

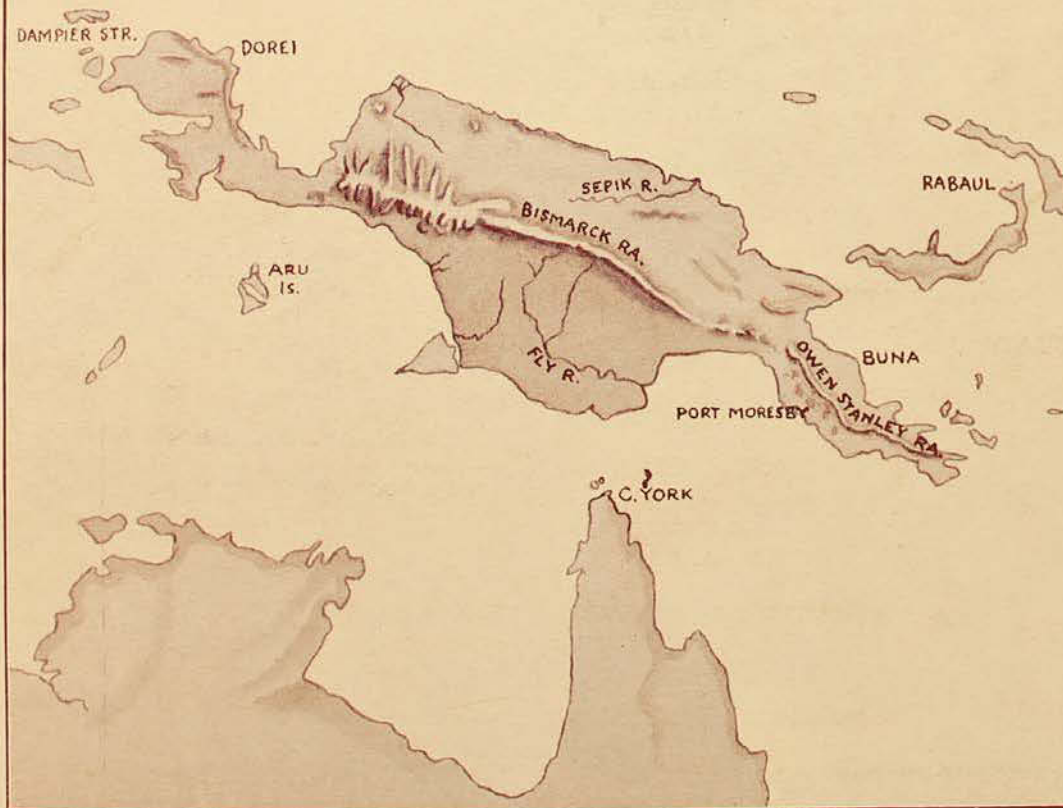
The AUSTRALIAN MUSEUM MAGAZINE

Vol. VIII, No. 3.

JANUARY-MARCH, 1943.

Price—ONE SHILLING.

NEW GUINEA ISSUE



THE AUSTRALIAN MUSEUM

HYDE PARK, SYDNEY

BOARD OF TRUSTEES.

PRESIDENT :

F. S. MANCE, A.I.C.A.

CROWN TRUSTEE :

F. S. MANCE, A.I.C.A.

OFFICIAL TRUSTEES :

HIS HONOUR THE CHIEF JUSTICE.
THE HON. THE PRESIDENT OF THE LEGISLATIVE COUNCIL.
THE HON. THE COLONIAL SECRETARY.
THE HON. THE ATTORNEY-GENERAL.
THE HON. THE COLONIAL TREASURER.
THE HON. THE SECRETARY FOR PUBLIC WORKS.
THE HON. THE MINISTER OF PUBLIC INSTRUCTION.
THE AUDITOR-GENERAL.
THE PRESIDENT OF THE NEW SOUTH WALES MEDICAL BOARD.
THE SURVEYOR-GENERAL AND CHIEF SURVEYOR.
THE CROWN SOLICITOR.

ELECTIVE TRUSTEES :

E. C. ANDREWS, B.A.	FRANK B. SPENCER.
C. GORDON MACLEOD, M.A., M.D., Ch.M.	PROF. ERIC ASHBY, D.Sc. (London), A.R.C.S., D.I.C.
G. A. WATERHOUSE, D.Sc., B.E., F.R.E.S.	JOHN SPENCE, C.M.G.
PROF. A. N. ST. G. BURKITT, M.B., B.Sc.	THE HON. SIR SAMUEL WALDER, Kt., M.L.C.
PROF. W. J. DAKIN, D.Sc., F.L.S., F.Z.S., F.R.Z.S.	C. A. SUSSMILCH, F.G.S.
H. B. MATHEWS, B.A.	O. G. VICKERY.

DIRECTOR :

A. B. WALKOM, D.Sc.

Assistant to the Director :

J. R. KINGHORN, C.M.Z.S.

SCIENTIFIC STAFF :

Vertebrate Zoology :

Birds, Reptiles and Amphibians.
J. R. KINGHORN, C.M.Z.S.

Mammals and Skeletons.
E. LE G. TROUGHTON, F.R.Z.S., C.M.Z.S.

Fishes.
G. P. WHITLEY, F.R.Z.S.

Geology :

Minerals and Rocks.
T. HODGE-SMITH.
R. O. CHALMERS, A.S.T.C.

Fossils.
H. O. FLETCHER.

Invertebrate Zoology :

Insects and Arachnids.
A. MUSGRAVE, F.R.Z.S., F.R.E.S.
K. C. McKEOWN, F.R.Z.S.
NANCY B. ADAMS.

Molluscs.
T. IREDALE, F.R.Z.S.
JOYCE ALLAN.

Crustacea and other groups.
F. A. MCNEILL.
ELIZABETH C. POPE, M.Sc.

Anthropology :
F. D. MCCARTHY, Dip.Anthr.

LIBRARIAN :

W. A. RAINBOW.

DEPARTMENT OF PREPARATION :

T. HODGE-SMITH.
G. C. CLUTTON, *Articulator.*

HONORARY SCIENTIFIC STAFF :

Zoologists.

PROF. T. HARVEY JOHNSTON, M.A., D.Sc.
Asst. PROF. E. A. BRIGGS, D.Sc.
H. LEIGHTON KESTEVEN, D.Sc., M.D.
MELBOURNE WARD, F.R.Z.S., F.Z.S.

Entomologists.

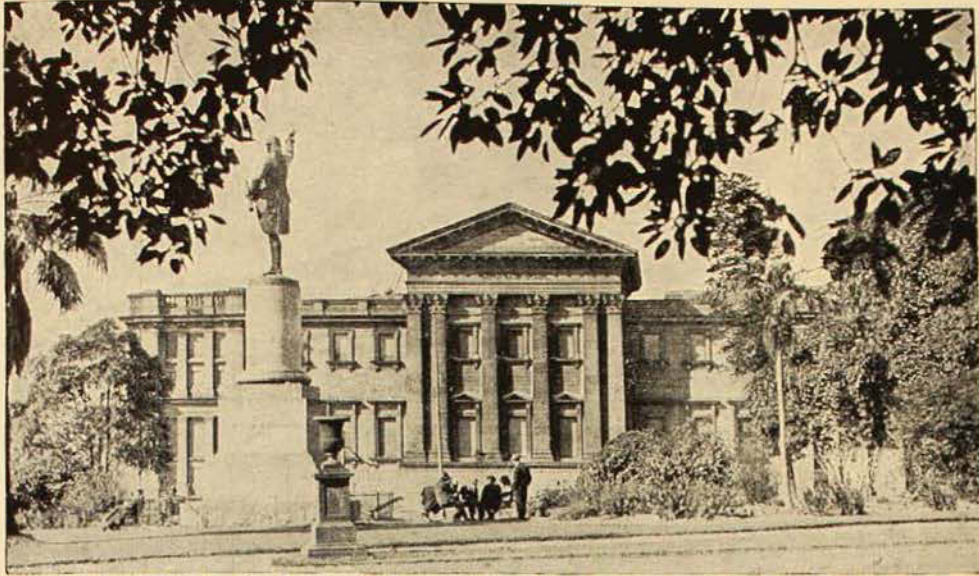
G. A. WATERHOUSE, D.Sc., B.E., F.R.Z.S.
T. H. GUTHRIE.

Ornithologists.

A. F. BASSET HULL, M.B.E., F.R.Z.S.
K. A. HINDWOOD, C.F.A.O.U., F.R.Z.S.
A. J. MARSHALL.

Archaeologists.

PROF. J. I. SHELLSHEAR, M.B., Ch.M.
GEORGE A. THOMAS.



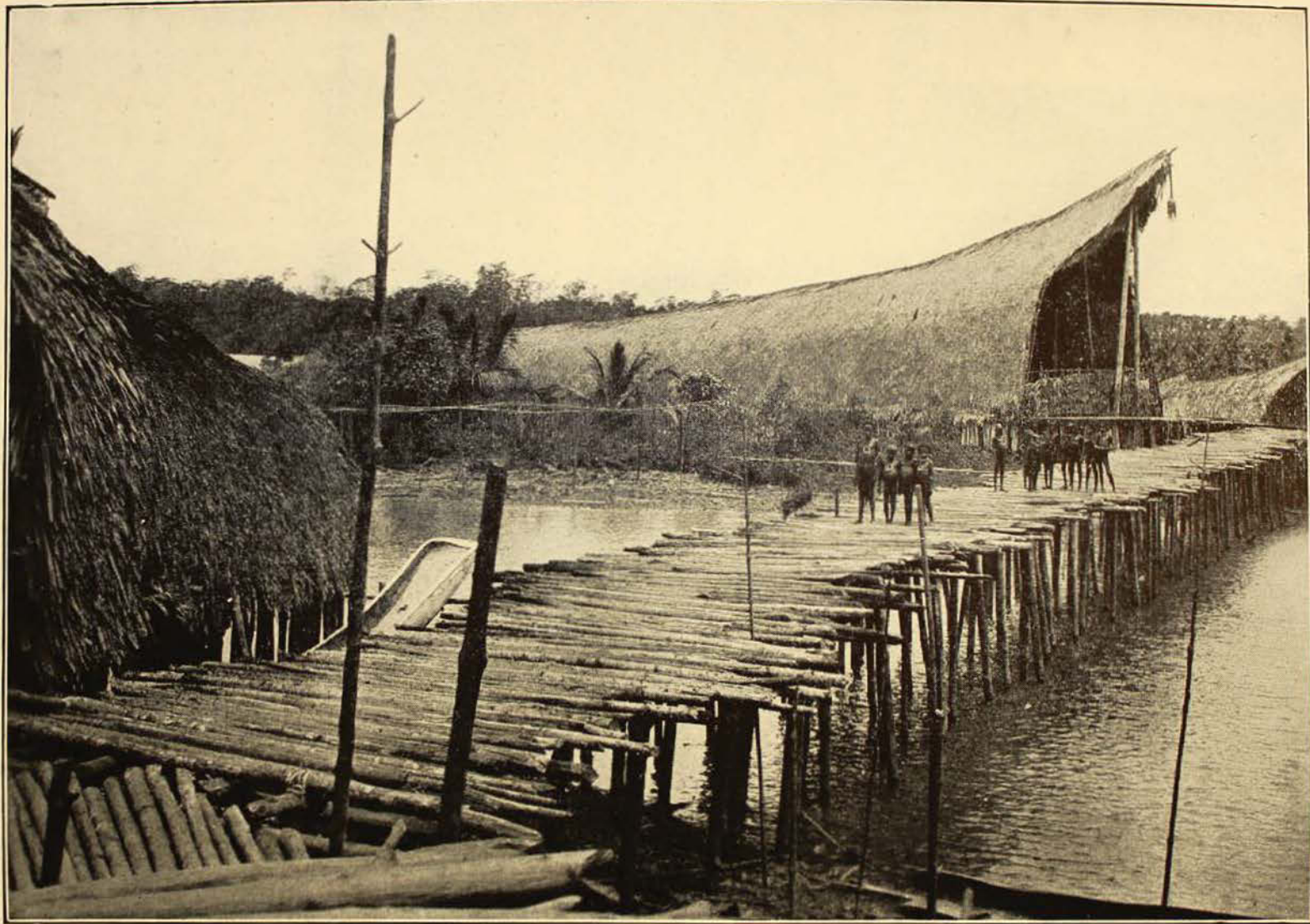
THE AUSTRALIAN MUSEUM MAGAZINE

THE GREAT RAVI, KAIMARI, GULF OF PAPUA	<i>Frontispiece</i>
NEW GUINEA	75
HUNTERS AND GARDENERS OF NEW GUINEA— <i>Frederick D. McCarthy</i>	76
THE FURRED ANIMALS OF NEW GUINEA— <i>Ellis Troughton, F.R.Z.S., C.M.Z.S.</i>	82
THE GEOLOGY OF NEW GUINEA— <i>T. Hodge-Smith</i>	91
POPULAR SCIENCE LECTURES	95
SOME PAPUAN INSECTS— <i>A. Musgrave</i>	96
REVIEW	100
SOME BUTTERFLIES OF THE PAPUAN REGION— <i>G. A. Waterhouse, D.Sc., B.E., F.R.E.S.</i>	101
"AUSTRALIAN INSECTS"	103
STRANGE NEW GUINEA BEETLES— <i>Keith C. McKeown, F.R.Z.S.</i>	104
NOTES AND NEWS	81, 108

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

● OUR FRONT COVER is by Nancy B. Adams. This issue of the AUSTRALIAN MUSEUM MAGAZINE is devoted entirely to New Guinea.

Additional articles on this island will appear in the subsequent issue.



THE GREAT RAVI, KAIMARI, GULF OF PAPUA.

Kaimari village is elevated upon platforms built over a mud-flat, and stick bridgeways connect the many houses with the "road". This ravi, or men's clubhouse, is two hundred and eighty-five feet long, and thirty feet across the entrance; its greatest height is sixty feet.

In these ravis the men foregather to smoke, feast, and while away the hours making dance-masks. A cross-section of a ravi forms an interesting exhibit in the Australian Museum.

Photo.—Captain Frank Hurley.

THE AUSTRALIAN MUSEUM MAGAZINE



Published by the Australian Museum

College Street, Sydney

Editor: A. B. WALKOM, D.Sc.

Annual Subscription, Post Free, 4/4

VOL. VIII, No. 3.

JANUARY-MARCH, 1943.

New Guinea

UPON museums and kindred institutions today there beats a never-ceasing demand for assistance and information. The requests originate from varying sources and interests, but in many instances they have a definite bearing upon the travail through which we are passing. Of these it is but natural that many should be concerned with a region in which we are directly interested, and we have, therefore, brought together in this issue of the MAGAZINE a series of articles dealing with New Guinea. Such articles must necessarily be limited in scope, and we have been compelled to hold several over for the following issue.

