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The Satin Bower Bird.

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THE AUSTRALIAN MUSEUM

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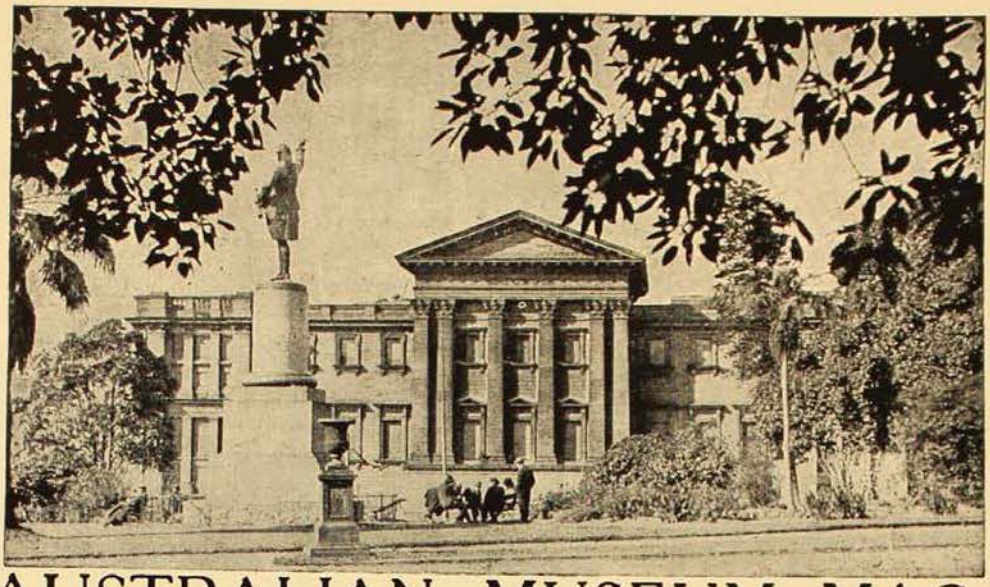

THE AUSTRALIAN MUSEUM MAGAZINE

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

● OUR FRONT COVER. The Satin Bower Bird (*Ptilonorhynchus violaceus* Vieillot) is by Lilian Medland. It is one of a series of post cards issued by the Trustees of the Australian Museum.

The Satin Bower Bird, to give it its full title, is one of a group of birds confined to Australia and New Guinea, which have developed the curious habit of building playgrounds or "bowers" for themselves, in and about which they play. The Satin Bird's bower is built of two rows of twigs set in the ground rather less than a foot apart, and arching over towards one another at the top. A circle nearly a yard in diameter is cleared about the bower, and this place is strewn with leaves, brightly coloured feathers of parrots, snail shells and small bones. One genus of Bower Birds is confined to the interior, with several species, while several others, of which the Regent Bird is one, are confined to the scrubs of the east coast. The Cat Birds do not make a bower.

The Satin Bird ranges from north Queensland to Victoria, and often causes severe damage in orchards and kitchen gardens. In such circumstances it is shot, and, as it is both plump and tender, subsequently eaten. Its note is a peculiar churring sound, rather like that made by tearing hard cloth. The nest is a flimsy affair of a few twigs, placed in the top of a thick bush, or in a clump of mistletoe, and two or three eggs are laid, of a cream colour, lightly spotted with brown and purple.

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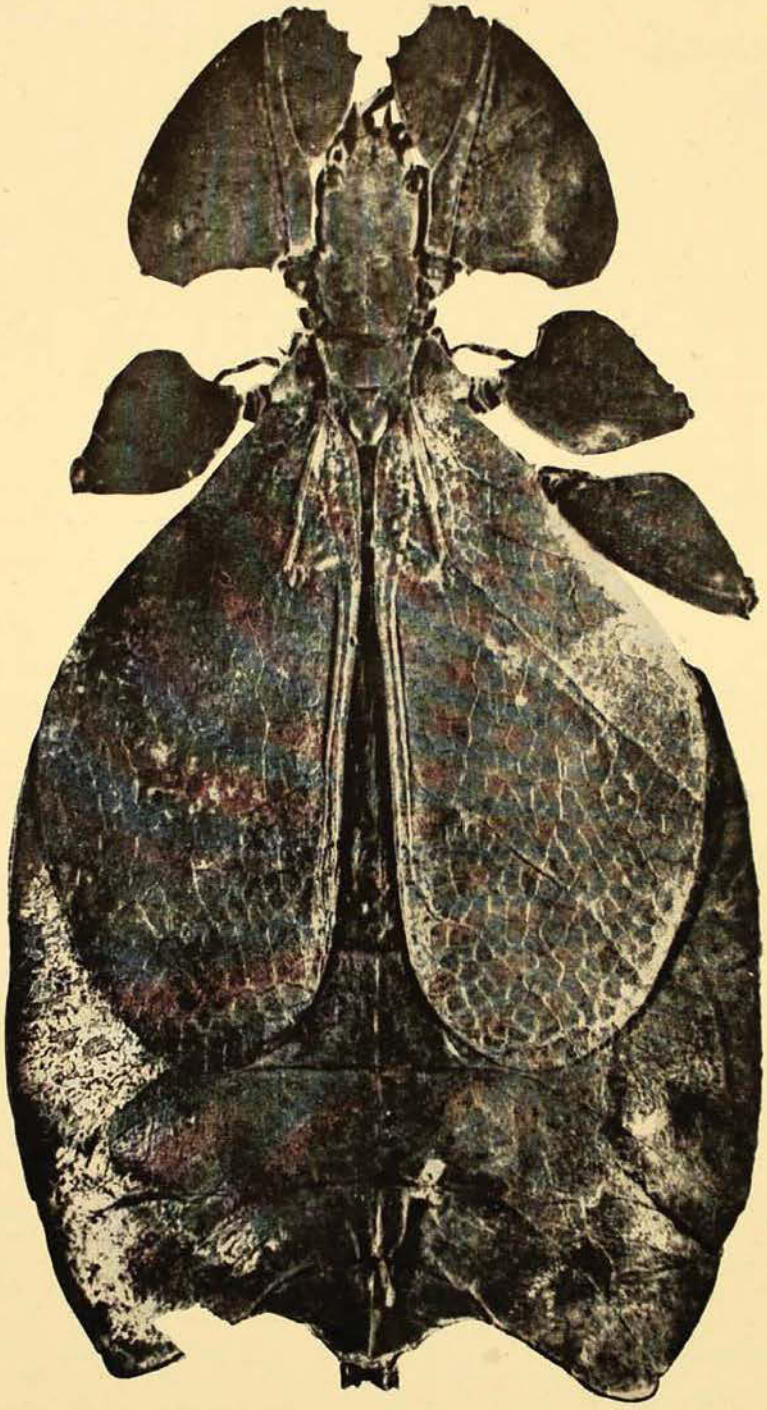

An interesting New Guinea Leaf Insect or Phasmid (Phyllium frondosum Redtenbacher). Greatly enlarged. **(See page 414.)**

Photo—F. H. Taylor.

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VOL. VII, No. 12. MARCH–MAY, 1942.

Museums To-day

SOME sixteen years ago in these pages we wrote:

"The collection and safeguarding of all these things upon which human knowledge is based must ever remain the primary function of museums; secondary functions are the advancement of knowledge by continued study of museum collections, and the making of new knowledge available to those who ought to receive it."

The words were those of Dr. Herbert Bolton of the Bristol Museum, and they were uttered at the annual conference of the Museums Association at the Wembley Exhibition.

The passage of time has given them a fresh meaning—a meaning which was clearly and poignantly expressed by Captain S. F. Markham, of the British Expeditionary Force, in the June, 1940, issue of the *Museums Journal*. Captain Markham, then President of the Museums Association, will be long and well remembered by Museums of this country, for, a decade ago, in association with Professor H. C. Richards of Queensland, he conducted a survey of these institutions. We will not repeat his message *in extenso*, for it may be read in a previous issue.[1] But one passage is surely worth quoting. It is this:

"As I see things, all that we have been fighting for in terms of culture and art for years will be checked, confused and even perverted until peace rules again. For some of us there is the pride and the honour of helping to push back a ruthless barbarism that is the enemy of everything we hold dear, but we shall fight in vain if behind us there is not kept burning with a sturdy light a flame of learning and culture. The great task of museums and art galleries in this country during the war is to help preserve the basic sanity of our peoples, and anything that can be done in this respect will be of greater ultimate value than most of us perhaps can now realize."

Since that was written the burning brand of destruction has continued its sweep around the globe, and each mail brings, lamentably, fresh evidence of chaos wrought. Yet, despite these setbacks, institutions concerned with the increase and diffusion of knowledge among men are still continuing their service, even though it be with sadly depleted staffs.

The contents of a museum are very susceptible to damage in the war of today. Buildings, collections, and especially the glass cases in which exhibits are displayed have alike suffered from direct hits by bombs, from incendiary bombs, and from the effects of blast. In one English gallery practically every sheet of glass in the building was shattered as the result of a high explosive bomb which landed in a street nearby, while the works of art

[1] THE AUSTRALIAN MUSEUM MAGAZINE, Vol. vii, No. 6, September-November, 1940, page 183.

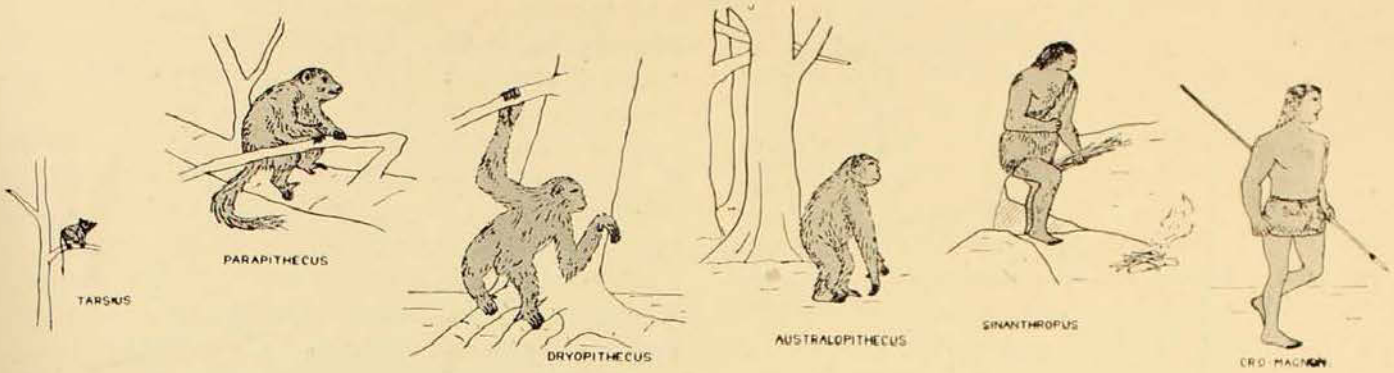
still on the walls were practically unharmed. In a museum, measures may be taken to ensure the comparative safety of the more valuable portion of the national collections, and to render the buildings and remaining contents capable of some protection from fire. Unfortunately, however, the comparatively great amount of plate glass so essential in museum displays is difficult to protect; in the exhibition cases the glass must be firmly fixed in order to protect the exhibits, and being thus rigid, it is susceptible to shattering by blast.

Changes recently effected in the galleries of the Australian Museum represent part of the measures taken for protection of the building and its contents. These changes are noticeable, and some of them will doubtless be appreciated by the public for reasons other than those for which they were primarily made. The removal of many of the cases in the central portions of the galleries has resulted in much more spacious vistas in the museum, comparable in some degree with the halls of museums of modern design.

Dr. Margaret Mead recently referred to American Museums and the part they play today. She drew attention to critics who condemned the institutions as out of date, lacking in verve and modernity, and who urged high-pressure salesmanship methods and less thought of fidelity to the subjects of display. This, of course, is anathema to any museum worker, for faith and honesty were never more necessary than when an exhibit has to educate by telling its tale. As Dr. Mead says:

"Because the staffs of Museums have insisted on saying, "Is this true?", instead of asking, "Will this make a hit?"—they have kept the people's trust. . . . The Museum which has refused to give up its faith in the materials of science, the Museum which has scorned to substitute emotional appeals for orderly demonstration, finds itself with a definite place in the national program. As a place that the people trust, it is now a place in which they can renew their trust in science and democracy."

For ourselves, we feel that visitors may now view exhibits in greater comfort than formerly, and the restful contemplation of favourite subjects may help some to escape for a very brief period from the cares and anxieties of these tragic and difficult days.



The Story of Man

By ELSIE BRAMELL, M.A., Dip.Ed.

IT is astonishing that so inquisitive a creature as man should have waited as late as the last century to make a serious attempt to find out something about his own heredity. Did he lack the intelligence, or the courage? Or was it just another of those awkward riddles set aside for more pressing problems?

In spite of his many intellectual endowments, man is wilfully blind to certain dangers that threaten his social and physical welfare. So imperfect is the health of the world at large that the medical profession is still preoccupied with curing and preventing the ills of the individual rather than devoting itself to improving the human animal as a biological organism. The old rule of natural selection, whereby the unfit were efficiently, if mercilessly, eliminated, has become obsolete as a result of humanitarianism and increased medical skill, and there has risen a grave and embarrassing social problem of increasing numbers of helpless and dependent members of society—the old, and the physically and mentally unfit. The far-seeing student, be he anatomist, anthropologist, sociologist or anyone else, must know that the future of mankind depends firstly and basically on the production of better minds in sounder bodies. But no control and no reforms can be attempted until we acquire more knowledge of man's heredity and the restrictions or potentialities of which it admits. Our general ignorance of biology cannot be too frequently deplored, nor too soon remedied, and it must be urged that we, having done so much to bend nature to our will in other ways, will now put our best efforts forward to improve the calibre of the human stock. The implications that lie behind all this take us beyond the scope of this article, but it is necessary to have mentioned these facts in order to show why scientists still bother about such oddities as "missing links", and cannot permit the past to be under-valued or left out of account.

In a former issue of THE AUSTRALIAN MUSEUM MAGAZINE appears an article[1] wherein is given a brief summary of the history of the earth and its peopling by living creatures. The animals are classified and man assigned his place among them. The writer goes on to inquire when man first appeared, to sort out human traits among primate forms and therefrom trace the history of the development of the brain. Fossil finds of early forms of man are then examined, and the conclusion summarizes the status of *Homo sapiens*, the only survivor of a large family.

This article does not propose to cover the same ground, but has been written to

[1] Brown, A. R. Radcliffe.—The Antiquity of Man, THE AUSTRALIAN MUSEUM MAGAZINE, Vol. iv, No. 1, January-March, 1930, pp. 28-36.

