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The Raven.

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THE AUSTRALIAN MUSEUM MAGAZINE

THE HONOURABLE ALEXANDER MACLEAY.
From a portrait by Margaret Carpenter, 1838. *Frontispiece*

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

● OUR FRONT COVER. The Raven (*Corvus coronoides* Vigors and Horsfield) is by Lilian Medland. It is one of a series of postcards issued by the Australian Museum.

The Raven, commonly but wrongly called a Crow, has earned an unsavoury reputation amongst pastoralists by its habit of attacking sick sheep and lambs and picking out their eyes. This fault has to be admitted, but it has to be remembered that the Raven is a useful destroyer of carrion, with the maggots it contains, and may more than pay for the sick and weakly sheep which it destroys.

The Raven is found throughout Australia in every kind of situation. It is an omnivorous feeder, but prefers flesh, and fresh flesh at that. It is as a rule an extremely wary bird, and difficult to approach within gunshot. In captivity it makes an amusing pet, and can be taught to talk, when its deep gruff voice is very comical.

The nest is a large affair made of sticks, and three to five eggs are laid, dull green in colour, blotched and freckled with brown.

VOLUME VII, NUMBER 10. SEPTEMBER–NOVEMBER, 1941.

The Hon. Alexander Macleay, F.R.S.
From a portrait by Margaret Carpenter, London, July, 1838.

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VOL. VII, No. 10. SEPTEMBER–NOVEMBER, 1941.

Portrait of Alexander Macleay

By A. B. WALKOM, D.Sc.

ALEXANDER MACLEAY was one who took a very close interest in the early progress of the Australian Museum. He was Colonial Secretary of New South Wales from 1825 to 1836, and from 1843 to 1846 was the first elected Speaker of the Legislative Council under the Constitution Act.

The earliest records of the Museum are unfortunately not as complete as could be wished. According to the late Robert Etheridge[1] it was "currently believed and officially stated that the Australian Museum was inaugurated in 1836, and under that name was consolidated by the Hon. Alexander Macleay, Colonial Secretary". Mr. Etheridge was able to show, however, that a Museum "was evidently resolved on as early as 1827" and that "a Museum of some kind was established between the years 1827–9".

In 1836 a General Committee was appointed which exercised control of the Museum and of the Botanical Garden, and was divided into two sub-committees, one for each institution. This joint Committee existed until 1851, when at its own request it was relieved from the reference to it of the Garden.

Alexander Macleay was a member of the Committee from its inception in 1836 until his death in 1848. When it is added that his two sons, William Sharp and George, were members of the governing body of the Museum for long periods (1841–62 and 1836–59 respectively) and that his nephew, William John, was a Trustee from 1861 to 1877, it will be seen that the Macleay family made a notable contribution to the administration of the Museum.

Though we may not know exactly what part Alexander Macleay played in the earliest stages of the Museum, Mr. Etheridge states (p. 74): "Whatever connection the Honbl. Alexander Macleay had with the inception of the Australian Museum, there can be no doubt of his long and lasting interest in the establishment; the old minutes prove this."

The Museum has had for many years a very fine portrait of Alexander Macleay. It hung in the Curator's room till about 1920, when it was removed to the Board Room. Little information has been available regarding the history of this portrait. In an address to the Linnean Society of New South Wales in 1920, the late J. J. Fletcher referred to two addresses received by Alexander Macleay on his retirement from the office of Colonial Secretary,[2] one of which was "from twenty-five gentlemen who had been officially associated with him in

[1] *Records of the Australian Museum*, xi, 1916-17, p. 68.

[2] *Proceedings of the Linnean Society of N.S.W.*, xlv, 1920, p. 582.

public life, and who asked 'that you will do us the favour to allow your portrait to be taken at our expense, for the purpose of being placed in some appropriate situation in the colony, as a lasting memorial of our regard and esteem for your private worth, and of the grateful sense entertained by us, of the co-operation we have always experienced from you, in conducting the business of our respective departments' ". The list of signatures to this address was headed by the Lord Bishop of Australia and the Colonial Treasurer.

Of the portrait Mr. Fletcher said: "I have not been able to ascertain the history of the contemplated portrait, or, if painted, where it was or is located unless it be in some Government building. Or it may be the portrait now hanging in the Curator's room at the Australian Museum, whose history is unrecorded."

Recent renovation of the portrait and subsequent investigation have provided some further details which are of interest. The portrait was recently renovated at the National Art Gallery, through the courtesy of the Director, Mr. Will Ashton, O.B.E., and the name of the artist and date of painting were revealed. The portrait bears the signature: "Margaret Carpenter, London, June, 1838."

The address presented to Mr. Macleay was dated January 23rd, 1837, and it therefore appears reasonable to conclude that the portrait in the Museum is the one painted in response to the request contained in that address. Mr. Macleay, however, was not in London in 1838, but a portrait of him had been painted by Sir Thomas Lawrence for the Linnean Society of London on his resignation from the Honorary Secretaryship of that Society in 1825, when he was appointed as Colonial Secretary of New South Wales. That portrait was presented by subscribing Fellows to the Society. It may be that the portrait now in the Australian Museum was a copy of that painted in 1825 by Sir Thomas Lawrence. Further inquiries may disclose more of the history of our portrait.

MARITIME SERVICES BOARD OF NEW SOUTH WALES: Destruction of Timber by Marine Organisms in the Port of Sydney. Supplementary Report No. 2. By R. A. Johnson and F. A. McNeill. Sydney, 1941. Cr. 4to. 92 + xxii pp., 20 half-tone illustrations, 1 map, 4 graphs.

A noteworthy contribution to the ecology of marine boring organisms is the project conducted during the past twelve years by local specialists on the conditions in Port Jackson and neighbouring harbours. Two reports have already been issued and the latest makes known an unusually interesting body of new data. A comprehensive subject index enables ready reference to any item in this and the antecedent reports.

Sydney Harbour seems unhappily rich in organisms with destructive wood-boring habits. There are several teredrine forms—"cobra" in the local vernacular—and the authors have found that for all but the freshwater *Nausitora* ten days or a fortnight's immersion in fresh-water of affected wood will kill all the borers. The destructive isopod, *Sphaeroma quoyana* confines its attack to intertidal structures and *Limnoria* extends its operations deeper, scars in timber having been determined as the most vulnerable foci for attack. The other crustacean associate of these borers, *Chelura cambrica*, concerning whose destructive status there has long been dispute, is now absolved as not being directly injurious. Newly discovered culprits are *Martesia striata*, a burrowing bivalve of the well-known *Pholas* type, and an ascomycete fungus which causes surface decay even in hardwoods—this instance of a sea-water fungus being something new for Australia.

On the technological side solid achievements lie to the credit of the investigation. There has been discovered, and proved effective, a new plastic compound which protects timber from low water-mark down to the mud-line, while for the inter-tidal piles an ingenious floating collar process has been contrived by which it is claimed that turpentine piling can now be given indefinite life in Port Jackson. The whole investigation is a clear demonstration of the effective team-work of zoologists and engineers.

H. THOMPSON.

Mrs. Swanston (Nov. 1967) says
that our Alexander Macleay
portrait was copied in London
by Margaret Carpenter and
brought out to Australia by
Alexander Macleay's son.

Aboriginal Grindstones and Mortars

By FREDERICK D. McCARTHY

MILLSTONES and mullers, mortars and pestles, are uninteresting terms, but the origin of the implements which bear them take us back some thousand years to a period of the human occupation of the earth when the people were hunters and food gatherers, to a time long before the great cradles of civilization, such as Mesopotamia and Egypt, dominated man's culture.

Many people associate the origin of these implements with that of the cultivation of grain at the beginning of the Neolithic period, but they were in use long before this era, in the Upper Palaeolithic period, when the nomadic peoples gathered seeds and nuts and developed processes, similar to those of our aborigines, for preparing them in a more edible form than in their raw state.

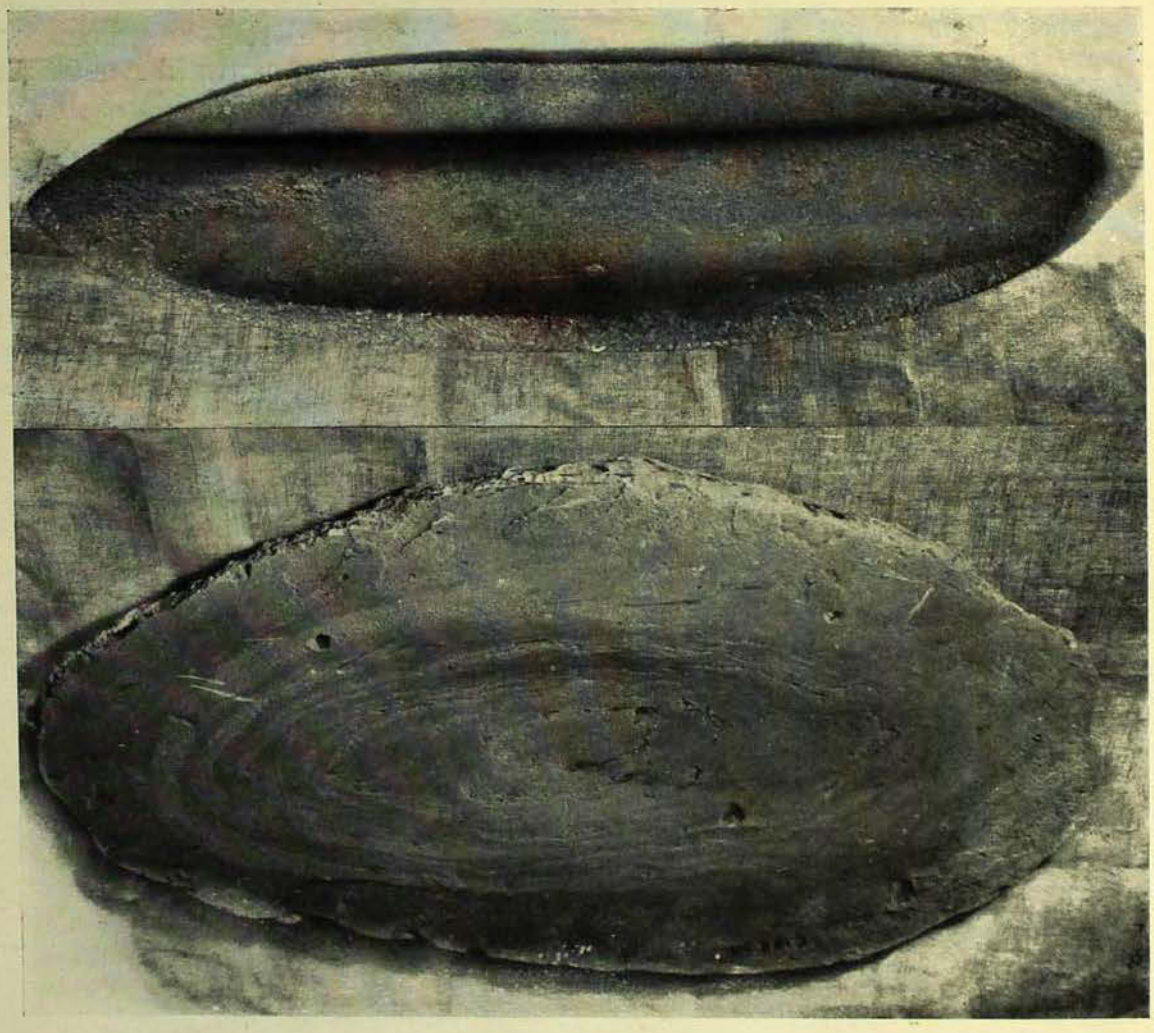
Millstones and mortars have a world-wide distribution and occur in many strange shapes and forms on the various continents and islands where they are found. It is of interest to look back into history and examine the tools of primitive peoples, especially in our own country, even though we are strongly impressed with the tremendous strides in technical knowledge and skill that have been made in our mechanized age when we compare an aboriginal millstone with our grinding machinery, a mortar with our crushing plant, or an axe-sharpening stone with our emery-wheel. It is surprising to note that very little has been written about these implements in Australia, even though they illustrate some interesting sidelights of aboriginal life.

In Australia the mortars are made either of water-worn pebbles of flattened, rounded shape, or of blocks of sandstone, and even hard igneous rocks, roughly fashioned to an oval form by the removal of large flakes round their margins. As a rule, only one surface has been used on

On the left is shown an anvil stone, six inches long, from western New South Wales, with three indentations caused by percussion. On the right is a pestle and mortar, seven inches long, from Rushworth, Victoria.

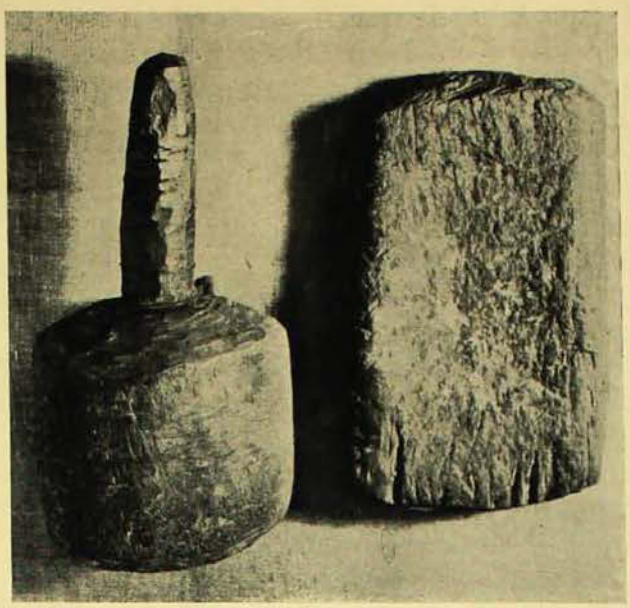
the pebble mortars in eastern Australia, but in the interior of the continent there may be one, two, or three working depressions on the mortars, and percussion marks on their edges caused by hammering or anvil use. In size they range up to nine inches in length and six inches in width, and the average thickness is between two and four inches. The pestles are usually rounded pebbles from two to five inches in diameter, or elongate pebbles (commonly used on the eastern Australian coast) up to seven inches long. In the interior of the continent, one stone often served as a pestle, hammerstone and muller. The principal function of the mortar and pestle is to crush up hard nuts, seeds, and ochreous pigments, for which purpose they are employed by both men and women. In Cape York, mortars and pestles made of hardwood are used instead of the stone artifacts, but these are an introduction from the Papuans of Torres Strait.

