The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.

The Wellington Caves - - *C. Anderson, M.A., D.Sc.*

Discoloration of Harbour Waters—A Reason Why
F. A. McNeill and *A. A. Livingstone*

The Wunderlich Aboriginal Group

Tambourine Mountain, Queensland - - *A. Musgrave*

The Mystery of Marsupial Birth and Transference to the Pouch - - - - *Ellis Le G. Troughton*

Some Familiar Butterflies - - *Thomas G. Campbell*

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A Tasmanian Red-necked or Bennett's Wallaby (Macropus ruficollis var. bennettii) in a resting attitude, in which kangaroos and wallabies are often seen. Accounts of eye-witnesses also show it to be the attitude assumed when the young are born and making their journey to the pouch. The position serves to shorten the journey and, though the body was probably more erect when observations were made, it is doubtless the characteristic attitude on such occasions.

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VOL. II., NO. 11. JULY-SEPTEMBER, 1926

Editorial.

BLIND VISITORS.

Of the many activities in the field of general education in which the Australian Museum is engaged, perhaps the most appealing is that of lectures or talks to the blind, a function in which this Museum has been engaged for some years. Classes of these afflicted children visit the Museum regularly for instruction in nature study. The instruction imparted is, naturally, more individual than that given to those who can see, and since these classes are small, usually containing not more than ten or twelve children, each child "sees" the article upon which the discourse is based.

The specimens selected for instruction are more or less familar to the audience through everyday conversation — opossum, native bear, wallaby, boomerang, womerah, shells and objects of the sea-shore. The object, when size permits, is passed round the audience and is "seen" by the fingers, and, be it said, it is seen more throughly than by many whom Nature has more generously endowed. The lecturer is plied with questions showing an eagerness to learn, and the size, shape, and general characteristics of the object are comprehended to a degree surprising to the ordinary mortal, and the instruction imparted is retained with remarkable accuracy. At a recent lecture one of our youthful visitors was handling a model of an octopus; his fingers delicately traced, with exceeding care, their way over the exhibit not omitting a detail, however trifling, then passing it to his neighbour he remarked that the shape of the creature's body was similar to that of an electric light bulb—a rather apt likeness.

That these lectures are worth while is shown by the appreciative way in which they are received. Children, who most likely knew little or nothing of the marvels of creation, leave the Museum portals richer in knowledge than when they entered, and, are able to impart to their friends intelligent recollections of their instruction.

By these unfortunate children the lectures are hailed with delight, for the handling of the Museum's treasures presents a new world to them.

THE AUSTRALIAN ABORIGINE.

In this MAGAZINE, Vol. II, No. 7, July-September, 1925, the editorial article made reference to the lamentable fact, patent to everyone, that the Australian blackfellow is fighting a losing battle with his environment. The hope was there expressed that a remnant

of this dying race will for years be enabled to live the wild free life of their ancestors, and it is cheering to find that proposals are being made to set aside a large reserve for exclusive use of the aborigine.

Contact with civilization is fatal to races as primitive as the Australian, well meaning efforts to "civilize" them are doomed to end in failure. There is an incompatibility difficult to define but nevertheless potent in its effect, which renders such attempts hopeless, in spite of the fact that instances can be quoted of Australian blacks who have reached a certain stage of education and training in white man's ways.

There are wide areas of Australia beyond the frontiers of profitable settlement by white men, where, nevertheless, the aborigine, whose prowess as a hunter is well known, could easily maintain himself, and it is to be hoped that concerted action by the Federal and State Governments will result in the establishment of a reserve large enough to ensure the preservation for years to come of a residue of this race, one of the most interesting in the world.

Notes and News.

Dr. G. A. Waterhouse, B.E., F.E.S., was elected a Trustee of this Museum on July 2nd. Dr. Waterhouse, who is one of the world's leading authorities upon Rhopalocera (butterflies) has contributed many important papers to various journals, considerably enlarging our knowledge of this group. His major work, however, is *The Butterflies of Australia* published in 1914, which was written in conjunction with Mr. G. Lyell, another leading authority.

In the pursuit of his studies Dr. Waterhouse formed a fine collection of Lepidoptera which he presented to the Australian Museum some time ago; this ranks as one of our most treasured possessions. Apart from his scientific investigations Dr. Waterhouse is an active member of local scientific societies, having been president of the New South Wales Naturalists' Club (1906-7), the Naturalists' Society of New South Wales (1914-15), Linnean Society of New South Wales (1921-22), the Zoological Society of New South Wales (1924-25), and honorary secretary of the Royal Society of New South Wales during 1923-24. It has also been the privilege of this Museum to include Dr. Waterhouse upon its staff as an Honorary Entomologist, since 1919; he was recently elected an Honorary Correspondent in recognition of the invaluable assistance he has rendered.

Mr. W. W. Thorpe has recently made two trips to the Port Stephens and Newcastle districts to examine aboriginal camp sites. He was successful in acquiring a number of aboriginal skulls and skeletons and a large collection of stone implements from six different sites.

An interesting new exhibit is a series illustrating the structure and peculiarities of *Meiolania*, an extinct turtle remains of which have been found in Australia, on Lord Howe and Walpole Islands and in Patagonia. A description of this interesting form appeared in the last issue of this MAGAZINE.

The Trustees have decided to issue a series of picture post cards featuring some of the most striking members of the Australian fauna. A series of birds is now in preparation, the drawings in colour having been made by Mrs. Tom Iredale. It is anticipated that these will be on sale shortly at a nominal price. Each series will be accompanied by an explanatory leaflet—these cards should prove invaluable to teachers engaged in nature study work.

Messrs. E. Le G. Troughton and A. A. Livingstone of the scientific staff have departed for Vanikoro, Santa Cruz Group, where they will be the guests of Mr. N. S. Heffernan, one of our Honorary Correspondents. The island of Vanikoro is of exceptional interest to collectors as it was visited by the *Astrolabe* under Dumont d'Urville and zoological collections were made, the specimens being described by Quoy and Gaimard. Since then no systematic collecting has been done on the island, and it is hoped that an important series of specimens will be secured by our officers during the forthcoming visit.

The Wellington Caves.

By C. Anderson, M.A., D.Sc.

AMONG the several justly celebrated limestone caves of which New South Wales can boast, those of Wellington occupy a unique position. They are less spectacular than, for instance, the Jenolan or Yarrangobilly Caves, but scientifically they are the most interesting of all because of the vast accumulations of fossil bones which are found there.

HISTORICAL.

As previously mentioned in this Magazine (Vol. II., No. 4, 1924, p. 114), fossils were apparently first discovered at Wellington by George Rankin of Bathurst in or before the year 1830. In that year Major Thomas L. (afterwards Sir Thomas) Mitchell, Surveyor - General, visited the Wellington Caves and made a collection of the fossil bones which were described by Professor Richard Owen of the Hunterian Museum, London, in Mitchell's work, *Three Expeditions into the interior of New South Wales*. This report, prepared in 1838, is of extreme interest to us, for, though brief, it is the first systematic account, with illustrations, of some of the commonest and most striking members of the extinct marsupial fauna of Australia. Here we find the first use of the name *Diprotodon*, and the earliest figure of the characteristic tooth of the so-called Marsupial Lion (*Thylacoleo carnifex*), although it was some years before the discovery of additional specimens enabled Owen to describe and name the animal to which the tooth belonged. Our common Wombat (*Phascolomys mitchelli*) was first described in this report, Owen believing it to be an extinct species. Another interesting fact, first made known at the same time, was the former existence on the Australian continent of the Tasmanian Wolf (*Thylacinus*) and the Tasmanian Devil (*Sarcophilus*), which are now confined to Tasmania.

The " Pleated Skirt," Wellington Caves.
[Photo.—*G. C. Clutton.*

From time to time more specimens were obtained from the prolific bone beds of Wellington, and in 1867 Owen, impressed by the value of the discoveries, communicated with the Colonial Secretary (afterwards Sir John Robertson) suggesting that a careful and systematic survey of the caves might be made by the Government of New South Wales. This suggestion was favourably received, and, in September 1869, under instructions from the Trustees of the Australian Museum, Gerard Krefft, Curator, accompanied by Dr. A. M. Thomson and Henry Barnes, of the Museum staff, proceeded to Wellington and commenced the work of excavation. They obtained a large series of specimens, which were transmitted to Owen and examined and, with others, described by him in a series of important papers. In 1881 the Trustees resumed the exploration of the caves, and, under the superintendence of Dr. E. P. Ramsay, who

succeeded Krefft as Curator, another large collection was obtained.

In the years 1913-1917 the New South Wales Phosphate Company put in a number of drives and shafts near the caves in the search for phosphate to be used in the manufacture of fertiliser. During these operations a number of fossil bones were found, some of which were presented to the Museum.

During April of this year, Mr. G. C. Clutton, Articulator, and myself paid a short visit to the caves to enquire into the possibilities of securing additional specimens, Mr. J. H. Truman, Shire Clerk, having informed us that some exploratory work was being done with a view to improving the caves and installing electric light. At the same time he forwarded to the Museum some interesting specimens which had been secured recently. On the occasion of our visit, which lasted only a few days, we were successful in collecting a considerable number of isolated bones and fragments, and two nearly complete skulls, which are figured in this article. Most of the bones collected were those of kangaroos and wallabies, but jaws and teeth of the wombat, native cat, rat kangaroo, *Thylacine*, Tasmanian Devil, *Diprotodon*, *Thylacoleo* and a number of other marsupials, living and extinct, as well as bones of rodents, birds, and lizards were secured during the short period of our stay. We did not find any monotreme bones, although scanty remains of both the platypus and the echidna have been recorded from the caves.

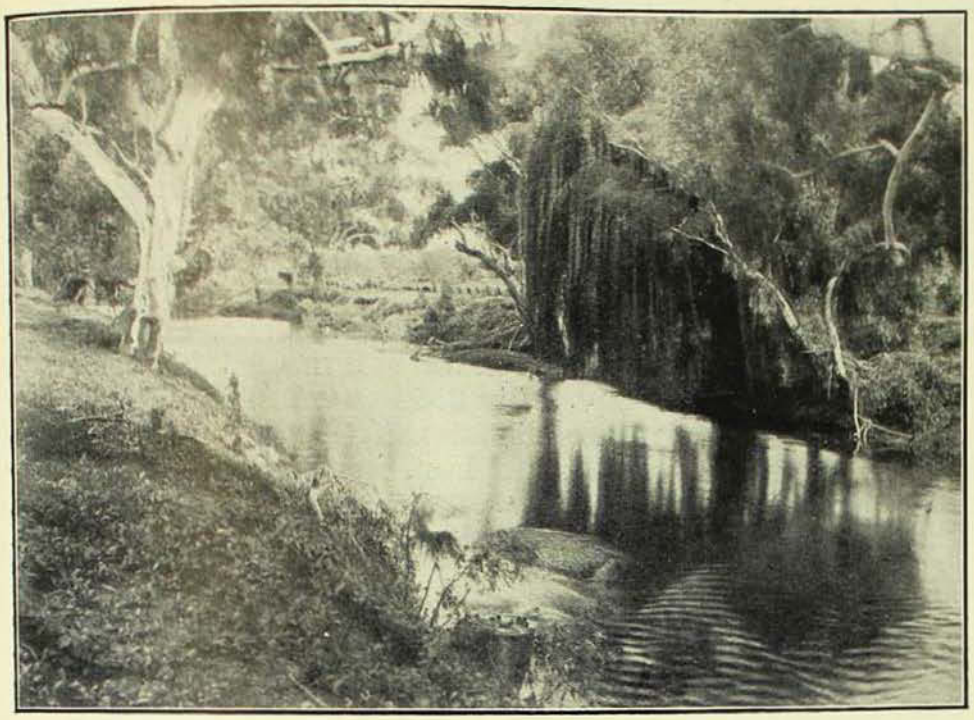
The "Cathedral," Wellington Caves. This huge stalagmite is over 50 feet high.
[Photo.—*G. C. Clutton.*

THE CAVES.

These are situated in the valley of the Bell River, about five miles from the pretty town of Wellington. The entrance to the largest cave is about a hundred feet above the bed of the river, in the upper slope of a limestone ridge. Mitchell entered this cave through a small fissure between large blocks of limestone, but the entrance has now been widened and steps constructed along the passage leading downwards. About 125 feet from the entrance a large chamber is reached, and at 169 feet we encountered an immense stalagmite called the "Cathedral," extending upward almost to the roof, a height of over fifty feet. On one side the wall of this chamber is composed of contorted limestone strata, having almost the appearance of masonry. The nearly level floor is covered with a deposit of red earth, which is prevalent throughout the caves, filling up the vertical chimneys and the openings between the limestone blocks. A little farther on is a peculiar dripstone resembling a pleated skirt. From this chamber proceed a number of ramifying passages, one of which, high up on the wall and reached only by the aid of a ladder, leads to a grotto where a colony of bats have their home. At a lower level a subterranean stream is reached, the waters of which no doubt run into the Bell River.

About thirty yards to the westward of the opening into this cave is the entrance to another of a different type; it was here that Mitchell obtained most of his specimens, and it is now known as the Skeleton Cave. The entrance is a sort of pit, nearly vertical, and the walls are not composed of solid limestone but of shattered blocks, held together by red earth full of bone fragments.

