. Geary, though treating with a bug of a different genus. It may be as well to mention here that five species of the genus *Ptilocnemus* have been recorded from Australia, viz., *P. lemur* Westwood, 1840, from Tasmania and Australia; *P. sidnicus* Mayr, 1865, from Sydney; *P. quadrinotatus* Reuter, 1880, Adelaide; *P. femoralis* Horvath, 1902, Tamworth, N.S.W., Rockhampton, Q.; and *P. plumifer* Horvath, 1902, from N.S.W. and Rockhampton, Q. These all resemble one another very closely in general appearance, so as to render identification by a layman almost an impossibility.

Mr. Geary is therefore fortunate in having been a witness to an interesting method of capture of prey by one of our little known bugs.

New Exhibits

Work has recently been completed on the first of a series of four insect habitat groups for display in the Insect Gallery.

These groups are constructed with models, and open up a new means of illustrating insect life-histories, especially where the actual specimens are too small for adequate display. Each model is six times larger than natural size and modelled from the insect, care being taken that it is accurate in detail. The groups are being constructed to the design, and under the direct supervision, of Mr. K. C. McKeown, Assistant Entomologist; the modelling and construction are by Mr. J. Kingsley, Assistant Articulator.

The finished group shows the life history of that curious creature the Ant-Lion, and depicts a small area of bush-land. A little track among the grass passes into the distance, and is traversed by foraging ants. Ants run over the ground or ascend a tree-trunk. In the immediate foreground one of the conical pits excavated in the sand by the ant-lion larvae is displayed in section, showing the larva as it lies beneath the ground, about to seize an adventurous ant that has tumbled into the trap. At the bottom of another pit can be seen the jaws of another "lion" lying in wait for its prey Resting upon a broken branch above is the perfect insect, a beautiful gauzy-winged creature, seldom associated by the casual observer with the clumsy pit-digging larva.

A second group, now under construction, will illustrate the life of the Caddis-Fly, and should prove of intense interest to anglers and others. It will be an under-water scene in which case-bearing larvae feed or contend with their enemies. An adult insect rests upon a flowering plant above the water.

It is hoped that the completed group will be on exhibition at an early date.

Australian Insects

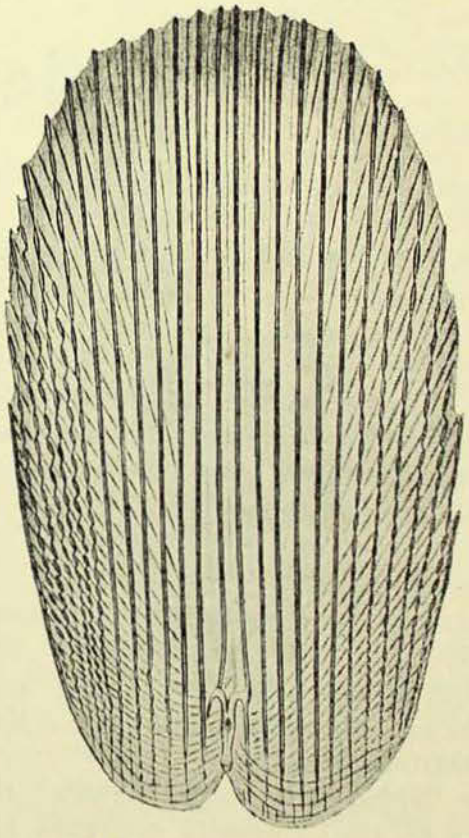
II. Silverfish and Their Allies

By KEITH C. McKEOWN

THE members of the Order Thysanura, the silverfish, Campodeids, and Japyx, are considered to be the most primitive of living insects; but should we seek confirmation of this opinion in the form of fossils in that wonderful history of past ages—the 'Record of the Rocks'—disappointment awaits us. No fossil forms have been found, apart from those insects whose remains became entombed in Tertiary amber. A little consideration will explain this absence: the insects are so soft and delicate that they must disintegrate and leave no trace long before the silt in which they were embedded could harden into enduring stone. Their claim to antiquity rests upon their primitive structure and their resemblance to certain lower forms of life.