The millstones are the largest stone artifacts in the aboriginal tool-box. Many people in the country are familiar with them mainly because of their size, and because they make splendid paths and edgings for gardens, and form tool-sharpening stones, purposes to which they have been put on many farms and stations. They are made of sandstone, quartzite, schist, and other stone; the slabs are broken off outcrops and either left in their irregular form or trimmed to an oval shape. It is remarkable that the method employed by the aborigines

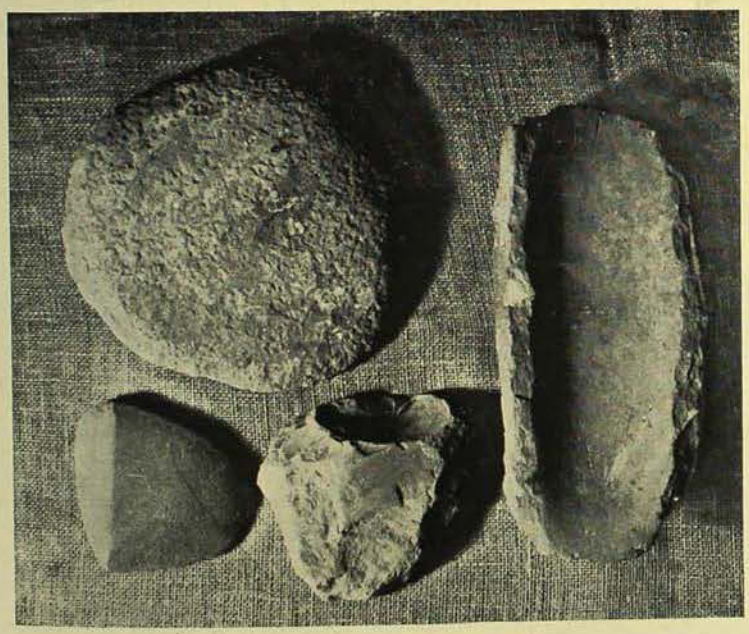


The lower millstone has been shaped by flaking round its margins, and it has an all-over depression; it is from Murtee Holding, Darling River, New South Wales, and is twenty-four inches long. The upper example has been shaped by hammerdressing, and it has two narrow depressions; it is twenty inches long, and is from Central Queensland.

for detaching the slabs from outcrops is not known, although a number of quarries have been reported. Sometimes large flattened pebbles are utilized. The millstones are carried to camping places where they are left by the aborigines to avoid the labour of carrying them about, a wise practice when it is considered that they weigh up to fifty pounds. The grinding depressions are of two types, one of which covers the whole of one face of the slab, and the other only half of it; these depressions occur in various combinations, as, for example, two all-over depressions, an all-over depression with a long groove on the reverse, or from one to four of the narrow type on the one slab. Well-used millstones have depressions up to several inches deep, depending on the thickness of the stone, and on some examples the stone is worn right through from one or both sides. Specimens in the Australian Museum collection range from fifteen to thirty-one inches in length and from eight to fifteen in width, but larger stones may occur. In north-eastern Queensland transverse incisions are made in the millstone for the purpose, it is said, of allowing poisonous secretions to escape from the seed being crushed.



A wooden mortar and pestle, nine inches long, from northern Cape York, Queensland.



The muller (top left) is hammer-dressed; it is six inches long and is from Broken Hill, New South Wales. The muller (middle) has been shaped by flaking; it is four inches long and is from Lake Narran, New South Wales. The muller (bottom left) is well worn and suitable for use as a knife; it is three and one-half inches long and is from Bourke, New South Wales. The axe-sharpening stone (right) is eight inches long and is from Black Springs, New South Wales.

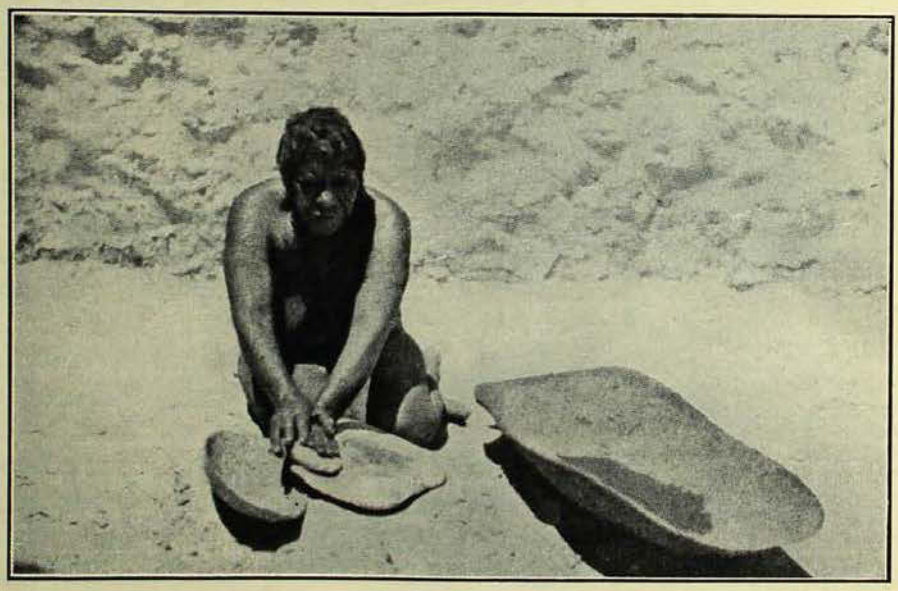
Millstones form an important item of barter in regions where suitable stone is scarce or is not found, and for this reason they were traded, for instance, from the Toko Ranges in western Queensland throughout neighbouring areas, as were specimens from a quarry in the Flinders Ranges in South Australia. Grinding depressions and mortar holes are worked into outcrops of suitable stone adjacent to a camping place, as a substitute for the portable implements.

The mullers or rubbing stones are either flat pebbles or shaped pieces of stone, and measure up to nine inches in length. They are often found in pairs on camp-sites, indicating that they are employed as grinders apart from the millstone. The original stone used as a muller may be several inches thick, and it is gradually worn down, especially on the narrow grooved millstone or when it is rubbed on both surfaces, until only a crescentic section with an out-curved blade remains; this blade is suitable for use as a knife for skinning animals and dressing the skins. The economy exercised by the aborigines in the carrying about of stone implements, by the elimination

of specialized types and the use of generalized tools in their place, is also demonstrated by the use of pestles as mullers, percussion and anvil stones. The original stone used as a muller may be several inches thick, and it is gradually worn down, especially on the narrow grooved millstone.

The finest mortars and pestles, millstones and mullers, are finished off very neatly by hammer-dressing, their lateral margins and unused surfaces being carefully smoothed and rounded by means of this pecking technique. Many of the hammer-dressed millstones are pear-shaped in outline, others are ovals pointed at both ends, and the fashioning of their symmetrical shape and convex back entails a considerable amount of tedious labour. We might wonder why the aborigines went to so much trouble with strictly utilitarian artifacts. The obvious reasons are the craftsman's pleasure in making and using a well-finished tool, the smooth edges making it easier to handle, and the fact that a convex bottom rests securely on sand; the main reason is probably that the example was set by one of the culture-heroes, and the living tribesmen, notwithstanding the labour involved, accept the sanction, as they do with many other introduced traits. Thus, the tool would not be believed to function properly unless the precedent of the culture-hero was followed, a principle in aboriginal culture which explains the decoration of weapons with sacred designs, and which provides the sanction for modes of behaviour in many aspects of life. Hammer-dressed millstones and mortars appear to be limited in distribution to western Queensland and the Darling-Lachlan river systems in New South Wales.

Now that the implements have been described, a summary of the preparation of plant food may be given. The hard nuts are broken up with the mortar and pestle, and are either eaten raw or roasted in the ashes. The seeds may be shaken from the bushes into a closely woven basket or wooden container, or swept off the ground with bushy twigs; sometimes the bushes are pulled up, placed in a heap to dry, and beaten with a branch or digging-stick by the women to separate the seeds. In some localities the woman puts the seeds in a hole in the ground and stamps upon them with her feet so as to separate the husks before winnowing, and the harder seeds may be pounded in a mortar. If winnowing is necessary, the seeds are thrown into the air so that the light husks and earth or sand are blown away. The seeds may then be ground on a millstone, the powder tipped into a wooden container, sprinkled with water, and mixed into a dough which is baked in the ashes to form a damper. The millstone with the long narrow groove is



Grinding munyeroo seeds. Water is sprinkled on them whilst grinding, and a dark paste is produced, which is accumulated in the wooden bowl or pirrha. This is either eaten at once or cooked in ashes. The mill stone, muddha, may have two grooves, one at each side running full length, which are worn by the rubbing stone.
After Horne and Aiston.

tipped up on one edge with a pebble placed under its opposite side, the dough is mixed as the grinding proceeds, and is worked off the edge of the stone into a container.

The preparation of dampers is a daily job in some areas for the aboriginal women, and when animal food is scarce, as it often is in times of drought in the interior of Australia, dampers form the main item in the diet. They are sodden masses, flavoured, if it may be so termed, only with the grit from the grindstones, but they provide essential food requirements for the aborigines. It must be remembered that the aborigines do not plant seeds to produce crops, neither do they cook their greens in water, but eat them raw or bake them in the ashes; no doubt a succulent morsel is occasionally got from the steaming of a leaf or stalk wrapping in the stone oven.

Two other types of rubbing stones may be mentioned in this article. Flattened pieces of sandstone or quartzite, or coarsely grained pebbles, are used for smoothing wooden weapons and other objects after the workman has shaped them as well as he can with a stone chisel or scraper. The mullers are often employed for this purpose. Various odd pieces of stone are carried about or left at camp-sites for re-sharpening axe blades and some of these artifacts are like miniature millstones, being shaped by careful chipping all round their margins.

An exhibit of the above artifacts may be seen in the Hall of Australian Ethnography.

VICTORIAN FUNGI: A Key and Descriptive Notes to 120 different Toadstools (Family Agaricaceae), with remarks on several other families of the Higher Fungi. By James H. Willis, B.Sc. Published by the Field Naturalists' Club of Victoria, Melbourne, 1941. 8vo, 72 pp., 3 coloured plates, 13 half-tone plates, 18 text figures. Price: 2s. 6d. Our copy from Robertson and Mullens, Ltd., Melbourne.

THERE is still a need in Australia for popular natural history handbooks that can be used by the beginner seeking to identify his collection of some particular group. Many of the published 'handbooks' are too advanced and too technical to be of much use to such a beginner. This volume on Victorian fungi is an admirable example of the type of book needed—it is of a handy size and is inexpensive; the descriptions are easily understood; and the illustrations are excellent. Its scope is limited to the Victorian members of the "toadstool" family, with a few notes on some conspicuous genera from other families, but it should be useful to many nature-lovers in other States.

For the Victorian Agaricaceae there is a key for the identification of 120 species, followed by short descriptive notes on each of the species. In addition there are short notes on some of the polyporoid fungi, coral fungi, puff-balls and their kin, and vegetable caterpillars.

To most people fungus growths are something to be shunned, indicative of decay and of damp, and to be regarded generally with suspicion on account of the known toxicity of some species. Indeed, as the author says, "the ignorance of the average person concerning such common objects as fungi is truly remarkable". One may even doubt whether the average person thinks of the popular mushroom as a fungus, and one can be quite sure that the average person will be astonished at the variety and beauty exhibited by members of the family Agaricaceae, so well shown by the very fine series of illustrations in this book.

A short list of references, to which the beginner could graduate from this handbook, would have added to the usefulness of the book. When it is not possible to have the illustrations close to the descriptions in the text, the plan of having all the plates together at the end of the book would save some irritation at having to hunt for the figure while studying the description of any particular species.

The Field Naturalists' Club of Victoria in publishing this book has made a notable contribution to the cause of natural history in Australia.

A.B.W.

The Pterodactyls of the Mesozoic Era

Nature's Greatest Flying Machine

By H. O. FLETCHER

NO story of mythology or fact can even remotely compare in interest with the fascinating story of the gigantic and fantastic reptilian inhabitants of the world in Mesozoic times. This era of the earth's history, often referred to as the "Age of Reptiles", embraced the geological periods known as Triassic, Jurassic and Cretaceous. They were peopled with large unfamiliar creatures, which developed along grandiose lines from Triassic days, reached their culminating point in the Jurassic and Cretaceous, and died out at the close of the latter.

The Mesozoic reptilian fauna came into existence about two-hundred million years ago, and had a time span of seventy-five million years in which to develop and spread to most parts of the world.

From time to time the fossil remains of these interesting reptiles have been unearthed from the rocks laid down in the Mesozoic and it is from these fossils that palaeontologists have been able to reconstruct with great accuracy the type of life existing in those days.

The climatic conditions were ideal for the reptilian population. They enjoyed a fairly uniform climate, for the most part equable and almost sub-tropical, although over large areas of the world arid conditions at times predominated. In the Jurassic there was a greatly increased growth of trees and later in the Cretaceous many new types appeared, including the deciduous trees and the flowering plants.

The distribution of land and sea in the Mesozoic era was not as it is today. Throughout geological history the face of the earth has been constantly changing and in that era the continents were not wholly stable. Vast changes took place by the subsidence of land masses, and transgressions of the sea caused large areas to become low-lying and swampy.

It was in this environment that the reptilian groups lived and flourished. Food was plentiful for the herbivorous dinosaurs, and as a natural corollary there was ample food for the carnivorous or flesh-eating forms. In the sea a plentiful food supply supported shoals of great swimming-reptiles, while in the air the pterodactyls held sway, so that in the sea and air and on the land the reptiles were masters of all they surveyed and reigned supreme.