The Gaden Cave is entered on the summit of the hill, and its most striking feature is the occurrence of a coralline growth on the roof and walls, due to the deposit of carbonate of lime from the water percolating from the



On the banks of Bell River

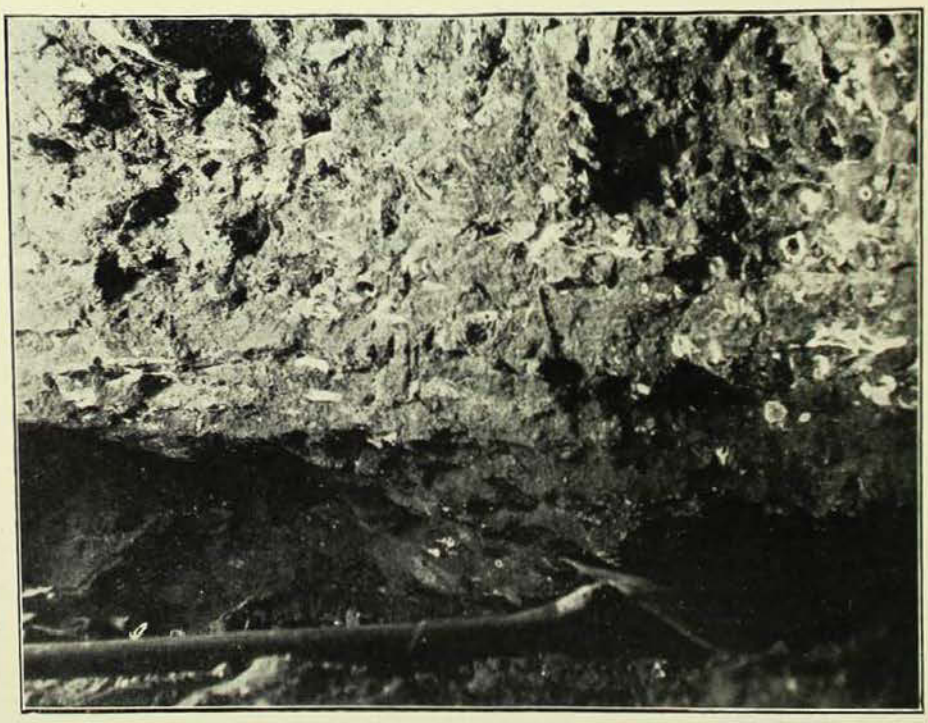
[Photo.—*G. C. Clutton.*

surface and dissolving the limestone in its passage.

HUNTING FOR FOSSILS.

We devoted most of our attention to the passages driven into the hill by the Phosphate Company, for here the prospects of obtaining good specimens seemed to be most favourable. Entering through an open cut near the top of the hill we climbed down over fallen limestone blocks for about seventy feet, then crawled, painfully and with much wriggling, through a narrow cleft, and wormed our way on hands and knees for another ninety feet. Here we found a bank of hard red clay packed with fossils, pieces of jaws, leg bones, teeth, and fragments of all kinds. The appearance of this bone repository can be judged from the flashlight photograph reproduced here. Near this spot Mr. Truman, who accompanied us, discovered the skull of a kangaroo embedded in the roof. After hours of hard work with hammer and chisel we were successful in extracting the skull along with a considerable mass of enveloping matrix. This was conveyed intact to the Museum, where the matrix was carefully removed. It is the nearly complete skull of an extinct marsupial closely related to the existing Great Grey Kangaroo (*Macropus giganteus*), and from its dentition we learn that it was a young animal, for the replacing tooth is still embedded in the jaw and the second molar has not emerged.

Another passage was entered from the level of the river flat, and, at about 100 feet from the point of entry, one of the party noticed a tooth of the Marsupial Lion projecting from the red earth. Working in relays in an exceedingly cramped position, in the course



The "red earth," Wellington Caves, crammed full of bone fragment.

[Photo.—*G. C. Clutton.*

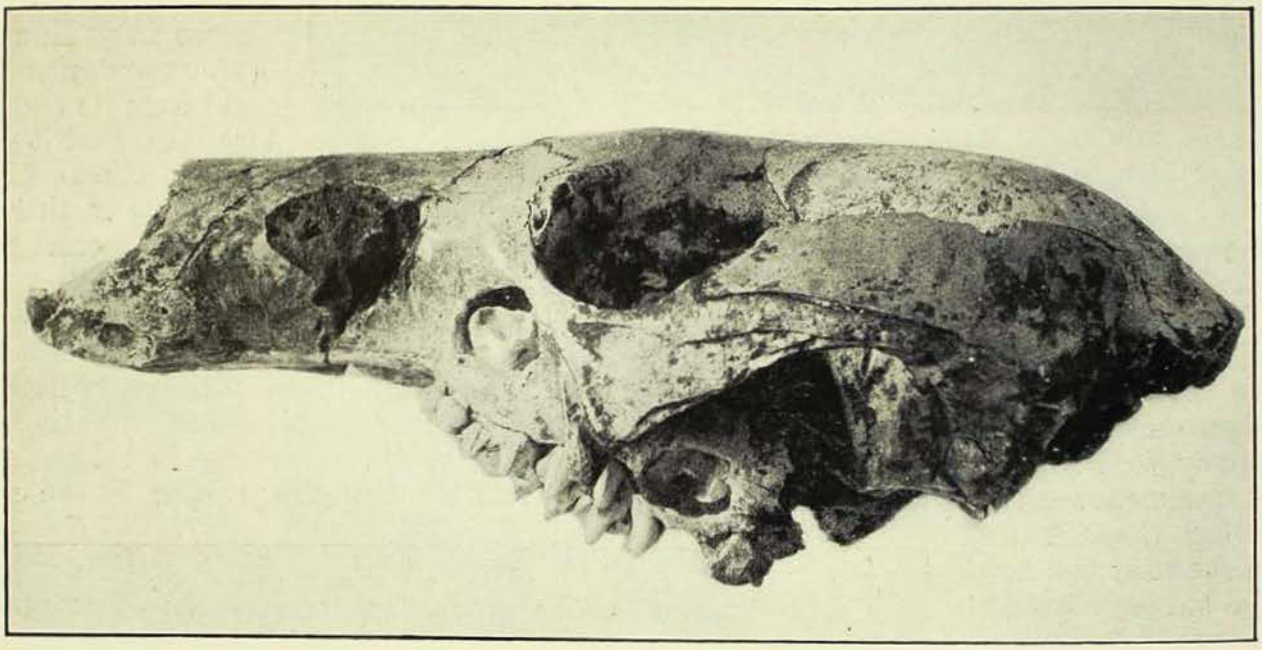
of an afternoon, we managed to remove the skull to which it belonged, and, subsequently cleaned, it revealed itself as a splendid specimen, almost complete, but lacking some of the smaller teeth.

No complete skeletons were discovered, and no such specimens have ever been found in the Wellington Caves, nor, from the nature of the occurrence, is it likely that any fossil with the several bones associated will ever reward the eager seeker.

ORIGIN OF THE CAVE EARTH AND FOSSILS.

It is of some importance and interest to enquire how the remains of the animals found their last resting place in these caves, and why there should be such large accumulations of their bones in certain spots. The red earth in which the bones occur is clayey in texture, in places soft and friable, in others hard and compact; sometimes it contains small boulders and pebbles of limestone. Evidently this red clay is the insoluble residue of many cubic feet of limestone, the red colour being due to oxide of iron. In all regions where limestone caves occur this red clay is a conspicuous feature, and it is sometimes sufficiently rich in iron to be used as a pigment.

Evidently this red earth has worked down from the surface, either by gravity or by stream action. In limestone country vertical chimneys and sink holes leading to subterranean caverns are of common occurrence, and these form channels by which the surface soil and living or dead animals are conveyed to the depths below. The broken condition of many of the bones indicates that the skeletons had suffered dismemberment before coming to rest where we now find them. Few or none of the animals, remains of which are found in the caves, are habitual cave dwellers, and the probabilities are that they either fell in through the sink holes, or were swept in by flood waters, where the honeycombed limestone formed the bottom of the valley. It has been suggested that the animals were poisoned by emanations of carbonic acid gas, but there is no warrant for such a conclusion. A still more improbable suggestion is that they took refuge in the caves during volcanic eruptions. Some may have been dragged in by carnivorous enemies, such as native cats or the thylacine or possibly the Marsupial Lion, but there is little doubt that most of them entered in a much more prosaic manner.

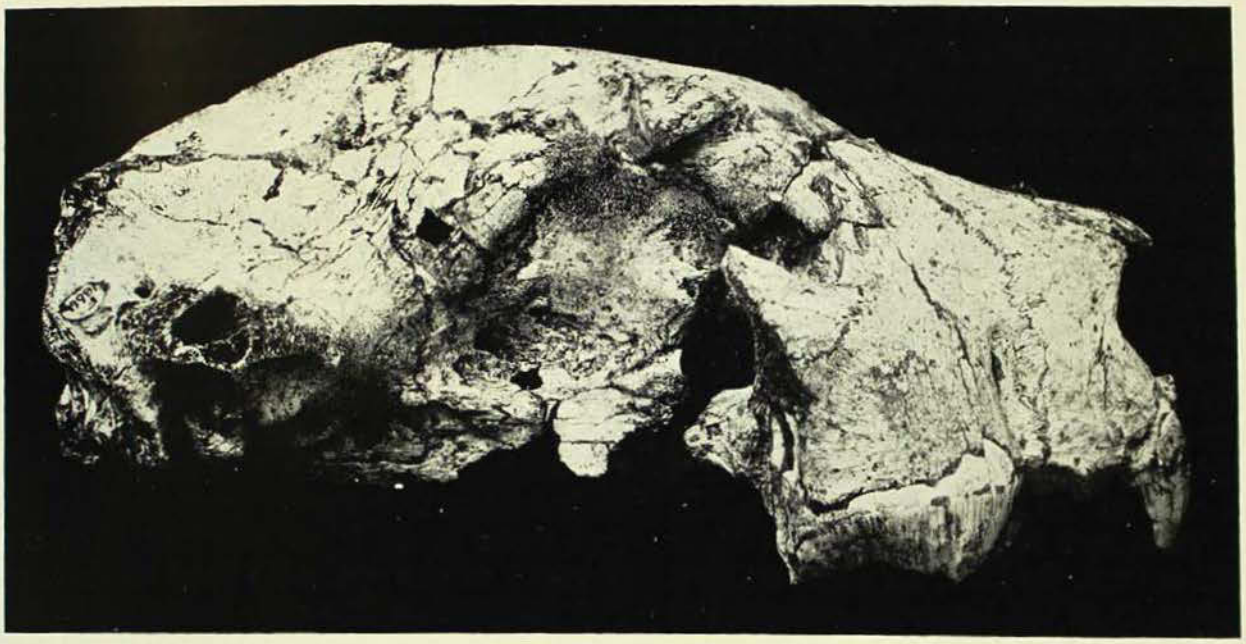


Skull of an extinct Kangaroo. The replacing tooth has been revealed in its crypt by cutting away the bone.
[Photo.—*G. C. Clutton.*

When Mr. Musgrave of the Museum staff and myself were exploring the Belubula Caves (MAGAZINE, Vol. II., 1, 1924), we discovered on a ridge a funnel-shaped opening leading down to unknown depths. Having no ropes we were unable to explore this cave, but Mr. William Hosie, a resident of the district for many years, informed us that the hole contained a considerable number of

small skulls. He subsequently made another descent but was disappointed to find that most of the skulls had been covered by earth since his last visit. He obtained some however, including those of a Rat Kangaroo, a bandicoot, and a calf, which was known to have fallen in about forty years before. All the skulls found were those of still existing species, which had slipped down the treacherous incline and perished miserably. Here we have an illustration of the method by which cave fossils are made, and no doubt those of the Wellington Caves have a somewhat similar history.

Let us imagine that through hundreds and thousands of years earth and bones accumulated on the floor of a cavern. As the work of solution and excavation proceeded through the ages, the floor of a cave containing the skeletons would be attacked and undermined as the subterranean waters sought a lower level. The floor of the older cave would form the roof of a new one, and, should it ultimately collapse, the bones would be precipitated into the depths below. So the skeletons would become dismembered, the separate bones broken, and we would get the heterogeneous collection of bones, earth, and pebbles that we now find at Wellington.



Skull of the " Marsupial Lion " (Thylacoleo carnifex). In front there are two pointed incisors and behind a long cutting posterior premolar or " flesh " tooth.

[Photo.—*G. C. Clutton.*

THE WELLINGTON FOSSILS.

What kinds of animals lived in Australia in these days? Investigation by Owen, Krefft, Lydekker, and others has revealed to us that, sealed up in the cave earth of Wellington, are the remains of animals such as the wombat, Red Kangaroo, possum, dasyure, bandicoot, and other marsupials which still exist. Bones of birds, lizards, and snakes have also been found in this rich deposit, and Krefft discovered part of the carapace of a small turtle. But the most interesting and important are the remains of animals now extinct, for they reveal to us a phase of the past when life and conditions were different from what they are now.

Some of the extinct forms, such as various species of kangaroos, the thylacine, the sarcophile, and *Palorchestes*, a huge kangaroo-like creature with a skull as large as that of a horse, were more or less closely allied to forms which still exist, but others have passed away and left no descendants or near relatives. Such were the *Diprotodon*, the *Nototherium*, and, perhaps most interesting of all, the Marsupial or Pouched Lion (*Thylacoleo*).

MARSUPIAL LION.

Few animals have been the occasion of so much controversy as this. Owen regarded it as a carnivore of a particularly destructive nature, while other authorities, such as Krefft and Flower, were of opinion that it was a harmless vegetable feeder. It cannot be said that the echoes of this battle have yet died down, but the general opinion now is

that the animal was a flesh-eater. Unfortunately only the skull and lower jaw and the dentition of *Thylacoleo* are known with certainty, though limb bones have been tentatively assigned to it. We are ignorant, therefore, of its build and bodily structure, and such knowledge as these afford. Usually teeth give the clearest indication of an animal's food habits. Confronted with the dentition of a horse a comparative anatomist would without hesitation pronounce it to be a herbivorous animal, its incisors (front teeth) adapted for cropping the herbage, its molars (back teeth) for grinding and mastication. So the teeth of a cat clearly indicate, in the sharp piercing canines and the compressed scissors-like molars, that they are meant for a flesh diet, the canines to hold and kill its struggling prey, the molars to remove from the bones and divide the flesh of its victim. Also the skull and jaws are modified for the attachment of the muscles in accordance with the purpose and use of the teeth.