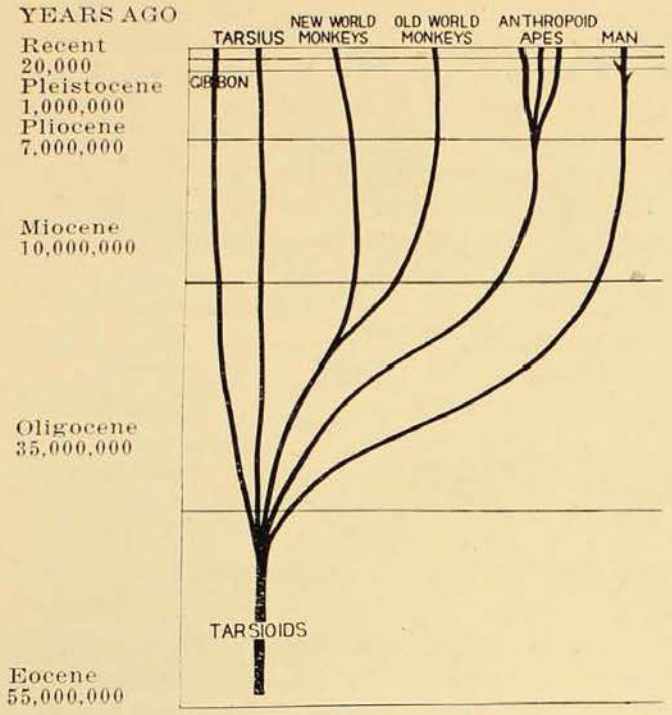


Chart I.

provide an introduction to an exhibit entitled "The Story of Man", which has not long since been placed in the ethnological galleries. So frequent were inquiries concerning man and his ancestry, that we felt obliged to revise the subject in the light of recent knowledge, quite appreciating the limitations of the data, but convinced that those seeking information should not be deprived of it through undue timidity on our part.

The theory that man did not suddenly appear "ready-made" on this earth, but evolved from a much simpler form of organism, is now generally accepted. It was Charles Darwin who, by his collecting and analysis of evidence, crystallized the principle of evolution. He has frequently been misquoted as having said that man was descended from the apes, but in truth his actual words suggested that man and monkey were descended from some *common species* that lived in the past, and warned us that "we must not fall into the error of supposing that the early progenitor of the whole simian stock, including man, was identical with, or even closely resembled, any existing ape or monkey". The enormous amount of accumulated data has not uncovered a single fact which weakens the evolutionary hypothesis, though the danger of going beyond the evidence must be avoided.

Our present state of knowledge tends to indicate that man and apes were both evolved from a creature like the Tarsius, a tiny hopping animal whose ancestors were primates who lived in the Lower Eocene epoch, more than fifty million years ago, and which has changed its form but little through the ages. Its important feature is the prominence of its eyes, with the recession of the nose, paving the way for the high degree of binocular and stereoscopic vision found in apes and reaching the culminating point in man. It makes its home in trees and to-day is found in Borneo and other parts of the Indo-Malayan Archipelago, though fossil forms are widely distributed, even to America.

One school of thought, sponsored by Professor F. Wood Jones, thinks that man branched off from Tarsioid ancestry at a very early stage (Chart I); another school thinks that man branched off at a comparatively late stage from the stem of the large anthropoid apes (Chart II). The latter view is more generally held. It might be noted that the main facts of

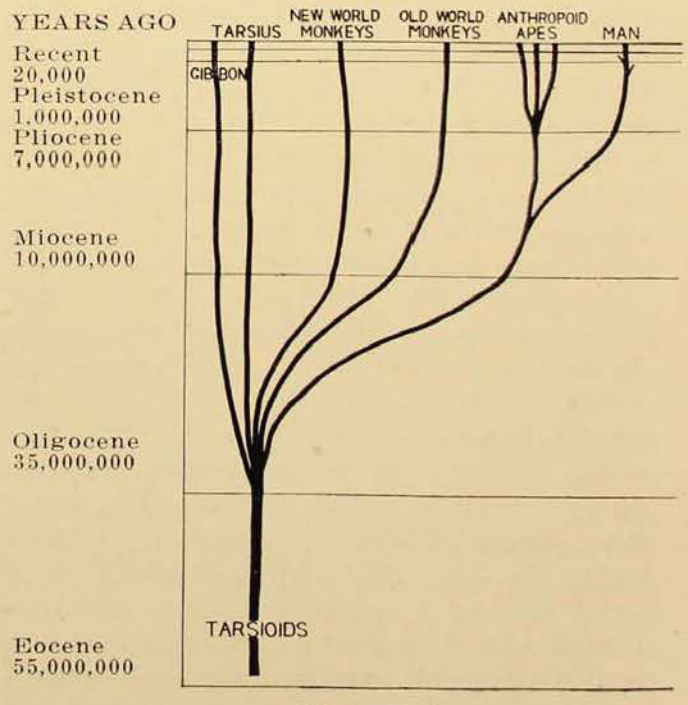


Chart II.

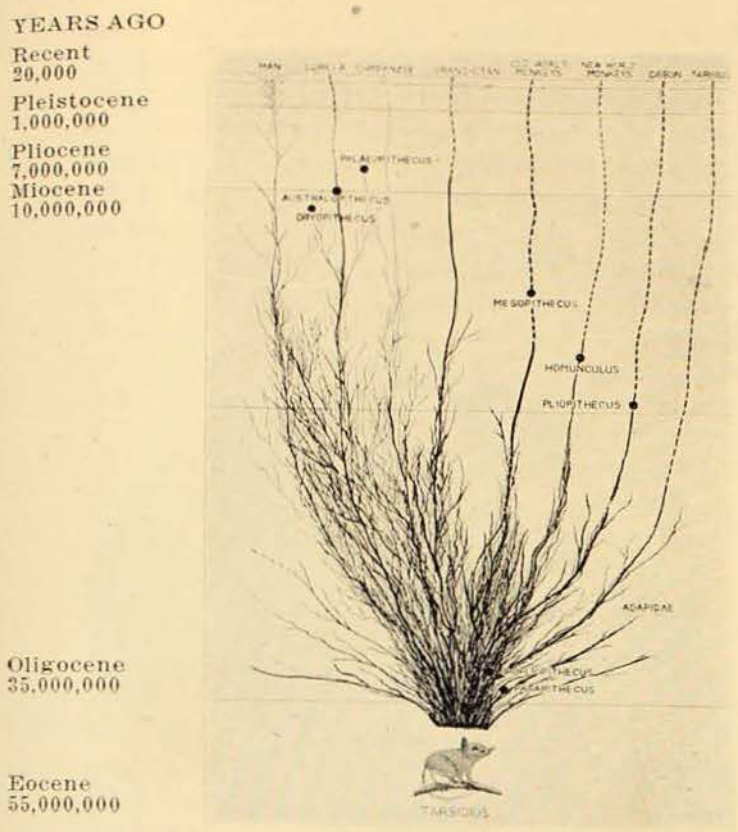


Chart III.

evolution are not in dispute, but details must remain uncertain until more material comes to hand; some of our data are as much as 500,000 years separated in time.

Chart II indicates that it was not till the middle of the Tertiary era that the monkeys were first differentiated, apparently in the New World. New and related forms, comprising the Old World monkeys and the anthropoid apes, similarly evolved in the Old World. Through the whole of the latter part of the Tertiary and in the Quaternary era we find fossil remains of anthropoids; of these, Australopithecus of South Africa has certain features in brain and teeth which bring it closer to human beings than other fossil apes. It is from such forms as these that the second school mentioned above would derive modern anthropoids and man.

With the passage of time, some anthropoids, endowed with greater initiative than others, took to moving about on the ground instead of always in the trees. This transition produced structural alterations which liberated the hands from being mere supports, and thus the animal now had two arms and two legs instead of four legs. This naturally led to the assumption of an erect posture, which is present to a limited degree in the gorilla, chimpanzee and orang-outang, more in the gibbon, still more in many primitive human types, and attains its maximum in modern man. The bone structure of man is remarkably similar to that of the apes. Anatomical evidence shows them to be merely variants of the one fundamental pattern, and this is confirmed by a study of their physiology, embryology and psychology. The assumption of the erect posture, development of binocular vision, increased size of brain and alteration in form of pelvis tend to make the differences more apparent than real.

EARLY FORMS OF MAN.

For all tangible evidence of these early times we are dependent upon fossil finds. Human remains of extreme antiquity are rarely discovered, and then generally in a fragmentary condition; fortunately, the skull and teeth are fairly durable and so more commonly found.

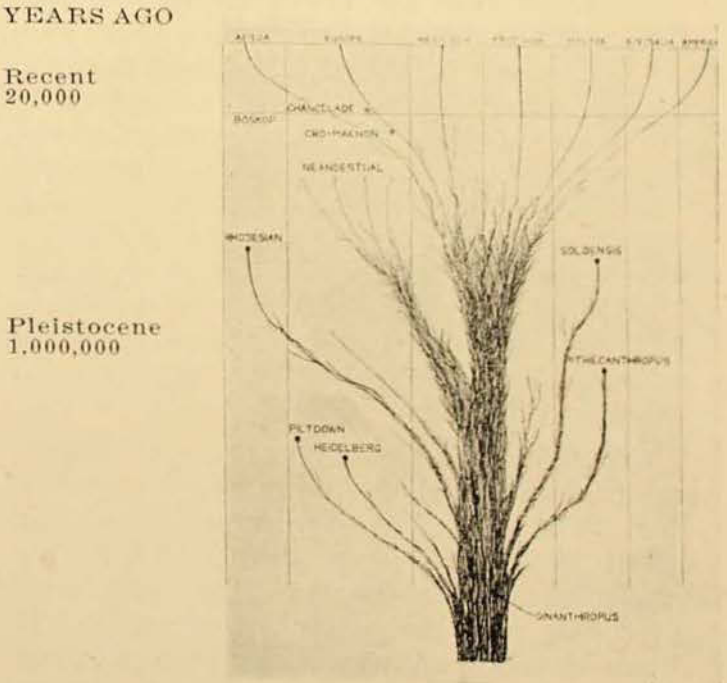


Chart IV.

Much thought and experiment have been devoted to the arrangement of our reproductions of extinct forms of man, and many schemes were turned aside. Arranged chronologically as the finds were unearthed, the story was too confusing because it meant continually going backwards and forward in time, and the dating of many fossils is uncertain. So we have arranged our early men in sections: first, the most primitive forms so far discovered, and then, in turn, Neanderthal Man, Cro-Magnon Man, Neolithic or New Stone Age Man, and, finally, some of the varieties of modern man.

Sinanthropus is regarded as the most primitive form of man of which we have knowledge. He was found near Peking in China. His geological age was established from a description of one molar tooth; subsequently a large amount of material was discovered, including two almost complete skulls and very many fragments of jaw and teeth. These discoveries completely confirmed the conclusions arrived at from the study of the tooth. The skull is characterized by prominent eyebrow ridges, a low retreating forehead, and a form of occipital region associated with large neck muscles indicating that he had not yet attained full erect posture. The study of the cast of the inside of the skull shows that his brain development was considerably more advanced than that of any of the known species of ape, and completely warrants his inclusion in the human family. Abbé Breuil, a great authority on the stone implements of early man, concludes from a study of the evidence that Peking Man could make implements of stone and probably of wood, and also understood the use of fire.

Heidelberg Man. Excavations at Mauer, near Heidelberg, Germany, were watched for twenty years for human remains, until in 1907 a lower jaw or mandible was brought to light. The size and strength of this jaw distinguish it immediately from any living form of man and most other fossil specimens. The chin is less receding than that of an ape, but the ascending ramus is simian in type. The U-shaped dental arch is human, while a specialized condition of the teeth suggests a rough vegetable diet and kinship with Neanderthal Man. Heidelberg Man, in brief, exhibits characters both human and simian; he probably predates the Chellean culture, and lived in the first or second interglacial stage of early Pleistocene times.

Skull of Neanderthal Man, found at La Chapelle-aux-Saints, France. The forehead is receding, the eyebrow ridges large, the jaws project forward, and the chin is not prominent.

Piltdown Man or Eoanthropus dawsoni. In 1911 fragments of a human skull were found in a gravel pit near Piltdown in Sussex. Associated with it were crudely worked stone tools and fossilized bones. The brain case is small, thick-walled, and ill developed as compared with modern man; the jaw contradicts the evidence of the skull inasmuch as the palate is most ape-like, and the chin recedes, which would permit of but a crude form of articulation. Piltdown Man is a puzzling combination of generalized and specialized features. Early Pleistocene is the date assigned to him.

The exact age of the most recent find in England, the *Swanscombe Skull*, can, since complete geological data were available, be determined as mid-Pleistocene, and the hand-axes found in the skull layer are mid-Acheulean in type. The occipital and left parietal bones were recovered,

and are considered to have belonged to a woman in the early twenties. A cast of the brain cavity shows it to have been well developed even compared with modern brains. Both bones are exceptionally thick, and the occipital unusually broad.

Pithecanthropus erectus, one of the most primitive forms that has come to light, was unearthed in 1894 as the result of a special search by Dubois, a Dutch army surgeon. The vault of the cranium, left thigh bone and three teeth were found, though it is very doubtful whether the thigh bone had any relationship to the skull. The teeth are more human than anthropoid, the skull height lies midway between man and gibbon, and though very flat, is within human range. The forehead slopes gradually down to great eyebrow ridges which betoken a massive, heavy face and jaw. Quite recently, in 1937, another representative of this race was found, which definitely establishes that *Pithecanthropus* was a human being and not a great ape. Again, the Trinil layers were discovered to be Mid and not Lower Pleistocene, so he is placed higher in the scale of time than formerly. His similarity with *Homo sinanthropus* is very remarkable considering the wide interval of time separating them.

The *Modjokerto Child* was found in 1936 by Dr. G. H. von Koenigswald in sediments of Lower or Mid Pleistocene age near Modjokerto, Java. The brain capacity is much less than that of the modern child; the whole forehead is more receding and the eyebrow ridges more prominent.

Homo soloensis. Eleven skulls were discovered in an ancient gravel deposit of the Solo River by the Geological Survey of Java during 1931–33, not so very far away from the spot where *Pithecanthropus* was found. The crania resemble *Homo rhodesiensis* and Neanderthal Man. Crude implements of bone and antler were associated with the remains, together with fossil fauna which indicate existence during the late Pleistocene era.

London Skull was found during the excavation for the foundations of Lloyd's, London, at a depth of 42 feet. Only the hinder two-thirds remain; there is no forehead, face or base. Even so, it has been decided that it is the fossilized skull of a woman who lived in Aurignacian times prior to Neanderthal Man, to whom, nevertheless, she shows certain likenesses.

Skull-cap of the Ape-man of Java (Pithecanthropus erectus). This figure shows that this animal had a low type of brain compared with that of true man. Its brain indeed was in size about midway between that of man and one of the higher apes.