As an island, New Guinea is second in size only to Australia. It is evident that from it many of the animals of the adjacent islands have been derived. In times past it was a great attraction for voyagers. Probably our earliest record, or association, with it is the fact that the *Victoria*, the only survivor of Magellan's fleet, and the first circumnavigator, returned in 1522 with skins of birds of paradise from the Moluccas—but these most likely came, originally, from New Guinea. The natives at this time were known to the Spaniards and Portuguese as *papuas*. Later, in 1546, Ynigo Ortiz de Retes sailed along the north coast and named the island New Guinea. Subsequently the Dutch began their explorations and place-names reveal their activity. In 1700 Dampier made additions to its nomenclature and discovered the strait bearing his name. Then, in 1770, came Cook, to be followed in the next sixty years by various French voyagers who did much to advance our knowledge of the zoology of the southern seas. In the past hundred years the work has been carried on principally by our own men. Blackwood, in 1843, discovered the Fly River, which was named after his ship. Then in 1846-50 H.M.S. *Rattlesnake* made surveys, and it was its officers who named the Owen Stanley Range after their commander. Moresby, commanding H.M.S. *Basilisk*, surveyed the south-east, and this task completed the coastal survey.

Many scientific expeditions have journeyed into the interior. Alfred Russel Wallace in 1858 visited Dorei, and for some months stayed there. He was the first European to reside alone upon the mainland. In 1871 Miklouho Maclay was for some months on the north coast enduring intense discomfort, and d'Albertis in the next few years made notable zoological collections. There were many others before the close of the century, but space precludes their mention. Yet this brief summary would be incomplete were we not to mention Sir William MacGregor, who, in 1896, crossed British New Guinea and made his way over the Owen Stanley Range, and Sir Hubert Murray, a most enlightened administrator, who gave generous encouragement to scientific workers.

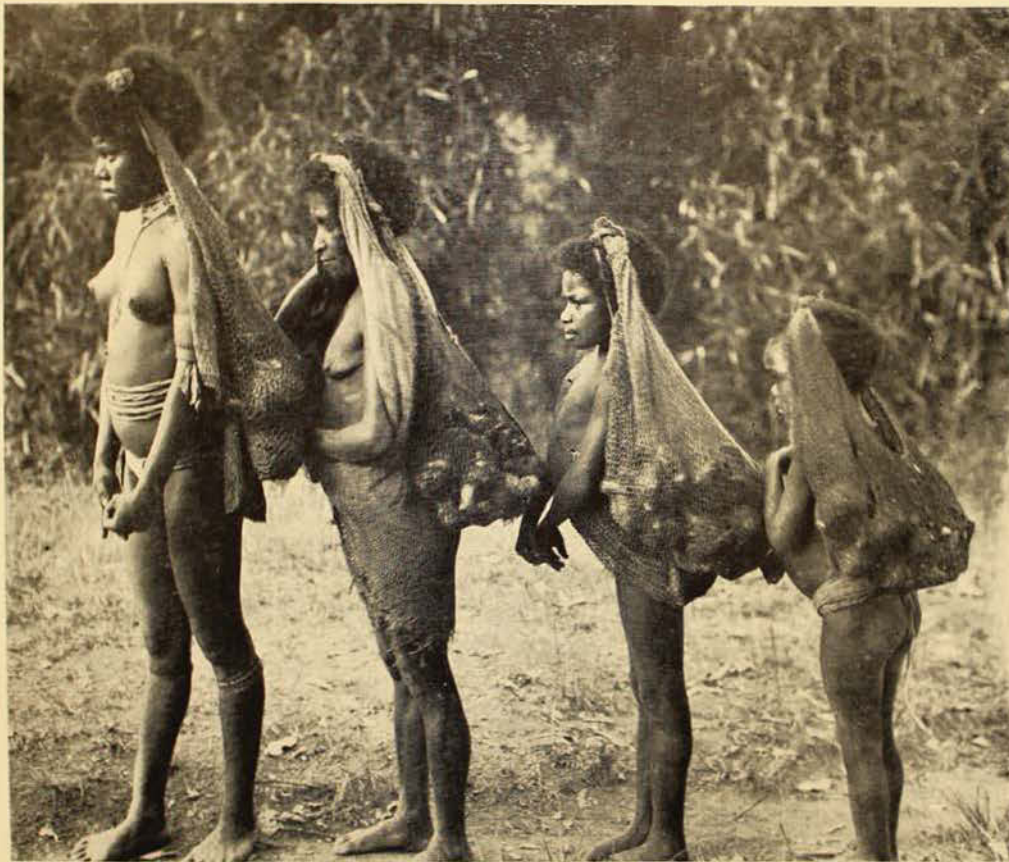
The work of these men has proved invaluable in recent months, and it is hoped that one outcome of the present conflict will be an augmented knowledge of this richly endowed island.

Hunters and Gardeners of New Guinea

By FREDERICK D. McCARTHY

IT is generally believed that the Pacific islanders live in a veritable paradise in which abundant food is to be had at all times of the year and where life is mostly pleasure and ease. This is true to a point because bananas, coconuts, and wild fruits are always on hand, but, apart from normal daily requirements, large quantities of food have to

the coast find gardens a necessity, some of the bush natives live an almost nomadic life, and inland villages exchange jungle and garden produce for fish from the saltwater people. Generally speaking, the population relies upon a mixed diet of plant and flesh foods, and their methods of maintaining the supply are interesting and varied.



Women and girls returning from the gardens laden with tubers for the evening meal. Ononghe, Central Division, Papua.
Photo.—Captain Frank Hurley.

be supplied for feasts and trade, and the natives are obliged to work constantly, adapting their activities to the dry and wet seasons, and thinking always of the replenishment of stores of garden and other produce. There are, in addition, many other activities to be attended to, and lazy people are despised.

In New Guinea the environment varies considerably, as do the modes of getting food. Thus the fishing communities of

The heavy work of clearing plots for gardens in jungle-covered land is done by the men, who cut or burn down the large trees, and erect a fence to keep out pigs and other pests. The men and women co-operate in the planting, although certain crops are planted by each sex, and the women do the tedious cultivating and weeding. A series of magical rites is performed prior to planting and at certain stages of growth to

ensure the success of crops, and during harvesting a thanksgiving ceremony is carried out to propitiate the garden spirit. The gardeners, however, have a deep knowledge of their work, and the specialists acquire considerable prestige if they are able to produce prolific yields of staple foods.

New gardens are prepared towards the end of the dry season so that they will be ready for cultivation during the wet season. Agricultural implements are crude and limited in number, and comprise pointed poles and shell hoes for

potato are dug up from day to day, because they go bad if kept very long. Sago is a staple food in swampy areas, and the palms are so highly prized that the permission of the village headman or council must be obtained before one may be cut down. In old gardens, and round new ones, are planted banana, bread-fruit, plantain and other fruit trees, coconut and areca palms, and sugarcane, while tabu marks indicate individual ownership of useful trees in the jungle. Nowadays, manioc, pineapple, pumpkin, sour-sop, maize, cucumbers, melons,

A garden of taro and yams beside a communal family house. Aramia River, Papua.

Photo.—Captain Frank Hurley.



digging the holes into which are thrust the seeds, tubers, cuttings or suckers; wooden spades are used in the fertile valleys of the central range, where cultivation is highly developed. Various crops are rotated. Yams are planted up to four times during the year and take as long as ten months to mature. Their trailing vines are trained to stakes or allowed to run wild over logs, and add a picturesque touch to the gardens; the tubers are stored in special huts to tide the community over the dry season. In some localities yams form the subject of a special cult, and enormous examples are grown in mounds. Taro and sweet

mango, and paw-paw, obtained from government officers and settlers, are cultivated by many villages.

During the dry season, when it is impossible to garden in some localities, the people hunt and fish. The jungle provides animal and plant foods of many kinds, but constant hunting causes a scarcity of game in the vicinity of large villages. Many kinds of wild fruits, leaves, roots, nuts and seeds are eaten by the natives, some of them requiring special treatment to leach out poisonous secretions. It is, therefore, advisable to eat raw only those foods that the natives consume in this state. Tribal names for



A young woman using a digging-stick to plant a taro shoot. Note the pig fence. Wogeo Island, New Guinea.

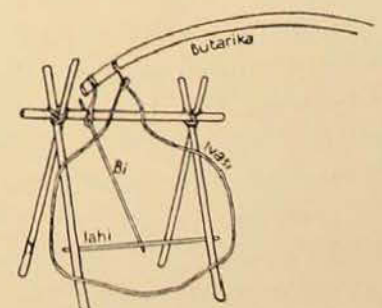
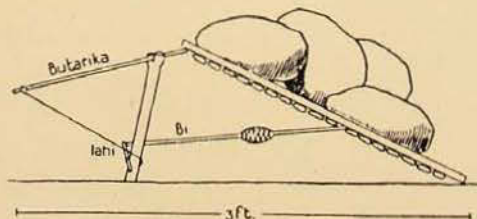
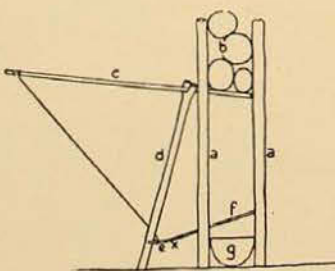
Photo.—Dr. H. I. Hogbin (courtesy Australian National Research Council).

these wild plant foods vary, and, moreover, there are few standard pidgin-English or European names, so that it is a difficult matter to identify them. Any animal food, from mammals to the lowest invertebrates, is eaten, though even here there is need for some discrimination.

Mass hunts are a popular and effective method of catching pigs, wallabies and

cassowaries. These hunts are of two kinds. In one type a cord net of large mesh, four feet high and twenty feet long, is set across a track at the bottom of a ravine, or on top of a ridge; beaters, sometimes boys with dogs, drive the animals into the net, where waiting warriors kill them with spears, arrows, clubs or axes. Sometimes a net is not used. In the other type of hunt four parties of men light each side of a selected patch of grassland, the animals attempting to escape are killed, and those roasted in the fire collected from the ashes. In group hunts there is a great hullabaloo, and the set formation of the beaters and killers is often upset when the game appears, because the one who kills an animal, or in whose net it is caught, becomes the owner, although its flesh is shared with his comrades.

The men are fearless hunters, and one or two will go out to kill the dangerous wild boar, either in the day or on a moonlight night. They are armed with bamboo-headed spears, and in some areas use a pig-catcher, which consists of a cane loop on a long pole, the loop being thrust over the head of the charging animal, a terrifying opponent with his long razor-sharp tusks, speed of movement, and great strength. Pits, camouflaged with vegetation, are dug in gardens or along trails, and into them fall unwary pigs and wallabies, sometimes on to sharp stakes. These animals often impale themselves on stakes set behind a gap left at the top of a garden fence when they leap through it to raid the crops.



Pig and wallaby traps. When the trigger-bar (f on left, and bi in middle) is disturbed by a pig, the heavy logs or stones fall on to its back and imprison it. Similarly, the noose tightens round a wallaby when it releases the lahi.

After F. E. Williams.



Two men are removing the rind of the trunk and the other two are breaking up the mass of sago-pith forming the interior. It is then strained and either eaten or parcelled for barter.

Photo.—Captain F. Hurley.

Mammals are also caught with various kinds of spring traps. The strongest type, for pigs, is made of two fences of poles, eighteen inches apart, blocked at one end with logs; near the top one or more heavy logs are set on a trigger-bar which, when disturbed by the pig rushing in to eat the bait of yams and sago, releases the spring and brings the logs down on to the pig's back. Other traps work on the principle of a noose on a springy stick held down by a light rod connected to the trigger-bar, which, when displaced by an animal, causes the noose to tighten about its body. They are set in trees and to stakes in the ground, and a very stout type is constructed for catching crocodiles.

The noose is also effective with birds. A boy or man, having set a line along a branch of a fruit-bearing tree, waits in a leafy hide-out, and when a pigeon, paradise-bird or hornbill hops into the noose, the latter is pulled quickly and

tightly round its legs. This method is also employed for catching bower birds and those drinking beside pools. Birds that nest in hollow trees are hunted out by beating the trunk or bough, and are caught in a net held over the exit hole. Another way of trapping birds is to cut a passage up to twelve feet wide through the vegetation on top of a ridge, and to set three parallel nets across it; the two outer nets are of large mesh and are designed to confuse the birds, whose impetus carries them through the large mesh into a small-meshed inner net, where they are killed with arrows or clubs. Cassowaries are speared or shot with bow and arrow, a weapon used for killing all kinds of birds and animals, including the tree kangaroo.

Nooses are set on the ground, or hung in trees, to catch pythons, and a running noose on a long stick is manoeuvred over the head of a monitor lizard, the hunter often falling out of a tree when attempt-



A woman preparing for fishing. Note the scoop net and conical trap. Aramia River, Papua.

Photo.—Captain F. Hurley.

ing to edge out along a branch at the end of which is a cornered lizard. Even fruit-bats and flying-foxes are eaten, and they are caught in several different ways: a tangle of nooses to catch the claws of the creatures is woven on a bag containing a breadfruit, or an irate gardener waits for them to visit his garden at night, when he strikes them with a bundle of thorny palm fronds on the end of a pole. Otherwise he indulges his wrath by lashing wildly with a club at startled bats in a cave. On the march, when game is sighted, every encumbrance is dropped,

and the handiest weapon used, even by carriers: canoe-men will drop their paddles and pull a snake down out of an overhanging tree, sometimes into the shaky craft, and a great stir ensues until it is despatched.

The fishing methods are adapted to the numerous kinds of fish sought in deep and shallow waters. Gorges and hooks of wood, bone and turtle-shell are fastened to tow-lines, or set on stakes on which a rattle indicates a catch. Fish are shot with arrows in shallow water, and spear-men fight hazardous duels with sharks in the lagoons. Conical and other shaped traps, and beautifully made nets from small scoop forms to large set types are extensively employed. Dams and weirs are constructed of logs, stakes and stones across streams, and the fish in them speared or scooped out in nets. Sometimes still water is poisoned with the branches and leaves of certain trees. One of the most interesting methods of fishing is with a hook or noose on a float, dozens of which are set; a similar practice is that of attaching balls of spider-web to kite-lines. A dangerous variation of this method is employed for capturing sharks: a large noose on a propeller-like float is put in the water beside the canoe, and the fisherman shakes a coconut rattle to attract his quarry, over which he slips the noose and then struggles valiantly until he gets the shark into the canoe and kills it with a club. Turtles and dugongs are speared or harpooned. Most of the deep-sea canoe fishing is done by the men, and the innumerable marine foods of the reefs and shore are collected and caught in various ways by the women.

Food may be baked in the ashes, roasted on the fire, or cooked in pots where they are obtainable. Large puddings and animals are steamed in an oven made of stones, lumps of clay or ant-bed. A large fire of wood is made on the oven blocks, the ashes are scraped off when it burns out, and the food, wrapped in leaves, is then arranged, and some of the heated blocks placed on the top and sides. The oven is then sealed with leaves

A fishing-weir made of intertwined branches and vines. Kea River, Central Division, Papua.
Photo.—Captain Frank Hurley.



and clay to prevent the steam from escaping. Such ovens may be thirty feet long for the preparation of food for feasts, and in them are cooked puddings of yam and coconut, or other ingredients, flavoured with spices, coconut cream and leaves, and up to one hundred pounds in weight. Pigs are first singed over a fire, until, with the aid of repeated applications of water, the outer skin peels off the white and bloated carcass, which is then carved by experts and the pieces put into the oven. Pieces of sago, split banana stalks, broken yams and other garnishes are carefully dispersed among the lumps of flesh, the cooking of this animal being recognized as a skilful and important job.

