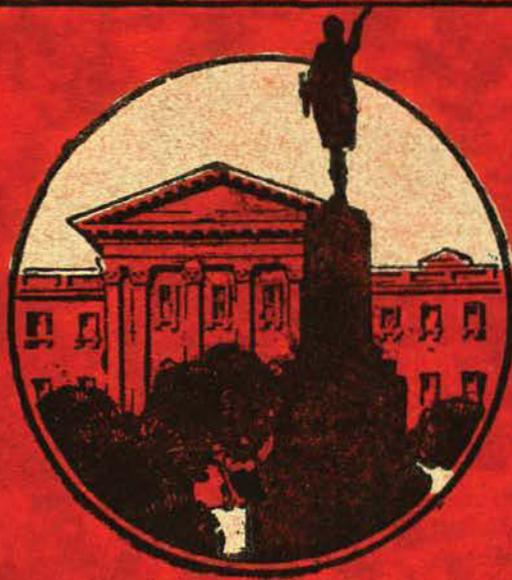


The AUSTRALIAN MUSEUM MAGAZINE

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



Cruising in the Santa Cruz - - - - -

E. Le G. Troughton and A. A. Livingstone

The Wandering Albatross - - - - - *J. R. Kinghorn*

The Queensland Lungfish - - - - - *G. P. Whitley*

Further Notes on Marsupial Birth - - - - -

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The Carrier Shell - - - - - *Joyce K. Allan*

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Wombats and their Ways - - - - - *Chas. Barrett*

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APRIL-JUNE, 1927.

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THE AUSTRALIAN MUSEUM

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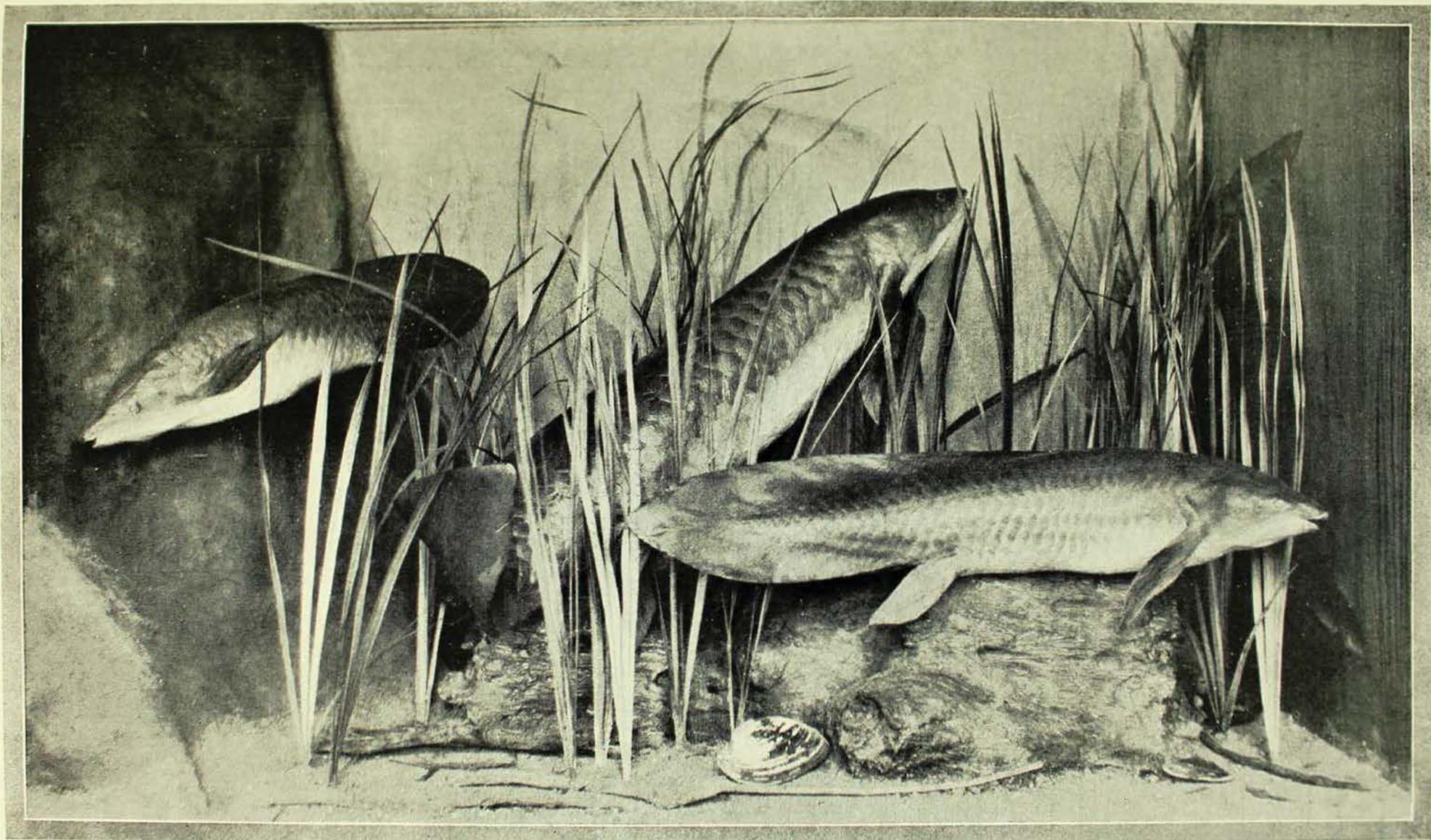
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The new Queensland Lungfish group, which will shortly be installed in the Australian Museum. Three Lungfishes are here shown swimming amongst weeds (*Vallisneria*) near a river-bank. The originals of the fishes and weeds, and the freshwater mussels and snails which are also shown, were specially obtained from the Burnett River, Queensland, for this group.