Homo rhodesiensis was discovered in a cave at Broken Hill, Rhodesia. There is no evidence allowing us to determine the geological period in which this individual lived. His head, face, and brain place him farther away from modern man than Neanderthal, but his erect stature places him nearer. The skull is remarkable in that the face is very gorilla-like, and is associated with a large and definitely human brain-case. It is interesting, too, in showing dental and bone decay. Rhodesian Man is regarded as being allied with the Neanderthal type.

(To be concluded.)

The Cycle of Erosion

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

PEOPLE often say that something is "as firm as a rock", or when landing from a 'plane passengers often remark that they are glad to be back on "terra firma" again. From this it might be thought that the earth is so strong and unyielding that it never changes. This is by no means the case. We know that the earth is not solid right through to its core. Scattered throughout the inner part of the earth are great masses of red-hot liquid rock. The heat is so great that the rocks have melted and this red-hot liquid is shut in by the great weight above it. Sometimes it finds a weak spot and shoots right up to the surface of the earth, accompanied by great clouds of steam and smoke. When this happens we have a volcano such as can be seen in New Zealand, Java, Japan and many other places. So great are the forces that lie within the earth that sometimes when they break loose, shocks are felt on the surface and we have an earthquake. Luckily for us, there are no volcanoes in Australia, and earthquakes do not happen very often here, and are only slight when they do.

Apart from these violent and sudden happenings, the great forces of Nature that lie deep within the earth work in a steady manner and so slowly that no one in an ordinary lifetime could see any change whatever. All over the world at the present time there is no coast-line that is really remaining still. Some are rising and some are falling, but the movement is so slow that it is only by careful scientific observation that we know it is really happening. The whole of the eastern part of Australia has been beneath the sea six times since the beginning of geological time, many millions of years ago. After each submergence Nature's forces have raised it above the sea and converted it into dry land. We know this because in the solid rocks of to-day fossils are found. These are the remains of sea-animals such as molluscs and corals that live beneath the sea, showing that what is solid rock to-day was once the mud and sand of the sea-bottom.

Something must be known of Nature's forces and the way they work before the fascinating story of the hills and valleys can be fully understood. People are often heard to say that something is as "old as the hills", but geologically speaking hills are not really old at all. How do you think they were made? Sometimes in the country you will hear people say that hills were thrown up by an upheaval. This is only part of the story. Or else it is sometimes said that they have been there since the world began. This is certainly not true, because in Nature nothing remains still, everything changes. When a land area is raised above the level of the sea the stage is being set for Nature to commence a very interesting phase of her work. Nature may be likened to a sculptor working on a large scale and

Commencement of gullying on Gostwyck Station, near Uralla, New South Wales. Due to the removal of trees, the soil has been loosened and is easily washed away by showers.
Photo—Miss E. Pope.

for whom time is no object. Something else is needed, however. A flat stretch of land is not sufficient. It is as though we placed the hammer and chisel in our sculptor's hands but gave him no marble to work. Before Nature can use her tools

The Jenolan River flowing through a hard, resistant belt of granite. Note the gorge-like character of the valley.
Photo—R. O. Chalmers.

to shape and fashion the land she must form mountain ranges by raising the land to a considerable height above sea-level. This may be done by a steady lift, or by another method which causes the land to bend upwards in great folds. This method may be illustrated by placing a pile of blankets flat on a table, fixing one end firmly and pushing the other end horizontally towards the fixed end. The blankets would be pushed up in the air in the form of a series of folds.

Millions of years ago the whole of New South Wales was flat from the coast right into the far west. There were no mountain ranges at all and the rivers were slow sluggish streams that wound in great curves over this monotonous plain. Then gradually a change commenced. The great forces within the earth slowly elevated a great belt of land along the whole eastern coast of Australia and that part of this belt to the west of Sydney we call the Blue Mountains. Some bending of the rocks took place during the process of elevation. On leaving Penrith by car and climbing the mountains to Glenbrook great tilted layers of sandstone can be seen. This same sandstone outcrops on the coast near Bondi, Coogee and any of our beaches, but in these places it is quite level. Further up the mountains it is level too, only here it has been lifted up to a height of about 3,000 feet above sea-level.

Have any of you who have visited Katoomba stood on Echo Point and wondered what could have carved the huge valley below? Difficult though it may be to believe, the river far below was the tool that Nature used to cut out this great valley, and this is the way that all the Blue Mountains valleys were made.

Nature carves in an opposite way to a human sculptor. The human sculptor starts with a big chisel and a hammer and, quickly knocking all the rough marble away, puts the finishing touches on his work with small delicate tools. Nature ends her work of erosion by using a big carving agent like a river. Let us see how she begins. Let us imagine our Blue Mountains before any streams had started to cut through them.

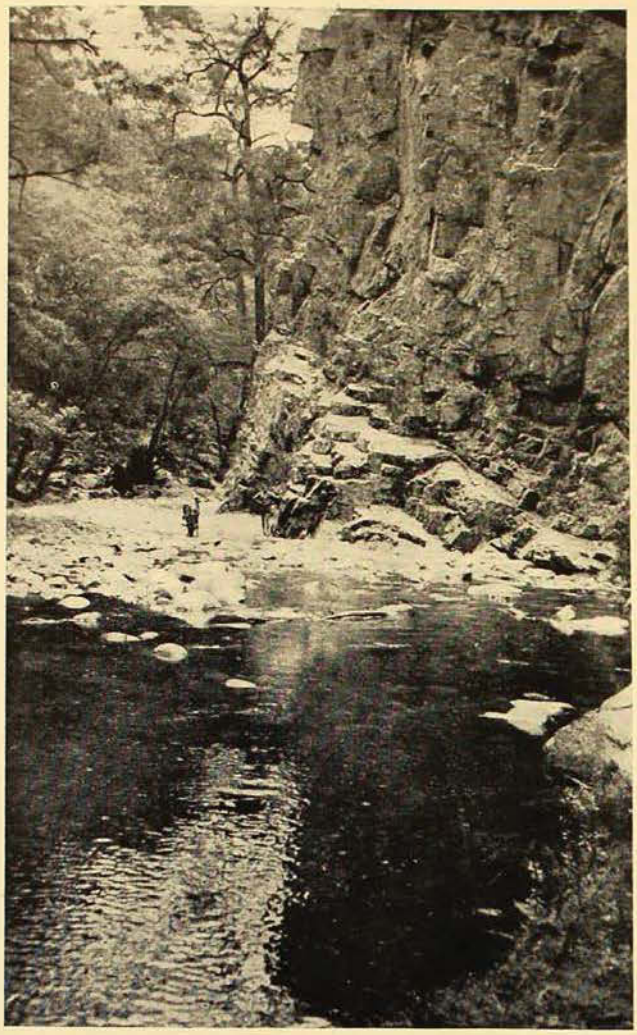
First the rain soaks into the rocks and softens them. Rain contains small quantities of the gas that we breathe out, the gas known as carbon dioxide, and this enables rain to disintegrate the rocks chemically. Rocks are often covered with little patches of moss and lichens. These help to retain water against the rock surface and thus aid the work of decay. The roots of plants growing on rock surfaces, although small, push their way into

the tiny cracks and crevices in the rock and help to break it up. After all these things have been going on for some time the rocks become covered with a blanket of powdered rock material which we call soil. If this were allowed to remain there it would protect the rock from further attack. However, it does not remain in position, or *in situ* as the geologist says, because further showers of rain beat down on it and cut furrows, removing the soil. The muddy appearance of little rain streams in the bush indicates this. In time these rain-cut gutters become larger and larger with each following shower, and they turn into creeks and finally into rivers. Nature makes use of other aids in cutting away the rock and the soil. Fierce winds blow small particles of sand against the rocks and wear them away. Frosts help too, because when water freezes in the little cracks in a rock it forms ice and expands. The pressure of this, although it may seem small, will shatter rock in time. All this loosened material is eventually brought to the river, which then proceeds further with the work of cutting its valley. It seems incredible that a placid rippling mountain stream, cold and crystal clear, could ever cut out a valley. Yet look at the same stream in flood. It has become a raging torrent. It has overflown its banks and is a brown muddy colour. This colour is caused by all the rock material that has been cut out by the river itself and also brought to it by the agency of wind, rain and frost. In flood time the river cuts its valley away not only by the force of the water but by the banging and scraping of this rock material, of all sizes from boulders down to fine mud, against the sides of the valley. Thus the river's rate of work is tremendously increased in flood time. It has been calculated that if the speed of the stream be doubled it can carry sixty-four times as much material as before.

The shape of the valley cut by a river depends largely on how hard and resistant the rock is. In very hard rock the river uses up all its strength in cutting downwards and a steep-sided narrow valley results, known as a gorge. Gorges are also found near the headwaters of rivers, because there the streams, being small and not very strong, use all their strength in cutting down. In softer rocks we find wider valleys with gently sloping sides, and little creeks and other tributary streams coming in from side valleys. Our old friends rain, wind and frost can act more effectively on the sides of a valley in soft rock and can help the river by widening the valley.

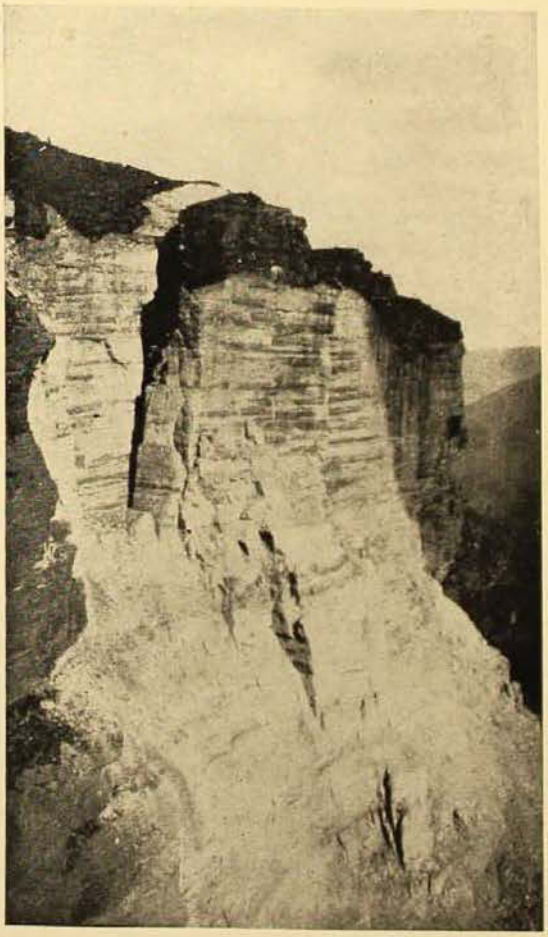
The great Blue Mountain valleys illustrate all these types of valleys. The top parts of these valley walls consist of upright bare sandstone walls, showing us that when the rivers formed in this hard

The Jenolan River after it has emerged from the granite belt. It has widened its valley considerably here because it flows through much less resistant slates.
Photo—
R. O. Chalmers.

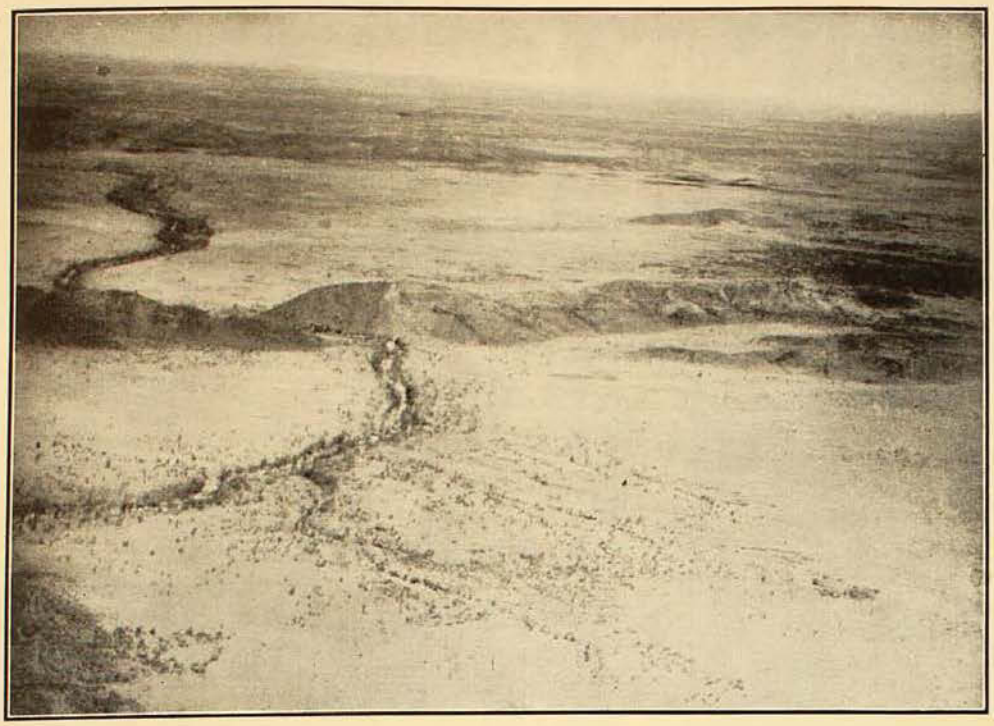


After leaving the soft slates the Jenolan River encounters a very hard, resistant quartzite series, and once more the valley assumes a gorge-like character. A large cliff of quartzite is shown, marking the start of the canyon.
Photo—R. O. Chalmers.

sandstone they were only strong enough to cut steep-sided gorges, partly because they were in the stage of extreme youth and partly because of the resistant nature of the sandstone. In time, however, they sawed their way right through this sandstone and started cutting in much softer rock, so that in the beds of these valleys where the rivers now flow, we find gently sloping, well-wooded banks of soft rock. The way in which these valleys have been widened to their present tremendous size is interesting. Wind, rain and frost gradually cut away the soft rocks under these sandstone cliffs, until they form great overhanging walls. Finally the strain becomes too great and down will crash hundreds of thousands of tons of rock, making the valley a little bit wider than it was before. One of these landslides happened only a few years ago at Narrow Neck, near Katoomba. We may ask what will happen as these valleys get wider and wider? The mountains will be worn completely away and New South Wales once more will become a flat plain with hardly any slope on the ground to make the rivers flow. From our knowledge of geology we can safely predict that Nature will cause another uplift before the mountains are completely denuded, thus giving the rivers a fresh lease of life, or, if the process of denudation goes far enough to make New South Wales once more a mountainless country, Nature will again build more mountains, more rivers will form and the fascinating work of erosion and denudation will begin all over again.



The landslide at Narrow Neck, Katoomba. One large mass of sandstone has fallen and another is about to fall.
Photo—E. T. Hill.