What then do we find in *Thylacoleo* ? Its skull is rounded and massive, and comparable in size with that of a small lion. Apparently its temporal muscles were strongly developed, so that we may conclude that it was necessary for the animal to close its jaws forcibly from a widely open position. Its teeth are of a most unusual and specialised type. In front above and below is a pair of large pointed incisors, the lower ones not meeting the upper as in the kangaroo but passing them. These are followed in the upper jaw by a small canine and two small anterior premolars ; in the lower jaw, behind the incisors are two small premolars of no functional importance. But the last premolar in both upper and lower jaws is an enormous cutting tooth, greatly elongated in a fore-and-aft direction, and marked by shallow vertical grooves. The lower tooth shears past the upper on the inside, and in old animals a polished worn surface develops at the point of contact. No such tooth is known in any other mammal, its nearest analogue being found in the family Plagiaulacidae, belonging to an extinct order called the Multituberculata, the precise affinities of which are uncertain, and in the Rat Kangaroos, in which the last premolar is lengthened in the same manner and grooved vertically. An extinct form, *Burramys*, from the Wombeyan cave district, in which the last premolar is in a measure intermediate in appearance between that of the Rat Kangaroo and *Thylacoleo* has been described by Dr. R. Broom (*Proc. Linn. Soc. N.S.W.* Vol. X., 1895 p. 563), but in none of these is the premolar strictly comparable with that of *Thylacoleo*. Behind this large trenchant premolar are the true molars, one on each side in the upper jaw and two in the lower ; these like the canines and anterior premolars, are small and apparently useless, though the foremost molar in the lower jaw may have been used to supplement the cutting action of the large premolar. We are left then with the incisors and the enlarged premolar as the effective teeth of *Thylacoleo*, and the problem is to discover for what kind of food such a dental equipment is adapted.

It is difficult to escape the conclusion that it was a flesh eater. Every mammal which lives on vegetable food, except certain bats which are fruit eaters, have efficient grinding teeth to reduce their food to a state fit for easy digestion. *Thylacoleo* has no such equipment, and its teeth in no way suggest a fruit diet. Flower offered the hypothesis that its blade-like premolars might have been used like a turnip slicer to cut up bulbs and roots, but even that food requires to be masticated. It is certain that the Australian vegetation was much the same during the period when *Thylacoleo* lived as it is to-day, and there is no kind of plant that we can point to as the probable food of this animal. The suggestion has also been made that it was a scavenger, a kind of marsupial hyæna, and several cases have been quoted of fossil bones found in various parts of Australia which appear to have been gnawed by some large animal.

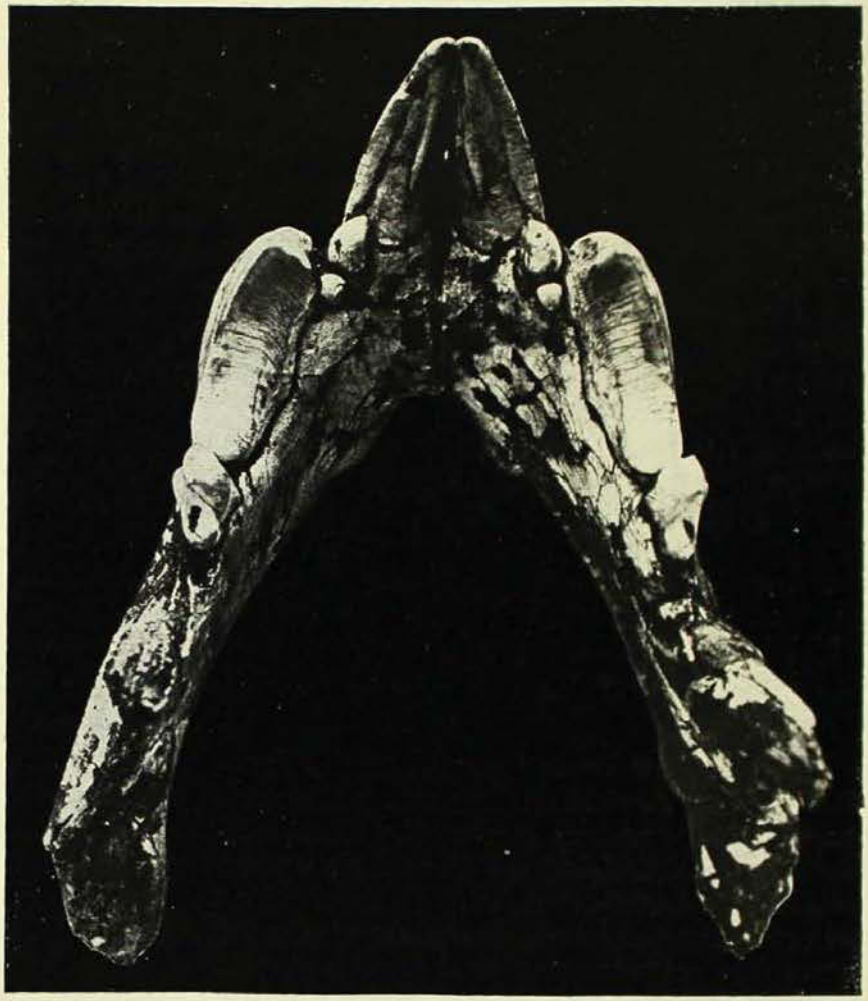
In considering the evolutionary history of the marsupial order of mammals, the conclusion has been reached that its members were primarily insectivorous, and were furnished with teeth appropriate for insect eaters. By a process of evolution some of them acquired an omnivorous habit, and subsequently one branch became carnivorous, while another culminated in the kangaroos and wallabies, in which the teeth are perfectly adapted for a herbivorous diet.

When we enquire into the probable affinities of *Thylacoleo* we find that it presents the greatest resemblance to the phalangers among living marsupials ; its skull and teeth are quite unlike those of typical carnivorous

forms, such as the dasyure and the thylacine, nor do they present any resemblance to those of typical herbivores, such as the kangaroos and wallabies. Apparently its ancestors reached the omnivorous stage and proceeded some distance along the path leading to herbivority, but reverted later to a carnivorous habit. By that time the canines had become reduced and the law of irreversible evolution lays it down that an organ once lost or considerably reduced cannot be regained. But grasping and piercing teeth are necessary to any carnivore, and so in *Thylacoleo* the front incisors were modified to serve the purpose usually fulfilled by canines, while the enlarged posterior premolar became converted into a flesh tooth.

HUMAN TOOTH.

One of the most interesting finds made in the Wellington Caves was the discovery by Krefft of the fractured crown of a human molar. This specimen is in the Museum collection and has been discussed by R. Etheridge, Jr. (*Rec. Austr. Mus.*, XI., 2, 1916, p. 31). According to Krefft it was found embedded in the cave earth, and Dr. J. M. Creed informs me that he was present when the find was made. There is still some red earth adhering to the tooth but no actual matrix containing bones of extinct animals, so that there is an element of doubt as to this tooth being of the same age as *Thylacoleo*, *Diprotodon*, and other forms of the Pleistocene period. The nature of the occurrence of fossils at Wellington makes it difficult to determine the contemporaneity or otherwise of the fossils. The probabilities are that they differ considerably in age, and it is possible that the human molar belongs to a later period than other bones found there. During our visit we discovered the greater part of the skeleton of a possum, deep down in the main cave at the bottom of a chute entered through an opening in the wall; the animal had not long been dead, for the ligaments were still attached to the bones. Imagine a fall of the roof to occur here carrying with it some "prehistoric" red earth, and this specimen might then become enveloped in the same matrix as much older bones. Under favourable circumstances the drip of carbonated water might in a comparatively short period seal up these recent bones in such a manner that it would be hard to recognize their relative youth.



Lower jaws of the "Marsupial Lion" (Thylacoleo carnifex). In front are two long pointed incisors followed by two small useless teeth in front of the large cutting posterior premolar; behind this is a small true molar.

[Photo.—*G. C. Clutton.*

THE AGE OF THE FOSSILS.

This raises the interesting question of the lapse of time since the *Diprotodon*, *Thylacoleo*, *Palorchestes*, and other marsupial giants roamed through the bush and round the water-holes. It is quite possible, even probable, that the aboriginal had arrived in

Australia before these animals had become extinct, and that he actually saw and perhaps hunted the lumbering *Diprotodon* somewhere between twenty and a hundred thousand years ago.

Dr. George Bennett, a former Trustee, in "A trip to Queensland in search of Fossils" (*Ann. Mag. Nat. Hist.*, April, 1872), refers to a tradition of the blackfellows regarding the *Diprotodon*. The passage is of such interest that it is worthy of quotation.

"I have had a long conversation with 'Charlie Pierce,' an aboriginal, relative to these fossils; and he avers that they are those of an animal, long extinct, known to the natives by the name 'Gyedarra.' Tradition among them has handed down the appearance and habits of the animal for generations, but Charlie says he never paid much attention to the descriptions that have been given to him, but imagines the animal was as large as a heavy draught horse, walked on all fours the same as any other four footed beast, eating grass, never went any distance back from the creeks to feed, and spent most of its time in the water, chiefly in enormous holes excavated in the banks. I told him he must mean some other animal; but he spoke most positively, and asserted that the bones we have been finding are those of the animal of which he was speaking, and that at one time the bones were very numerous about the Gowrie water-holes, where his fore-fathers had seen the animals themselves sporting about. I again asked him if they did not live on the leaves of trees; and his reply was that they were never seen to feed on them, but always on grass, the same as a horse or bullock."

It may be remembered that the *Diprotodon* is generally supposed to have dwelt mainly in the near neighbourhood of lakes and water-holes, that it certainly walked on all fours, and lived on grass and shrubs, but that it was aquatic or a burrower has never to my knowledge been suggested, nor would its skeletal structure support such a view. If there is anything in the tradition it may be that the animal referred to was *Phascolonus*, a large extinct form of wombat.

ACKNOWLEDGMENTS.

Our stay at the Caves was rendered much more pleasant and profitable by the hospitality and cordial assistance we received from Mr. J. Harvey Truman, Shire Clerk, and Messrs. R. Newton Tabrett and C. H. Munro, Shire Engineers.

To Mr. E. J. George, Caretaker, "a fellow of infinite jest," and his family, we owe a deep debt of gratitude for their great kindness and willingness to assist us in every possible way.

There has just been presented to the Trustees of the Australian Museum what one may justly regard as one of the finest collections of bird skins yet brought together within the Commonwealth. The collection was made by the late Robert Grant, who for a number of years was taxidermist at this Museum and who had been a discriminating collector from boyhood.

The collection is notable in that it contains series of great value to the systematic worker, and specimens of birds which, unfortunately, are now nearing extinction. Some idea of the importance of this collection may be gleaned from the fact that it contains *Atrichornis rufescens* (Rufous Scrub Bird), *Psophodes nigrogularis* (West Australian Coach Whip), *Psephotus pulcherrimus* (Paradise Parrot), *Ptiloris victoriae* and *alberti* (Rifle Birds), *Pezoporus wallicus* (Ground Parrot). In addition to these species the bower birds, honey eaters, parrots, robins and wrens are well represented. Exotic forms were not overlooked by Mr. Grant for this collection contains foreign parrots, woodpeckers, pittas, kingfishers, sun-birds, hawks, owls, finches, and others too numerous to list here, likewise a series of New Zealand birds, including male and female Huia (*Heteralocha acutirostris*).

To students of our avifauna the collection is priceless, though its catalogue value may be set down at about £1000, and the State owes a deep debt of gratitude to the following donors whose timely generosity saved the collection from leaving Australia: Messrs. Burns, Philp and Co., Ltd., Mrs. Dangar, Messrs. R. H. and R. R. Dangar, Sir Hugh Denison, the late Sir Hugh Dixson, Messrs. Farmer and Co. Ltd. (the Directors), Mr. R. H. Gordon, Sir Samuel Hordern, Mr. L. E. Palmer, Miss Eadith Walker, C. B. E., and Mr. H. L. White and Mr. H. Wolstenholme.

Discoloration of Harbour Waters—

A Reason Why.

By F. A. McNeill and A. A. Livingstone.

THE recent occurrence of reddish patches in the open waters of Port Jackson has excited the interest of many people, and the strange phenomenon has inspired much conjecture as to its cause and effect.

Early in 1891 a controversy waged in the pages of the Sydney dailies over a similar but more pronounced occurrence, and " Rivers of Blood " was a subject which stirred the minds of the populace. Several prominent authorities of that day were induced to study and report upon the subject and the true solution to the problem fell to the lot of Mr. Thomas Whitelegge, late of the Australian Museum. This gentleman was subjected to adverse criticism at the hands of many well-meaning enthusiasts, who have not since comprehensively substantiated their claims as he did in a scientific journal.

CAUSE AND OCCURRENCE.

One of the main reasons for the marked "discoloration" is the presence of minute single-celled animals, and the density of the colour is governed by their number and age. These organisms belong to the lowest type of animal life and are classified in a group known as the Infusoria. Usually two or three species are concerned in an epidemic, but a form known as *Peridinium* appears to be the most prevalent. This animal is enclosed in a transparent, more or less elliptical case with a single whip-like flagellum at the broad end of the body. It measures about 1–1000th of an inch long, and 1–1500th of an inch wide. A deep groove is present in the equatorial region and is bordered by a ring of cilia which assists the creature in locomotion. The contents of the case consist of densely granular protoplasm and a very large nucleus.