[Photo.—G. C. Clutton,



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VOL. III., No. 2.

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Editorial.

WHEN the white man came to Australia he found the land occupied by an aboriginal race, primitive in many respects yet in others highly organised. The total number of aborigines living in Australia is a matter of conjecture, but it is reasonable to assume that the continent was occupied to its fullest capacity appropriately to the mode of life practised by the inhabitants. We must remember that the Australian was not a cultivator, nor did the land contain any useful animals that could be domesticated. He was a hunter and fisherman, but mainly a hunter, and a large area of country is necessary to support quite a moderate population when that population is dependent upon the products of the chase. Several authorities concur in putting the aboriginal population of Australia previous to settlement by whites at 150,000. This seems a small number, but it has been estimated that when Denmark was in a state of culture corresponding to that of the Australian aborigines, its population was no more than 500.

The land was parcelled out among groups, who inherited the hunting rights over that land from their ancestors. Everything on that area belonged to the group, and trespassers were liable to prosecution with the utmost

rigor of the law. Within its own territory the "owners" had favorite camping places where they would sojourn so long as food was sufficient, moving off to fresh fields when the supply became inadequate. With the coming of the white man, with his flocks and herds and his cultivated crops, all this was changed, and the blackfellow was faced with a set of conditions of a devastating nature. The European did not understand the laws and regulations of aboriginal society, nor did he care to understand them. He simply took possession of the land and pastured his sheep and cattle on the hunting grounds of his predecessors. Who shall blame the aborigines if they regarded the white man as a trespasser, and considered his flocks and herds as welcome additions to the larder? Then came reprisals on the part of the settlers and sometimes the blacks were treated very unjustly and cruelly. We all know the fate that overtook the Tasmanian aborigines, and it seems that the Australian blackfellow is also doomed, unless some means can be devised to preserve at least a remnant of this interesting race.

The conservation of the aborigines presents a very serious problem, but unless we are content to watch the race dwindle and finally vanish,

some form of protection must be adopted and that soon. It has been suggested that a native state or territory should be founded, the affairs of which would ultimately be managed by the natives themselves according to their own laws and customs; this is the objective of the Aborigines Protection League (Native State), an organisation recently established in South Australia. It is proposed that the projected state shall be situated in Arnhem Land in the Northern Territory which is as yet very sparsely settled by whites. Such a project, though admirable in

conception, presents practical difficulties, and requires careful consideration, but the collected wisdom and counsel of men who have studied the aboriginal question in all its aspects, and sympathetic consideration on the part of Federal and State Governments, should result in a practical and satisfactory solution. What is required is a wholehearted desire to accord fair treatment to the aboriginal remnant, a willingness to explore the possibilities thoroughly, and to proceed cautiously with any project that may be finally adopted.