On the land surfaces roamed the dinosaurs—the name means "terrible lizard", and when applied to these monsters is no misnomer. There were many types of dinosaurs, one of the largest being *Tyrannosaurus rex*—"King of the tyrant reptiles". Fifty feet in length and when erect fully twenty feet in height, this great reptile had an enormous head with saw-bladed dagger-like teeth six inches in length. He could open his mouth to an extent of four feet and, being built for quick action, must have been one of the most fearsome of all known creatures.[1]

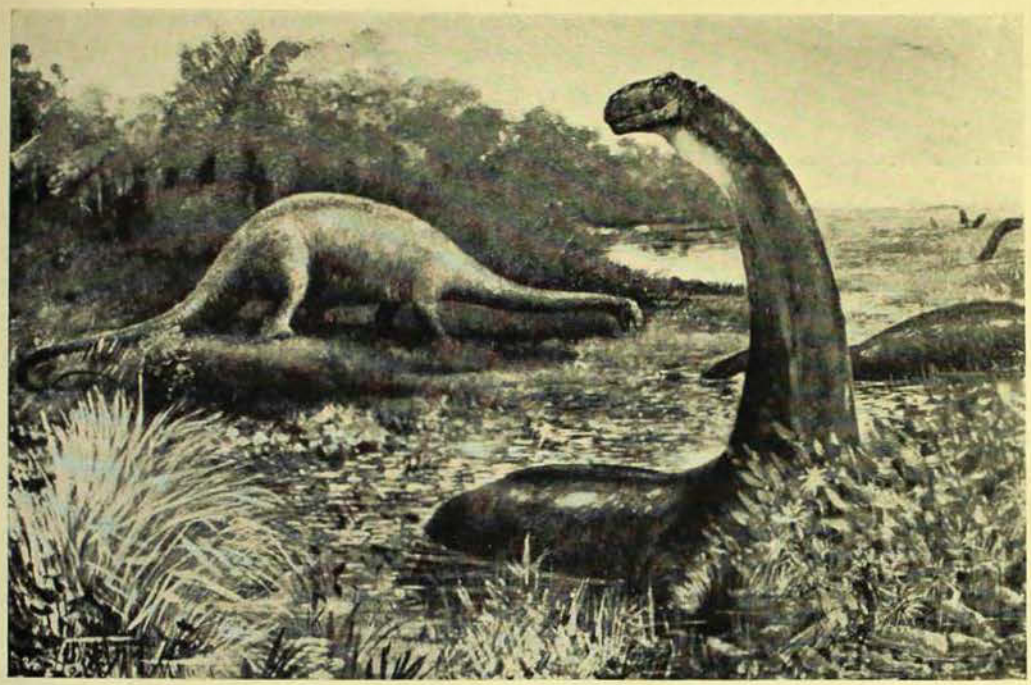
Frequenting the marshes and more swampy areas of the Mesozoic terrain was *Brontosaurus* the "thunder lizard", a gigantic although inoffensive amphibious dinosaur which lived on trees and shrubs. It is estimated that his daily meal would at least amount to 700 pounds, and as he possessed a very small head and mouth his meal-time must have been a constant

[1] Anderson: A Dinosaur Exhibit, THE AUSTRALIAN MUSEUM MAGAZINE, i, 1923, pp. 314-319.

source of worry. *Brontosaurus* weighed approximately twenty tons, attained a length of about seventy feet and had a long tail and neck. In times of strife, not being fitted for battle, he retired into deep water where, out of harm's way, he could survey, by means of his long neck, the movements of his terrestrial enemies.

The armoured dinosaurs had a bizarre protective ornamentation of body plates which reached almost absurd limits. Nature appeared to run riot on this reptile had very small teeth and a powerful parrot-like beak.

It is not difficult to imagine that life in the Mesozoic was by no means dull or monotonous for its inhabitants. Life must have been a continual challenge and the battle for existence is well exemplified in the extreme development of these reptiles for waging war, or else becoming lumbering impregnable fortresses against which attack must have been practically useless.



Brontosaurus, one of the largest animals that ever walked, lived for the most part in swampy areas where it would be out of harm's way and the weight on its legs lessened.
After F. A. Lucas.

group, but it must be remembered they relied solely on their means of defence and had few means of offence. The "Roofed Lizard", *Stegosaurus,* is one of these weird reptiles and his means of offence was a long tail terminating in four long razor-like spines. By lashing out with this rather effective weapon he could inflict severe injuries on any opponent injudicious or rash enough to attack such a reptilian "tank".

Triceratops, meaning "three horns on the face", lived during the Cretaceous period, and after many of the other dinosaurs had become extinct. His armour was most effective and no doubt he was left in peace to feed on shrubs and roots which formed his diet. This

In the Cretaceous rocks of Queensland the fossil remains of many of these reptiles have been found, particularly the marine Ichthyosaurs and Plesiosaurs which grew to lengths of thirty and forty feet. From the Jurassic beds of Durham Downs in Queensland a giant dinosaur was collected and later named *Rhoetosaurus brownei* by Mr. H. A. Longman of the Queensland Museum.

However, it is not with these marine or terrestrial reptiles that this article is really concerned. The rise and fall of these creatures, like that of an ancient civilization, is a story which has filled many volumes. It is the flying-reptiles, "The Dragons of the Air", in which we are interested. These pterodactyls, more

The invulnerable Triceratops showing the strong protective neck plate and the horned guards for its eyes. After F. A. Lucas.

recently known as the *Pterosauria*, ranged in size from that of a small bird to large Cretaceous species with a wing-spread of twenty feet and a wing area equal to that of a small 'plane.

The flying-reptiles did not appear in the Mesozoic skies until the early part of the Jurassic, and, gradually increasing in size, remained until the close of the Cretaceous when they died out with the land and sea reptiles.

Flying in association with them was *Archaeopteryx*, the forerunner of our present-day birds, small in size, and in comparison with the pterodactyls their flight must have been only at the fluttering stage. Whereas *Archaeopteryx* was clothed in feathers, the pterodactyls, it is thought, were covered with small scales or perhaps a covering of fluffy hair.

The first fossil remains of a pterodactyl were collected from the white lithographic limestone quarries of Solenhofen, in southern Germany, and soon became known through the writings of Collini in the latter part of the eighteenth century.

The foremost naturalist of those days, the citizen Cuvier, found time, even in those troublesome days of the French Republic, to interpret the animal as a saurian, a term used then to include lizards and crocodiles. He named it Pterodactyl as it was distinguished by the extreme elongation of the fourth finger of the hand. This was the support for a thin membrane which was attached at the other end to the body and used as a wing.

An American scientist, Goldfuss, after an examination of an exceptionally fine fossil skeleton, saw in this flying-reptile an example of the process of evolution and stated it was a form changing to a bird-like or mammalian type. Supporters of this theory, therefore, placed the flying-reptiles in a group between the reptiles and the birds.

The great banker-naturalist of Germany, Hermann von Meyer, after a critical review of everything known about these animals, regarded them as true reptiles with the power of flight. This interpretation was followed by famous palaeontologists from all parts of the world, and present-day research has shown no reason why Meyer's theory should not be still accepted. In fact, it is now generally recognized that the pterodactyls, although exhibiting characters in common with the birds, cannot be regarded as the ancestors of them. They are even more widely separated from them than other reptilian groups.

The flying-reptiles are very easily divided into two large sub-orders accord-

The great Pterodactyl, Ornithostoma, sailing after the manner of a present-day albatross.

After F. A. Lucas.

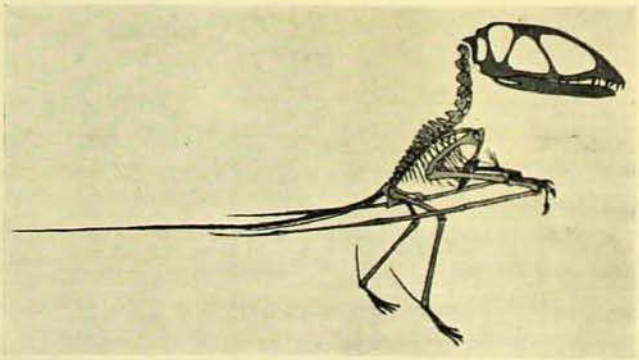
ing to the age of the rocks in which they are found and by definite skeletal characters. All the early Jurassic forms are grouped in the sub-order Pterodermata and these more generalized types have elongated tails and sharp spine-like teeth in the jaws. Representatives of this group are the well-known genera *Dimorphodon* and *Rhamphorhynchus*.

In the second sub-order, the Ornithocheiroidea, we find all the Cretaceous species and these are characterized by possessing short tails and by the teeth being either absent or very much reduced. It is in this group that *Pteranodon* and *Ornithostoma* are found. Representatives of these genera grew to a large size and like other members of the group had developed the art of flying to such an extent that they could have easily outdistanced, and had greater endurance than, the Wandering Albatross, one of Nature's greatest fliers of today.

The weight of *Ornithostoma* has been estimated at only 25 pounds, the body weighing just sufficient to counterbalance the weight of the large head and neck and ensure equilibrium. The wings had an overall length of twenty feet and were spread by means of the fore-feet to which they were attached. The legs were weakly developed and obviously the pterodactyl was more at home on the wing than on the ground, where it would have to assume a grotesque sitting posture or else stagger along on its hind-legs with the assistance of the wings.

The beak was nearly four feet in length and extended back on top of the head to form a large but thin protecting helmet or crest. It was dagger-like, narrow and pointed, and in this particular genus quite toothless. It is thought that in all probability *Ornithostoma* was a fish-eater, and if this was the case a pouch was possibly developed similar to that found in a Pelican.

The whole skeletal construction of the pterodactyls was obviously designed to give them a strong and swift flight, attained, however, by sailing or soaring rather than by rapid movements of the wings. The larger bones are pneumatic, that is, air-filled, and from a study of the breast-bone it can be confidently



A skeleton of Dimorphodon, one of the long-tailed flying-reptiles showing the extreme development of the fourth finger of the hand.

After F. A. Lucas.

inferred that the flight was similar to that of a Wandering Albatross, using the wind to every advantage in their progression through the air. Birds with a flight like the albatross have the breast-bone very much reduced, whereas in birds which fly by a rapid beating of the wings it becomes deeply keeled for the attachment of strong muscles.

An albatross has been known to travel a distance of 3,150 miles in 12 days. When one realizes that the bird would have taken its time over this distance, feeding and at times flying off a straight course, the speed and endurance are remarkable. Taking into consideration that the pterodactyls had almost double the wing-area of an albatross and were designed almost solely for flying, their capabilities in this respect must have been enormous. They could have easily out-distanced and outstayed any animal of the air, either in the past or present.

At the close of the Mesozoic era the reptilian groups became extinct. Some orders lingered on and, although at the present day there are no living animals which can be compared with them, the crocodiles and alligators are their nearest relatives.

One might ask why such highly specialized reptiles as the dinosaurs, the pterodactyls and other groups should completely disappear. Many were strong and powerful and the great flight of the pterodactyls surely should have been sufficient to assist them in reaching a sanctuary from unsuitable conditions. It is a difficult question to answer, but usually it is considered when an animal group attains great size and bulk it becomes less adaptive and is doomed to extinction.

We must also remember that the dinosaurs possessed very small and lowly organized brains in comparison with their size, and their mental capabilities therefore would not tend to assist them over even minor obstacles placed in their way.

Whether their extinction was due to a change in climatic conditions causing a diminution or total loss of their staple diet, or to great changes in continental and ocean areas it is difficult to state with certainty. Perhaps a combination of both, together with a temporary poisoning of the air by volcanic eruptions, would explain their hurried exit from the pages of geological history.

They served their part as a strange and almost fantastic offshoot in the process of evolution which in another 200 million years led to the rise of man and our civilization of today.

Popular Science Lectures

FOR many years past the Popular Science Lectures delivered at the Australian Museum have been an important and attractive feature of its activities.

These lectures, which are illustrated by films, lantern slides and specimens, are held on Thursday evenings at 8 p.m. on the undermentioned dates, and there is no charge for admission:

September 11: "A Museum Man in America", E. Le G. Troughton, C.M.Z.S., F.R.Z.S.

September 25: "Biology in War", Professor E. Ashby, D.Sc., A.R.C.S., D.I.C.

October 9: "The Romance of Gold Mining in New South Wales", T. Hodge-Smith.

October 23: "Wandering Through China", E. A. Briggs, D.Sc.

November 13: "Life Histories of Some Australian Butterflies", G. A. Waterhouse, D.Sc., B.E., F.R.E.S.

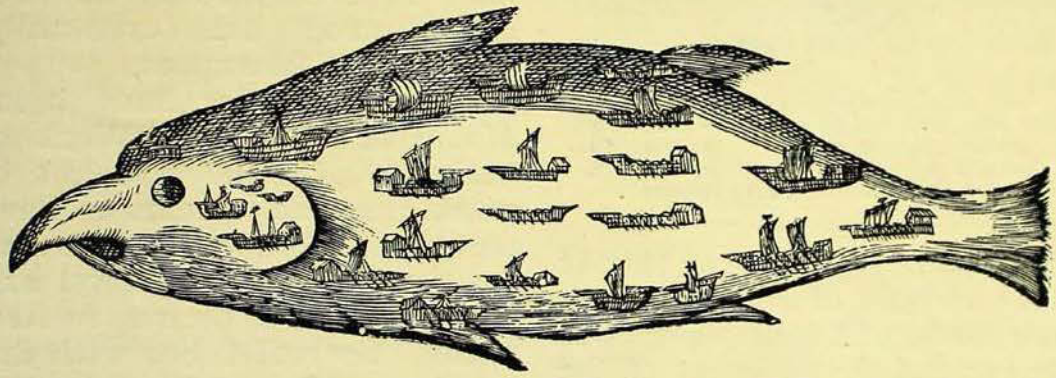
"Photographic" Fishes

By GILBERT P. WHITLEY

A sudden crop of superstitious stories buzzed about the islands. Rivers had come down red; unknown fishes had been taken on the reef and found to be marked with menacing runes; a headless lizard crawled among chiefs in council. . . .
R. L. STEVENSON, *Footnote to History.*

THE early Roman soothsayers pretended to foretell events from a study of the heavens, of the habits of animals, of the flight of birds, or even of an inspection of their internal organs. Another ancient method of augury was Ichthyomancy, the examination of the entrails of fish, in which the diviners thought they could see signs and portents. Thence arose the "doctrine of signatures" according to which all flowers and animals had distinctive markings indicating their medical uses or illustrating the legends of their origins: for example, the spots or heart-shaped marks in a foxglove showed that it was a good cure for ulcerated throat or for heart disease, whilst the pig was said to have three prong-marks on its foreleg from the devil's pitchfork. Throughout the ages, men have been attracted by any curious marks on animals: unusual markings on a herring were presumed to herald the death of a king of Denmark, another herring had a prophecy written on its sides, whilst every herring is supposed to have a picture of a fishing-boat outlined by the bony margins of its cheeks and gill-covers. Curious markings like fleets of ships on the flanks of a tunny were figured by Aldrovandi in the seventeenth century.

In an hotel at Medlow Bath, on the Blue Mountains, there is exhibited a piece of rabbit skin on the inner surface of which is a dark mark similar in shape to another rabbit. This was present before the rabbit was skinned and has been miscalled "skin photography" in the belief that the rabbit in some way photographed another of its kind on its skin. This example was illustrated in the *Evening News*, Sydney, July 8, 1907, but several like cases have since appeared and have been illustrated in the *Evening News* of July 28, 1917, and the *Sun* for June 11, 1932. Our mammalogist, Mr. Ellis Troughton, informs me that specimens in the Museum collection show that the rabbit-like device occurs in the black rabbit as well as in normally coloured examples and that the uniformity of the design disproves the popular idea that the marking is the out-



A seventeenth-century illustration of a Tunny with figures resembling a fleet of ships on its skin.
After U. Aldrovandi.