It seems as though these infusorians have made their appearance regularly each year in larger or smaller quantities since 1856. An explanation has been put forward by Mr. Whitelegge that their appearance in enormous numbers may be due to a favourable alteration in the salinity of the harbour waters in calm weather following excessive downpours of rain. The " discoloration " of the water on these occasions has quite naturally been attributed by many to large quantities of earth matter that has been washed into the harbour waters—a casual observation easily rejected. The idea that the colour is due to waste products is also out of the question, as are many other hypotheses as to its origin. Some have attributed the phenomenon to the presence of numerous spores of algae as in the Red Sea, while others have maintained that the larval stages of jellyfishes are responsible. It is preposterous, however, to assert, as some do without convincing evidence, that the matter must be chemical pollution from commercial enterprises such as paper mills and sugar works, or the blood and offal from abattoirs.

A little knowledge is a dangerous thing, as the following extract written by a correspondent to a Sydney newspaper will show. After first considering the red " discoloration " to be due to the presence of huge numbers of minute young jelly fish, he sought later to ally such forms with the Infusoria. His discourse commences: " After all, putting aside scientific classification, the largest of the medusidae are but a form of life not a very great remove from infusory life ; in fact, to my mind they are " infusoria " made visible by their gigantic size. Their actions, motions and economy are similar to the lowest forms of life inhabiting water." This unfortunate effort closes with the statement that " I will gladly acknowledge I am mistaken if any scientist of standing who, by research and not from books, proves, I am wrong."

REPRODUCTION OF ORGANISM.

The free-swimming *Peridinium* and its allies pass through a series of changes, increasing in size up to a certain point, and then increase in numbers by a characteristic process called binary fission. This simple form

of reproduction enables one individual to split into two and these in turn again divide, and so on until myriads of them are formed. This division may be longitudinal or transverse. In the final stages of an epidemic the organisms make provision for a rest from their former active mode of reproduction. They accomplish this by developing spores within their cases and remain dormant until suitable conditions recur. If placed in an artificial environment active animals have been known to settle down and develop these spores, each spore having a thick cell wall which is able to resist all kinds of injurious influences. So great is this resistance that they may be boiled, or kept in a dry state for a considerable period without having their vitality destroyed.

HABITS.

It is considered that the life histories of the organisms account in some degree for the density of the "coloured" patches of water, which may be light brown, or dark red like blood when the organisms age and their contained spores are almost mature. When infected water is viewed in a bottle with one side shaded from the light, the creatures will arrange themselves in cloudy patches and form a miniature reproduction of the conditions obtaining in open water. This proves their social or gregarious habit, which is apparently stimulated by favourable light conditions.

No doubt much of the controversy of 1891 was caused by lack of sufficient knowledge in handling the organisms after capture. Mr. Whitelegge has personally informed the authors that he could not determine the characteristics of the creatures until he conceived the idea of warming the glass mount upon which the specimens were placed before examination under the microscope. This procedure had to be adopted in order to prevent the creatures from casting their tests, or cuirasses, in which case they are almost unrecognisable.

EFFECT.

The pronounced epidemic of 1891 had a very marked effect on the shore fauna of Port Jackson and the mortality was so marked in some areas as to create a very offensive atmosphere. Fish life, too, was not immune to the effects of the visitation, and this recalls a similar incident which occurred in the Bay of Agu, Japan, where, it is stated, large numbers of fish were rendered drowsy, and were easily speared by the inhabitants. At this place also pearl oysters were destroyed in large numbers.

From what is known of the chemical composition of the *Peridinia* there are no reasons why they should be regarded as injurious when eaten by fishes and other organisms. The composition of these organisms is very similar to that of diatoms, desmids, and such like, which, owing to their oily property, are known to constitute a highly nutritious food for fish, oysters, and other forms of animal life. Also, experiment has proved that the organisms do not die and undergo decay, for a bottle containing them may be left untouched for ten days without showing traces of decomposition.

It would seem that the exact cause of an epidemic's effect on shore life is very obscure, but Mr. Whitelegge has submitted some reasonable arguments to account for the mortality. He noted that the bivalve molluscs such as oysters had evidently been the most affected, and that their decomposition had some influence in killing the limpets, periwinkles, and other life. The death of the former was considered to be due to one or more causes. The organisms may have been present in such numbers as literally to clog the gills and prevent respiration, or the water may have been so deficient in oxygen as to be unfit to support the higher forms of life. Again, they could perhaps be so overfed as to produce indigestion or sickness. No doubt any one of these causes acting for weeks in succession, or a combination of the whole, would be sufficient to render the entire littoral fauna unhealthy. The death of larger animals would tend to make the conditions worse for those that remained.

The sudden appearance of *Peridinia* in great bulk and their consequent depredations reminds us of the great national importance of, and necessity for a thoroughly efficient biological station. It also affords another instance of our ignorance of the conditions affecting our marine food supplies.

The Wunderlich Aboriginal Group.

THERE has recently been placed on exhibition a fine series of models of the Australian aborigine, comprising an adult male and female, and a boy. This interesting exhibit has been presented by Mr. Ernest Wunderlich, F.R.A.S., President of the Board of Trustees of this Museum. Mr. Wunderlich, who is keenly interested in anthropology, has for long regretted the absence of an exhibit of this nature in our galleries. The figures, which we illustrate overleaf, were prepared from life by Mr. G. Raynor Hoff, A.R.C.A., R.S., A.R.B.S., and subsequently coloured, also from life, by Miss E. A. King.

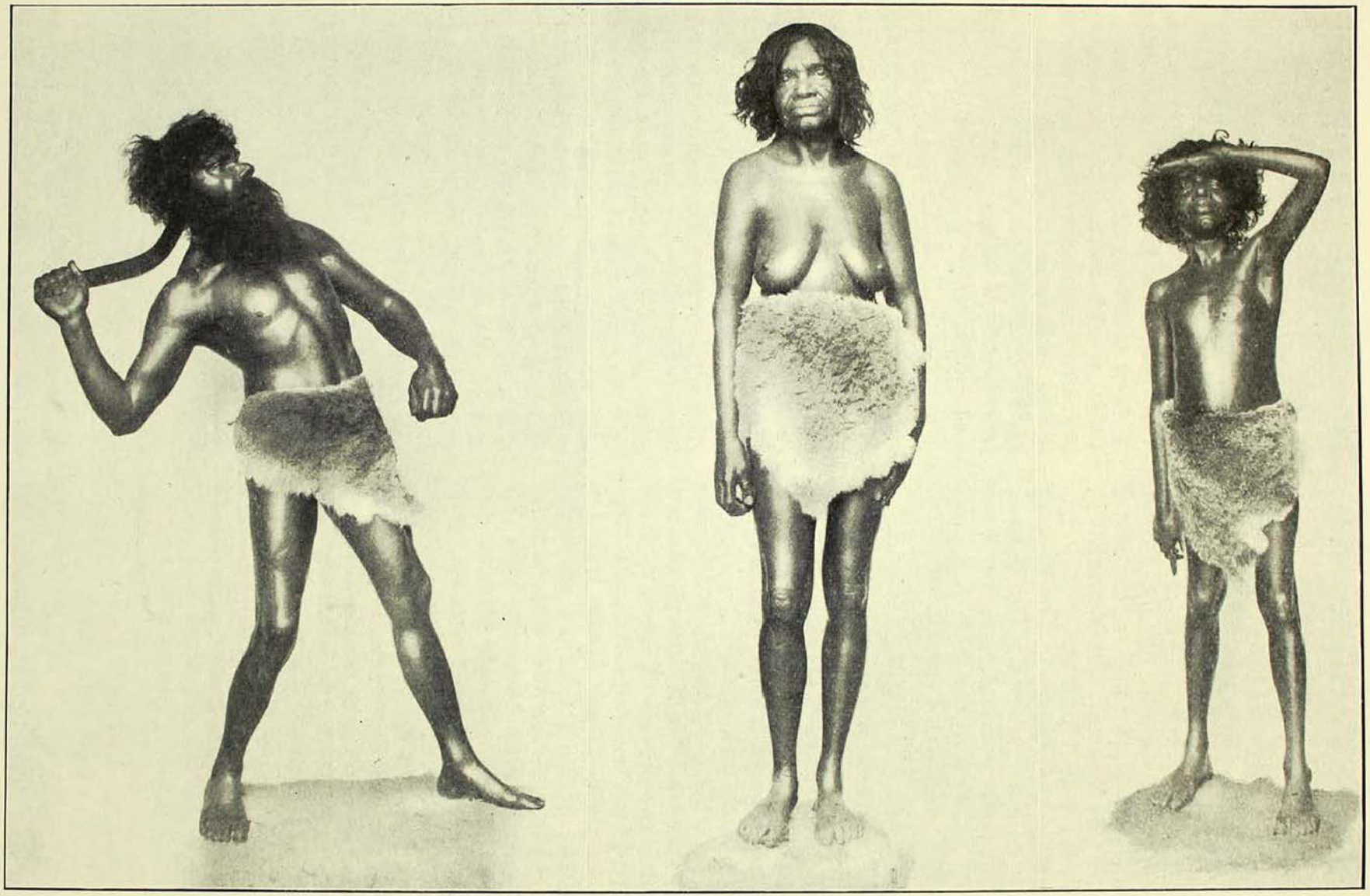
It will not be many years before the aborigine, in New South Wales and Victoria at least, will be an entity of the past. Every year sees a shrinkage in their number, and the coastal tribes that once roamed the Sydney district are, unfortunately, no longer with us. In the January-March, 1926, issue of this MAGAZINE Mr. W. W. Thorpe illustrated with statistics, the decline of this race from 7000 in 1883, the first census, to under 1000 at the present time. These figures were for this State, but Victoria in 1924 possessed only 74. Of course, in the more remote parts of the Commonwealth there is still an aboriginal population of some dimensions, though even here time and contact with whites and Chinese are working changes. In his recently issued book, *The Australian Aboriginal*, Dr. Herbert Basedow says: "Every year the number of people who have seen the unsophisticated savage is dwindling. When I look back to the time of my first meeting with the tribes of central Australia, just twenty years ago, and compare the conditions of then and now, I shudder to think how quickly the romance of aboriginal affairs, together with all the scientific treasures it encompassed, has vanished and is now irretrievably lost to the world. The rising generation will not have the advantage of men of even our time. Bones, stone artefacts, and wooden implements will be in our Museums for ever, but the habits, laws, beliefs, and legends are doomed to rapid extinction." It was the realisation of this tragedy which induced Mr. Wunderlich to make this timely presentation.

Perhaps some facts concerning the individuals who posed for these figures may be of interest.

The man, who is hurling a boomerang, is Yangar, or "Jimmy Clements," son of Gayan-Blouer-Galoom, the late "King of Orange," western New South Wales. "Jimmy" is an old man, but well preserved. He has a very retentive memory and recollects the various tribal customs and initiation ceremonies, but regarding these he is extremely reticent and will not communicate his "honoured secrets." The female figure is "Nellie Walker," a daughter of Geri-Bungul, and a native of Bombala, Monaro district, southern New South Wales. The boy is Harold Marsh, aged nine years, who was born at Kinchela, Macleay River, northern New South Wales. He is now living at the Brewarrina settlement.

In the selection of aborigines great care had to be taken to ensure that the individuals were pure bloods, and to the Aborigines' Protection Board and the Police Department of this State thanks are due for the valuable assistance rendered by them.

Mr. R. H. Cambage, C.B.E., F.L.S., Trustee, has been appointed to represent the Australian Museum at the meeting of the Australasian Association for the Advancement of Science, to be held at Perth, Western Australia during the week commencing 23rd August. An interesting and instructive programme has been arranged for the meeting, and it is hoped that a large body of members will attend.

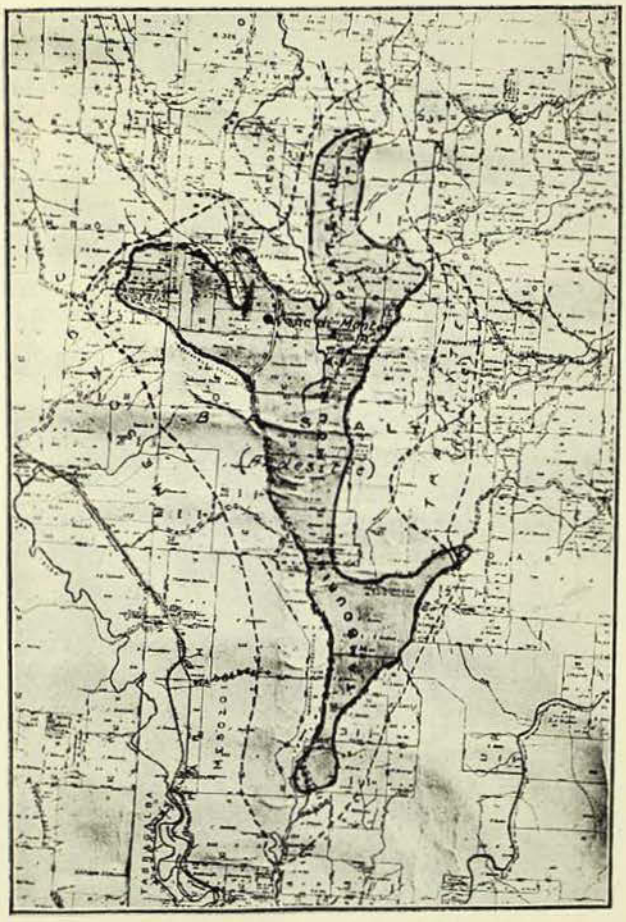


Figures comprising the Wunderlich Aboriginal Group, modelled by Mr. C. Raynor Hoff, A.R.C.A., R.S., A.R.B.S., and coloured by Miss E. A. King.
Presented by Mr. Ernest Wunderlich, F.R.A.S., President of the Board of Trustees of the Australian Museum.
[Photo.—*G. C. Clutton.*

Tambourine Mountain, Queensland.

