The AUSTRALIAN MUSEUM MAGAZINE

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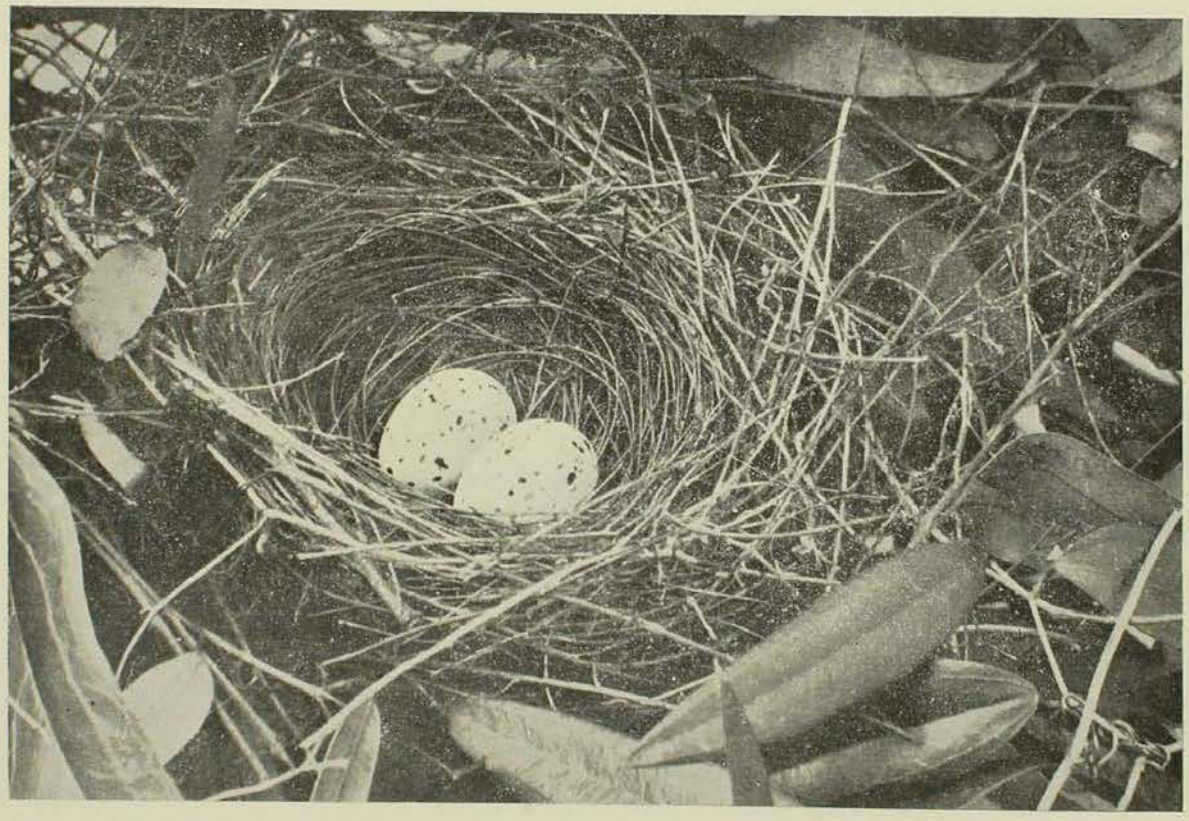

Nest and Eggs of Whip-Bird.

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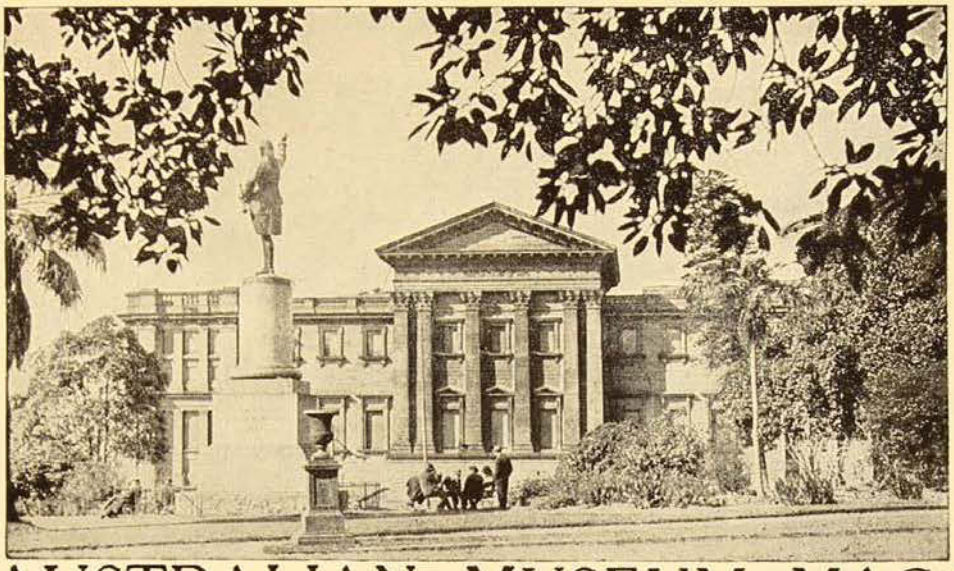

THE AUSTRALIAN MUSEUM MAGAZINE

● OUR FRONT COVER. The nest of the Whip-Bird (*Psophodes olivaceus*) is an open structure irregularly formed of long thin twigs or spiny stems and fibrous rootlets, the inside is cup-shaped and neatly lined with fine rootlets or thread-like leaves such as those of the Casuarina or she-oak or horse-hair, the rim being almost flat. Generally the nest measures about six inches in diameter by about two and a half inches in width. Sites vary but the nest is generally about two or three feet from the ground in a low shrub. Eggs are usually two in number, seldom three. The shell is close-grained, smooth, and slightly lustrous. The ground-colour ranges from pale blue to a delicate bluish white with small black spots, blotches and markings.

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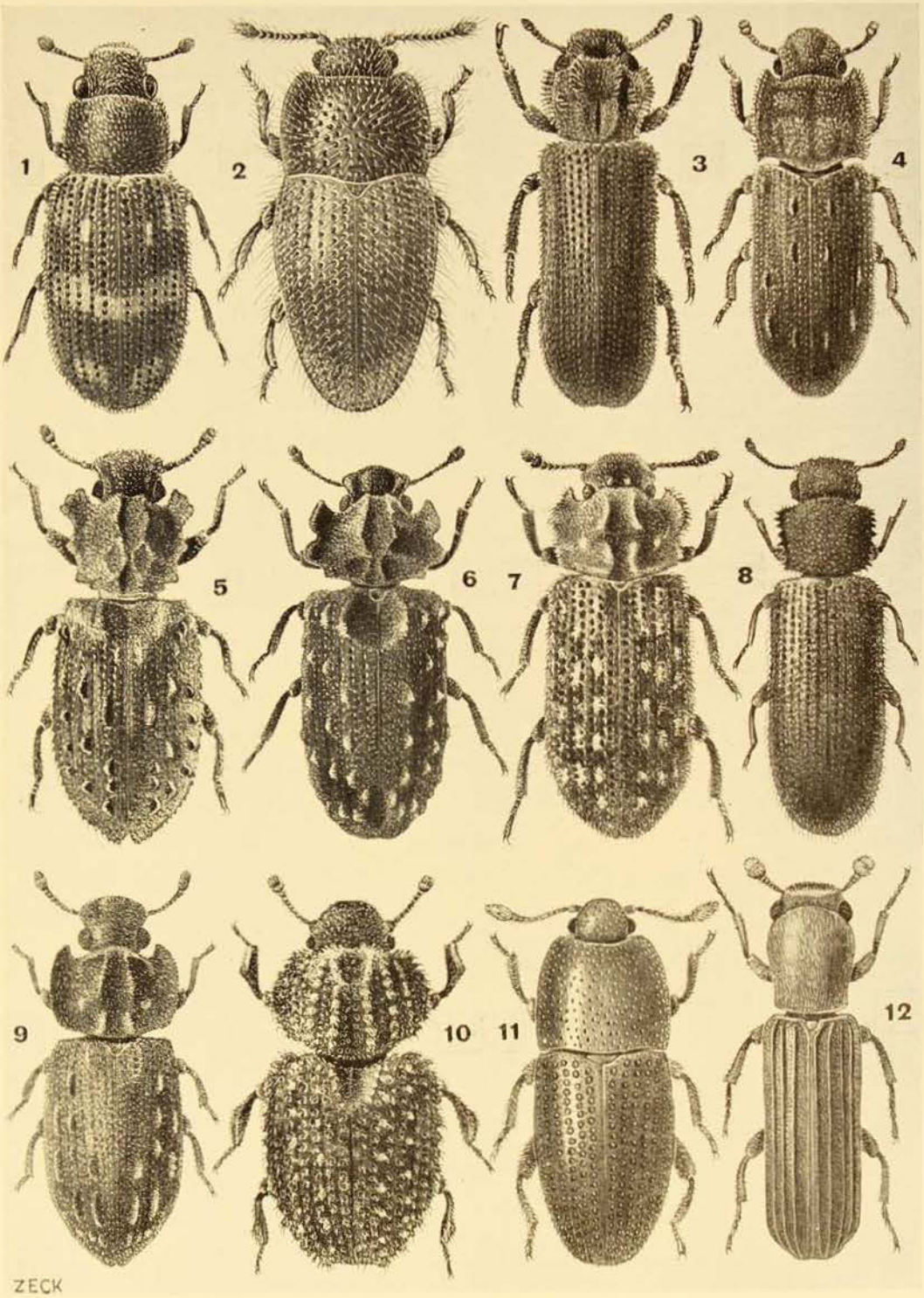

Australian Colydids. (See page 241.)

1. Bupala fasciata. 2. Cerylon longipilis. 3. Neotrichus acanthacollis. 4. Cebia tumulosa. 5. Ablabus mimus. 6. Ablabus tuberculatus. 7. Ablabus pulcher. 8. Pabula dentata. 9. Ablabus integricollis. 10. Epistranus tibialis. 11. Cerylon parviceps. 12. Metopiestes strigicollis.

E. H. Zeck, del.

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Museums in UNESCO Programme

NORMAL museum activities of any particular type are likely to produce different results in different countries. An interesting proposal has been brought forward by UNESCO to provide useful information on museum methods under various conditions. It is proposed to invite a number of museums in different countries to carry out programmes of activities of comparable types, to keep records of them, and to furnish reports for comparison. There are many subjects which could be selected for such an experiment. The results should be of great interest not only to museums but to all who may be concerned with teaching by visual methods, and should furnish a very interesting comparison of the reactions of various peoples to the type of exhibit activity selected for the experiment.

Museums figure in a variety of ways in the 1948 programme of UNESCO—especially in so far as they may make some contribution to conditions of world peace. It is perhaps not generally realized that museums available to the ordinary person are, in the world at large, comparatively rare and that relatively few people have access to them. The term "museum" as used by UNESCO covers a very wide range of institutions, including art galleries, museums of science, technology and history, aquaria, botanical and zoological gardens, nature and wild life preserves, and national parks. Museums in this wide sense can display and interpret things for the instruction and pleasure, on every level, of mankind.

One of the aims of UNESCO is to promote the development of museums' functions in the broad educational field as an addition to their accepted tasks of accumulation and preservation. Encouragement of extension services to bring some of the benefits of great museums to country centres and even small villages is part of this problem of widening the opportunities for cultural and intellectual influence.

The Antiquity of Man in Australia

By FREDERICK D. McCARTHY

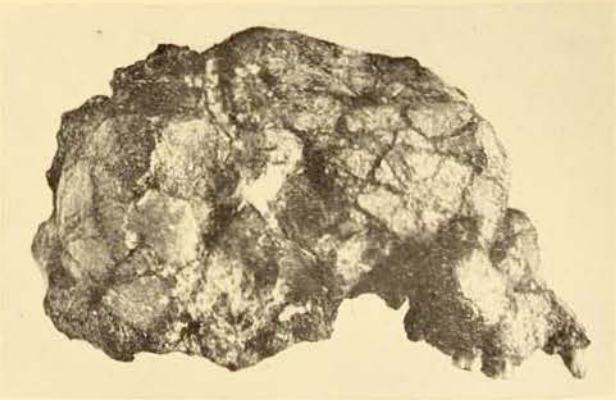
PART II

When man occupied Sahul Land during the Pleistocene period he found it to be a fertile continent with no economic or topographical difficulties to obstruct his gradual diffusion southward. The vegetation of the whole land, because of the higher rainfall then prevailing, was very similar to that in well watered areas of the present time. On the great plains and plateaus of the interior were vast lakes and big rivers, and the fauna included giant extinct marsupials. But Mother Nature changed this Utopian environment for man and animals. The high rainfall belt receded to the north and south, movements of the land changed the topography to such an extent that the great lakes almost dried up, the rivers either disappeared or became smaller, and the Central region gradually developed into the arid semi-desert country of today. The giant marsupials were thus driven away to the still fertile plains towards the coasts of Australia, where they ultimately died out. It is not known precisely when they were finally extinguished, but it is certain that man, probably both the Tasmanians and the southern Australians with their dingo, assisted in their obliteration.

Many other important changes took place during this eventful and dramatic period in the prehistory of Australia, among which was the breaking up of Sahul Land into the Bismarck Archipelago, Australia, Tasmania, and other smaller islands along its northern periphery. Now, the Tasmanians might have penetrated to Tasmania prior to this partition but here again fluctuations in the sea level in Bass Strait no doubt enabled them to reach their last stronghold either by a land bridge or by travelling across a narrower sea channel than that of the Strait of today.

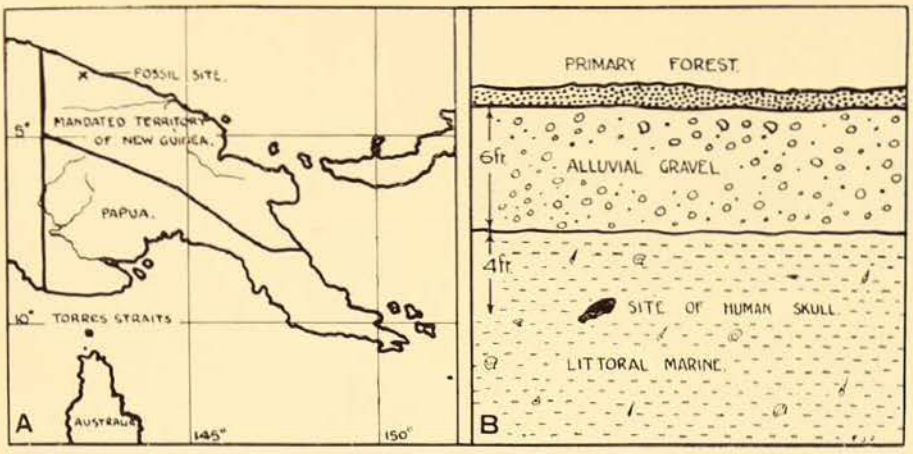
Skeletal Evidence of Antiquity

Numerous claims have been made about the great age of single stone implements and skulls found in Australia but few of them have stood the test of scientific examination. An interesting discovery was the famous Wellington tooth. This was found in a limestone cave in Wellington, New South Wales, which



The Talgai skull was found in 1884 by a workman who saw it jutting out from the bank of a creek on Talgai Station, Darling Downs, Queensland. He had it in his possession for thirty years before it became known to science, and it is now in the collection of the Anatomy Department, University of Sydney.