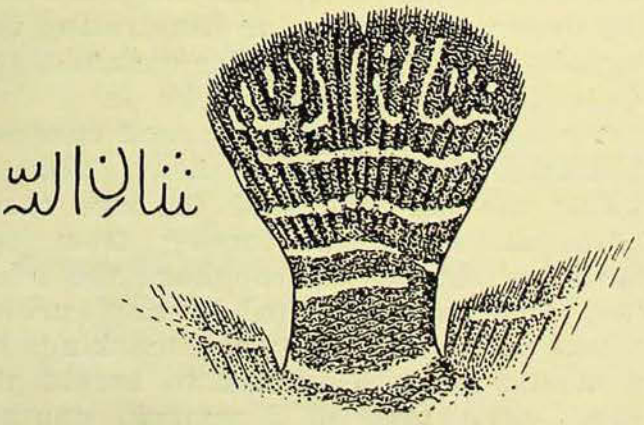
The veins on the swim-bladder of the Murray Cod are remarkably tree-like in form and make a "picture" which is popularly, though wrongly, regarded as a "photograph of the fish's birth-place".

come of the effects of lightning or that it is inherited as a result of abnormal conditions before birth, and indicate that it is merely an unusual development of the vascular system within the skin.

Bushmen in Australia explain the tree-like markings on the swim-bladder of the Murray Cod (*Maccullochella macquariensis*) by swearing that the fish takes a photograph of its birthplace and surroundings on the river bank. Such "photographs" showing trees, river and logs can be mounted on a card and varnished for souvenirs. The legend may be an attractive one, but it is only a legend, as the most elementary knowledge of photography and of the development of a hatched fish would prove. The markings are merely the branching blood vessels on the fish's swim-bladder, an internal gas-bag which is used for balancing it in the water. This bit of bush lore does not appear to have been noticed in natural history literature. Many years ago, *Smith's Weekly* published a paragraph on "Photographic Phish" and Harris, in his *Outback in Australia,* 1919, has a picture of a Murray Cod's markings. Thanks to Mr. J. Clarke, of Bondi Junction, who has lent me a specimen, I am able to give a photograph of another of these curiosities here.

Some years ago a Coral Fish (*Holacanthus semicirculatus*) was caught at Zanzibar and attracted little notice, being sold for about a penny. Then somebody observed that the white curved lines on its tail resembled old Arabic script, nay, actually spelt sacred words; on one side "Laillaha Illalah"—"There is no God but Allah", and on the other, "Shani Allah"—"A warning sent from Allah". These solemn symbols immediately enhanced the value of the specimen, so much so, in fact, that no poor fisherman could afford it, for the enscriptured fish eventually changed hands at 5,000 rupees.

Other examples have been found at Mombasa with the "Work of God" or "Miracle of God" wrought by the tail-markings, and specimens have been preserved in Mosques in Cairo and Medina for the Faithful to marvel at. The same species of fish occurs in tropical Australia. Several fishes with dark blotches on their sides, such as the John Dory, Queenfish, and Moses Perch, are reputed to have inherited them from the finger-prints of St. Peter, when he caught a fish at Capernaum to yield tribute money.



Tail of a Zanzibar Coral Fish (Holacanthus semicirculatus) with markings resembling Arabic holy writ.
After J. R. Norman.

Monograms have been artificially produced on goldfish. Investigators at a Connecticut university found that scales could be transferred from one region of a goldfish to another and continue to retain their original colours. Care is necessary in doing this: the fish is first anaesthetized and the transfer of scales performed quickly with forceps. Red scales transplanted to white areas give the best results. Goodrich and Mercer (*The Aquarium*, ii, 12, 1934, p. 290) remark: "When it was first discovered that scales could be exchanged in this manner, flights of imagination suggested many possibilities. A friend desired a fish with initials to use as a gift. This was prepared for him, and it was shipped away bearing the initials of the recipient, and it lived for four months, finally dying from unknown causes. This is the only fish so far treated in such elaborate manner and is the one which gave rise to all the newspaper stories, cartoons and radio items."

In the *Evening News*, Sydney, for May 25, 1918, the following paragraph appeared:

"A finny curiosity was caught by A. W. Letts near Bradley's Head, Sydney Harbour, last Sunday. It was a small sweep, on one of whose sides was the dark imprint of the shape of a fish like a bream. It was as if the skin of the sweep had become chemically sensitized, and had somehow photographed another fish. The outline of the imprint was darker than the ordinary dull black of the side and extended on each side of the lateral line."

The curiosity was not preserved, but the markings on the side of the Sweep (*Scorpis lineolatus*) were possibly due to its contact with other surfaces after death. Many fishes become marked with irregular light and dark areas when lying with others in the bottom of a boat or basket, but this is not associated with "photographic" action.

THE Museum has recently acquired some interesting fishes which have been placed on view in the public galleries. Two Sea Garfish (*Reporhamphus australis*) with rubber rings around their middles were presented by Mr. T. C. Roughley. Altogether fourteen "gartered garfish" had been caught last June near Tuggerah Lakes, New South Wales, in this remarkable banded condition and many persons wondered who had put the rings on them. Actually, the fishes, when poking about for food with their long beak-like jaws amongst the rubbish tipped overboard at sea, enter the rings and cannot get them off again. The body becomes encircled and wounded, but may heal around the unwelcome object. A detailed account of this phenomenon was given in THE AUSTRALIAN MUSEUM MAGAZINE, Vol. V, No. 10, 1935. Since that article appeared other examples of Sea Garfishes in like plight have been caught at Kiama, New South Wales, in January, 1937. Some ringed fishes have been found in the River Danube, and a codfish was caught in America which had thrust its head into a syrup can—the "fish in the iron mask".

Several reports of Oar Fishes having been washed up on various beaches in New South Wales recently have come as a surprise, since this huge deep-sea fish, which may exceed twenty feet in length, is usually regarded as exceptionally rare. This Museum has unfortunately not been able to secure any of the latest specimens, but an old one is on view in the fish gallery. A supposed "young Oar Fish" recently sent to us from northern New South Wales proved to be a rather scarce blenny (*Xiphasia*).

The Australian Museum is always glad to receive specimens of unusual fishes and printed "Hints for Collectors" are supplied on request.

G. P. WHITLEY.

Australian Insects. XIV

Perlaria, the Stone-flies, and Embiaria, the Web-spinners

By KEITH C. McKEOWN

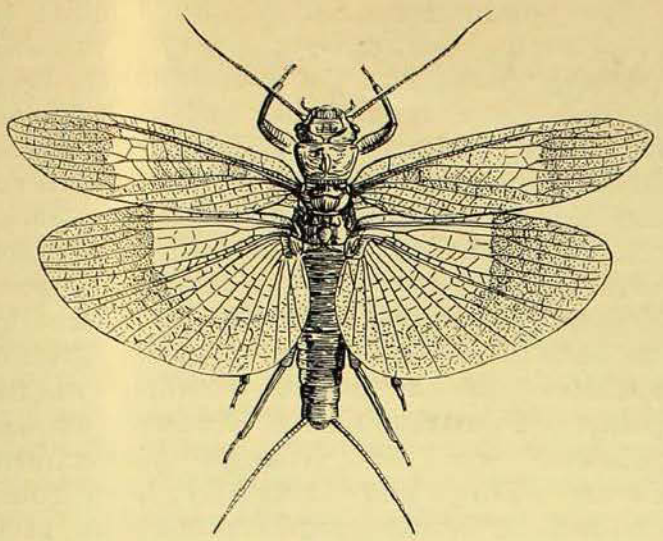
PERLARIA—THE STONE-FLIES.

THE Stone-flies, which form the order Perlaria (or Plectoptera), are generally considered to have affinities with the Orthoptera. They are mostly dull-coloured insects, furnished with two unequal pairs of wings with a close network of veins; the fore pair are narrow, the hind broad and fan-like. The antennae are slender and many-jointed, and the abdomen usually terminates in a pair of feeler-like jointed cerci. In the adult insects the mouth-parts are greatly reduced, or may be evident as mere vestiges, so that it is very unlikely that the winged insects take food in any form.

The early life of the Stone-flies is aquatic. The nymphs live beneath stones in rocky-bedded streams, especially where the water is clear and swiftly flowing. The typical nymph is broad and flattened, and bears slender cerci upon the extremity of the abdomen, and these appendages are often of considerable length. The legs are long, stout, and well suited for strong swimming, but, as a rule, the insects seem to prefer crawling over, or clinging to, the rocks; when disturbed they slip away and seek situations shaded from direct light. Along the sides of the abdomen are a series of gill tufts, by means of which the oxygen necessary for the insect's life is obtained from the water which bathes its body; these gill-tufts are remarkable, for they frequently persist as shrivelled and useless remnants in the adult insect. The food of the Stone-fly nymph appears to consist of small aquatic life, and the remains of the larvae of Harlequin Midges (Chironomidae) have been found in the alimentary canal of specimens in England. The length of life of the nymph is not known, but when fully fed it crawls on to a rock or tree-trunk, where it anchors itself securely to irregularities by its strong claws; in a little while the skin splits, and the perfect insect emerges.

The adult Stone-fly is a poor, clumsy flyer, driving itself through the air with a great expenditure of energy but indifferent result. They seldom travel far from the water in which their early life was spent. By day they rest upon the bark of trees growing close to the water's edge, with the wings folded down flat over the back, and when resting in this manner their coloration makes them very hard to detect. With the coming of dusk they take wing and fly up and down the centre of the stream close to the surface of the water, and usually well out of the reach of even a long-handled net. On the Tuross River I have seen *Stenoperla australis* flying about over the river just as the light is fading. The eggs are retained in a small packet at the extremity of the female's abdomen, and are washed off into the stream as she flies, dipping the tip of her abdomen beneath the surface; the eggs sink to the bottom among the stones, where they hatch. The nymph grows slowly, and sheds its skin in a somewhat irregular series of moults. It is unfortunate that so little should be known of the life-histories and habits of such interesting insects.

The family Eusthenidae contains comparatively brightly coloured species, with a red or purple tint at the base of the broad, rounded hind-wings. The genus *Eusthenia* is found only in Tasmania, where *E. spectabilis* is a somewhat common species; *E. lunulata* is a somewhat



Eusthenia spectabilis, the Stone-fly of Tasmania (adult).
N. B. Adams, del.

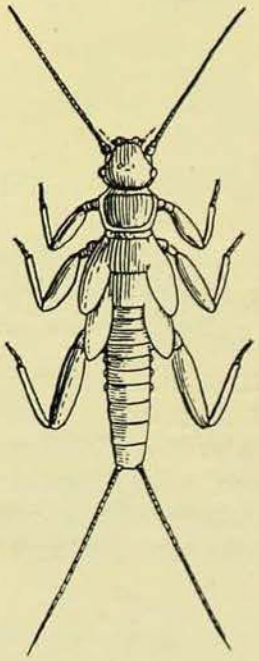
similar insect with the forewings marked with a crescent-moon of white. *Eusthenopsis venosa,* with purplish hind-wings, is found in Victoria and on Mt. Kosciusko; it occurs in two forms, one with very short wings. *Stenoperla australis,* a greenish-brown insect, is not uncommon in mountain streams in eastern Australia. The families Austroperlidae and Leptoperlidae contain small and inconspicuous forms. The Nemouridae are very rare, and the species in the genus *Spaniocerca,* which look rather like winged termites, have the wings with a remarkable reduced venation.

EMBIARIA—THE WEB-SPINNERS.

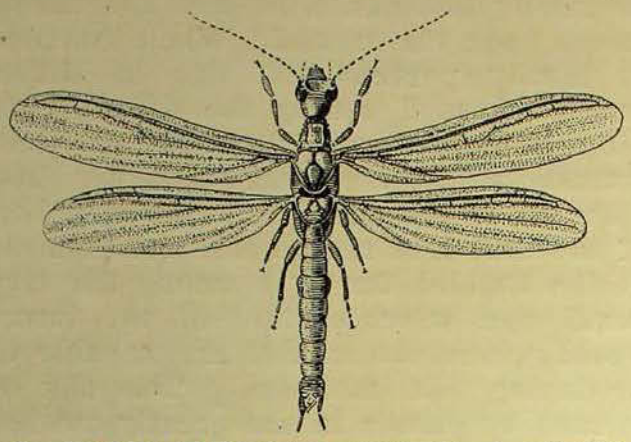
The Embiaria (Embioptera of some authors) or, as they are popularly known, Web-spinners, form a small but quite remarkable order, little known to the average collector. Embiids are small, fragile, and retiring in their habits, and they are seldom seen, unless they are specially looked for. In colour they are sombre brown, with the two pairs of wings smoky—but, as will be seen, they may be quite wingless. The fore and hind wings are very similar, and have a simple venation of but few veins.

In habit these little insects may be solitary or gregarious, living in the cracks and crevices of bark, under stones, or among leaf-mould, or dry and fallen leaves upon the ground. Whole colonies or family parties may live in silken tunnels formed among the debris, running backwards and forwards in their retreat with surprising agility. The spinning of the silk for the construction of the nest is a remarkable development in the Embiid, for it is among the very small and select section of the insect world where the adults are capable of producing the material. The silk is formed by glands in the greatly swollen front tarsi or feet. Imms has described this spinning apparatus, and he says: "On the plantar surface of the 1st and 2nd tarsal joints of the fore-legs are a number of hollow bristles which communicate each by means of a fine duct, with a small glandular chamber. . . . In *Embia texana* Melander estimates that about 75-80 chambers are present in the whole joint. Since a fine thread is emitted from each bristle a number are available simultaneously, which accounts for the rapidity with which these insects weave their tunnels." Newly hatched insects are capable of weaving fine silken tunnels for themselves.

The colonies consist, as a rule, of a number of adult males and females together with young in various stages of



Nymph of Eusthenia spectabilis.
N. B. Adams, del.



An Embiid (Oligotoma gurneyi)—a winged male.

N. B. Adams, del.

development. Wings are usually present in the males—but both sexes may be wingless, or even the males of one species may be of both forms, winged or wingless. Growth is attained by a series of moults, but metamorphosis is wanting in the females, and occurs only to a slight degree in the males. I have been quite unable to find any record of the discovery of the eggs of these strange little insects, and the details of their lives are but little known.