Notes and News.

Mr. E. C. Andrews, B.A., Trustee, left Sydney on February 10th, for America, where he will deliver the Silliman Lectures at Yale University. It is a very high honour to be selected as Silliman Lecturer and that the choice this year has fallen on Mr. Andrews is a great compliment to Australian Science.

After delivery of the lectures Mr. Andrews will attend the Empire Mining and Metallurgical Congress in Canada, and will subsequently proceed to Europe. During his absence Mr. Andrews will be engaged in the study of various geographical problems, particularly in connection with prospecting methods.

Among visitors to the Museum during recent months were Professor W. A. Benson, of Otago University, New Zealand; Mr. A. D. Combe, Uganda Geological Survey; Dr. Arthur Sweeney, President of the St. Paul Institute, St. Paul, Minnesota; Mr. H. A. Longman, Director of the Queensland Museum; Sir Baldwin Spencer, Director of the National Museum, Melbourne; Mr. Gregory Bateson, St. John's College, Cambridge, on his way to New Britain to study the sociology of the Baining; Messrs. H. M. Hale and N. B. Tindale, South Australian Museum. Professor T. Thomson Flynn, University of Tasmania, has been working in the Museum for the last few weeks; he is engaged in the preparation of a report on the Pycnogonida collected by the Mawson

Antarctic Expedition, and finds our library of the greatest assistance to him.

Colonel F. J. Hayter, working on behalf of the Cambridge Museum of Anthropology, is making a study of aboriginal designs based on specimens contained in our collection.

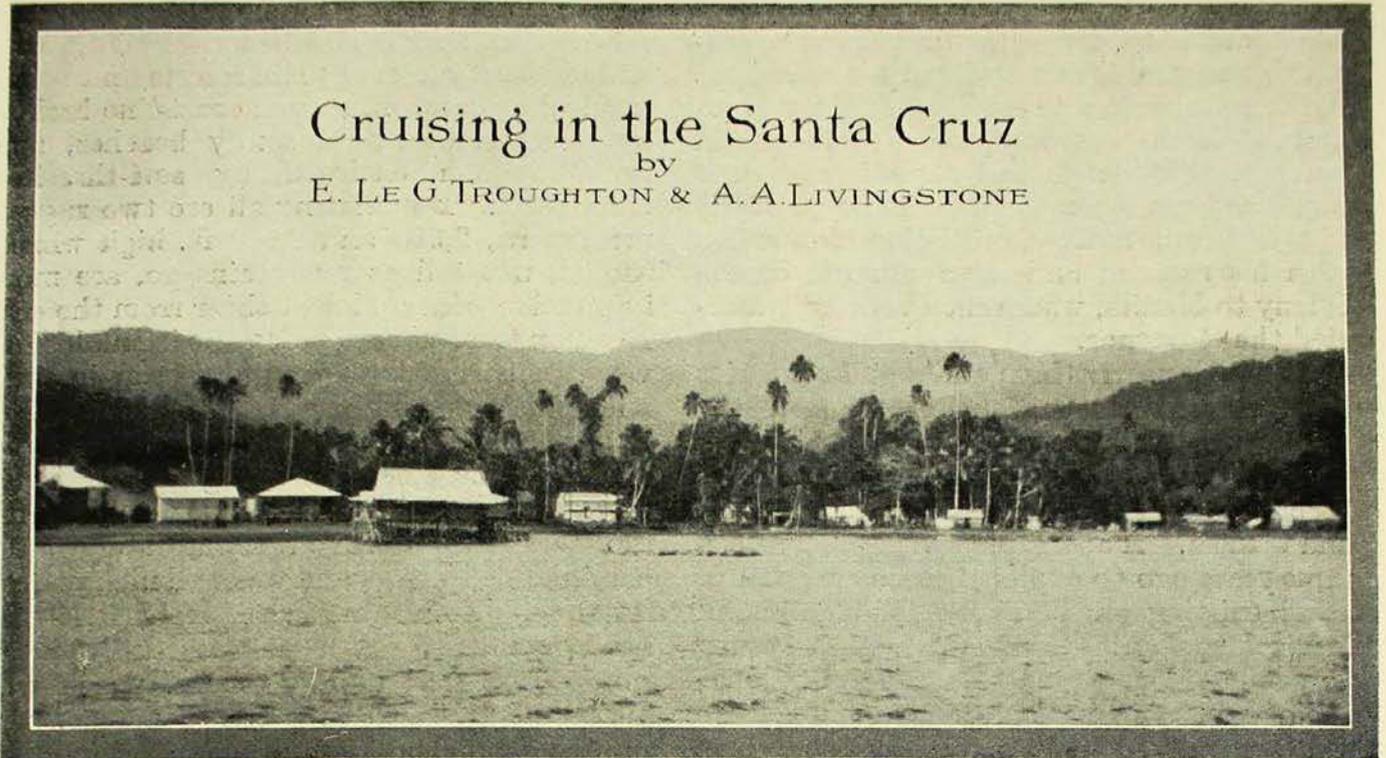
Mr. R. H. Cambage, C.B.E., F.L.S., Trustee, who was one of the Australian delegates to the recent Pan-Pacific Congress at Tokyo, visited the Kyoto Imperial Museum, The Historical Museum, Peking, and the Raffles Museum, Singapore. To each of these sister institutions he conveyed greetings from the Australian Museum.