It might be considered that the silverfish is so well known that any description is unnecessary. This is largely true, but attention must be drawn to the fact that the metallic silvery coloration of these insects is produced by a coating of minute overlapping scales upon the body. The ease with which this clothing becomes detached may be demonstrated by catching one of the insects with the fingers, and then observing how the silvery dust adheres to them. These minute scales are really beautiful objects when viewed under the microscope, since they are very delicately sculptured, the sculpture and the form of the scale differing with the species concerned.

The silverfish that infest our homes are immigrants from other lands; the native Australian insects prefer the seclusion of the bush and do not enter houses. The most familiar house-frequenting forms are *Lepisma saccharina* from Europe, an insect with a rich silvery lustre, and *Stenolepisma longicaudata* from Africa, which is of a whitish cream colour and lacks the metallic appearance of its associate. The remarkable 'Fire-brat' of Europe (*Thermobia domestica*) has been recorded from Western Australia, and an allied species from Victoria. It is very probable that it is also to be found in Sydney.



A scale, highly magnified, from a silverfish (Lepisma saccharina), showing its beautiful sculpture. The whole insect is thickly covered with such scales.
After Lubbock.

Like so many common things, little is known of the details of silverfish life-histories. What little we know may be summed up rather briefly. Like all the members of the order, they do not pass through those striking changes, or stages, so well known in insect life: the egg, larva, pupa and imago. There is an egg, it is true, but, on hatching, the baby insect is in all essentials a silverfish—a true child of its parents—and cannot be mistaken for anything else. Silverfish and their relatives never attain to the dignity of wings. As it grows, the little creature casts its coat, and resumes its activities in clothing of a more roomy fit, until, once more, when further expansion is necessary, another moult occurs. There are possibly some six or seven of these moults. With the casting of the last skin, the insect emerges sexually mature and fitted in every way to lead an adult life; no further growth takes place. Throughout its life the silverfish is active; there are no resting periods. The development from egg to adult appears to occupy several years; the adults, too, are long lived, and there is a record of their survival in captivity for about four years.

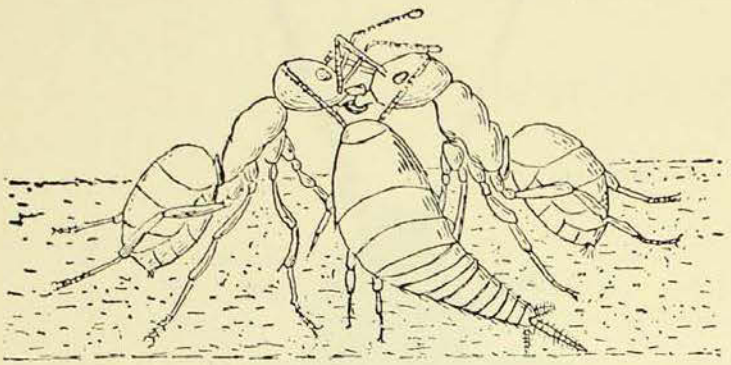
The eggs, produced by the mature females, are dropped about with apparent carelessness among materials suitable as food for the young, but sometimes the eggs are stuck to fabrics by a viscid secretion. The egg is large in comparison with the size of the parent, being about the size of a small pin's head. They are globular and of a pale yellowish colour. Egg-laying seems to take place any time between September and March, and is apparently influenced by the prevailing climatic conditions. As the egg develops, the eyes of the unborn silverfish can be seen as two black specks through the thin eggshell, and the youngster emerges some six to nine weeks after the eggs were laid.

At last the enclosed young one ruptures the eggshell and enters the world. It is a minute white creature, and resembles its parent in every way, save that the antennae and tail filaments are shorter.

The common house silverfish (Lepisma saccharina), an immigrant from overseas. After Lubbock.

Silverfish are nocturnal, coming out to feed after dark. They shun the light, and when disturbed make all haste to hide in cracks and crevices, or anywhere they can find the desired obscurity. As may be imagined from their depredations, silverfish possess strong toothed mandibles or jaws, well suited for scraping and cutting. Their food consists of the surface of book covers, pictures, photographs, and wallpaper, the securing paste or the starchy dressing in the material seeming to provide the chief attraction. They will also attack starched linen, artificial silks and starchy food-

stuffs, and they will readily devour their own cast skins, or the dead bodies of other insects, and in captivity they show very unmistakable cannibalistic tendencies.



One of the minute silverfish (Atelura) snatching food from two ants. These insects are uninvited 'guests' in the nests of ants.

After Janet.