The commonest Australian Embiid is *Oligotoma gurneyi*—a very variable species, which has, in consequence, been divided into a number of subspecies. The typical form is widely distributed throughout New South Wales, Victoria and Tasmania; while another, *centralis*, extends into Central Australia. Another form, *agilis* (now classed as a subspecies of *gurneyi*), was originally discovered by the late W. W. Froggatt under granite boulders on the most westerly of the group of rocky hills known as the "Sisters" on the Wagga Experiment Farm. They have recently been rediscovered in some numbers on the same hill, forming their tunnels in the fallen foliage of the Cypress-pines (*Callitris*). Its habitat seems to be very restricted, for I have no knowledge of its having been taken on the adjoining south-eastern hill, which is more thickly clothed with *Callitris*.

A valuable field for study awaits the worker who will devote time to elucidating the lives and habits of these strange little creatures.

Natural History Films

ONCE a month a short film on some Natural History subject will be shown in the Museum Lecture Hall at 2.30 p.m.

The screening will occupy from twenty minutes to half an hour, and there will be a short talk about each film by an officer of the Museum. An opportunity will be given for members of the audience to ask questions at the conclusion of each film.

This series was inaugurated a few months ago and has proved most popular. The remaining items on the 1941 programme are:

September 19: "Life on a Tidal Flat."
October 16: "The Platypus."

Additional films may be added to the above.

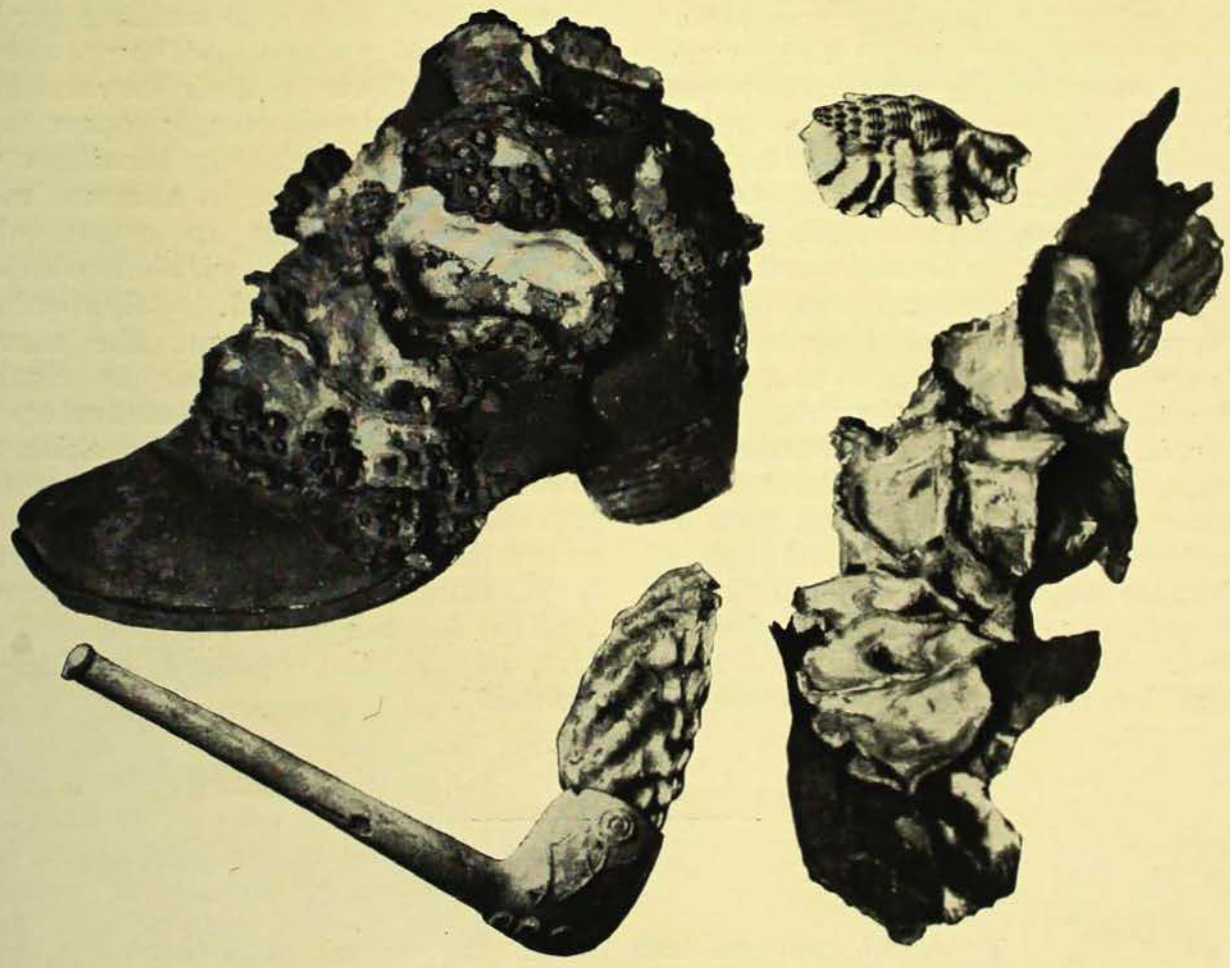
Admission free.

Any Port in a Storm

By JOYCE ALLAN

A MILLION or so microscopic oyster larvae are set free in the sea by an individual oyster in a season. Imagine these tiny creatures, at the mercy of tidal currents and faced with innumerable dangers, condemned to find a suitable place of attachment within a few days, otherwise they will perish. Is it to be wondered that any object offering security becomes to them a port in a storm? The young oyster is the last to worry if its home for life is an old submerged boot, a clay pipe, another shell, or even a trap especially provided by an oyster cultivator.

Whether oyster larvae emerge after an incubation period within the parent, as happens with the Australian mud oyster, or after fertilization has taken place in the open sea—a habit of the rock oysters—the larvae of all kinds exhibit the same behaviour. They embark on their larval swimming stage when a few days old, equipped with a swimming organ, the "velum", and during the week or so in which they are carried about by currents it is impossible to predict where they will be when ready to settle. Quite possibly many are carried far from shore, or left stranded by receding tides.



An old submerged boot from Sydney Harbour, a clay pipe and a small mud whelk, are only a few of the strange objects which may become permanent homes for oysters. Having settled on these as "spat", the young oysters must remain there for life, making the best of whatever conditions exist. These specimens, as well as the oyster-covered piece of wood, are displayed in the Museum.

Though they can ascend or descend to some extent by swimming or ceasing to swim, they cannot choose their course, but are entirely dependent on the currents to carry them to a secure base within a limited time.

From the beginning of their independent career the larvae participate in a constant battle against enemy attacks and adverse biological conditions, and only a few of the millions produced survive this early stage. Even provided a suitable settling place presents itself, additional adversities may further reduce their numbers. Barnacles, sea-squirts, fish, crabs, sea-stars, boring molluscs, changing temperatures, heavy rains and freshets all work towards their destruction. The enormous production of young allows for the great mortality in the larval stage alone.

When ready to settle, the young oyster, known as "spat", is about three weeks old, and measures approximately one seventy-fifth of an inch (about twice the size of the larva when first set free). Its habits are very simple. Once cemented to a base, it must remain there for life and make the best of whatever conditions exist. The only movement it can perform is the opening and closing of its shell, and by this restricted movement it must carry on the vital functions of feeding, respiring, breeding, growing and warding off enemies. There being no further use for the swimming organ or the foot used for first attachment, these two, though of considerable importance during its larval stage, rapidly degenerate and become absorbed. Contact with the water is essential for the oyster's existence. It breathes the oxygen, and feeds on food, brought by the water into its shell. An outgoing stream of water carries away waste products from the intestines and kidneys. This is the same in most bivalves. The well-known "beard" or gills of the oyster is responsible for this constant flow of water into the shell and over the animal. The gills act as a food sieve, sorting that to be retained or discarded; as a food transporter, sending it on its way towards the oyster's mouth; and as a suction pump. Though the oyster has no choice of what is swept into its shell, yet planktonic organisms (diatoms, microscopic animals, bacteria, and fragments of plants), upon which it is dependent for food, can be extracted from the water by gill action once inside the shell.

As the majority of marketable oysters are artificially cultivated, oyster farmers have utilized the spat-settling period to their own advantage. Although they cannot protect them in their larval stage, by providing spat-collecting properties, such as stones and sticks, in localities where spat are liable to be in summer months, they can give them an opportunity to settle on a surface, without which they may have perished. Spat-collecting objects are placed near the mouth of rivers, where the water is clear and salinity fairly high, but maturing of the oysters is carried out in brackish water. Having secured the spat, the cultivator can then assist the growing oyster to evade its many enemies, "even if", as Mr. T. C. Roughley says, "only to provide a festival for the most cunning and relentless of all the oyster's enemies—man himself".

To enable our readers to see the actual objects which are described in this issue of THE AUSTRALIAN MUSEUM MAGAZINE, a special exhibit featuring them has been arranged. This has been placed on view at the main entrance to the Museum galleries.

The Home of the Diamond

By T. HODGE-SMITH

IN a recent article in this MAGAZINE[1] I dealt with the way in which man transforms the rough stone into the most beautiful of all gemstones, but I did not give any idea of where the diamond is found.

INDIA.

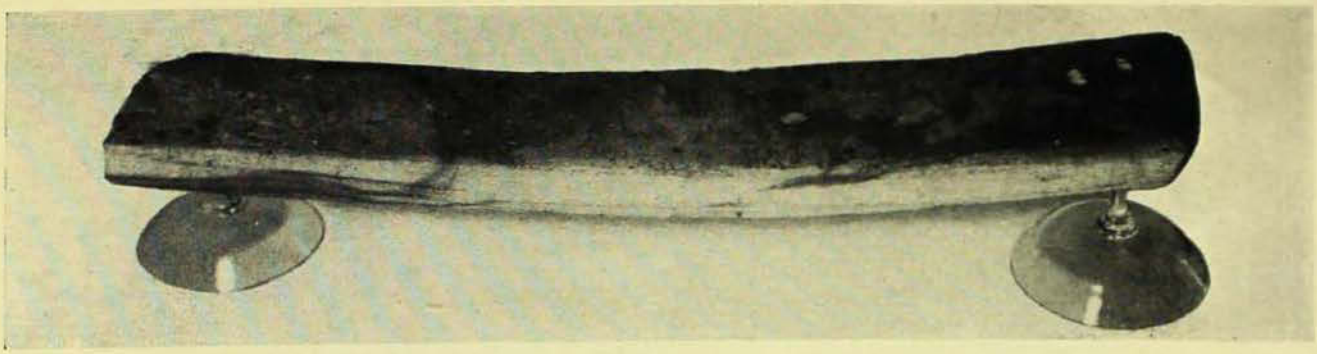
For many centuries India was the only country which produced diamonds, and their exportation was not permitted until the tenth century. They were not exported in any great quantity until a century later when the invasion and plunder of India began. It is easily understood how the Indian princes achieved such wonderful collections of precious stones for which they are famous even today.

In India the diamond is confined to the eastern half of the great Deccan Plateau, where it is found in the sandstones and conglomerates that cover this enormous area and in the river gravels derived from the weathering of these rocks. So it is that at Sambalpur, an island about four miles long in the river Mahanadi, thousands of natives, mostly women, may be seen digging the stiff clay of the river bed for the precious stone during the dry season.

BRAZIL.

With the discovery of diamonds in Brazil in 1725 in the state of Minas Geraes the export of diamonds from India was very greatly reduced. This state has been the principal producer in Brazil, Bahia being the only other state producing commercial quantities.

There are three distinct modes of occurrences in Brazil. On the high plateaus the diamond occurs in a very ancient rock of most peculiar structure. This consists mainly of interlocking quartz grains, and will split into thin slabs which will bend without breaking, for which reason it is often spoken of as flexible sandstone. It is best developed in the Sierra Itacolumi and petrologists call it itacolumite.



Itacolumite slab supported on two glass pillars to show how it will bend. This specimen is in the mineral gallery of the Museum.

The diamond is found also in river gravels on the sides of the valleys, high above the flood-water level. However, the beds of the rivers of these valleys are by far the richest producers. To work these beds it is first necessary to divert the course of the river; consequently they can be worked only in the dry season from May to September.

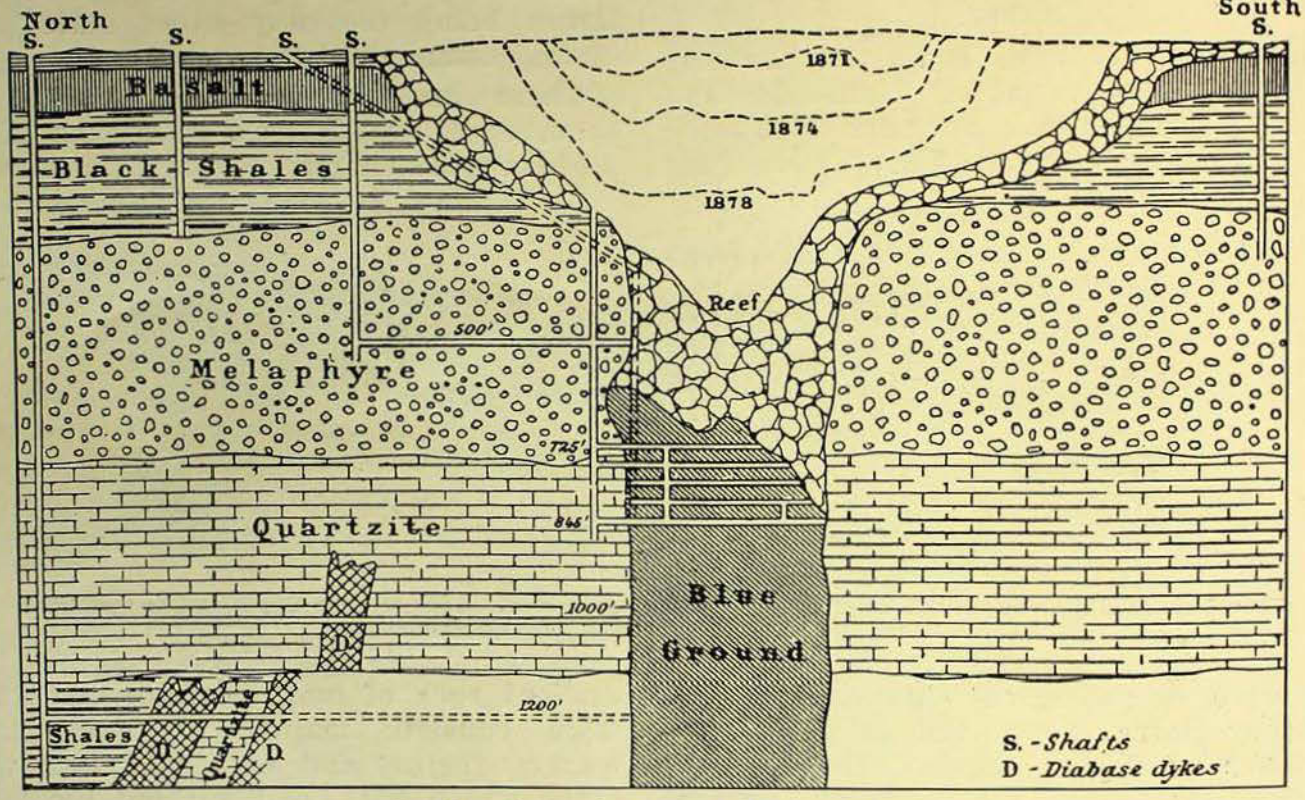
SOUTH AFRICA.