By Anthony Musgrave, F.E.S.

MIDWAY between Brisbane and the New South Wales border lies a long, low, mountain, an offshoot of the Mac Pherson Range, known as Tambourine Mountain, which enjoys the distinction of being a spot frequently visited by Australian entomologists and overseas naturalists. For many years I longed to visit the mountain, for everyone who has seen its glorious scrubs has sung its praises. Eventually (as a result of an invitation by Miss Hilda Geissmann, a resident of the mountain) I spent some time there in November, 1924, and again in December, 1925. The following notes are results of these sojourns, which, though brief, gave me a general idea of the topography and natural history of the district. Miss Geissmann and her brother, Mr. Colin Geissmann, were my guides on trips to various parts of the mountain, and I am greatly indebted to them for their assistance.



Map of Tambourine Mountain, showing its peculiar outline, and geological features.

As the mountain owes the wealth of its entomological fauna to the luxuriance of its vegetation and the fertility of the soil upon which the plants grow, a brief account of the physiographic features and the botany will be appropriate before dealing with the insects themselves.

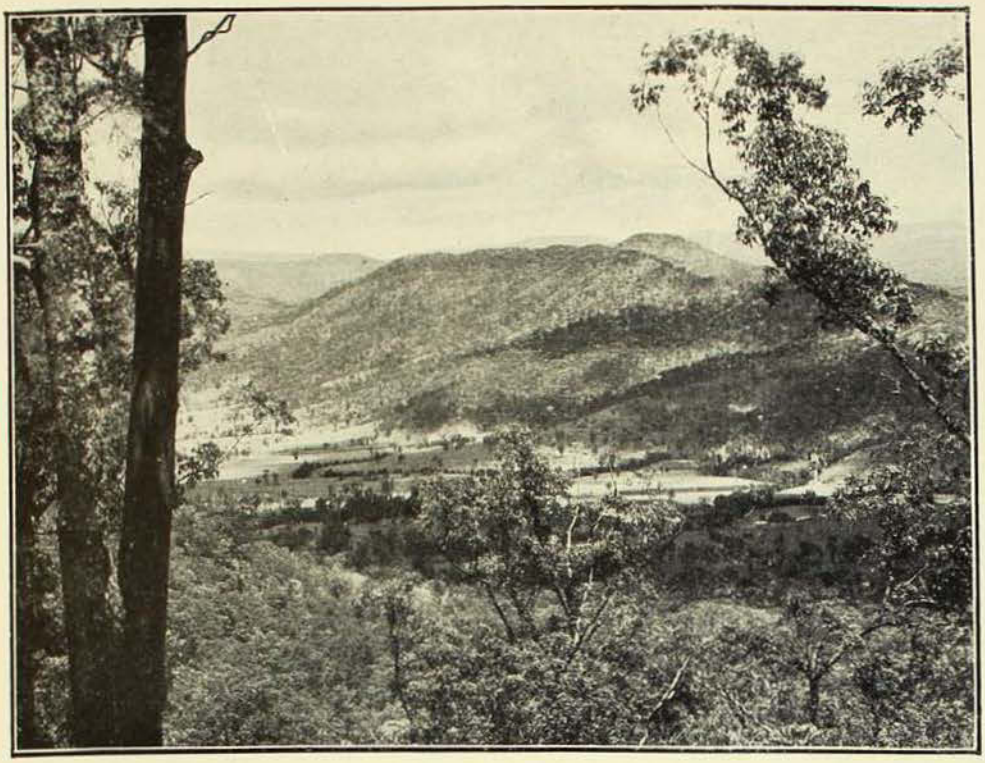
PHYSIOGRAPHY.

Tambourine Mountain forms part of the coastal range and divides the Albert River from the Pimpana, Coomera and Nerang River systems. The mountain lies roughly north and south, and is about seven miles in length, while the greatest width is three miles. It is also flat-topped and its highest point is said to be 1,835 feet. The northern end is precipitous but its southern end slopes down to Canungra. The eastern and western walls are also precipitous. On the southern and western sides of the mountain the rocks, according to the late Dr. John Shirley[1] belong to the Trias-Jura system; these are overlain by a cap of basalt. The rocks of the Trias-Jura beds are composed of sandstones, shales, and conglomerates, and, as they weather more rapidly than the hard basalt, the underlying rocks are cut vertically downwards on the eastern and western sides, thus accounting for the precipitous cliffs which occur there.

On the western side of the mountain, towards its northern end, is a group of columnar basaltic rocks called the "causeway," which here form cliffs. Not far from these occur hexagonal columns, with their ends protruding horizontally from the sides of the cliff, as though they had been bent over.

From the top of the St. Bernard Falls, on the eastern side of the mountain one looks down into the Guanaba Gorge, which lies between two spurs of the mountain. The Gorge provides some entrancing scenery, being filled with a very dense vegetation. Fine cliffs of trachyte occur on the left-hand side, and wooded hills on the right. The Coomera River lies in the distance and beyond it the sea. From Wilson's Lookout on the eastern side of the mountain on a clear

[1]Queensland Naturalist, I., 1908, pp. 46-49.



The Canungra Valley from the top of Tambourine Mountain, Mt. Misery lies in the background.

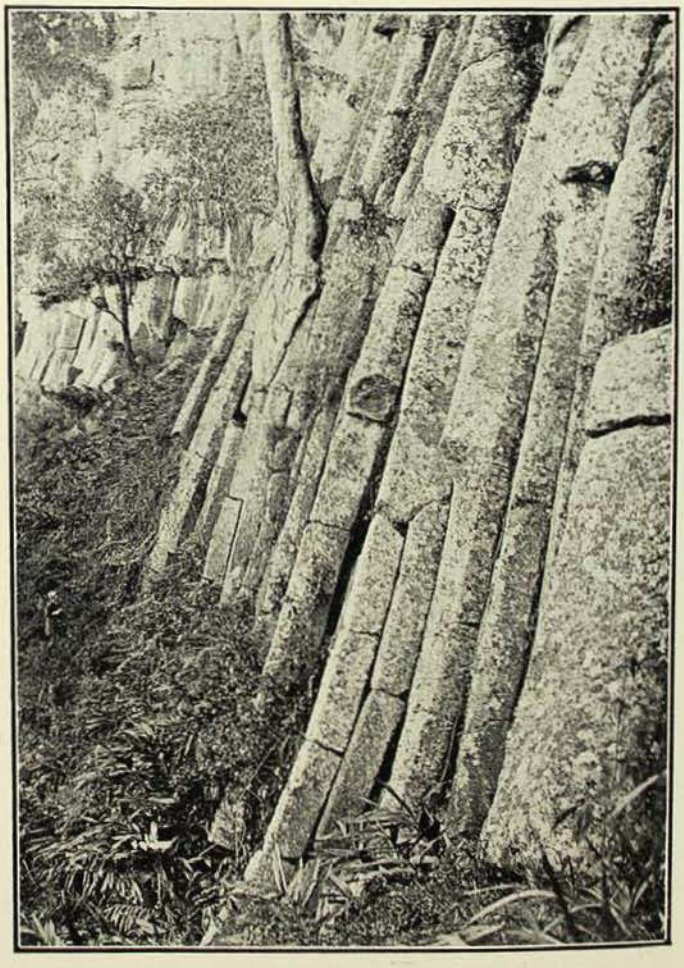
[Photo.—*A. Musgrave.*

day, a splendid panorama is afforded of the Coomera Valley and the Coomera and Nerang Rivers, while Beechmont, the Darlington Range, and the mountains of the Mac-Pherson Range, which rise to a height of 4,000 feet, pile away in the distance, and Mt. Warning's peak, twenty-eight miles away in New South Wales, shows plainly through a gap in the ranges.

PLANTS.

Owing to the nearness of the sea the mountain top is well watered. When we look down into the Canungra Valley from the edge of the plateau, we notice that the surrounding country is timbered with such trees as eucalypts, wattles and oaks; but on the mountain itself a very rich vegetation is present owing to the decomposing basalt. Driving up from Tambourine railway station at the foot of the mountain to the summit, over a beautifully tarred road, one is enabled to see on either side the changes in the vegetation due to the corresponding changes in the soil. After driving for some miles past the typical Australian gum-trees, and ascending, we follow the road along the Cedar Creek Valley, on whose banks flourish huge gums, Piccabeen palms, and masses of vines. On the right side coming up the mountain the hills have been denuded of vegetation to a great extent, basalt rocks showing here and there through the reddish-yellow soil in the cuttings. The summit gained, one is treated to a vista of huge gaunt ring-barked gums springing from the rich soil, with occasional patches of dense scrub or open forest country. Capo-di-Monte, the home of the Geissmann family, still retains some of the forest primeval at its back-doors, but the mountain scrubs are steadily falling before the axe of the settler, to provide pasturage for dairy cattle or space for citrus orchards, and thus are meeting with a fate resembling that of our Dorrigo scrubs.

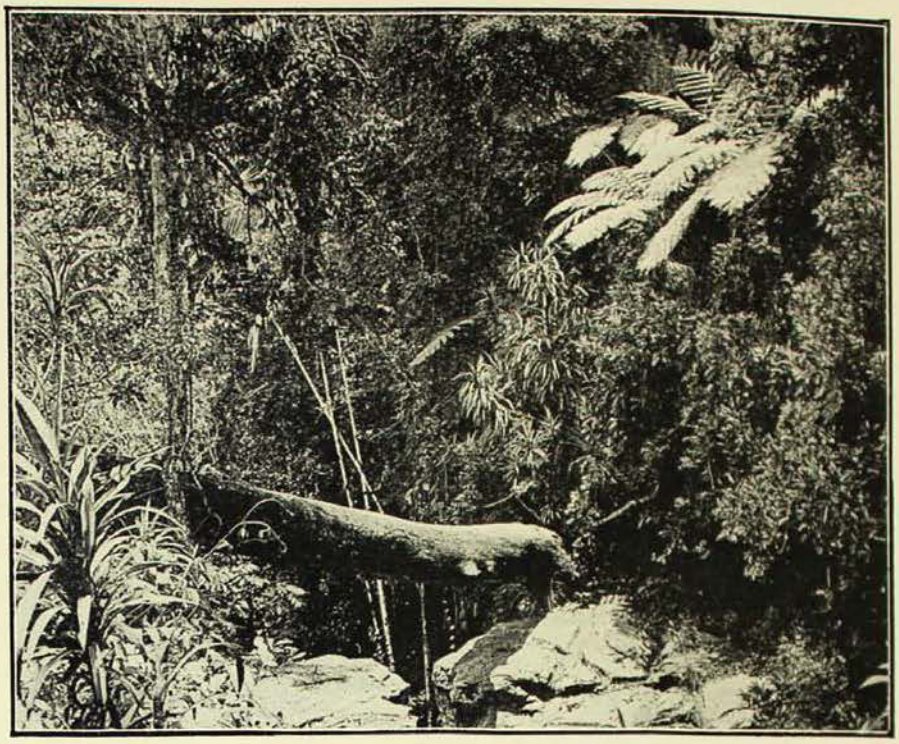
The top of the mountain is reminiscent of Mount Wilson in the Blue Moun-



"The Causeway"; cliffs of columnar basalt, forming the Mountain's northern boundary. Comparison with the figure of Miss Geissmann in the mid-distance gives some idea of their magnitude.

[Photo.—*A. Musgrave.*

tains, except that the vegetation of Tambourine Mountain is on a much more luxuriant scale. It possesses, in fact, many of the elements which go to make up an Indo-Malayan rain forest. Most of the valleys on the plateau resemble those of Cedar or Curtis Creeks, and are filled with Piccabeen palms, *Archontophoenix cunninghamiana*, in every stage of growth. Most of the branches of the figs and other trees which grow on the banks of the streams are laden with epiphytic plants of every description; stag-horn, elk-horn, and bird's-nest ferns occur abundantly. In these dense scrubs one's progress is impeded, and insect collecting rendered anything but a desirable pastime, by lawyer canes, which are really climbing palms; their fine sprays, armed with fish-hook-like prickles become embedded in one's clothing, and maintain a firm hold. To assist in her rambles about the mountain, Miss Geissmann usually carries a pair of secateurs, with which she snips off these tenacious tendrils.



Dense vegetation of ferns (Alsophila), Bird's Nest Fern (Asplenium nidus) and other plants near Curtis Falls, Tambourine Mountain.
[Photo.—*A. Musgrave.*

A large Flooded Gum, near Capo-di-Monte, Tambourine Mountain. The bark of the upper part of the trunk is smooth and white, that of the butt being rough and dark.
[Photo.—*A. Musgrave.*

Along the mountain roads we meet with such trees as Box, Tallow-wood, and Flooded-Gum. The last-named, *Eucalyptus saligna*, known as the Blue Gum in New South Wales, is one of the most beautiful trees on the mountain. It grows to a considerable height, and the bark near the butt is of a totally different texture to that in the upper part of the trunk, being described as "somewhat rough"; that on the upper part is smooth and white. According to Mr. C. T. White[2] Government Botanist of Queensland, it ranges from the Atherton Tableland in North Queensland to the Clyde River in New South Wales.

In the deeper ravines, such as the Guanaba Gorge, and the Cedar Creek Gorge in the shadow of Cedar Creek Knob, Hoop Pines, *Araucaria cunninghamii*, grow, their dark foliage standing out in relief against the brighter green of the Eucalypts. The pine ranges down the coast from Queensland to

[2]Queensland Naturalist, IV., 1924, p. 109, figured on p. 110.

the North Coast District of New South Wales. The timber is much sought after for making furniture and butter boxes.

