The AUSTRALIAN MUSEUM MAGAZINE

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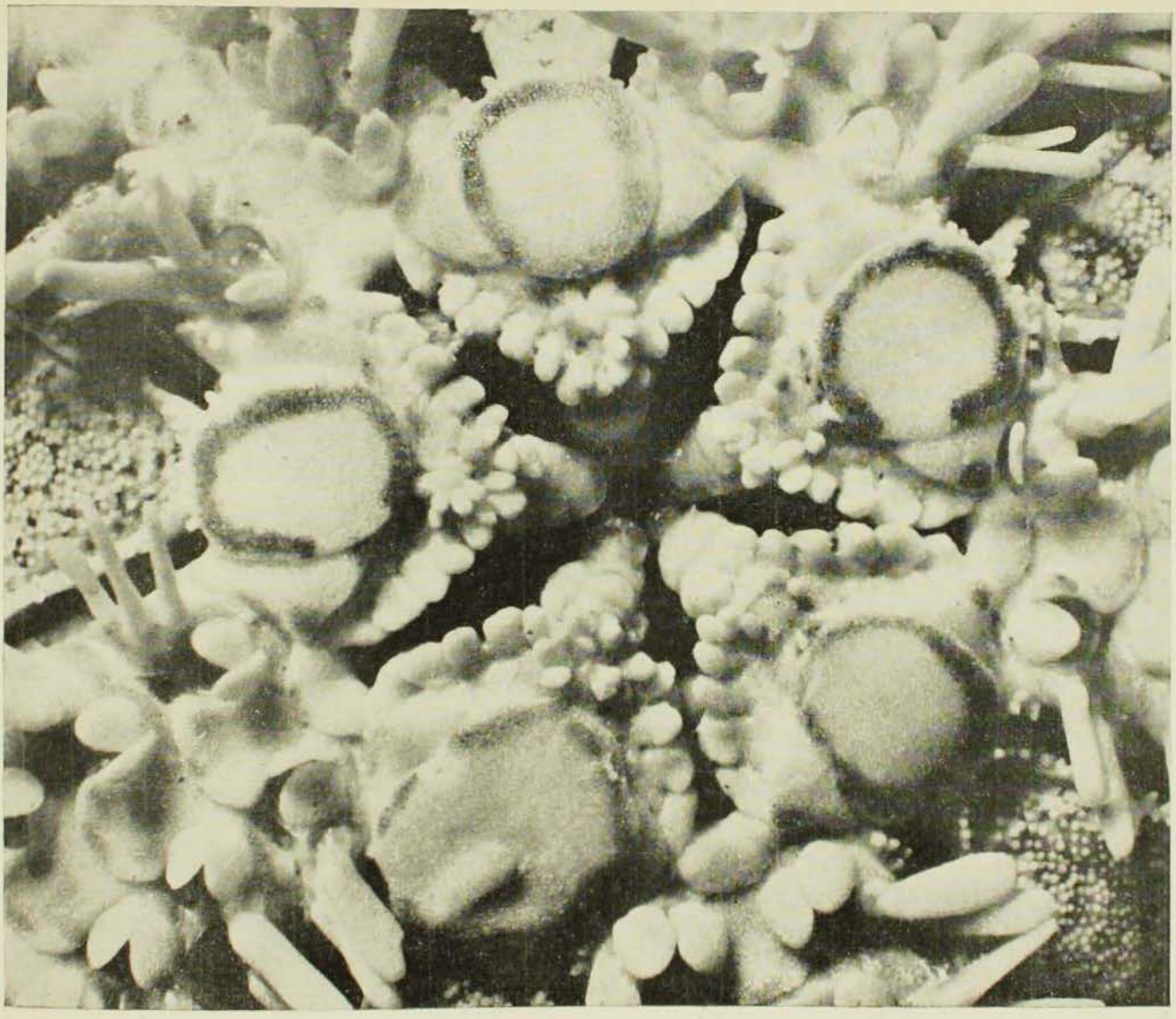

Enlarged view of the mouth and the beginnings of the five arms of the brittle-star.

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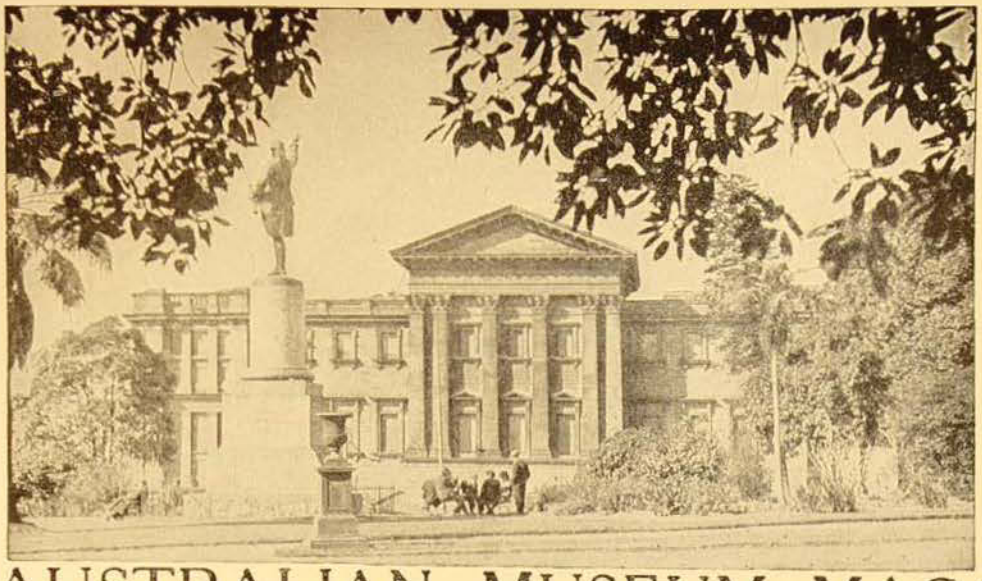

THE AUSTRALIAN MUSEUM MAGAZINE

● OUR FRONT COVER. Our front cover portrays the somewhat enlarged view of the mouth and the beginnings of the five arms on the underside of the disk of the brittle-star, *Ophiocoma brevipes*, Peters. Brittle-stars are relatives of the sea-stars and sea-urchins and, in common with many of them, exhibit the wheel-like arrangement of the body parts.

In the centre is the dark, five-rayed mouth-opening with the five teeth projecting into it. Each one of the small plates, spines and body parts has a characteristic shape and arrangement peculiar to the species concerned which is distinctive of that species.

Photo.—Howard Hughes.

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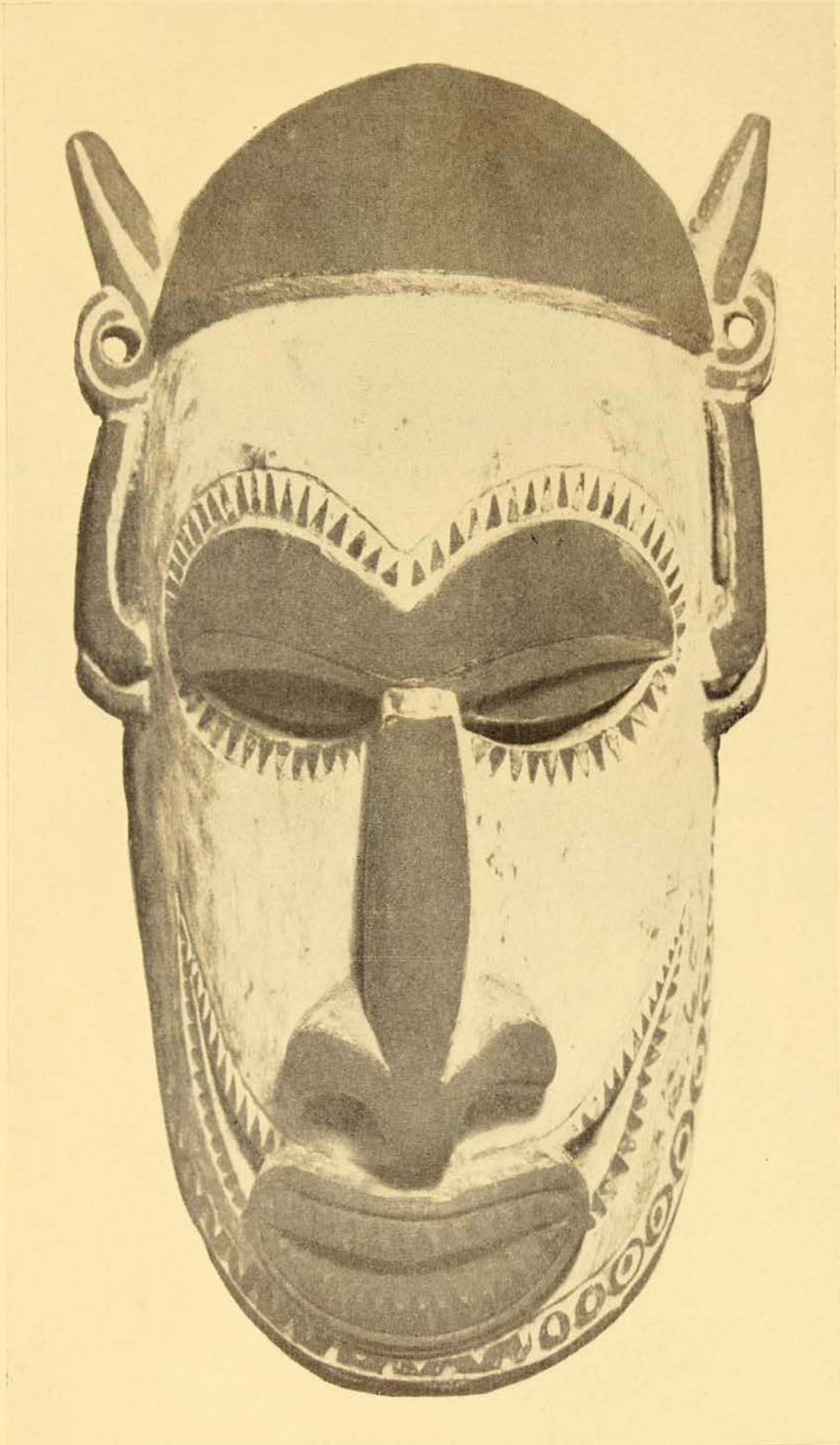

This fine face-mask, with distended ears, deep-set eyes, long nose, flaring nostrils, and large thick-lipped mouth, illustrates well the mystic power embodied in human sculptures by Tami Island wood-carvers.
These face-masks are worn during the secret society ceremonies.
Photo.—Howard Hughes.

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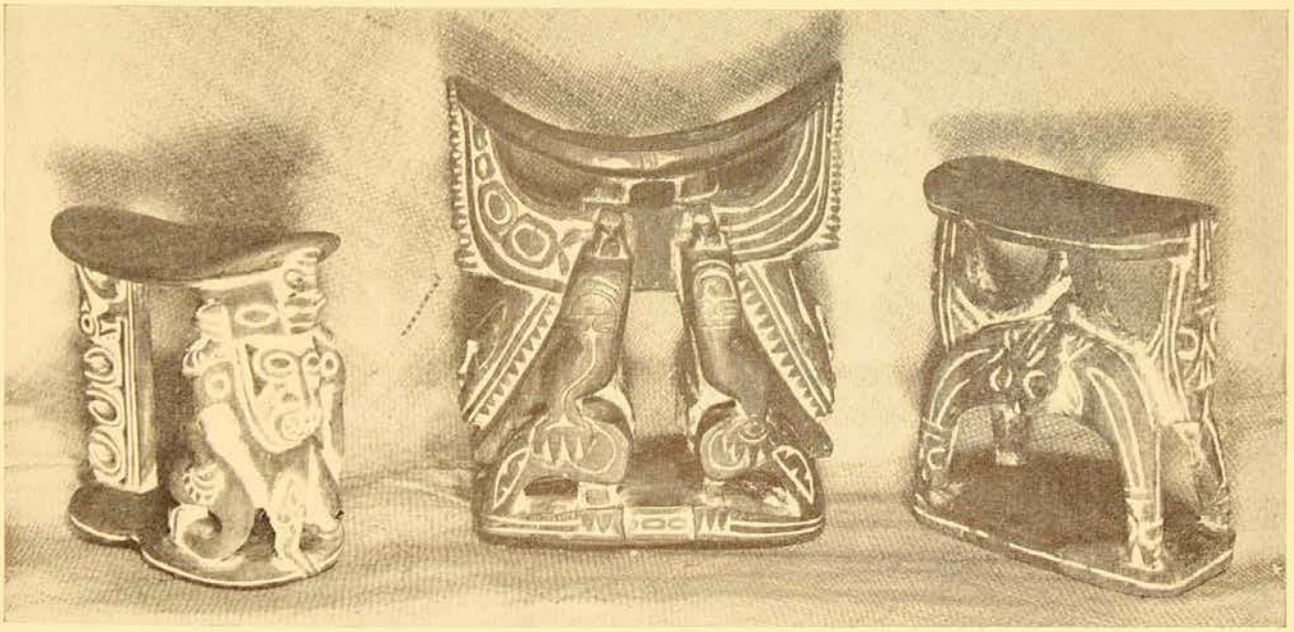
The Designers of the Huon Gulf, New Guinea

By FREDERICK D. McCARTHY.