Just as Brazil superseded India in 1725, so South Africa, where diamonds were first discovered in 1867, has sur-

[1] Hodge-Smith.—The Story of the Diamond. AUSTRALIAN MUSEUM MAGAZINE, vii, 1941, pp. 286-288.

passed both these countries to the extent that probably more than nine-tenths of the diamonds marketed today come from there.

The actual discovery is of interest in that the first stone was actually picked up by the children of a Boer farmer whose property was on the banks of the Orange River near Hopetown. Their mother refused to accept any money for it and gave it away. After having been found in a volcanic pipe; that is, the pipe through which the material ejected from the volcano passed from the depths below. Generally when we speak of a volcano we imagine a fiery peak with lava pouring forth and overwhelming the surrounding country. Such is not always the case. A volcanic cone was built up at Rabaul a few years ago, but there was no lava. Only immense quantities of volcanic ash, which is really fragmental



Section through the Kimberley Mine.
After M. Bauer and L. J. Spencer.

lost, recovered, then thrown away to be regained later, it was eventually sold for £500 to Sir Philip Wodehouse, Governer at the Cape. Although it was a really fine stone weighing more than 21 carats, it did not seem to attract much attention. However, with the finding of the "Star of South Africa" in 1869 and its subsequent sale for £11,200, diamond prospecting began in earnest and rich finds were made in the alluvial deposits along the Vaal River.

A few years later came the discovery of the Kimberley mines and with it an entirely new mode of occurrence of the diamond. Here the precious stone was rock material, were ejected from the pipe.

The ancient volcanoes of the Kimberley were of this type, and although they have long since been denuded away, the pipe-like orifice through which the material was ejected remains. Even this has been subjected to weathering, and for a depth of from fifty to sixty feet the bluish hard rock of the pipe has been converted into a soft yellow rock. The miner describes them simply as the yellow ground and the blue ground. There is ample evidence to show that the blue ground has been subjected to enormous pressure. Beside the diamond these pipes produce a semi-precious stone marketed as the "Cape

Ruby". This is not a ruby but a garnet, a typical high-pressure mineral. Sometimes the diamonds contain inclusions of liquid carbonic acid.

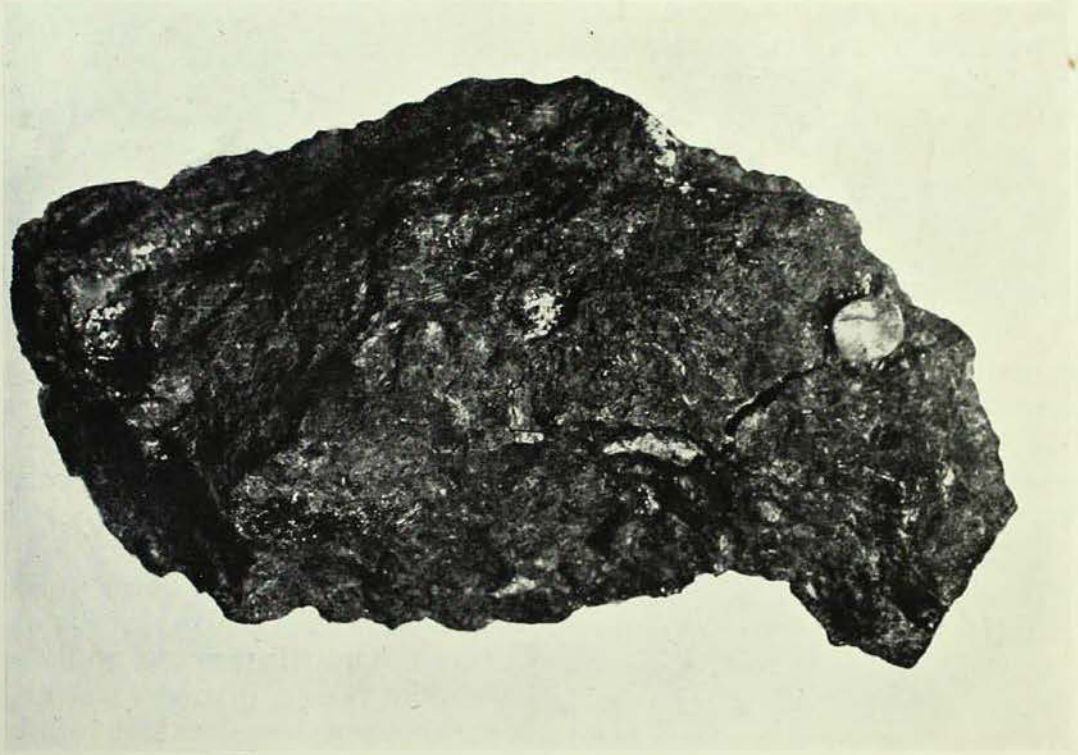
BORNEO.

In Borneo the diamonds are confined to the western and south-eastern parts of the island. They occur associated with sandstones and coarse gravel. The best indication of the diamond is the presence of sapphire. It is said that natives will not trouble to search for the diamond unless this mineral is present.

diamonds won in New South Wales, which means Australia, to the end of 1938 is £147,949, but the actual amount is much greater.

EXTRA-TERRESTRIAL.

No account of the home of the diamond would be complete without reference to the fact that meteorites, those mysterious visitors from the skies, sometimes contain diamonds. They have been recorded from the Cañon Diablo (U.S.A.) iron, Carcote (Chile) stone and the Novo-Urei (U.S.S.R.) stone. They are all small and



The white pebble near the edge of the stone is a diamond and the rock is the "blue ground" of the Kimberley Mines, South Africa. Exhibited in the mineral gallery of the Museum.

AUSTRALIA.

Diamonds were first found in Australia in 1851, some sixteen years before they were known to exist in South Africa. The site of this discovery is on the Turon River near Bathurst, New South Wales. Other finds in this state were made at Mudgee, Bingara, and Tingha, but the latest find at Copeton in the Inverell district proved the most profitable, though mining is sporadic and not of any great volume. The total recorded value of

not of gem quality, varying from black to grey.

DIAMONDS COMPARED.

India has produced the greatest number of famous diamonds[2] including the Koh-i-nor, now part of the crown jewels, and the ill-famed "Hope" which is the largest coloured stone, weighing 44⅛ carats. It is a greenish-blue and not the

[2] Anderson.—Some Famous Diamonds and their Story. THE AUSTRALIAN MUSEUM MAGAZINE, i, 1921, pp. 75-78.

royal blue of the glass models one sees in museums. The largest Indian stone is the "Great Mogul". Its original weight was 787½ carats, but it was badly flawed, and the present rose cut bearing the name is only 240 carats.

While the Brazilian mines were very productive the stones were seldom more than a carat in weight, but their quality is good. The largest stone, "Star of the South", weighed 254½ carats.

South Africa has produced the largest of all diamonds, known as the "Cullinan", which originally weighed 3,025¾ carats. It showed one large cleavage face which, together with its shape, indicated that it was only portion of an immense stone more than twice its weight. This beautiful colourless stone with only one little flaw near its surface was found in 1905 in the Premier Mine which has produced at least seven stones of more than 300 carats weight. Generally speaking the South African diamonds are slightly yellowish.

The Borneo stones are well crystallized and generally of pure water colour, though yellow stones are not uncommon. They are usually small, though the largest stone weighed 77 carats.

The Australian stones are quite small and generally colourless. They are the hardest of all diamonds and consequently are costly to cut. The largest stone is 6½ carats from Copeton. A stone weighing 28 carats was supposed to have been found at Mount Werong near Oberon, New South Wales, but it almost certainly came from South Africa.

THE ORIGIN OF DIAMOND.

The occurrence of the diamond is almost universally confined to the alluvial gravels and sedimentary rocks. As both types of deposits are derived from the disintegration of other rocks the original home of the diamond is not known. The curious flexible sandstone of Brazil is also known not to be the parent rock of its contained diamonds.

In South Africa the brecciated peridotite of the Kimberley pipes may possibly be the parent rock in so far as the fragmental material of the pipe was subjected to enormous pressures causing the formation of new minerals and the crystallization of carbon to form diamond. Even here the origin of the carbon and the mechanism of its crystallization still remain matters of conjecture.

The Cullinan diamond before cutting. A model of this famous stone is exhibited in the mineral gallery of the Museum.

In New South Wales several attempts have been made to trace the alluvial deposits to a pipe similar to those of the Kimberley. At Copeton underlying the diamond-bearing alluvial wash dirt is an altered basic intrusive rock supposed to resemble the yellow ground at Kimberley. Two stones were exhibited by the late Professor Sir Edgeworth David at the tenth International Geological Congress held at Mexico in 1906 as being the first diamonds to be found in a primary rock. However, no other stones have been found in this rock and without further confirmation the story must be treated with caution. Having been shown the site by the finder and having examined the specimens, I still find myself among the cautious.

The origin of the diamond is still a mystery, and all that we can be sure of is that it can only be formed under conditions of great pressure.

Butterflies and Ants

By G. A. WATERHOUSE, D.Sc., B.E., F.R.E.S.

IN an earlier number of this MAGAZINE[1] I gave a short account of the association of butterfly caterpillars with ants. I noted that I was able to rear some caterpillars to butterflies by placing them on slices of apple on which the caterpillars fed. Mr. J. Macqueen, of Milmerran, Queensland, has recently sent me some interesting notes regarding the caterpillars of a closely allied butterfly (*Pseudodipsas myrmecophila illidgei*) which he has had under observation.

He found the larvae (caterpillars) in the nest of the ant *Iridomyrmex nitidus*, in a fallen log. He brought home a number of the ants with their larvae and pupae and established a colony of them. When the ants had settled down, he put the butterfly larvae with them. After a day or two they had all left the pile of chips and debris and taken up residence with the ant larvae and pupae under a piece of cardboard on a slightly moist board. They were always mixed up with the ant larvae and pupae and at first he was inclined to think that the butterfly larvae fed on the ant larvae and pupae, but never saw this happen. The butterfly larvae came out regularly to feed on slices of apple which he had provided. In feeding on the apple they stayed with their heads buried in it, and seemed to suck the juice rather than eat the apple. He thought it possible that they were fed by the ants and found in the apple juice a substitute for the honeydew supplied by them. He could not understand why they should come so readily to feed on the apple if they had previously been fed by the ants. He has thus confirmed my previous observations on feeding these larvae on apple.

For a long time I have been of opinion that in some cases the ants feed the larvae of certain butterflies of the family Lycaenidae, but have never been in the position of having suitable caterpillars near my home to investigate. Proof of this is now to hand, as Mr. C. Cripps[2] has seen this happen in Kenya, Africa. In this case the attendant ants are very much larger than those watched by Mr. Macqueen and myself. The following is quoted from Mr. Cripps:

> Soon after the larva has hatched an ant finds it, and investigates it with its antennae for a few seconds. The ant then seizes the larva in its mandibles, from the side, and gently pulls it free of the leaf. The larva, stiffening and curling slightly, is lifted and turned upon its back; it is now easily and quickly carried down the branch to the base of the shrub. It is there dropped, and then finds its way to a resting place among the ants. . . . On one occasion, an ant was descending the stem with a small larva I had placed at the top of a branch, when, about half-way down, they came to a hole in the bark on the underside of the stem; the ant popped the larva into the hole. Next day, I examined the hole and found the larva still there, and it remains there as I write, attended by ants all the time, who fight with each other over guarding and tickling it. I examined several other branches with holes in them; each hole contained a larva, and ants were at the entrance. The holes are always on the undersides of the stem, protected from the weather, and the larvae were always very small.
>
> I brought up a full-grown larva from under a *Vernonia* on a piece of bark with five or six ants, and placed them all under an inverted tumbler on my table. These were kept under my observation from 2.30 to 6.30 p.m. At six o'clock I was rewarded by seeing an ant approach the larva from in front. It started a gentle tickling process with its antennae over the proximal portion of the larva. After submitting to this for some time the larva suddenly rose up on its abdominal segments, felt the ant with its forelegs, and then rapidly vibrated these against the sides and cheeks of the ant. The latter vibrated its antennae for a second, then spread them wide apart, and kept them still. The larva placed its mouth-parts within the mandibles of the ant, which were now wide open; a small drop of 'honey-dew' was regurgitated, appearing as a minute shining drop at the mouth of the ant. The larva seized this drop of 'honey-dew' in its jaws, and drew gently away, still sitting up over the ant; it appeared to absorb the drop slowly until it had all disappeared. I observed

[1] Waterhouse: THE AUSTRALIAN MUSEUM MAGAZINE, Vol. iv, No. 7, July-September, 1931, pp. 219-221.

[2] Cripps: *Trans. R. Ent. Soc. Lond.*, xc, 1940, pp. 449-453.

this again next afternoon and on several occasions; sometimes nothing was produced by the ant, presumably because it had nothing to give. . . .

This is an important advance, and it is to be hoped that we, in Australia, will be able to observe the same procedure in feeding. In our case, however, the ants are much smaller than the larvae they attend, whilst in the Kenya observations the ants are nearly as large as the full-grown larvae.

In the genus *Ogyris*, of which twelve handsome species are found in Australia, ten have been reared from larvae and pupae, which, with the exception of *O. olane* Hew., are intimately associated with ants. The larvae of these ten species have all been found feeding on *Loranthus* (Mistletoe) and their life-histories are well known. In most cases the eggs are laid on or near the mistletoe so the young larvae have not far to travel for their food. The older larvae hide during the daytime in holes and under pieces of bark near the mistletoe, and with one notable exception rarely descend to the ants' nests on the ground. The larvae, with the exception of *O. olane* and sometimes *O. orcetes*, have ants in attendance, and the ants are also with the pupae which are found in similar situations to the larvae. Many empty pupal shells are often found.