It is apparent that the success of the natives in obtaining an adequate supply of food depends not only upon skill in gardening, hunting and fishing, but on a logical division of labour between the sexes and members of a community, a deep knowledge of factors affecting the crops, such as the seasons and the soil, and an intimate association with their environment. A limited equipment is adapted to the habits of the innumerable terrestrial and marine creatures sought for food and other purposes, just as methods are varied to meet abnormal seasons. Co-operative work is more important than individual effort, and specialists play an important part in the maintenance of the food supply.

Mr. C. A. Sussmilch, F.G.S., has been elected a Trustee of this Museum. Mr. Sussmilch for many years was attached to the Technical Education Branch, N.S.W. Department of Public Instruction. He is well known for his geological researches.

* * *

Mr. O. G. Vickery, Managing Director, Coal Cliff Collieries, Limited, has been elected a Trustee in place of the late Mr. G. M. Goldfinch.

Recent visitors to the Museum included Messrs. W. Boardman, B.Sc., of the Australian Institute of Anatomy, Canberra; R. Settor, B.Sc., Council of Scientific and Industrial Research (Fisheries Division); and L. Stach, B.Sc., of Melbourne.

* * *

Mr. R. O. Chalmers, A.S.T.C., of this Museum, has been seconded to the Scientific Liaison Bureau, recently founded to assist industry in problems which may confront it.

The Furred Animals of New Guinea

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

FROM recent descriptions of Papuan mountain and coastal jungles through which Allied troops have fought, one might suppose that New Guinea harboured typical denizens of Malayan jungles, such as small deer and the tapir, large cats like the peninsular tiger, chattering groups of monkeys, and even our old friend the Ourang-utan of Sumatra and Borneo. On the contrary, the furred animals of New Guinea actually parallel those of the Australian continent in the predominance of a remarkable variety of marsupial or pouched mammals. As on the mainland, only four out of fourteen odd orders of furred animals inhabited New Guinea in prehistoric times—namely, spiny ant-eaters (egg-laying relatives of the platypus), marsupials, numerous rats, and the flying mammals known as bats.

This close relationship of fauna is not surprising when one surveys the chain of reefs and islands linking south-west Papua with Cape York Peninsula, through the shallows of Torres Strait. The real problem concerns the means by which archaic marsupials actually reached these great southern sanctuaries, unaccompanied by hooved and clawed competitors of the Malayan jungles. Some support for a theory of invasion over once temperate Antarctic land bridges has been deduced from the existence of primitive marsupials in South America. But the prevailing assumption is of a diverging deployment of ancestral marsupials, one route leading to the "dead end" of South America; the other along an insular Malaysian chain to the sub-terminal sanctuary of New Guinea, and the final refuge of the Australian continent.

The miniature furred migrants must have arrived in an age when primitive marsupials and rodents were the dominant forms of mammalian life. Such

tiny creatures, with skeletons generally too frail for fossil record, could travel by debris-rafts over narrowed waterways, or by land-bridges since vanished. Subsequently, natural phenomena established an invisible zoological barrier, running between the Philippines and Celebes, through Macassar Strait and down between Bali and Lombok. Known as "Wallace's Line" in honour of its discoverer, a great explorer-evolutionist and contemporary of Charles Darwin, this intangible barrier excluded the Malayan mammals of a later epoch, and favoured the maximum development of marsupial life in splendid isolation.

Though New Guinea is mainly rugged and mountainous, there are fairly extensive lowlands in south-western Papua, with patches of eucalypts and tea-tree or paper-bark (*Melaleuca*) swamp-land. Here the birds and mammals resemble those of Australia, and the first furred animals seen by our troops are likely to be a few familiar wallabies of the kangaroo family. Ascending through jungle zones to the elevated grasslands of Papua and the Mandated Territories, and the 16,000 ft. Mt. Carstensz in Dutch New Guinea, tropical influences are displayed in the remarkable arboreal development of tree-kangaroos, and the many varieties of the largest member of the Australian possum family, the monkey-like pouched Cuscus.

THE MONOTREMES OR EGG-LAYING MAMMALS.

A general affinity of fauna is indicated by the fact that in New Guinea and Australia alone do we find those quaint egg-laying relatives of the platypus, the spiny ant-eaters or so-called "native porcupines". These most primitive mammals, called monotremes in reference to the single aperture for the egg-laying and excretory functions, actually have traces



Spiny Ant-eater. In southern Papua the spiny egg-laying relatives of the platypus are like the mainland species. Two remarkably long-snouted, more thickly-furred and shorter-spined species inhabit the highlands of New Guinea.

Photo.—K. C. McKeown.

of reptilian ancestry in their skeletons. But they are true mammals, as shown by the furry covering, warm blood, and suckling of newly-hatched young.

Although these egg-laying mammals evolved when New Guinea was united with Australia, the root-entangled banks of tropical waterways apparently proved too much for the soft-snouted platypus, which is restricted to the lakes and streams of Tasmania and eastern Australia. But the relationship of fauna is stressed by the occurrence of a short-beaked spiny ant-eater around Port Moresby, differing less from the mainland ant-eaters than does the Tasmanian kind. The more tropical regions of Papua and the rest of New Guinea have influenced the development of two remarkably long-snouted species of spiny ant-eater which have the tubular "beak" almost twice the head-length and strongly curved downward.

The scientific names of both long- and short-beaked ant-eaters refer to the whip-like extensible tongue which draws ants and crushed insect-food through the tubular snout. Differences in habits are not recorded, but the greatly elongated snout evidently evolved in probing the damper earth-mould of New Guinea jungles for earthworms and insect-grubs. A general reduction of the spines, which are almost concealed by denser fur in the damp cold of altitudes up to 8,000 feet, indicates less need of protection. The reduction of the fore-claws from five to

three, in the more prevalent species, would also suggest either less need, or even greater facility, for the ant-eaters' well-known protective manoeuvre of digging themselves underground.

MARSUPIALS—THE KANGAROO FAMILY.

Unchallenged by flesh-eating enemies as are American marsupials, the pouched mammals of New Guinea, by natural process of *adaptive radiation*, evolved their own flesh-eating and grazing types to occupy the customary haunts of foreign non-marsupial mammals. Though large kangaroos are absent, the kangaroo family replaces the grazing hoofed quadrupeds, as on the mainland. A race of the Agile Wallaby (*Wallabia agilis papuanus*) is recorded from the Papuan coast, near Daru in the Western Division, and from around Port Moresby, in country resembling its river-haunts of the northern mainland. Several species of small Pademelon Wallabies also inhabit Papua and the Mandated Territory, including New Britain, and are found westward to the Aru and Kei Islands. Another genus of small wallabies, having canine teeth and large premolars indicative of the semi-insectivorous diet of mainland rat-kangaroos, is restricted to New Guinea.

The jungle influence is stressed by the remarkable development of tree-climbing kangaroos, with their extraordinary readaptation of hopping structure for life amongst the tree-tops. The hind-limbs are reduced and the forearms relatively strengthened, with more prehensile hands and stronger nails for climbing in tangled vines and branches. They are less dependent on hearing, the ears being short and not deer-like. The long whip-like tail, instead of acting as a counter-poise in hopping, serves as a climbing-prop or as a rudder for great leaps among the branches and from a height as much as thirty feet to the ground.

Two of the five recognizable New Guinea species have the most brilliant coloration of any living marsupial. One species, from the 8,000 ft. zone of the Owen Stanley Ranges, and the Mandated Territory, combines a foxy-red coat with a



Tree Kangaroo. Jungle growth in mountainous regions of New Guinea has influenced development of a striking variety of tree-living kangaroos, known as "Sikow-belong-on-top" to Territory natives. Note the shorter face and ears, relatively more powerful fore-quarters, shortened grasping foot, and slender tail. Two species inhabit the Atherton Tableland region of the mainland.

bright yellowish face, belly, hands and feet, with yellow lines extending up each side of the spine. An even more spectacular tree-kangaroo from the ranges of the Huon Peninsula, Mandated Territory, adds a bright yellow tail to the above startling ensemble. The other three species, ranging from Papua to the north-west of Dutch New Guinea, are of a more sombre brown coloration. Affinity with the fauna of the mainland is shown by the occurrence of two species of tree-kangaroo in the Atherton Tableland region of north Queensland. Though they are said to spend considerable time on the ground their food consists mainly of tree-foliage, ferns, creepers, and almost all tropical fruits. Males are pugnacious, but become friendly in captivity, though rather short-lived, apparently owing to deficiencies in diet.

BANDICOOTS, "MARSUPIAL-MICE", AND "NATIVE CATS".

Absence of the small semi-insectivorous rat-kangaroos from New Guinea is balanced by a plentiful variety of bandicoots, often mistaken for little kangaroos because of their hopping feet. Although they hop leisurely when feeding, bandicoots run when hurried, and might be likened to small hopping pigs. The name "bandicoot" belongs to the pig-rat of India, and was applied to the marsupials because of a superficial resemblance observed by early explorers. They are easily recognized by their sharply tapered muzzles, absurdly short rat-like tails, and generally coarse bristly hair. Eating insects, mice, and a certain amount of succulent vegetable matter, they are mainly useful, but are well-known in suburban gardens of the mainland for

Bandicoots form a separate family of marsupials, sometimes mistaken for small kangaroos because of their lengthened hopping feet. Species of five genera are plentifully distributed throughout New Guinea. The slender snout extracts beetle-grubs and worms from cone-shaped pits. Useful destroyers of vermin, infestation by ticks and mites unfortunately makes them carriers of scrub-itch or tick-fever.

Photo.—Harry Burrell, O.B.E.



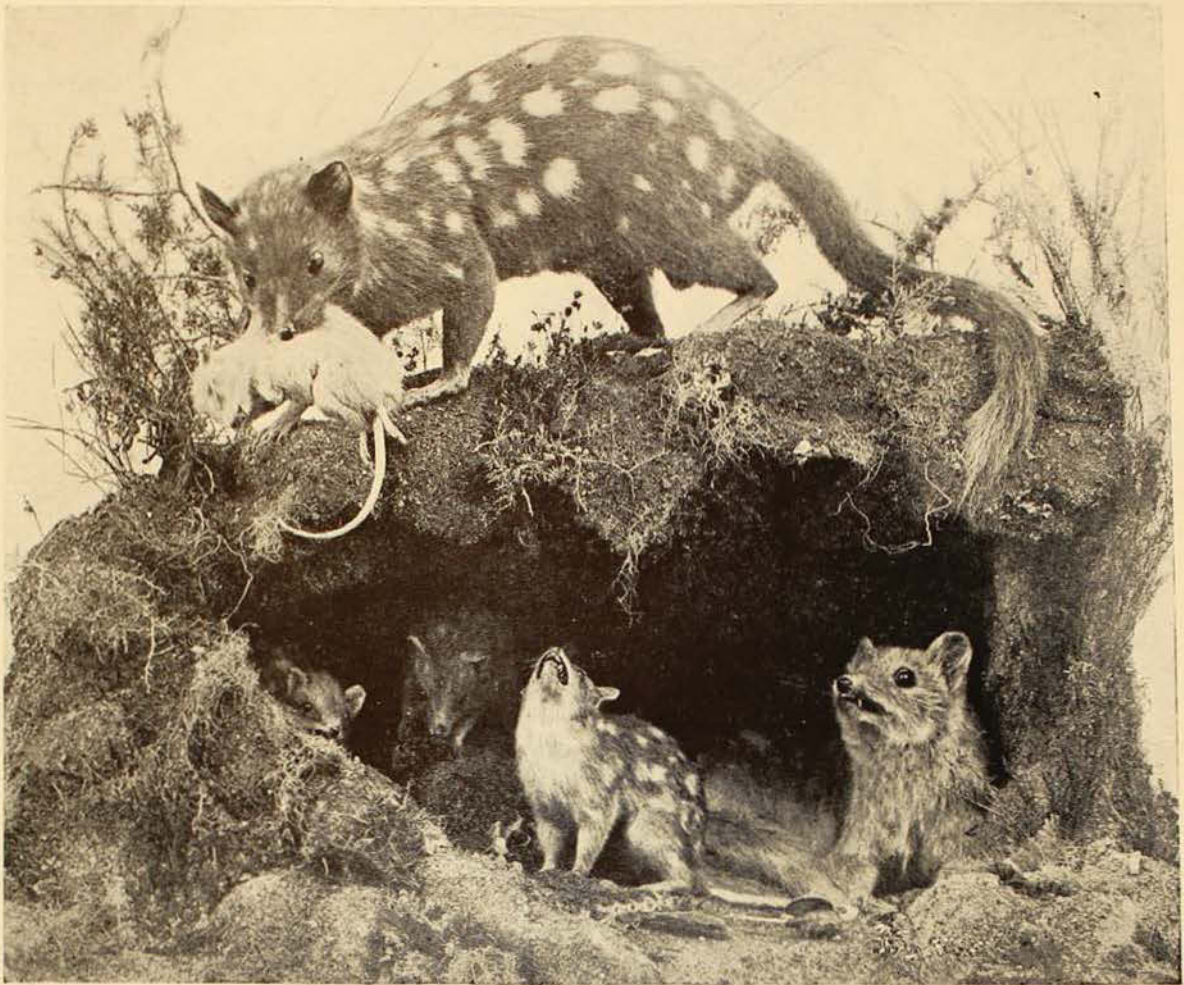
damage by scratchings which are really for insect life. The cone-shaped pits, from which earth-worms and beetle-grubs are extracted by the tapered snout, are a usual indication of bandicoots. They make a quaint grunting noise, hunting by night, and sleeping in brush-covered hollows by day; none of the New Guinea kinds are burrowers, like the Bilbies or rabbit-eared species of the mainland. Two to four young may be in the pouch, which differs from that of kangaroos in opening backward, instead of upward to suit an entirely hopping action.

Two of the five New Guinea genera of bandicoots also occur in Australia, and there is a plentiful distribution of species, ranging from a small rat-like animal with soft mole-like fur, to a relatively giant species, about the size of a hare, named *gargantua*. Mixed feeders, the quaint marsupials are often attracted to bush-camps by scraps of bread and vegetables, but there is a very apt saying, "lousy as a bandicoot", and they should be discouraged around tropical encampments. It was recently discovered that bandicoots are potential carriers of the serious infection of endemic typhus or "scrub-itch" fever, which may be communicated to man by the ticks and mites with which they are infested. Appropriately enough,

by eating small rats and mice which are more likely carriers of disease to man, bandicoots balance the ledger to a certain extent.

The insectivorous marsupial-mice have not so varied a representation in New Guinea, although a number of the more primitive species are widely distributed. All of the mouse- or rat-like marsupials are readily separated from the true rodents by their sharply tapered snouts, and the upper and lower rows of tiny incisor-teeth for holding insects, instead of the gnawing paired chisel-teeth of rodents. The pouches of marsupial-mice may be reduced to a mere flap surrounding four to eight teats.