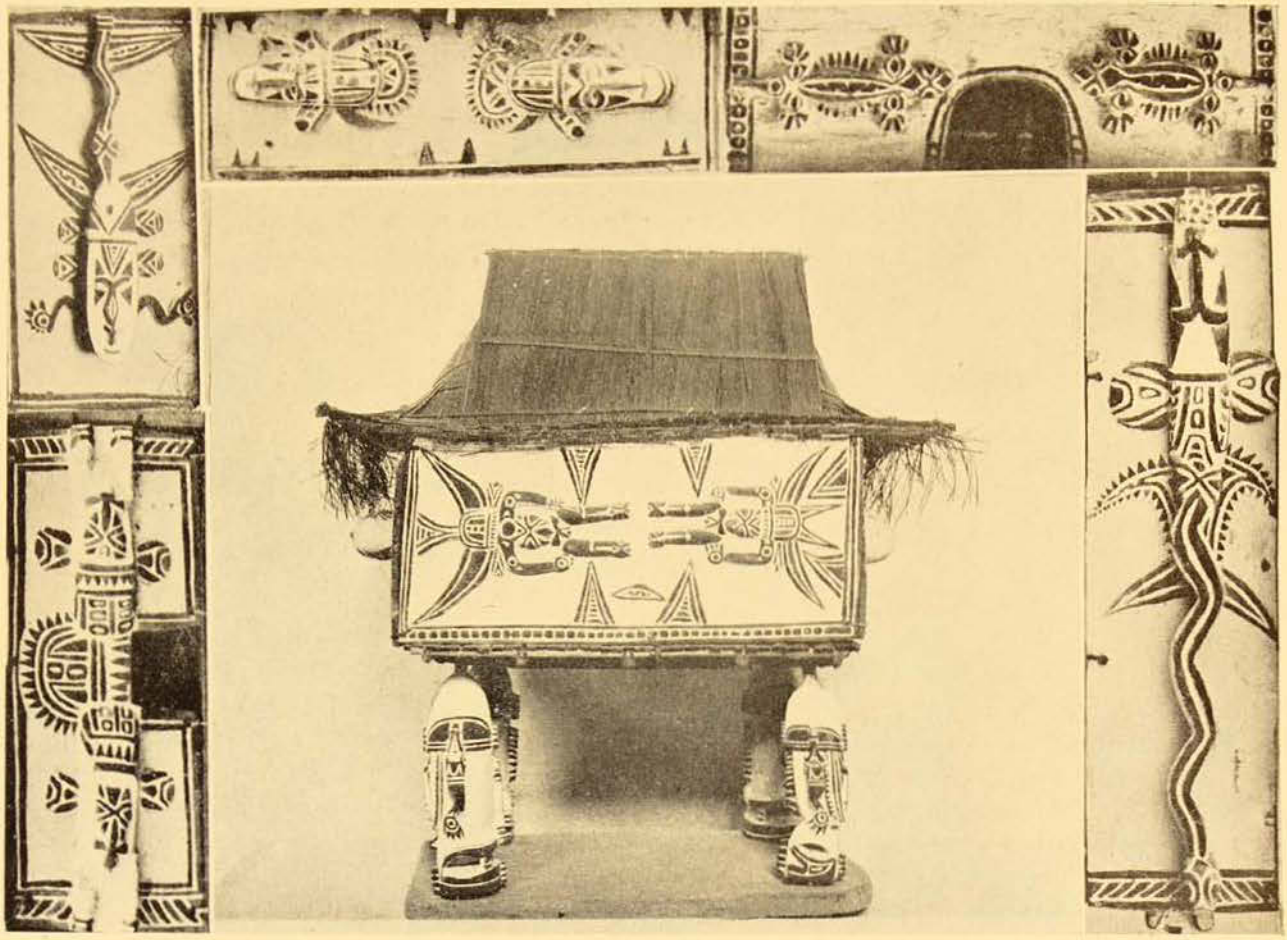
MELANESIAN art arouses our interest not only because it is so different from western art in its form of expression but because its inspiration is an integral part of the ritual and daily life of a living primitive people. It is rarely beautiful in our sense of the term in art, it is creative to a minor degree only, and its development is restricted by the implacable bonds of tradition from which there is rarely any major departure. Nevertheless, Melanesian art embodies a genuine artistic feeling, and the native tribes living on the Tami and Siassi islands, and along the shores of the Huon Gulf in New Guinea, have gone further than most other Melanesian cultural groups in using their art as a creative expression of their aesthetic sense.

Their environment consists mostly of hills and swampy flats covered by dense tropical jungle noted for its high inci-



The human face, or the kneeling human figure, combined with snakes and fish, are the principal motives on Huon Gulf neck-rests. Old and well carved neck-rests are passed on from father to son, or from a maternal uncle to his sister's son, and they are highly valued and revered by their owners for their intimate association with past members of the family group.

Photo.—Howard Hughes.



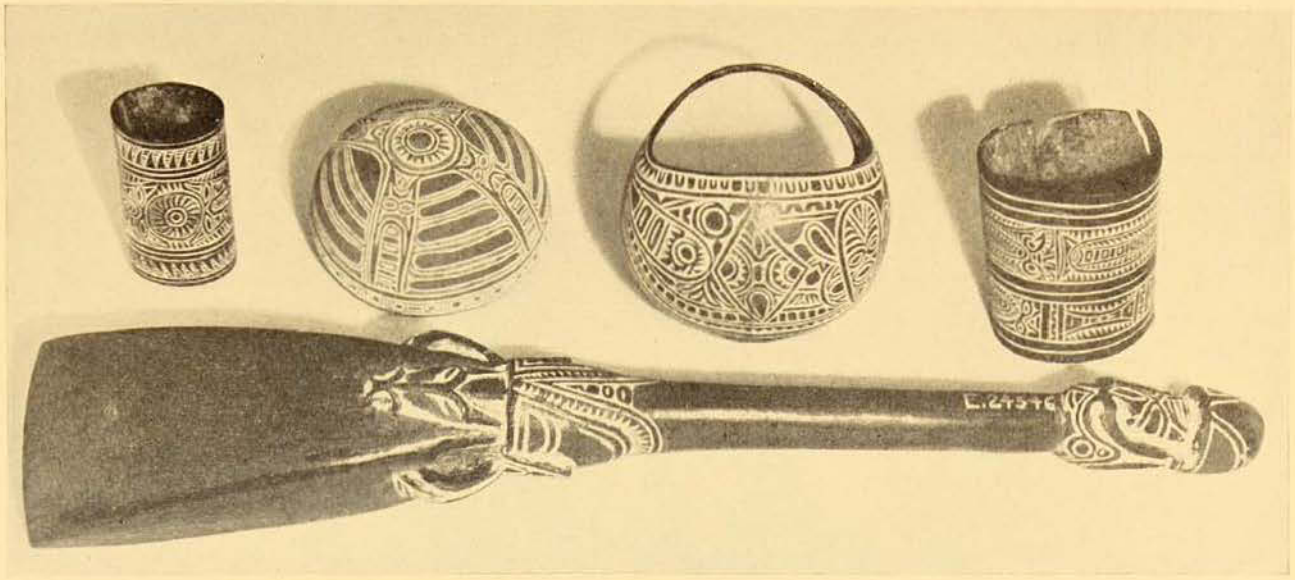
The posts, walls and ridge-pole ends on the men's club-houses in Tami Island villages are elaborately carved in the round and in high relief. The red and black designs form a striking contrast to the white surface. The designs on the walls represent the family and clan crests of the chief man of a club-house, and ancestors, spirits, and totems are also depicted among the carvings. The model club-house is in the Australian Museum collection; the wall panels surrounding it are on models in the South Australian Museum collection.

dence of malaria. The Huon Gulf natives are gardeners and fishermen who live chiefly in coastal villages. They possess a rich culture which includes a number of language groups. A wide trade is conducted in large sea-going and beautifully decorated canoes, which not only visit the Gulf and adjacent villages but also others in the Admiralty Islands and in New Britain. In this trade the Tami wood-carvings, Buang dogs' teeth and bird of paradise feathers, Busama adze-stones, Siassi obsidian knives, canoes and pigs' tusks, Markham River baskets and pots, Kai nets and spears, Bukawa mats and bags, and many other products are widely exchanged. This trade necessitates a high standard of workmanship, and is a source of cultural enrichment with ideas garnered from other communities.

The Huon Gulf natives live in villages composed of a number of joint families. Each initiated man gives his adherence to a club-house of his father's or mother's kin, and thereby joins a group of men who assist one another in economic activities, the meeting of social obligations, and the protection of each other's personal rights. A son inherits his father's chattels and his family's art designs but he is at liberty to learn wood-carving from any skilled craftsman to whom presents are given in payment. These villages are governed by a council, presided over by a supreme headman, consisting of the headmen of the men's club-houses, and the leading fishermen, warriors and magicians. There is a wide scope for men with outstanding manual and leadership qualities, and skilled craftsmen are highly respected.

These three small Tami Island sculptures of the human figure, brightly coloured in red, black and white, represent ancestors and spirits and are a type used in the initiation ceremonies. The one on the left has a fish carved along its back and an animal's head at its base. They illustrate the characteristic headdress, the ears extended to the shoulders, the hands resting on the hips, and a wide range of decorative motives.

Photo.—Howard Hughes.



A wider range of decorative motives, among which the human face is often featured, is shown on the turtle-shell bracelets and coconut-shell cups than on any other objects produced by the Huon Gulf designers. The surface of a bracelet or cup is almost completely covered with well arranged panels, bands and sectors of incised and complex designs often infilled with a white pigment to form a strong contrast against the black, red or brown background. A well-designed sago-scoop is also shown in the above illustration.

Photo.—Howard Hughes.

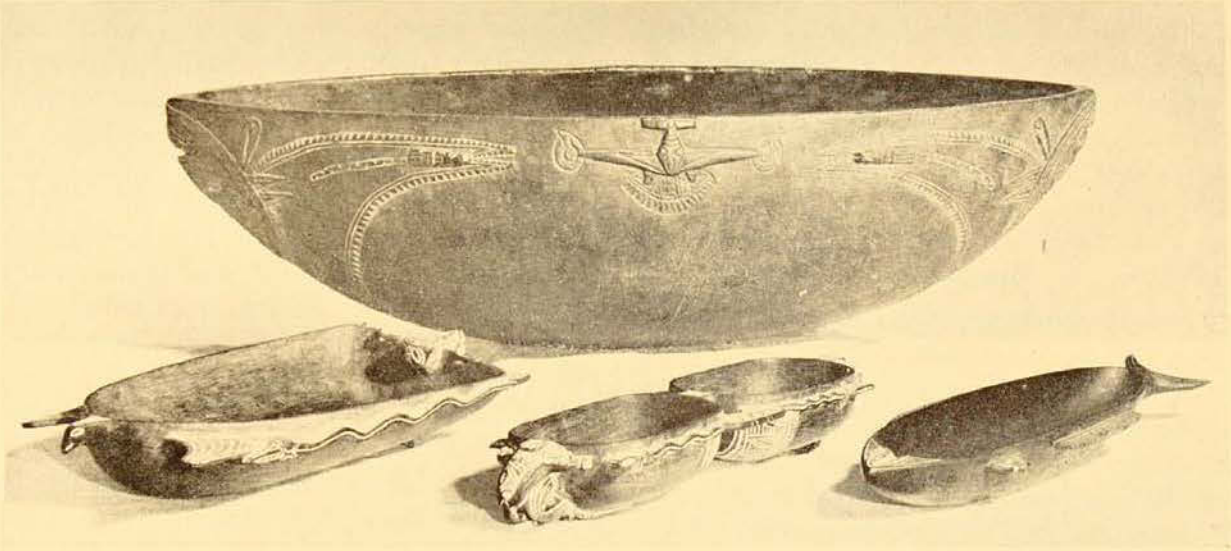
Spirits participate in every phase of the life of these ancestor-worshipping people. The spirits of the dead become members of a colony living in a secluded and eerie place on the joint-family's land. These family spirits occasionally assume the brightly coloured forms of an eel, snake or lizard; they are a source of magical power, and have power to destroy crops and other economic undertakings. The spirits are ever watchful to punish living people who disregard tribal laws and custom. There are the great *balum*, anthropomorphic spirits, led by the sun and moon, torch-bearing inhabitants of the sky who were the creators of the tribal world. Their supernatural help is maintained through secret ceremonies carried out by the men to ensure good crops, abundant hauls of fish, a large and healthy herd of pigs, and safety in warfare and canoe voyages. Other powerful spirits prominent in the men's sacred rites are enormous crocodiles whose voice is the buzz and roar of the bullroarer, and who are impersonated by the men in the rites. They are summoned from their underground lairs during the initiation and mourning rites, and for ceremonies in which crops and other food are tabooed so as to conserve them for a feast. The men's rites are carried out in or are centred round their clubhouse so lavishly decorated with large and striking carvings, the crests of the headmen and joint-families.

In such an environment and social setting has been developed an art in which sculpture is allied with a vivid imagination in the use of decorative motives, and one in which a certain amount of freedom is permitted to the artist. This art is displayed on a wide range of ritual and everyday objects made of wood, including the magnificent club-houses and canoes; the sacred sculptures, face-masks and bullroarers; and on the drums, bowls, sinkers, neck-rests, sago-scoops, and adze-handles. Coconut cups, lime gourds and turtle-shell bracelets are other media for decoration. The tools used include stone and clam-shell adzes and chisels, bamboo and shell knives and scrapers, bone awls, animal-teeth etchers, and rough-leaf smoothers. Most of the objects are stained black with a mixture of volcanic mud and the juice of a beach plant. The red and white clay pigments, used to highlight the designs, were smeared on rather care-

lessly in the old days but they are applied very neatly in modern times.

The same range of motives decorates the various objects, and although a few designs seen only by initiated men occur on sacred bowls and bullroarers, there does not appear to be a separate body of secret art—the motives are sacred in a ritual context and their mythology is known only to the men, but they give the essential sanction of the spirit world to weapons, implements and utensils in everyday use.

flat planes, surmounted by a high rounded headdress or hat. The face is either rectangular or triangular in shape, with its features carved in high relief or in a line pattern. The eyes, nose and mouth, often outlined with a zigzag line, form one unit, and the nostrils are frequently large and prominent. The chin is either straight, rounded or pointed. The perforated ears usually extend to the shoulders or form an arch down the sides of the face, just as do the arms on the sides of the body. There is no neck, and the



The beautifully shaped bowls from Tami Island vary from oval to elliptical, or boat-like, in shape. The domestic ones serve as containers for puddings and other foods, but others are used to hold the sacred bullroarers in the men's club-houses. Many of the latter, like the one above, are carved so as to be viewed when they are lying upside down. The designs, which are carved in high or low relief on the ends, bottom and rim, may or may not be arranged symmetrically. Some of the bowls represent a turtle, fish or bird, with the head carved at one end. They are either painted black or polished to a rich brown finish.

Photo.—Howard Hughes.

Even though a passion for complex decoration exists amongst these natives, it has not entirely subordinated naturalism. Subjects such as the human figure, birds, sharks and other fish, sea and other snakes, crocodile, turtle, lizard, dog, scorpion, centipede, sea-horse, crab, butterfly and others are features of the art. On the sides of the club-houses men are shown in a dancing posture wearing masks and feather headdresses.

The human figure is a stylized sculpture with a heavy, static, somewhat mystical and sinister expression. It is a squat figure dominated by a large, long and narrow head carved in rounded or

hunched and powerful shoulders sit astride the straight-sided and short body. The sexual organs may or may not be present, but the legs are always bent inwards as though the figure is kneeling. The ancestors or spirits which this figure represents are identified by the number of triangles above and below the eyes, such as one pair for the *tago*, two for the *waman*, and so on. One kind is indicated by two mussel-shell rings incised on the forehead.

The human and animal motives are combined in an ingenious variety of compositions, particularly of man, snake and fish. On the beautifully proportioned

canoe-shaped bowls, for instance, may be seen two crocodiles in line; a double-ended crocodile; a crocodile swallowing a bird or fish; a twin-monster with a head at each end; a long, sinuous figure with a human face at one or both ends; a snake or fish with open jaws showing rows of long teeth, and many others. The art is further complicated by the extensive use of the head, body and tail separately or in perfectly blended combinations of man, fish, crocodile or bird, such as a mouth from which a bird's head projects on a snake-like body with a fish's tail. In many instances, the degree of conventionalization is so extreme that it is impossible to identify the parts of the design so created. These designs are carved in high relief in a balanced arrangement, but each one may be different or there may be three of one kind out of four rim designs, so that variation is preferred to repetition.

The great variety of decorative motives so lavishly employed in all Huon Gulf art include the mouth, nose and eye separately; plain, zigzag and toothed lines; circles, triangles, lozenges, trapezes, crescents, anvils, and chevrons; star, flower, outline cross, buffalo-horns, spiral and scroll. One of their most interesting applications is within the outline of a figure which looks like an open-winged, fan-tailed bird carved on the middle of the sides of bowls.