The case of *O. genovera* is somewhat different. The eggs may be laid some distance from the mistletoe. I would suggest that on emergence the young larvae are either taken to their food by the large *Camponotus* ant attending them, or else taken down to their nests at the base of the tree and there fed by the ants until they are large and strong enough to be guided by the ants to their food. I have never found the larvae and pupae of *O. genoveva* anywhere except in the nests of *Camponotus* and usually underground. Also there is no record of empty pupal shells of this butterfly being found in the ants' nests; indeed, Mr. J. Macqueen tells me that as soon as the butterflies have emerged from the pupae the ants tear the empty pupal shells to pieces and so keep their nests clean. There is no need for this with the other species as they are rarely found in the nest of the ants, although ants are in attendance.

With the allied species *O. zosine*, Dr. C. P. Ledward finds many empty pupal shells under bark. Although the larvae and pupae of this species are attended by another *Camponotus* ant, they do not go into their nests.

As most of the species of *Ogyris* fly around the tops of tall trees where they can only be caught with difficulty, searching for pupae under pieces of bark and in cracks in the trees is desirable, and in addition gives better results and better specimens. As a help I have often tied bandages of bark, linoleum or cloth on the branches of trees on which mistletoe is growing and in districts where the butterflies have been seen flying round the tree tops. The bandages are then examined from time to time, and any pupae found taken home to the breeding cages. Several collectors have tried this method for years with very satisfactory results. I have myself found the pupae of eight of the ten species of *Ogyris* whose larvae are known to feed on *Loranthus* in this way.

So far the life-histories of the remaining two species, *Ogyris idmo* and *O. otanes*, have eluded us. They both are found in the southern parts of Australia and seem to frequent the Mallee. The butterflies do not fly as high as the other species. It is doubtful if their larvae feed on mistletoe, as very little, if any, is to be found in the spots where they have been most frequently taken. Both Mr. J. Clark and Mr. F. Angel have seen the butterflies near the nests of a *Camponotus*, but they have been unable to find either larvae or pupae. Mr. Clark has seen females of *O. idmo* walking over the nest of the ants. From all the information I have received I would suggest that when the young larvae emerged from the egg the ants collect them and feed them until they are full-grown. Then they either pupate in the ants' nests or in curled leaves on the ground. It is only someone who is on the spot who can prove the truth or otherwise of this suggestion.

Porphyry, the "Purple Stone" of the Ancients

By R. O. CHALMERS, A.S.T.C.

PORPHYRY is a name applied to a very well-known group of igneous rocks. Porphyries are amongst the most easily distinguished of rocks, because generally they consist of large crystals of felspar, sometimes accompanied by large crystals of quartz, set in a groundmass so fine-grained that the mineral constituents cannot be seen by the naked eye.

As is the case with all igneous rocks, porphyries originated as masses of molten material in the depths of the earth. Rocks such as granites solidified very slowly from these masses of molten material because the rate of cooling was very slow at great depths, so that the minerals had time to form large crystals and the resulting rock presented a uniformly coarse-grained appearance. Porphyries commenced to solidify also at great depths, so that the earliest minerals to form were just as large as in any granite. However, the cooling history was interrupted by some movement from below, or a weakening of the pressure of the overlying crust, and the partly crystallized material was forced to a position nearer the surface where the remaining molten material cooled so much more quickly that the individual mineral constituents were too small to be seen by the naked eye. Sometimes the partly crystallized material actually reached the surface where the cooling was still more rapid. Thus the final product of solidification shows the large individual crystals set in a fine-grained groundmass or, as the petrologist would say, the rock has a porphyritic texture.

As is the case with many of our very common rocks, and minerals also, the name porphyry is of very ancient origin. The name was first applied to a handsome dark crimson rock which occurred in a remote part of the eastern Egyptian desert, but although its striking colour should have made it an object of value as a decorative stone, it was apparently not used at all by the ancient Egyptians. It remained for the Romans to exploit the beauty of this stone to the full, and they quarried it, brought it to the Nile valley, and then transported it to Rome, where the ancient craftsmen vied with each other in carving from it vases, columns (some up to 42 feet long), sarcophagi and statues. The colour must have made it popular in ancient Rome, because it resembled so closely the rich Tyrian purple dye used solely for dyeing the robes of emperors and patricians, and which could be used by commoners only on pain of death.

This dye was obtained from a fluid in the glands of certain shell-fish belonging to the genera *Murex* and *Purpura*.[1] The Greeks called both the shell-fish and the dye obtained from them *porphyra*, from which the Romans derived their adjective *porphyritis* or purple-coloured, and so the name was applied to this handsome rock from the Egyptian desert. The colour probably approximated more closely to the original Tyrian purple than we imagine, because we read that the true Tyrian purple was actually rich-red.

Thickly scattered in the dark crimson groundmass of this Imperial Porphyry or Red Antique Porphyry (*Porfido Rosso Antico*), as it came to be called, are rectangular crystals of felspar, and so the name porphyry came to be applied to any rock showing this peculiarity

[1] Allan, Joyce.—Tyrian Purple—an ancient industry. AUSTRALIAN MUSEUM MAGAZINE, v. 5, 1934, pp. 147-151.

regardless of its colour. As geologists unravelled the story of the solidification and crystallization of igneous rocks the term porphyry implied solely that type of crystallization, described at the beginning of the article, in which there are two periods of crystal growth, one slow, and one very rapid, producing two generations of minerals, one large in size and the other microscopic.

Unfortunately for our story, the Imperial Porphyry from Egypt has been recently examined and found not to be a true porphyry at all, but a tuff. A tuff is formed by the deposition of fine rock fragments, expelled from vents in the earth's crust by volcanic action, usually with explosive force. Apparently this tuff contained sizable crystals of felspar which were scattered throughout the finer material. This material consolidated, and was subsequently pigmented by red iron-oxide (hematite), giving rise to the Imperial Porphyry which, if not a true porphyry, is at least porphyritic in appearance.

On speaking of Tyrian purple and Imperial Porphyry, visions of the splendour and luxury of ancient Rome are brought to mind, and it takes little imagination to picture a riotous scene of dining and wining such as the Romans indulged in, at any rate in the days of decadence during the decline and fall of the empire. It is of interest, therefore, to mention that "porphyry" is a name applied exclusively to an Australian wine, first produced in the Hunter River district. The rock in this vineyard is a true porphyry of a type very similar to that occurring in wine-producing districts in southern Europe. It was for this reason that the wine was christened "porphyry" by the original grower. The name is now the exclusive property of a well-known Australian firm of wine merchants.

A diagram illustrating the formation of porphyries, specimens of various Australian porphyries, and a specimen of the Imperial Porphyry itself, are to be seen in the Rock Display cases in the Museum.

THE Sydney University Graduates Fighter Plane Fund organized a popular scientific exhibition to augment its funds. This exhibition was held in Farmer's Blaxland Galleries from 15th to 23rd August and was well attended. The exhibition was extremely varied, featuring many things of diverse interest, substitutes for petrol, stockings from coal, camouflage, Australian munitions—being but a few. The Australian Museum contributed an exhibit of poisonous animals, an exhibit which attracted considerable attention.

* * *

Mr. J. R. Kinghorn, C.M.Z.S., Assistant to the Director and zoologist of this Museum, was recently appointed as Government Liaison Officer to the N.S.W. Recruiting Committee. He is also acting on the sub-committee which is organizing local governing bodies throughout the State in connection with the State recruiting campaign.

* * *

Mr. A. A. Livingstone, zoologist in the Department of Lower Invertebrates of this Museum, resigned from his position in August. Mr. Livingstone had been attached to the Museum since 1920, and had specialized in the study of polyzoa, in which he had earned a reputation as a sound and painstaking worker. His researches were published mainly in the publications of this Museum. He had also elucidated collections made by several expeditions, notably those of the Australasian Antarctic Expedition.

Australian Aboriginal Art and Its Application

FROM August 11th to 22nd the Australian Museum conducted an exhibition in Messrs. David Jones Ltd.'s Auditorium, Castlereagh Street, Sydney, to demonstrate the application of Australian aboriginal art. Owing to the illness of the Hon. Clive R. Evatt, K.C., M.L.A., Minister for Education, it was opened by the Hon. C. E. Martin, Attorney-General. It was visited by three thousand.

General view of section I of the exhibition.

A wide interest in this subject has developed in Australia in recent years, if one may judge by the numerous inquiries made at the museums about it by students and commercial artists, and it is evident from the nature of these inquiries that the interest in the subject is gradually being extended from the cultural viewpoint to that of the practical application of the motifs. The belief that aboriginal art represents an unexploited storehouse of inspiration for our designers led to the Australian Museum publishing a handbook of Australian aboriginal decorative art[1] in 1938, and this year organizing an exhibition to demonstrate the scope of application of aboriginal art generally.

It is, however, necessary to utter a word of warning. It is not contended that aboriginal art equals the abstract and imaginative qualities, or the richness of design, of the art of many other primitive peoples, nor that it approaches the magnificence of the art of the classical civilizations, but it may be claimed that the variety and simplicity of the wide range of motifs and equally numerous techniques of aboriginal art give it a character sufficiently distinctive to

[1] McCarthy, F. D.—"Australian Aboriginal Decorative Art." 48 pp., 1 coloured plate, 33 half-tone illustrations. Cr. 4to, Sydney, 1938.

identify it with the people, and for this reason it may be said to represent a definite phase of art in Australia. Adapted with intelligence and taste, aboriginal art can make a unique contribution to modern Australian enterprise in craft-work; in some spheres, such as pottery, floor coverings, glassware and fabrics, it is particularly applicable, and examples of such work, skilfully made, might well be sought by connoisseurs in other countries. In addition, the myths and legends, daily life and art motifs, form an inspiration that may give rise to a national decorative element in Australian architecture. One could elaborate these examples, and those who visited the exhibition must have been impressed with the suitability of the motifs in the applied art field.

One difficulty which has to be overcome is that so much aboriginal art has not been recorded and made available in book form, and this applies particularly to the rock paintings and engravings, the ground drawings, and body decoration. Again, each museum in Australia has material not accessible to designers in other cities, and of which reproductions are not available. It might be pointed out, therefore, that a great deal of research and field recording have yet to be done to reveal fully the potentialities of aboriginal art.

The exhibition was arranged in three sections, the aim being to display aboriginal art and to show examples of its application.

SECTION I.

The first section comprised a comprehensive collection of aboriginal art, as shown on the weapons, utensils, ornaments and ceremonial objects, from the collections of the Australian Museum, National Museum of Victoria, and the Australian National Research Council at the Department of Anthropology, University of Sydney. It included reproductions and photographs of the rock engravings and paintings, and of the ground drawings, from various sources, and photographs of the life of the aborigines. Features of this section were forty bark paintings from Arnhem Land and a series of crayon and finger-drawings on paper done by initiated natives in Central Australia. The latter were kindly forwarded by the South Australian Museum. A tableau consisting of life-size casts of an aboriginal and his wife and baby, with their dog, was displayed.

SECTION II.

The second section consisted of exhibits contributed by craft-workers, commercial artists and architects, whose response proved to be most gratifying, and the exhibits displayed a wide range of media in which the aboriginal motifs have been applied.

In buildings, photographs were shown of the Western Australian designs, adapted by Mr. G. C. Benson, used by the Western Australian University in the Gledden Building, Winthrop and Hackett Memorial Halls. An interesting house now under construction at Castlecrag, Sydney, for Mr. S. G. Moriarty was shown by an architect's sketch, its feature being cement grilles representing the yam totem design of the *Tjingilli* tribe of north Australia. Inlaid floor designs by Douglas Annand were shown, as were also those of Gert Sellheim used in the floor of the Victorian Government Tourist Bureau's head office in Melbourne; a similar idea has been admirably employed by H. Epstein in a counter of the Bodega Wine Company's cellars, in which the motifs, made of polished brass, are set in the mahogany counter. Rudder & Grout Ltd. exhibited photographs of the buffet of the Great Northern Hotel, Newcastle, where the art motifs of the aborigines and some of their customs are shown on the walls, doors, ceilings and various panels. These examples indicate the possibilities of the application of aboriginal art in architecture, and to them may be added mosaic and tile patterns; they suggest that a more liberal use might be made of the designs in this manner, and one regrets that the idea has not been utilized in any of the national buildings in Canberra.

This group of exhibits comprises hand-printed linens by Miss F. Burke and E. and M. Quick, handspun scarves and a bed-cover by Miss J. Booth, pottery by Mrs. J. Seccombe, Misses Holden and Atkinson, a tea-cup and saucer by Miss O. Nock, a glass vase and towel by David Jones Ltd.

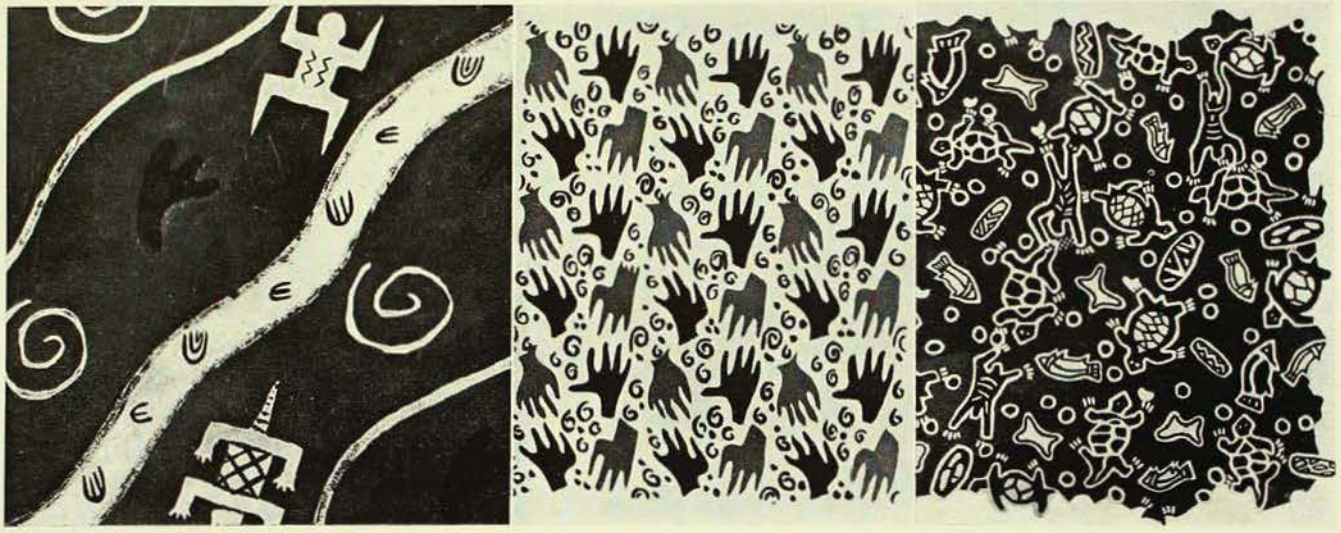
Pottery was represented in a variety of forms by members of the Society of Arts and Crafts, Sydney. The attractive motifs painted on the shields of north-east Queensland, and on various objects along the coast of Arnhem Land, formed the sources of most of the motifs used by Mrs. G. Seccombe, Miss N. Davidson, Miss H. Hirst and Miss N. Holden, on vases, jugs, plates, bowls, tobacco-jars, cigarette-boxes, ash-trays and table-rings. Miss Nock exhibited a tea-set and a sandwich-set bearing geometrical and fish motifs, and Miss M. Innes a tea-set bearing a geometrical lip motif with kangaroos as the main design. A mug by Mrs. Vi Eyre, vases and a bowl by Miss Newman bore geometrical designs, and Miss Atkinson used as the motif on her pottery, in shades of brown, various figures from the rock-engravings of the Sydney district. Miss Mace's exhibit comprised a series of brown bowls and trays on which were shown in black, natives dancing, hunting, fighting and carrying out their domestic duties. The aboriginal motifs were painted on most of the pottery, but one would like to see them modelled as well, and the texture of the surface of aboriginal objects retained. Examples of David Jones Ltd.'s glass water-sets and vases, bearing designs by Gert Sellheim, added interest to this group, as examples of a medium perfectly adapted to the application of such motifs.