Phillipson's Creek, Central Australia. A mature stream flowing across the plains. A hard, resistant ridge has barred its progress, through which it has cut a gorge.

Photo—
C. T. Madigan.

So far we have been thinking of rivers in the days of their youth, rippling over rocks and boulders, and forming cascades and rapids as they flow along. What happens when rivers leave the mountains and come to the plains? Travelling to the Blue Mountains, everyone will have seen the Nepean, that broad river crossed by the train just after leaving Penrith. It is a wide slow-moving stream and its sources are in the mountainous regions to the south and west. Any of our coastal rivers, such as the Clarence, Manning, or Shoalhaven, after leaving the mountains, flows gently across the plains in the same way. We say that rivers in this stage are in their maturity. There are no rocks and boulders over which they can splash and, like "Ole Man River", they just keep rolling along, except in flood time, when they may flow very swiftly and overflow their banks. On each side of these mature rivers, sometimes for as far as the eye can see, stretch great flat banks of rich soil. Soil forms from the broken rock material washed into the river and used as a cutting agent when the river is widening its valley. As the river cuts deeper and deeper into the mountains it becomes bigger and all the time keeps adding to its load of rock material of all sizes. By the time it reaches the plains it is carrying great quantities of mud and sand. In the case of very large rivers the amount of fine particles in suspension may be so considerable that the river will always be muddy in appearance. For instance, the Yellow River or Hoang-Ho in China was so called because of this. When these large rivers flood they may spread over their banks for many miles on either side. The Hoang-Ho drowns hundreds of thousands of people every few years when it floods. Whole towns and villages may be swept away. As soon as a river floods its banks its speed is checked and much of the mud and sand is dumped; when the river returns to normal this deposit remains in the form of soil. Reeds and rushes spring up and help to hold fresh quantities of mud the next time the river floods. In this way a fertile soil may be built up through the years by any river. In the more inland parts of our State we see the effects of thousands of years of flooding, in the shape of the Black-Soil Plains of the north-west and the Riverina Plains of the south-west. There rivers have flooded time and time again, building up great flood-plains of

soil which have grown larger until they have joined, forming one vast plain.

The work of a river, the chief agent of erosion, has been described. There is another agent, however, which carves out a valley and deposits broken up rock material. This agent is the glacier, or river of ice,[1] but since this is not an agent to be reckoned with in sunny Australia no more mention will be made of it.

One more aspect of the constructive work performed by a river remains to be dealt with before we can complete our account of the cycle of erosion. The entire burden of sediments is not deposited in the form of flood plains on the river banks. Much of it is transported by the river right to the sea, where it commences to sink. The coarsest fragments sink most rapidly and accumulate closest to the shore-line. Material of medium grain-size is deposited further out in the shallow-water zone, and the finest mud accumulates still further out in the deep-water zone.[2] All this material consolidates to form the sedimentary rocks and remains on the sea-bottom until Nature again marshals her giant forces and elevates these rocks above sea-level to form a new land-mass. The agents of weathering again commence to act and so the ceaseless cycle continues.

[1] Chalmers.—Ice Clad Continents. AUSTRALIAN MUSEUM MAGAZINE, vii, 3, 1940, p. 96.

[2] Anderson.—The Sydney District a Hundred Million Years Ago. AUSTRALIAN MUSEUM MAGAZINE, v, 12, 1935, p. 403.

Notes and News

THE hours of admission to the public galleries of the Australian Museum have been revised recently. They have been altered to:

Mondays to Fridays, 12 noon to 5 p.m.
Saturdays and Public Holidays, 10 a.m. to 5 p.m.
Sundays, 2 to 5 p.m.

The office and scientific departments will be open each week-day from 9.30 a.m. to 1 p.m. and 2 to 4 p.m. for the transaction of business and supply of information.

THE Popular Science Lectures held monthly or thereabouts at 8 p.m., which have been a feature of the Museum's educational policy for a number of years, will probably be discontinued for the present. Last year film talks were introduced, and these were conducted as an afternoon feature. Most likely these will be continued, but further details will be announced in the next issue of this MAGAZINE.

AT the annual conference of the Entomological Society of America, which was recently held at San Francisco, Mr. Anthony Musgrave, F.R.E.S., entomologist of The Australian Museum, was elected an honorary fellow.

AMONGST recent visitors were Dr. W. Willems, prehistorian of the Netherlands East Indies Archaeological Survey, who has done a considerable amount of research work and directed excavations of neo-lithic and meso-lithic sites in Java, Celebes, Sumba, and other Netherlands East Indies islands, and Mr. A. Rentse, of Malaya, an authority upon Malayan numismatics.

MR. G. P. WHITLEY, ichthyologist of this Museum, has been seconded to the Council for Scientific and Industrial Research (Fisheries Division) to assist in the elucidation of edible fish problems. He will be with the Council for some considerable time.

An Interesting New Guinea Phasmid

By A. MUSGRAVE

SPECIMENS of a rare New Guinea Phasmid,[1] together with the accompanying illustration, have recently been presented to the Australian Museum by Mr. F. H. Taylor, Lecturer in Entomology, School of Hygiene and Tropical Medicine, University of Sydney.

This curious leaf-insect, *Phyllium frondosum* Redtenbacher, is a member of the family Phasmidae, a group including those insects popularly termed Stick and Leaf-insects. All these insects are noted for their amazing resemblance to the leaves and twigs of the plants upon which they feed, for, unlike their near relatives the Mantids, they are all vegetarians.

Most of our Australian forms are stick-like rather than leaf-like, a well known exception being the Spiny Leaf Insect, *Extatosoma tiaratum* Macleay, which is found in Queensland and New South Wales. It, however, is included in a different tribe from that of the New Guinea insect.

Phyllium frondosum is a member of the tribe Phyllini (Leaf-like Phasmids), which includes three genera of which representatives have not yet been scientifically recorded from Australia, though the tribe is well represented in New Guinea and the Pacific Islands. *Phyllium frondosum* is a member of a genus which includes the well-known *Phyllium siccifolium* Linnaeus, a species with a wide range throughout India and the Dutch East Indies to New Britain. In the insects of this genus the colour is green, yellowish or reddish, and all the femora, the anterior pair in particular, are flattened into leaf-like expansions, while the apical part of the tibiae may be flattened likewise. The whole body is compressed and suggestive of a leaf, and in *frondosum* the abdomen of the female is deeply indented in the middle to form two lobes at the sides which surpass the end of the abdomen. In *frondosum* the length of the body is about 2½ inches or a little more in length. Dr. Redtenbacher's specimen, which he described and figured in his great work *Die Insektenfamilie der Phasmiden*, in collaboration with Prof. K. Brunner van Wattenwyl, was recorded simply from New Guinea, but the specimen presented by Mr. Taylor, and determined for him by Mr. T. P. Uvarov, is from Maimai via Wewak, New Guinea. In the AUSTRALIAN MUSEUM MAGAZINE, Vol. vii, No. 4, March, 1940, appears an article on the Stick and Leaf Insects of Australia by K. C. McKeown, to which attention is directed to those interested in the members of this quaint group.

[1] See Frontispiece.

The Spiny Leaf-Insect (Extatosoma tiaratum) among foliage; an almost perfect example of protective mimicry.
Photo—K. C. McKeown.

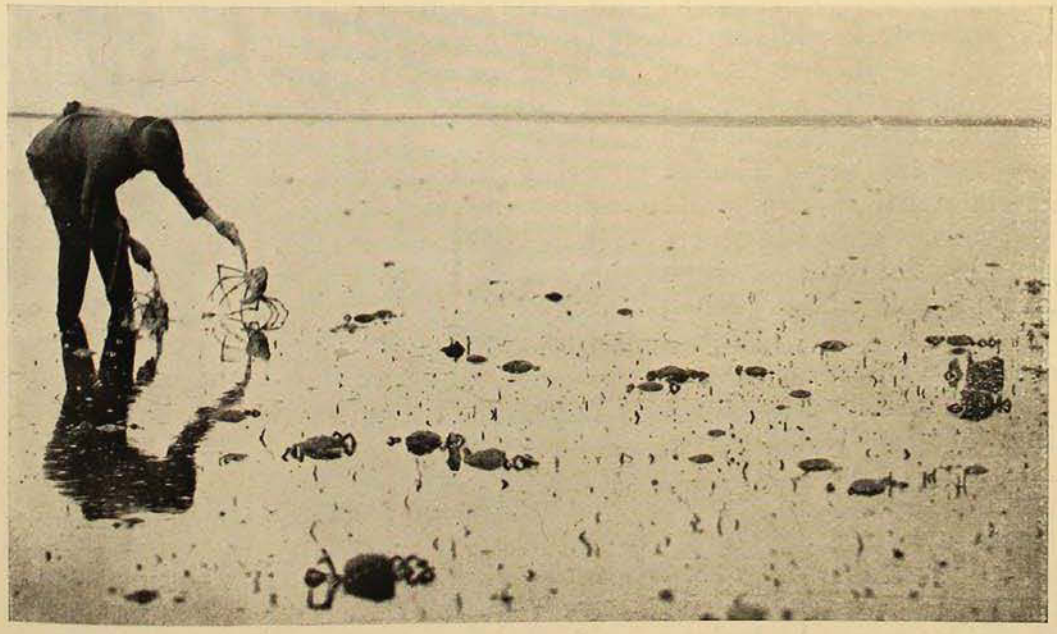
Animal Plagues

By ELIZABETH C. POPE, M.Sc.

ORDERLY as they might appear to be, the affairs of the animal and plant world do not always run smoothly. There are a great many factors operating on populations of living creatures, all pulling and pushing in different directions and all operating at once. When the majority of factors are favourable the numbers of a species tend to increase; when unfavourable, they decrease. It is not therefore a matter for surprise when the balance of nature changes and the attendant conditions favour one species more than others, that the favoured one tends to increase rapidly, and if it gets beyond normal bounds it may become a plague.

Recently an outbreak of green slimy weed occurred in our aquarium to remind us of these plagues. Some factor favouring growth was suddenly brought into operation and caused it to increase to such an extent that the voracious freshwater snails could no longer keep it in check. Soon it became quite impossible to see the inhabitants of the aquarium through the glass walls of the tank.

Such plagues occur in nature more frequently than most people realize, especially in the animal world. This is due to the fact that the power of increase of most wild animals is tremendous and, unless all the natural checks are in operation, a species tends to increase enormously. The immensity of this power of increase may be understood when it is realized that if a pair of rabbits were to be freed in New Zealand (where they would not meet with their natural enemies), they could increase to a population of about nine million in three years even if half of every generation perished. Smaller animals can breed at a greater rate than this, so it is easy to see how they can reach plague proportions in a very short time if not rigidly checked.



Invasion of the shallows of Corner Inlet by the Spider Crab army. The bodies of dead and dying crabs are seen to litter the flats in every direction.
Photo—Sydney "Sun".

The invaders were quite formidable in size. The largest male received by the Australian Museum measured 28 inches from tip to tip of the nipper-limbs.
Photo—Sydney "Sun".

In ordinary times such checks as predatory enemies, parasites, and limited food supply, to mention only a few of the factors, are constantly acting as brakes on increase. However, the numbers do tend to vary despite these checks. Some of these fluctuations are quite irregular in their occurrence, while others happen with great regularity, as though controlled by some stimulus, clock-like in its regularity.

A classical case of regular fluctuation in population is furnished by the small, rat-like lemmings which inhabit the tundras of Scandinavia, Greenland and the north Canadian mainland. Every three or four years a "breeding storm" occurs and a peak of abundance is reached and the lemmings become a plague. In such peak years the lemmings undertake amazing migrations, moving by night in huge swarms. These migrations lead to a huge loss of numbers through accident and disease. The travelling creatures cross rivers and surmount all obstacles, flowing like a river of fur over fences, walls and ditches. Finally thousands reach the sea and commence swimming, just as if it were a gigantic river to be crossed. A case has been recorded where a ship steamed for fifteen minutes through miles of swimming lemmings. Mass drownings result, and none return to their homes, so that the excess numbers are wiped out. What causes these wholesale migrations? Is it a shortage of food, or a change in the weather, or is it to avoid disease? Of the lemmings which never leave on these journeys many sicken and die of epidemic diseases which

attack them. Even some of the migrants succumb to the diseases which break out wherever overcrowding occurs, for the chances of infection are increased under these conditions.

One of the most amazing facts about the fluctuations in lemming populations is that "breeding storms" occur simultaneously in such widely separated areas as Canada and Norway. This would make it appear as though it was some breeding-rhythm born in the species which caused the terrific outbursts of activity, rather than external conditions such as the weather and food supply of the particular part of the world in which they are living.

Even Man himself is subject to "breeding storms", but, since none of us lives long enough to see the full course of a cycle, most people are unaware of this fact. The period covered by the "Good Victorian Era" is now recognized by scientists as being the crest of the wave of the last great human "breeding storm".

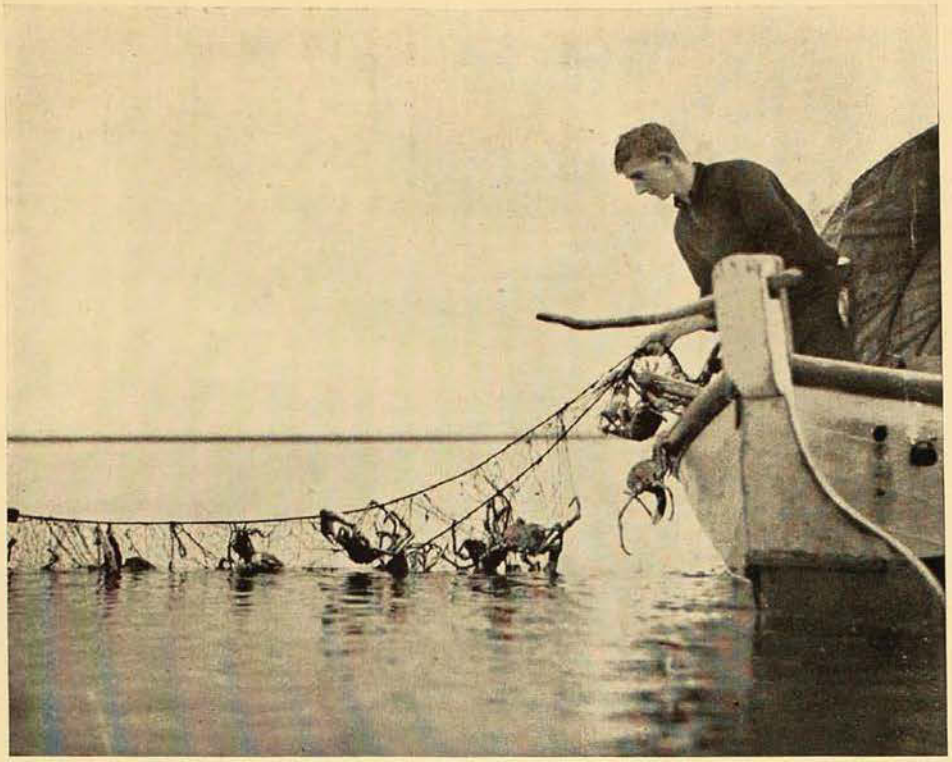
In Australia we have animal plagues which are similar to those from overseas. Who does not remember years when we read about disastrous plagues of mice or locusts in the country, or were subjected to the discomforts of a flea plague similar to the one now occurring in the eastern suburbs of Sydney?