Photo.—G. C. Clutton.

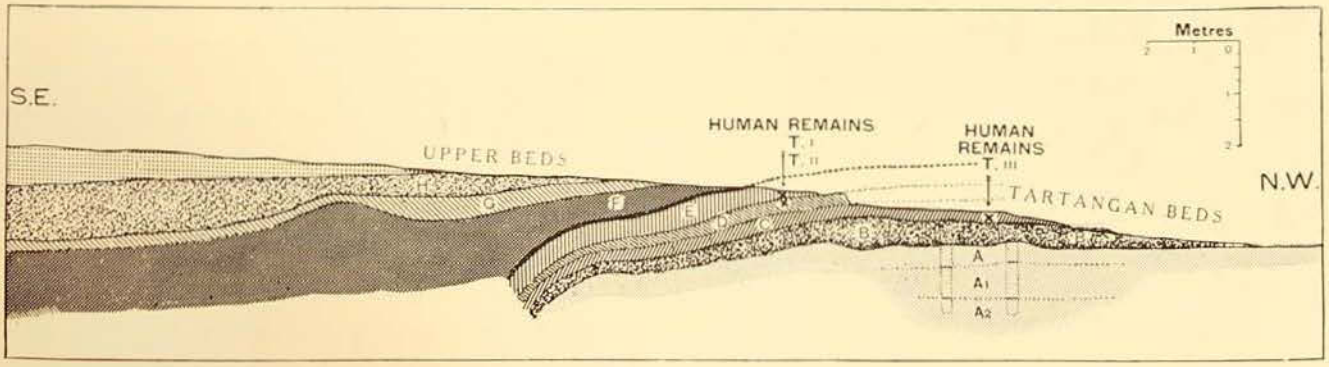


Portion of a human skull was found in a bed of littoral marine clay in the Upper Wanimo Series, forming part of the eastern bank of Paniri Creek, near Barida village, Aitape district, New Guinea. After Fenner.

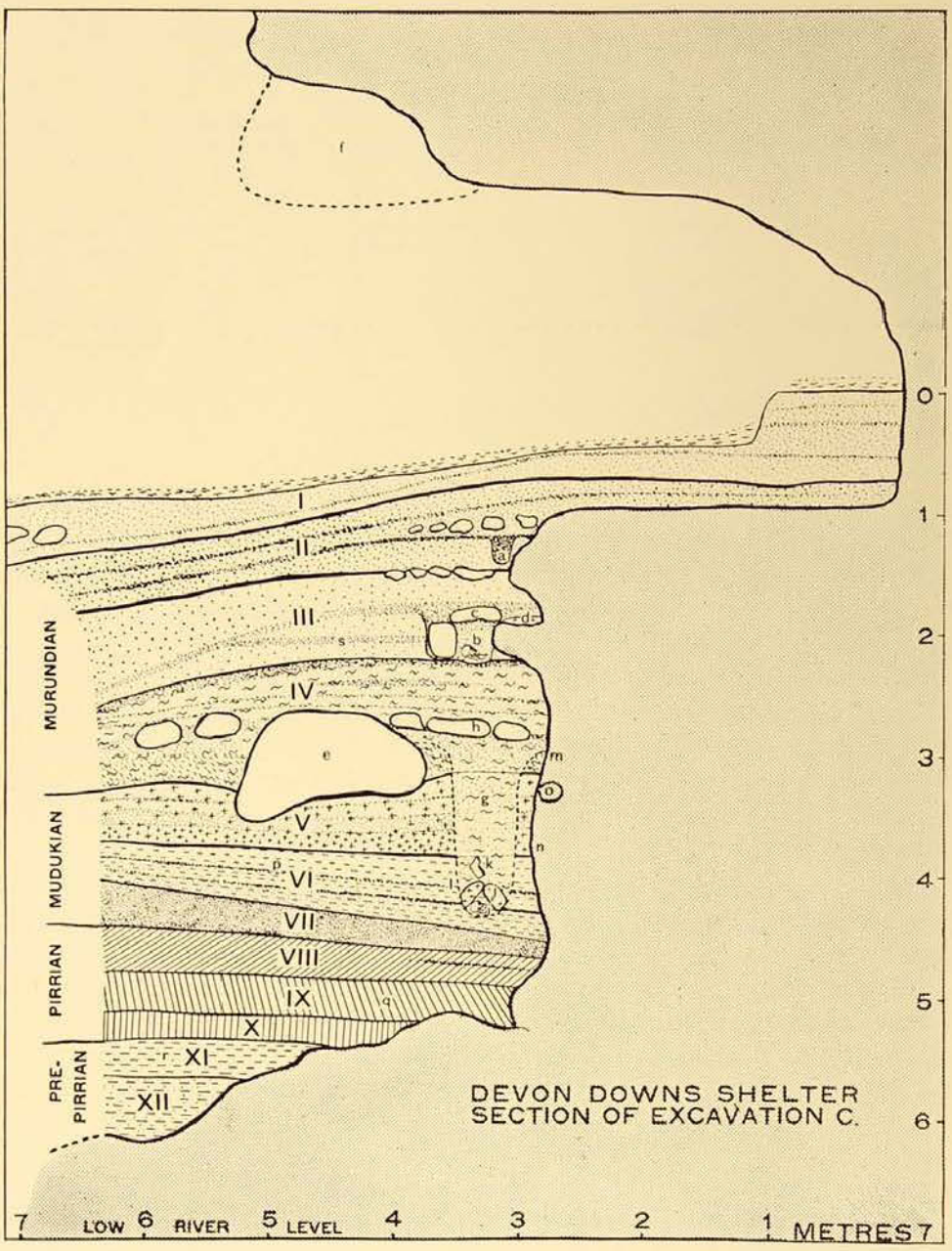
contains a re-distributed breccia bearing the bones of extinct animals, and for this reason the tooth was cited as evidence of great antiquity. It is, however, only the cap of a molar tooth, extremely difficult to identify, which Campbell said does not bear the usual attrition or wear of aboriginal teeth. When, moreover, we consider that it is doubtful whether it came out of the breccia, it is apparent that it can no longer retain its former importance.

Then there are the mineralized skulls found in various parts of the continent, particularly in the Murray-Darling river area of New South Wales where replacement of the bone structure by minerals in solution is a rapid process. Among these is the Cohuna skull which Mackenzie measured with the hard matrix still adhering to some parts; the extraordinarily large dimensions that he got in this way misled Keith into declaring it to be the most primitive known type of human skull ever found! Shellshear removed all of this matrix and found the skull to be within the normal range of modern aborigines without any specially important primitive characters. The Jervois skull was another one in this category also cited by Mackenzie as an ancient relic of man in Australia.

Several other skulls, however, are of great importance and the one found at Talgai, Queensland, in 1884 is an outstanding example. Some thirty years later Edgeworth David visited the finder, then an old man, and got him to point out the approximate position of the skull, which he indicated as projecting from a layer of red clay. In this same clay, which is of Pleistocene age, some ten miles away and elsewhere in the district were found the bones of extinct animals.



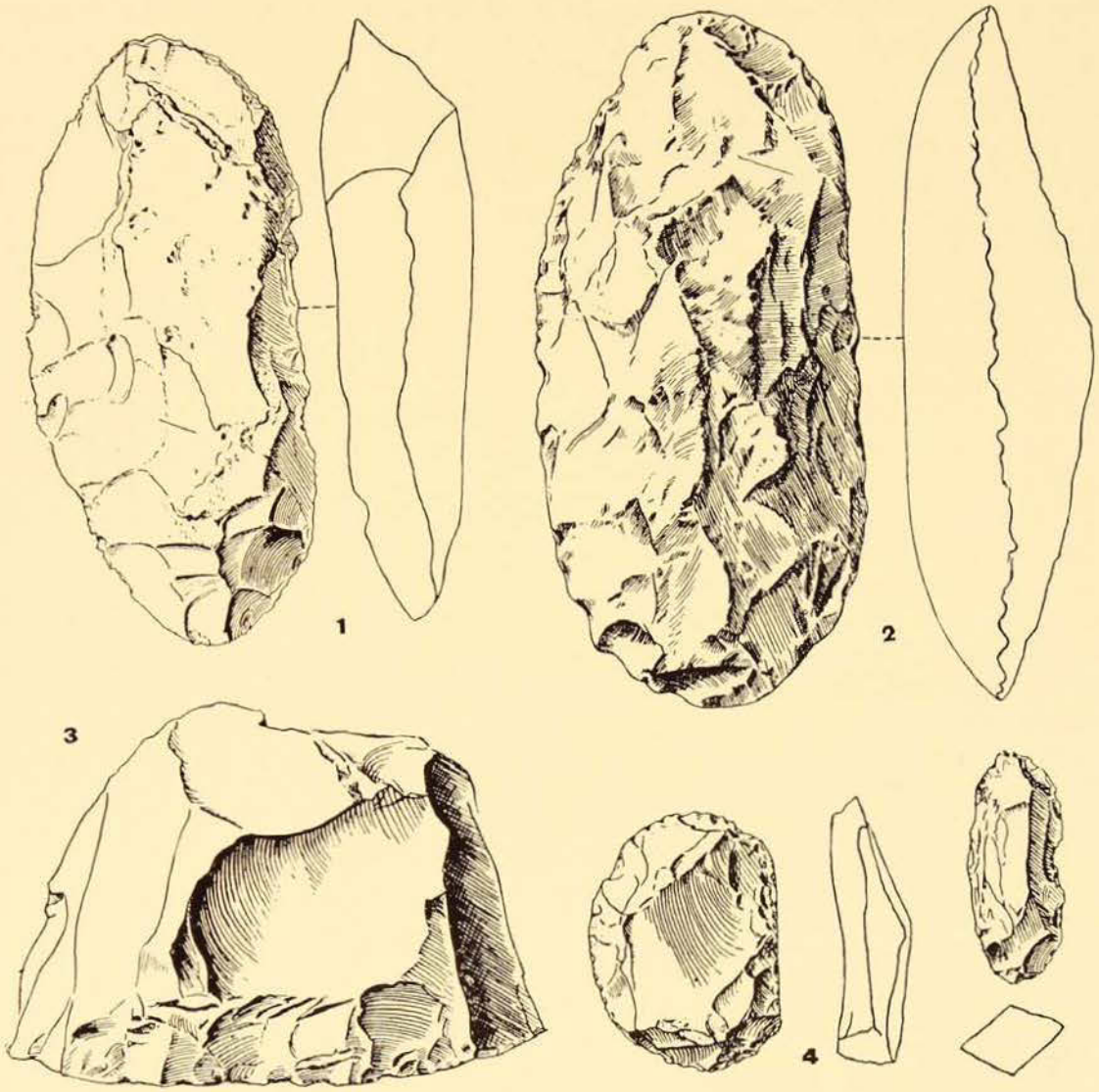
The beds at Tartanga, lower Murray River, South Australia, showing the old and hardened stratified layers covered by recent deposition, and the position of the human remains. After Hale and Tindale.



The stratified culture layers in the Devon Downs cave represent a long period of occupation, but the precise age of the earlier cultures is as yet unknown. The position of the human remains found is shown in the various graves.
After Hale and Tindale.

The skull was covered with a matrix of hard red clay, and it is now generally considered from this fact together with its distortion from pressure, and because its state of mineralization is similar to that of the animal bones, that it belongs, as its finder claimed, to the red clay deposit. It is the skull of a male youth of Australoid type. Smith claimed that its cranium, facial structure, large palate and faceted canine teeth were primitive characters, and the latter of ape-like nature. Burkitt, however, showed that the position and faceting of the canine teeth are similar to those of some modern Australian aborigines, but that the teeth anterior to them are larger and more primitive than in those of the latter of corresponding age, a conclusion with which Campbell agreed.

Another important discovery was made in 1929 by Hossfeld, an Adelaide geologist, who found portion of the cranium of an Australoid skull at a depth of four feet in a Pleistocene marine clay in the Aitape district, northern New Guinea. The site is about three hundred feet above sea level, and ten miles from the present



Key implements in the prehistory of Australia. 1. Buandik biface hand-axe made of flint. 2. Sumatra-type hand axe, a uniface implement. 3. Horsehoof nuclei. 4. Tula adze-flake showing a complete example on the left and a worn-out slug on the right.

G. Binsted, del.

coast, so that a considerable change in topography has taken place since the deposition of the clay by the sea. There are six feet of gravel, and then a few feet of soil in which the jungle is growing, above the clay. Fenner described this specimen as portion of the skull of a woman about forty-five years of age, similar to the southern Australian aboriginal type, but he drew attention to the similarity to it of occasional Australoid skulls found in New Guinea. The Aitape fragment, and the Talgai skull, thus form important links between the Australians and their migrations from the north.

Two skulls and some other bones were uncovered in 1940 at a depth of nineteen feet in a sand-pit at Keilor, ten miles north-west of Melbourne. The pit forms part of a Pleistocene terrace of the Maribyrnong river, and several workmen claimed that the sand above the bones was undisturbed. One of the skulls has been described as embodying Tasmanian and Australian characters and it is of the southern Australian type. Mahony claimed that Keilor man lived during the Riss-Würm Interglacial period, about 150,000 years ago, but Keble and Macpherson consider that the bones were

in a grave dug in the terrace which would make their age comparatively recent.