Our ethnological collection has been considerably enriched by the acquisition of the Robins Collection. Its acquisition is due to the generosity of the Hon. Sir Alfred Meeks, K.B.E., M.L.C.. It is very difficult to-day to acquire Polynesian material and in the collection there are many desirable pieces. Amongst these may be mentioned obsidian weapons and carved figures from Easter Island, and pounders and adze blades from Tahiti. The Melanesian portion contains some fine stone implements from Fiji, and some shell blades from the New Hebrides. The remainder of the collection comprises British palaeolithic stone implements and aboriginal axes, hafted and unhafted. The collection will shortly be on view in the ethnological galleries.

Cruising in the Santa Cruz

by

E. LE G. TROUGHTON & A. A. LIVINGSTONE



The settlement at *Peu Vanikoro*, on the reef opposite to which *La Perouse* was wrecked. Here the S.S. "*Makambo*" calls every five weeks for a cargo of logs, a string of which is seen in the foreground awaiting shipment. The photo shows the "house-along-water" which accommodates the manager and other white officers of the *Vanikoro Timber Company*. The company's buildings and native quarters are seen under the clump of tall coconut palms.

[Photo.—A. A. Livingstone.]

TO most of us the thought of tropic isles and people makes instant appeal, and to museum workers the attraction is enhanced by opportunities for studying native races and collecting all phases of the animal life which flourishes in sun-warmed lagoons and humid forests. Add to this bundle of tropic charms the remote situation of the *Santa Cruz Group*, associated with the fate of intrepid voyagers such as *La Perouse* and *Alvaro de Mendana*, and it is not surprising that two members of the *Australian Museum Staff* eagerly availed themselves of the generous invitation of *Mr. N. S. Heffernan*, District Officer of the Group, to be his guests at the Government Station at *Vanikoro*, and travel amongst the neighbouring islands.

With the exception of mission workers, traders, and students of the history and geography of the Pacific, it is doubtful if many people could say which hemisphere embraces the *Santa Cruz Group*, or describe its better known surroundings. A popular query concerning the trip was "seems dreadfully ignorant, but where exactly is this place!" As one person had an impression that it was near the coast of South America,

and another supposed the *Canary Islands* were within range of our destination, an account of the location and history of the group may prove interesting, without casting an undue reflection upon the geography of readers.

LOCATION AND HISTORY OF THE SANTA CRUZ.