Some of the designs are common property and any carver may use them; others belong to joint-families and schools of carvers, and their ownership and exclusive use are jealously guarded. The various schools of carvers produce bowls of different proportions and they also employ trade-marks which are inherited by a carver from his maternal uncle. The designs carved on bowls in everyday use are intended to be viewed when a bowl is in its normal standing position, but those on some ceremonial bowls are to be looked at when the latter are lying upside down.

Thus we see that in this extraordinarily rich art the carvers are masters of their materials and motives, and have achieved a remarkable virtuosity in the use of design elements through their absolute study of and delight in composition. It is an art characterized by neat, intricate and compact designs, a limited number of motives used in an unlimited variety of ways, a dislike of symmetry within a design but a full understanding of its function in the placement of them, a perfect blending of art with utilitarianism, and fine craftsmanship in which form is well controlled. It is an art in which naturalism has been subordinated by a love for complex surface decoration, and an association of naturalistic subjects with purely decorative motives, both featured in Melanesian art generally. Linton and Wingert[1] claimed that Huon Gulf art developed in an area isolated by mountains; the widely spread canoe trade, however, gave its villages constant contact with other cultures from which were obtained motives such as the lovely Admiralty Island's bowl handle design, among others, including the so-called buffalo-horn motive. To me the development of Huon Gulf art appears to be due to the thought and true aesthetic appreciation of generations of skilled craftsmen in whom a genuine feeling for design and composition enabled them to produce a localized and different art from that of other Melanesian cultures. It is not, as Linton and Wingert also claim, an art of "lethargic heaviness and inertness, the outgrowth of a culture where static inherited rights oppress and restrain the active forces of man's nature" —rather is it an art perfectly suited to its purpose, that of a material symbol for the perpetuation of the precious beliefs of its creators who have no wish to change it fundamentally, who have enriched it constantly with their own and borrowed ideas, and who are quite content with the mystical power of its human faces, the active postures of its fish, the graceful curves of its snakes, and the attractive and lively colouring of its decoration.

[1] Ralph Linton and Paul S. Wingert.—Arts of the South Seas. 8vo. New York, 1946.

Reviews

NATURE IN AUSTRALIA. By Keith C. McKeown, F.R.Z.S. (Angus and Robertson, Limited, Sydney, 1949.) Pp. xii + 235, 16 plates. Price, 12/6.

THIS reviewer has often felt that the published literature on Australian natural history is more notable for its volume than its quality, and therefore approached the reading of "Nature in Australia" in an unusually critical frame of mind. The book was finished in a single sitting—this in itself a tribute to its quality—and left one with the conviction that here is a really outstanding work.

The author is already well known for three important books dealing with spiders and insects, as well as a number of other publications of merit, but "Nature in Australia" is in a different category, for it has a much broader scope; it is true that one finds here the assemblage of curious facts about insects, spiders, birds and other animals, that one has come to associate with the writings of the author, but this time they are used as background material to illustrate the broad problems of natural history, such as the struggle for existence, the relations between animals and plants, the cycle of life, soil erosion and its impact on human affairs, animal migration and the conservation of Australian fauna and flora.

Above all, one is impressed by the sincerity of his writing, his genuine love of nature, and the breadth of his approach. Although the book in its present form is hardly suitable as a text—and this is by no means to its discredit—it should become a first priority reference work for all students who are studying biology at school, if only to make up for the somewhat stodgy approach of the average biology textbook.

The author is to be congratulated on a really notable achievement, and one which must bring credit to himself and the Australian Museum with which he is associated.

A. N. COLEFAX.

THE CULT OF THE GOLDFISH. By T. C. Roughley, B.Sc., F.R.Z.S. Second and Revised Edition. (Angus and Robertson Limited, Sydney, 1949.) Pp. xv + 170, coloured frontispiece and plates i-xiv, xiv*a*, xv-xxvii and text-figures 1-2. 8vo. Price 15/-.

THE post-war revival of interest in goldfish keeping has induced Mr. Roughley to issue a second and revised edition of this useful and attractive book on the subject, the first edition of which, published sixteen years ago, has long been out of print. This book not only gives an up-to-date and comprehensive account of goldfish and how to keep them, but deals with a wealth of associated plant and animal pond life. The life-history and treatment of the dreaded white-spot disease is given in detail and problems associated with the keeping of fish in garden pools are fully discussed. Mr. Roughley says, on page 5: "It is impossible to say when the goldfish first reached Australia, but it has undoubtedly been here for a long period." According to early annual reports of the Acclimatization Society of New South Wales, goldfish and Prussian carp were introduced here in the 1860's, principally by Sir John Young. Chinese goldfish were imported into Portugal as early as 1611.*

The illustrations are mostly from excellent photographs and drawings by the author himself and are repeated from the first edition; a coloured plate by Neville Cayley shows the principal varieties of goldfish. Figure 1 was apparently upside-down in the first edition, as it is reversed in the second; in compensation, perhaps, Figure 2, which was right-way up in edition one, is standing on its head in the second edition.

G.P.W.

* *Vide* Arnold, *Natur und Volk*, lxxiii, 1943, p. 203.

The Peregrine or Black-Cheeked Falcon

By J. A. KEAST.

RECENT announcement from Britain that civilian air officials plan to follow the lead of the Royal Air Force in training Peregrine Falcons to keep starlings and other birds from the vicinity of airports marks another phase in the history of this regal bird. Only two or three years previously it had been voted No. 1 killer of carrier pigeons and was sought by the Home Guard, for those were grave days for the Mother Country and the loss of a message from occupied Europe might have had disastrous results. The falcons, from their eyries on the coastal cliffs, were well placed for attacking the tired pigeons—they knew no better, for pigeons have been an important food item from time immemorial. And so the slaughter of falcons, though regrettable (for Britons are very bird-minded) had to be undertaken with the utmost vigour.

Falcons are amongst the first birds to which there is reference in history. The ancient sport of falconry, the use of trained hawks to catch game, was carried on by the aristocracy of China, Japan, and the Middle East, at dates as far back as 2000 B.C. There is a bas-relief in the ruins of Khorsabad (Turkey) considered by Sir A. H. Layard to be a falconer with hawk on his wrist. Many ancient manuscripts make reference to it. The sport was introduced into England from the Continent about A.D. 900, and from that time to the middle of the seven-

The Peregrine or Black-Cheeked Falcon at nest near Heathcote, New South Wales.
Photo.—Norman Chaffer.

Head of young Peregrine or Black-Cheeked Falcon, female.
Photo.—J. A. Keast.

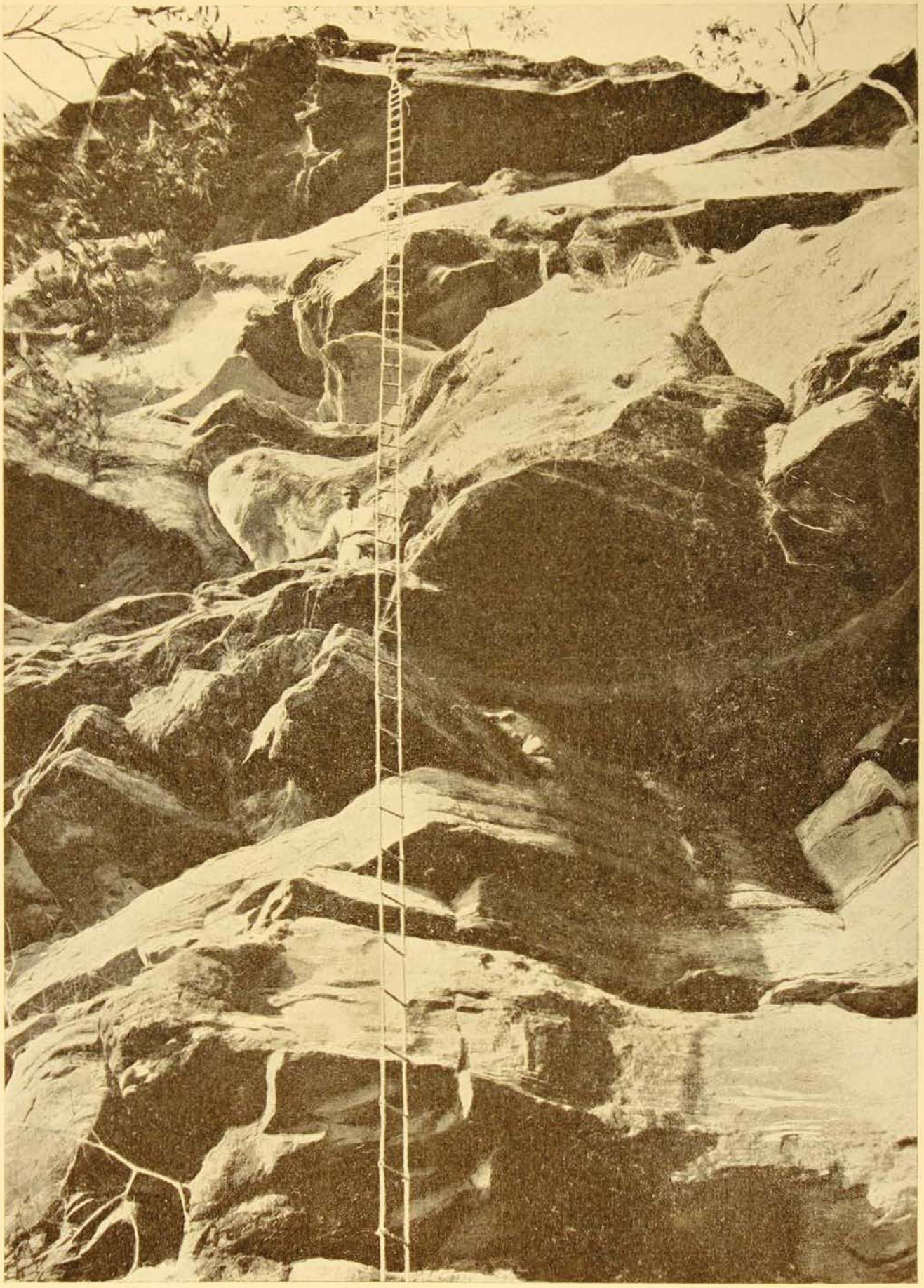
teenth century it was followed "with an ardour that perhaps no English sport has ever evoked".

Falconry is almost non-existent in Australia for its devotees are very few. It is very popular in the Orient, however, and has a small following in Europe.

The training of hawks is an art and amounts to an honoured profession in India. It requires patience, a love of wild creatures, and not a little knowledge of animal behaviour and psychology. Birds are most easily trained when obtained from the nest. A hood is fitted over the bird's head until it becomes docile and accustomed to its master. This is then removed for increasing periods, the bird being slowly admitted to the company of strangers, the dogs and other animals. The hawk is taught to perch on the wrist and to come at a shout or bell. Throughout this training it is well fed, is treated gently and kindly. Later the bird learns to swoop on food thrown to it and finally, by easy stages, to catch and bring back wild game. The game at which hawks are set varies from blackbirds and thrushes in the case of sparrowhawks, to wolves and antelopes with eagles. Falcons and goshawks are set at pheasants, quail, duck, snipe, herons, crows, hares, rabbits, geese, and bustards. Of all the hawks the Peregrine is universally considered one of the most efficient.

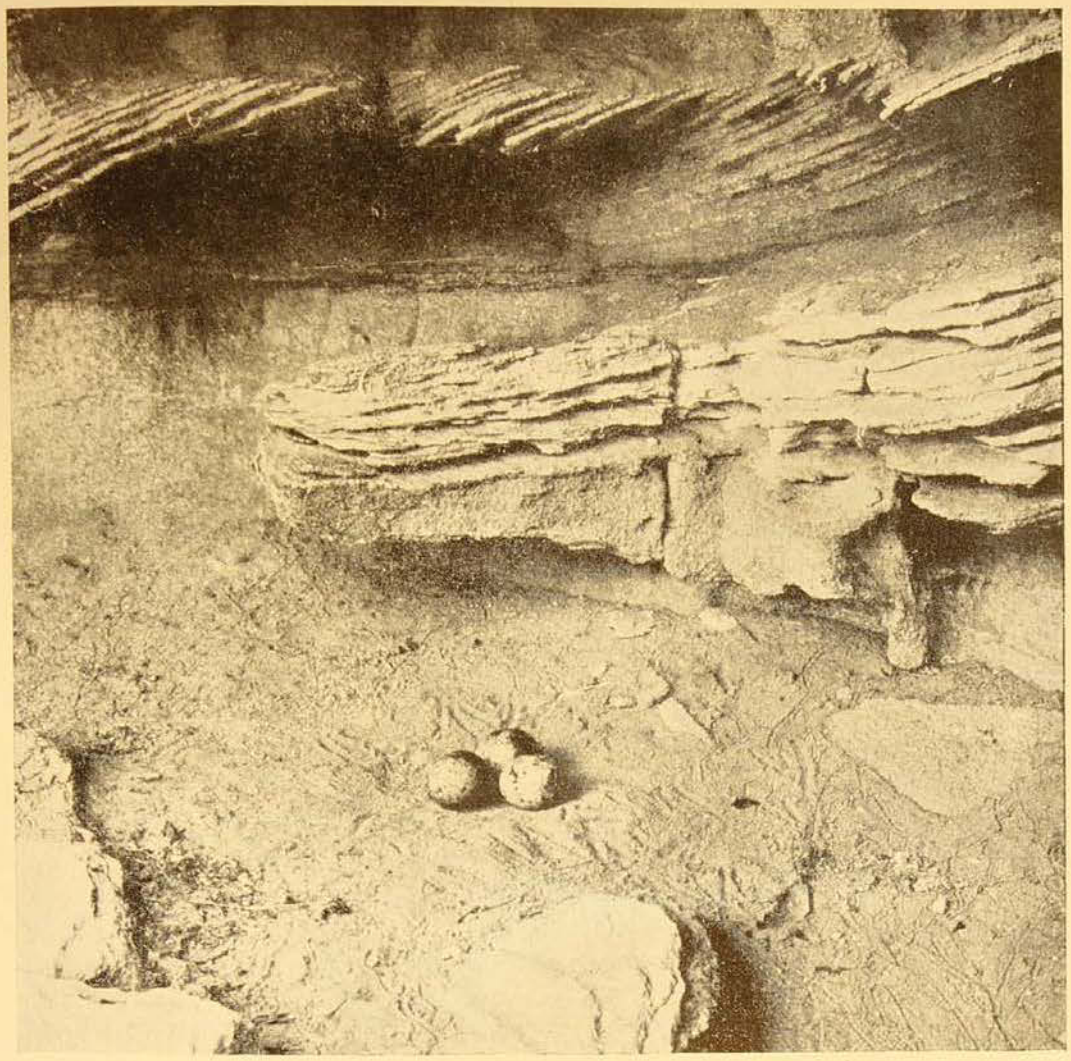
Falco peregrinus has a range that is almost world-wide, being a familiar sight in Europe, Asia, Australia, and the Americas. Despite this it appears nowhere to be common, usually being ob-

Burragorang Valley, a typical haunt of the falcon.
Photo.—Howard Hughes.



The nesting-place of the Peregrine or Black-Cheeked Falcon is indicated by the aboriginal, Copmanhurst district, New South Wales.

Photo.—G. Savidge.