Queensland possesses about one hundred and sixty species of named orchids, and of these one hundred are epiphytic species, growing on rocks or trees, while sixty are terrestrial. Miss Geissmann has published in 1922[3] a list of twenty-one epiphytic species and ten terrestrial forms from Tambourine Mountain, and since that time she has discovered several other species.

In a pretty spot on the summit the Geissmanns showed me an interesting cycad, *Macrozamia denisoni*. According to Professor Chamberlain of the Chicago University, who is an authority on the cycads of the world, the genus *Macrozamia* has more than a dozen species, and is the dominant genus of our Australian cycads. Its species range from the northern part of Queensland to the southern limit of the cycads in New South Wales, while there is at least one species in Western Australia. There are only three species with tall cylindrical trunks, and these are said to be so distinct as to be readily recognisable, and one of these three is *Macrozamia denisoni*. It is native to Tambourine Mountain and the MacPherson Ranges, and is considered to be the most beautiful species

"Grandfather Peter" (Macrozamia denisoni), a three-branched cycad, eighteen feet in height. Mr. C. Geissmann standing beside the trunk gives some indication of its size.

[Photo.—*A. Musgrave.*

A Tenebrionid beetle (Encara floccosum) occurs commonly on tree-trunks and logs, the white flocculent matter with which it is covered, resembling lichens, thus enabling it to escape detection.

[Photo.—*A. Musgrave.*

of the genus; it is not common everywhere on the mountain but is restricted in its range.

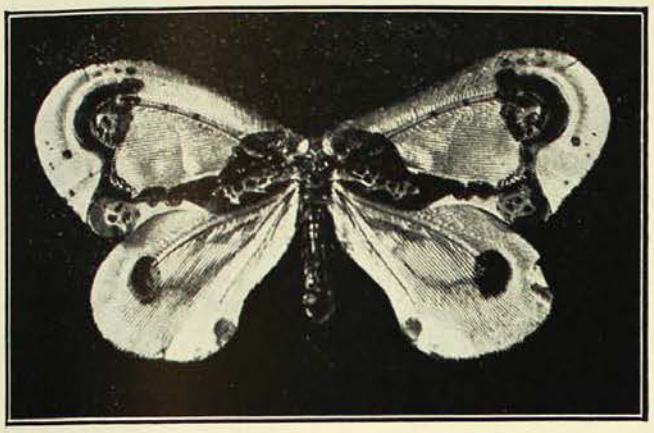
The typical *denisoni* has a short stem, from which the palm-like leaves radiate, but one specimen was twenty feet in height and had two branches. Yet another, called "Grandfather Peter," had three branches and measured eighteen feet in height. These heights may appear to be considerable for a cycad, but *Macrozamia hopei*, which occurs in the Cairns district, grows to a height of sixty feet. From a typical *Macrozamia denisoni* the Geissmanns secured for Professor Chamberlain a seed cone weighing eighty-five pounds. The seeds from one of these cones are bright red in colour, and are so large that they are used as match boxes,

INSECTS.

Tambourine Mountain is an entomologists' elysium. It has been visited by very many Australian insect-collectors, but probably

[3]Op. cit., III., 1922, pp 53-57.

many species remain to be captured in its dense scrubs. Much time could be spent by an entomologist collecting both harmless and noxious insects, for the gardens and orchards abound in all kinds of insect pests, and in the scrubs and open forests the insect life during the summer months is wonderfully abundant. At a farm near Curtis Creek,



A Lacewing (Megapsychops illidgei), a rare denizen of the Mountain, and of which about six specimens only have been secured. The wings are here seen outspread.
[Photo.—*G. C. Clutton.*

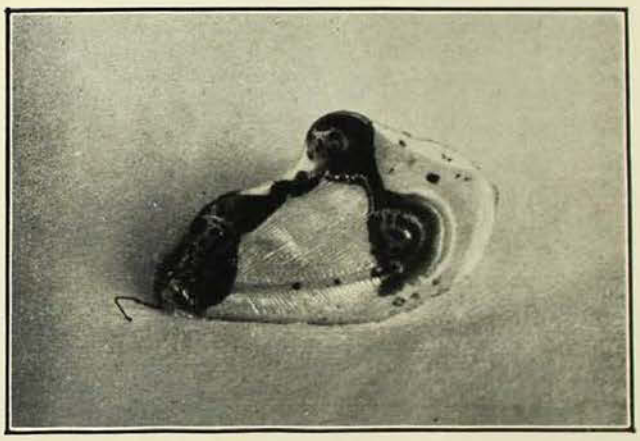
which flows into Cedar Creek, I found insect pests causing havoc everywhere. Much of the land nearing the house was under maize, which seemed to be badly infected by a maize moth, and nearly every "ear" examined appeared to be full of larvæ.

Orange trees yielded the Bronzy Orange Bug, *Oncoscelis sulciventris*, and the Green Citrus Bug, *Biprorulus bibax*, both well known native pests of the orange. The Cherry Bug, *Peltophora picta*, was secured on the fruits of a plant resembling the Dog-wood of Lord Howe Island. Of the insect groups collected the beetles predominated, and of these weevils seemed to be the most abundant many occuring on trees and vines.

Under decaying logs live the large carnivorous ground beetles or carabs, *Castelnaudia imperiale*, a species first described from north Queensland in 1894 by Mr. T. G. Sloane, but since recorded from Tambourine Mountain, Mr. W. W. Froggatt contributing a note on its life-history to the Proceedings of the Linnean Society of New South Wales for 1904. This insect measures from $1\frac{1}{4}$ to nearly $1\frac{1}{2}$ inches in length. The head and thorax are brassy-green in colour, and the elytra or wing-covers are black, with brassy-green outer margins. The legs and under surface of the body are black.

A Tenebrionid beetle, *Encara floccosum*, provided an interesting example of protective mimicry. This insect is covered with a flocculent matter, which resembles in appearance the dry lichens one finds on trees. The beetle is found commonly on trunks and parts where lichens occur, and thus escapes the eyes of enemies.

On Tambourine Mountain occurs also the Bird's-Wing Butterfly, *Troides priamus* subsp. *richmondius*, a species which ranges from Maryborough, Queensland, to the Clarence River, New South Wales. The first time I secured this butterfly was while riding up Mount Warning on the Tweed, and carrying a butterfly net. As several flew past I caught a female specimen. The species was very common there flying over the lantana bushes, and at Tambourine Mountain they seemed to be abundant on the slopes of the range. The male Bird's Wing is a rich velvety black, with brilliant golden green markings; the hind wings are golden-green with three large round black spots, the abdomen is golden-yellow. The female is much larger than the male, and is dark-brown in colour, with dusky white markings, the abdomen is dusky white.



The Lacewing (Megapsychops illidgei), showing the normal position of the wings when at rest; here they are folded tent-wise over the body. An antenna is seen projecting from the head.
[Photo.—*A. Musgrave.*

A RARE LACEWING.

A capture which created excitement in the Geissmann household during my last trip to the mountain, was the taking of a rare Lacewing, *Megapsychops illidgei*, by Mrs. Geissmann. While I was engaged in loading my plate-holders one evening Miss Geissmann rushed to the door of the room and called, "Come quickly; mother has caught an *illidgei*."

The Bird's-wing Butterfly (Troides priamus, subsp. richmondius) which occurs on the slopes of Tambourine Mountain. The female is seen with folded wings. The male in the top left hand corner, displays the under surface of the wings and body, while the male on the right shows the upper surface. The insect is one of the four subspecies of Troides priamus occurring in north Australia, and is distinguished by the absence of a green stripe on the median vein of the upper surface of the forewing of the male; by its smaller size; and by its distribution, which represents the southernmost range of the species, and which extends from Maryborough, Queensland, to the Richmond River, New South Wales. The food plant of the larvae are climbing vines (Aristolochia).

[Helena Forde, del.

I hurried out, and found that they had certainly caught the rare lace-wing, of which only about six specimens have been recorded, —all, with one exception, from Tambourine Mountain. The insect had flown into Mrs Geissman's bed-room, apparently attracted by the light, and there it settled and remained still while a tumbler was placed over it. Its wings were folded tent-wise over its body, and when I killed it the wings remained in the same typical attitude ; in this position I secured a photograph of it. A day or so later a visitor to the mountain, Miss Harrison, presented me with the wings of an *illidgei* —ants had eaten the body of the insect.

Megapsychops illidgei was first recorded in 1903 by Mr. W. W. Froggatt[4] from specimens taken at Tambourine Mountain by Mr. Rowland Illidge, the veteran Queensland entomologist. The species is a member of the family Psychopsidæ which is placed in the Order Neuroptera, and sub-order Planni-pennia. In this sub-order are a number of families, including such insects as lacewings of different kinds and ant-lions, which have the wings complexly veined, and in the larval stages are predaceous and feed on aphides and other insects. The lacewings of the family Psychopsidæ are nocturnal in their habits, and the species are rare ; they occur in Australia, Tibet, China, and Burma.

Megapsychops illidgei measures about 2 inches across the outspread wings, but when the wings are folded over the body the length is about one and a quarter inches. The general colour is creamy-white and the wings and body are covered with silvery hairs. On each forewing is a yellow-brown irregular, L-shaped mark, the top of the letter consisting of an embossed yellow-brown spot ; beneath it is another yellowish spot with white mottlings, and the end of the L is bent up and terminates near the thorax in a similarly coloured and mottled spot. These curious yellow-brown markings have been aptly likened by Mr. Froggatt, to a drop of yellow varnish placed on the wing close to the thorax allowed to run down the hind-margin and then turned up and allowed to remain on the embossed centre. The hind wings are smaller than the forewings and have a dark brown spot towards the centre of the wing.

[4]Proc. Linn. Soc. N.S.W., XXVIII., 1903, p. 455, pl. xxi., fig. 7 and 9. See also Tillyard, Op. Cit. XLIII., 1919, p. 771, pls. lxxvi., lxxvii.

SPIDERS.

So far as the spider life of the mountain is concerned, Rainbow and Pulleine[5] state :— " On such a high, undisturbed island plateau, we expect to find a rich hunting ground for Araneidae, and, indeed, for Araneidae as a whole it is so, being especially rich in Attidae." These two authors record eight new species of trap-door spiders from the mountain. To one species, which was secured only at the top of the St. Bernard Falls, they have given the name of *Tambouriniana variabilis*. These large spiders were found living in burrows with large thick lids, and are apparently local in their range on the mountain. They have been taken at Eidsvold, in the Burnett district, Queensland.

Tambourine Mountain contains so much of natural history interest that in the above notes I have but sketchily traced some of the more obvious features which came under my notice. I have not dealt with such interesting and important subjects as the birds and furred animals, but these are best left to specialists. An article on the birds of Tambourine Mountain may be seen in the " Emu " for December, 1910.

[5]Rec. Austr. Mus. XII., No. 7, Dec. 1918, p. 86.

Dr. T. Storie Dixson, Ex-President, left Sydney for a trip to Europe and America, during which he will examine various Museums in these countries. Dr. Gordon MacLeod, Trustee, has also gone abroad.

Mr. Rollo C. Beck of the Whitney South Sea Expedition visited the Museum on May 17th and inspected the collections in the Bird Gallery. He expressed high appreciation of the exhibited series of birds, and was much attracted by the display of humming birds, saying he had never seen a finer exhibit of these beautiful little birds.

Obituaries.

J. J. FLETCHER.

BY the lamented death on 15th May of J. J. Fletcher, M.A., B.Sc., the Board of Trustees loses a member whose ability and wide knowledge of natural history were of the greatest service.

He was born in Auckland, New Zealand, in 1850, and was educated at Ipswich Grammar School, Queensland, at Newington College, Sydney, and at the University of Sydney, where he graduated M.A. In 1876 he proceeded to England to complete his scientific studies, and was a pupil of the great masters, Huxley and F. M. Balfour, taking the degree of B.Sc. of London University. Returning to Sydney he joined the teaching staff of Newington College, but left there in 1885 to become Secretary of the Linnean Society of New South Wales, from which position he retired a few years ago after nearly forty years service. During his long period he was the guiding spirit of the Society, and conducted its affairs, including the editing of the *Proceedings*, with judgment and devotion.

Mr. Fletcher contributed many articles to the *Proceedings* of his beloved Society, and the wide range of his knowledge may be judged by the fact that these included contributions on marsupial embryology, on frogs and earthworms, and, particularly in more recent years, on eucalypts and acacias; he was regarded as an authority on all three branches of natural science. He had a marvellous memory and was seldom at a loss for a reference to the literature on the many subjects in which he was interested.

Personally he was a kindly, sincere, and helpful friend, ever ready to put his vast knowledge at the disposal of anyone who sought his advice and assistance.

SIR HUGH DIXSON.

The death of Sir Hugh Dixson has removed one who was a good friend to this Museum. When funds were required for any particular purpose an appeal to his generosity never failed to find a ready response. He contributed to the cost of several of our recently installed habitat groups, and we owe many valuable mineral specimens to his liberality.

Sir Hugh had reached the advanced age of eighty-five, and for some time he had been in feeble health. During recent years he had been accustomed to spend the Australian winter at Colombo, where he died on 12th May last.

Review.

Sally Warner. By Florence M. Irby. Cornstalk Publishing Company (Angus and Robertson Ltd.), 1926.

The authoress is a valued correspondent of this Museum to whom we owe several valuable specimens and much interesting information. Miss Irby is intensely interested in the life of the bush, her mind is stored with bushlore, and in this pleasantly written story she has drawn on her knowledge of nature and the ways of wild creatures in weaving a wholesome romance round the life story of the pretty little bush girl Sally Warner, to whom every living creature is a joy.