Our locusts resemble the lemmings in that, in years when favourable weather and food conditions lead to an enormous increase in population, a peculiar instinct to mass together and to form dense swarms makes itself felt. These dense swarms migrate for considerable distances from their breeding grounds—travelling together, resting together and eating together. They cause great damage by stripping the surrounding countryside of all vegetation. In the years between plagues the locusts form sparse populations and show no tendency to migrate. The swarming and migrating instincts only manifest themselves when populations are greatly increased.

The occurrence of plagues among land animals is common knowledge, but not so many people are aware of the great outbursts of breeding activity that take place in the sea. Some of the marine "plagues" are actually beneficial to man, since they ensure a great increase in the foodstuffs of the fishes. Every spring and autumn in the coastal waters of New South Wales this outburst of activity occurs among the plankton—the minute drifting plants and animals of the sea. Occasionally in Sydney Harbour we have visual evidence of plankton plagues when the waters of the harbour suddenly show patches of "red slime" or the so-called "red tides" occur. At these times it occasionally happens that someone writes to the papers complaining that the water is being contaminated by blood from the abattoirs. The true cause of the redness is the presence of millions of microscopic creatures called Peridinians. Just as was the case with the lemmings, these tiny creatures exhibit a gregarious tendency whenever their numbers become extraordinarily high and they remain massed together as they multiply rapidly. These Peridinian plagues cause widespread mortality among the fishes and molluscs, possibly by choking up their gills. A particularly destructive local visitation occurred in 1891 and a smaller plague in 1913–14.* A more recent epidemic of Peridinians was noticed in the harbour in 1936. It is interesting to note, in passing, that, so far, the plagues of these creatures have occurred at intervals of about twenty-three years, and this points to the possibility of the existence of a regular cycle.

One of the most unaccountable animal plagues in Australia was the invasion in 1933 of the shallows of Corner Inlet, Victoria, by hordes of the Spider Crab, *Leptomithrax spinulosus*. Hitherto known only from deeper waters, for it had constantly been taken in trawls in 40–50 fathoms off the south-east coast of Australia, it suddenly forsook its former habits and marched in armies towards the shallows. The scene was reminiscent of the descriptions of the spider armies in H. G. Wells's story *The Valley of the*

* See AUSTRALIAN MUSEUM MAGAZINE, Vol. ii, No. 11, page 375, "Discoloration of Harbour Waters —A Reason Why", by McNeill and Livingstone.



Victorian fisheries were ruined during the crab invasion. Nets were torn and bottom fishing equipment was either lost or damaged. Photo—Sydney "Sun".

Spiders. Here is an account from an eye-witness, taken from *The Sun*, Sydney, June 9, 1933:

A great array of giant crabs appeared just beyond Corner Inlet at the ebbing of the tide this morning. They covered sandbanks like a thick growth of exotic red plants. They jostled and crawled over each other in the shallows.

The average size of this monstrous regiment was thirty inches from tip to tip, but some were reported to be larger. They have practically no flesh on [in] their distended bodies and claws. They have overwhelmed the outer fishing grounds. They have cleared the sea-bed of all growth and lie like a red carpet spread over the sand.

The evidence at Corner Inlet suggests that this is not a passing plague, but the climax of a pest which has been developing for the last two and a half years. . . .

Flounder fishermen at both Port Welshpool and Port Albert have been compelled to cease operations, as the crabs have torn their nets to shreds.

No one can say why these crabs suddenly increased so, and migrated to the shallows. Perhaps it was a case similar to that of the lemmings. Perhaps they came inshore to mate or to spawn, but if this was the case, why have invasions not been recorded before? As no investigation of conditions was made at the time, the true cause must remain shrouded in mystery. Whatever the causes, the loss of life by misadventure was colossal. The crabs ruined the Victorian fisheries during their visit, for they scoured the bottom of its fish and fish food, and they caused wholesale damage to equipment.

Large-scale migrations of land crabs are recorded where the adults travel by night from the tropical bush to the sea and there mate and spawn, for they are still dependent on the waters of the ocean for the upbringing of their young. So far, however, the Corner Inlet invasion is the only case of its kind recorded in Australia where crabs from the deeper coastal waters have made large-scale migrations to the shallows.

Similar visitations by crabs from the sea are reported from Alaska, where they occur at regular intervals. Fishermen trade on this habit and catch and can great quantities of them for export. Should the Australian spider crabs make a regular habit of such invasions, it may be possible to turn an event, formerly a disaster to the fishermen, into an asset for them as has been done in other parts of the world.

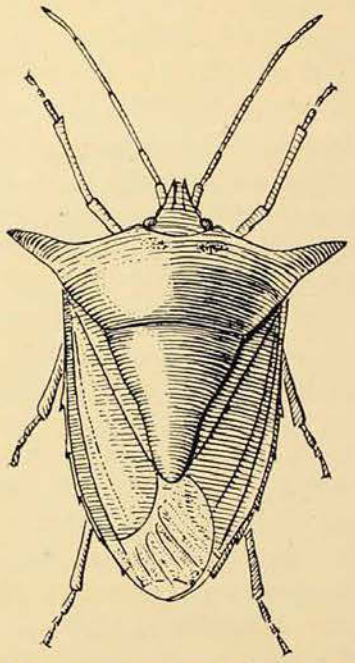
Australian Insects. XVI

The Bugs, Cicadas, etc.—Order Hemiptera

By KEITH C. McKEOWN

THE evolution of the word "bug" is of considerable interest, although its origins are somewhat obscure. Originally a "bugge" seems to have been a ghost or bogey, and is derived from the old Welsh "bwg" or "bug". In 1529, More, in his *Comfort Against Tribulation*, says, "Lest there happe to be such black bugges in dede as folk call devilles", while Coverdale, in his version of Psalm xc [i], declares that "Thou shalt not nede to be afrayed of any bugges by night". Perhaps the ubiquitous Bed Bug (*Cimex lectularius*), with its nocturnal activities, retains some remote affinity with the night-prowling "bugge" of olden days! Later, we find the word used for a person of self-importance, in which the American slang term "big bug" has its origin. It is used in this sense in *Humphrey Clinker* by Smollett, when he writes: "That I'm nine times as good a man as he, or e'er a bug of his country." Finally the word bug became applied to insects of all kinds —a sense in which it is widely used in the United States of America today, where every crawling thing is referred to as a bug. But, to the entomologist, a bug is a member of the order Hemiptera, and especially of the suborder Heteroptera.

The Plant Bugs, Cicadas, Leaf-hoppers, and allied forms brought together in the order Hemiptera are amazingly diverse in form and habit, but all are linked together by one essential character which, without exception, is possessed by each and every species, and is retained throughout life—a tubular sucking mouth. It is a highly specialized organ, perfectly adapted for piercing plant tissue or animal flesh, and for sucking up the sap or body juices. The order is a large one, almost 2,000 species having been described from Australia up to 1926, when the last census was compiled. The world figure stands at about 37,000 species.



A typical bug—a member of the Heteroptera.
N. B. Adams, del.

The wings of the Hemiptera show possibly even greater diversity in form than are to be found in any other order of insects, and for this reason the group has been divided into two clearly defined suborders, the Heteroptera and the Homoptera—usually expressed as Hemiptera-Heteroptera and Hemiptera-Homoptera. There are usually two pairs of wings present, but even here it is impossible to be dogmatic, for the wings may be reduced to a single pair, or the insect may be wholly wingless throughout its life. In the members of the Heteroptera the fore-wings are usually strongly

divided into two quite distinct portions: the base thickened, hard and horny, and the terminal portion gauzy and transparent. When at rest the wings are closely folded flat down over the back, with their thickened bases forming a protective covering over the fore-part of the abdomen. The hind wings are diaphanous, and shorter than the fore-pair. In the Homoptera the two pairs of wings are more or less similar in character, but the fore-wings are often toughened, and more strongly coloured than the hind. The wings of these insects when at rest are held like a more or less steeply inclined roof over the body. Where wings are present, in both Heteroptera and Homoptera, they are efficient flying organs, and many of the species are capable of strong and sustained flight.

The habits of the members of the order are as diverse as their form, for we find among them dwellers on land and in the water; insects which are active throughout their life, and others which, after a youthful period of gadding about on six strong legs, settle down into the enclosed life of an anchorite, sealed up in hard wood or under close-fitting covers of wax. To such lengths is this seclusion carried that they may never again enter the world, and their limbs degenerate and may even disappear altogether. Some of the bugs feed upon the sap of plants, others upon mammalian blood, or prey upon inoffensive members of the insect world or other creatures. The predaceous bugs are aptly termed "Assassin Bugs", and some of them have evolved astonishing ways of securing their prey.

The metamorphosis of hemipterous insects is incomplete. The newly hatched larva or nymph is an active little creature, and, apart from its small size and wingless state, bears a general resemblance to its parents, but is soft, and as yet lacks the hardened body walls. The skin is cast six, or rarely nine, times in the Heteroptera, but in the Homoptera the number of moults is remarkably variable, and recorded observations show a wide range. With each moult the bulk of the insect increases, and the wing-pads—at first completely absent—appear and grow steadily larger and more conspicuous until, with the final moult, the insect is mature, and grows no more. Its wings are now fully developed, and capable of flight, and the insect may reproduce its species. The life-history, as set out here,

The Green Monday Cicada. Cicadas are placed in the Homoptera.
Photo, A. Musgrave.

is simple, but even in this apparently straightforward matter it is impossible to generalize and fit everything into a standardized pattern. Nature has a habit of upsetting theories. Among the coccids or scale insects we find the males going through what appears to be a complete, or almost complete, metamorphosis! Such are the pitfalls which await the unwary investigator of life-histories and habits in the world of the insects!

The eggs of the bugs are interesting objects, and show considerable variation in form and size. Some eggs are elongate-oval, those of some of the aquatic forms have the top decked with curious tube-like expansions, the purpose of which is obscure, while the egg of the typical plant

bug is usually barrel-shaped with a clearly defined lid or cap upon its summit, which is pushed off by the young insect when it hatches. Some, at least, of the bugs are provided with a specialized egg-burster to facilitate their escape from the enclosing shell, to be absorbed when the open air has been attained and reappear no more. Its purpose has been fulfilled. The exterior walls of many hemipterous eggs are delicately and strikingly sculptured, and form fascinating objects when viewed under the microscope. Some species deposit their eggs either singly or in clusters upon the surface of the food-plant; others, in slits cut in the plant tissue by means of a specialized ovipositor or egg-placer. Before passing on to other matters, it may be mentioned here that, unlike the majority of insects, some of the plant bugs show remarkable devotion to their eggs and young, standing guard over them, and attempting, at least, to protect them from the attacks of rapacious parasites. Some of these strange species will be discussed in detail in subsequent articles, when their respective families come up for review.

Many of the plant bugs have the power of emitting a nauseous, pungent, "buggy" odour from two glands opening on the lower surface of the body, or, in some species, ejecting a strongly smelling and somewhat irritant fluid, for a considerable distance, from the extremity of the abdomen. Such tactics are defensive, and render the insect distasteful to its enemies. An inexperienced and unsuspecting young bird seizing one of these nauseous insects for the first time is likely to remember the adventure for a very long time afterwards, and treat similar creatures with considerable respect, especially if the insect, as is often the case, wears a livery of bright colours. Such a combination of striking colours and offensive taste or odour, or a sting or other weapon, occurs frequently among the insects.

Certain members of the order, especially the aphids and leaf-hoppers, are capable of an amazingly rapid increase, and calculations running into figures of astronomical proportions have been computed as representing the possible progeny of a single aphid at the end of a given period—provided, of course, that every individual survived. Fortunately, such figures, owing to the unceasing attacks by the enemies of these insects and other factors, which keep their numbers rigorously within bounds, cannot be attained, but they are of considerable interest, even if accepted as a very remote possibility. Réaumur calculated that one aphid might be the mother of no less than 5,904,000,000 individuals during the month or six weeks of her life. T. H. Huxley took the calculation yet further. Assuming that an aphid weighed $\frac{1}{1000}$ of a grain, and that only a very stout man weighed more than two million grains, the tenth brood of aphids—excluding all the generations preceding the tenth—would contain more substance than five hundred millions of stout men. G. B. Buxton, in his *Monograph of the British Aphids*, considers that this figure is an under-estimate, and bases his argument upon the supposition that every aphid lives twenty days, and that, at the end of that period, each aphid shall have produced twenty young—and no more. Then, at the end of three hundred days only, the living individuals would be represented by 32,768,000,000,000,000,000!! Using this figure as a basis, he assumes that their weight would be equal to that of 1,638,400,000 men! But that is not the end! He points out that the calculation implies that no young were produced until the end of, and not during, the first twenty days—therefore, the number at the end of three hundred days would be not less than the fifteenth power of 210!!! The mathematician may work that out, if he pleases, but the average mind reels! In connection with the leaf-hoppers, Perkins has estimated that, supposing each female hopper lays 50 eggs, and the sexes are approximately equal, with six generations per year, the progeny of one female at the end of twelve months would be 500,000,000. So much for figures!!

Many hemipterous insects are important economic pests, and it will readily be seen how great can be the drain upon the sap of a plant when they appear in their millions; but this draining of the vitality of the plant is not the whole tale of injury—the pathological agents of the virus diseases, fire-blight, bunchy-top of banana, and others are transmitted from plant to plant by the agency of some of these sucking insects, while the coccids or scale insects are among the most important enemies with which the fruitgrower has to contend, and many thousands of pounds are annually spent on their control.

The life-histories and habits of the hemipterous families will be considered in subsequent articles.

Review

STRANGE NEW WORLD: THE ADVENTURES OF JOHN GILBERT AND LUDWIG LEICHHARDT. By Alec H. Chisholm, F.R.Z.S. (Angus and Robertson Ltd., Sydney, 1941.) Pp. 382, 24 plates. Price 12s. 6d.