The larger insect- and flesh-eating spotted relatives of the marsupial-mice, known on the mainland as "native-cats", are represented by races of one small species, recorded from Papua and northern New Guinea. The weasel-like appearance of these rather bloodthirsty marsupials has apparently evolved from the adoption of similar hunting habits to those of the foreign flesh-eaters. Although useful in eating rats, mice, and harmful insects, native-cats are exterminated on the mainland because of their destructive liking for poultry. Closely related to a north Australian species, the New Guinea



The Native or Marsupial "Cat". The spotted pouched-cat inhabiting New Guinea is closely related to a mainland species. Adoption of a mainly flesh and blood diet has evolved the weasel-like appearance. Though destructive of bird-life, they are useful in destroying rats and mice and young rabbits on the mainland. Australian Museum group.

native-cat is reddish to olive-brown, strikingly spotted with white. The head and body averages ten inches, the tail about nine inches, and the pouch may hold from four to six young. In spite of many reports of a giant flesh-eating marsupial in north Queensland jungles, there is no indication that the Thylacine or striped "marsupial-wolf", once of the mainland and now restricted to Tasmania, has ever inhabited New Guinea.

THE POSSUM FAMILY.

The tree-haunting Australian possums are richly represented in New Guinea, in spite of the absence of the well-known grey or brush-tail kind, and their much-admired distant sedentary relative, the tail-less koala. The popular family name was first applied to a Cape York ring-tail by Captain Cook, on noticing its general

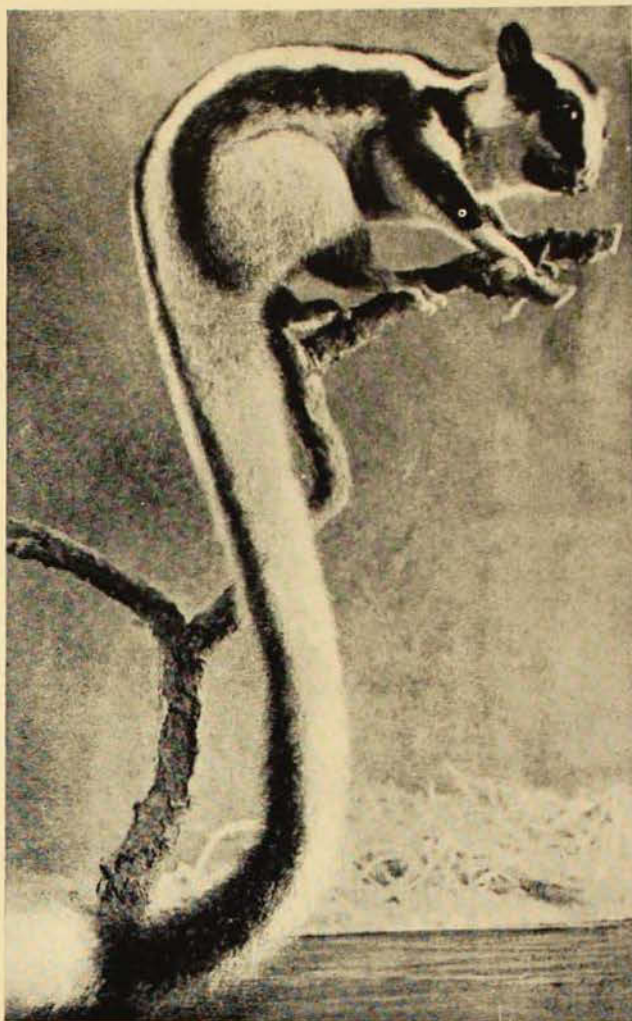
likeness to the American marsupials known by the Red Indian name "opossum". But they are mixed feeders, more like our poultry-killing spotted "native-cats". On the contrary, the smaller possums of Australia and New Guinea are insect and nectar feeders, and the medium-sized ring-tails are leaf, blossom, and fruit eaters; only the large and monkey-like Cuscus adds birds and mammals to its diet.

The mouse-like pigmy possums of the mainland, rarely seen unless taken from cats, or from their nests in hollow branches, are represented by two kinds ranging from Papua to Dutch New Guinea. One, with slender prehensile tail, and brush-like tongue for gathering insects and pollen, is related to a north Queensland species. The other is distinguished by the tail having long side-hairs

giving it the appearance of a feather, and rendering it useful as a rudder when leaping amongst branches, rather than for clinging. Another pigmy feather-tailed possum, with definite gliding membranes between the limbs, has been described from an island off northern New Guinea, but so far the pigmy-gliders, so plentiful in eastern Australian forests, have not been recorded on the mainland of New Guinea.

The medium-sized grey glider or "flying" possum of eastern and north coastal Australia, known as a "Sugar Squirrel" by early settlers because of its love of sweets in captivity, is represented by a single New Guinea species, occurring also in New Britain, the Aru and adjacent islands. The most striking medium-sized members of the family are the striped possums, so-called because of the skunk-like white and blackish-brown striping of the body. Apart from the distinctly sportive appearance, these possums are unique in having the fourth finger elongated to as much as twice the length of the fifth. With its small hooked nail, the digit is used for extracting insects and their larvae from timber. Strangely enough, a similarly specialized digit was independently evolved by the primitive "Aye-Aye" or lemur-monkey of Madagascar. There is also a rodent-like development of the front incisors, in both possum and monkey, for the gnawing-out of grubs from timber. Originally discovered on Aru Island, about five species are recognized in New Guinea, and one striped species inhabits Cape York Peninsula, south to Townsville.

The well-known ring-tailed possums of the mainland are represented by about twelve species. They are easily distinguished by their whip-like and rather short-haired tails, the prehensile tip being naked underneath, and usually coiled up, as indicated by the popular name. The tip of the tail is not usually white, as in mainland species, and the general colour tends to be more variable and brilliant, and the fur longer and more dense in the higher altitudes. Living almost exclusively on leaves, blossoms, and fruit, the ring-tails either construct large domed

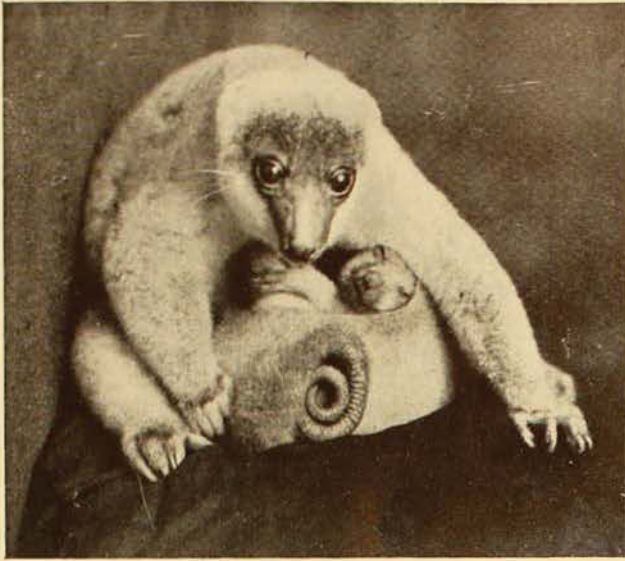


Striped Possum. These strikingly marked marsupials are represented by almost a dozen species in New Guinea, the Aru, and adjacent islands, one species occurring in north-eastern Queensland. Note the elongated 4th finger, the small nail of which extracts white-ants (termites) and grubs from timber.

After Lucas and Le Souef.

nests of interwoven leaves, ferns, and bark, or line a hollow branch with similar materials. Two young are usually carried in the pouch, and are tended in the nest for some time.

The largest and most monkey-like of the possum group are the cuscuses, represented by about twelve variably coloured and widely distributed species, extending from Celebes at the western extremity of the Australasian zone, throughout New Guinea, and the New Britain and Solomons groups. They are at once distinguished by having the outer half of the tail entirely naked and covered with rasp-like scales. The small ears scarcely show above the fur, and the combination



The Cuscus or Phalanger-Possum. Largest of the Australasian possum family, these monkey-like marsupials, generally known as Cuscuses in New Guinea, are also known as "Kapoule" to natives in the Mandated Territory. About twelve species are described, many with strikingly piebald markings. The species inhabiting Cape York has inspired reports of monkeys inhabiting the mainland.

of rounded cheeks, thick woolly coat, and prehensile tail, gives the marsupials a remarkably monkey-like appearance. The males of some species are strikingly spotted with large irregular markings.

A cuscus usually spends the day coiled up in thick foliage in the fork of a tree, as indicated by a worn rump-patch. Appearing sluggish in daylight, they become more active by night, consuming great quantities of leaves. In addition to foliage and fruits, cuscuses capture and eat lizards, birds, and small furred animals. The carnivorous habit is reflected in their rather fierce disposition, and it is said that they are the only marsupials which fail to respond to friendly efforts at taming them. They are hunted and eaten by natives, and the skin is worn for ornament or as a charm. A single species inhabits Cape York Peninsula, being responsible for frequent reports of monkeys having been observed in that region of the mainland.

RATS, BATS, AND INTRODUCED MAMMALS.

The prolonged isolation of Australia and New Guinea is stressed not only by a mutually rich development of marsupial types, but also by prehistoric exclusion of

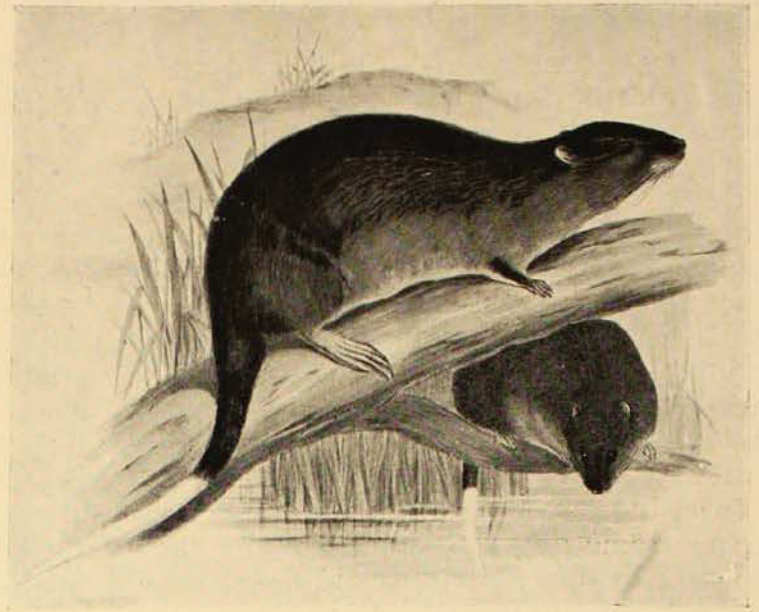
all the well-known non-marsupial mammals, such as monkeys, clawed flesh-eaters, and hooved grazing animals. Lack of non-marsupials is emphasized by the fact that the native pig and dog of New Guinea evidently accompanied ancient human migrations. The original non-marsupial furred fauna, as in Australia, is restricted to a remarkable variety of rats, and the large fruit-eating and small insectivorous bats.

The bats or flying mammals attained mastery of the air ages before man walked upright and their distribution is self-explanatory, while the infiltration of small rodents across the zoo-geographical barriers of the "Wallace Line", south-east of the Philippines and through Macassar Strait, evidently coincided with that of the archaic marsupials. Actually, the occurrence of five genera of true water-rats in New Guinea, and three in the Philippines, provides convincing evidence of an aquatic deployment of the smaller mammals. Apart from several purely local semi-aquatic rats, the luxuriant water-ways of New Guinea have encouraged a wide distribution of the well-known Australian genus of water-rats, characterized by the stream-lined body, valuable seal-like fur, partly webbed paddle-feet, and white-tipped tail. A favourite food of water-rats is fresh-water mussels, and their presence can often be traced by the shells which are left high and dry by the cunning rats until forced to open up.

The luxuriant jungle-growth of rugged mountain regions has influenced the development of some remarkable giant tree-climbing rats. The head and body length may exceed fifteen inches, and the foot attain three inches, while the general size is exceeded in the rat group only by the giant Philippine Rat of the genus *Phlocomys* (bark-eater), with a head and body of 19 inches. The long tails of the large tree-climbing rats are almost entirely hairless and covered with a rasp-like mosaic of scales which function as miniature "climbing irons". Their chisel-like paired incisors are powerfully developed for breaking open such hard-shelled objects as the coconut. Some

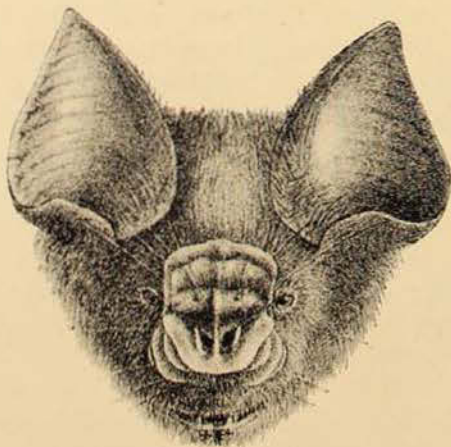
Native Water-Rat. Tropical waterways have encouraged the development of several remarkable varieties of water-rats, and the distribution of members of the Australian genus. There are also many kunai-grass and jungle-haunting rats, including tree-climbers with rasp-scaled prehensile tails.

After Gould.



smaller squirrel-like rats have the hands and feet better adapted for climbing, and the rasp-like tail has a prehensile grasping curl at the tip. In addition to the climbers, there is a vast population of ground species ranging from large coarse-haired rats to small mouse-like ones, occurring commonly either in lowland or upland forests and patches of kunai grass. Although considerable economic damage is done by the climbing rats in coconut plantations, village-haunting ground rats are the greatest danger to health and industry as carriers of "scrub-itch" or "tick-typhus", a serious infection almost identical with the rat-borne "Japanese

River Fever". The fever is transmitted by mites and ticks, causing excessive skin-irritation, and Professor Harvey Sutton has suggested that washings with antiseptic soap and occasional light rub-downs with kerosene or eucalyptus oil, would provide the simplest protection against mite- and tick-infestation, soothing the skin while tending to keep mosquitoes away. The use of aromatic dressings by troops in contact with the enemy would naturally be prohibited, and it is most desirable that natives be employed whenever possible in clearing away the rats' haunts in the jungle, kunai grass, or rubbish adjacent to military camps.



The Diadem Bat of Cape York and New Guinea belongs to the "horseshoe" group of insectivorous bats, named in reference to the lower half of the sensory nose-leaf. The specific name *diadema* refers to the upper half.

In New Guinea, the well-known fruit-bats or "flying-foxes" of the Indo-Australian region are represented by several prolific species which camp by day in great numbers in vine-covered trees along river banks. With their "foxy" heads tucked under the rainproof wrapping of leathery wings, these big flying mammals hang by their hind claws like great fruits. On the hottest days they may be seen slowly fanning themselves with the large wings, spanning about four feet. A remarkable genus of smaller fruit-bats is distinguished by whitish spots on the wings and ears, and by tubular extensions of the nostrils, probably of assistance when eating pulpy fruit, while the monkey-like lips are fringed with

flesh-bristles for manipulating live insect prey.