The Group is situated in the centre of a triangle formed by the better known *New Hebrides* and *Solomons* at the western base, and the *Ellice Islands*, which constitute the eastern apex of the triangle. The largest island about to be visited is *Santa Cruz*, or *Ndeni*, which gives the Group its name, discovered by *Mendana* in 1595. Prior to this the Spaniard had discovered the *Solomons*, having sailed from *Peru* in 1567 to search for the great southern continent. After exploring those islands, many of which bear his names, *Mendana* returned to *Peru* and did not set sail again until 1595, intending to establish a Spanish colony in the *Solomons*. Had he been successful it might have led to *Australia's* becoming a Spanish colony, and bull-fighting our national pastime.

Instead of the Solomons, Mendana made the Santa Cruz, over 200 miles to the northward, and there tried to form a settlement. An unsuitable and ill-fated choice, for Mendana's death was followed by dissension amongst the settlers and depletion of their numbers from sickness and conflict with the bitterly hostile natives, until his widow sailed with his remains and the remnants of the colony to Manila, where she eventually married the Governor.

Although nearly three and a half centuries have elapsed since Mendana pierced the shimmering veil of the Pacific, it is only very recently that the Santa Cruz have become easily accessible save to missionaries and traders. A company was formed about three years ago to exploit the fine growth of kauri existing on Vanikoro Island, second in size to Santa Cruz and some seventy five miles from it, and as a result Burns Philp and Company, Ltd. have extended the run of the S.S. *Makambo*, making Vanikoro, only two days steam from Vila, the turning point of the voyage and enabling tourists to visit the scene of La Perouse's fate. Dwelling but briefly on the way, let us go to Vanikoro, the headquarters of our host and an important collecting field.

EN ROUTE FOR VANIKORO.

The purpose of our trip being that of general collecting, including everything from butterflies to bats, and corals to human crania (not that one engages in the career of a head-hunter) there was a last minute rush to prepare our extensive equipment. Departure on the 2nd July, 1926, was an unpromising beginning of a very fascinating and successful experience, the night being cold and wet, and the wharf inches deep in mud. Unfortunately, too, we went out into heavy seas, which broke over the bows and washed overboard or damaged gear which could not be replaced, including boxes containing bottles of preservatives, and a six-gallon can of pure alcohol, which was punctured and its contents sent to demoralise the fishes.

To our regret, temporary alterations of schedule prevented landing at Lord Howe Island, about 420 miles out from Sydney, and about due east from Port Macquarie. The first land sighted, it is always heartily welcomed by bad sailors as a stopping place after rough

cold seas such as we experienced. Only seven miles long it is a beautiful spot, with its luxuriant green of palm forests and semi-tropical vegetation, rugged coast-line broken by the fine sweep of sandy beaches, and broad lagoon enclosed by surf-thrashed coral reefs. Dominating all are two rugged mountains, 2,500 and 2,800 ft. high which, though not tall as mountains go, are most impressive, rising almost sheer from the sea. Even on that cold grey day the island looked very attractive as the captain drew in close and, passing round the towering wall of Mt. Gower, sounded the siren to display the reverberating echo. Longing glances dwelt on the receding land, but, as often happens, the weather improved immediately after passing Lord Howe, and was well nigh perfect for the 480 miles onward to Norfolk Island. Arriving before dawn all were delighted at the prospect of a day ashore, which was increased by watching the beauty of the sunrise from the Kingston anchorage. As morning mists dispersed, the severe outlines of stone buildings, relics of a penal regime long past, made a striking contrast with the brilliant green of rolling hills, while in their natural surroundings the Norfolk Island pines seemed to acquire an unwonted variety of tints. As at Lord Howe, the steamer anchors some distance out, and eager parties of tourists, the luggage of visitors, and stores are taken ashore in large boats rowed by the island crews or towed by the steamer's launch. The hospitality of island friends made the day a memorable one, and we were loath to leave the charming spot and its friendly folk after driving amongst the green hills and along the great Pine Avenue which is over a mile long. A dinner of pea fowl, home grown vegetables and fruit, and home made bread, was an additional attraction of course, and so we go on board at sunset, with a sugar bag of the famous Norfolk Island oranges to stave off incipient pangs of mal-de-mer on the next stage of our journey.