THE name of Leichhardt always attracts attention through the mystery of his passing. Fêted and lauded as a brilliant and successful explorer, it became a problem to account for his later oblivion. The discovery by Chisholm of the diary of an accurate recorder, John Gilbert, who accompanied him upon his first "successful expedition", has solved completely any doubts the student might have had. Because it was obvious from Leichhardt's own publication that the expedition had reached its goal in spite of, rather than due to, Leichhardt's leadership. Gilbert's diary, the basis of this excellent book, was only unearthed through the persistence of Chisholm, and no one was as well qualified to deal with it as the finder, who is a trained writer, an historical student and a good ornithologist. This last is important as Gilbert's diary was in the first place the notebook of an ornithological collector, which, however, developed into an intensive diary of the journey. While the book will be read by many a general reader it will be zealously guarded as an invaluable book of reference by every Australian naturalist and every Australian historical student. It is a mass of information in the latter respect as a great deal of research has been incorporated regarding the personnel of the party, and the men who assisted in its inception. In this connection the dual personality of Leichhardt will be discussed for years to come, the quaint dreamer who succeeded (once) in spite of himself. However, that must be left to others, as we are concerned with the naturalist Gilbert, who became a forgotten martyr to all save students of bird life, and who has now been revealed as a very studious diarist. This point is rightly emphasized as the work of writing an average of 300 words every evening after an arduous day's travel and hardship is a feat worthy of great emphasis. Every field naturalist keeps a notebook of his daily events, but although some may start off at the rate of 300 words per day, very few keep it up for any length of time. This gives a good key to the industry and enthusiasm of Gilbert, and for this result alone this book would have been worth publication. It was known that Gilbert was a good collector, and that the notes, published by John Gould, the Bird Man, in his memorable *Birds of Australia*, were accurate, but otherwise very little was on record. The work contrasts Gilbert's accuracy with Leichhardt's slipshod records of the journey as far as Gilbert went. For unfortunately it was fated that Gilbert, the best bushman and most understanding of the party, should be the one to suffer from his leader's incapacity.

Through that fate his notebook was lost, until now, after nearly a century, its discovery has thrown much light on a little understood occurrence. It is impossible to review a book like this in the ordinary way, as it is so complex in its subject matter. Gilbert and his diary are fully discussed, the life history of Leichhardt, his virtues and failings, excellently portrayed (a book in itself), and notes provided for reference on nearly all the people at any time associated with either man. As a reference work it should be in the library of everyone interested in Australian history.

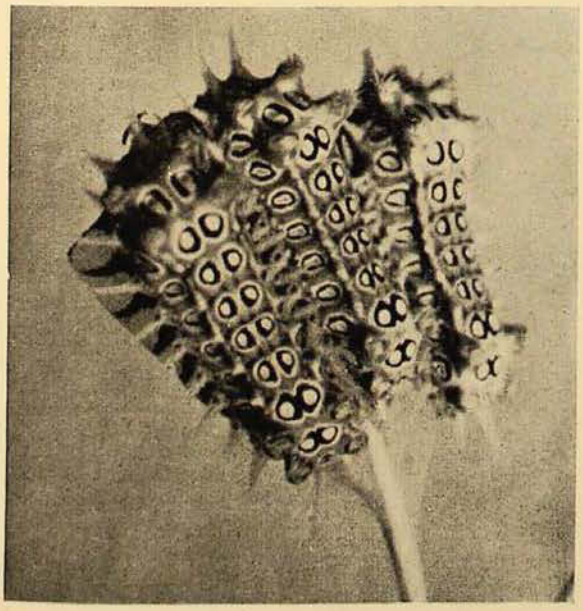
T.I.

The Life-history of the Cup Moth *Doratifera ochroptila* Turner

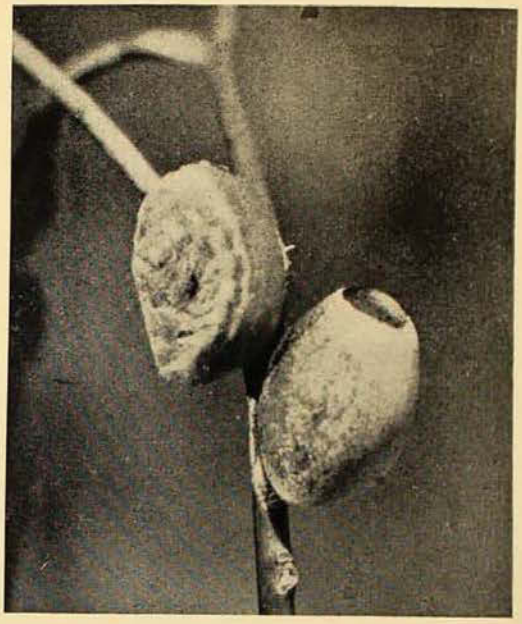
By N. GEARY

CUP MOTHS are members of the family Limacodidae, and the caterpillars with their urticating spines, and the hard oval pear-shaped cocoons are familiar objects on the gum saplings in the bush in eastern Australia. An article entitled "The Cup Moths", from the pen of Mr. K. C. McKeown, appeared in the AUSTRALIAN MUSEUM MAGAZINE, Vol. vi, Jan., 1937. For the first time the larva and cocoon of *Doratifera ochroptila* are illustrated. Specimens of this hitherto rare moth are in the Australian Museum collection, which I collected at Cunnamulla, Queensland.

The larvae of the Cup Moth, *Doratifera ochroptila*, emerge from groups of eggs deposited on the leaves of eucalypts and other trees. On a single gum leaf I have counted as many as eighteen larvae.



The voraciousness of the larvae is remarkable.



The half-made bag, and case, of the Cup Moth.

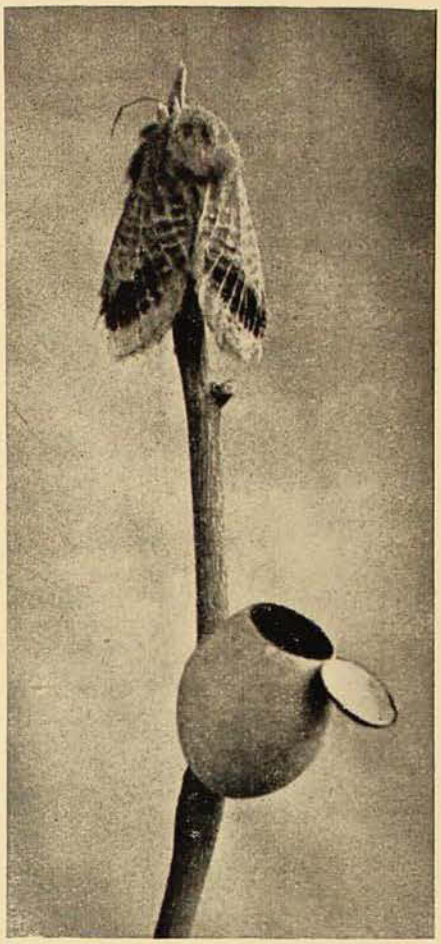
The larvae are ravenous feeders, and eat the whole of the leaf, ribs and all. When the leaves are almost completely eaten, the larvae one by one depart for fresh leaves, but only when they are practically pushed off the leaf by other larvae —a point which is illustrated in the accompanying photograph.

When a larva is ready to pupate, its first action is to eat a small portion of bark from the twig it has selected as a base to its cup or pupal case, and then on the bare spot makes a foundation of silk. The posterior portion of its abdomen is then placed on the pad, and it proceeds to spin a thin film of silk round its hinder part, and gradually builds up this silken bag until the body is half encased. It now turns a somer-

Photos by the author.

sault inside the half-made bag and proceeds to complete it, which it does in a very short time. The larva is now enclosed in a very thin bag. The bag is very elastic and gives to every movement of the larva. From now on all the building of the cup is done from within, but the operation can be seen quite plainly from the outside. The first strengthening of the cup is a strip of about one-eighth of an inch wide which runs longitudinally round inside the cup or bag. This is continued until the whole structure is completed. It is now a beautifully made and weather-proof case. How the cap is constructed I could not determine, but it is perfectly made, and when the moth is ready to emerge it comes off as neatly as if it had been cut with a razor.

The time taken to complete the cup is about two hours, and it takes about twelve hours to harden. The silk is emitted from the mouth, and not as in spiders from the spinnerets at the posterior end of the body. The larva appears to regurgitate the liquid silk, and then to spread it with the mouth; one can distinctly see small lumps coming up through the body to the mouth.



The newly emerged moth. Observe the neatly-hinged cup.

Review

RECORDS OF THE QUEEN VICTORIA MUSEUM, Launceston. Vol. i, No. 1, 15 January, 1942. (City Council of Launceston, Tasmania.) Cr. 4to, pp. 1-62, 12 plates.

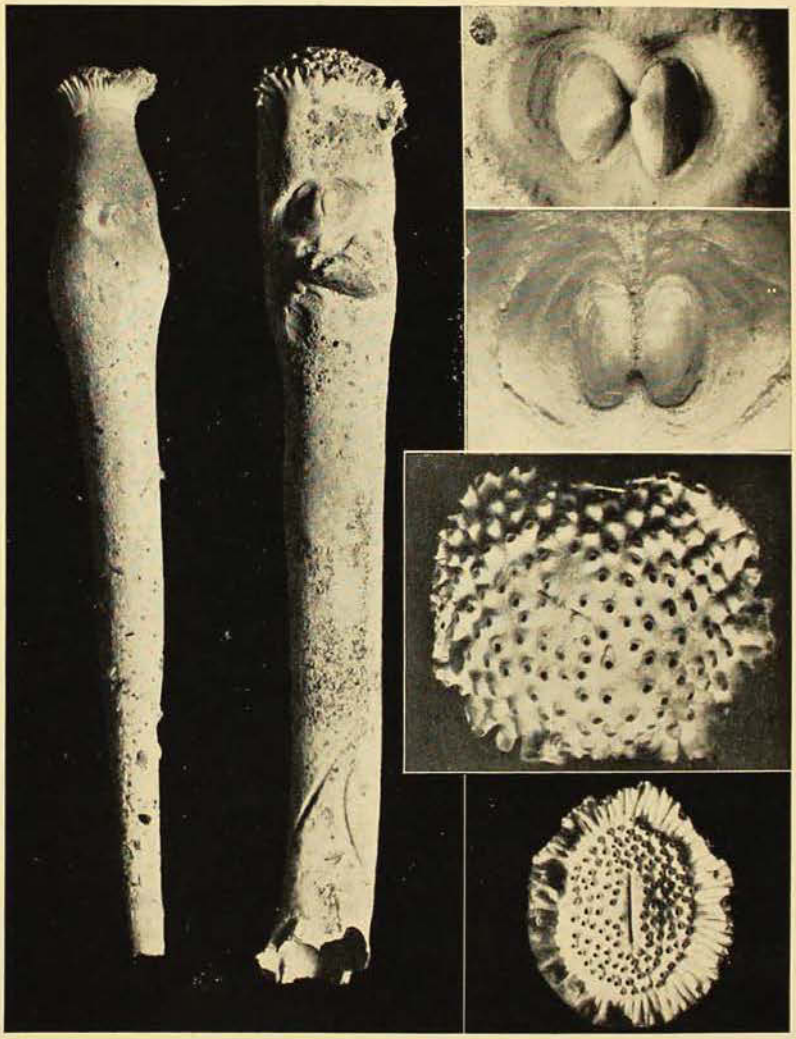
THE Queen Victoria Museum, Launceston, Tasmania, one of the smaller institutions of the Commonwealth, has earned a very creditable name and position amongst our cultural institutions. This is largely due to its former Curator, the late H. H. Scott, during whose régime it published a series of Museum brochures. Now under the control of Mr. E. O. Scott, it has just issued the first part of its "Records". This publication, excellently produced, cannot do other than enhance the good name of the institution. This issue contains no less than seven papers, each a worthy contribution to our knowledge of the natural sciences of Tasmania.

The City Council of Launceston is to be complimented upon its institution, and the Tasmanian State Government also for the generous aid it has granted towards publishing. Incidentally it may be remarked that some of our mainland cities might well pattern themselves upon Launceston's example and contribute something to the cultural development of the Commonwealth.

The Watering-Pot Shell

By JOYCE ALLAN

A STRANGE creature builds the Watering-Pot Shell. Though only a tiny bivalve mollusc, it outgrows its original bivalve shell and builds a greater one in the form of a shelly tube, enlarged and perforated at one end, like the spout and rose of a watering-pot. The two insignificant valves of the true shell can be seen cemented to the wall of the trumpet-shaped tube, just beneath the perforated base. The tube is produced by secretion from the cuticular surface of the animal, and may reach a length of seven inches, though the shell itself may be only a few millimetres long. The base of the tube, which is often elaborately ruffled round the edge, has minute shelly tubes, perforated at their tips. Into these extend fleshy processes from the surface, or mantle, of the animal. Through the opposite end of the tube protrude two fleshy tubular siphons, by means of which water containing nourishment is taken in and waste products are thrown out. All the organs of the bivalve mollusc are changed to suit its life in the new abode.



Watering-Pot Shells (Aspergillum).
Upper right: Valves of the true shell which may also be seen attached to the tubes. Lower right: The roses of the spout.

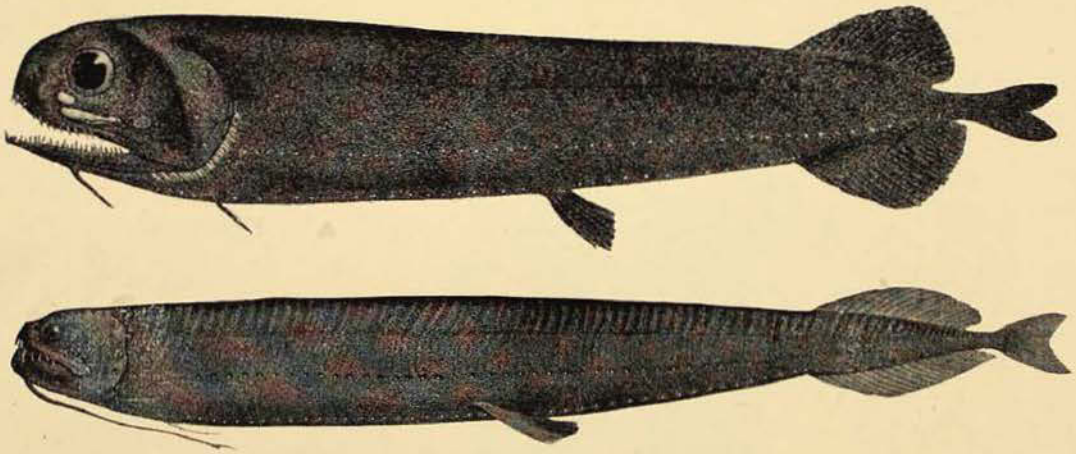
Watering-Pot Shells live in sand, mud, or coral growth near low tide mark, from the Red Sea to Australia. Beautiful specimens are sometimes found in north Australia. Their peculiar shape, quite distinct from a typical bivalve pattern, is designed to line the burrow in which the animal lives. This tube-building habit occurs in a few other groups of molluscs, a notable one being the shipworm or Cobra. In this case, however, the shelly tube lining the burrow is very delicate, and the bivalve shell is not cemented into the wall, but is exposed at the end of the tube farthest from the surface of the wood in which the shipworm has burrowed.