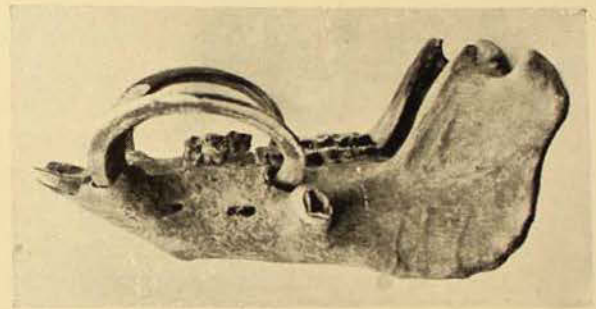
As on the mainland, the useful little insectivorous bats are represented by about thirty species, which casual observers usually dismiss as "just the little flying mouse". Close examination, however, shows that the small flying mammals have remarkable variations of wing and tail structure. Though bats are by no means blind, many also have large quaintly-shaped ears, and peculiar sensory nose-leaves which enable them to avoid obstacles while catching swift-flying mosquitoes and other insects.

Introduced centuries ago, village pigs become tame and playful, following their owners like dogs, but the wild boars grow to quite dangerous proportions. Immature

ones show traces of ancestral brown and yellow striping, and there is a tendency to reproduce the suppressed toes. Arm-lets are made by causing circular growth of the lower tusks as a result of knocking out the upper ones, and pigs rank second only to wives in the Papuan social scale at about two for £A.S. Described as of mangy mongrel type, the native dog is also prized throughout New Guinea for its keen hunting instinct on which meat supplies usually depend, while the teeth are valued as trade currency. Introduced by primitive man, like the mainland dingo, the smaller New Guinea dog also had short, erect ears, brushy tail, and a mournful howl associated with inability to bark, but such characteristics are increasingly affected by introduction of domestic breeds.



The Spectacled Fruit-Bat or "Flying-Fox" (*Pteropus conspicillatus*). This large species, with head and body measuring 12 inches, ranges from northern Australia to north-west New Guinea. Several other species of these frugivorous "hand-winged" flying mammals are natives of New Guinea. After Gould.



Lower jaw of a pig, with circular tusks. The opposing upper tusks have been removed so that the lower tusks grow without hindrance, curve round and re-enter the jaw. The point of the left tusk has encountered a molar tooth which, unable to grow forward, has pushed its root out through the side of the jawbone.

In the predominance of gentle marsupials in New Guinea, and the absence of great flesh-eating beasts of prey, nature has achieved her kindest balance, as on the Australian mainland. Let us hope that when the present world upheaval is brought to just conclusion, nature-loving men may grapple with the task of conserving Australia's fading fauna, while regarding New Guinea as the everlasting sanctuary of its fascinating fauna and native races.

The Geology of New Guinea

By T. HODGE-SMITH

FOR the better appreciation of the natural history of New Guinea, with its curious commingling of Australian and oriental plants and animals, it is essential that we should have some understanding of its geology, and particularly of its geological history.

the rocks accompanied by a differential movement on either side of the crack so formed. This is what the geologists call faulting.

Both the direction and age of the folding and faulting of the rocks in New Guinea correspond with those of the



The Owen Stanley Range. This is part of the central horst of New Guinea. The rocks here are Pre-Cambrian in age.

Photo.—Captain Frank Hurley.

New Guinea, together with Sumatra, Java, and Timor, constitutes a prolongation of the Himalayan-Burmese arc through the Malay Peninsula. This arc is characterized by great movements of the earth's crust causing intense folding of the rocks as well as the snapping of rock masses to relieve crustal stresses. For instance, south of Mount Leonard Darwin in Dutch New Guinea is the greatest precipice in the world with an estimated height of 10,500 feet. It is considered that this stupendous earth feature, comparable with the walls of the lunar craters, is due to the snapping of

Himalayan-Burmese arc. The crustal movements responsible for this great arc took place during the Pliocene times—that is, about two or three million years ago. It is interesting to note that in Australia the last great crustal deformation comparable with that in New Guinea died out in Carboniferous times about 250 million years ago.

Actually these crustal movements extended beyond the Pliocene as shown by a subsidence of about six feet along the north coast at Aitape about thirty years ago, and the frequency of earth tremors.

New Guinea is the second largest island in the world, covering an area of 306,000 square miles. Its length is 1,500 miles, while the greatest width is only 380 miles. Along practically the entire length of the island runs a range of mountains varying in height from 11,226 feet at Mount Suckling in Papua to 15,832 feet at Mount Leonard Darwin in Dutch New Guinea. We may call this feature the backbone or central horst of New Guinea.

From the extreme south-eastern end of this horst to beyond the border of Dutch New Guinea, including the Owen Stanley Range, the rocks consist of extremely old (Pre-Cambrian) schists and gneisses. They rank among the oldest existing rocks in the world.

Beyond the Dutch border the character and age of the rocks change. They consist of younger schists and gneisses of somewhat doubtful age and sediments of Cretaceous age (about 120 million years old as against about 1,000 million years for the Pre-Cambrian rocks).

During the Tertiary Period, which commenced about 60 million years ago and closed not more than two million years ago, only this horst appeared above sea-level, and then often only as a chain of islands.

In Cretaceous times New Guinea was joined to both Australia and Asia. However, there were incursions of the sea over what is now the mainland of New Guinea and a considerable amount of Cretaceous sediments was deposited in these seas.

At some unknown date before Cretaceous times it is probable that New Guinea was again just a chain of islands, because there is a series of rocks which have been so altered as to make it difficult to determine their age.

Conglomerates, sandstones, mudstones, and limestone were laid down in the Tertiary seas to both the north and the south of the central horst. Subsequently these rocks were elevated to approximately their present position, and, as mentioned before, were subjected to the great crustal stresses so characteristic

of the Himalayan-Burmese arc. Thus it is that instead of being horizontally bedded as they were under the sea, they are bent into many folds and in some places actually broken and faulted. In part they are oil-bearing, and in this they form the counterparts of Sumatra, Java, and Timor.

Resting on the folded Tertiary rocks are more or less level-bedded deposits of Pleistocene and recent age, covering a period of something over a million years. They consist of estuarine and river gravels, mudstones, sandstones and coralline limestones interbedded with volcanic ash and mud.

The final phase in the evolution of the New Guinea landscape was the building up of river deltas on the continental shelf, particularly by the Fly and Kikori Rivers.

The present snow line in New Guinea is 14,500 feet above sea-level, so that Mount Wilhelmina and Carstensz Range are capped by perpetual snow. During Pleistocene times there were a number of glacial periods of world-wide extent. The presence of glacial lakes in the Owen Stanley Range at a height of 9,000 feet indicates that New Guinea was affected by these cold periods.

Thus, generally, it may be said that New Guinea consists of a central horst of very old rocks, running the whole length of the island, against which sediments have been piled up to form the subsidiary ranges and low country to both the north and the south. On the north-western end of the central horst the ancient rocks do not outcrop, but are covered by younger sediments.

IGNEOUS ROCKS.

This is not the whole picture. Earth movements are always accompanied by intrusions of molten rock from below. Sometimes these intrusions do not reach the surface, and the rocks formed are known as intrusives. At other times the molten rock does reach the surface and pours over it in the form of lava, and the rocks so formed are called extrusives.

The schists and gneisses of the central horst have been intruded by such rocks as granites and diorites (intrusives). Associated with the former are the gold-bearing quartz reefs of Bulolo, Edie Creek, and Waria River.

Another type of intrusive is serpentine, which occurs in a number of belts, of which the largest is in the Owen Stanley Range. It is the weathering of this rock that has produced the alluvial deposits of platinum and osmiridium.

The middle Tertiary rocks have been intruded by gabbros, associated with which are the copper deposits of the Port Moresby area.

it is the only active volcano within the territory of the Commonwealth. It is situated on the north coast to the east of Buna.

FOSSILS.

During the Tertiary Period there appears to have been a number of alternations of marine conditions, sometimes favouring the deposition of coralline and foraminiferal limestones, and at other times the deposition of sandstones or mudstones containing marine shells closely related to the present-day forms. Near Port Moresby is a development of radiolarian cherts. Tertiary fossil leaves



The Kikori Delta. The most recent sediments in New Guinea.

Photo.—Captain Frank Hurley.

So far as the extrusive rocks are concerned little is known of their history prior to the Tertiary period. Fairly early in this period andesitic lavas were extruded. Lava flows appear intermittently throughout the Tertiary, becoming more frequent toward the close of the period and reaching a maximum in the Pleistocene when thick beds of lava (mainly basaltic and andesitic), pumice, and glassy rocks (obsidian) were extruded. The extinct volcano, Mount Dayman (9,305 feet), belongs to this period.

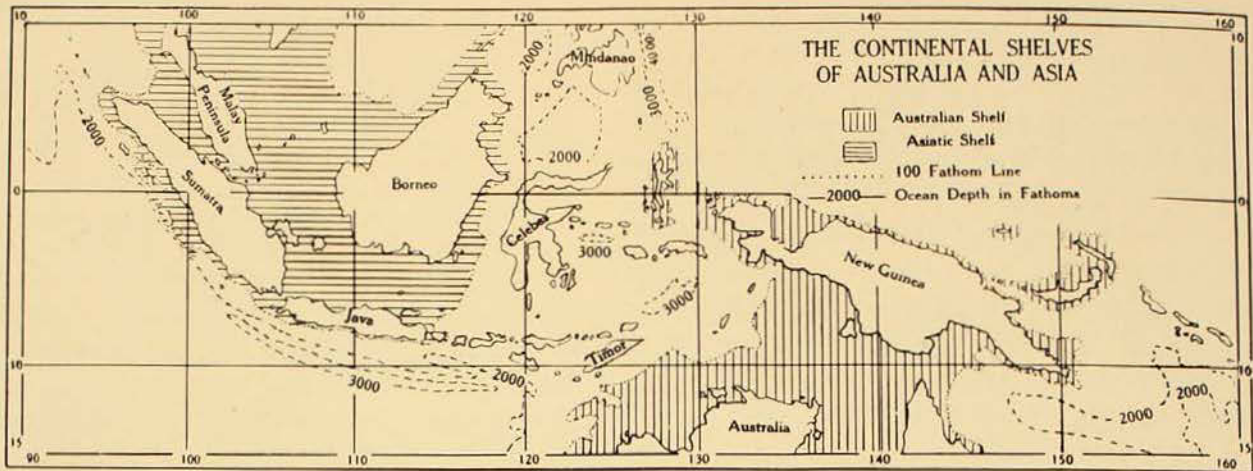
That this volcanic activity has not wholly died out is evidenced by the active volcano, Mount Victory (6,000 feet), which is still producing lava. Incidentally

have been found that are related to, if not identical with, present-day forms living in Australia and New Guinea.

In addition to marine shells the Pleistocene rocks contain fossil bones of the cassowary and emu. The bones of *Nototherium*, another typical Australian form found fossil in Western Australia, eastern Australia, and Tasmania, are found in these rocks. This animal is a marsupial only a little smaller than a rhinoceros, which it resembles only in its proboscis or overhanging lip.

LAND CONNECTIONS.

The hundred fathom line is generally considered as the seaward edge of the



so-called continental shelf. Taking this into consideration, it is found that New Guinea and Australia form one continental mass and that Borneo, Java, and Sumatra are joined to Asia. These two stable masses are separated by a relatively narrow unstable area consisting of great ocean depths and numerous islands.

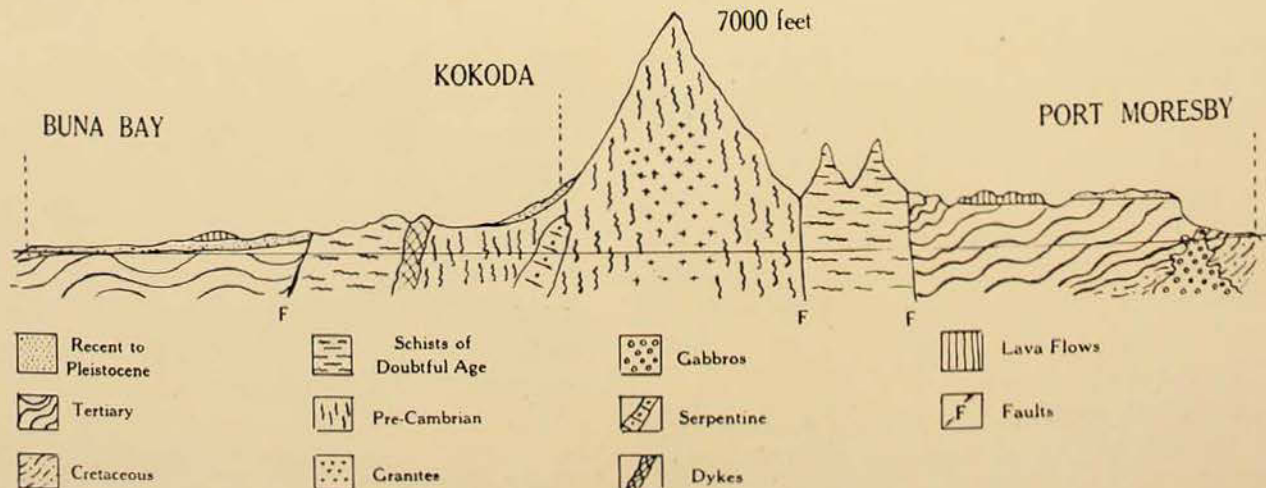
These conditions have existed since the close of the Cretaceous period. Prior to this Australia, New Guinea, and Asia were connected, so that the plants and animals of those times were able to migrate freely over a continuous land mass. Subsequent to this—that is, since early Tertiary times—the free migration of plants and animals has been impossible. Thus it is that many Asiatic types of life found occupying the areas bounded by the hundred-fathom line around Asia have few or no representatives in New Guinea. Similarly, many

Australian types found in the areas included in the hundred-fathom line around Australia have either no representatives or very few in the Asiatic area.

However, a study of the geographical distribution of individual families of either plants or animals gives apparently conflicting results. In the unstable insular area the islands have been raised and depressed not once but many times. As the various families have developed at different times, their distribution will be controlled partly by the distribution of the land masses within the unstable area at that particular time.

ECONOMIC GEOLOGY.

Reference has been made to the now famous goldfields of Bulolo and Edie Creek. Here the story of the work of the prospector and the ingenuity of the



Section from Buna Bay to Kokoda, thence to Port Moresby.

mining engineer in overcoming almost insuperable difficulties makes an epic of Australian mining history. Gold has been found in quite a number of other localities, and in some of the islands of the Louisiade Archipelago.

The osmiridium deposits lie in a line running north-west from Kokoda to Bulolo. A little platinum and gold have been found inland from Astrolabe Bay.

Silver has been found at Bulolo. Indeed, the gold of Bulolo contains quite a considerable quantity of silver.

Copper has been worked in mines close to Port Moresby. Lead, zinc, iron, manganese, sulphur and gypsum have

also been discovered. Phosphate deposits are known to exist.

Brown coal is the only variety of coal found in New Guinea. Graphite is known to occur in a number of places, but the quality does not appear to be good.

Oil has been found associated with foraminiferal limestones at Matapau and Upoia. In addition, it has been found in the Aitape region north of the Torricelli Ranges. Much work has been done in prospecting for oil, and, while the results have not so far been sensational, there is much more work to be done and many more promising areas to be examined.