The scene is laid in the picturesque North Coast district and in New England, New South Wales, and we have interesting glimpses of the daily round of a struggling dairy farmer and the more spacious life of the wealthy squatter. Incidentally the reader will learn much concerning the fascinating ways of the robin, the flycatcher, the mistletoe bird, and many other charming inhabitants of scrub and bush.

The Mystery of Marsupial Birth and Transference to the Pouch.

By Ellis Le G. Troughton.

A young kangaroo eyes the intruder from the safety zone of its cosy retreat. Though fully furred and feeding upon grass, the pouch is sought at sign of danger. When hard pressed by pursuers the young may be thrown from the pouch either in an attempt to save the young or to relieve the parent's distress.

[Courtesy of Sydney "Sun."

FROM the sun-bathed centre to the damp forests of tropical Queensland, and over to the Leeuwin where the sun sets west of Australia, the problem of the birth and transference of the baby marsupial to the sheltering pouch provides much argument for the bush naturalist. Many cling tenaciously to the belief that it develops on the teat, much as an apple grows on a twig, emphatically stating that the tiny baby could not possibly reach the pouch, and so, by camp fire and country bar the argument has been waged for many years.

The truth is that no real mystery exists at all, though, after recent newspaper efforts to impart the facts, and the uncompromising attitude of many correspondents, one almost despairs of convincing the die-hard doubters. However, let us briefly consider the fundamental difference between marsupials and other furred animals.

MARSUPIALS AND OTHER FURRED ANIMALS.

A distinguishing feature of all furred animals or mammals is that their young are nourished by milk suckled from the parent.

They are divided into three groups, the lowest consisting of the egg-laying Platypus and the Spiny Ant-eater or Echidna. Next come the marsupials, whose young are born at a very immature and almost hairless stage. Thirdly we have the higher placental mammals, whose young are born completely haired, their advanced development enabling them to move about and suckle at will. In these higher mammals provision is made for the nourishment of unborn young by the close connection between them and the blood stream of the parent, known as the placental connection or "navel cord." This is absent in most marsupials, only the Bandicoots (Family Peramelidae) having a fairly efficient placental connection, while the Kangaroo has none. Thus the young of most marsupials prior to birth, depend for sustenance upon a surrounding yolk-sac the contents of which are soon absorbed. A result of this meagre provision is that they are necessarily born at an early and imcomplete stage of development when a new and immediate source of nourishment is essential. To meet this need, nature has evolved a unique method for nourishing and transporting the young of marsupials, and the foregoing shows that there are definite peculiarities of internal structure to account for the unusual conditions of birth and nourishment which have given rise to so much useless argument.

TRANSFERENCE TO THE POUCH.

Though it has been known for over a century that the young marsupial is conceived and born in the usual mammalian way, there will doubtless always be ardent exponents of the born-in-the-pouch hypothesis, while amongst those who have accepted the truth there has been controversy as to the method of transference to the pouch. It was generally believed until recently that the parent was entirely responsible, but it is now known beyond all doubt that the young are able to reach the pouch and teats unaided, though it is reasonable to suppose that maternal instinct may frequently prompt the parent to assist the tiny voyagers. There are at least three Australian accounts of young marsupials travelling unaided towards the pouch, the earliest known to me being that of the Hon. L. Hope read in 1882 and quoted in Volume III. of the Transactions of the Philosophical Society of Queensland. The following extracts from this account are interesting:—"My observations have reference only to the mode of transference of the embryo to the pouch, which I now believe to be effected by the embryo itself; or, at any rate, with very little assistance from the mother, and that almost unconsciously given. I heard lately of an instance of the same appearances having been observed by a kangaroo hunter, and was pleased to find the confirmation of his story by my own experience. He had concluded that the young one had been born during the parent's dying agonies and described almost exactly what I afterwards saw, 'that the embryo was working its way through the fur straight towards the orifice of the pouch.'

"The dam that I shot had been dead, perhaps, five minutes before I had noticed what was going on, but I don't think sufficient time had elapsed for the young one to have made its way so far. It was then within about five inches of the orifice of the pouch. . . . closer inspection showed it to be working actively with its fore legs—arms, in fact—which were considerably developed, with the claws apparent. It was about one and one-third inches in length, the tail and hind legs undeveloped. . . . After watching it a few minutes, and not having much time to remain, I took it from the fur, to which it seemed to adhere pretty firmly, and placed it on the closed orifice of the pouch. It soon left this, however, and commenced travelling through the fur, which was pretty long, with considerable energy: as, however, it began to describe circles, and appeared, as I may say, rather to have lost its way, after a few minutes more I placed it again on the supposed orifice of the pouch, taking care that the head sunk among the folds of the skin I have mentioned. It then seemed to endeavour to burrow in. At this stage I had to leave it, as the day was advancing, and I had an engagement elsewhere." Stating that he would have kept the skin and embryo had preservatives been available the observer remarks: "What struck me was the marvellous energy and apparent endurance of the embryo in its course, and the small chance there seemed to be of its falling from the fur, which, while producing adherence, did not seem to impede its progress materially."

These observations were later confirmed by Mr. A. Goerling, of Marloo Station in the Murchison District of Western Australia in

an account of the birth of a Red Kangaroo, published in the Perth " Western Mail " for January 3rd, 1913. He wrote that " On the morning of the abovementioned date (February 25, 1906), I was attracted by the peculiar behaviour of a female *Macropus rufus*. She refused the feed placed before her, and I came to the conclusion that the animal had just given birth to a young one. She was sitting in that resting position in which kangaroos can often be seen, the tail passed forward. Thus she was sitting almost entirely on the thick part of her tail. She took no notice of my presence, although not more than three weeks in captivity. Presently she lifted her head, when I was astonished to see a young kangaroo clinging to the long fur about four inches below the opening of the pouch.

" It moved slowly, very slowly, through the fur upwards, using the arms in its progress, and continually moving the head from side to side, thus assisting the upward movement. Nearly 30 minutes were required by the little wanderer to reach the top of the pouch, the last end in a semi-circle. During the whole of this time the mother paid no attention to her offspring, offering no assistance, and leaving it entirely to its own exertions." On a previous occasion Mr. Goerling had noticed a baby wallaroo clinging to the fur below the pouch of a female captive and had thought that the mother's restless movement had dislodged it.

The agreement between these two accounts is very striking and, strangely enough, during the preparation of this article a further very definite account was published by Professor Launcelot Harrison of Sydney University in the " Sydney Morning Herald " on May 20, 1926. Under the heading " Birth of the Marsupial," The Professor wrote that " Through the courtesy of the Hon. Fred. Flowers, M.L.C., chairman of the Taronga Park Trust, the following document has been placed in my hands for publication :—

April 22, 1926.

I hereby state that on the above date, about 10.30 a.m., having noticed the actions of a wallaby (female of the species Macropus thetidis) to be peculiar, I watched carefully and noticed her to be sitting with the tail brought forward under the legs. The animal was vigorously licking the fur between the base of the tail and the pouch. I was then able to see the foetus clinging to the fur near the tail. At this juncture, I summoned to witness, L. McHugh, E. Harrison, and F. Stone. The foetus moved slowly up through the fur with an automatic kind of movement of the fore limbs, but was unable to find the pouch and moved on high and got lost near the chest. The female continued to lick the foetus, but made no attempt to render other aid, or remove it to the pouch. The female became restless, and in hopping away dislodged the foetus, which was recovered.

A newly-born Great Grey Kangaroo, attached to a teat in its mother's pouch. Its fore limbs are abnormally long and are provided with claws which are wanting on the weaker hind limbs.
[Photo.—*G. C. Clutton.*

(Signed) J. S. Munro
(keeper's asst.).

We the undermentioned did witness the movements as mentioned above, and swear that these statements are correct.

(Signed) L. McHugh (keeper)
E. Harrison (keeper's asst.).
F. Stone.

As Professor Harrison says, Mr. Munro is to be congratulated upon the important observations he has made, and upon his forethought in securing an adequate number of colleagues to support his testimony. Though the observations are not new they substantiate in a striking way the Australian and American accounts of marsupial birth.

BIRTH AND TRANSFERENCE OF THE AMERICAN OPOSSUM.

For further confirmation, unnecessary though it appears, we may turn to ancient marsupial forms of another continent, the American opossums, which have lived much in their present form for geological ages and from which in the remote past our own marsupial fauna appears to have evolved. As early as 1823, Dr. Barton wrote in the Annals of Philosophy that "The young opossums, unformed and perfectly sightless, as they are at this period, find their way to the teats by the power of an invariable, a determinate instinct." This statement, queried by the great Sir Richard Owen, has recently been completely proven by the investigations of Dr. Hartmann, which are detailed by him in the "Anatomical Record" for 1920, the following extracts being of interest. A report of an experiment in the presence of Dr. Heuser says: "Young which were removed from the teats crawled about, moving hands alternately, as in swimming. Were able to crawl among hairs and find teats by their own efforts. One specimen, removed three times, found teat each time and three others found teats after wandering about." Later the following method was adopted for observation: "The animal was placed just outside a window in a cage illuminated with a red electric light, which arrangement was least disturbing to the animal as she was insulated against noises from within the room: the sight of persons moving about in the room caused little response on the part of the animal, but slight noises near the cage startled her greatly." After stating that the young are born when the mother is in a sitting position with outstretched legs, Dr. Hartmann writes: "Unerringly the embryo traveled by its own efforts; without any assistance on the mother's part . . . this ten-day-old embryo, in appearance more like a worm than a mammal, is able, . . . to crawl a full three inches over a difficult terrain. Indeed, it can do more: after it has arrived at the pouch it is able to find the nipple amid a forest of hair. This it must find—or perish. . . . One detached young . . . crawled readily back into the pouch. Two or three others regained the teats after some delay, and one wanderer, which lost out in the first scramble, found a vacated teat and attached itself even after twenty minutes delay, showing that the instinct to find the teat persists for some time. If the skin be tilted, the embryos can, be made to travel upward and even away from the pouch, for they are negatively geotropic. For locomotion the embryo employs a kind of 'overhand stroke,' as if swimming, the head swaying as far as possible to the side opposite the hand which is making the propelling stroke. With each turn of the head the snout is touched to the mother's skin as if to test it out, and if the teat is touched, the embryo stops and at once takes hold."

We have then, at the risk of being tedious, quoted five reliable accounts in complete agreement on essential points, and may now consider several important modifications found in marsupials, in addition to the means for nourishment prior to birth already discussed.

ADAPTATIONS FOR TRANSFERENCE AND FEEDING.

Nature has provided a means of locomotion for the baby marsupial in that the fore-limbs are greatly enlarged in comparison to the hind ones, exactly the reverse of what we find in adult kangaroos and wallabies, while the tiny hands are equipped with claws and able to cling tenaciously. After grasping the teat, the tip swells within the young one's mouth, helping to hold it there after it has become incapable of independent movement.

The general belief is that the young marsupial cannot even suck, and that a special arrangement of muscles in the mother's milk-glands regulates the flow. On the contrary, Dr. Hartmann states that whether it is true or not that the mother pumps milk into the pouch-young "certain it is that from the very beginning the young opossum engages in active sucking movements." Whether nature has provided a form of forcible feeding entirely acceptable to the patient or not, there is definite provision made for continuous breathing without fear of the lungs being flooded. The epiglottis is produced upwards to form a tube extending into the nasal chambers and embraced by the soft palate, a continuous passage being formed from the nostrils to the larynx so that air passes down the windpipe to the lungs, while milk flows unobstructed to the gullet.

ERRONEOUS BELIEFS AND THEIR EXPLANATIONS.

Adherents of the pouch-birth theory speak of a tiny bud appearing on the end of the teat, and of definitely formed young, too small to have survived the journey to the pouch. The apparent budding of the teat is really a natural swelling, possibly increased by the expected flow of milk, while we know that the tiny young of the American opossums can make the journey unaided, as can the inch-long young of a five foot kangaroo. Bleeding follows forcible removal from a teat, leading many to believe that the young one is part of it, but this is really due to the nipple swelling within the mouth which splits with the force of removal, also rupturing the softened skin of the teat. It is notable that dead marsupials often reach the Museum with young detached from the relaxed teats without any sign of injury, while an authority has suggested that at birth the mouth is wider and more elastic than it is after closing around the teat.

In fairness to observers who arrive at wrong conclusions and are usually keen nature lovers, it may be pointed out that they are misled by inability to observe continuous development of the offspring of such timid creatures, basing their views upon observations of many animals, instead of the steady development of one subject. Thus the observer, noting a swollen nipple awaiting a tenant, and later killing a parent with the tiny hairless occupant clinging firmly to the teat, jumps to the conclusion, in a manner he would heartily condemn in any scientist, that it is born there. Finally should the juvenile's mouth bleed upon forcible removal he regards the case as settled.

Last year in the " Daily Telegraph " Mr. A. H. Chisholm outlined the truth, and kindly acknowledged a few comments to the present writer. The facts proved unacceptable to several correspondents, one writing that in spite of " Le Troughton and Co., and all your Pitt and George St., naturalists " he would stick to his opinion. This description though amusing, is hardly correct, as the writer has collected in many localities in South and Western Australia and still has a vivid memory of shattering the life-long belief of an old hunter on Kangaroo Island by dissecting out the unborn young of a kangaroo before his reluctant eyes.

Having always found bushmen keen observers and been much indebted to them for assistance in the field, one cannot but regret the stubborness with which some persist in believing that marsupials are born on the teat. They pit their views, based upon superficial observations, against truths expounded by giants of the scientific world such as Owen, Huxley and Haswell, who knew the structures of marsupials as great surgeons know the human anatomy.