Nesting place and eggs of the Peregrine or Black-Cheeked Falcon, Copmanhurst district, N.S.W.
Photo.—
G. Savidge.

served singly or in scattered pairs. It frequents inland forests as readily as the seaboard, its only requirement in this direction being a suitable cliff for the nest. Typically the Peregrine Falcon is seen dashing through the trees after a quarry or passing so swiftly overhead that no sooner does it appear over one mountain-top that it is lost over the next. It is amongst the swiftest of birds, speeds up to 180 miles per hour being credited to it.

To see the Peregrine make a kill is a never-to-be-forgotten thrill. One November day in 1946 a friend and I were boiling a luncheon billy on the Nepean River, some miles downstream from Penrith. The nesting season was in full swing and the air and river oaks echoed a medley of chattering birds. Suddenly all became silent and flocks of starlings which had been gyrating in the air above dashed madly for shelter. Like an arrow a Peregrine flashed overhead and fast overtook a zigzagging flock; the whole were momentarily lost between the trees, then through field glasses we were just able to distinguish a crumpled starling in the talons of that fast-disappearing falcon. It was several minutes before birds recommenced their singing and many more before a normal life was resumed. I recalled an earlier occasion when I had seen such a kill, then the site was Wahroonga and the victim a pigeon snatched from a panic-stricken flock—it was no wonder, I reminisced, that the Homing Pigeon Protection Society pays a bounty of 10s. per head on falcons. But by no means always does the Peregrine catch its prey. I have seen a Brown Pigeon successfully evade

capture in a National Park forest and little New Guinea loris scrambling to safety amongst the nuts of the coconut palm.

Falcons often play with potential victims, dashing above and beneath them without making a strike. It is a fearless hunter, tormenting birds up to the Galah and Black Duck in size. It is not afraid of habitation, and Peregrines will come right into Sydney in the autumn and winter to prey on the pigeons about the city buildings.

Several pairs of these birds live in National Park, choosing well nigh inaccessible sandstone cliffs for nesting. A pair nested annually on a cliff-face near Marley Beach for a number of years. Other birds (the only ones ever to be photographed at the nest in the Park) occupied a gully near Heathcote. It was at this nest that Norman Chaffer took the accompanying photograph, using a telephoto lens and a treetop "hide". The eggs, three in number, are hidden behind the ledge. The other illustration is of an immature female which was found with a broken wing. The vertical striping denotes immaturity—adult birds have transverse barring on the breast.

With the exception of the much smaller Little Falcon (*Falco longipennis*), which is only 11½ inches in length compared to the 15 inches of the Peregrine Falcon, the black face readily distinguishes the species from other hawks. The female is the larger of the sexes.

With regret we have to announce the deaths of Dr. C. Gordon Macleod, M.A., and Mr. John Spence, C.M.G., members of the Board of Trustees of this Museum. Both gentlemen had been associated with this institution for many years and had taken active interest in its development.

* * * *

RECENT visitors to the Australian Museum included Dr. C. Skottsberg, Director of the Botanic Gardens, Gothenburg, Sweden; Professor L. G. M. Baas-Becking, Deputy Chairman of the Research Council, South Pacific Commission, Noumea, New Caledonia. Dr. Olof H. Selling of the Naturhistoriska Riksmuseum, Stockholm, Sweden, whilst in Sydney critically examined the collections of Tertiary plants in the Australian Museum and the Geological and Mining Museum. He is particularly interested in the Tertiary plants and his researches have taken him during the past twelve months to many parts of the world. He devoted some time to examining the type collection of plant remains from Australia described by Baron C. von Ettingshausen. He is now returning to Sweden via New Caledonia, Fiji, Hawaii and America.

Mr. E. Riek, M.Sc., of the Division of Entomology, Commonwealth Scientific and Industrial Research Organization, has presented his comprehensive collection of freshwater crayfish from eastern Australia to the Australian Museum, a collection the result of many years' work. It is an extremely valuable addition to our reference collection.

* * * *

Two years ago we acknowledged gratefully the generous gift of a notable collection from Arthur D. Combe, a discriminating collector of fine mineral specimens. With regret we now record his sudden death on 23 May at Entebbe, where he was Assistant Director of the Uganda Geological Survey. As a geologist he ranked very high and was recognized, not only in his own continent, as possessing a unique knowledge of the geology of Central Africa. He eschewed office routine and the preparation of papers, devoting himself to field work. His tremendous enthusiasm for geology, the whimsical accounts of his extensive travels, his straight-to-the-point utterances combined to make him an outstanding personality. To quote a former colleague, "his memory will be perpetuated by his work for generations to come"

Australian Insects. XXXVI

Coleoptera 13 — Phalacridae, Georyssidae, and Lyctidae

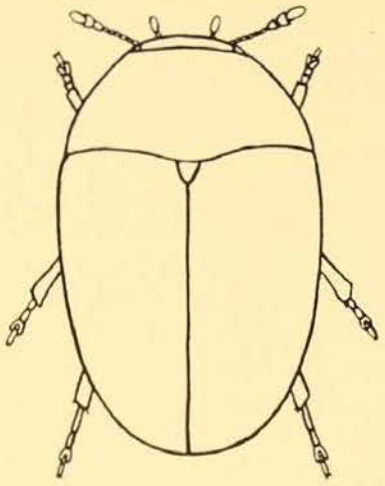
By KEITH C. McKEOWN.

THE chronicler of the families of Australian insects and their lives frequently finds himself confronted by a "dead end", in the form of a complete, or almost complete, lack of information concerning the creatures of which, if his chronicle is to be complete, he must make some mention. This is especially true of those groups, often containing but few species, which include small and obscure insects which escape the observation and interest of the nature lover whose field is a wide one and who has escaped the "strait-jacket" of specialization. How true this is will be sadly apparent to those who have followed this series in the past.

The Phalacridae, although represented in Australia by some fifty species, adds another to the families of which we know but little. The beetles themselves are quite small, even minute, of oval form, with the wingcovers glossy and smooth; indeed, they have but few striking features. To the uninitiated, they look rather like very small water-beetles. The joints of the feet (tarsi) are five on each foot, but to make things more difficult, the fourth is exceedingly small and difficult to locate. The thighs (coxae) are, however, globular, while the antennae are slightly clubbed, with the swollen portion consisting of three joints.

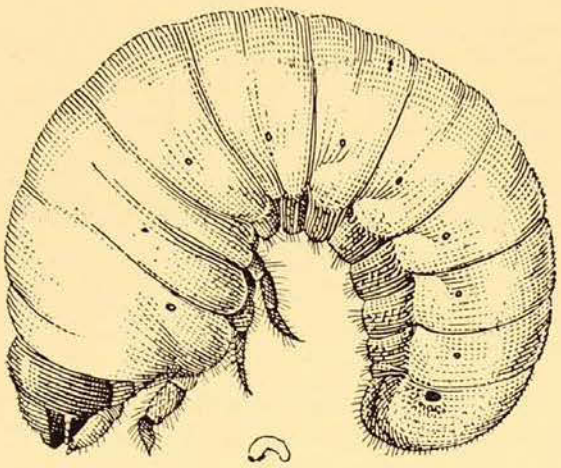
The larvae are subcylindrical, with the legs short, a character which might be expected from their sedentary way of life, for they live in blossoms, a situation where the adult beetles are also to be found, as a rule. The larva of a European species is said to bore in the stems of plants, but this habit has not, so far, been observed in the Australian insects.

Phalacrus comes Blackb. has the pale yellowish-brown elytra bordered externally by a wide flange. *Litochrus maculatus* Blackb. is a minute black beetle with each wingcover adorned with a bright yellow-brown spot, both coalescing on the inner margins of the elytra to form a shield-shaped blotch. *Olibrus victoriensis* Blackb. is a brownish-red with the thorax black.

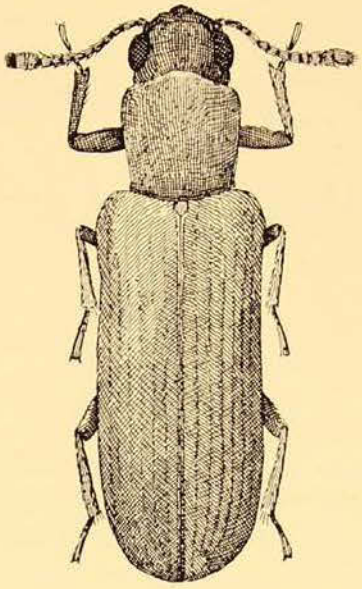


Litochrus maculatus. This is a minute black beetle, 2·3 mm. long.
After A. Tonnoir.

Only three species of the family Georyssidae have been described from Australia. Even more minute than the insects of the preceding family, their form is similar, but the wingcovers are strongly ridged and sculptured; they are dull black in colour, unrelieved by paler tints. The joints of the feet are four throughout, and the antennae bear a well-developed three-jointed club. Beyond the fact that they inhabit moist sand or mud, we know nothing whatever of their lives. *Georyssus australis* King, *kingi* Macl., and *occidentalis* Carter are our species,



Larva of Lyctus brunneus, Powder Post Beetle.
After E. H. Zeck.



Lyctus brunneus. Adult of the Powder Post Beetle.
After E. H. Zeck.

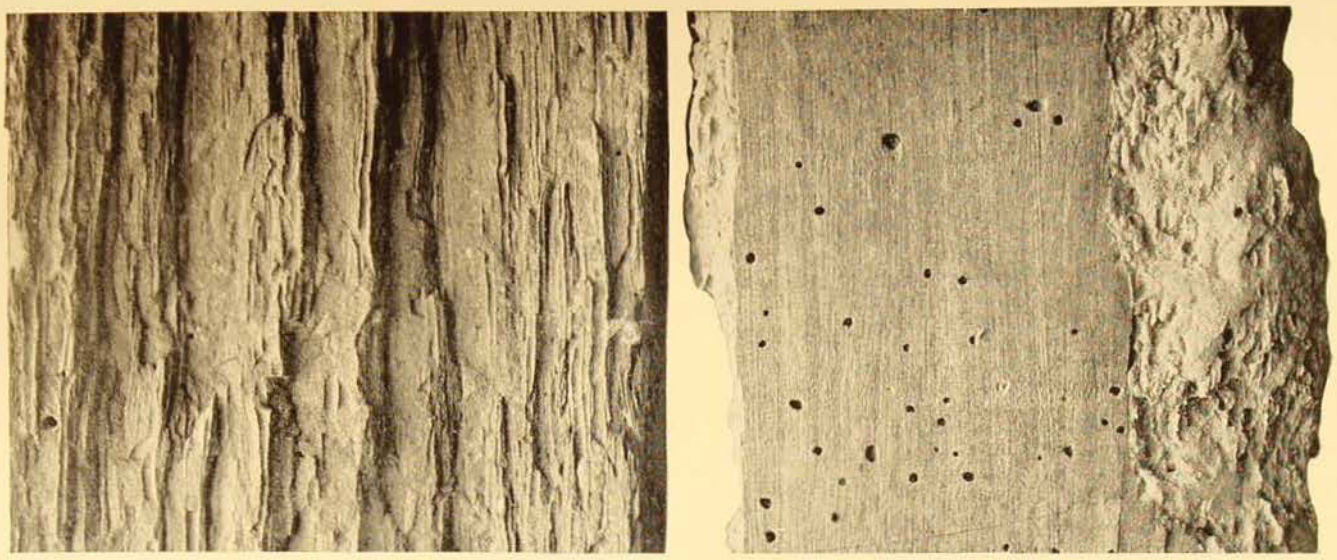
coming from New South Wales, Queensland and Western Australia respectively.

The Lyctidae, although a very small family, is, in contrast to the preceding, well-known, since it includes among its members the introduced and cosmopolitan Powder-post Beetle, *Lyctus brunneus* Steph. Perhaps "well-known" is an understatement, for the insect is only too well-known, attacking the stability of our homes and, in consequence, our peace of mind. It must be numbered high in the scale of "public enemies". Four species have been described from Australia by Blackburn; these are *Lyctus costatus*, *discedens*, *parallelicollis*, and *angustulus*. The status of some at least of these is doubtful, and it is also possible that they, like at least one other species, are migrants from overseas. With the exception of *L. brunneus*, none of these have assumed economic importance.

Members of the family Lyctidae are slender, elongate beetles, with five tarsal joints on each foot, of which the first is small and imperfectly separated from the second. The head is prominent and not shielded or covered by the prothorax, and the antennal club consists of two segments only. Little is known of the life-history of the other species, so our attention will be here confined to that of the Powder-post beetle since it is well-known and, probably, similar in all species.

The larvae of these beetles attack timber with open pores, and essentially the sapwood which is rich in starch, which provides their nourishment; the true wood is rarely attacked, at least to the extent of causing serious damage. Sapwood may be infested over long periods, by generation after generation of the insects, until it has been completely destroyed, save for a thin external shell pierced by the flight-holes of the insects which have emerged to mate, lay their eggs and die with the future of the race amply provided for. The interior of the infested timber becomes reduced to a mass of fine flour-like dust which, when the adult beetles are active, spills out in small heaps through the flight-holes. Ill-seasoned timber used during the war years for the construction of army huts-ments and similar purposes has provided an almost inexhaustible banquet for these destructive insects.

The eggs are deposited by the female in the pores of the timber in minute cracks and crevices, or on roughened surfaces. The roughly smoothed sapwood used for backing cupboards and other furniture is often a prolific breeding ground from which the beetles may spread and infest hitherto untouched timber. The eggs hatch in from eight to twenty-five days.



Wood damaged by the Powder Post Beetle. The left-hand section shows the crumbling interior; the right-hand one, the surface dotted with flight holes.

Photo.—G. C. Clutton.

On hatching, the minute grubs or larvae eat their way into the wood, the tunnels usually running parallel to the grain of the wood and frequently intersecting, a condition rarely found with the Furniture Beetle (*Anobium punctatum*), a member of another family. Nourished by the starch-content of the sapwood, the larva grows steadily. The stout, whitish larva is smooth and, when removed from its tunnel, curls itself into a semi-circle. Its legs are short, the front legs stouter than those of the other pairs, and the last spiracle or breathing pore situated at the end of the body is the largest of the series. When fully fed, the larva makes its way to near the outside of the timber where, after eating out a small cell at the end of its burrow, it pupates.

The adult beetles, coloured from reddish-brown to dark brown, are narrow-bodied and somewhat flattened; they may range in size from about one-eighth to one-fifth of an inch in length. Apart from eating its way out into the open air, no boring is done by the adult insect. The insects can fly well and are most active at night, when they fly or crawl about buildings where timber is infested. They emerge during the warmer months of the year.