Australian Museum Lectures

THE Popular Science Lectures, for very many years an important feature of this Museum's work, will be resumed on April 29. 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:

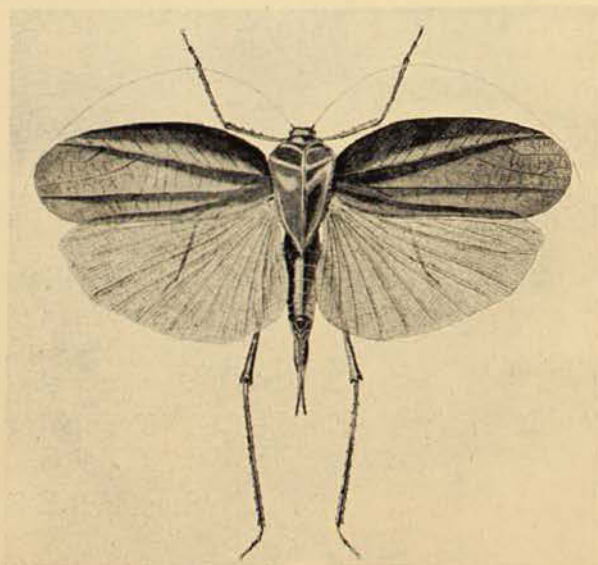
APRIL	29	..	"Meteorites"	T. Hodge-Smith.
MAY	13	..	"Native Life in the Solomon Islands"	H. Ian Hogbin, M.A., Ph.D.
"	27	..	"You and Heredity"	A. N. Colefax, B.Sc.
JUNE	10	..	"Man's Insect Enemies"	A. Musgrave, F.R.Z.S., F.R.E.S.
"	24	..	"A Naturalist with the 1st A.I.F." ..	J. R. Kinghorn, C.M.Z.S.
JULY	8	..	"Some Problems of Nutrition"	H. S. Halcro Wardlaw, D.Sc., F.A.C.I.
AUGUST	19	..	"Science and Soil Conservation" ..	W. H. Maze, M.Sc.
SEPTEMBER	2	..	"Cruising in the South Pacific"	E. Le G. Troughton, C.M.Z.S., F.R.Z.S.
"	16	..	"Mosquitoes and Disease"	F. H. Taylor, F.R.E.S., F.Z.S.
"	30	..	"Marine Borer Pests"	F. A. McNeill.
OCTOBER	14	..	"The Climate of Australia in Past Ages"	C. A. Sussmilch, F.G.S.
"	28	..	"The Biology of Water Supplies" ..	Elizabeth Pope, M.Sc.

Some Papuan Insects

By A. MUSGRAVE

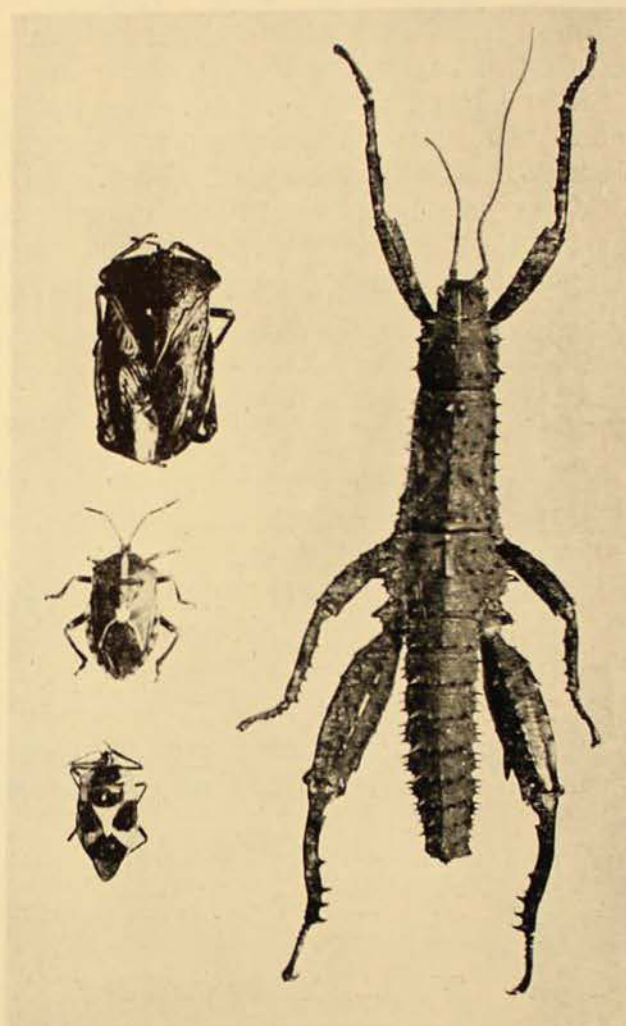
NEW GUINEA, with its backbone of high mountain ranges, its jungles, its swamps of mangrove, nipa or sago palm, its coastal savannahs and its coral islands, has long been regarded as a naturalist's paradise. Here, under a tropic sun, drenched by monsoonal rains or fanned by the trade winds, nature luxuriates, and amid the steamy, humid conditions which prevail, the island is like a vast incubator of life. In New Guinea we have, therefore, all the essentials for an insect fauna of a richness of beauty and form unsurpassed.

In 1892 there appeared from the pen of Mr. H. Tryon, in an appendix to J. P. Thomson's *British New Guinea*, the only general account of the insects of New Guinea yet published. Many collectors have visited the island since that year, and the results of their expeditions have been recorded in the pages of scientific journals or in their own published works. In an article such as this, with so many interesting species to consider, a general



The Giant Long-horned Grasshopper, *Siliquofera grandis*, a native of New Guinea and the Aru Islands, was first collected by a French expedition to the Pacific. Note the great expanse of the wings and the large triangular shield-like thorax.

After Blanchard.



Left: New Guinea Plant Bugs: (top) *Oncomeris flavicornis*; (middle) *Rhoecocoris antennatus*; (bottom) *Catacanthus sumptuosus*. Right: Spiny Phasma or "ogai", *Eurycantha horrida*, from New Guinea.

account of the insects must necessarily be brief and inadequate.

The order Orthoptera (cockroaches, mantids, phasmids, Long- and Short-horned Grasshoppers) includes some giants. Outstanding in size and form are the large green or brown Long-horned Grasshoppers or Katydid. In this group the triangular-shaped thorax is produced backwards over the base of the abdomen as a pointed hood which is toothed or spined at the sides. The wings are leaf-

Nests of the Green Tree Ant, *Oecophylla smaragdina*, are common in trees along the coastal regions of New Guinea and in tropical Australia. The species has a wide range to Africa.

Photo.—Chas. Barrett.



like and meet tent-wise when at rest. Four genera, including about a dozen species, are recorded from New Guinea. One of the largest species is *Silicofera grandis*, in which the hood measures two inches in length, and the wing expanse of the female is about nine inches.

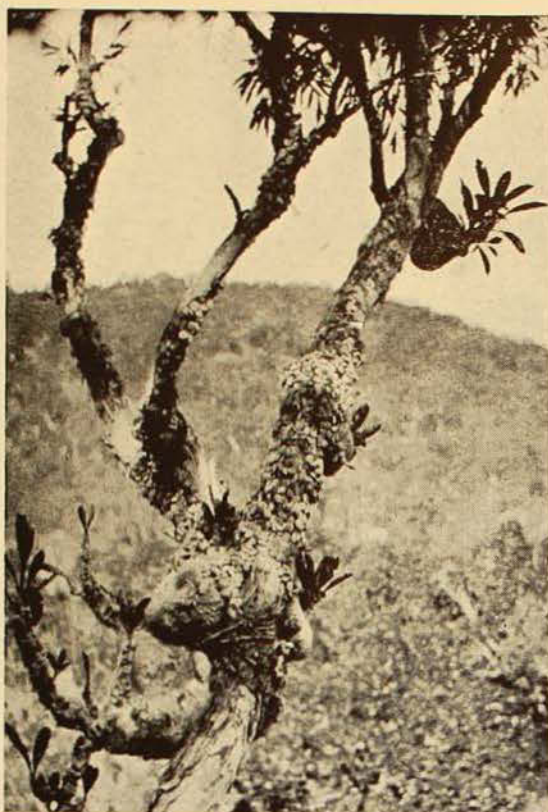
Another member of the order is the spiny, wingless phasmid, *Eurycantha horrida*, which occurs also in the Bismarck Archipelago and the Solomon Islands. The male is about 4 inches long, the female about 5½ inches. The body is blackish-brown with a slight sheen. The sides of the thorax and abdomen are spined, and a row of 5 spines occurs before the posterior margin of each segment. In the male, the posterior thighs (femora) are strongly thickened and armed with a stout spine. In the order Rhynchota, which includes the plant-bugs, aquatic bugs, assassin bugs, cicadas, leaf-hoppers, and scale-insects, we find many interesting and beautiful forms. Among the Shield Bugs (Pentatomidae) we note the shining black bugs of the genus *Brachyplatys* and the allied genus *Coptosoma*. The widely distributed Cotton Stainer, *Tectocoris diophthalmus*, is recorded from the island, as is also *Cantao variabilis*, a yellow bug with black spots, originally recorded from Woodlark Island. In the genera *Lampromicra* and *Calliphara* are many handsome forms with metallic tints. Amongst the

largest of the Shield Bugs are *Rhoecocoris antennatus*, from Mabu Duan, and *Oncomeris flavicornis*. Another beautiful red and blue-black bug is *Catacanthus sumptuosus*.

Miss L. E. Cheesman, in her book *The Two Roads of Papua*, relates how, while collecting for the British Museum, she discovered at Kokoda a new species of Assassin Bug (Family Reduviidae) which she later described in a scientific journal as *Gonteosphodrus bicolor*. This species secretes a sticky fluid from glands at the base of certain hollow hairs. While hiding in flowers, petals or pollen adhere to the hairs and serve to conceal the bug; unsuspecting insects, such as bees, visiting the flowers are seized and eaten.

More than thirty species of cicadas have been recorded from New Guinea, and doubtless others will be discovered when the interior of the island becomes better known. The genus *Diceropyga* is well represented by five species in which the opercula, the plates on the underside of the body associated with the sound organs, are broad and elongate and nearly meet at their inner margins.

In the order Hymenoptera, the ants, wasps and bees, which constitute the group, are well represented by many interesting forms. In the family Formicidae (ants), every visitor has at some time or other remarked on the nests of



Ant Plants, members of the Rubiaceae, occur as epiphytes on trees in New Guinea, the Austromalayan region, including northern Australia. The cavities in their bulbous stems usually contain ants. The plant in the accompanying illustration appears to be one of the forms of *Hydnophytum formicarium*. It was photographed at Cooktown, N. Queensland.

Photo.—A. R. McCulloch.

the Green Tree Ant, *Oecophylla smaragdina*, which are constructed of living leaves united at their edges by means of silk spun by half-grown larvae. These are used as shuttles by the worker ants. The ants are very pugnacious towards intruders, and hang on with their jaws until forcibly removed. They do not sting, but discharge formic acid which smells very strongly. Their nests are common along the coasts of tropical Australia, as well as in New Guinea, and the species ranges to Africa and Asia. The Italian naturalist Beccari has dealt with certain epiphytic plants called Ant Plants (*Myrmecodia*) which occur in North Australia, New Guinea, and the adjacent islands, in his work *Malesia*. The cavities of these plants are the homes of ants of the genus *Iridomyrmex*.

The Paper-nest Wasps of the family Vespidae are represented by some large species of which may be mentioned *Vespa tropica* and *V. affinis* which have a wide range in the Oriental region. Miss

Cheesman records the former, and *Polistes tepidus*, as common at Kokoda. About Port Moresby, smaller members of the family make their nests among the long Kangaroo grass which grows along the hillsides. These wasps have a painful sting and are avoided by the natives.

Various kinds of bees (superfamily Apoidea) are native to New Guinea, and a species of *Trigona*, a tiny black bee, allied to the Australian native bee *T. carbonaria*, was encountered by D'Albertis on the Fly River in 1875, and by Miss Cheesman at Kokoda in 1933. This tiny bee is a nuisance to man, for D'Albertis writes:

If we anchor near the shore during the day, we are attacked by a bee which is quite as vicious as is the mosquito. It is small, black, and voracious. There is nothing on board, hard, dry, soft, or liquid, which it spares; meat, biscuits, fruit, nothing comes amiss to this tormenting insect. It has no sting, and therefore causes no pain. But it is noxious in other ways, for it settles on the hands, on the face, in the eyes, in the ears, in the beard, and in the hair. If one attempts to remove it with one's fingers, it leaves a most unpleasant odour. It comes on board when the sun has hardly risen, leaving us at sunset. On land it lives in old trees, and produces a blackish honey and wax of a red colour, which is used by the natives in various ways.

Miss Cheesman says:

There were lots of small, Stingless Bees, too, of two different kinds. These are very pretty little insects when seen under a lens, though they are too small to show off their beauty to the naked eye. As a rule one feels no tenderness towards them, because they like to crawl and crawl over one's face and arms and can be an intolerable nuisance.

In the order Diptera (flies) New Guinea can claim to be the home of some of man's greatest plagues—mosquitoes, sandflies, blood-sucking midges, house flies and blowflies. D'Albertis, while at Yule Island in 1875, experienced gnats and sandflies, and complained of their being a "continual torment". Miss Cheesman writes of the "very minute biting flies which are the plague of Kokoda. Most people call them sandflies or midges, but in reality they are neither. There were sandflies as well, but the chief offenders have no popular name; their scientific name *Culicoides* is prettier than any other which could be invented."



Day-flying moth, *Alcidis orontes* (above), and Swallowtail butterfly, *Papilio laglaizei* (below), showing upper surfaces of specimens.

Photo.—A. Musgrave.



Day-flying moth, *Alcidis orontes* (above), and Swallowtail butterfly, *Papilio laglaizei* (below), showing differences in the under surfaces.

Photo.—A. Musgrave.

Mosquitoes are only too well represented, and include the Tiger Mosquito, *Aedes aegypti*, the vector of dengue fever, and various species of *Anopheles* and *Culex*, certain members of these genera being the carriers of malaria and filariasis. In addition, many other genera and species have been recorded. Some species bite during the day and others at night, making life unbearable without the sanctuary of mosquito or cheese-cloth nets or the smoke from sandalwood fires. In Port Moresby, as a child, the author remembers that it was often necessary to beat a retreat to the shelter of the mosquito nets soon after sunset. Outside the net the murmur of the insects blended with the "moora", the noise of the surf on the reef, till dawn broke.

In the large order, the Lepidoptera, comprising the moths and butterflies (the latter are dealt with elsewhere by Dr. Waterhouse) we find an amazing assemblage of forms. Dr. A. Seitz, dealing with the Indo-Australian Bombyces and Sphinges, says:

The scarcity of insect life shown in some parts of the regions dealt with in this volume is partially counterbalanced by a superabundance of species in other parts of the same territory (for instance the Himalayas and New Guinea). These districts are known to be among the richest in insect fauna in the whole world. . . .

The Papuan (Austro-Malayan) fauna, represented as an intergrade, is a subfauna of the Indian region and has nothing to do with the very primitive native Australian fauna. The latter is much more prevalent in the southern and western half of the Australian continent and in Tasmania than northwards.