Of what avail to contend that the tiny young could not possibly reach the pouch, or marvel at the instinct which urges them on, when nature is daily proving that there are more things in heaven and earth than are dreamt of in our philosophy. As Dr. Hartmann says in discounting the contention that the adult must assist the young to the pouch "Why should it be necessary. . . . to presume such undue skill and sensitivity in the adult when a pure reactive instinct in the young will suffice ?" To express it simply and conclusively, it may be said that the newly-born marsupial seeks the teats within the sheltering pouch with a flash of instinctive energy which lapses when the goal is reached, and to suppose that they are born upon the teats, which as in all mammals are merely associated with the supply of milk, is as reasonable as to suppose that a calf is born upon the cow's teat.

Messrs. Tom Iredale and G. P. Whitley, zoologists, recently returned from Michaelmas Cay, off Cairns, North Queensland, where the Great Barrier Reef Committee, under the direction of Mr. Charles Hedley, has been conducting boring operations. These officers stayed four weeks on the island, investigating the coral reefs when conditions permitted and examining the drift and land fauna and generally making observations on the life of the islet. The Trustees are much indebted to the Committee for the facilities afforded.

The Common Brown Butterfly (Heteronympha merope), one of the most abundant species occurring in the vicinity of Sydney. It appears to favour grass-lands or the sunlit glades in open forest country. During dull weather specimens are rarely seen. The two larger butterflies in the above illustration are both females, one being at rest and showing the under surfaces of the wings, while the other has the wings outspread displaying their upper surfaces. The two smaller individuals are males and display the upper and lower wing surfaces in a similar manner. Two caterpillars may be seen upon their food-plant.

[*Helena Forde, del.*

Some Familiar Butterflies.

By Thomas G. Campbell.

AMONG the vast number of individuals which comprise the insect world, perhaps no group commands so much attention as the Lepidoptera, the order which includes the butterflies and moths. The Lepidoptera are the most familiar and easily recognisable of all insects, and it is in this group that coloration shows the highest degree of specialisation. These insects have always been popular objects for study, and approximately eighty thousand species have been described. In their perfect state, the Lepidoptera exhibit great elegance of form, and while on the wing their coloration is displayed to its greatest advantage. Not only are adult butterflies extremely fascinating creatures, but the study of their life-histories proves to be even more entertaining, and some forms have an additional interest on account of their economic importance.

In their young stages butterflies attract but little attention, as their coloration usually simulates that of their environment and so enables them to escape detection. The eggs, which when seen under a microscope appear extremely beautiful objects, are laid on plants destined to provide food for the caterpillars when they emerge.

Young caterpillars feed rapidly, and at frequent intervals cast their skins and grow new ones until finally they are fully grown. An examination of a caterpillar reveals a number of pairs of legs. Not all of these, however, are true legs which are represented by the three pairs at the anterior end of the body corresponding to the normal three pairs of an adult insect. The remaining "legs" are fleshy pads which are unjointed, and merely assist the caterpillar to move about over its food plant with greater ease. In addition there is usually a strong pair of claspers at the posterior end of the body, by means of which the caterpillar can retain a firm hold on a twig or leaf.

The pupæ or chrysalids are likewise subject to variation, and some hang suspended by the tail, others may be supported by a silken girdle, while others again resemble many moth pupæ in resting on the ground, enclosed in a rough silken cocoon. As a rule, butterfly chrysalids are quite unprotected. In the pupal stage the young butterfly remains quiescent, the caterpillar structure having entirely disappeared. The internal organs are altered considerably, and many of the adult structures are formed from the breaking down of various tissues which existed in the caterpillar. The pupal stage is often the most lengthy period in a butterfly's life history, but after a time the pupa case splits open and the adult butterfly emerges. At first its wings are soft and crumpled in appearance, but they expand rapidly and dry in a few hours, after which they are ready for use and the adult insect is able to enter on the final stage of its life history.

The difference between adult moths and butterflies is chiefly in habits and the structure of the "feelers" or antennæ. These structures on an insects' head, which are popularly known as "feelers," are of a sensory nature enabling the insect to feel, smell, and, as it is also thought, to hear. In the butterflies, which are included in the sub-order Rhopalocera, the antennæ are thread-like and have a distinct swelling or club at their extremities, while in the Heterocera (moths) the antennæ are never distinctly clubbed, but may be pectinate, plumose, thread-like, or else take on some other form. Furthermore almost all butterflies are day-flying insects, while the vast majority of moths fly only at night, comparatively few being seen during the day.

In this article it is the intention of the writer to give a brief account of several of the more striking Australian butterflies, particularly those forms which occur in the vicinity of Sydney. Throughout Australia there are approximately some three hundred species of butterflies, though there are very many more species of moths. The first butterflies to be recorded from Australia were those collected by Sir Joseph Banks and Dr. Solander, the naturalists on Captain Cook's ship "Endeavour," during his voyage of 1770. These and other insects collected during the expedition were described by the naturalist Fabricius in 1775.

The Tailed Emperor Butterfly (Eulepis pyrrhus, subsp. sempronius), a handsome species which occurs chiefly in the coastal districts of New South Wales and Queensland. The two tails on each hind-wing easily distinguish the species from all other Australian butterflies, while the smooth blue-green larvae have a number of horn-like processes on the head giving them a somewhat striking appearance. The pupa or chrysalis has a very smooth surface and may thus be distinguished from all other Australian butterfly chrysalids included in the same family. The colouration of the sexes differs but little on both upper and lower surfaces, though the female (above) is usually larger than the male (below). When feeding on plant juices this species is usually easily captured, but at other times is possessed of strong and rapid flight.

[*Helena Forde, del.*

THE COMMON BROWN BUTTERFLY.

This species, *Heteronympha merope*, is one of the most abundant forms occurring about Sydney, and along the eastern coast of Australia, the northern limit of its range being Gympie in Queensland. It was secured first by Banks and Solander, and specimens were doubtless secured during their stay at Botany Bay, as the only other places on the coast where members of the expedition landed were Bustard Head and Endeavour River on the Queensland coast, both of which are considerably further north than the limit of the butterfly's range. *Heteronympha merope* was thus one of the first insects to be collected in Australia. This species makes its appearance about the end of October and remains until the end of autumn. It is said that in the early part of the season the males are much more numerous than the females, but as the season progresses the ratio changes, and at its close the females predominate. In bright sunny weather this butterfly may be seen in great numbers on grassy lands, or flitting about through the sunlit glades in open forest country ; during dull weather it is rarely met with.

The coloration of the sexes differs somewhat, and of the two the male is the smaller. In the male the upper surfaces of the wings are orange-brown, marked with black. At the apex of each forewing is a black spot with a white centre, and on each hindwing is an ocellus or eye-spot. On their undersurfaces the wings are similar, though some of the markings near the wing-bases are wanting.

In the female the upper surface of each forewing is marked by an orange-brown patch, somewhat triangular in outline and covering about half the wing. The remainder of each forewing is black, marked with orange-spots, and with an ocellus at its tip ; the hind wings are orange-brown marked with black, each bearing an ocellus near its hind margin. On their undersurfaces the forewings are marked with orange-brown, black and straw-colored areas and bear ocelli near their apices. The hind wings are grey mottled with yellowish-brown, and each has three small ocelli. When the butterflies are settled with the wings erect, they bear a close resemblance to dead leaves.

The larvæ or caterpillars of this species measure about one and a half inches in length, and are brownish or dull-green in colour, with the head somewhat reddish. On the upper surface, a broad dark line runs almost the full length of the body, which tapers towards both ends, the tail being bifid. These caterpillars are sluggish creatures and usually remain hidden near the ground. Their food plants consist of various grasses.

Unlike most butterflies, the pupa of *Heteronympha merope* is enclosed in a flimsy cocoon resting upon the ground. In the pupa the thorax and wing-covers are pale green, the wing cases bearing a number of black spots along their margins. The species occurs in suitable situations throughout eastern Australia, South Australia, and Tasmania.

THE TAILED EMPEROR BUTTERFLY.

The Tailed Emperor, *Eulepis pyrrhus* subspecies *sempronius*, is a handsome species, which enjoys the distinction of being the only representative of the Genus *Eulepis* occurring in Australia. Numerous allied species are found in Africa, India, and the Malay Archipelago, but the distribution of the genus is limited in the Pacific, though some forms occur in New Guinea and Fiji. The Australian species, *Eulepis sempronius* is comparatively rare in the inland parts of Australia, but is not uncommon in the coastal regions of New South Wales and Queensland. The sexes differ but little, and in the adult the upper surface is creamy-white with black markings, while below it is silvery-white marked with brick-red and black, with a row of orange spots on each hindwing. Occasionally specimens of the butterfly may be taken feeding on the juices exuded by plants, while the late George Masters once noticed several specimens feeding around the leaky bung of a wine barrel.

The eggs are laid singly on the upper surfaces of the leaves of the food-plants, which, in most instances, is the Spiny Acacia. The adult larvæ are bright bluish green, with the head rather rough in appearance and bearing four to six horns which give them a very characteristic form. Though the larvæ are characteristic in appearance, the pupæ, have very little to distinguish them from other members of the same family. The pupæ are attached to their food-plant by means of the tail only, and hang head-downwards. Newly-formed pupæ are usually green in colour, but after a time change to a dark-brown hue. The external surfaces of the pupæ are quite smooth.

The Migratory White Butterfly (Delias nigrina) which often occurs in considerable numbers along the eastern coastline of Australia. The food-plant of this species is Mistletoe (Loranthus) upon the foliage of which the caterpillars feed in large communities. The butterfly on the right of the above illustration shows the upper surface of the male, while in the top left hand corner is the female; the individual in the centre of the picture displays the markings on the under surface of this species, which is the same in both the male and female. The larvae and pupae are also illustrated, the former bearing hairs and tubercles, while the latter are armed with spines on their external surfaces.

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The Orchard Swallow Tail Butterfly (Papilio aegeus), a frequent visitor to orange groves in the coastal districts of New South Wales and Queensland. In the illustration the butterfly at rest in the top left hand corner is a male, showing the undersurfaces of the wings, while in the top right hand corner is a male with the wings outspread, and whose upper surfaces are visible. Below is a female displaying the upper wing surfaces. The difference in the colour pattern of the sexes is thus shown. The three caterpillars are in different stages of growth, and give some indication of their form and size.

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THE MIGRATORY WHITE BUTTERFLY.

The Migratory White Butterfly, *Delias nigrina*, is also very common around Sydney, and often occurs in large flights. It is plentiful along the whole of the eastern coast-line of Australia, and like *Heteronympha merope* possesses an historic interest, for it, too, was first collected on these shores and brought to England by the naturalists of the "Endeavour." It is reasonable to suppose that *Delias nigrina* was met with in fairly large numbers at each of the three places visited by Captain Cook. During the time when the "Endeavour" was being repaired, after striking a coral reef near where Cooktown now stands, the naturalists of the expedition found time for field-work and collecting. There they would be likely to meet with specimens of *Delias nigrina*, for its range extends as far north as Thursday Island.

In the adult insects the upper surfaces differ somewhat in colour in the two sexes. The upper surface of the male is white with a black patch at the tip of the forewing, while the female is darker, with the front border and half of the fore wing black in colour. Both sexes are alike on their undersurfaces, which are blackish-grey, the tip of the forewing being yellow, while an irregular band of carmine marks the hind pair, resembling in outline three sides of a rectangle.

The larvæ live in communities upon their food plants (various species of mistletoe), and when fully grown measure about one and a half inches in length. The bodies of the caterpillars are dull-green in colour, the surface being studded with small yellow tubercles, which bear long white hairs. Each pupa is attached to the food-plant by its tail, and is further held in position by a silken girdle which passes around the middle. The pupæ are armed with a number of curved spines.

THE ORCHARD SWALLOW-TAIL BUTTERFLY.

Perhaps one of the most striking and best known of all our Sydney butterflies is the Orchard Swallow Tail, *Papilio ægeus*. Not only is this insect common, but it is the largest butterfly occurring south of the Richmond River district.

Of the two sexes the male is far more common in collections than the female. The upper surfaces of the forewings are a rich velvety-black, with patches of white at the tips; the hind-wings are also black above, with a central patch of greenish white and a bright crimson spot near the hind border. On the underside the forewings are grey at the tips but otherwise very similar to the upper surface. The hindwings are black beneath, with red V-shaped marks and faint bluish patches along the hind margin.

The female is larger than the male and quite distinct. In the forewings the upper surfaces are dark smoky-brown, the edges being grey and marked with white; the hind-wings are mainly dark brown, their central portions being white, while there are several large crimson marks on the outer margins. On the undersurfaces the coloration is similar to that above, but may sometimes be lighter. Between August and May the adult butterflies are on the wing, and late Autumn larvæ pupate during May and do not emerge till the following Spring. The larvæ appear to be free from parasitic insects, though many are said to be destroyed by Silver Eyes.

The eggs are usually to be found on the undersurface of the leaves of its food plant, the orange, and the larvæ hatch after about ten days. During the various stages through which the larvæ pass the colour changes very considerably. The fully-grown larvæ measure about two and a half inches in length and are olive or pale-green above, while below and at the sides this color changes to a golden or golden olive hue. When irritated the larvæ emit a disagreeable odour like that of rotting oranges. The pupæ, which are somewhat angular in outline, measure about one and a half inches in length, and are green in colour like the stems and foliage to which they are attached.

Papilio ægeus has a wide range and occurs throughout eastern Australia and extends to Lord Howe and Norfolk Islands.

For those readers of the MUSEUM MAGAZINE, who would care to go more deeply into the subject, I would recommend to them two useful books; "The Butterflies of Australia," by G. A. Waterhouse and G. Lyell, and "A Guide to the Study of Australian Butterflies," by W. J. Rainbow, The latter is a useful primer for the beginner, while the former gives a scheme of classification embracing all the Australian species with their descriptions, as well as a large series of plates.