THE NEW HEBRIDES.

Turning due north for the 700 miles to Vila Harbour, we were favoured with fair and gradually warmer weather, passing through the Loyalty Islands, with New Caledonia well to the westward. On the afternoon of the third day the hazy outlines



Vila Harbour is very beautiful and surprisingly extensive. The large vessels have to anchor some distance from shore and are unloaded into boats towed by launches.

[Photo.—A. A. Livingstone.

of the southernmost islands of the Group were seen, including Tanna with its active volcano, and Erromanga, on which there is a large sheep station, and about midnight the guiding lights to the Port of Vila winked a steady welcome. The town with its hilly surroundings, on which are perched the government buildings and homes of the officials and townspeople, is embowered in a wealth of foliage and overlooks a beautiful harbour, the size of which is surprising in comparison with that of the island of Efate in which it is situated.

The presence of two European nationalities adds to the otherwise limited interest of Vila, which is the headquarters of a remarkable innovation in government, the New Hebrides being administered by a condominium of English and French officials under a Spanish President. Hence offenders are tried by a joint court, and one may see joint proclamations in both languages at the post office, where stamps of each country are obtained. Both currencies are accepted in business, the rate of exchange, owing to depreciation of the franc, greatly favouring holders of English money, a fact not lost upon native labourers and traders throughout the group, who invariably request payment in the latter coinage. Money for personal expenditure was converted at 180 francs to the pound, the rate being 24 at par, and it was amazing how much could be purchased for a few pounds. Tobacco, perfumes and powders, and all beverages arriving straight from France were remarkably cheap, the

“*pièce*” requiring considerable resistance being *Veuve Cliquot* at five shillings a bottle!

Though the accord between the two nationalities may not be exactly perfect, there is much that is pleasant in the social life of Vila, including tennis and dancing at the British and French Residencies, launch picnics, and riding parties. The British Residency, stands on a small island, which is easily accessible, together with the John G. Paton Hospital, the fine equipment and efficient staff rendering it a haven of healing for both natives and whites. There is not much accommodation for travellers, the *Hotel Moderne* somewhat belying its pretentious name, while the novelty

of the sunbaked main street, quite busy save during the rest hour from midday to two o'clock, quickly palls. The French are permitted to import Tonkinese labour, and the quaint little brown people are everywhere, the sexes dressed alike in what looked to be badly made black pyjama suits. The English are handicapped one is told, by being allowed to recruit only a limited number of natives from the adjacent islands, of which sufficient are not always available.

On the evening of the second day we steamed away, having transferred coal to Burns Philp's inter-island steamer which tours the group, meeting the *Makambo* periodically at Vila. A temporary but very important addition to the ship's complement is a party of fifteen or twenty natives who accompany the steamer through the group to unload stores, load copra and cotton, and carry out painting and cleaning operations after the dusty work of coaling. Their gaily coloured lava-lavas of red or blue patterned cloth provide a bright note of colour to accord with their cheerful behaviour, while their head man Tom, an admirable type of native, controls the engine and activities of the steamer's launch in masterly style and is a law unto himself.

The New Hebrides, so named by Captain Cook in 1774, were discovered in 1606 by de Quiros, who attempted to found a colony on the large island of *Espiritu Santo*. Imagining it to be the great Southern Continent, he called it “*Tierra Australis*,” which afterwards led to a supposition that he had

actually visited and named Australia. Two days' steaming through the group was a tantalising experience, with the red glow of Ambrym volcano and vague scents of tropic lands by night, and distant outlines of islands by day, so there was much satisfaction when our destination loomed ahead.

VANIKORO ISLAND AND ITS HISTORY.