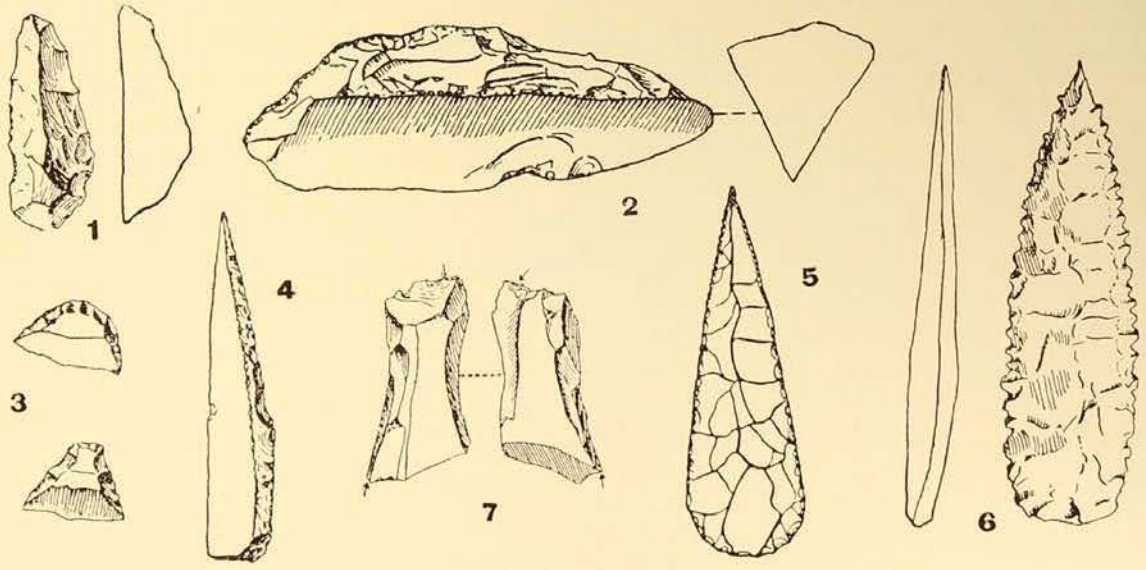
The Pejark find ranked in importance with that of Talgai but its discovery was attended by misfortune. Workmen digging a cutting through this Victorian swamp discovered a stone pestle and other implements, and a mineralized human skull, in a late Pleistocene yellow clay bearing extinct animal bones, but they smashed up the skull and the pieces were not recovered for restoration.

ANCIENT IMPLEMENTS

The greatest antiquity claimed for stone implements in Australia was by Howchin for the flaked stones that he found on the eroded gibber plateau of central Australia. He thought they were eoliths belonging to the Pliocene age, but they are now considered to have been produced by natural forces such as heat, cold, concussion, sand-blow, and other factors. Among other claims are ground-edge axes unearthed at various depths in geologically recent alluvial deposits, some of which are thousands of years old. One of the most interesting finds of this kind was that made by a geologist, Brittlebank, who discovered an anvil stone and two pebble choppers in a gravel-clay bed beneath a volcanic lava of late Pleistocene age at Myrniong, Victoria.

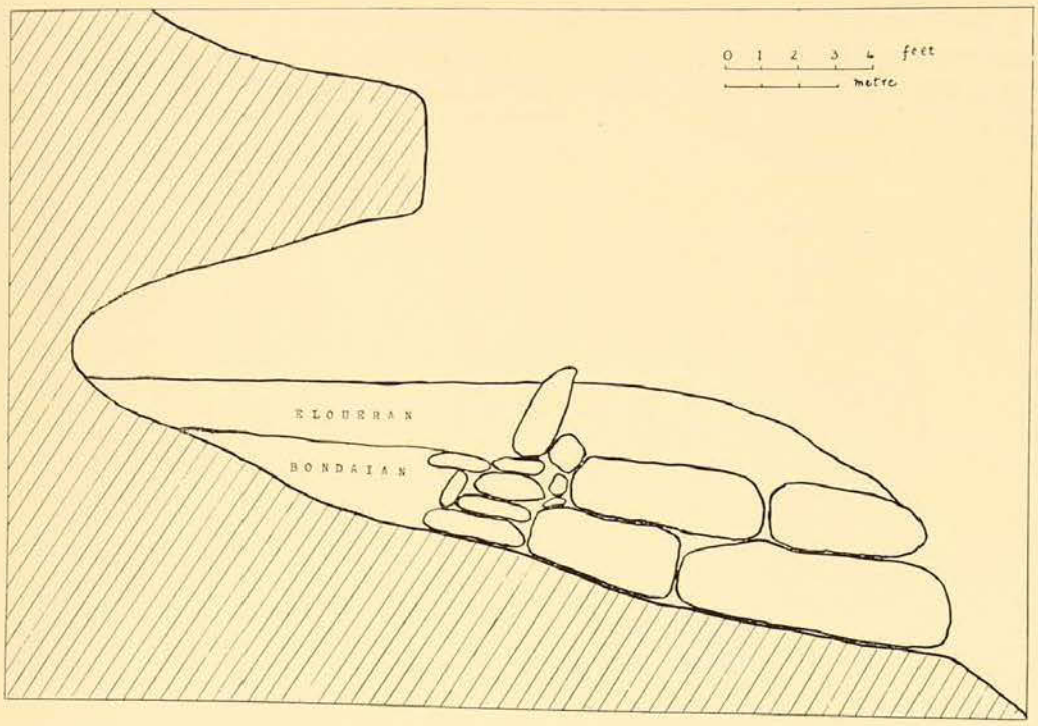
Stone implements are best considered in cultures, that is, in assemblages belonging to the one period usually discovered in excavations of cave and camp-site deposits. A number of these prehistoric cultures has been established in Australia and they form an important approach to the age of man.

An interesting group of cultures exists in South Australia. The Gambierian culture consists of trimmed biface and uniface flint hand-axes, picks, choppers and scrapers from the Coorong district; it is, in appearance, a very primitive culture but its precise age has not yet been determined. The Kartan culture from Kangaroo Island and elsewhere in eastern Australia comprises large pebble choppers trimmed on one surface, cores shaped like a horse's hoof (after which they are named) and hammer-stones; it is a mesolithic culture of late Pleistocene age, identical in type with the Hoabinhien I culture of south-east Asia and Malaya. The Tartangan culture was discovered in consolidated river silts on a narrow island in the lower Murray river. It consists of chipped stone flakes



Key implements in the prehistory of Australia. 1. Burren adze-slug. 2. Elouera adze-flake. 3. Geometrical microliths. 4. Bondi point. 5. Pirri uniface point. 6. Kimberley biface and serrated point. 7. Burin, a type which remained undiscovered in Australia until recent years.

G. Binsted, del.



The two culture periods revealed in the Lapstone Creek cave, in the Blue Mountains of eastern New South Wales, represent a period of more than ten thousand years in the history of man in New South Wales. G. Binsted, del.

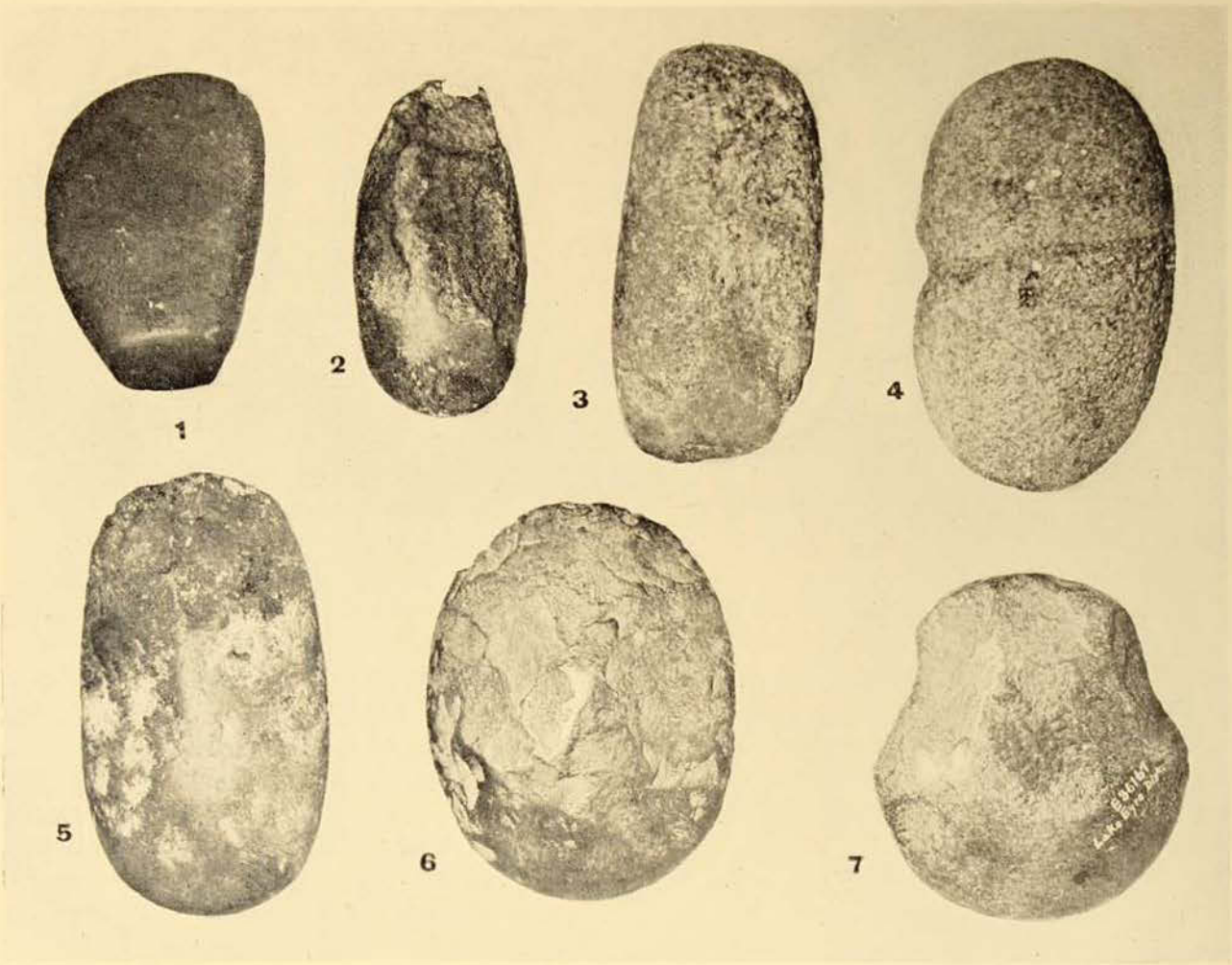
and bone points associated with an extinct species of mussel; among several human skeletons was found the skull of a boy with a palate and teeth larger than in modern aboriginal boys. Tindale believes the Tartangan people were akin to the extinct Tasmanians, and lived many thousands of years ago.

In a great rock-shelter a little further up the Murray river at Devon Downs, a party from the South Australian Museum unearthed four more cultures and named them the Pre-Pirrian, Pirrian, Mudukian and Murundian. They represent a more or less unbroken occupation of the cave for thousands of years. Not much is known about the Pre-Pirrian period, but in the Pirrian the well made *Pirri* points are prominent; otherwise the *Burren* adze-slug occurs throughout the Tartangan and Devon Downs cultures, the *Tula* adze-slug in the Mudukian and Murundian, and a few microliths in the Mudukian indicate an early stage in their development in Australia. The Murundian culture is the modern one incorporating the ground-edge axe, but the age of the other cultures is unknown.

In New South Wales two interesting cultures were discovered in a cave in the Blue Mountains scarp near Emu Plains. The earlier one, called the Bondaian, consists of the beautifully made *Bondi* points, the *Elouera* adze, and other chipped flakes. The later one, named the Eloueran, is much richer in composition, and the edge-ground axe and knife, *Elouera* adze, and pebble choppers are its principal stone implements. This culture extends back in time from the present day to the end of the Pleistocene period some ten thousand years ago, to the period of the buried land surface at Shea's Creek, Botany, on which edge-ground axes, dugong bones and petrified tree stumps were unearthed during the cutting of a canal. It might also be mentioned that the outline rock engravings of the Sydney district belong to the Eloueran culture period. The Kartan, Bondaian and Eloueran cultures appear to be coastal in distribution, while the Tartangan and Devon Downs cultures form an interior group.

Thus it is apparent that the earliest known Tasmanian and Australian stone

implement cultures are of late Pleistocene age, as is the oldest skeletal material, an agreement which indicates that the known antiquity of man in Australia and Tasmania may at present be stated in general terms of about twenty thousand years. Future archaeological work may reveal more ancient material with a greater antiquity than we have at present.



Evidence now available indicates that the ground-edge axe technique came into Australia at the end of the Pleistocene period from nine to ten thousand years ago. Since then the axe has undergone a series of refinements in shape due to the use of advanced flaking techniques and of Neolithic techniques such as pecking and polishing the body of the implement. The above series shows axes made from (1) a pebble, (2) a piece of stone, shaped by crude flaking, and (5-6) small slabs of stone shaped to a lenticular section and oval shape by skilful flaking. Nos. 3, 4 and 7 have been shaped by flaking and then by pecking.

Photo.—Howard Hughes.

Mr. H. B. Mathews, President of the Board of Trustees of the Australian Museum, entertained members of the Arnhem Land Expedition, trustees and officers of the Australian Museum shortly prior to the expedition's departure. Members of the expedition present were Mr. C. P. Mountford (leader), Drs. G. W. Setzler, Robert R. Miller, David H. Johnson, Howell Walker, Messrs. H. G. Deignan, and F. D. McCarthy, the last-named being anthropologist of this Museum as well as a writer familiar to our readers.

Fishing for trout in the Upper Manning River.
Photo.—A. Musgrave.

Tubrabucca, Barrington Tops—The Northern End

By A. MUSGRAVE

THE Barrington Tops district of New South Wales, forming the southern end of the Mount Royal Range, lies north-west of Newcastle and is the highest land mass north of the Kosciusko Plateau. It has already formed the subject of articles in the AUSTRALIAN MUSEUM MAGAZINE. These however, have dealt with the southern part of the plateau and its southern approaches from the Williams or Allyn Rivers, so when I received an invitation from my friend Mr. Alex N. Burns, Entomologist to the National Museum, Melbourne, to accompany a small party early in January to Tubrabucca at the northern end of the Tops, I felt I was about to realize a long-felt ambition. During January, 1946, and January, 1947, the Australian Museum had sponsored two trips to the Barrington Tops with the object of securing a colour film of the district. Accordingly it seemed too good an opportunity to miss of getting additional material for our film and, at the same time, affording a chance to collect in an area not often visited. The Australian Museum party consisted of the following: Messrs. W. Barnes, J. McIver, L. Newton, H. Hughes, and the author. The party from the National Museum, Melbourne, consisted of Mr. R. T. M. Pescott and Mr. A. N. Burns, accompanied by Prof. O. W. Tiegs, of the University of Melbourne.

THE WESTERN APPROACH

Leaving Scone, we proceeded through hilly country bordering the Hunter River, passing by "Belltrees", well known to ornithologists as the home of the late H. L. White, whose collection of bird skins and eggs is now preserved in the National Museum, Melbourne. Gradually rising, we got to Moonan Flat (1,380 feet) about 7 p.m. and next morning set off for the steep ascent to Tubrabucca, crossing the Hunter River, whose head waters at Pol Blue we were later to visit. At 3,300 feet we were forced to stop and find water for the radiator, as the gradient had been particularly severe for the heavily laden utility. The hills had been denuded of most of their trees to provide feed for stock and thus we had wonderful panoramas over the valley of the Hunter and the mountains which seem to surround it on all sides.