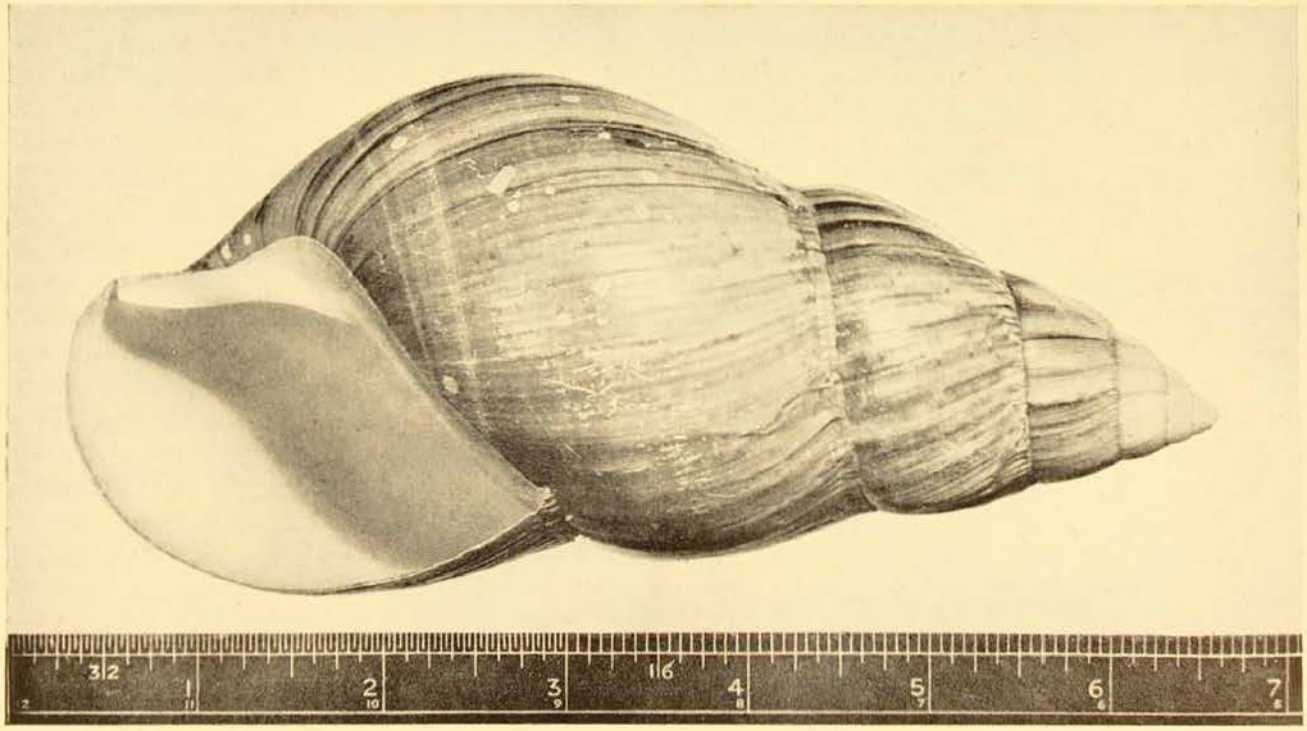
The duration of the life-cycle is variable, depending largely upon climatic conditions and the proportion of starch contained in the sapwood. The life-cycle may be as short as three months, from egg to adult, but as a general rule may be said to be about twelve months.

Those desirous of obtaining information on the control of this destructive insect are referred to Insect Pest Leaflet No. 21, *Wood Borers*, issued by the New South Wales Department of Agriculture, Entomological Branch, Sydney, which gives detailed advice on control measures, together with a list of susceptible and immune timbers, too lengthy to be given here. The Department of Wood Technology, Forestry Commission of New South Wales, Harrington Street, Sydney, also issues valuable leaflets on the Powder-post Beetle, and will be glad to advise enquirers.

The Giant African Snail—A Crop-destroying Traveller

By JOYCE ALLAN.

DR. R. TUCKER ABBOT of the United States National Museum has covered the facts concerning the rapid and devastating advance of the Giant African Snail of the genus *Achatina*—across the Indian and Pacific Oceans, from Zanzibar to California—in the February issue of *Natural History*. In this attractive article, *March of the Giant African Snail*, he tells of its introduction by man from the east coast of Africa, its natural home, into Mauritius, Madagascar, Reunion and Seychelle Islands, India, Ceylon, Straits Settlements and Malaya, southern China, Netherlands East Indies, Java, Sumatra, Philippines, Hawaiian Islands, Mariana Islands, Guam, and other parts of the Pacific. Of importance to America is the more recent discovery of its appearance in gardens in California, the eggs or estivating adults, it is theorized, having been brought there on army vehicles from the Mariana Islands soon after the war. Wherever this snail has been introduced there is left a trail of devastation amongst cultivated crops, and few pests have caused so much concern in recent years to agriculturalists and biologists alike. There are many factors which make it a formidable pest to the agriculturalist. These are the rapidity of its invasion into areas far removed from its natural home; its



The Giant African Snail—Achatina fulica.
Photo.—Howard Hughes.

hardiness; tremendous fertility and ability to breed in the first year of its life, laying usually about 300 eggs at a time, and repeating this every few weeks during wet weather; also its great size, for of about twenty species known, some have shells between five and six inches long, others grow to as much as eight inches long, so that the length with animal extended may reach up to 12 inches. When speaking in terms of "land snails" one is inclined to envisage a small object like the common garden snail. Imagine, not one or two, but hundreds upon hundreds of pugnacious looking snails, six to eight times the size of a garden snail, swarming across jungle roads, banked up in masses upon one another at the foot of trees, climbing trees, and worse still, wrecking cultivated crops, tea and rubber plantations! Their great size only adds further to the nightmare sight of them in action as witnessed by so many persons, including servicemen in the Indo-Pacific, who encountered them during the war. Dr. Tucker Abbot has seen as many as fifty large *Achatinas* clinging to a small 10-foot tree on Saipan Island (Mariana Islands), and from various reports, including those I have had myself from interested persons, it is quite usual to find more than two hundred snails on one stem of a tree. Going about our normal life in a city, worried perhaps because the garden snail has demolished a few of our pet seedlings, it is difficult to imagine what a sight an invasion of these Giant Snails must present. Perhaps a quotation from Tucker Abbot's article may give the reader some idea of the amazing, in fact horrible, sight which must have confronted an army sergeant in the cool of the evening on Saipan Island after its capture from the Japanese. "Suddenly, the sergeant saw that the road ahead was littered with large stones. He braced himself for the jolts and applied his brakes. But under the wheels the stones popped and crunched like hen's eggs. Then the jeep skidded, and the beams of the headlights tangled with jungle vines and went out. The dazed sergeant crawled out of the ditch and limped back on to the road with flashlight in hand to investigate the 'stones' A long whistle of wonderment escaped his lips. These were not stones. They were dozens of huge, crawling snails, many nearly half a foot in length! All were marching across the road, and the smeared carcasses of a number of them marked the skid trail to the ditch where the wrecked jeep lay on its side." And, as stated above, that is a sight constantly confronting persons inhabiting areas where this invading, crop-destroying mollusc has unfortunately been introduced.

Its introduction from Africa and its outlying islands has primarily been for food (in one instance to make a snail soup for the favourite lady of a French Governor at Reunion Island), and undoubtedly has provided a stable food for the poorer masses of the Near East, but in spite of its use in stews and so on, control measures have to be taken if crops and gardens are to be preserved. As mentioned before, *Achatina's* reproductive powers are amazing. In the first place, like other land snails, adults have both male and female reproductive organs in an individual so each adult snail is able to contribute to an increase in numbers. Exterminating them becomes a race against time, and as many as half a million adults and twenty million eggs are stated to have been destroyed in one area in fifteen days. Even that eradication did not prevent the snails becoming as plentiful as ever in a year or so.

Dr. Abbot does not specifically mention the snail's presence in islands just north of Australia. But there, in New Guinea, New Britain and New Ireland, authorities have been faced with the same devastating invasion as elsewhere, and the same strenuous efforts are being made to eradicate the pest as quickly and effectively as possible. Just as the Japanese introduced it as food into the Mariana Islands before 1940, so they introduced it into other islands, including those mentioned above, in their southern progress. For this reason it is commonly known in

this part of the world as the "Japanese Giant Snail". But in most places it has been found, and this applies equally in New Guinea, New Britain and New Ireland, that although the Japanese like *Achatina* stew the native population does not. I can remember seeing a letter from an ex-prisoner of war in a local paper when reports of the ravages of these snails first appeared in our newspapers. It appears that, whilst a prisoner of war in the Philippines, he frequently made *Achatina* stew for the prisoners and it was at least found eatable. But the chances of natives helping to eradicate the snail by utilizing it as food is apparently slight so other methods must be adopted, and an investigation of natural enemies is now under way in both America and Australia. Already in Malaya they have found that the snail is able to transport common plant diseases. The ease with which it could be introduced into north Australia from nearby islands is obvious. Even last year some barely adult living snails arrived in Sydney on copra. Fortunately they were discovered by Customs officers and on being identified at this Museum for the Department of Agriculture as *Achatina*, immediate fumigation was carried out and a vigilant search made for possible eggs. Its eggs, incidentally, are round, creamy yellow and pea-like in shape, laid at night on the ground in a mucous mass, rubbery to touch, but when removed from the mucous become extremely hard and shelly and may be effectively bounced. In appearance the animal is like an extremely "tough" looking brownish-black garden snail, in fact a pugnacious, ugly-looking customer, that one would not relish meeting in hundreds across a roadway or tearing, with its 80,000 or so teeth, one's money-producing crops. The shell of the predominant species, *Achatina fulica*, is, on the other hand, very handsome, glossy, yellowish with streaks of reddish-brown on the outside, and the inside pale lilac tinted.

The advance of this snail across two oceans presents so great a menace that the U.S. National Research Council is setting out to solve the problem. Dr. Francis X. Williams, an insect-fighting scientist of renown, has already investigated natural enemies of this and related snails in their native home of eastern tropical Africa. Natural enemies found included a mongoose-like animal, certain rodents, a land crab seen feeding on snails close to the coast, beetles of certain types, and important enemies were found to be carnivorous snails of the family Streptaxidae. I have gleaned the above findings of Dr. Williams from a paper by him which was read before the Seventh Pacific Science Congress held in New Zealand last February. Dr. Williams is at present following up these investigations and his discoveries will no doubt be utilized in his country's attack on this pest in the Pacific. Its control may possibly mean introduction of some, at least, of the natural enemies, but the biologist is always on the watch to see that a controlling agent may not become a menace itself, especially to harmless creatures. Regarding the introduction of carnivorous snails as a possible controlling agent, Australia possesses a very attractive little carnivorous snail of the genus *Strangesta*, formerly known as *Rhytida*, a proved formidable enemy of the garden snail. Besides this, several other smaller species have shown carnivorous habits, including the introduced English snail *Helicella cellaria*, which will devour both garden snails and slaters, but unfortunately, being carnivorous, has the tendency to eat the *Strangesta* in its young stage. Experiments with these two snails have been recently carried out by C. F. McLauchlan and described in the Proceedings of the Royal Zoological Society of New South Wales, 1949. It is possible that use of such snails might contribute to the eradication of the snail in islands adjacent to Australia. Australian authorities already have investigation upon control methods in hand. Moderate success has been obtained in tea, rubber and other plantations at various times from laying different types of poison baits, mixed in

whitewash, bran or other substance, but DDT is not considered effective. Another method, for at least temporary control, which was tried in Malaya, according to Dr. Abbot, was to put a price on the snail's head, but unfortunately most of the thousands collected in a day and dumped in the sea were washed ashore alive when the wind turned. I have already said they are "tough" snails! Some plantation owners have had success, if reports are reliable, by using well-known brands of commercial "snail killer". Natural enemies of the snail in Africa appear to have an arresting effect on its prolificacy, but in the Pacific they apparently do not exist to the same extent or are not yet recognized. Large lizards have been known to feed on them, a common pond tortoise attacks them in Ceylon, and the larvae of the Indian glowworm will devour young ones, but their control is not extensive, in view of the epidemic stage they frequently reach. It is only natural that complete destruction of eggs whenever encountered will combat to some extent the menace of future progeny-producing adults.

Popular Science Lectures

THE 1949 series of Popular Science Lectures has, unfortunately, been interrupted by power and light restrictions due to the coal situation. The complete syllabus as arranged for the dates indicated is as shown herewith. The suspension of these began with the lecture scheduled for June 23. The resumption of the series will be announced as soon as practicable.

May 12: "Spiders", A. Musgrave, F.R.Z.S., F.R.E.S.

May 26: "The Port of Sydney and How it Works", R. A. Johnson, A.M.I.E. (Aust.).

June 9: "'Fish Doctor' in Papua", G. P. Whitley, F.R.Z.S.

June 23: "Resources and their Possible Development in New Guinea", J. Andrews, B.A., Ph.D.

July 7: "The Fascinating Problem of Animal Migration", Elizabeth C. Pope, M.Sc.

July 28: "Cold Light", D. P. Mellor, D.Sc.

August 11: "The Wild West of Tasmania", R. O. Chalmers, A.S.T.C.

August 25: "In Search of Birds", K. A. Hindwood, F.R.Z.S., C.F.A.O.U.

September 8: "The Lake Eyre Basin", H. O. Fletcher.

September 22: "Some Active Volcanoes of the Pacific", Professor L. A. Cotton, M.A., D.Sc.

October 6: "With a Science Congress in New Zealand", Joyce Allan, F.R.Z.S.

October 27: "Some Queer Parasites", A. N. Colefax, B.Sc.

Admission is free, lecture 8 p.m. The lectures are usually illustrated by films or lantern slides.

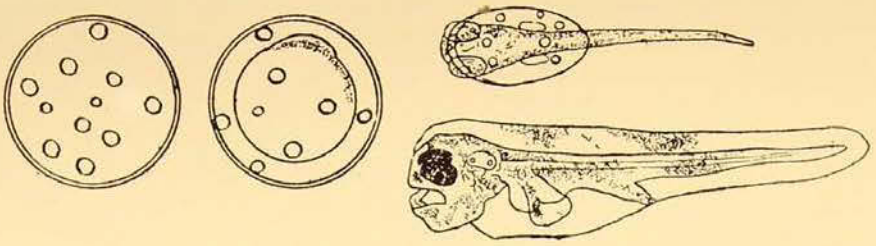
Flounders and Soles

By G. P. WHITLEY.

THE FLATFISHES (Flounders, Soles and Tongue Soles, collectively the Order Heterosomata) are some of the most remarkable of all vertebrates because of the distortion of the head caused by both eyes being on one side. They appear to have originated from fishes rather like the Dories, particularly through alliance with a genus known as *Amphistium* found fossil in the Upper Eocene.

Parrot fishes and some others habitually rest for long periods on an uneven keel, even careening over to one side so far that aquarium visitors call the attendant's attention to what they think is a dying fish. Imagine this resting habit to be pursued further so that the fish lies permanently on one side and you may have the beginnings of the habit which caused the flatfishes to sacrifice their symmetry. Whether by Darwinian or Lamarckian precepts or by any other we can ever explain how the lower eye struggled to join its light-enjoying mate is quite beyond my capacity to elucidate. When first hatched, the larval flatfish has one eye on each side of its head and swims in the vertical manner normal amongst fishes. Soon, one eye moves round the upper surface of the head (or even through the head-tissues, according to some authors) to join or nearly join its fellow. The fish then lies on the bottom on the blind side, with both eyes uppermost, and the eyed side becomes dark-coloured. The skull, some of whose bones had been soft and undeveloped

Three ichthyologists outside Baron Cuvier's old home in Paris in 1937. Left to right: Paul Chabanaud, world authority on soles; the late J. R. Norman, author of a "Monograph of Flatfishes"; and the late Professor J. Pellegrin.
Photo.—G. P. Whitley.