Deepsea Blackout

By G. P. WHITLEY

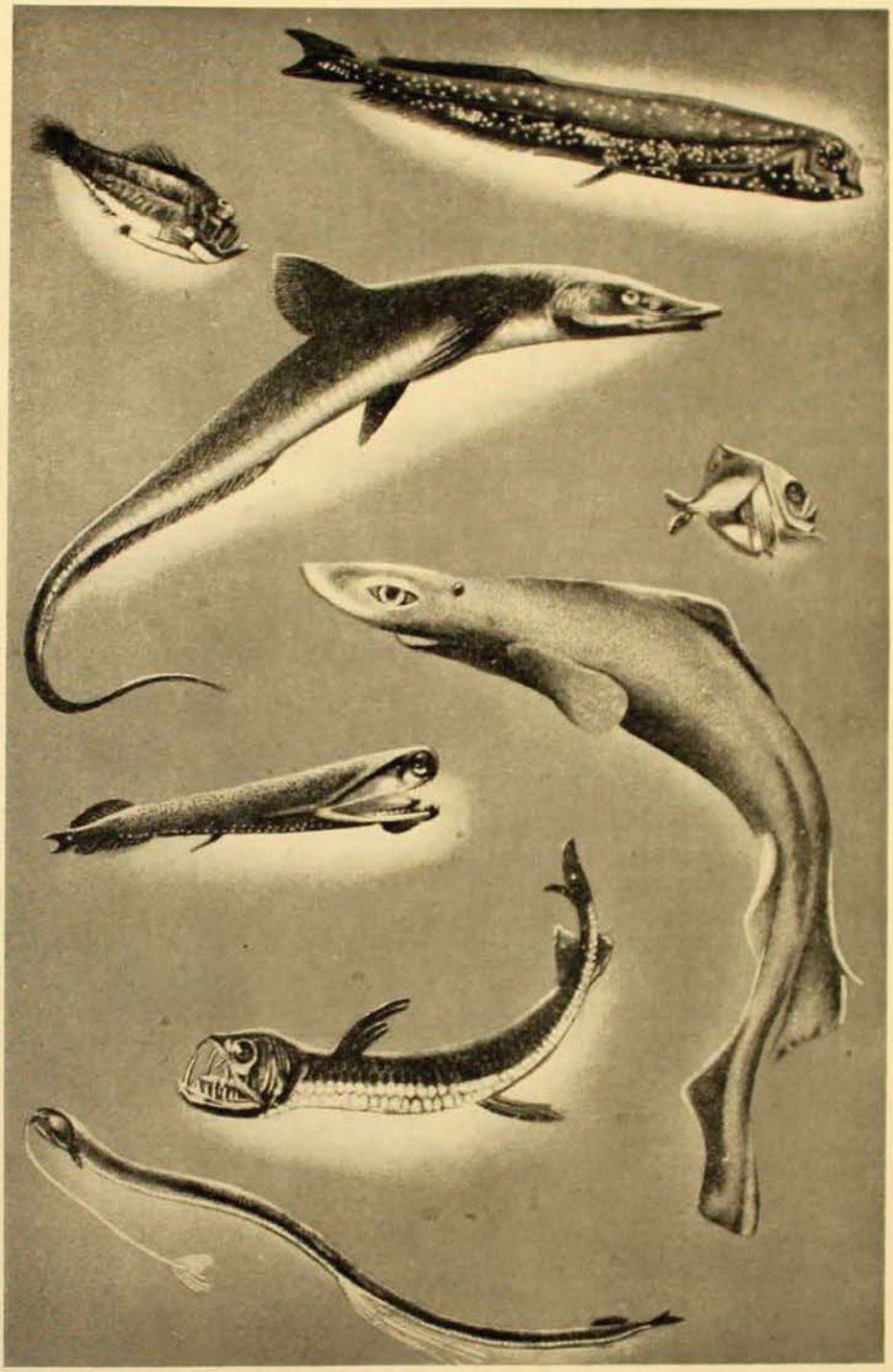
FOR thousands of years, blackout restrictions have been imposed on certain areas not far from what are now the most populated parts of Australia. Yet very few persons have ever heard of the places concerned and nobody has ever visited them. I refer, of course, to the great depths of the ocean, beyond our continental shelf, where in water between 200 and 2,000 fathoms deep no sunlight penetrates, there is no plant-life, and all is cold and black. The inhabitants of this miserable region are certainly out of the range of air raids, for the air is so far above them that it belongs to a different world and any "rain" from above is welcome as manna, for it consists of falling food. The fishes, squids, worms and crustaceans of these ocean depths have assumed grotesque forms to suit the terrific pressure to which they are subjected and, to relieve their gloom, have evolved their own luminescence, some of them being adorned with regular rows of light-organs or photophores, like lamps or glowing portholes along the sides of ships (before the war).

Many of the fishes have huge goggly eyes to pierce the gloom, but whereas these eyes are often telescope-like and looking upwards (the "roof-spotters" of the deep), their luminous organs are arranged along their *lower* surfaces. Thus whatever the latter illuminate cannot be seen by the "roof-spotter". Either the luminous organs are useful for keeping fishes together in a school or else they are, in my opinion, extra "eyes" themselves. The organs, known as photophores, vary in different fishes. Parts or all of many different animals, both land and marine, are luminescent, but in the photophores the light is concentrated into definite small "lamps".



These fishes were trawled by the "Challenger" off the Australian coast at a depth somewhat greater than 2,000 fathoms. The light organs, or photophores, which may be likened to torches, are arranged in regular rows. These provide the luminescence.
After Gunther.

Photophores are developed in diverse deepsea creatures (certain squids and crustaceans as well as fishes), and vary from luminous glands and channels, or "phosphorescent" areas to eye-like organs with "blinds" and reflectors. In the Baldfishes (family Alepocephalidae) they are fairly simple and distributed over the body, but in other deepsea fishes the photophores are arranged in very definite



These fishes, residents of great depths, have developed weird shapes due to the great pressure. Their photophores are arranged in various ways, some like portholes, others in groups, whilst the angler fish has a luminous bait.

After Plehn.

groups which must be carefully studied by anyone wishing to classify the species. In the Headlight Fish (*Collettia*) luminous organs in front of the eyes gleam like the lamps of a vehicle.

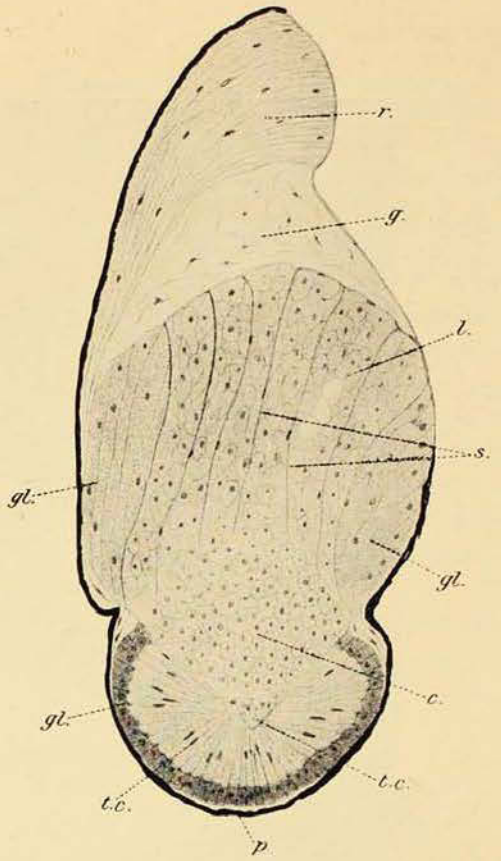
Some fishes actually have colonies of bacilli, living on or in them, which give off light. *Anomalops* and *Photoblepharon* (not yet known from Australia) are examples from volcanic crater waters.

Some of the Soldier Fishes (*Acropoma, Fodifoa, Adenapogon, Siphamia,* etc.) have siphon-like tubes in the body which are probably luminous organs, as are the channels found on parts of the bodies of the Rat Tails and Grenadiers (*Malacocephalus* and other Macrouridae). The Pony Fishes (Leiognathidae) have recently been found to have luminous internal organs which shine through their silvery body-walls.

Deepsea Angler Fishes have a luminous "bait" at the end of their "fishing rods". Another deepsea denizen (*Ipnops*) has no eyes, but a blaze of light shines through the frontal bones of its skull; *Ipnops* has not yet been discovered in Australia.

In the blackout of the ocean there is always a state of emergency or "alert". Some famished fish which may not have fed for weeks may sink its needle fangs into a feebly protesting prey and either take its time to swallow and digest or be joined by others in the silent feast. There is no "first-aid post"—no sympathy for the weak or wounded—and every fish is his own warden. Fear counsels them to dim or douse their lights when danger threatens. Some of the prawns even give off a kind of luminous smoke-screen.

All the animals of the abyss are carnivorous and predaceous (almost as "civilized" as we are, in fact) and are rarely seen unless especially fished out by special nets used by well-equipped expeditions such as the *Challenger* and *Dana*, about the only two to have visited Australia. Some of these remarkable catches are figured in this article. It is hard to visualize these as relatives of herrings and salmon—how far have the "speckled beauties" gone astray and how have the silver herring fallen to assume the weird or ghostly aspects of these bizarre fishes of the ocean blackout.



Sectional view of a bottle-shaped photophore of the fish Stomias. The organ has been cut lengthwise to show its structure. It consists essentially of an outer, non-reflecting pigment sheath (p.), within which is a lining of glandular tissue (gl.) which produces the substances responsible for light production. The remainder of the organ is made up of structures which magnify and reflect the light. These include the conjunctive tissue (t.c.), the crystalline lens (c.), the conducting tissues (s. & l.), a gelatinous body (g.) and the reflector (r.).
After Nusbaum-Hilarowicz.

The work of William Beebe in the Atlantic has done much to popularize the study of the creatures from a "half-mile down", and in recent years some American millionaires have made a hobby of the collecting of rare deepsea fishes.

Further research on this fascinating subject must, however, be deferred until the ocean highways are safe again for travel and the war-torn world settles back to recreation and the resurgence of science which follows wars and revolutions.

Interesting Meteorite Additions to the Museum Collections

By T. HODGE-SMITH

RECENTLY specimens of two new Australian meteorites have been added to the Museum collection, and they are both of special interest. One is composed of iron and was found in the Tawallah Valley some 48 miles north-west of Borroloola, Northern Territory, and the other, composed of stone, was observed to fall at Moorleah, six miles west of Wynyard on the north-west coast of Tasmania.

The iron has three special points of interest: its shape, its chemical composition, and last, but by no means least, its structure as revealed by etching a polished surface. Its weight as received here was 86¾ lb. and it is more or less flat. The surfaces of many iron meteorites are characterized by numerous depressions called "thumb-marks", but in this case there is almost a complete absence of these.

Most meteoric iron does not contain more than ten per cent. of nickel, but the Tawallah Valley iron contained nearly seventeen per cent. It is the first and only iron from Australia to belong to this class; indeed, there are only twenty-four of this class recorded previously.

Irons of this class have been regarded as having no definite structure as revealed by etching, though some sort of structure has been noted in most of them. It has been left to a young Australian scientist, Dr. A. B. Edwards, Research Officer, Council for Scientific and Industrial Research, to work out the real significance of the structure of this class of iron meteorite by his mineragraphic study of the Tawallah Valley iron. Previously this class has been called "Nickel-rich Ataxite", meaning that it is an iron rich in nickel but without order or structure. Now this name will have to be discarded, and I have proposed the name "Eotaxite" because the definite structure represents the early stages in the formation of the well-known Widmanstätten figures of the more common octahedrite class.

The Moorleah stone, which weighed 19½ lb., is of interest mainly because it was seen to fall. Of the eighty-nine meteorites recorded from Australia only seven have been seen to fall, and incidentally these were all stones. Although the exact day is not known, it fell about 6.30 p.m. in October, 1930. Mr. H. G. Watts, who witnessed the fall, said that it first started as a streak of fire travelling from east to west. Then suddenly a loud explosion took place, followed by a number of smaller ones which resembled the back-firing of a motor car. Mr. Watts had the uncomfortable experience of hearing the stone fall with a whine like that of a bullet. Next morning, when his father discovered the meteorite, it was realized that Mr. Watts had been standing only thirty chains from the spot where it landed.

Another interesting addition to the collection is a specimen of the Murnpeowie iron weighing 2½ lb. The iron originally weighed more than a ton, actually 2,520 lb. It was found in August, 1909, by an aboriginal on the Beltana Pastoral Company's Murnpeowie Run, and sixteen miles north-east by east of Mount Hopeless, South Australia. All writers, including myself, have previously credited Mr. L. L. Smith as being the finder. Mr. Harley E. Hooper, Curator of the Technological Museum, Adelaide, South Australia, carried out a considerable search to establish the fact that an aboriginal was the real finder.

A portion of the Tawallah Valley iron weighing 66½ lb. is displayed in the Museum Gallery, while another piece weighing 86¾ lb. is in the collection of the

Geological Survey, Department of the Interior, Canberra, A.C.T. A portion weighing about ¼ lb. of the Moorleah stone is shown. The main mass of this stone will be displayed in the Queen Victoria Memorial Museum, Launceston, Tasmania, for at least a year, but it is to be hoped that it will remain there permanently. Casts of both these meteorites are displayed with their specimens.

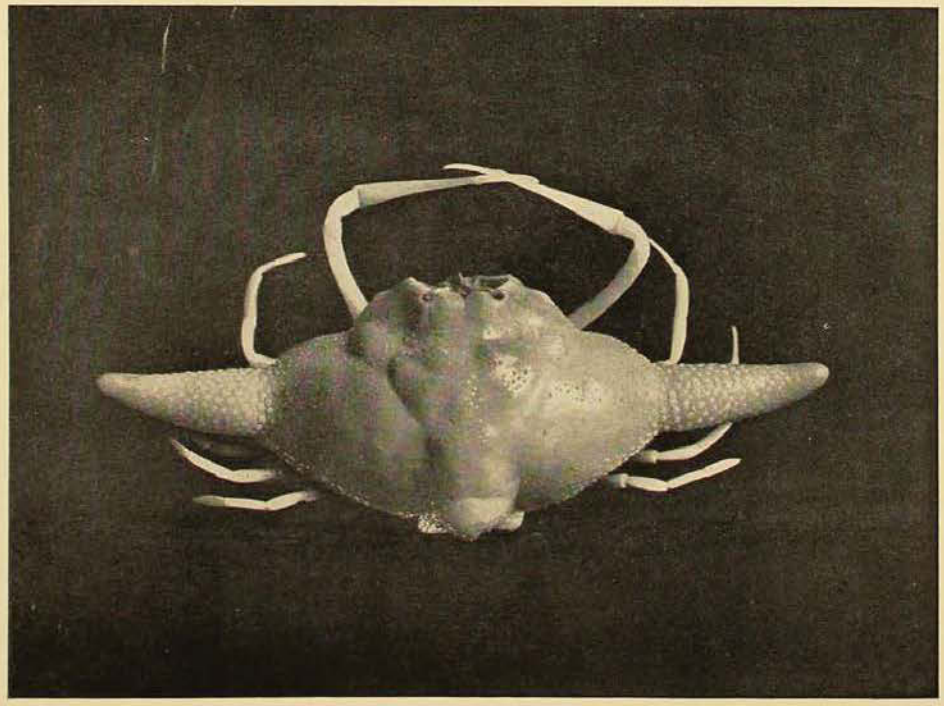
A Crab Wonder

WHO ever heard of a crab with horns? Strange as it may seem, such a creature does exist.