What a contrast is here provided to the southern approach to the Tops. There, the visitor is forced to make his way by a narrow bridle-track, up the steep mountain side and through a dense brush of sub-tropical vegetation on the lower slopes, until he reaches the sub-antarctic forests of beech trees at an altitude of about 3,000 feet, and finally, the snow-gum clad summit. The northern end, as I have shown, is accessible to motor vehicle, but the approaches are through

country almost arid by comparison to those from the south. In their series of papers on the ecology of the Upper Williams River and Barrington Tops districts, Dr. Lilian Fraser and Miss Joyce Vickery show that "the plateau falls away on its western side, where it is drained by the Upper Hunter River and its tributaries. The rainfall on these western slopes is less than that of the eastern, southern and north-eastern slopes, and the evaporation rate is high, as the slopes are exposed to the full action of the westerly winds. This country has been extensively cleared for grazing."

On the property rose Tubrabucca Creek and the Hunter River (or one of its many branches), for this river captures all the streams on the southern and western sides of the plateau, while the Manning River, which also "heads" in the plateau some four miles or so distant, receives all the waters of the Barrington and other streams which flow down the northern side of the escarpment. On the cleared hillside which overlooked the Hunter valley the Silver Wattle, *Acacia dealbata*, grew abundantly and, according to Fraser and Vickery, "is characteristic of cold localities of moderate to good rainfall in light forest associations".

Tubrabucca, the home of the Meehan family. Nearby are the tents of the Australian Museum and National Museum of Victoria parties, and Mr. Frank Dodd of Coramba, North Coast.

Photo.—A. Musgrave.

TUBRABUCCA

Tubrabucca lies on the road to Tomalla Station, but, where a notice board indicated "Barrington Tops", we turned off to the right and, after driving about half a mile, camped near the Meehan's house in a large clearing at an elevation of from 4,200-4,300 feet. Our host, Mr. Tom Meehan, has a farm of about 1,800 acres, much of it still in its native state and a week was spent collecting and photographing in the neighbourhood. Geographically Tubrabucca lies in the Parish of Bronte, County of Durham, Land District of Scone, Upper Hunter Shire, in the Eastern Division of New South Wales.

THE UPPER HUNTER RIVER

One morning Messrs. McIver, Newton and the author paid a visit to the Upper Hunter River which lay over the hill to the east of the camp about three-quarters of a mile distant. As we pushed our way through the undergrowth of bracken fern and tussock grass we collected insects in the beating net. The Silver Wattles and the young eucalyptus saplings yielded many leaf-eating beetles and plant bugs, while flies of various kinds rested on the leaves. The small Chrysomelid beetle, *Cadmus litigiosus*, which occurred in great numbers on the leaves of the eucalyptus was perhaps the dominant insect. Various

View from a spur near Tubrabucca looking down the valley of the Upper Hunter River north towards the main Hunter River Valley.

Photo.—
A. Musgrave.

species of *Paropsis*, members of the same family, were collected on the leaves of both wattles and gum-trees.

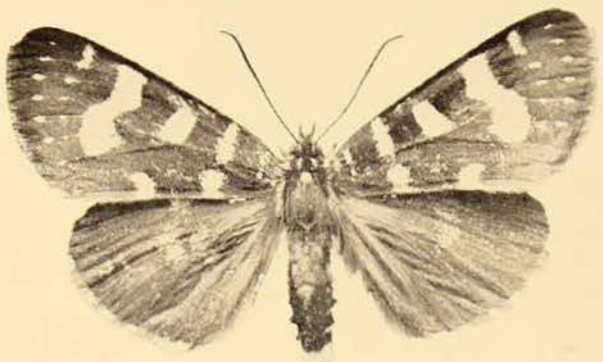
Proceeding down the steep hillside we came to the Upper Hunter here flowing in a northerly direction, a small but swiftly running mountain stream, its rocky banks lined with Ti-tree, *Leptospermum myrtifolium*, in bloom, and the yellow-flowering *Callistemon salignus*, one of the bottle-brushes. Insects of all kinds were attracted to the flowers of the Ti-tree and a large undertermined wasp of the family Thynnidae was common. The brown-winged males with black bodies and yellow spots along the sides of the abdomen were captured in the net, sometimes with the females, wingless creatures armed with a sting, and with the yellow spots on the black abdomen almost meeting on the upper surface. Alighting on the blossoms was a beautiful specimen of Macleay's Swallowtail, *Papilio macleayanus*, an insect long known as an inhabitant of mountainous country in eastern Australia.

Under logs we met with the large earwig, *Titanolabis colossea*, and the curious flattened earwig, *Apachys australiae*, well known denizens of the Tops. Log-rolling produced many insects and arachnids, centipedes and millipedes not usually encountered elsewhere. We had to exercise care, however, as Bull-dog ants, *Myrmecia tarsata* Smith and other forms sometimes had selected a log as a shelter for their nest and soon they would be skirmishing in all directions looking for the disturbers of their peace.

TUBRABUCCA FALLS

An afternoon visit was paid to the falls on Tubrabucca Creek about a mile south-west of the camp. The track led through the eucalypt forest and some time was devoted to entomologizing on the way. Resting on the grass or rising up as we

Falls on Tubrabucca Creek, situated about a mile south-west of the Meehan's home.
Photo.—L. Newton.



The Day-flying moth, Phalaenoides tristifica Hubner, was everywhere abundant, flying in the sunshine or resting upon the grass.
Photo.—A. Musgrave.

advanced were numerous examples of the Day-flying moth, *Phalaenoides tristifica* Hb., a species with a wide range from New South Wales to Tasmania and South Australia. The larvae which were also seen by us have been recorded feeding on *Epilobium*, *Oenothera* and *Balsamina*, and a larva was secured on *Epilobium glabillum* Forst (the willow herb).

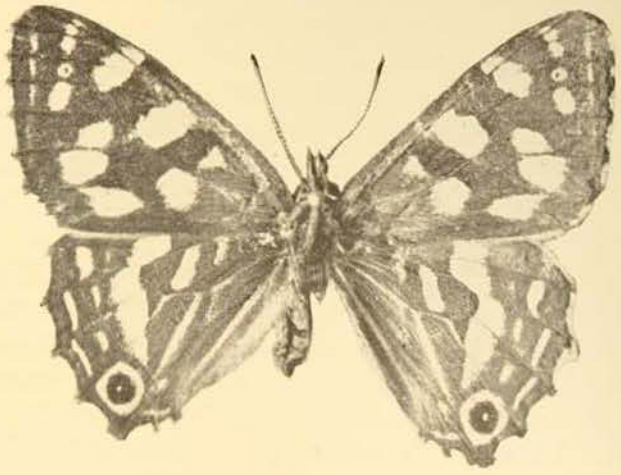
The falls were about fifty feet in height and were running strongly, the stream flowing in a westerly direction. The banks were lined with the same flowering ti-tree as that on the Upper Hunter. Growing nearby was a plant with white flowers, one of the Speedwells, *Veronica Derwentia*, a species occurring on the coast district as well as the tableland and along river banks.

The Weather

As so much depended upon the vagaries of the weather a few remarks might not be out of place. The temperature early in the morning of the 12th January was 53° F. and we continued to have cold weather for the duration of our stay. The Summer season was exceptionally cold for the whole State. There were snowstorms in the southern alps and the coldest January day on record occurred. At Tubrabucca, on the following day it was 43° F. in the early morning and only 46° F. at 8.40 a.m., while at 2 p.m. it was only 48° F. On one occasion during our stay the mercury fell to 36° F. We were thus experiencing colder conditions than usually obtain about Sydney during the Winter months though our fairly high altitude should be taken into account. The unusually cold weather for this time of the year must have an effect on the development of insect life, retarding growth until warmer conditions prevailed, or even destroying many forms about to emerge from the pupal condition.

The Upper Manning River

Upon two occasions we visited the Upper Manning River some four miles to the south-east. Our route, for part of the distance, lay along the track to Barrington Tops, or south from our camp, then we turned eastwards, passing through eucalypt forest with Silver Wattles growing in open spaces amongst them. Where the ground sloped towards the river, we came upon a large area where tree ferns grew in profusion. We passed many examples of the broad-leaved Pepper bark, *Drimys purpurascens*, a plant native to the Tops. It is one of the most typical plants of this region, growing as a small bush or shrub with very conspicuously coloured broad leaves measuring up to about eight inches in length. The stem of each leaf is blood-red, the raised mid-rib shading into purple until it lightens into yellow. The purplish fruit hangs in clusters. Along the banks of the river



The Ella Brown, Oreixenica kershawi ella Olliff, occurs among the Beech trees on the Barrington Tops above 3,000 feet, from December to February, though none were taken on this trip by the Museum party.
Photo.—A. Musgrave.

The beautiful dragon-fly, Diphlebia lestoides Selys, which was not uncommon along the banks of the Manning River.
Photo.—A. Musgrave.

we found its smaller but more widely distributed ally, *Drimys lanceolata*, with long, narrow pointed leaves measuring up to about two and three-quarter inches in length, and also with red stems. It occurs also on the tablelands of Victoria and Tasmania. The plants of the genus *Drimys* are placed in the botanical family Wintereacae. If the leaves are chewed it will not be long before it is appreciated how they have come to have the popular name of "Pepper Bark", as well as the scientific name which also is in reference to its bitter aromatic taste.[1]

There were many other interesting plants. The Mint Bush, *Prostanthera lasianthos*, so typical of the Tops, was flowering and the Ti-tree, *Leptospermum myrtifolium*, was just as much in evidence as on the other streams we had visited. On a broad serrated-leaved plant, *Lomatia arborescens* Fraser and Vickery,[2] we found a long-bodied weevil which seemed to prefer this plant "foresaking all others"; a fly also was caught nesting on the leaves.

A small waterfall on the river was visited and then we returned by a fine strand of Beech Trees, *Nothofagus Moorei*, which lined a gully, but collecting was then out of question owing to the late hour for light was fading.

On my second trip, an all day one, we had sunshine varied with showers. We reached Coaching Flat and then collected along the river banks searching for insects under logs, upon the ti-tree flowers, or caught butterflies and dragon-flies in our nets. In the sunshine, the river looked beautiful as it rippled over pebble banks, or swirled past the cream-flowering ti-trees; dandelions and buttercups gave an added touch of brightness to the scene. On some stretches there were deep pools and over these our guide cast his flies for the speckled trout, not unsuccessfully as he secured seven.

Some specimens of insects were very common, notably the Crane Fly or tipulid, *Macromastix costalis*, among the grass, and the red and black *Metriorrhynchus rhipidius*, a beetle of the family Lycidae, and the Soldier Beetle, *Telephorus pulchellus*, a member of the family Telephoridae. We secured many examples of the beautiful blue-bodied dragon-fly, *Diphlebia lestoides* Selys.

Some interesting Stone-flies (Perlidae) were also taken and in a rotten log Mr. Pescott secured four specimens of *Peripatus*, that curious slimy black caterpillar-like creature which seems to be a link between the worms and the arthropods and which are placed in a group the Onycophora. On a sedge rush I caught a specimen of a fly, *Pelecorrhynchus distinctus* Taylor, hitherto represented in the Museum collection only by the type females, though the male had been described from specimens taken by the Sydney University Expedition to Barrington Tops in 1924. This insect is closely allied to the March flies.

The day-flying moth mentioned earlier was abundant here also, and small brown butterflies, the Bright-eyed Brown, *Heteronympha cordace* Hübner, were not uncommon. The collecting hereabouts was the best we had experienced since our arrival at Tubrabucca.

After lunch we made our way upstream to the little waterfall and then proceeded up the steep hill to the Beech Forest where a short time was spent looking for insects and arachnids under the bark of fallen

[1] Joyce W. Vickery, *Proc. Linn. Soc. N.S.W.*, lxii (3-4), 15 Sept., 1937, 78-84, pl. v, 2 tfs.

[2] Fraser and Vickery, *Proc. Linn. Soc. N.S.W.*, lxii (5-6), Dec., 1937, 284-293.

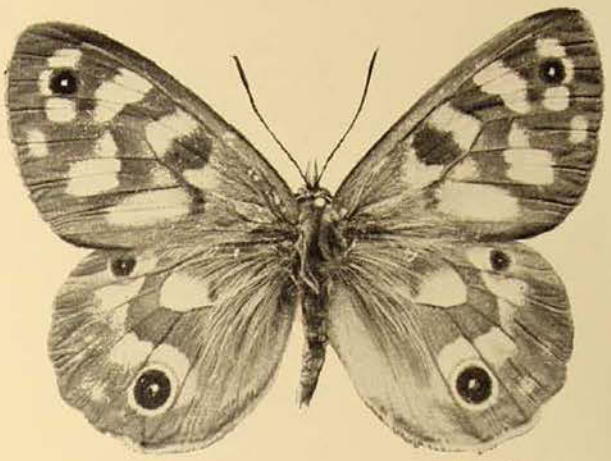
trees, Mr. Pescott's efforts being again rewarded by the capture of three fine examples of long-legged Harvest-men in a rotten trunk. Then on back through the eucalypt forest to the Barrington Tops road and at one spot we found many larvae of a Lycaenid butterfly attended by ants on the leaves of the Silver Wattle. This small black ant (*Crematogaster* sp.) was a good indication of the presence of the larvae on the bushes.

Then followed the usual practice of setting the day's captures, labelling the specimens in the spirit tubes, cutting short lengths of grass-stems "to straw" out the abdomens of the dragon-flies to prevent them breaking up later (a delicate and tricky business). We were finding the work of setting doubly tiring and laborious on account of the poor illumination of our hurricane lamp, when suddenly Mr. Pescott appeared with a 300 candle power petrol lamp for our use, to be hailed as a public benefactor. Time being the essence of the work, many specimens were placed in tubes with cotton wool to be set on return to the Museum. It was cold as we bent over our store boxes and our thermometer, which hung at the tent entrance, registered 38° F. at 9.45 p.m. when we had completed our task.

By Blitz Buggy to Pol Blue

Perhaps the most outstanding event of the trip was an excursion to Pol Blue (stated to be 4,770 feet approximately).