Eggs and newly-hatched larvae of the New Zealand Flounder (Rhombosolea plebeia) showing symmetrical eyes, vertical swimming position, and both sides equally coloured. When about an inch long and perhaps a year old, both eyes will be on the right side and the fish will lie on its blind side with all its colouring uppermost.
After Thomson and Anderton.

during the migration of the eye, now solidifies in a distorted shape. The optic nerves and nostrils are asymmetrical, the dorsal fin may extend to near the nostrils and the ventral fins are sometimes asymmetrical too, or one may be dwarfed or absent. Swimming is performed by wavy motions of the flat body and marginal fins (compared by William Beebe with the "flying carpet" of the Arabian Nights) but flatfishes spend most of their time on the bottom, often partly buried in sand, and altering their colour to harmonize with their surroundings. It must be remembered that the upper, eyed side of the flatfish is really one side, not the back of the animal as in the case of the superficially similarly-shaped skates and stingrays. The flatfish is compressed laterally, the ray is depressed dorsoventrally. Flatfishes are thus not so called because they are flat. They're not; as the Rev. Theodore Wood has emphasized, they're *thin*, but custom would never sanction changing their name to Thinfishes.

Experiments have shown that even checkered or circular patterns, upon which flatfish were placed in tanks, could be imitated to a surprising degree, but some brilliant colours, not present in the fishes' repertoire could not of course be simulated. Flounders, especially, have series of eye-spots or blotches on the ocular side which are constant in position and useful recognition marks for their species. The colour-changes are caused by the nervous system, expanding or contracting the chromatophores (pigment cells), as a result of messages from the eyes and brain. The eyes can be elevated rather like periscopes and are believed to be capable of distinguishing the different colours in the environment.

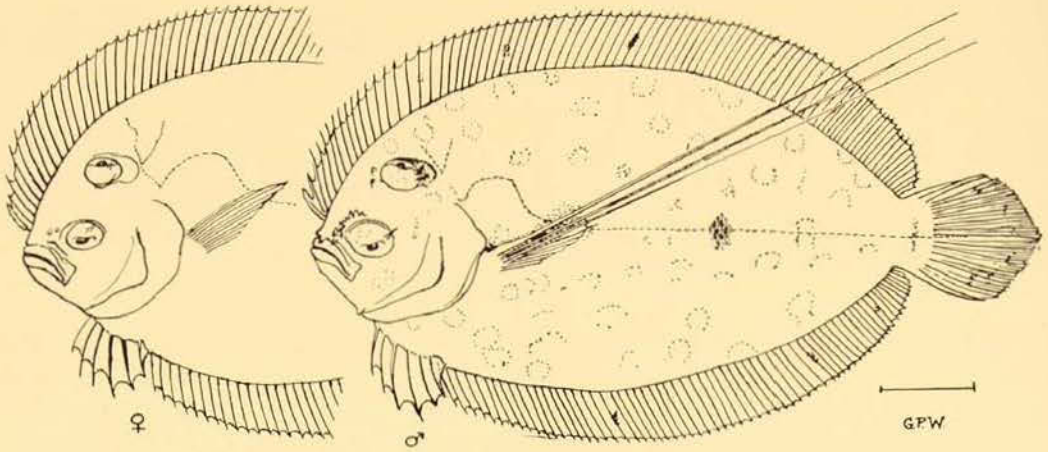
The sole has the cheekbone (preoperculum) covered by scales and the dorsal and anal fins often link up with the tail fin; in the flounder, the edge of the cheek plate is exposed and the tail fin is separate from dorsal and anal fins. In the soles the upper jaw is often overhung by a rostral hook but in the flounder the lower jaw is more prominent. The terms "flounder" and "sole" are often used for the wrong fish in the trade and in restaurants.

Tongue soles are very long and thin and shaped like a dog's tongue. The usual length of most flatfishes is hardly one foot.

The famous New Zealand Flounder belongs to the genus *Rhombosolea*, which is comparatively rare in Australia. The largest flatfish in the world is the Halibut of the Northern Hemisphere—up to eight feet and 600 pounds.

There is some difference in the form of the two sexes in some flatfishes, notably the Wide-eyed Flounder (*Scaeops*) in which the male has the eyes much farther apart than the female and bears spines on his snout; but in the Crested Flounder (*Lophonectes*) the female also has some head-spines, only weaker. The anterior dorsal rays of some flatfishes are elevated like a crest, particularly in males, and the upper pectoral rays may also be lengthened in males (see the figure of the Panther Flounder, *Bothus*).

Flounders and Soles are carnivorous, eating fishes, molluscs, worms, et cetera, but different species probably have their own preference for foods related to their habits and environment and reflected to some extent in the shape and size of the jaws of the flatfish themselves. There are teeth on the pharyngeal bones for crushing the prey as it is swallowed. Some

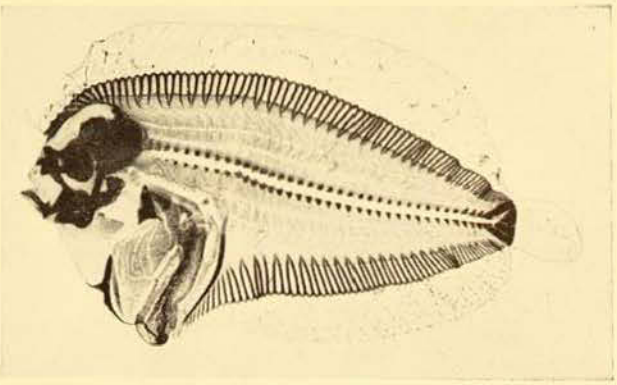


Male (♂) and female (♀) of the Panther Flounder (Bothus pantherinus) from Murray Island, Queensland. The pectoral fin of the male has very long rays and there are spines before the eyes.
G. P. Whitley, del.

rare soles have been caught on tiny hooks baited with bits of grass.

Many of the flatfishes enter very shallow and even fresh water, especially when small, where they may be speared, and they indulge in massing and migrations apparently not necessarily associated with spawning. Others are trawled from deep sea waters. Several species belonging to almost as many genera may be obtained in one haul of a trawl. In Queensland when I was sorting such a catch into quite a number of heaps, each of a different species, I found it impossible to convince a colleague with merely North Sea experience that I was not indulging in what he regarded as my customary excessive species-splitting. No cases of hybridism in flounders have been discovered in Australia, but some examples have been noted in other countries. We have about eighty distinct species.

For an account of the fascinating elucidation of the life-history of the Plaice in the North Sea the reader is referred to Russell and Yonge's *The Seas*. How long will it be before we know, to a similar extent, as much about even one of our Australian flatfishes? As usual, New Zealand is ahead of us in investigations on her Heterosomata, the modern work on which may be said to have been inaugurated by Waite's work in association with the New Zealand Government's "Nora Niven" trawling experiments in 1907 (see *Rec. Canterbury Museum*, vol. i) and some observations at the Portobello Marine Hatchery (*Trans. N.Z. Inst.*, xxxviii, 1906, pl. lv.). Hardly any investigation has been made on the eggs and larvae of Australian flatfishes, but a photograph of a beautifully mounted specimen of the larval Crested Flounder has been published by Dakin and Colefax (*Univ. Syd. Monogr.* i, 1940, p. 204, pl. iv, fig. 6). J. R. Norman, in his classic *Monograph of the Flatfishes* (1934) has noted the eggs as being mostly buoyant and pelagic and points out differences in the number of oil-globules in several families. In larval *Arnoglossus* there is a remarkable long tentacle above the head, perhaps to protect the soft anterior part of the cranium. Other genera may have a similar structure and in some there may be characteristic arrangements of spines on the body before the scales are developed. The eggs are produced in millions. Flounders may be artificially propagated and in Scottish lochs experiments in "fertilizing" the water with sodium nitrate and superphosphates have



A young specimen of the Crested Flounder (Lophonectes gallus) from New South Wales in which the eyes are on separate sides of the head.
After Dakin and Colefax.

resulted in an increase in the size of flounders. Similar experiments have been mooted in the coastal lakes and inlets of south-western Australia.

Dannevig, nearly fifty years ago, introduced English flatfishes into the old Fisheries Pond at Gunnamatta Bay, New South Wales. They thrived for a while and were released (*Rept. Fisher, N.S.W.*, 1902, ii (1903), p. 5) but seem to have died out.

That flatfishes are amongst the most delicately flavoured fishes cannot be doubted by any who have partaken of Dover Sole or Lemon Sole. The Australian species are finely delicious too, though as with the Old World ones, there is a difference in the various kinds; "turbot is ambitious brill" as Buttercup and the Captain sing in *H.M.S. Pinafore*. We import large quantities of the excellent New Zealand Flounder (*Rhombosolea*) and several types of sole from South Africa. Connoisseurs of fish-food distinguish finer flavours in fish from various localities; "How different in respect to quality", says the Rev. Badham, "are the same species, fetched from different districts."

Crude puns on "soles" and "eels" are recalled when we remember that in Greek mythology soles, the fish, were regarded as fitting sandals for ocean nymphs. Badham renders the lines:

> They served those "sandals" of the foamy sea
> Which nimble Nereids, send on errants fleet,
> Apply protective to their tender feet.

From Greece to that antipodean Arcady, the South Seas, we travel for the story retailed in Radcliffe's *Fishing from the Earliest Times*:

> Ina, the daughter of Vaitooringa, attempted flight to the sacred island. Fish after fish essayed to bear her thither, but, unequal to the burden, dropped her in the shallow water. At last she besought the sole, which managed to carry her as far as the breakers. Here, again unshipped, she lost her divine temper, and stamped with such fierceness on the head of the unfortunate helper of distressful maids that its under eye was squeezed right through to the upper side. Hence the sole is now obliged to swim flat on one side of its face, having no eye on the lower side.

A legend explaining the wry expression of the flounder's face is included in F. E. Hulme's *Natural History Lore and Legend* (1895, p. 334), thus:

> Our ancestors found apt moral against the scornful in the reason assigned for the mouth of the flounder being on one side. It appears that at the time the flounder's mouth was as fair to see as any other, but that it lost all its beauty through contemptuous flouting of the herring, and it has borne this evil mark of its jealousy ever since, and will probably so bear it to the end of time. At the vague date known as once upon a time we are told that all the fishes of the sea assembled to choose a king, and that the herring was elected to this dignified position. The flounder, on account of his red spots and other features that were evidently more appreciated by himself than by the main body of electors, had strong hope that he should himself be chosen, and the unlovely grimace with which he saluted his sovereign was, as a judgment upon him, made a fixture for all time as a punishment to himself and a warning to others.

Whilst telling stories about Flatfishes, I should like to reproduce here the tail-end, complete with sting, of a very brief newspaper review by Mr. Neville Cardus of a certain musical recital:

> The singing was indifferent; the piano accompaniments were worse. "The Trout" of Schubert was changed into a Flounder.

ABNORMAL FLATFISHES.

Flounders and Soles in themselves are abnormalities which have become normal through the laws of stability, but sometimes they go still further and exhibit such freaks as albinos, parti-coloured (piebald) or ambicolorate (dark both sides) "sports", or there may be "reversed" examples in which the eyes and related phenomena pass to the left side instead of the usual right, or *vice versa*. Many cases have been reported from various parts of the world and in some museums there are more abnormal than normal specimens of certain species. A few Australian freaks have come my way from time to time but not many have been recorded. I know of no case of xanthochroism (golden orange or red colour-variety) from Australia.

Sometimes a dorsal hook or excavation remains where the eye has passed but the tissues have not joined. Such a one was the *Teratorhombus excisiceps* of Macleay, of which a couple more have come to light since, but which is really an abnormal Large-Toothed Flounder (*Pseudorhombus arsius*). Macleay at first thought it was an abnormal flounder which "had had the forehead bitten out in its youth by some other fish, but I have lately seen, with Mr. Ramsay, another specimen so exactly resembling it in all its peculiarities, that I am compelled to look upon it as not accidental".

A similar abnormality has been described from South Africa as *P. andersoni* Gilchrist, and several cases of abnormal *Rhombosolea* have come from New Zealand.

Ambicolorate and piebald specimens are represented in some Australian museums, notably an ambicolorate *Pseudorhombus arsius* (Austr. Mus., regd. no. IA. 1574) from New South Wales and a *P. jenynsii* (W.A. Mus. regd. no. P. 587) from Perth. Similarly, a "double example" of the Black Sole of the Parramatta River was mentioned in Ogilby's *Edible Fishes of New South Wales*, 1893, p. 161.

In other parts of the world, numerous examples of ambi- and parti-colorations have been studied. For a review, see the papers of Dr. E. W. Gudger,* who showed me, in New York, a tank containing probably more abnormal specimens of flatfishes than have been gathered together by any other museum in the world.

Flatfishes with the eyes and colour on the right side are called dextral, on the left side sinistral. To acertain on which side the eyes are, the fish should be placed on its "edge" with the gill-openings and mouth downwards and the head pointing away. The eyes will then be visible on the left or right side as the case may be.

Reversed flatfishes are those in which the eyes are on the left instead of the usual right side, or *vice versa*. Thus the usually blind, uncoloured side becomes eyed and darkened and the optic chiasma is affected. The explanation may some day be found in genetics. For the latest account of reversal in Heterosomata, see Hubbs and Hubbs, *Pap. Mich. Acad. Sci. Arts Lett.*, XXX, 1945, p. 229. I have not come across any Australian examples to date.

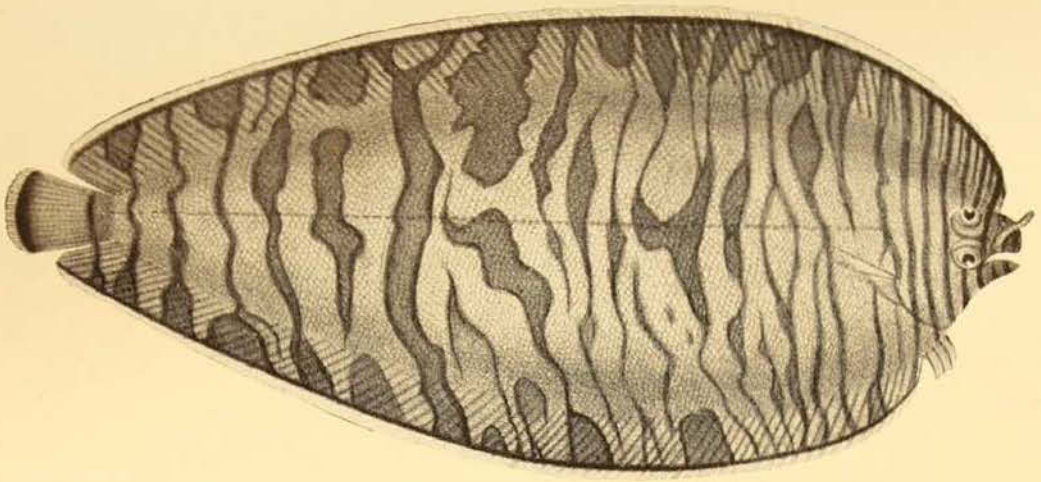
In ordinary bony fishes, the optic chiasma is dimorphic, in other words, the nerve from the brain to the right eye crosses over the left optic nerve about as often as the left one crosses the right. This condition still obtains in the Queensland Halibut (*Psettodes*) and the Soles. In all other flatfishes, whether dextral or sinistral, the nerve of the migratory eye is dorsal, except in "reversed" specimens, which are not mirror images of normal ones.