As a group, the crabs are outstanding for their variety of form and their modifications. There are kinds stocky of body and limb for a hardy life on reefs. Other lanky-limbed delicate types are peculiarly suited for a life among seaweeds. Swimming and sand-burrowing crabs have evolved terminal joints for paddling and shovelling. One family even simulates eroded fragments of dead coral, and another the smooth rounded pebbles of the sea floor. To the latter belongs the subject of this note, *Ixa inermis*—a variety unique among its kind. The quaint shape is beyond all comprehension. It is not an imitation of anything calculated to ensure immunity from detection. Perhaps it depends solely upon a most uncrab-like appearance to hide its true identity. The delicate nippers and walking limbs are ridiculously fragile against the awkward heavy body which appears to have evolved along mistaken lines.

This crab wonder is rare. Although it was first discovered in the East Indies one hundred years ago, only a limited number of examples have since been collected. The range of distribution extends to the shallow waters of the tropical Queensland coast. The specimen illustrated (natural size) is from Port Denison, Queensland, where it was discovered on the surface of a sandbank from which the tide had receded. The collector stated that several have been found by local people on the beaches after very heavy weather, and the species is considered a great rarity.

F. A. McN.



Ixa inermis, a crab which simulates the smooth worn pebbles of the sea-floor.
Photo—
A. Musgrave.

The Striped Possums of Australia and New Guinea

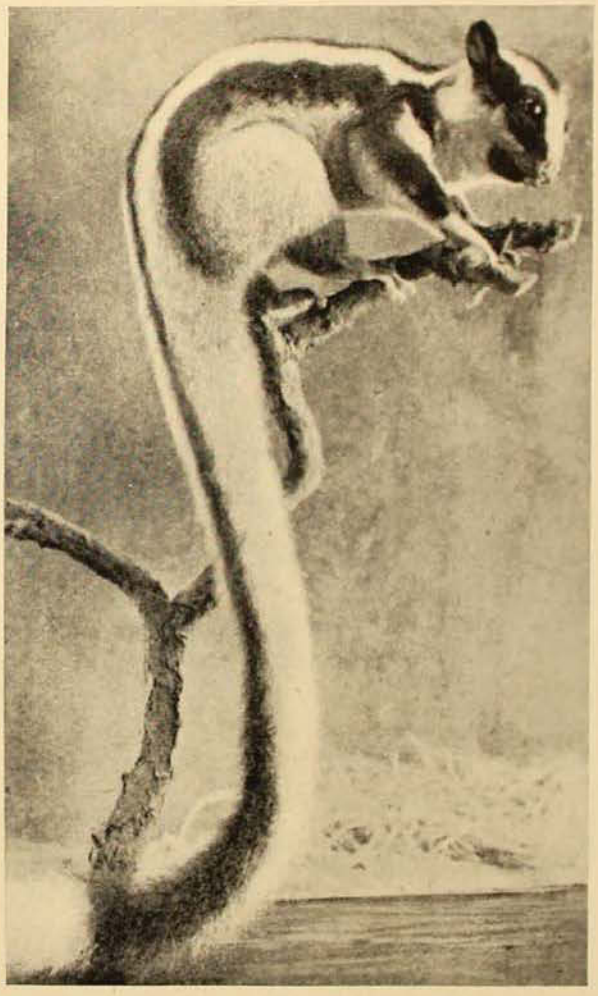
By ELLIS TROUGHTON, C.M.Z.S., F.R.Z.S.

ALTHOUGH the word "opossum" of the North American Indians refers to an entirely different family of marsupials, it has been applied commonly to one of the Australian families ever since Captain Cook's naturalists observed an outward resemblance in a ring-tail possum at Cooktown in 1770. Both families have the limbs and tail adapted for climbing, with the great toe opposable to the others in a thumb-like way, and the tail either surrounded, or tipped below, with roughened skin for a gripping or prehensile action.

The Australian possums, however, are less inclined to the mixed and largely flesh-eating diet of their distant American cousins, being more exclusively tree-dwellers, feeding either upon the primitive ancestral diet of insects, a cultivated diet of foliage, blossoms, and honey, or a mixed menu of such arboreal commodities. This difference in diet is naturally reflected in the herbivorous development of the molar teeth, as well as by the reduction of the lower incisors to two flattened and forwardly directed teeth, a feature also common to kangaroos.

The structure of the foot provides another important character, common to kangaroos, and bandicoots also, which distinguishes the Australian possum family from the American kind. The second and third toes are conjoined so that they appear as a single digit with a double nail, in what is known as the syndactylous condition. As early as 1839 Sir Richard Owen expressed the view that the divided nails of the combined toes provided a comb for cleansing the fur, involving degeneration of the digits. On the contrary, the individual muscles of the toes have been rearranged to control the compound toe as a single unit which, though useful as a scratching implement, originally evolved as a tree-climbing adaptation of the primitive marsupial stock.

Some natural history books have attempted to popularize the name of "phalanger" for our possums, in reference to this specialized arrangement of the joined toes, but the old-established and more attractive name has definitely come to stay. No single term, however, could indicate the amazing variety of kinds



The Striped Possum (Dactylopsila picata) of north-eastern Queensland. Note the elongated fourth finger of the right hand.
After Lucas and Le Souef.

evolved within the Austro-Malayan region such as the first-named phalanger or Cuscus of New Guinea and Cape York, the cause of reports of monkeys on the Peninsula, the honey-eating,[1] ring-tailed, brush-tailed, and gliding[2] possums, as well as the quaint striped creatures which are the subject of this article.

STRIPED POSSUMS: CHARACTERS AND DISTRIBUTION.

As though conscious of their skunk-like black and whitish marking, which is the most striking of all marsupials, striped possums are rarely seen because of their secretive nocturnal habits. The single Australian species inhabits the coastal scrubs and rain-forests of north-east Queensland from Cape York to Clump Point near Townsville, and the high altitudes about the Atherton Tableland. The genus *Dactylopsila*, alluding to the naked appearance of the fingers and toes, was founded in 1858 on a specimen collected on Aru Island by the great naturalist-explorer Wallace; his name has been given to that theoretical "line" or Austro-Malayan geographical barrier which appears to have stemmed the southward march of foreign fauna, subsequent to the invasion by the original primitive marsupial stock.

At least ten species have been described from the New Guinea mainland, but so great is the individual variation in the "football colours" of these odd little marsupials that a full team might easily be mustered, without due regard to their essential specific characters. According to my examination of original specimens abroad, including those of five species at the Berlin Zoological Museum in 1930, the ten listed are reducible to five definable species, including the original white-footed one of Aru Island and north-west New Guinea, the black-footed *melampus* of the south-east, and a doubtful one named *hindenburgi*; also one with a remarkably bushy tail, spreading wider than the body, which was described from the Weyland Range in Dutch New Guinea by the late Lord Rothschild and Captain Dollman of the British Museum in 1933.

The fifth and most distinct species is placed in a separate genus because of the even greater lengthening of its fourth finger and smallness of the nail, and its more powerful front or incisor teeth. These features, which are to a lesser degree characteristic of all striped possums, are associated with the marsupial's method of obtaining food. The slender elongated fourth finger (double the length of the fifth), with its hooked nail, is used in searching for and picking out insects and their larvae from timber. It is most interesting to note that a similarly specialized digit was evolved, quite independently of course, by the most primitive of lemur-monkeys, the Aye-Aye of Madagascar. Its even more powerful, rodent-like front incisors, likewise used for gnawing out grubs from timber, led to the primitive monkey being first classified as a squirrel. An interesting example is therefore provided of the manner in which similar function has produced remarkably similar adaptations of physical and dental structure in animals of quite distinct zoological heritage.

By a strange coincidence, these rather dainty little possums not only resemble a skunk in colour pattern, but they also exude an extremely pungent odour which, according to observers, should have the skunk-like effect of repelling their enemies, or at least assuring them of undisturbed tenancy of their favourite tree-hollow. Although of glandular origin, the scent cannot be ejected in the "offensive" manner of skunks. According to Mr. David Fleay, the well-known Victorian naturalist, writing of his captive specimen in *The Australasian* of June 21, 1941, the disagreeable scent soon permeates the animal's dwelling place, and even one's clothes if the possum is handled incautiously. This unpleasant capacity is shared, in lesser degree, by its closest relative, the lovely little grey Sugar Glider (*Petaurus breviceps*). It would seem that the striped coloration

[1] Troughton: AUSTRALIAN MUSEUM MAGAZINE, ii, 4, 1924, pp. 127-132.
[2] Troughton.—*Loc. cit.*, v, 8, 1934, pp. 257-264; 9, 1935, pp. 314-319.

is a kind of protective camouflage, rather than a warning design as with skunks.

NATIVE HAUNTS AND HABITS.

Until recently, little was known of the wild or captive life-history of these striking but secretive little possums. Quoting the observations of the noted explorer-naturalist Dr. Carl Lumholtz, Collett wrote in 1887 that they were called "Nolloa" by the aborigines, and were supposed to feed partly on wild honey; only one was seen. Notes from the collector's diary of Dr. Eric Mjöberg regarding two specimens taken in the rain-forest at Millaa Millaa, Queensland, stated that the intestinal caecum was small and the ventricle was filled with half-digested larvae of flies and beetles as well as other insect remains.

The animal was stated to pick out the larvae from cracks in timber by means of the elongated fourth fingers, and to hunt eagerly for nests of small stingless bees of the genus *Trigona*, for both bees and honey. Nests of the possums are made of dry leaves in hollow trees. According to the late Robert Grant, Taxidermist at the Australian Museum for many years, remains of berries and leaves were found in the stomachs of the two which he collected in the Atherton district. He was assisted by four blacks, and one who was searching among the elkhorn and orchid clumps suddenly called out "Tamin!" Roused from their slumbers, the tamin were quite dazed in the daylight, but were soon scampering nimbly amongst the branches, when the blacks said not to shoot as they would catch them alive. A quiet and inoffensive captive at Taronga Park fared well for some time on a variety of food, including condensed milk (a good foundation food for any kind of possum orphan), biscuits, fruit, and lettuce. As with all but the entirely herbivorous marsupials, honey and insects are also relished, and flowering branches should be placed in roomy cages for any captives to hunt through during the night.

I am indebted to David Fleay's article for the following interesting notes about his remarkable little captive, which received much attention as a privileged passenger of Australian National Airways on the 2,000 miles flight, snuggled warmly in a small cage packed around with coconut fibre. Two days after leaving the warmth of the Cairns district it was established in the centrally heated tropical house at Healesville Sanctuary, where Mr. Fleay is Curator, and quickly recovered from a slight cold caused by the rapid transit to the Victorian winter.

The male possum was obtained for study with the enthusiastic co-operation of the Curator of the Civic Park at Cairns, Mr. Leslie Wright, who took the stunned marsupial from a large tree felled in the local scrub. Possibly accounting for the rarity of observation, it is his opinion that the strikingly marked creatures mainly live amongst the tops of large trees, seldom descending near the ground and crossing over by way of limbs to other trees. A female captured later proved much more delicate and difficult to reconcile with captivity and her death was hastened by the spiteful attitude of the male, whose powerful front teeth also left some painful impressions with its captors. When thoroughly annoyed and in biting mood it utters a prolonged gurgling shriek somewhat like, but louder than, that of the better known Sugar Glider, to which it is most closely related, though lacking any trace of the gliding side-flaps.

Careful watching at night has provided Mr. Fleay with some extremely interesting observations concerning the habits of his spectacular captive. Sleeping in a hollow log all day, it is so strictly nocturnal that it has never appeared until several hours after dark, and is most sluggish if disturbed during daylight. Even in sleep it is not typically possum-like in that, though curled into the usual ball, it lies down on its side instead of rolling up in a sitting position. Emerging for the night, it yawns heavily and then settles down to an elaborate performance of its toilet, combing the fur with the nails of its long slender digits.

Thereafter, it is ceaselessly active, moving with a lithe striding action and appearing to "flow", as Fleay says, from branch to branch without ever being observed to make a single jump. The use of the elongated fourth fingers in procuring insect food was clearly observed when loose-barked eucalypt limbs were provided. Running to a new bough the possum vibrates its sensitive hands rapidly on the bark, apparently to disturb the insects beneath. It then seems to locate its prey by a keen sense of smell, after which the bark and slivers of wood are ripped away by the rodent-like incisors with a surprising display of force. If holes or crevices in the timber are deep or narrow, the lengthened fourth finger with its flattened and hooked nail is brought into action and usually some kind of grub is extracted. Sitting up in exactly the same manner as a marsupial mouse or native cat, the possum chews up its catch and then returns for more.

Various fruits, eucalyptus blossoms, coconut, jam, milk, and bread and honey are popular items on the menu. However, the marsupial's pursuit of cockroaches, "wireworms", and termites among the branches convinced Mr. Fleay that not only is it the most exclusively insectivorous of all our possums, but also that the specially adapted sensitive hands are all important in securing the insect food. The large wrinkled wood-boring beetle and moth grubs were the most favoured morsels of all.

The body of the full-grown male from Cairns is described as about half that of a ring-tail possum, though the animal is almost of the same length from nose to tail-tip; the tail of the striped possum therefore being proportionately longer than that of the ring-tail, while it also differs in being evenly haired or "bushy" except for a naked strip under the extreme tip.

The spectific name *picata*, referring to the pied or magpie coloration, was given to the Queensland species when it was separated from the New Guinea kinds. So greatly does the colour-pattern vary that some years ago I made a careful study of the skins and skulls of more than a dozen specimens, ranging from Cape York to Townsville, to check the possibility that a second species was involved. Emerging some weeks later from a sort of marsupial maze of cleft or complete stripes and chin-spots, to the amusement of colleagues interested in their intricacies, it was reluctantly decided to leave the mainland striped possum to its specific single blessedness in the comparative safety of its tropic scrub and jungle haunts.