The fabrics constituted a most interesting group notable for the striking but attractive designs utilized. In the hand-painted series Miss Francis Burke exhibited seven examples in which she employed a variety of designs, including those from *Gulmari* shields, bark and rock paintings. Miss N. Mackenzie adapted the *Wollunqua* ground drawings of the *Warramunga* tribe, and emu and goanna motifs, to curtains, and E. and M. Quick adapted a concentric circle pattern. Miss Booth, of the Sydney Hand-Weaving School, displayed a bed-spread in linen and wool, and a cushion in hand-spun wool, bearing a salmon-fish totemic design from north-east Queens-

land, and two scarves in hand-spun wool, also bearing totemic designs from that area. Miss R. Wilson displayed a table-mat on which were embroidered rock-painting figures from Ayer's Rock, Central Australia. Messrs. David Jones Ltd. contributed examples of dress materials and beach towels bearing designs from central and north Australia adapted by Gert Sellheim, and known collectively for the purpose as "Arunta" designs.

Mr. H. T. Greenhill, from the Julian Ashton Art School, whose design consisted of a skilful arrangement of naturalistic motifs. Miss Joan Leaver's design was highly commended. Entries were received from various States.

An excellent example of the decorative value of aboriginal motifs in book illustration is the Commonwealth of Australia Sesqui-Centenary Volume, 150 Years in Australia, the designs being adapted by Gert Sellheim. *Art in Australia* has shown enterprise with its fine cover designs and full-page illustrations of aboriginal art in lino-cuts by Paul Haefliger, while *The Home* magazine has used Queensland shields, cleverly photographed, for the cover of one of its numbers. The Victorian Tourist Bureau, also, has issued a series of Sellheim's designs on the covers of some of its tourist maps, and Miss J. Mackenzie used a group of aboriginal rock engravings, depicting a kangaroo hunt, for an attractive Christmas card. These exhibits indicate also the suitability of aboriginal art for book-plates, cover designs, and feature illustrations, as shown in a book of designs exhibited by the Stockland Press of Melbourne. A poster by Sellheim shows men dancing a corroboree, and several others by students of the Art School of the East Sydney Technical College for the Australian Museum



The prize-winning designs in the competition for a dress material design derived from aboriginal art. First, second and third are shown from left to right.

There has been great interest in the use of aboriginal designs for textile patterns, and the East Sydney Technical College displayed a number of examples of its students' work, in which motifs from all parts of the continent were embodied.

The seventy entries for the Students' Competition for a dress material design derived from aboriginal motifs included some excellent designs, which comprised a wide range of aboriginal motifs tastefully and intelligently applied. The first prize was awarded to Miss Gwen Eichler for a well-balanced design combining naturalism and geometric designs, the second prize to Miss Anne Wienholt for a neatly adapted arrangement of the stencilled hand motif—both these competitors were from the East Sydney Technical College, and the third prize to

illustrated the aborigines with their material culture.

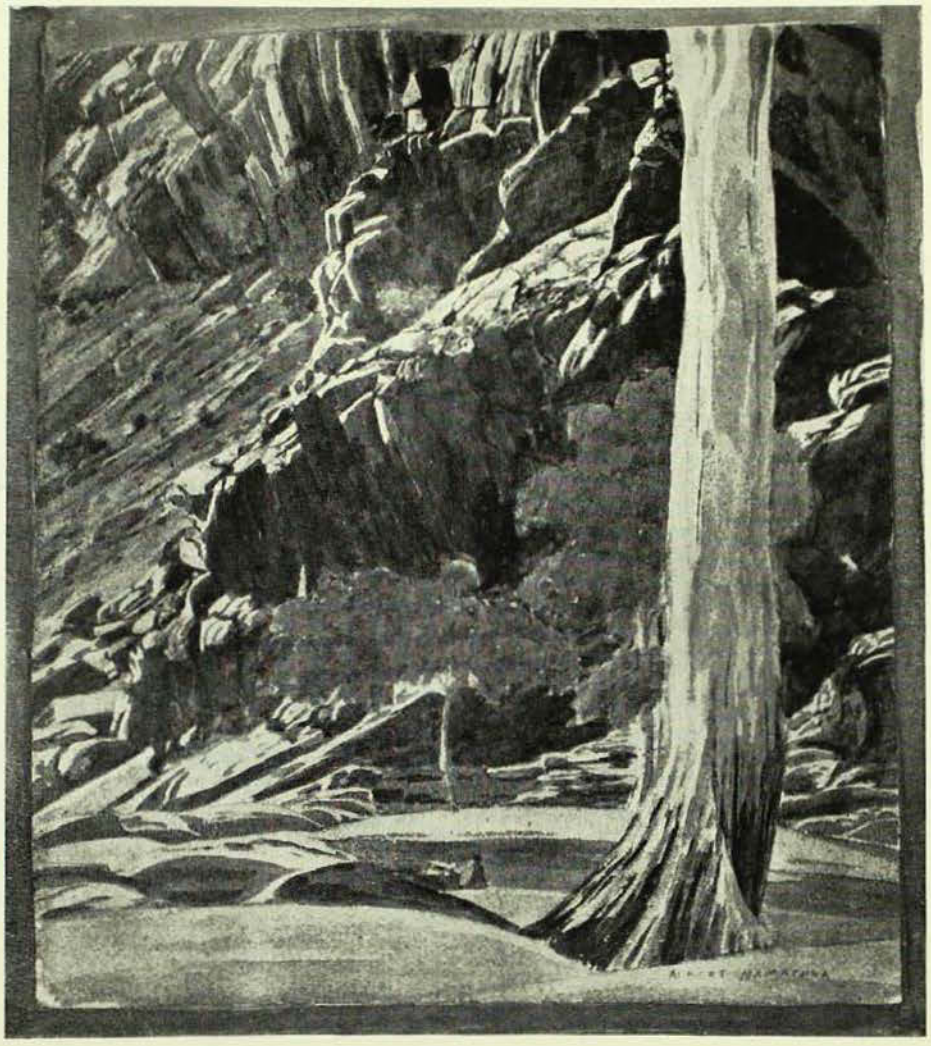
Other interesting applications of aboriginal motifs were shown by Miss Davidson on a papier-mache tray and a fruit-dish, by Miss Creed on a copper brooch, by Miss Innes on pewter book-marks, and by David Jones Ltd. on women's ornaments.

It might be pointed out that Australian aboriginal motifs could be employed with advantage in Australian-made carpets and other floor coverings, wallpapers, and in cushions and lamp-shades, as a distinctive theme in interior decoration.

SECTION III.

The underlying idea of this section was to promote a greater interest among artists and sculptors in the customs, mythology and religion of the aborigines as sources of inspiration for paintings, murals and modelling work.

In Sydney several artists have tried to develop this idea. Fred Leist has done several mural designs, the one exhibited displaying a sensitive treatment of a native, armed with spear and coloured shield, sitting in front of a banksia tree. Margaret Preston has used the aboriginal motif and mode of working in her four oil-paintings, which comprised cream and gold banksia flowers against a Queensland shield background, a basket of fruit and a basket of fish in Arnhem Land style, a landscape of the Hawkesbury River, and, in addition, a woodcut of a group of aboriginal rock engravings in Kuring-gai



A water-colour of a rocky gorge in Central Australia by Albert Namatjira.

Chase of a shark attacking a school of fish.

Photographs were shown of murals, at the entrance to the Australian Hall of Ethnography in the National Museum of Victoria, which were designed by Murray Griffin and made by the students of the Melbourne Technical College; they are formalized interpretations of aboriginal beliefs and legends, customs, and material culture, and reveal a most attractive decorative idea for Australian buildings. The Public Library of New South Wales displayed a plaster cast of one of the thirty-six panels for the bronze entrance doors in the new building in Macquarie Street, Sydney; this panel depicted the guardian of the Emu totem of the Arunta Tribe, central Australia, and the other panels will illustrate the most typical aboriginal customs.

Five landscapes in water colours were shown by Albert Namatjira, a full-blooded Arunta native, who has had lessons in painting from Mr. Rex Batterbee, the Melbourne artist. The work displays a fine sense and control of colour, and illustrates beautifully the strong sunlight and harshness of central Australian scenery.

Finally, an exhibit by William Ricketts, Mount Dandenong, Victoria, of ten of his sculptures in clay was displayed. His work is inspired by the records made by the late Sir W. Baldwin Spencer of the tribes of central Australia, and this pioneer anthropologist is shown with the aborigines on some of the pieces. The largest specimen exhibited depicted the dwelling place, called *Pertalchera*, of a spiritual ancestor known as *Kuruna*, worked out in a garden fountain design five feet long. Another fountain, three feet in diameter, interpreted the story of the lizard totem spiritual ancestor, *Inkata*. One piece represented the spirit of a great tree. Several pieces showed the Kangaroo men, one with their sacred *Tjuringa*, the other revealing their secrets to Sir Baldwin Spencer. One vase, on which long stone spear-points formed the motif, and the graceful shape of the wooden coolamon was used for the lid, illustrated other phases of Ricketts's work. The exhibits of this potter reveal a sensitive treatment of aboriginal inspiration based upon a sound knowledge of aboriginal culture, so sound indeed, that only an anthropologist is able to appreciate the full meaning and significance of the work, and the high degree of intelligence brought to bear in his interpretation of the secret life of the aborigines. Each of Ricketts's pieces is unique and is never repeated.

F. D. McCARTHY.

The Australian Museum is collaborating with the Eastern Command in its Army Education Service. This service has a panel of more than sixty experienced speakers which will give addresses to the troops on about four hundred topics, embracing natural science, economics, psychology, music, industry, *et cetera*. Officers of the Museum will visit various camps and their lectures will be similar to those which have been a feature of the Museum's popular educational activities for so many years. The talks will be illustrated by film, slide and specimens.

War on the Liver Fluke

By ELIZABETH C. POPE, M.Sc.

CAUSE of much financial loss and worry to the farmer and breeder of sheep is the Liver Fluke. It is an annoying pest because eradication is, as a rule, a rather tedious procedure, involving the drenching of the sheep with substances poisonous to the worms, and also the treatment of wide areas of country to remove the pest.

Recently an original and rather ingenious method, developed by one of the residents for treating fluke-infested areas, was observed in the Armidale district, where the fluke is rather prevalent. Bluestone or copper sulphate is the poison recommended for killing the freshwater snails which are the intermediate hosts in the life cycle of the flukes; also it kills quite effectively several of the infective stages of the flukes themselves as they swim about in the water in their passage from host to host during their development. Where a pest has a long and complicated life cycle, with an intermediate host necessary for its full development, it is possible to attack the pest in a very effective way. This is by destroying the intermediate host and thus removing an essential link in the chain of events of the life history which would ordinarily lead to the re-establishment of the pest in a new host.

Although it is possible to get rid of the flukes by drenching the sheep with substances which will poison the pests, this method is not sufficient in itself, for sheep will soon become reinfected unless the intermediate hosts which harbour some of the young stages are also wiped out. The intermediate host in the fluke's life cycle is the freshwater snail, *Limnea brazieri,* which lives in moist spots such as swampy ground or in ponds and streams. The areas in New South Wales where the sheep fluke is of economic significance are on the New England and Monaro Tablelands where an abundance of fresh water is nearly always available for the water snails.

The seed broadcaster used to spread the sand and bluestone. The mixture is placed in the hopper of the machine and the handle at the side is turned while the operator walks along the area to be treated.

Luckily the snails are easily killed by very minute doses of the bluestone, one part in a million parts of water being sufficient, not only to kill all snails, but also to wipe out the infective larval stages of the flukes, the *Miracidia* and *Cercariae.* The bluestone should be scattered at the rate of twenty-five to thirty pounds per acre. In order to dilute the bluestone and to make it easier to spread it in quantities small enough not to harm the sheep, the powdered substance is mixed with four times its own amount of sand. It is no easy matter even then to spread this mixture evenly

The machine in operation. The effectiveness of the dispersal of the sand and poison compels the operator to wear goggles, for the bluestone is harmful to the eyes. Note the fine spray of the medium.

over a wide area by hand and the use of machines is difficult, as a rule, because of the rough nature of the ground which has to be covered and the fact that it is difficult to drive a machine such as is used for spreading fertilizers along the edges of small streams and over marshy ground.

The effectiveness of the method now to be described is therefore a matter of great interest since it enables one person to treat large areas very effectively in a short time. A small hand-propelled seed-broadcaster is used in the manner illustrated. Its use ensures an even, wide, and economical spread of the bluestone poison. The operator places the mixture in the machine and then walks along the banks of the stream or through the marshy area, turning the handle of the machine at a fairly fast rate. A fine spray of sand and bluestone flies out on either side for quite a considerable distance and its spread is so even that no area remains untreated and few snails can escape. Most of the snails are killed in as short a time as half an hour, and an examination of the area will show that all snails and infective larvae are dead after a treatment of this kind.

Since the Liver Fluke can also infect a human being and cause, as it does in the sheep, grave disorders or even death, the discovery and use of such a simple method as the one described here is important for speedy eradication of the pests and is a boon not only from the point of view of the sheep farmer but also in the interests of public health.

Half an hour after the broadcasting of the poison a detailed examination of the treated area revealed that every snail was quite dead. If the first treatment is not quite effective a further one is generally sufficient to complete the job.