Pol Blue lies southward on the track to the Tops, if we regard that area in the vicinity of Carey's Peak and the Barrington River as the main part of the Barrington Tops. It was originally proposed that some of the Australian Museum party should proceed to Crosby's Hut on Eckford Swamp, some eighteen miles away, but we were advised that it would very likely snow on the Tops so the trip was abandoned. This was a disappointment to those who had not seen the area, but we compromised on Pol Blue, eight miles distant. We were fortunate in securing the services of a resident,

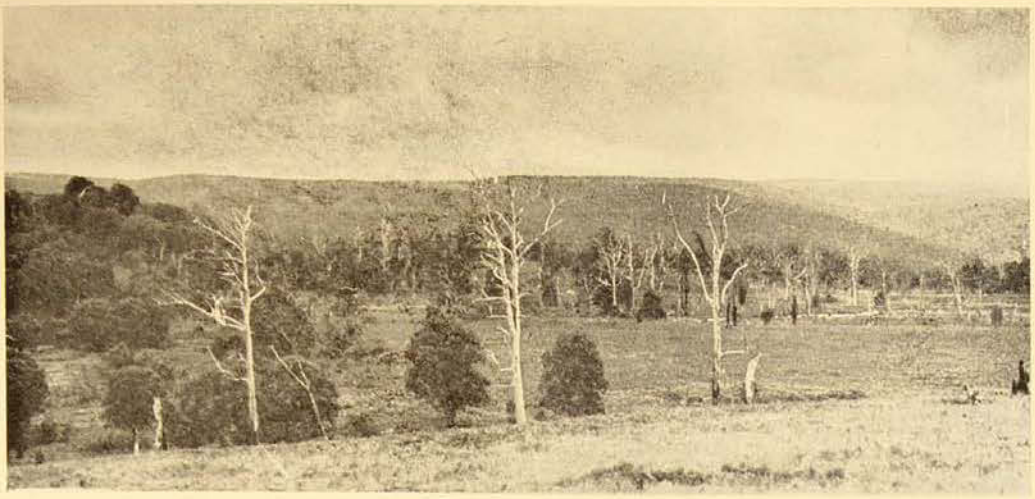


The Bright-eyed, brown Heteronympha cordace Hübner, is the smallest member of the genus, with a wing expanse of slightly over 1½ inches. It occurred at various localities at Tubrabucca, and has a range from Dorrigo to Tasmania
Photo.—A. Musgrave.

Mr. Albert Davidson, to drive us out in his blitz buggy.

We stopped beyond the line of snow gums in an open area on the northern side of the Pol Blue Creek, which further down the valley assumes the name of Omadale Brook. This mountain stream ran swiftly mid banks lined with Restio sedges, and with marshy areas in which grew the blue bladderwort, *Utricularia dichotoma*, but the outstanding botanical feature was the bushes of *Epacris microphylla* var. *rhombifolia* Fraser and Vickery which were in flower and made a beautiful picture with their white flowers against the darker green. These bushes, in places, indicated the course of the stream.

Along the hillsides amongst the snow grass, grew plants which are very much in evidence on the Tops; *Diuris venosa* Rupp, an orchid native to the area, and *Euphrasia Brownii*, with its purplish flowers, while the pink trigger-plant, *Candollea serrulata*, which enlivens the landscape from Tubrabucca to Pol Blue, and, in fact, everywhere on the Tops, was very abundant. In a little creek, which joined the Pol Blue Creek, I found *Drimys lanceolata* growing, and this Pol Blue area was very similar to that at the southern end with its low snow-gum clad hills and swampy meadows.



View from Avonlea Trig. Station to the Barrington Tops. Cleared in the foreground, though the country to the south is a region of snow-gum clad hills and marshy meadows.

Photo.—
A. Musgrave.

THE TRIG. STATION (AVONLEA STATION).

One afternoon, in order to get some idea of the general topography of the surrounding district, Messrs. Hughes, McIver and I went to the trigonometrical station on a small hill about two miles from the camp from which fine views were to be obtained. My aneroid made the elevation of this point at 4800 feet, but I estimate that 400 feet should be deducted from this reading. The sun was shining on the distant hills to the north and south-west, and the Hunter River valley was seen in its full magnificence. On our left, to the south, was the main road to Tomalla, while beyond, far to the southward, lowering skies extended over the distant Tops where the rain clouds could be seen sweeping over the tree-clad hills. A cold wind made us eager to take our movie photographs and stills of the valley and get away.

Earlier in the day we had taken shots of the country looking north from the hill near our camp, so we felt that we had achieved something to add to our film if our photographic attempts were successful.

COLLECTING.

The main object of our Museum party was to enrich our collections. Traps were set, but the results were disappointing, the weather being either too cold or else the small ground-dwelling forms, such as rats, were absent. Kangaroos were seen on one occasion, but they were too far away even if we had desired them for the collection. At night, however, we were more successful and several of the large flying squirrel, or Greater Glider-Possum, *Schoinobates volans* Kerr, fell to the shotguns from the tops of the gum trees. This species seemed to be not uncommon in the bush near the camp.

But it was amongst the Reptilia, or rather the Lacertilia (lizards) that Mr. Barnes scored his greatest success, some seventy specimens being obtained. These were secured chiefly by rolling over logs in the bush and then pouncing on the lizard before it had recovered from its astonishment.

The largest reptile encountered was a red-bellied Black Snake, *Pseudechis porphyraceus*, which was observed in a swampy place by Mr. Meehan who chased it and flung it by means of a stick onto dry ground where it was pinned down and eventually fastened to the stick by a piece of cord. At the camp it was measured, and found to be 6 feet 8½ inches in length. It found its way into the National Museum collection.

A small snake with a white upper lip, *Denisonia coronoides*, was said to be common about the farm, but only two specimens were secured during our stay.

It was in my own section of entomology and arachnology that we obtained our largest number of specimens for all

members contributed in securing a large assortment of insects, spiders, mites and other arachnids. Many of these should be of considerable interest when all the material is pinned, labelled, and sorted out into their respective families.

FINALE.

We broke camp on a cold Saturday morning, after bidding farewell to our very kind friends the Meehans and those of the National Museum party who were staying on for another week.

As we drove down the mountain side the mists descended upon us and blotted out the Barrington Tops and its tree-clad hills. Further down we came out into sunshine and with the Valley of the Hunter stretching before us in all its grandeur, though behind us Tubrabucca and all its associations were hidden beneath a canopy of rain-clouds.

This year the Royal Society of New South Wales has conferred upon Dr. A. B. Walkom, Director of the Australian Museum, its highest honour, the Clarke Memorial Medal. This distinction is, in successive years, awarded to a botanist, zoologist, or geologist, for distinguished work in one of these fields done in or on the Commonwealth or its dependencies. Dr. Walkom, an authority on Mesozoic plants of Australia, began his studies in palaeobotany in 1913 when appointed to the University of Queensland. Later he extended his researches to Palaeozoic floras, some of his work being done at Cambridge whilst holding a fellowship of the International Education Board (1927), where he studied with Professor (later Sir Albert) Seward, the eminent palaeobotanist.

Apart from these researches Dr. Walkom has attended several international scientific congresses where his contributions to the subject of correlation of fossil floras commanded attention. For the past twenty-one years he was honorary general secretary to the Australian and New Zealand Association for the Advancement of Science; this year he is its president-elect. He has given much time, also, to the Australian National Research Council, and to other scientific bodies.

A former Director, the late Robert Etheridge, Junior, was awarded this distinction in 1895, and it is surely an interesting coincidence that both these recipients won this for work in palaeontology.

To the Australian Museum this award is but a link associating it with the past. For this medal memorializes the Rev. W. B. Clarke, M.A., the "Father of Australian Geology", who did so much for the advancement of science on this continent. He was associated with the Museum in various capacities, either as committeeman, secretary and curator, or elective trustee during the years 1838 to 1874.

G. D. OSBORNE.

* * * *

Amongst recent visitors to this Museum were Dr. Hobart van Densen and Mr. E. Thomas Gilliard, both of the American Museum of Natural History, New York.

* * * *

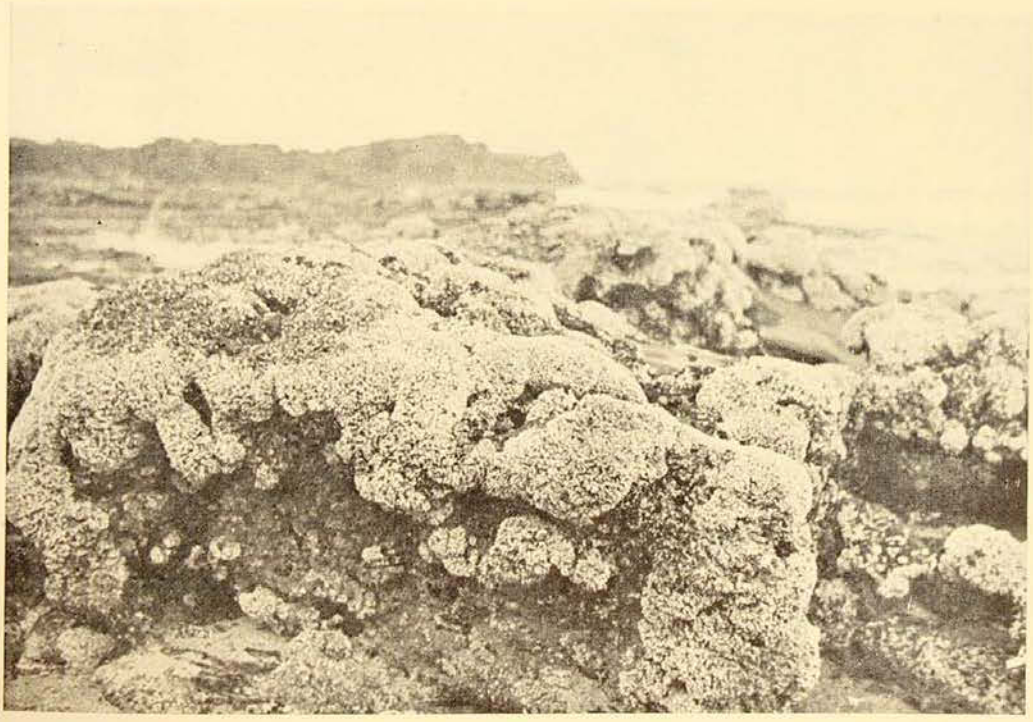
With regret the death of Mr. J. H. C. Wright, on March 8, is reported. Mr. Wright, whose retirement from the preparatorial staff of this Museum was referred to in the last issue of this MAGAZINE, had been in indifferent health for sometime. His versatility and readiness to assist brought him in close contact with museum workers, particularly those from overseas, and visiting expeditions derived much help from his knowledge of bush craft and wild life.

'Sydney Coral' is a Worm!

By ELIZABETH C. POPE

ONE of the commonest animals to be found along the rocky coasts of New South Wales is the quaint little tube-inhabiting worm, *Galeolaria caespitosa*. Frequently thousands are found growing together in a frieze-like band on the rocks a short distance above low-water level. But, occasionally, where a rock platform occurs with its upper surface just at the height above low-water mark, beloved of *Galeolaria*, luxuriant and almost cauliflower-like masses of the small, inter-twined tubes will completely coat the rocks, to the exclusion of almost all other creatures.

So closely packed are the small white calcium carbonate homes of these worms that the growth *is* reminiscent of certain types of coral. In fact one popular name for the worm which has been current for many, many years is 'Sydney Coral', and the men in the docks who scrape the hulls of ships classify all growths roughly into three categories—weed, coral and blubber. 'Weed' is any algal growth or any animals with a plant-like appearance, such as the polyzoan *Bugula neritina*. The term 'blubber' covers any gelatinous, softish type of growth—especially compound ascidians and simple sea squirts like *Ciona intestinalis*. The word 'coral' covers any growths which have calcium carbonate walls surrounding the soft animal parts, and under this heading come the serpulid worms of the genera *Galeolaria*, *Hydroides* and *Salmacina*, and also many of the barnacles.



Some of the finest growths of Galeolaria caespitosa worms may be seen at Merewether near Newcastle, just south of the baths. Almost cauliflower-like growths cover the tops of the rocks.

Photo—E. C. Pope.

Enlarged photograph of a single Galeolaria worm to show the feathery gills and the operculum with its tip armed with calcareous spikes. Below these is the ruffle-like thorax, which passes into the curled abdomen.
Photo—Howard Hughes.

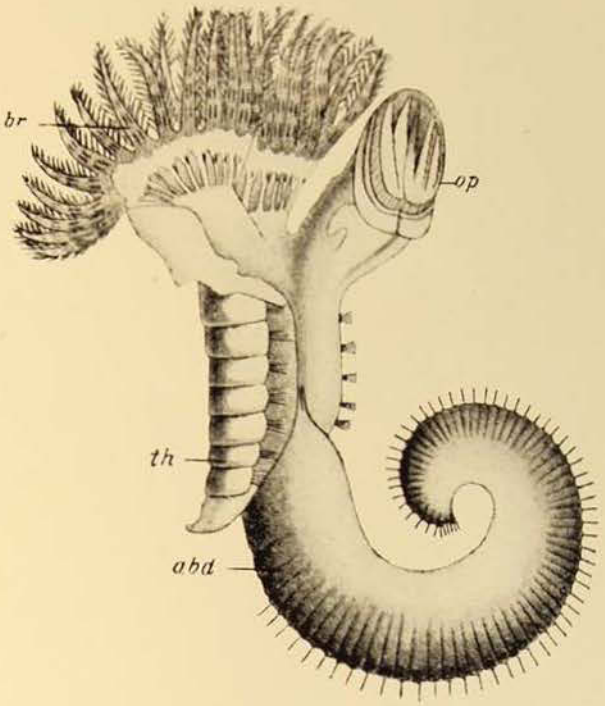


Diagram of Galeolaria to explain the parts shown in the foregoing illustration. abd, the abdomen; br, the branchiae or gills; op, the operculum; th, thorax
After Parker and Haswell.

Actually the workmen in the docks were quite surprised when told that the occupants and builders of the small white tubes were worms, for they had, on occasions, observed the little rings of feathery tentacle-like gills which poke out of the tubes as the worms' heads are extruded and had believed them to be the polyps of coral. A demonstration, however, of the worm's ability to withdraw its body quickly right down inside the tube and then to close the entrance by means of a small plug-like operculum—a structure which is foreign to corals—was enough to convince them that the creature was not of a coral nature.

Galeolaria caespitosa is one of the sedentary sea worms of the bristle-footed class Polychaeta—a class which also includes such well-known types as the bait worms which are so eagerly sought in the sands by fishermen. This particular group of the polychaetes is characterized by the fact that the body is divided into distinct regions, in this case two regions. The posterior, soft, curled abdomen and the anterior thorax which carries the two bunches of feathery gills, seen in the photograph, together with the plug-like operculum with its fancy lid-like cap which lies between them. The accompanying diagram of a worm removed from its tube shows the relationships and names of the parts for comparison with the picture of the living animal.