Among the moths certain large day-flying forms of the family Uraniidae are to be encountered, these tailed forms resembling the butterflies of the genus *Papilio*. The brown-winged *Nyctalemon patroclus* L., which has a wide range from India to the Solomon Islands, is represented by geographical races in New Guinea and other islands. Its general colour is brown with a whitish band on each forewing; the hindwings have very long broad tails tipped with white. Another species, *Alcidis orontes* Cl., is an

even more beautiful, if smaller, insect. It ranges from the Moluccas to New Guinea and north Australia. The forewings are black with a bronzy-green transverse band through the middle of the wing, sometimes with a narrower band towards the tip; the hindwings are also black with transverse light-blue bands. Many local colour forms have been recorded.

This moth is mimicked by a butterfly, *Papilio laglaizei*, which closely resembles it on the upper surface of the wings, but on the under side of the hindwings differences are easily seen. The butterfly also resembles the moth in keeping its wings expanded when at rest. The pictures of the insects reproduced here were photographed from specimens collected by the late Mr. F. P. Dodd in New Guinea.

New Guinea shares with north Queensland the distinction of being the home of the giant Atlas Moths of the genus *Coscinocera* (family Saturniidae). The Emperor Gum Moths, *Antheraea*, so well known to dwellers in S.E. Australia, are members of this family.

Coscinocera hercules Miskin is the north Queensland form, and *C. eurystheus* Rothschild a New Guinea form. The males of the genus have long tails, but the females have the hindwings obtusely lobed. The Australian insect has been described and figured by Mr. T. G. Campbell in the AUSTRALIAN MUSEUM MAGAZINE. These moths are among the largest in the world, surpassed in wing expanse only by the Brazilian Noctuid Moth, *Thysania agrippina*, or by allied Saturnid moths of the genus *Attacus*.

In addition to the forms mentioned above, there are many insects of other orders and families not touched upon. Such are the dragon-flies, the interesting swarms of may-flies which occur on the Fly River, white ants or termites, ant-lions, and the silver-fish which destroy one's books and papers. Those forms dealt with, may serve as an introduction to the study of the New Guinea insects or direct attention to certain species liable to cause annoyance and misery to man.

Review

THE BUTTERFLY FAUNA OF CEYLON. By L. G. O. Woodhouse and G. M. R. Henry. (Surveyor-General's Office, Colombo.) 4to, xix + 154 + xviii pages, and 50 plates (36 in colour). £1 10s.

We have just received a copy of this useful and interesting monograph. When a new work on any group of zoology dealing with any particular district appears, it is usual to point out that the new book brings the information of that group up to date. Here the authors have gone much beyond that. They have made a landmark in giving the details of a new method of preparing the originals of coloured plates. The method is described in detail in their work.

When I began to correspond with Mr. Woodhouse some years ago, I took a keen interest in his work and received specimens of Sinhalese and also of Australian butterflies I had sent him, prepared in this way. Later, in 1936, I spent a few hours at his home in Colombo and learnt much more about his method and his proposed book. The method

ensures extreme accuracy of shape and disposition of the wing markings. This is rarely the case when the originals of the blocks are drawn by hand.

The authors are far from satisfied with some of the coloured plates, wanting them to be as good as the living butterfly. This is, of course, impossible in any coloured plate, and I find the colours good except in the case of some of the Lycaenidae. I also find that electric light, especially a blue globe, improves the illustrations.

The book is an excellent one, and is useful for Australia, as no less than sixty species of butterflies have races common to Australia and Ceylon, and in many of these the nymotypical race was described from Ceylon.

The whole work is full of valuable information, and I would direct the attention of the economic entomologist to the third and fourth paragraphs in the excellent foreword written by His Excellency the Governor of Ceylon.

G.A.W.

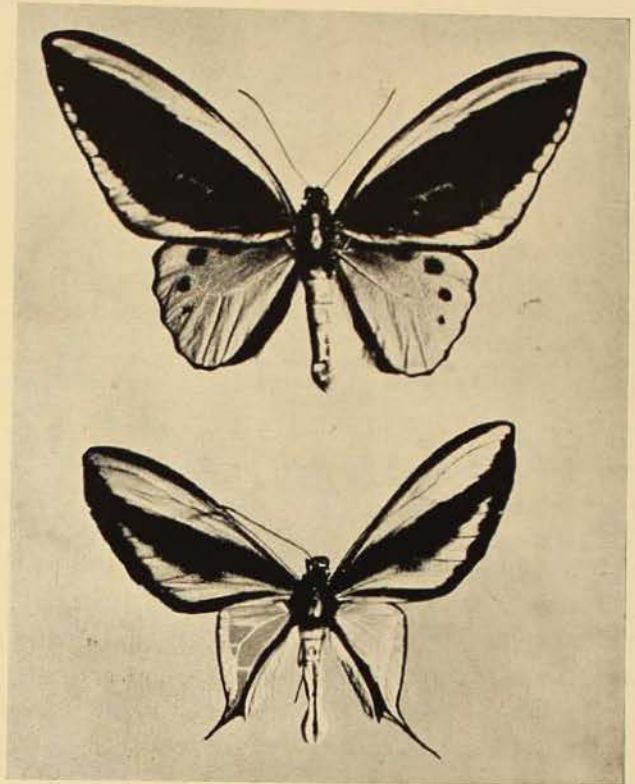
Some Butterflies of the Papuan Region

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

ALTHOUGH coloured illustrations of some of the butterflies of this region have been published in various scientific works, no complete account of the species which are already known has yet appeared. Indeed, it would take several years and considerable expense to prepare it. When in England in 1936, I saw several species that had not received a name, and there are many other new species awaiting discovery.

New Guinea probably has a greater variety of butterflies than any area of equal size in the world. There are found species of all sizes, large and small, showy and plain; many are confined to New Guinea, others are found as far away as Ceylon and New South Wales, whilst one has a representative almost everywhere in the world. Some of the species rival those of the jungles of Brazil. First, there are the wonderful Birdwing Butterflies, of which we have in the Museum some females having a forewing length of five inches, but there are still larger ones in the collection of the late Lord Rothschild. At times they have been called the Butterflies of Paradise on account of the brilliancy of the males. The females, as in the Birds of Paradise, are much more sombre coloured than the males; indeed, the sexes have often been considered distinct species. It is often difficult to distinguish the females of the Birdwing Butterflies from one another as they are brown or black with whitish or yellow spots. The males of the various species are easier to recognize. These butterflies have been placed in the *Troides* section of the genus *Papilio*.

The first known to science was the black and green male, *T. priamus*, described from Amboina more than one hundred and seventy years ago. Allied forms are found in Ceram, New Guinea,



Upper: *Papilio priamus poseidon* Doubleday. N.E. Papua. (Male.) The forewing is black with green stripes extending close to the fore and hind margins, while the hindwing is green with black spots at the sides. The thorax is black with a green spot in the centre; the abdomen is golden-yellow. The wing-spread is 5 inches.

Lower: *Papilio paradisea* Stgr. New Guinea. (Male.) The forewing somewhat resembles that of the above species, but the green stripes are broader and of a more golden-green; the triangular hindwing, ending in a tail, is golden with green and black striped margins. The thorax is black with a greenish spot, and the abdomen is yellow. The wing-spread is 5 inches.

Kei and Aru Islands, and in Australia as far south as the Richmond River. All these show differences—indeed, we have no less than four different races on the east coast of Australia. The race found in New Britain has a green male differing considerably from the New Guinea one, whilst that found in New Ireland and the Solomon Islands has a dark blue and black male. To the west of New Guinea, in the northern Moluccas, the

males are black and orange-yellow. This is the commonest *Troides* in New Guinea and is found from the coast to a considerable altitude. It is an imposing sight to see an array of the various coloured males of *T. priamus* in the cabinet, but it must be more so to see them on the wing. The largest of the Birdwings is the narrow-winged *T. alexandrae*, in which the male is dull blue and brown, the female brown with paler markings. It is probably the largest butterfly in the world, and is found in low situations in north-east Papua. In the Owen Stanley Range are found two rare species with very handsome males. *T. goliath* is almost as large as the preceding species, but of a different shape; the forewing in the male is black and green, but the hindwing is almost transparent gold. This butterfly is also found in other parts of New Guinea. The other species is *T. chimera*, which is somewhat similar, but smaller, and the markings are differently disposed. The females vary only slightly, but that of *T. chimera* has a hairy body, and one race of *T. goliath* has orange instead of white. A similar, but rarer, species, *T. tithonus*, is found in Dutch New Guinea. The smallest of the black and green *Troides* is *T. paradisea*, the male having a long thin tail, which in the race found near Milne Bay is flattened out at the tip. *T. victoriae* is the only other *Troides* known with a black and green male. It is found on most of the Solomon Islands, where the native girls catch these butterflies and wear them tethered to their hair. The only other *Troides* is black and yellow in both sexes and found throughout New Guinea, except in the mountains. It is the representative of a group of which many species occur further west. Some of these butterflies are so large that the first specimens obtained were killed with gunshot.

There are many other fine *Papilios* in New Guinea, such as the large blue and black swallowtail, which is a glorious sight as it flies along, especially over water. This and many other butterflies are attracted by bright orange or red

flowers. There are several black and white species, some with swallowtails, and the females usually having red or yellow spots. There are a number of other smaller species, some with a blue band across the wing and others with green spots.

Yellows and whites are well represented. The smaller species of the former flit among the grass. The larger whites have a stronger flight and are difficult to catch. In this family, New Guinea excels in the number of species with brilliant red or yellow markings on the underside of the hindwing. One species is almost wholly orange above and black beneath.



Papilio priamus poseidon Doubleday, N.E. Papua. (Female.) The wings are dark-brown in colour with greyish-white spots which, on the hindwings, merge into dingy-yellow towards their basal ends. The abdomen is greyish-yellow. They have a spread of six inches.

A group of butterflies consisting of large and small dark-brown species with white spots in differing positions occur in considerable quantities. Their flight is slow unless disturbed. In North Queensland on a very hot day I have seen dozens, usually the one species, settled together in the shade.

The browns of various sizes are found amongst the grass, and usually when they settle are very difficult to see. One in particular is often disturbed in daytime, flutters a few yards and comes to rest again, but although the spot is watched with great care, it is impossible to detect it on the ground. This butterfly only flies at dusk or in the very early morning.

In New Guinea are to be found a number of species of large whitish butterflies with two very conspicuous large eyespots on the underside of each hindwing. From their appearance they must have a slow and lazy flight. So far they have not been found on the mainland of Australia.

There are many other beautiful species that flash past—reds, yellows, greens and blues. I have not mentioned the smaller species, such as the smaller silvery blues and the slightly larger dark purples, which are so conspicuous a feature in North Queensland and must be more so

in New Guinea. The Skippers, so called on account of their flight, are numerous, but there are probably fewer species than in Australia.

Butterflies are often attracted to patches of moisture alongside the tracks. They congregate there to suck up what little water there is. One may be fortunate enough to see some hundreds of these at one moist patch, with the different species arranged in concentric rings. From a distance they appear like a gigantic flower on the ground, but when one approaches they all take wing.

“Australian Insects”

SOME comment is called for on the review of *Australian Insects* which appeared in the last issue of THE AUSTRALIAN MUSEUM MAGAZINE,¹ because of its unequivocal statements of alleged errors which may possibly be accepted as “gospel” by the reader who is unaware that scientific opinions differ, and that leading authorities are not in agreement with the reviewer. While it is impossible, in the space available, to deal with all the points raised, certain of them cannot pass without comment.

The reviewer states: “The Dixidae are true mosquitoes”. This statement is disputed by many world authorities, who have shown that the inclusion of the Dixidae in the Culicidae is inadmissible, and the Imperial Institute of Entomology still retains the Dixidae as a distinct family. While such sound opinion differs from that of the reviewer, it is difficult to see why the retention of this family is “wrong”.

Again quoting from the review: “There are no species of *Dixa* known in Australia”. The late A. L. Tonnoir considered that the Australian species indubitably belonged to the genus *Dixa*, as they differ little from the forms

of the rest of the world. Mr. Taylor’s statement is surely a strange one, since in his “Check List of the Culicidae of the Australian Region” (1934)—the latest list of the group—we find all the Australian species placed in the genus *Dixa*! Nor has he subsequently published any change of opinion on the matter.

The reviewer condemns the fact that, in *Australian Insects*, “*Culicoides molestus* Skuse . . . is placed in *Ceratopogon*”. The words “retained in” would be more correct than “placed in”, since the species was only transferred from *Ceratopogon* to *Culicoides* by Macfie in December, 1939—and this change has not yet been confirmed by other workers.

Further, I am taken to task for omitting to state that *Aedes aegypti* had been found in Narrandera—but, since this locality record was only published on 15th September, 1942, almost two months after the issue of *Australian Insects*, my statement, “As a rule it does not extend much further south than Newcastle, N.S. Wales”, appears to be adequate, especially as its appearance in the south-west may well be considered sporadic and outside its normal range.

The other points are based on equally debatable foundation, and can be similarly disposed of, but sufficient has been mentioned to indicate the value of the review.

K.C.McK.

¹ McKeown.—*Australian Insects: An Introductory Handbook*. Review by F. H. Taylor. THE AUSTRALIAN MUSEUM MAGAZINE, Vol. viii, No. 2, September-November, 1942, p. 70.

Strange New Guinea Beetles

By KEITH C. McKEOWN, F.R.Z.S.

AS with other groups of New Guinea insects, the beetles (Coleoptera) prove to have affinities with those of neighbouring lands, so far as the term 'neighbouring' may be used in the case of island groups widely dispersed over the vast expanse of the Pacific Ocean. But these problems of distribution hold a great fascination on account of the glimmerings of light which they cast upon the making of our world. Unfortunately, the knowledge, so far laboriously pieced together, is as yet insufficient to give us a clear picture of the whole problem of distribution, but Miss L. E. Cheesman, who has travelled extensively in Papua, has shown that the insects of that region—especially those of the drier areas—have relationships with those of northern Australia, which is to be expected, as there was a land connection between these areas in past ages. Tahiti has a few species which are related to insects living in New Guinea, while the insect faunas of Fiji and the Solomon Islands show even stronger affinities with that of the great, sprawling island lying to the north of Australia.

New Guinea possesses such a prodigal wealth of different species of beetles that it is difficult, in the confines of a short article, to select some few to the exclusion of others. Even if attention is directed solely to the more striking forms, the chronicle would be rather in the nature of a catalogue, and scarcely more interesting, for, concerning the majority of these insects, it is seldom that more is recorded of them than their names—and we know nothing of their lives and behaviour. A compromise must, therefore, be attempted, in an effort to sail between the Scylla of the dryness of mere names and the Charybdis of omitting mention of many remarkable forms, by confining ourselves to those beetles of which some little is known.