In some old books illustrations of flatfishes have been artificially reversed through, for example, printing from a lithographic stone. I hope I have them all the right way round in this article!

Most of our Australian Flounders and Soles are of small size, but the Queensland Halibut or Indian Flounder (*Psettodes erumei*) grows to about two feet long, has the migratory eye on top of the head and the front dorsal rays spiny and not extending far over the head. Many years ago, Saville-Kent recommended the artificial propagation and acclimatization of this fine food-fish which has been commonly trawled in Queensland.

Other flounders are the large-toothed and small-toothed species of *Pseudorhombus*—a genus which includes many kinds, some with curious skull-like markings on the eyed side—and several other genera from tropical and temperate seas. The Cockatoo Flounder (*Samaris*) and Crested Flounder (*Lophonectes*) have the front dorsal rays much lengthened in males. In the Long-Snouted Flounder (*Ammotretis*) there is a "rostral hook" rather like the snout in soles, whilst in the delicious New Zealand Flounder (*Rhombosolea*) there is a comical "nose" like that of a tapir.

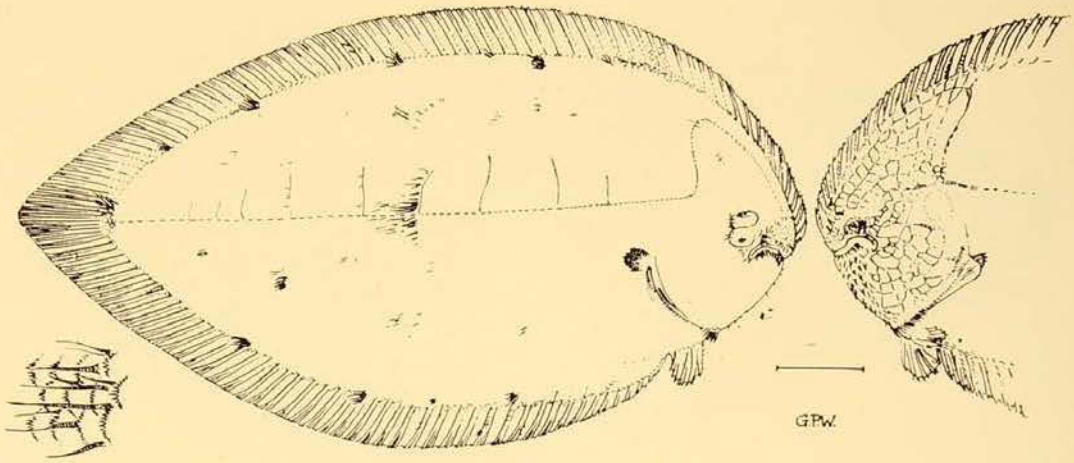
* *Journ. Morph.*, 58, 1, 1935, p. 1; *American Museum Novit.*, 717, 768, 811, 885, 896, 897, 925, and 959 (1934 to 1937); *Copeia*, 1941, p. 28; and *Science*, 102, Dec., 1945, p. 672. The first-named paper has a fine bibliography, as one would expect in Gudger's work.



The Aesop Sole (Aesopia heterorhinos) has a striped "garment" such as Aesop must have worn. Note the tubular nostril, the eyes on the right side and the cheek-plate hidden by scales.
After Bleeker.

SOLES.

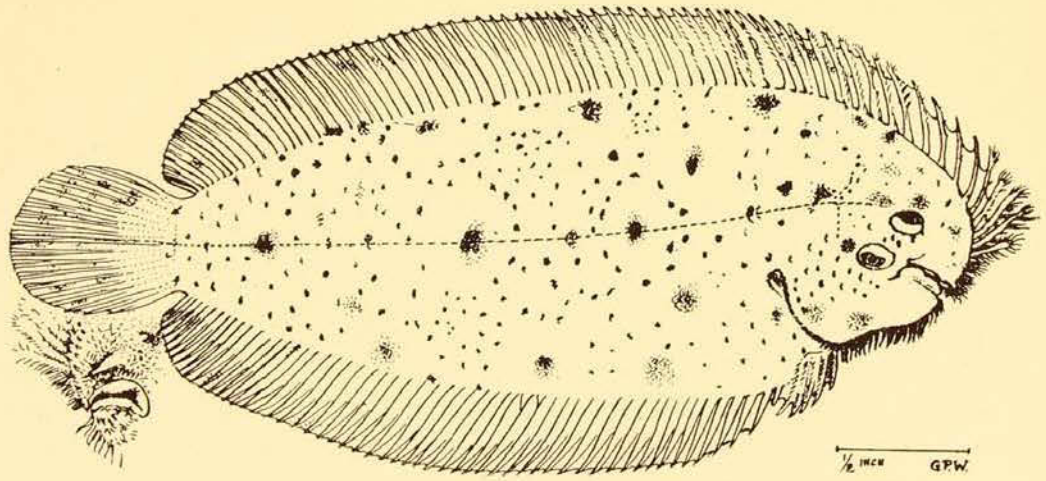
Soles are said to feed mainly by night, feeling their way and smelling their prey, the nostrils sometimes having a long tube. Their eyes are small and in compensation there are papillae, whiskers or whorls of hair-like sensory processes which probably aid in touching and tasting their food; some of the nocturnal New Zealand flounders (*Rhombosolea*) have similar structures. The pectoral fins of many soles are reduced to vestiges or entirely wanting and their classification has been attended with difficulty; as long ago as 1915 Ogilby flippantly wrote to McCulloch: "I have had to take a hand at the armless soles and they have made me cuss considerable". Small wonder, when it is realized that even today, in the competent hands of Chabanaud, the classification of this group has not yet been completed. In some soles (not so far found in Australia) eyes are rudimentary and the species are quite blind. The skin of soles is rough-scaled but easily peeled and has been used for rasps, for fining coffee instead of isinglass, and as a material for artificial baits. In the more elongate Tongue Soles more than one lateral line is usual and there is a complex system of small canals on the head. Soles have been identified amongst the scenes and hieroglyphics of old Egypt, but probably the earliest description of one which has come down to us is that of a Ceuta example by Abu Hamid, quoted in A.D. 1274, and Gesner in the 1550's gave some early information on the sole. Some of the soles are strikingly banded in coloration, one genus being named *Aesopia* after the famous teller of fables on account of the striped costume Aesop, as a slave, must have worn. The Narrow-banded Sole (*Synclidopus macleayanus*) ascends freshwater, matures at about six inches but grows to eleven, and is probably the only prime food-fish whose minimum length for capture is not proscribed by law. Other delicious morsels are the Peacock Soles (*Pardachirus*) of the tropics with their ocellated, soft bodies, but our most important commercial species is the Black Sole (*Achlyopa nigra*) which grows to about 15 inches long and a weight of about two pounds. There are about 27 species of soles known from Australia, some known only from a few rare specimens. Certain kinds imitate dead leaves which have fallen in north Queensland rivers, others (like the Queensland sole, *Dexillus muelleri*, figured here) have patches of "whiskers" protruding from the scales; sundry "Zebra" and "Harrowed" Soles (*Haplozebrias* and *Strabozebrias*) are beautifully banded, whilst a remarkable Bearded Sole (*Aseraggodes*) is illustrated here from north-western Australia to show the fringes on its head and front dorsal rays.



Tufted Sole (Dexillus muelleri) from Queensland showing the dorsal and anal fins united with the tail, a patch of scales and "whiskers" magnified, and (on right) the "honeycomb" of sensory ridges on blind side of head. G. P. Whitley, del.

The Australian Museum is always glad to receive specimens of flounders and soles, particularly the latter, since they have not all been critically classified. The death of J. R. Norman in London after he had completed Volume 1 of his fine *Monograph* (dealing with the flounders) deprived us of his second volume which would have embraced the soles, but the work is being continued by Dr. Paul Chabanaud in Paris. This Museum has sent its collections to England for comparison with the great series in British and European museums and with other collections from America, India, and elsewhere. Before the war, it was an honour and a great personal pleasure to meet colleagues and discuss flounders, soles, and many other fishes in the vicinity of the Jardin des Plantes and Cuvier's old home in Paris, that revered old *maison* of which Theodore Lyman has lovingly written:

> Those little low rooms, five in number, they should be the Mecca of scientific devotees. Perhaps every great zoologist of the past hundred years has sat in them and discussed those problems of life which are always inviting solution and are never solved. The spirits of great naturalists still haunt these corridors and speak from the specimens their hands have set in order.



A remarkable Bearded Sole (Aseraggodes) from north-western Australia in which the front of the head and dorsal rays have whiskery processes for finding food. Inset: mouth and nostrils of blind side. G. P. Whitley, del.

Spiders Harmful to Man

PART I.

By A. MUSGRAVE

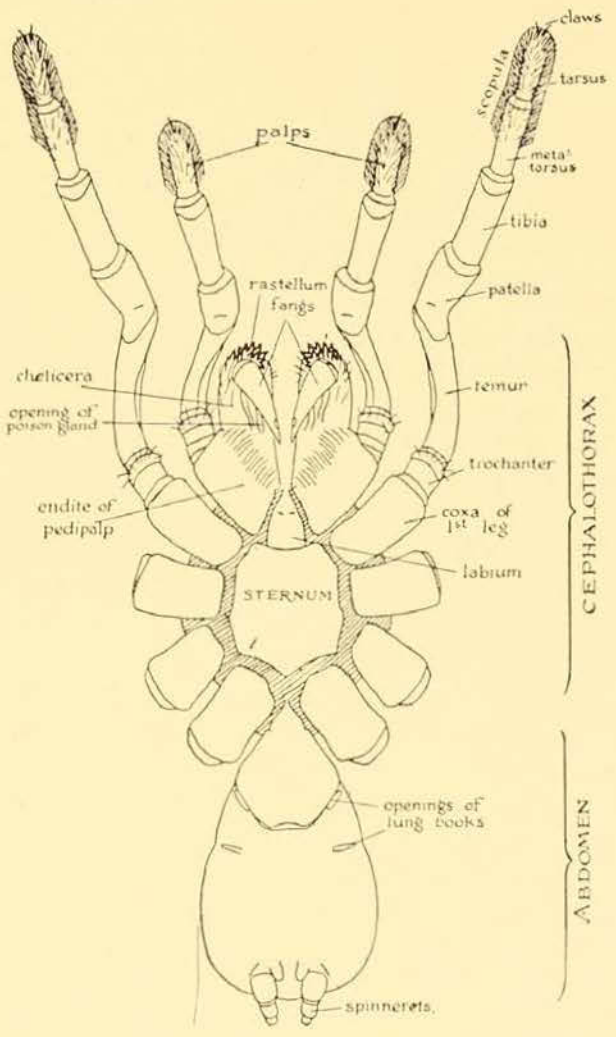
THE death at Lane Cove, Sydney, on January 26, 1949, of a boy of fourteen years of age from the bite of a Funnel-web Spider, *Atrax robustus*, has aroused considerable public interest in spiders. Many people who encounter spiders in their homes and gardens are submitting their specimens to the Australian Museum or to the officers of the Entomological Branch of the N.S.W. Department of Agriculture. Ever since the first recorded fatality from Funnel-web Spider bite in 1927, the Museum has endeavoured to educate the public in the metropolitan area as to the harmful forms. Towards this end leaflets of many common forms of spiders have been distributed, lectures given to school children, and broadcasts over the radio, while the press has been supplied with information, so that there should be few residents of the Sydney district not conversant to a greater or less degree with the harmful forms. The Department of Health, by means of posters displayed on railway stations, draws attention to the harmful spiders, ticks, snakes *et cetera* and gives suggestions for first-aid treatment when bitten.

In these articles it is proposed to give as complete a statement as possible of our knowledge of the poisonous qualities of certain of our Australian spiders and to refer briefly to some foreign species. While it should be stressed that no cause for panic, "tarantism", or other form of spider hysteria exists, for the number of deaths attributed to Funnel-web Spider bite is only five since 1927, nevertheless it is appropriate that the general facts about the few harmful local forms should be known.

Before dealing with the spiders themselves we might first briefly consider the position of spiders in the scheme of Nature and review the classification of these animals.

THE POSITION OF SPIDERS IN THE ANIMAL KINGDOM

The Animal Kingdom is divided into certain groups called phyla of which the greatest in point of numbers, if not in importance, is the phylum Arthropoda, which includes those animals with jointed legs and with a hard exoskeleton (accord-



External anatomy of under-surface of Mygalomorph spider of the genus Arbanitis. The endites of the pedipalps are often termed maxillae.
Nancy B. Adams, del.

ing to the group) made of a substance termed *chitin*. Arthropods also have a breathing system of tubes termed *tracheae* which occur in all but the members of the class Crustacea which have gills. The phylum Arthropoda is further subdivided into classes of which the Crustacea are aquatic for the most part, but the classes Insecta, Arachnida, Chilopoda (Centipedes), and Diplopoda (Millepedes) are, in the main, land animals, though many forms are aquatic or partly so.

Spiders are members of the class Arachnida and are therefore not to be confused with insects which constitute the class Insecta or Hexapoda. Arachnids are eight-legged animals with leg-like feeling organs called *pedipalpi* structurally dissimilar to the thread-like or many-jointed antennae of insects. These latter often possess wings which do not occur in the Arachnida. Grouped in the class Arachnida are the orders Araneida (spiders), Scorpionida (scorpions), Pseudoscorpionida (false scorpions), Phalangida or Opiliones (harvest-men), Acarina (ticks and mites).

The order Araneida, in which the spiders are included, may be identified by their unsegmented body and in having a united head and thorax (cephalothorax) joined by a narrow waist to the abdomen. To the cephalothorax are attached the eight legs, and at the end of the abdomen are the small projections termed spinnerets through which the spider spins the silk to catch its prey, line the shafts of its burrow, or spin egg bags. Placed between the pedipalps or feelers are the jaws or *chelicerae*, each consisting of a basal part and a jointed fang which may be bent under into a groove when at rest. The duct from the poison gland passes through the claw-like fang and opens on its convex side near the tip. The poison glands are stated to be in the basal joints of the *chelicerae* in all mygalomorph spiders, while the poison glands may extend into the head in the dipneumone spiders (the vast majority of spiders). Poison glands are wanting in certain spiders of the family Uloboridae.

The pedipalps are leg-like in appearance, and the terminal joint is usually complicated in structure, knobbed or with a flagellum, in the males, while in the females and immature forms the palps resemble the legs and end in claws. The eyes in spiders provide important characters in classifying them. They vary in number from six to eight, though eight is the number most usually met with. The spinnerets are also valuable in classifying spiders and, in addition, there is present in many spiders a spinning plate (cribellum) which is used in conjunction with a carding apparatus (calamistrum) on the hind legs.