The Fire-brat (*Thermobia domestica*) has a strong liking for the warmth of bakehouses and boiler rooms, where it clings to the hot bricks. In England it has been discovered swarming under bakers' ovens, and congregating around the mouth of the oven while bread was baking. It appears to feed chiefly on flour, while not despising the bodies of its own brothers and sisters. It has been reported to resist a degree of heat which would prove fatal to most insects.

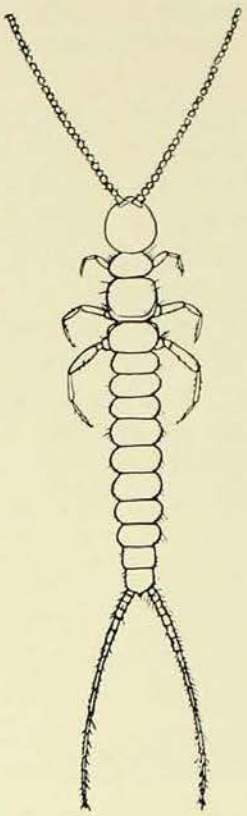
The native species of silverfish live under bark, stones, and in similar situations. Their food seems to consist of bark and lichens, while some species are possibly carnivorous. As has already been mentioned, none of our native species enter houses, and they cannot be classed as pests. Some of the indigenous forms live in ants' nests, the little *Atopatelura kraepelini* being a fairly common species. These ant-nest-inhabiting silverfish are in the nature of more or less tolerated 'guests' of the ants, although their hosts do not seem to benefit by their presence; the reverse seems rather to be the case. Janet, in 1896, described his observations regarding a European form of these little silverfish, *Atelura* (*Lepismina*) *formicaria*. He says that "these guests keep circulating and gliding about among the ants, but never remain standing in their neighbourhood. I have sometimes seen the ants threaten the *Lepismina* and even spring upon them, but the latter are so agile that they always escape. Nevertheless, in my artificial nests, where they have greater difficulty in concealing themselves than in the natural nests, they are eventually captured." Janet made further observations on the behaviour of these little creatures, which he described: "From the instant that the first foragers returned to the inhabited chamber of the nest, the *Lepismina* showed, by their excitement, that they perceived the odour of honey. Soon a considerable number of ants were grouped in couples for the purpose of regurgitating. They elevated their bodies slightly and often raised their forelegs, thus leaving a vacant space under their heads. As soon as a *Lepismina* came near such a couple it thrust itself into the space, raised its head, suddenly snapped up the droplet that was passing in front of it, and made off at once, as if to escape merited pursuit. But the ants standing face to face are not free enough in their movements even to threaten the audacious thief, who forthwith proceeds to take toll from another couple, and continues these tactics until his appetite is appeased." Similar habits will, no doubt, be found among the Australian species.

The silverfish are divided into two families: the Lepismatidae, which contains the true silverfish, and the Machilidae. The Machilidae are curious creatures, which look rather like dried shrimps as they cling to the rocks. They are probably even more primitive than their relatives the Lepismatidae. *Allomachilis froggatti* is found in eastern Australia, usually on or near the sea coast. It is rare, and nothing is known regarding its life-history and habits.

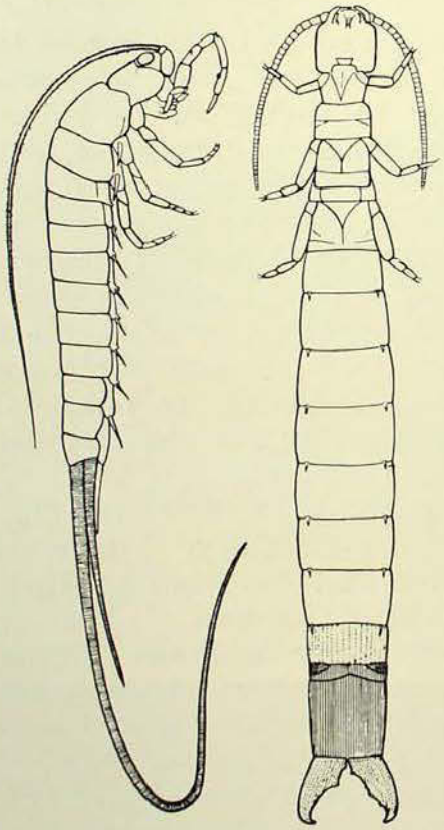
Two other families are included in the Order Thysanura to accommodate the allies of the silverfish; these are the Campodeidae and the Japygidae.