The ruffle-like region of the thorax is thought to be responsible for secreting the characteristic limey tube in which the worm lives permanently. The tapering tube is fairly small, being not more than an inch or so in length but is quite solid in its construction and keeled along its upper margin (*i.e.*, the side not attached to the substratum). This keeled portion is continued into a small, over-hanging lip which characteristically projects above the rounded mouth of the tube. A photograph of some live worms under water shows some specimens with these overhanging lips. Several worms in this picture have their feathery gills projecting, but in most the worms are retracted and the mouths of their tubes are closed against the bright lighting, used for

photography, by means of the small opercula which act like tight fitting little corks and shut off the tubes just as sea snails close their shells.

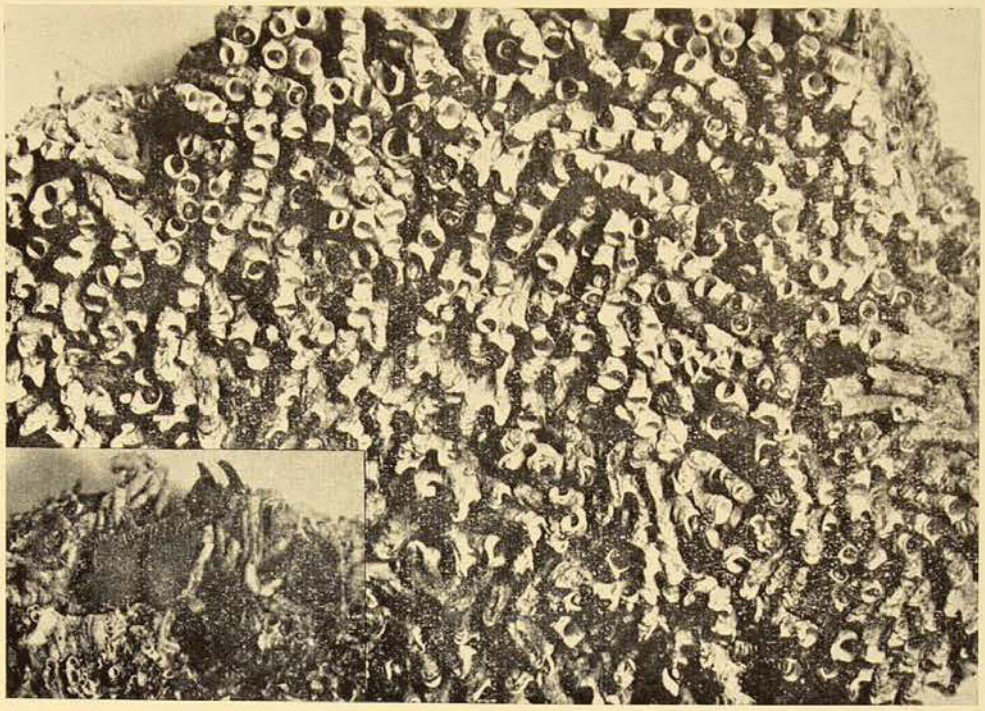
So tight-fitting are these opercula that the worms can often withstand prolonged exposure to very adverse conditions by tactically retiring into their thick-walled homes and closing the entrances. On one occasion it was desired to take a photograph showing a dead colony side by side with a live one with all its little black heads protruding. Accordingly a clump of worm tubes which had been pickling for three or four days in formol seawater, quite strong enough to preserve the vast majority of marine creatures, was taken out and washed under running fresh water preparatory to placing it alongside the live ones in some clean seawater. On peering down through the camera a short time later it was impossible to tell which clump was supposed to be the 'dead' one for black heads were poking out of all the tubes—the erstwhile 'pickled' worms revelling in the pure seawater. Perhaps this extremely well developed power of withstanding adverse conditions, through the protecting tube's shelter, explains how so delicate a creature can flourish in mid-tidal areas and withstand hours of exposure during low tides in the hot atmosphere of mid-summer.

The number of Galeolaria worms on a shore where the growth is thick must be incredibly high. Pictured here is a small portion of such a well-grown clump. In it, over a series of counts, it was found that on the average there were seventy tube openings to the square inch. Galeolaria are, however, sometimes found as scattered individuals over wide limits on the coastal rocks between high- and low-tide marks but in suitable places (where the degree of shelter is just right and where there is no mud in suspension in the water) densely packed growths an inch or more in thickness will be found. Similar thick growths are also found on harbour installations near the mouth of Port Jackson, where the waters are clear and where there is water movement due to swells or to currents, as at The Spit bridge in Middle Harbour. Pictured here

Part of a living colony of Galeolaria taken under water. Note how the feathery gills protrude from the mouths of several of the tubes and how the little plug-like operecula may be seen in some of the tubes which face the camera. Slightly enlarged.
Photo—Howard Hughes.

is a fender structure near Manly wharf; the piles carry a collar of worm tubes and the horizontal beams the usual frieze about a foot wide and an inch or two in thickness.

Although the tubes might appear to be so closely packed that no other creature could find 'lebensraum' there, a thick clump of Galeolaria houses a veritable zoo of small fry which find, between the tubes, just the sheltered nooks they require. On carefully breaking up such a clump or soaking it in a bucket of seawater to which has been added a dessertspoonful of formalin, a whole host of creatures will be disclosed, among which will be numbers of flattened leaf or wafer worms of the *Leptoplana* type and numerous errant, free-swimming polychaete worms of the family Nereidae. Also leaving the worm tubes hastily in search of a more salubrious spot are small velvety looking molluscs of the species *Onchidium patel-*



A thick growth of worm tubes. A small protruding lip characteristically overhangs the openings of many of the tubes. Inset: A small portion of a worm clump broken open to display five of the hairy barnacle Ibla and one tiny Lasaea shell near the centre of the picture.

Photo—Howard Hughes.

loides[1] and hundreds of amphipods (more familiarly known as sand hoppers).

But it is not until the clumps are carefully parted that the strangest tenants of the Galeolaria community are seen. These are the stalked barnacle, *Ibla quadrivalvis*, and the sea-going spider, *Desis crosslandi*. Another frequent tenant is the tiny bivalve, *Lasaea australis*, which is generally somewhat tinged by pink tones and about the size of a split pea or smaller.

Ibla, the small stalked barnacle, is peculiar in that it lacks the somewhat pipi-shaped shelly coverings which many of its relatives carry. The main part of its body is surrounded by a somewhat horny covering which is completely clothed by hairy processes and the two terga of the opercular valves project forward over the scuta, thus forming a hooked structure, somewhat like a parrot's beak.

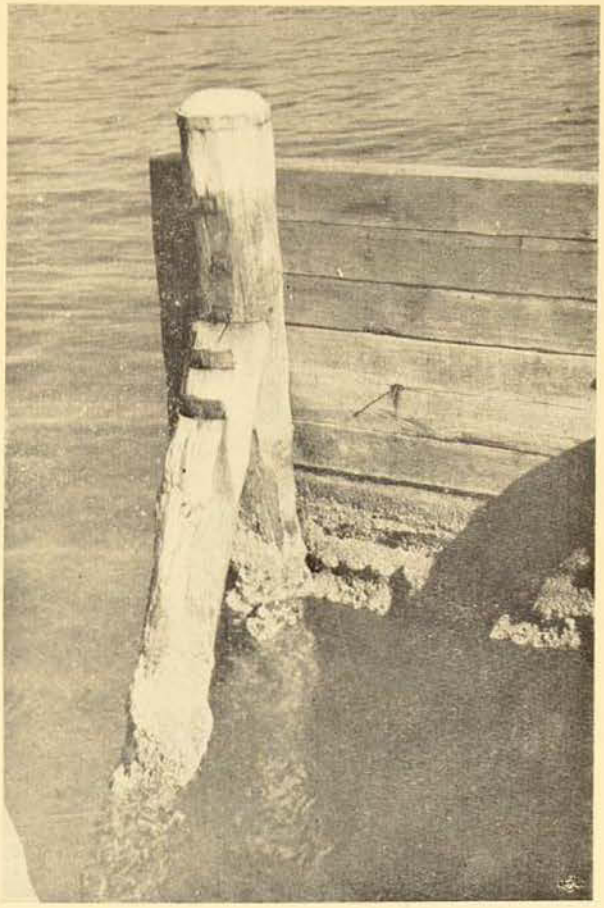
Generally the bodies of these extraordinary little creatures are so jammed and imbedded among the worm tubes that their presence is only disclosed when the clumps are broken apart—they seem to be right inside. Four or five *Ibla* may be seen in the inset (lower left-hand corner) of the picture of the mass of *Galeolaria* tubes. Until it was ascertained that the barnacle could nearly always be found among the worm growths, it had been believed that its occurrence on our coasts was sporadic, for it was usually found only after prolonged and careful searching in a few odd places along the coast, on the lower sides of rocks.

What makes *Ibla quadrivalvis* of such particular interest to the biologist is the fact that this species possesses what are known as complementary males which live inside the mantle cavity of the larger, hermaphrodite individuals. Most species of barnacles are hermaphrodite—having both sexes functional in each individual; a few kinds have large female individuals in whose mantle cavities live the relatively tiny males whose habit of life is almost parasitic, for they cannot live away from the protection of the females. *Ibla quadrivalvis*, however, fits into neither of these two categories in that its larger specimens are certainly properly functioning hermaphrodites but, in addition, as if to guard against accidents, they have the tiny "parasitic" males in the mantle cavity to make perfectly sure that the

[1] *Onchidium patelloides* was pictured in THE AUSTRALIAN MUSEUM MAGAZINE, Vol. ix, No. 4, p. 144.

eggs will be fertilized and able to develop. Here is yet another of the small, but fascinating tangles awaiting to be unravelled by the student interested in the causes and functions of sex in animals.

The writer's first encounter with *Desis*, the remarkable little spider, occurred in 1944 during a field trip, the object of which was to hunt for barnacles which grow on wharf piles. While working at the gravel wharf near The Spit, some *Galeolaria* tubes were accidentally knocked off one of the piles, thus disturbing quite a large *Desis* which had made its home there. It was about an inch across and so like an ordinary little land spider in appearance that it was not until the small, webby chamber which it had constructed was noticed among some of the worm tubes that thoughts were entertained of its being a normal inhabitant of the tidal zone. It might easily have been just a strayed specimen from the decking of the wharf. However, when some more worm tubes were chipped away and two further spiders turned up with small spider web hidey-holes we became convinced that this was their natural home. They were so deeply imprisoned between the worm tubes that they could not be mere strays from the land during low water.



A collar of Galeolaria tubes surrounds the pile and raking pile and a characteristic foot-wide frieze extends along the horizontal planking. Near Manly Wharf.
Photo—E. C. Pope.

Upon inquiry it was found that the presence of marine spiders had been recorded in Port Jackson as far back as 1889 by Thomas Whitelegge, but there was no mention of their occurring specifically in the clumps of *Galeolaria*. Such an idea is not too fantastic to entertain, for some species of spiders are known to construct small, bell-shaped webs beneath the surface in fresh-water ponds and streams and to imprison bubbles of air therein so that they may be used as breathing chambers. Arguing from this, it is reasonable to believe that enough air might be trapped during low-water period in the webs of the *Desis* spider to tide over the time when the worm tubes would be submerged by the sea. *Desis crosslandi* is found not only in harbour growths of *Galeolaria*, but occurs also on the open coast where the surging of the waters due to the surf could often replenish the air supply caught in the tiny web even during high tide. The hairy nature of the spider's integument seems to prevent its body from becoming wet even though it may be temporarily submerged by a wave. One never finds a *Desis* spider looking as though it needed to be dried off.

The genus *Desis* has quite a wide distribution in the southern hemisphere, having been recorded already from South Africa, New Zealand, the Java Sea, Zanzibar and several points on Australian coasts. Nearly all the descriptions of its habits give an account of its occurrence between tide marks either living among close-growing coral growths or serpulid worm tubes or in some such similar niche. Thus we find this habit of our local spider is in no way exceptional. There still remains, however, the fascinating problem as to how the spider manages to live under the water when it is still an air-

breather, and also it would be interesting to know what the spider preyed on. Does it catch amphipods or could its web possibly be used as a plankton net rather than an air trap?

Lasaea australis is such a small bivalve that it might easily be overlooked as one may see by observing the one shown in the inset which shows the *Ibla*. It lies just to the right of the base of the two hairy barnacles nearest to the middle of the picture. Though small, this little creature becomes important because of its enormous numbers, not only among these worm tubes, but also among the coralline weeds and in any other situation where it can obtain enough shelter.

There are, of course, quite a number of smaller fry which make their homes among the worm tubes besides the 'regulars' which have been mentioned already, but enough has been told to show that this closely associated community of animals is of peculiar interest and one well meriting more than a passing glance from the shore fossicker.

Australian Insects. XXXII

Coleoptera 9—The Colydiidae

By KEITH C. McKEOWN

THE Colydiidae is not a large family of beetles, but has a world-wide distribution. Some countries are much richer in species than others. New Zealand being credited with one hundred and seventy species, while Britain has only nineteen. The family is represented in Australia by fewer than one hundred distinct forms. Many of the insects are remarkable for their wide distribution, species from Japan, Malaya, Ceylon and elsewhere occur in Australia. This accounts for the frequency with which some of the insects have been described more than once under different names; this has greatly complicated the task of specialists working on the group. The insects are small and inconspicuous, and usually neglected by the general collector; in habit they are retiring and easily overlooked unless special efforts are made for their discovery. There is little doubt that many more species still await description.

The beetles are sometimes elongate and cylindrical, but many species are flattened and strikingly sculptured. A microscope will reveal many beauties of form and sculpture otherwise hidden by their small size. The tarsal formula is usually 4–4–4, but in the genus *Pabula* it is 3–3–3. This tarsal formula, as explained in previous articles in this series, indicates numerically the number of joints in the foot of the first, second, and third leg. The antennae are clubbed, with either two or three segments in the swollen portion. The coxae—'thighs'—of the fore and middle pairs of legs are small and globular.

The Colydiidae are chiefly restricted to forests, and when these are destroyed, the insects disappear. The larvae are cylindrical with short legs, and bear a horny plate upon the tip of the abdomen, and have a superficial resemblance to those of the Mycetophagidae, or Fungus-beetles, not yet discussed in this series. Both the beetles and their larvae live beneath bark, in decaying wood, in fungi, or in the soil and among vegetable refuse. Very little

is known concerning their lives and habits. Nothing has been revealed of the life-histories of any of the Australian species. A. D. Imms considers that "they are probably mostly predaceous; the larvae of several species of *Bothrideres* have been noted to be ectoparasites of other coleopterous larvae in America." Seven species of the genus *Bothrideres* are known from Australia, where they are amongst the commonest of our beetles, but we have no evidence to support or refute the role of their larvae as external parasites upon any other form of insect life. If any observer could work out the life-history of even one of our species of Colids, his efforts would be of value to science. Some exotic species of the family are known to feed solely on decaying vegetable matter, so that the feeding habits of the family are apparently varied, and little definite evidence is available to guide the investigator in his quest.