A striking insect which is likely, sooner or later, to come under the notice of even a casual observer is the arboreal Tiger Beetle (*Tricondyla aptera*), for it is seldom that a collection of New Guinea insects is received which does not include a few specimens of this strange creature. The arboreal habit is a truly remarkable one, for the members of the family (Cicindelidae) usually frequent open, sandy areas where they run about in the hot sunshine with remarkable speed and energy in pursuit of their prey, or carry



The strange tree-dwelling
Tiger Beetle (*Tricondyla
aptera*).
N. B. Adams, del.

out the other activities of their lives in an equally hectic manner. The adult beetles are carnivorous, as are their larvae which live in burrows dug in the soil with their heads level with the surface waiting, like Mr. Micawber, of optimistic repute, for "something to turn up". *Tricondyla* has abandoned the life of its relatives for one among the tree-tops. A. R. Wallace has described how this beetle is mostly found in trees, seeming to prefer the trunk and branches to the foliage. It has the habit of dodging swiftly round the tree-trunk when approached, and as its intending captor walks round the tree, so does *Tricondyla* go round also in a spiral manner, keeping the tree between itself and its pursuer.

The beetle itself is a strange looking creature, looking rather like a large black ant with protruding eyes and formidable jaws. Its colour is black, tinged with iridescent purple, and, as its name 'aptera' implies, it is completely wingless, trusting to the speed of its long slender legs to capture its prey or escape from its enemies; but for defence it also has another weapon, for, when disturbed, it is said to emit a strong odour, comparable with that of a cockroach.

The Carabidae, the Carnivorous Ground Beetles, are rather poorly represented in New Guinea, and here again many species have ascended into the trees—a remarkable adaptation to the heavily forested nature of much of the country. Under damp logs lives the Papuan Bombardier Beetle (*Pheropsophus papuensis*), a close relative of the well-known Bombardier Beetle of Australia (*P. verticalis*), with similar habits, but the male lacks the yellow blotch on the wing-covers. When disturbed, these beetles expel a puff of yellow vapour from the extremity of the abdomen, a proceeding accompanied by a distinct report. This action is a defensive one, and must have a very disconcerting effect upon a pursuing enemy; its purpose and effect are that of a rear gun in an aeroplane.

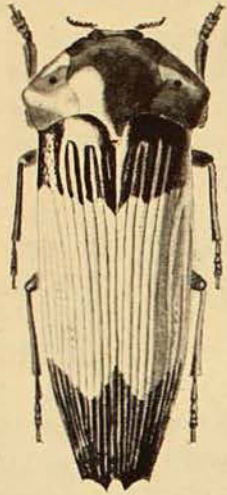
Among the Staphylinidae, beetles with short wing-covers or elytra, and an elongate, slender abdomen which is often carried turned up over the back in a menacing attitude, like that adopted by the earwigs, is a brilliantly coloured species, which has been described as the "most brilliantly coloured of all the Staphylinidae of New Guinea, comparable only in colour to the Paradise Birds". It is about an inch in length, and is glossy black in colour, with green elytra bordered with pale gold. Miss L. E. Cheesman has described the strange habits of another species which lives on the banks of streams. She writes: "Some small Staphylinid beetles were almost the quickest things I ever saw in the two elements. They hid under stones, ran about like earwigs, took off into the water and swam away without lowering

their speed. Nearly every amphibious insect slows down directly it takes to the water, but these were extraordinarily good swimmers." Two strange species, *Polypea coralli* and *Corallis polyporum*, have been recorded as living in the sea under polyps.

Fire-flies are plentiful in New Guinea, and there are many fine species. The so-called 'Fire-flies' are true beetles (Lampyridae), and are small insects garbed in yellow and brown, with soft wing-covers. The strange, cold light is produced by a pale-coloured area on the undersurface of the abdomen. In view of the interest which these insects have aroused in many parts of the world, it is strange how little has been written of them by travellers in New Guinea. A search has revealed only one account—that of Jas. Chalmers and W. Wyatt Gill in their book *Work and Adventure in New Guinea, 1877 to 1885*. They write: "As we passed through the narrow pass between Mourilyan and the mainland the utter darkness was relieved by millions of fireflies; the effect being marvellously weird." And, again, writing of Hula, fifty-two miles from Port Moresby: "It was curious, from the verandah to watch the fireflies rising from the soil like tiny globes of light. At times the whole place seemed alive with them. I placed one on its back on the table under the glare of a powerful lamp. The phosphorescent light scarcely paled. . . ."

The Jewel Beetles (family Buprestidae) of New Guinea cannot fail to attract attention by reason of their frequently brilliant coloration, although they are not so numerous in species as might be expected. Possibly the most striking of all is the beautiful, but unfortunately rare, *Calodema ribbii*, of which the only specimen I have seen was taken by C. T. Macnamara at Mt. Lamington, in the Northern Division of Papua, where it was being dragged along a jungle trail by a party of ants, intent on taking it to their nest. To them, no doubt, its disappearance was a serious blow to the commissariat, but as a museum specimen it still remains a delight to the eye. It is

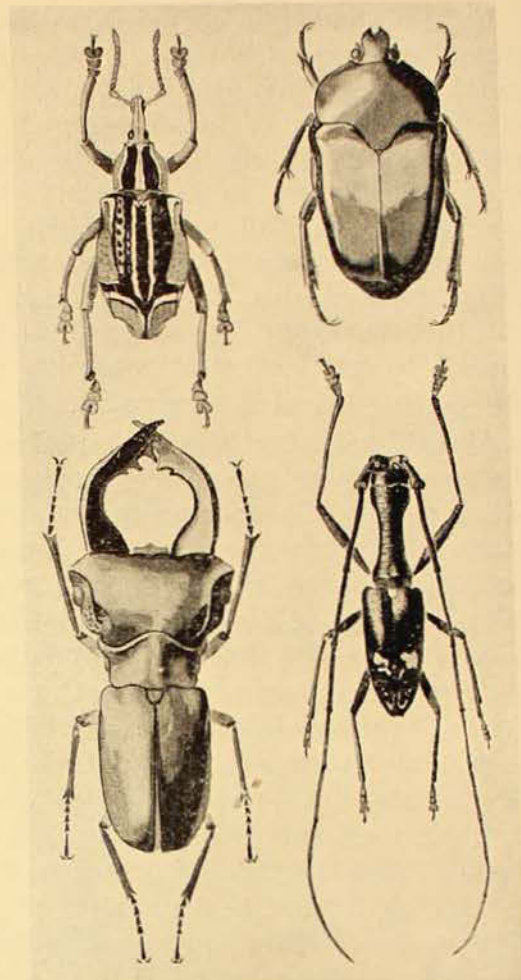
impossible to do justice in cold words to the richness of its colour. The central portion of the elytra is a rich cream, like that of old ivory; in sharp contrast, at base and apex, the colour is a rich metallic blue shot with green. The



Calodema ribbii, a beautiful Jewel Beetle, resplendent in metallic blue, sealing-wax red, and ivory.
N. B. Adams, del.

central portion of the thorax is shining metallic green with an area of sealing-wax red on either side; the legs are metallic green. The insect measures nearly two inches in length. One of the commonest species of Jewel Beetle is *Cyphogastra albertisi*, a shining green insect shading to metallic copper, with a bright yellow depressed patch on either side of the thorax; it measures more than an inch in length. The larvae of these beetles, curious elongate grubs with the forepart swollen into a large rounded mass, tunnel in the timber of trees.

The large shining black—or brownish—Passalid beetles are chiefly interesting by reason of their strange habits. They are usually to be found under, and in, rotting logs, where they live in little family parties. The eggs are deposited in a cluster, and are guarded by their parents. It has been found that in some species, at least, the parents break up the rotten wood, and apparently treat it with a digestive fluid to render it suitable food for the larvae, in which the jaws are somewhat poorly developed. The grubs follow their parents along the tunnels, and eat the prepared food. The



Some striking New Guinea beetles. Above: *Eupholus bennetti*, a striking cobalt blue and black weevil; a Flower-Chafer (*Ischiopsopha jamesi*). Below: the bronze Stag Beetle (*Cyclommatus speciosus*); and the "long-necked" Longicorn Beetle (*Gnoma affinis*).

N. B. Adams, del.

members of the family are kept together by squeaking or chirping sounds produced by the adult beetles. The largest of the New Guinea species belongs to the genus *Eriocnemus*.

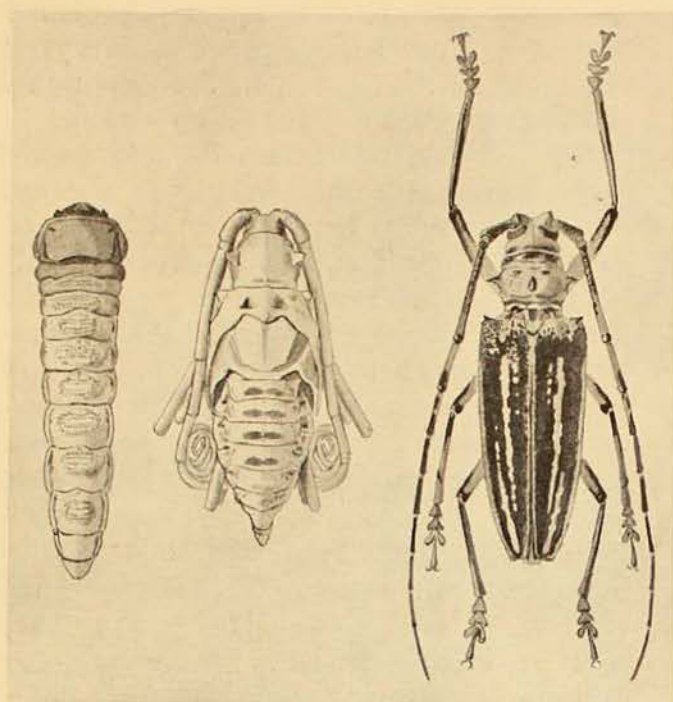
The Stag-beetles (Lucanidae) are represented by a number of very fine species. They are mostly moderately large insects in which the jaws of the male are enormously produced, toothed and expanded, and it is from this character that the name 'Stag-beetles' has been popularly bestowed upon them. Both in the size of the mandibles and of the insect itself, in the male, there is a wide range of variation, from small to large. In the female the mandibles are small and inconspicuous, and she is usually much

smaller than her mate. *Lamprima adolphinae*, a rich bronzy-green beetle with long upturned mandibles, clothed on the inner side with long golden pile, is closely related to the Australian Christmas Beetles (*L. latreillei* and *L. mandibularis*), closely resembling the latter in the form of the mandibles. *Cyclommatus speciosus* is an apparently common and striking brown-bronze insect, bearing a certain resemblance to the European Stag-beetle; the head of the male is amazingly broadened and truncate in front, and the mandibles are large and strongly toothed. *Metapodontus cinctus* is brown margined with bright yellow, with an oval yellow patch enclosing a small brown spot on either side of the thorax. *Eurytrachelus pilosipes* is a thick-set, broad, glossy-black insect.

The large family Scarabaeidae is very poorly represented in New Guinea when compared with adjoining lands. The Dung Beetles (Coprinae and Geotrupinae) occur, but, possibly by reason of the absence of large animals in the island, one species at least constructs balls of pulp from decaying fruit, and rolls them away to its burrow as food for its larvae in lieu of the animal excrement usually employed for this purpose. Mention must be made of the large Dynastid Beetles, which cannot fail to excite interest on account of their huge size and bizarre appearance, the male beetle being adorned with formidable-seeming horns on head and thorax, resembling those of the rhinoceros, or those borne by certain of the extinct animals of long ago. The female, smaller than her mate, has a regularly rounded thorax, and lacks his extravagant decorations—the purpose of which, by the way, is obscure. *Xylotrupes gideon* is the most widely distributed species. It is a huge brownish-black to chocolate coloured creature measuring up to three inches in length, with a stout cylindrical horn ending in two prongs, extending forward and downward from the front of the thorax, and a similar but smaller upward-curving horn rising from the head. Both in size and in the extent of the horns these insects are

extremely variable. It appears probable that these huge beetles breed in decaying vegetable matter. It is in the Cetonidae, the Flower Chafers, that New Guinea is really rich, and its fauna includes many large and incredibly beautiful species. As a rule these beetles are difficult to obtain, as they frequent the tops of tall trees; at times some species seem to be plentiful and are collected in large quantities. Two beautiful—and apparently common—species are *Ischiopsopha lucivorax*, which is a clear emerald green with a deep blue-black patch at the base of each wing-cover, and *I. jamesi*, which is of a similar green tint, but with a large red patch near the base of each elytron. Both these species are more than an inch in length. There are many other species equally striking in colour, but there is little purpose in attempting to describe them, for words are wholly inadequate to give even the faintest idea of their brilliant appearance.

The Longicorn, or Long-horned, Beetles (family Cerambycidae) include many strange and striking insects. One of the most remarkable of these is *Gnoma affinis*, a slender black beetle with white markings upon the elytra. It measures about an inch in length, and its most striking feature is the excessive slenderness and length of the thorax, which gives it a really remarkable appearance, and has caused an allied species, which is not found in New Guinea, to be named *giraffa*. Possibly the largest of all the New Guinea longicorns is *Batocera wallacei*, which has been recorded as measuring up to eleven inches in length from the extremity of the enormous antennae to the hind tarsi or feet. It is a greenish- or brownish-black, sparsely clothed with ochre pile, and the wing-covers decorated with snowy-white spots or blotches. The huge larvae of this magnificent beetle tunnel in the branches and trunks of fig-trees—and are reported to be very good eating. When fully fed, the larva pupates, or changes into a chrysalis, in a cavity gnawed in the wood, from which the perfect beetle subsequently emerges. *B. wallacei* has a



The huge Longicorn Beetle (*Batocera wallacei*), its large edible larva and pupa. The immature stages of this insect are spent in the branches of the native fig-trees.

N. B. Adams, del.

range extending from New Guinea to Cape York, Australia.

The Weevils or, as they are sometimes called, 'Elephant Beetles' (*Curculionidae*), like the Longicorns, as might be expected in a heavily forested land, are very numerous. Most of them are dull and inconspicuous, but such monotony of tint is strikingly broken in no uncertain manner by the members of the genus *Eupholus*. *E. bennetti* is a magnificent creature, clad in cobalt blue with an intricate pattern in black bordered with pale green upon the back. It is a com-

paratively large insect, measuring about an inch in length. Other species included in the genus are of a similar blue colour banded with black, while others again are green and black.

The small plant-eating beetles, *Chrysomelidae*, are extremely numerous, but space will not permit detailed mention of any of them—some are of dull tints, others are decked in brilliant colours, but their usually small size, and a habit of dropping from the foliage when disturbed, render many of them liable to escape notice.

IN the previous issue of this MAGAZINE we published an appreciation of the late Charles Davies Sherborn. This was written by Mr. A. Musgrave, whose name was omitted, unfortunately, from the article.

* * *

With regret we have to record the death of Mr. G. M. Goldfinch on 16th January, after a prolonged illness. Mr. Goldfinch had been a Trustee for two years. He had specialized in the study of *Geometridae*. Though he had published very little, he had acquired an extensive knowledge upon

which fellow-workers were ever able to draw. In his early life, 1905, he was a voluntary worker on the staff of this Museum.

* * *

Mr. H. S. Grant, after serious ill-health, retired from service in the preparatorial department of this Museum in December last. Mr. Grant had been on the staff since 1909. Trained by his father, the late Robert Grant, formerly taxidermist, he was possessed of considerable talent, and many of the exhibits in the galleries reflect his capacity.