The Campodeids are minute whitish creatures which bear a fairly close resemblance to young silverfish, but they are slenderer, their heads are markedly rounded, and there are two instead of three filaments, or cerci, at the extremity of the abdomen. These active little insects burrow in damp soil or moss, but nothing further is known as to their habits and life-history. They are but seldom seen, possibly on account of their small size and retiring habits, but the main reason is, I believe, that they are not specially looked for. Systematic collecting should considerably increase the number of our known species.

My first acquaintance with the little Campodeids came about through collecting soil suspected of harbouring beetle pupae in a gully in the ranges near the Tuross River, New South Wales, in 1936. On my return to the Museum, this soil was transferred to a breeding jar and kept moist. Having occasion to inspect



One of the minute soil-dwelling Campodeids (Campodea philpotti). This is a New Zealand species.
After Tillyard.



A Machilid (Mesomachilis maoricus), left, and a Japygid (Heterojapyx gallardi), right.
After Tillyard.

the jar a few weeks later, I noticed small white insects actively moving about in the soil; they were Campodeidae. Instead of the expected beetle pupae, I had a fine colony of *Campodea tillyardi*! The insects were kept under close observation for some time, but without contributing much towards a knowledge of their habits and behaviour. As a rule, the insects avoided the light, but from time to time they could be seen passing and repassing along narrow runways among the soil grains in contact with the glass, where they travelled at a really amazing pace for such small creatures in their cramped habitat. Each Campodeid seemed to live a solitary life in its own runway or series of runways. I never saw two or more together. They appeared to feed on small patches of green algae in the damp soil and on decaying vegetable matter. After a time, since they proved so reticent about their lives, I decided that there was

little use in continuing the observations, so converted the inhabitants of the soil into Museum specimens.

The Japygidae are the largest members of the order; the females of the Australian species may measure up to two inches in length. They superficially resemble earwigs, but with the exception of the terminal segments of the abdomen, which are horny and chitinized, the body is soft and pale creamy-white. The abdomen terminates in a pair of stout, toothed forceps, giving the insect a very distinctive appearance. The insects live in damp soil, and in captivity they burrow head first into the soil of the breeding jar, and lie thus with only the forceps exposed, and by this means they succeed in capturing other insects and slaters, which are then dragged down into the burrow to be devoured at their captors' convenience. The structure of the insect and its method of hunting are quite remarkable, and the trap so set is a cunning one. Here again lies an unexplored field open to the observer who will patiently observe and record the life habits of these insects. *Heterojapyx gallardi* is not uncommon around Sydney, especially on the North Shore.

SAVAGES IN SERGE. By J. G. Hides. (Angus and Robertson, Ltd., Sydney, 1938.) Pp. 231, with twenty-two full-page plates. Price: 8s. 6d.

Jack Hides, whose third book this is, died on June 19 of this year at the early age of thirty-two. In September of last year he sorely taxed his energies in bringing a desperately ill comrade through many miles of difficult country to obtain medical attention at Daru. Later he came to Sydney to recuperate and was able to complete the book, but he did not live to see it in print.

He was born in Port Moresby, and for eleven eventful years he was a patrol officer of the Papuan Government Service, during which time he made many hazardous journeys into various parts of that wild territory. He was thus well fitted to tell the story of the Papuan Native Constabulary, for he had an intimate knowledge both of the country and the people. He had acquired an insight into the psychology of the native, understood his customs, and had sympathy with his beliefs. He was thus enabled to handle with success the many difficult situations that arise when it is necessary to "bring in" a killer who is not a murderer in our sense, but merely one who obeys the dictates of Nature and of tradition. The headhunter of yesterday is often the constable of tomorrow, and Hides tells us in this work that the Orokaiva warriors, perhaps the finest in all Papua, who fought the Government, and killed some of its officers, provide the best recruits for the Papuan Armed Constabulary.

The book is a fine tribute to the native constabulary, their bravery, endurance and devotion to duty and to their white leaders. The narrative describes many arduous journeys into dangerous country where courage and tact were needed if lives were to be saved and missions brought to a successful conclusion. With justifiable pride the author tells us that he was instrumental in arresting 150 "murderers", including some of the most blood-thirsty headhunters in Papua—and this without having to shoot one of them.