Deretaphrus ignarus Pasc. is the largest of the Australian species of Colydiidae, and is widely distributed over the continent. It is a narrow, cylindrical beetle of dark brown or blackish colour, and measuring about half an inch in length. The thorax is narrowly 'heart-shaped' with a deep impressed longitudinal line in the centre; the elytra bear several strong ridges, with the interspaces strongly sculptured. This insect, together with several other species of the genus, is commonly found under bark. All these insects are superficially very similar in appearance.

Members of the genus *Bothrideres* come close in appearance to *Deretaphrus*, but are smaller and broader insects, with the longitudinal line wanting, a slightly raised area bounded by two depressed lines, or a series of somewhat indistinct depressions ranged across the thorax. The elytra are strongly ribbed. *Bothrideres equinus* Pasc., *B. illusus* Newm., and *B. mastersi* Macl. are typical species.

It is among the smaller, broader, and more flattened species that the great variety of form and sculpture becomes apparent. In addition to this diversity, some forms are decked with patches and erect tufts of hairs, usually of a paler tint than that of the general ground colour, giving the insect a distinctly mottled and blotched appearance, and adding considerably to its beauty. Representatives of these diverse forms may be found among the genera *Bupala*, *Cerylon*, *Neotrichus*, *Cebia*, *Ablabus*, *Pabula*, *Epistranus*, and *Metopiestes*. A detailed description of these insects framed in language readily understandable by the layman would be very difficult, if not impossible. Study of the accompanying illustration,* reproduced from a monograph of the family by H. J. Carter and E. H. Zeck, and published in the Proceedings of the Linnean Society of New South Wales, for 1937, will give a far better idea of the diverse appearance of these beetles than many pages of detailed description. It should be borne in mind that these insects do not measure more than some $1\frac{3}{4}$ to 4 mm. in length. Nature, truly, does not deny beauty in its truest sense to the very small.

* See Frontispiece. (Courtesy of The Linnean Society of New South Wales.)

Some Founders of Australian Fish Science

By GILBERT WHITLEY

THE study of fishes, or Ichthyology, is a branch of zoology which has many practical applications: in purely scientific classification, in fisheries development, the biology of food fishes, the investigation of behaviour, parasites, genetics, and in numerous other ways. In a museum, the main object of ichthyology is the exact naming and grouping of all the thousands of different species of fishes and the systematic arrangement of all the ascertained facts concerning each, a full-time task in itself without straying into the bypaths of the angler, the food-purveyor, the anatomist, and others equally fascinating. But here one may perhaps invade the historian's domain. Every year sees steady progress in research, field-work, and publication by workers overseas and in Australia, but it may be interesting to look back and pause to pay homage to the pioneers who laid the foundation of our present knowledge, perhaps to gain from them a little inspiration for fresh efforts in the future.

Our earliest documents are the rock engravings and paintings of the aboriginals, whose meaning, alas, is now dissolved in silence. Our written records, however, go back to 1606, since Torres, in that year and in the strait which bears his name, mentioned albacore and the eggs of fishes. The Dutchman Carstenszoon noted sharks, swordfish and the delicious varieties of the Gulf of Carpentaria in 1623, but Tasman left no record of any true Australian fish, though he seems to have been the first white man to remark upon the annual whale migration and he noted the mussels of Tasmania. But with the naturalists, explorers and collectors of specimens in early Australia I have dealt elsewhere[1] and in a short article the list of more than a hundred names must be compressed into a brief account of a few. This list has quite an international flavour, for the men who have added to our knowledge of Australian fishes have come from various countries. There was an honoured band of Frenchmen[2] and a no less esteemed body of Germans, Dutch, Danes, Poles, Spaniards and Americans, but naturally the majority of investigators was of British stock.

NATURALISTS OF NAPOLEON.

At the beginning of the nineteenth century, Baudin's expedition with the ships *Géographe* and *Naturaliste* thoroughly explored much of our coastlines. The chief zoologist, Réné Maugé de Cely was very ill and died in Tasmania in 1802, so the natural history was attended to by François Péron, probably the most brilliant zoologist who visited Australia, whose views are only now becoming valued at their true worth. He noticed that the shells, fishes and other marine animals differed in such localities as, for example, Sydney, Tasmania, Kangaroo Island and Shark's Bay and sought their limits of distribution. He collected and described many hundreds of specimens, many of which were painted by his friend and colleague, Charles Alexandre LeSueur.

[1] See "George Tobin, a Neglected Naturalist", in AUSTRALIAN MUSEUM MAGAZINE, v, 2, 1933, p. 44; "Some Early Naturalists and Collectors in Australia", in *Journ. Roy. Austr. Hist. Soc.*, xix, 1933, p. 291; "The First Naturalists in Australia", in this MAGAZINE, v, 6, 1934, p. 209; "Naturalists of the First Fleet", in this MAGAZINE, vi, 9, 1938, p. 291; and my Presidential Address, "The Study of Australian Fishes", in *Proc. Roy. Zool. Soc. N.S.W.*, 1940-41, p. 7.

[2] See "Naturalists in Australia—The Frenchmen", by Tom Iredale, AUSTRALIAN MUSEUM MAGAZINE, iii, 10, 1929, p. 357.

LeSueur.

Krefft.

Macleay.

Unfortunately the manuscripts and drawings have never been published in full and, if they survived the ravages of war, are probably stored at Le Havre, France. Josephine spoke well of the work of Péron and LeSueur to the Emperor Napoleon himself. The Kangaroo Island Emu, now extinct, is known to us almost solely from a painting by LeSueur and a specimen in the Paris Museum. So exquisite was LeSueur's draughtsmanship that he would hand a visitor a lens so that he might examine the brush-strokes in his paintings in which every hair, feather or scale was truly delineated. A portrait of LeSueur, published by D. S. Jordan in *Popular Science Monthly* in 1895 is here reproduced. He lived from 1778 to 1846. Other phenomenally gifted painters of Australian fishes were Ferdinand Bauer (1760–1826) whose work I have admired in the British Museum (fishes painted during Flinder's expedition) and James Stuart (1802-1842) a quarantine official whose paintings are a valued possession of the Linnean Society of New South Wales.

Freshwater Fishes.

The overland explorers made known our freshwater fishes. When G. W. Evans crossed the Blue Mountains in 1813, he named the Fish River in which he mentioned the presence of "trout". This is the first reference to the famous Murray Cod and Evans blazed the trail which led to the discovery of the unique fish-fauna of the vast Murray River system, stretching from South Australia to Queensland. Oxley gave the first detailed account of the Murray Cod; T. L. Mitchell inserted excellent drawings of catfish, cod, and silver perch in his journals; and Sturt, Cunningham and even Eyre mentioned the fish they gratefully ate.

Richardson and Günther.

Sir John Richardson (1787–1865) directed the Museum at Haslar Hospital, Hampshire, which contained many Australian specimens. He had earlier been with Franklin in search of a north-west passage, but from 1839 to 1857 published numerous papers on Australian fishes. Richardson's work on the fishes of the *Erebus* and *Terror* Expedition, now more than a century old, still stands as a well-illustrated and indispensable account of many Australian food-fishes.

The encyclopaedia of the working ichthyologist, at least until recent years, has been Albert Günther's great eight-volume *Catalogue of the Fishes in the British Museum*, in which many Aus-

tralian fishes were named and described for the first time. The appearance of this work between 1859 and 1870 enabled a school of Australian zoologists to emerge. However, at the same time or soon afterwards, continental ichthyologists were describing fishes sent overseas by explorers and naturalists like Baron von Müller so that there was some clashing and duplication of results. Peters in Berlin, Klunzinger in Stuttgart, Steindachner in Vienna and the workers in Paris, isolated by the Franco-Prussian war, were all contributing to Australian ichthyology independently so there was some confusion, which I tried, to a small extent, to disentangle when I visited all those places in 1937 and examined as many of their actual specimens as time allowed.

THE AUSTRALIAN SCHOOL.

Of what may be called the Australian School of the disciples of Günther, the most imporant ichthyologists were Krefft, Castelnau, McCoy, Macleay, De Vis, Tenison Woods, followed by R. M. Johnston, Saville-Kent, Ramsay and Ogilby, between 1870 and the close of the century.

Biographies of some of these gentlemen are readily available in public libraries, in memorial volumes, or in obituary notices in scientific journals, but mention may be made here of some which are perhaps less known than the others, whilst the portraits assembled here for the first time would be difficult to duplicate.

KREFFT, DISCOVERER OF THE QUEENSLAND LUNGFISH.

Johann Ludwig Gerard Krefft (1830–1880) was born in Brunswick, Germany, and came from America to Victoria in 1852 to try for gold. In 1857 he accompanied Blandowski's now almost forgotten expedition to the Murray River as naturalist and draughtsman. In 1860 he joined the staff of the Australian Museum and was curator from 1861 to 1874 with residence in the Museum building. Krefft sent a collection of Australian fishes to the International Exhibition in 1862 and helped Günther, who was writing his monumental *Catalogue*, by sending him Sydney specimens. Krefft himself wrote several papers on Australian freshwater fishes but his most dramatic discovery was first revealed in a letter he sent on 17th January, 1870, to the *Sydney Morning Herald* announcing the finding of "an amphibious creature inhabiting northern streams and lagoons. . . . I have named this strange animal *Ceratodus Forsteri*"; this was the now world-famous Queensland Lungfish. Teeth of similar animals had been found fossil in various parts of the world, but there was the "living fossil", so much unlike anything which had been imagined that Louis Agassiz wrote to Krefft, "My fossil sharks are sharks no longer".

Besides discovering the Lungfish, Krefft arranged for the mounting of a Giant Sunfish in this Museum, also the Devil Ray, which he named in honour of the Duke of Edinburgh, Prince Alfred, who was in Sydney at the time.

Krefft died at Woolloomooloo, Sydney, just after his fiftieth birthday, on 19th February, 1880.

COUNT CASTELNAU.

François Louis Nompar de Caumont, better known as the Comte de Castelnau, wrote under the names Delaporte, Laporte, Castelnau and even "M. de los Llanos Montanos". He was born in London on Christmas Day, 1810, and came to Melbourne in 1862. His early work was largely entomological but he prepared a great account of South American fishes, one of the fruits of his extensive travels. Many of his specimens were sent to the Paris Museum. Castelnau must have experienced a chagrin similar to Carlyle's since he complained, "On my return to Europe, I began to put in order my voluminous notes, but having been obliged, on account of sickness, to interrupt my work, I was, on my recovery, struck with a most disagreeable surprise, in discovering that my servant had, for more than one month, used the sheets of paper on which I had bestowed so much

De Vis.

Johnston.

Saville-Kent.

time and labour, to light the fires, and other parts of my learned lucubrations were discovered in the last place in the world where an author would be proud of finding his works". Notwithstanding this, Castelnau, as Consul-General for France in Victoria, began anew with Australian fishes, personally visiting the fish markets and describing many species for the first time. He might almost have been writing of the present state of Victorian ichthyology when he stated in 1872, "It is singular to remark that not one of the Australian Colonies has a particular work on one single branch of its zoology, whereas every State of North America has a complete series of valuable works on each branch of that science. In this the Australian Democracy seems to be far behind its American sister." Castelnau died in Melbourne on 4th February, 1880. I have been unable to trace any portrait of him, either in Australia or overseas, and even with the kind and expert help of the French Consulate in Melbourne and the research staff of the Public Library, Sydney.

Sir Frederick McCoy, Sir William Macleay, and the Rev. J. E. Tenison Woods are well known to all students of Australian natural history and indeed have made their mark in history as well. Ichthyologists are indebted to the former for his superbly illustrated *Prodromus of The Zoology of Victoria* and to Macleay for his basic *Descriptive Catalogue of Australian Fishes*, which, though published half a century ago, are still a necessity. Macleay's benefactions to science are well known and he was the instigator of the *Chevert* Expedition to Torres Strait which discovered many interesting tropical fishes.

C. W. De Vis.

Charles Walter De Vis (1829–1915) was one of several ichthyologists in Australia who were also palaeontologists, thereby maintaining a valuable link between knowledge of the fossil and living species of fishes and other animals. His name was originally Devis but, perhaps like Daniel Defoe, the famous son of James Foe, he may have thought the French particle more aristocratic, and so adopted it. Rector of Brecon in Somersetshire, De Vis published an article about the British Wolf Fish in the *Zoologist* for 1865. Five years later he came to Rockhampton, Queensland, prospecting. From 1882 to 1905 he was in charge of the Queensland Museum. He discovered and

described a number of new fishes from Queensland and the South Sea islands and wrote papers on spider-web fishing and the curious Papuan method of catching fish by means of a kite and cobweb.

R. M. Johnston (1845–1918) famous as a geologist, contributed over many years to our knowledge of the species and habits of Tasmanian fishes and a memorial volume has appeared in his honour.

Saville-Kent (18— – 1908) is justly famous for his great books on natural history and particularly his *Great Barrier Reef*, illustrated by his own photographs and drawings. He energetically encouraged the development of our fisheries, through his books and lectures, and by organizing exhibitions.

THE MODERNS.

It is still too early to assess the results of twentieth century research and as some of the earlier workers and all the present ones are still living, it were better to leave judgment to posterity. Amongst those who have passed on, however, praise must be given to Edgar R. Waite whose descriptions of our fishes were not only accurate but illustrated by good wash-drawings from his own brush.

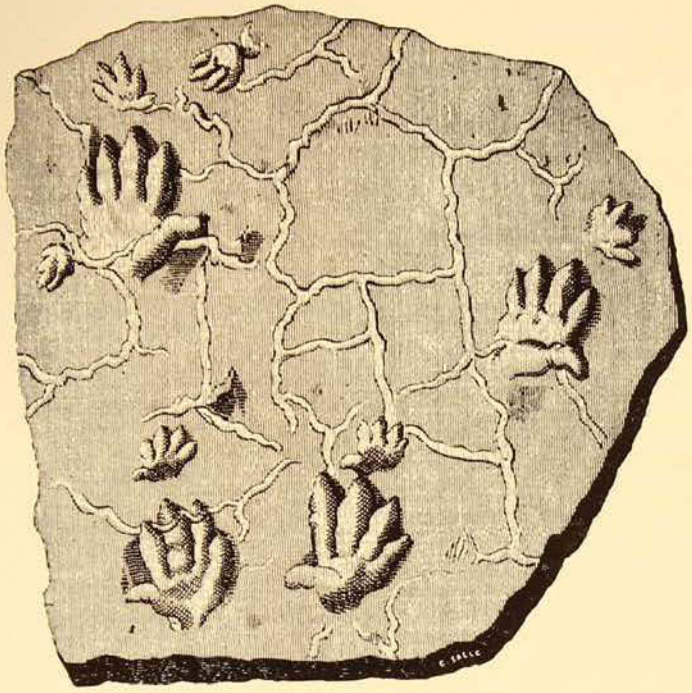
It was Waite who trained A. R. McCulloch and the pupil improved on the master. McCulloch[1] read and card-indexed everything that had been written about Australian fishes, he discovered new species which he described and illustrated so accurately and beautifully that there is little that can be added to his work, and the final fruit of his labour, published after his most untimely death, was the *Check List of Fishes Recorded from Australia*, issued by the Trustees of this Museum in 1929–30, which persists as a sure foundation for all future developments in the study of Australian fishes.