Poison and Treatment

The poison of spiders is secreted by certain glands, probably corresponding to the salivary glands in other animals. It has been pointed out in an article on ticks[1] that the products of these glands in the Dog Tick of the Sydney district may cause respiratory paralysis in man and the domestic animals. The secretions of the poison glands of snakes are likewise an aid to digestion in the animal, and to appreciate the nature of spider venom we may arrive at a better understanding of its toxic effects if we learn something of the venoms of snakes. In the past a great deal of research work has been done in Australia upon these reptiles by Dr. C. H. Kellaway,[2] who has written:

> Snake venoms are beautifully adapted to their functions in the reptilian economy. They serve rapidly to immobilize living and active prey which is to be swallowed whole. To assist in the digestion of this unmasticated food, the venom must be distributed throughout the body of the victim while it is yet alive. These ends can only be achieved by the injection of the venom, and the venomous snakes are provided with a biting mechanism which in its most perfect form anticipated the discovery of the hypodermic syringe.

In a symposium on snake bite published in 1929, articles by Dr. N. H. Fairley and Dr. C. H. Kellaway dealt

[1] A. Musgrave: Some Ticks Harmful to Dogs in Australia. *Aust. Mus. Mag.*, ix (5) May-August, 1947, 174-180, illus.

[2] C. H. Kellaway: Snake Venoms. I: Their Constitution and Therapeutic Applications. *Bull. Johns Hopkins Hospital*, lx (1), Jan., 1937, 1-39.

exhaustively with Australian poisonous snakes and their venoms. Dr. Fairley[3] writes:

> Snake venoms contain a number of different constituents exerting divergent physiological effects. These include neurotoxins acting on the bulbar and spinal ganglion cells, haemorrhagins destroying the endothelial cells lining the blood vessels, thrombase producing intravascular thrombosis, various cytolysins acting on red blood corpuscles, leucocytes and tissue cells, antifibrin or anticoagulin retarding the coagulation of the blood, antibactericidal substances, various ferments and kinases, the latter being of value in preparing ophidian food for pancreatic digestion. These toxic substances are differently distributed in various venoms, the vipers being characterized by the presence of haemorrhagin, thrombase and cytolysins, whereas the colubrides typically contain neurotoxin, haemolysin and anticoagulins.

It may be pointed out that in Australia all our snakes are colubrine, while vipers are not native to this country.

Dr. Fairley continues:

> Neurotoxin is the most potent constituent of colubrine venoms. It possesses a special affinity for the cells of the respiratory centre and the bulb, though it also involves nervous tissues elsewhere in the cord and brain.

Dealing with the effects of neurotoxin on sheep he points out:

> Respiratory failure is the common mode of death with all colubrine venoms and sheep die regularly from this cause.

In the spiders of the world-wide genus *Latrodectus*, all of which have a bad reputation as a cause of arachnidism (spider bite),[4]

> the chief constituent of the venom is a neurotoxin, but a haemolysin has been described. Castellani and Chalmers also state that it contains a substance which increases the coagulability of the blood. It is doubtful whether this is so, and the undoubted increased coagulability can be attributed to the extreme dehydration which occurs.

Certain difficulties appear to present themselves in overcoming the action of neurotoxin and some doubt exists as to the first-aid treatment for neurotoxin poisoning. This is of primary importance in certain Australian snakes and in those spiders harmful to man. Dr. Fairley, in dealing with experiments with ligature in sheep and goats which had been inoculated with colubride venom containing no thrombase, states:

> The typical colubride venoms kill by neurotoxin and contain no thrombase, and copper-head and death adder venom resemble cobra venom in this respect. In consequence nothing more than a prolongation of the death time could be anticipated from the application of ligature. This was fully borne out by the experimental results which showed definitely that in each instance ligature failed to save life even when only one or two certainly lethal doses of venom were inoculated.

Again, in dealing with those colubride venoms containing thrombase, he writes:

> Tiger snake venom contains much thrombase . . . It also contains large amounts of a most lethal neurotoxin, but haemorrhagin is poorly represented . . . Even after circulatory stasis has been produced by ligature, the mere presence of thrombase in the inoculated venom is not necessarily sufficient to lock up its neurotoxin and other constituents effectively *in situ* and contrary to Martin's results in rabbits *post mortem* evidence of increased local coagulation and thrombosis in the vicinity of the inoculations was no more definite in ligatured sheep and goats than in non-ligatured animals.

From the above evidence it would appear that ligatures are only effective in retarding the action of the poison of a few of our snakes, and though the human victim may not be always able to identify the snake responsible, ligatures are therefore tied more from a desire that the reptile responsible was not one of these more lethal forms. Certain anti-venines are available for counteracting the venoms of the more deadly of our snakes so that the ligatures possibly assist the patient until medical aid arrives. In the United States ligatures for Black Widow Spider bite are regarded as useless.

Certain South American spiders, viz., *Nephila cruentata* Fabricius (family Argiopidae); *Lycosa raptoria* Walckenaer

[3] N. H. Fairley: Symposium on Snake Bite. The Present Position of Snake Bite and the Snake-bitten in Australia. *Med. J. Aus.*, March 9, 1929, pp. 1-19, illus.

[4] W. W. Ingram and A. Musgrave: Spider Bite (Arachnidism): A Survey of its Occurrence in Australia, with Case Histories. *Med. J. Aus.*, July 1, 1933, pp. 10-15, illus.
W. W. Ingram and A. Musgrave: The Poisonous Spiders of Australia. *Aust. Mus. Mag.*, v (4), Oct.-Dec., 1933, pp. 121-125, illus. (An abridged version of the preceding.)

(family Lycosidae); and *Loxoscelis laeta* Nicolet (family Sicariidae) are harmful to man, and the effect of the bites is to cause necrosis of the tissues (gangrene) surrounding the bite wound. These spiders do not appear to be quite so dangerous as other local spiders whose bites have a neurotoxic action, but which I have not cited in this article. The two first-named species are mentioned in papers by Dr. Brazil and Dr. Vellard,[5] and the last by V. Macchiavello.[6]

Treatment. — The first-aid treatment that has been recommended for spider-bite (arachnidism) is that employed in snake-bite, viz., if the bite wound is located on a limb ligatures are applied above and below the site of the bite. The wound is then incised with a sharp knife or razor blade and the poison squeezed or sucked out. A doctor may then be called. The ligatures should not be permitted to remain on for more than thirty minutes without easing them and permitting the blood to circulate. Iodine or ichthyol may be applied to the site of the bite. The only drawback to this theory, as we have seen, lies in the fact that the poison is an arachnolysin and its effects are neurotoxic. Dr. Brazil and Dr. Vellard, who studied the venomous spiders of Brazil and prepared anti-venines to counteract the toxic effects of the venoms, summed up the position about arachnidism as far back as 1926. I give here a translation from a summary in their paper: The action of the venom of each species of spider being specific, it is necessary to know in each region the species of spider most commonly causing casualties in order to prepare correspondingly specific sera either monovalent (single strain) or, for preference, polyvalent (many strains). The authors then emphasize: In cases of spider bite, all symptomatic treatment being ineffective, the only treatment is by means of specific sera.

But if we think that by our researches we now hold "the eel of science by the tail", we are mistaken, for we find that in the United States where a serum is available it has not always been found expedient to use it and the treatment by an injection of 10 c.c. of 10 per cent. calcium gluconate or calcium chloride has been preferred. Even these last-named specifics are not always effective, and Dr. J. E. Bell and Dr. John A. Boone[7] have indicated the value of neostigmine methylsulphate in treating Black Widow Spider bite.

[5] V. Brazil and J. Vellard: Contribuicao ao Estudo do Veneno das Aranhas. *Mem. Inst. Butantan*, ii (1), July 25, 1925, pp. 1-77, pls. 1-14; Contribuicao ao Estudo do Veneno das Aranhas (Segunda Memoria). *Mem. Inst Butantan*, iii (1), 1926, pp. 243-299, pls. 12-22.

[6] V. Macchiavello: La *Loxoscelis laeta*, causa del aracnoidismo cutaneo o mancha gangrenosa de Chile. *Rev. Chil Hist. Nat.*, Santiago, 41, 1937 (1938), pp. 11-19.

[7] J. E. Bell and J. A. Boone: Neostigmine Methylsulfate, An Apparent Specific for Arachnidism (Black Widow Spider Bite). *J. Amer. Med. Ass.*, 129 (15), Dec. 8, 1945: pp. 1016-1017.

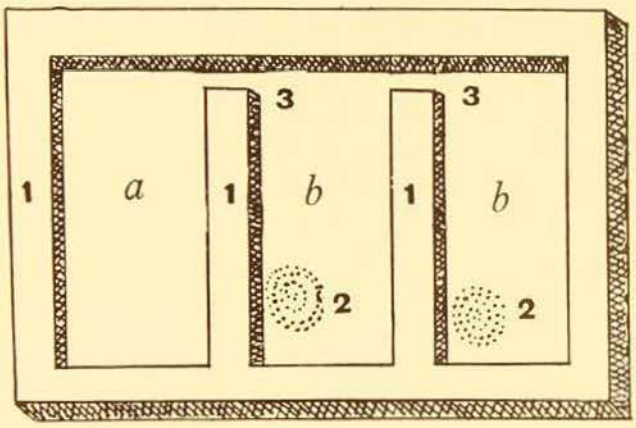
It was reported recently to the Australian Museum by Mr. H. Bailey, of Whale Beach, north of Sydney, that a fossil fish was embedded in the sandstone near the swimming pool. This fish had apparently been covered by a thin layer of sandstone which had subsequently weathered away revealing the fossil. The fish was identified as a cartilaginous Ganoid type known as *Myriolepis lata* Woodward, and was a record size for this species. The sandstone in which it was found belongs to the upper part of the Narrabeen series of the Triassic geological period. These Triassic fish are fairly abundant in New South Wales and have been found in beds of the same age at Gosford, in the Hawkesbury series at Brookvale, and the Wianamatta series at St. Peters. At Beacon Hill quarry, near Brookvale, there is a rich and varied fossil fauna found in shale deposits in the massive Hawkesbury sandstone.

How to make a Formicarium

By J. R. KINGHORN

> Go to the ant, thou sluggard; consider her ways and be wise.
> —PROVERBS vi, 6.
>
> The ants are a people not strong, yet they prepare their meat in the summer.
> —PROVERBS XXX, 25.

EVERYONE is familiar with an aquarium, the tank or artificial pond in which are kept aquatic animals and plants. Many have heard, also, of the terrarium wherein are kept salamanders, newts, and similar creatures. Few have heard of a formicarium in which one may keep ants and observe their ways of life, and young naturalists to whom I speak by radio may recollect that last year I mentioned the building of one; I spoke then from information supplied by Mr. K. C. McKeown of this Museum. Now I tell you how to set about doing this.



A Formicarium.
1, walls approximately 1 inch wide, ½ inch high; 2, moist pads; 3, passages from room to room; a, food room; b, living rooms.
J. R. Kinghorn, del.

The floor may be of wood, zinc, or glass and round the edge build a wall with strips, or plaster, about one-third of an inch high. Then divide the area enclosed into three or more rooms, leaving open spaces near one wall to act as doorways through which the ants can move from room to room. Two of the rooms are to be reserved as nests, and an outside one as a feeding chamber. Round the top of the wall glue a narrow strip of towelling or velvet so that when the glass top is fitted plenty of fresh air can enter the home without the ants being able to escape. The rooms to be used as nests must be kept dark, so place a piece of cardboard over that portion of the glass; this can be easily lifted when one wishes to observe what is happening there. The dining-room, which is open to the light, is really the outer world.

Food of various kinds, such as sugar or tiny pieces of meat, must be placed here from time to time, but be sure to remove dried-up and bad pieces so that the home can be kept perfectly clean. Ants must have cleanliness, water and fresh air, or they soon sicken and die. The glass top must be removed from time to time and you may have trouble with ants trying to escape, so it is better to have a separate piece of glass over the feeding chamber; this can be lifted and food and fresh pads saturated with water added without disturbing the ants. In the living rooms or nesting areas place a small piece of wet towel or thin slice of sponge because ants require a moist atmosphere in which to tend the eggs. It is suggested that the formicarium be no larger than a cigar box in external measurement. If a cut-down cigar box be used, the walls should be widened with plaster of Paris on the inside. One young naturalist has made a very good formicarium from a cigar box with a hinged lid. He built plaster walls inside, just a little lower than the wood-work, and the glass sits in a rebate thus formed which should be lined with velvet or towelling. This enables him to use the lid of the box as a cover for the nest, the portion over the feeding chamber being cut away to let in the light. However,

this is not as simple as the one recommended and described here. Your ant home is now ready, and you will have to devise some means of separating whatever ants, eggs and pupa you collect, from the earth before placing them in their artificial home. However the inclusion of some earth may be quite a good thing as ants will use it in ways that may interest you. The ants will be very excited at first, so cover them over and give them a chance to settle down. Be sure that you place only one species, or kind, of ant, and from one colony in the nest otherwise there will be a terrific fight as they set about killing each other. Some young naturalists at a country school had this experience lately.

If you are fortunate to possess that excellent book by Brewster and Couch, *Life Stories of Australian Insects*, you will find it most useful. It tells you of experiments with many insects, especially ants.

New Aids to Insect Collecting

By A. MUSGRAVE

FROM time to time enquiries are made to the Museum for substitutes for cyanide of potassium as a killing agent for insects collected in the field for study purposes. The disadvantages of cyanide are its high lethal qualities, which renders it unsafe for juvenile collectors and is, moreover, difficult to obtain owing to governmental restrictions of sale. In the series of articles written by me in the AUSTRALIAN MUSEUM MAGAZINE,[1] I overlooked the well-known *acetic ether* which has the benefit of being less toxic to humans, and *carbon tetrachloride*. *Carbon bisulphide* (highly explosive) is often employed to kill certain kinds of economic insects, and is a useful agent to employ in killing those kinds of ants which nest in the garden such as the bull-dog, soldier and hopper ants of the genus *Myrmecia*, and the meat or mound ants, *Iridomyrmex detectus*. But it is not recommended for use in a killing bottle.

Attention has recently been directed to another volatile liquid, *tetra-chlor-ethane*, by Dr. C. B. Williams, in an article[2] in which he points out how it was used to kill insects attracted to a light trap. He writes: "It is very much safer than cyanide, does no damage to the colour of Lepidoptera, so far as we have discovered, and leaves the insects in a relaxed condition suitable for setting."

He further points out: "One method of use is to place at the bottom of the killing bottle about 1½ in. of moist plaster of Paris and allow this to set and dry out. When the killing bottle is required, about a teaspoonful of tetra-chlor-ethane is poured on to the plaster, into which it sinks, and the vapour is slowly given off."

MOULD PREVENTIVE.

One of the difficulties which beset the collector in the tropics is the prevention of mould on his specimens. Insects stored in tins soon develop a rich fungous growth which spells the ruination of the material unless checked in time. To overcome this difficulty many collectors employ *thymol*. Others have found that *thymol* and *xylol* to form a saturated solution makes an efficient deterrent to both verdigris and mould. Recently Mr. N. B. Tindale, of the South Australian Museum, drew my attention to the chemical *trichlorphenol* which has the advantage of permitting insects to be kept in tins without developing mould.

[1] A. Musgrave.—Collecting and Preserving Insects and their Allies. THE AUSTRALIAN MUSEUM MAGAZINE, Vol. viii, No. 4, April-June, 1943, pp. 123-126, and No. 5, July-September, 1943, pp. 161-165.

[2] C. B. Williams.—The Rothamsted Light Trap. *Proc. R. Ent. Soc. Lond.* (A), 23 (7-9), 15 Sept., 1948: 80-85, 4 figs.