[1] See "For their Work Continueth", in AUSTRALIAN MUSEUM MAGAZINE, ix, 4, 1947, p. 121.

Australian Museum Science Lectures

The Popular Science Lectures, for very many years an important feature of this Museum's work, were resumed on May 13. These lectures, delivered at the Museum, begin at 8 p.m., but doors open at 7.30 p.m. They are illustrated by specimens, films or slides, and admission is free. The complete syllabus is as follows:

MAY	13	"The Zoo in my Garden"	Elizabeth C. Pope, M.Sc.
,,	27	"All About Sharks"	G. P. Whitley, F.R.Z.S.
JUNE	10	"Australia's Extinct Volcanoes"	R. O. Chalmers, A.S.T.C.
,,	24	"Fluorescence in Minerals"	H. F. Whitworth, M.Sc.
JULY	8	"Fossils and their Story"	H. O. Fletcher.
,,	22	"The World of Food"	Prof. H. Priestley, M.D., Ch.M., B.Sc.
AUG.	5	"An Insect Calendar"	A. Musgrave, F.R.Z.S., F.R.E.S
,,	26	"Lights Under the Sea"	Joyce Allan, F.R.Z.S.
SEPT.	9	"Diseases of Plants"	C. J. Magee, D.Sc.Agr., M.Sc
,,	23	"Greek Pottery"	Prof. A. D. Trendall, M.A., Litt.D.
OCT.	7	"Spectacular Experiments in Zoology"	A. N. Colefax, B.Sc.
,,	28	"Some Aspects of Australian Fishery Research"	H. Thompson, D.Sc.



Footprints of Saurian, Chirosaurus, from Hessberg, Germany.
After Nicholson and Lydekker.

Footprints in the Sands of Time

By H. O. FLETCHER

TO the early uncivilized people of the world a close study of footprints was essential to their very existence. Food was their greatest problem in life and hunting game with primitive weapons called for the greatest of skill not only in tracking down animals for the kill, but in deciphering their trails. The knowledge these early people were able to ascertain from footprints was considerable and there was little an animal did which could not be interpreted from its tracks.

It is possible to recognize the footprints of different animal groups by their definite characteristics. In a broad sense animal tracks can be divided into groups. There are those made by the flat-footed animals such as man and the bears; the long hind-legged creatures like the rabbits and squirrels; the toe-walking dogs, cats and wolves; and of course the very characteristic three-toed tracks left by the birds. Another group is what might be termed the toe-nail walkers, and of these the deer is an excellent example. Within these groups it is possible to identify the tracks of individual species by the size or some particular feature which is characteristic.

Footprints of a Palaeozoic quadruped from the Grand Canyon, Colorado.
After Lull.

The cat, like most animals which stalk their prey, is a perfect walker, for the hind feet fit perfectly into the tracks made by the fore feet. Long-tailed lizards which drag their tails always show a continuous

furrow or "tail-drag" between the two sets of footprints. On the other hand a leaping kangaroo touches the ground neither with his heel or his tail. In between jumps he rests momentarily on his toes only and therefore the impressions or footprints are unlike those of a slow-moving kangaroo.

To the average outdoor person of today the trails or footprints of animals have a fascinating interest and one can find endless pleasure in deciphering those found on soft beach or river sands and other areas where impressions may be left.

The Australian aboriginal is famous for his tracking capabilities and he can read so easily and readily an amazing amount of information from tracks that it appears to be due far more to instinct than training. While collecting in central Australia and the Northern Territory I have found the aborigines to be faultless in their tracking of animals and in the observations gained from the footprints. From the maze of tracks outside the entrance to a lizard burrow they find the last trail and never once were they wrong in stating whether the lizard was "at home" or had gone "walkabout".

In the study of fossils, footprints are also of some importance, as it has been found they may be preserved under certain conditions. Fossil footprints attracted little attention until approximately a century ago a number were described from Europe and America. Since that time knowledge regarding them has advanced to such a state that the footprints are now known of many animals which became extinct millions of years ago. It is not always possible to identify fossil footprints with the animals which made them. Some have been found totally unlike the tracks which could be made by any known extinct creature. It is possible that in time the fossil skeletons of these unknown animals will be collected and a correlation made with their already recorded footprints.

It is well known that at the present time we have by no means a complete record of the fossil remains of all terrestrial creatures which lived in past geological ages. The chances of burial and subsequent preservation as fossils of any land animal are not nearly as good as those of marine living forms and we possess actually a very fragmentary record of past land faunas. However, the surprising feature is really that so much of the life of the past continents has been preserved and has enabled us to learn so much of the life and conditions which existed in past geological periods.

In all parts of the world the rocks of the Triassic period are particularly rich in footprints. Why this is so is difficult to say, except that in those days the newly evolved group of reptiles was flourishing and becoming particularly abundant in an environment which was admirable for rapid development. The Triassic continents must have literally teemed with reptilian life. At the same time in all parts of the world great thicknesses of sandstone were being laid down under possibly lacustrine, fluviatile and terrestrial conditions. These rocks were most suitable for the preservation of impressions of tracks and trails of the Triassic land fauna of which the reptiles were dominant.

In the United States of America, in the valley of the Connecticut, fossil footprints are very abundant and are beautifully preserved in a fine sandstone. The wealth of animal life which roamed in this area in Triassic days may be gained from the fact that in two very extensive scientific publications 150 species were identified, and these represent many groups of animals.

Fossil footprints have been recorded from Australian rocks, but they are not by any means common. It was a discovery then of great interest when recently Mr. Geoffrey Scarrott found in sandstones of Middle Triassic age at Berowra Creek, near Sydney, many trails of extinct reptiles. The sandstones in which the footprints were found is beautifully laminated and splits perfectly. Many tracks were found in the rather limited area exposed to view and there can be little doubt that not very far away in Triassic days there was a lake or estuary which was subject to fluctuations of water

Footprints of a primitive reptile which lived in the Triassic Period about 200 million years ago. Probably the reptile was similar in structure to a crocodile, about six to eight feet long, and bulky. The footprints were discovered at Berowra by Mr. Geoffrey S. Scarrott.

Photo.—
Howard Hughes.

level. On the shore roamed the Triassic reptiles, leaving their footprints and trails in the soft wet sand. Dried, and slightly hardened by the sun, the sands would again be covered by water which at the same time would deposit a layer of fine sand in the footprints and over the shore-line. This process occurring again and again, and forming layer upon layer of sand, has now hardened into a well stratified sandstone. As these layers are now removed, the footprints are revealed, proving the existence of these Triassic animals over a long period of time.

It seems strange that at least some of the bones of the reptiles which made the tracks have not been preserved in this sandstone. In all probability, however, the strata which may have contained the fossil bones has been completely eroded away.

The sandstone at Berowra Creek is known as Hawkesbury sandstone, and although it is considered unfossiliferous there are found in it large lenticular shale deposits which have yielded a rich and varied fossil fauna. Most of these shale deposits have been used in the manufacture of bricks and are found at Beacon Hill (near Brookvale), St. Peters, Bexley, and Gosford. The shale deposits represent fine materials laid down in Triassic lakes or more possibly estuaries. Such conditions were ideal for the preservation of fossils and from all these brick-pits abundant fossil remains have been collected. These are represented mainly by many species of plants, fish, insect remains, including large dragon flies and cicadas and the important primitive amphibians known as labyrinthodonts. These early salamander-like creatures came into existence in the Carboniferous period and in the Triassic days were nearing extinction. Their footprints are well known from excellent specimens collected in Bavaria and are similar to the impression that would be made by a chubby hand.

It is possible that in the vicinity of the footprint horizon at Berowra Creek, there was also a shale deposit which in

The footprints occurred in beautifully laminated sandstone, known as Hawkesbury sandstone, at about the position indicated.
Photo.—
Howard Hughes.

the intervening millions of years has been completely weathered away. The sandstone horizon in which the footprints are preserved is near the top of the sandstone series in an area which has been weathered a great deal by active stream action and deep gorges have been formed.

In an attempt to identify the fossil footprints found at Berowra Creek one must consider the known terrestrial fauna of Triassic times. The Permian and Triassic geological periods are of considerable importance because it was during these times, over 300 million years ago, that we find the conquest of the land by the higher animals.

The first transformations of fishes into land-living amphibians had begun in the upper half of the Devonian period—possibly one hundred million years earlier. In the following long Carboniferous period a further rapid development of the amphibians took place as continental conditions were most suitable for their growth. These conditions were vast marshy plains in which grew thick forests half-submerged in water. The flooded forests were an ideal transitional environment for typically aquatic animals to become terrestrial ones and as a result the amphibians thrived. Amidst them, slightly later, appeared very primitive land animals approximating in their structure the true reptiles which were soon to follow.

In Permian and Triassic days the first great advance of the reptiles began and some of these primitive forms gave rise to fantastic and gigantic groups. The labyrinthodont type of amphibian, the Stegocephalians, became extinct in the late Triassic. At this stage the reptiles had invaded all the land regions and with them and kept very much on the defensive were the small forerunners of the mammals. It was not until the end of the Mesozoic Era when the day of the reptiles had waned that the mammals came into their own. In early Tertiary times they flourished and branched out into many groups from which developed all the known mammals of today.

Very briefly, then, it seems that any great abundance of tracks in Triassic times would have most likely been made by some reptilian or closely allied group. The tracks found at Berowra Creek were made almost certainly by a reptile of considerable size, one approximately six feet in length and of considerable bulk. The two lines of footprints are about thirteen or fourteen inches apart and as there is no

The sandstone in which the footprints occurred splits very readily and evenly, as may be seen in this quarry face.

Photo.—
Howard Hughes.

central tail furrow or "tail-drag" it must have been a short-tailed reptile. Impressions made by the tail of this reptile are preserved in the sandstone but possibly only when it was resting. The footprints themselves show characteristically only two fairly long toe-impressions separated by a definite ridge extending from the rounded convexity of the heel. Rather than postulate that we are dealing with an evolutionary stage or something of embryological significance as the evidence would suggest, it could be that the reptile was the normal five-toed type. In the locomotion of rather heavily built reptiles it is observed that the inner part of the feet first make contact with the ground and pressure is exerted to maintain the weight of the body. Hence, if the stride was made upon soft sand, a sinking of this portion of the foot would take place, leaving deep impressions of the inner two toes and perhaps little or no impressions of the outer three toes. A slight ridge at the back of each heel impression indicates displacement of the sand under the backward thrust of propulsion.

As far as the fossil record of the Triassic fauna in Australia is concerned, there does not appear to be any reptile with which the Berowra Creek footprints can be correlated. It is more than possible that, after further research has been carried out, they will have to be relegated to the Protopoda, a group name proposed for primitive and extinct animals known only by their footprints.

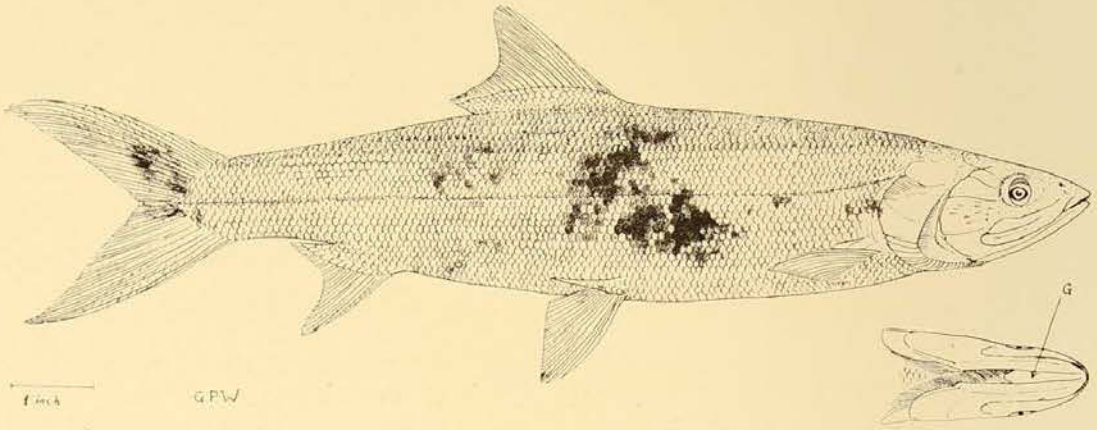
The finding of these footprints is of the greatest interest as they are in all probability the best set of fossil footprints yet found in Australian rocks. Their discovery is due entirely to Mr. Geoffrey Scarrott who, realizing their importance, spent a great deal of time and skill in uncovering them and removing the slabs so they could be transported to the Australian Museum. They are now exhibited in the Palaeontological Gallery.

The Giant Herring

By GILBERT WHITLEY

LAST of a long lineage of distinguished fossil ancestors, the Giant Herring is the reigning monarch amongst the vast assemblage of smaller herrings, the sprats, sardines, brisling and others. Apart from the "living fossil" East London Fish (*Latimeria*) of South Africa, and the Bowfin (*Amia*) of America, it is the only living fish which still has a "gular plate" (G in the figure), a bone between the two sides of the lower jaw. The bones of the head are also much more numerous than in modern fishes.

The Giant Herring is of a beautiful silvery colour, browner or greenish on the back, grows to four feet long, and is good to eat. It is also called the Chiro or Banana Fish, *Elops* (*Gularis*) *australis*, and travels over a wide range in tropical seas, harbours and rivers, coming south to Mandurah in Western Australia and Sydney in New South Wales. The life-history is unknown but it probably begins life as a long, ribbon-shaped, glassy larva, as does its American ally, the Ten-Pounder (*Elops saurus*).



The Giant Herring.

THE WESTERN AUSTRALIAN NATURALIST, Vol. i, Nos. 1-3 (Western Australian Naturalists' Club, Perth, Western Australia), 1947. Dr. D. L. Serventy, editor. 8vo, 24 pp., illustrated, 1s.

We have received from the Western Australian Naturalists' Club three issues of its journal. The publication is not intended to be a popular natural history magazine, but will contain original work and field observations by the Club's members. This will be a valuable addition to the knowledge of the fauna and flora of "The West", and cannot but be an encouragement to an interest in such matters. Each of the numbers forwarded contains a wide range of articles, a valuable feature being "From Field and Study", which records in brief items worthy of note.

It is an attractive publication and compares well in contents, style and production with others of a longer standing.