The island is of volcanic origin and is thirteen miles long and about seven miles in maximum breadth, Mount Kopogo rising 3,031 feet above the sea, traces of lava streams still being perceptible; the mountains generally descend directly to the sea, providing little level coastal ground. On the north-east side is a very large bay, nearly filled by the island of Tevai, which is eight miles long and four miles in breadth. A reef encircles both islands and several islets, extending as much as two and a half miles from the shore, and it was this coral line of defence, its treacherously calm openings inviting peaceful penetration and betraying with jagged hidden banks, which destroyed La Perouse's ships during a hurricane in 1788.

Fired by the splendid achievements of Cook, Louis XVI. of France despatched the accomplished navigator La Perouse on a voyage of discovery in the naval vessels *La Boussole* and *L'Astrolabe*. After reaching the Samoan Group in December, 1787, where the commander of the *Astrolabe*, the naturalist, and ten of the crew were massacred by natives, Norfolk Island was visited in January, 1788, and Botany Bay sighted on the 24th of the same month, just six days after the arrival of Governor Phillip with the First Fleet. The English were abandoning Botany Bay for the foundation of settlement at Port Jackson, and after some pleasant associations the French, bidding farewell to officers and colonists



The camp site of La Perouse and the survivors from his wrecked vessels. It is here that most of the relics have been recovered, and to this day grape-shot may still be found.

[Photo.—A. A. Livingstone.]

on March 10, 1788 "vanished trackless into blue immensity," being lost to civilisation for forty years, until Peter Dillon traced the source of relics in 1826. Natives told him that many years ago two large ships anchored off Vanikoro and were driven ashore in a heavy gale; the crew of one vessel fired on the natives in response to their attack, and, as the ship went to pieces, were either drowned or murdered on landing in the boats. The other ship, wrecked opposite Péu, was driven on a sandy beach; arrows were fired into her without response from the crew, who made a friendly demonstration, holding up beads and axes. An old chief who came aboard when the wind abated was received in friendly spirit and pacified his people on returning to shore. Compelled to abandon ship, the crew carried most of their stores ashore, where they built a small boat from the remains of the wrecks. Later as many as possible sailed away, never to be heard of again, while the rest remained on the island until they died. This information led to the Government of British India sending Dillon in search of further intelligence and on the second voyage he found living Vanikorans who remembered the French arrival, some believing the men to have been spirits, and describing their

peaked hats as a projection from their foreheads or noses a foot long, while the chief of the strangers was said "always to be looking at the stars and the sun and beckoning to them," the native conception of astronomical observations.



Coins unearthed on the site of La Perouse's camp at Vanikoro and in the collection of Mr. B. L. Hornshaw. The small one is a "Two Reals," or quarter dollar, Ferdinand VI., 1754: Mexico Mint. The large coin is the Dollar or "Piece of Eight" renowned in piratical literature: it bears the head of Charles III. and the date 1781.

[Photo.—G. C. Clutton.]

Dillon's officers purchased many relics, including a rusted sword-blade and razor, a silver sauce-boat with a fleur-de-lis engraved on it, a brass mortar, and part of a blacksmith's vice. Thus no possible doubt remained that La Perouse had been wrecked and his entire company had died in the vicinity of Vanikoro, the majority being either massacred or drowned, and Dillon had solved a mystery, the secret of which had been locked within the Pacific's blue bosom for forty years. Two years later Dumont-D'Urville, in charge of another *Astrolabe*, made further discoveries at Vanikoro, seeing in clear water the coral-encrusted remains of anchors, chains, guns, and such objects, which had clearly belonged to La Perouse's ships. Most important from the Museum's point of view was the visit in 1828 of the famous naturalists Quoy and Gaimard, the first to make scientific collections at Vanikoro, since when nothing extensive had been done prior to our advent.

With a thrill of anticipation the historic reef passage was negotiated, for we were on the threshold of unique experiences and a practically virgin collecting field, unworked to any extent for nearly a century. The collections of the French naturalists were

necessarily very incomplete, while much of their material and records had been confused and the localities doubted; hence we were in the unusual position, as collectors, of knowing that everything obtained would either constitute a new record or confirm an old one. A fraction of the varied forms of marine life on the coral banks around us could not be exploited in the five weeks ahead, and the thought of the teeming life thereon reduced our six-gallon cans to the proportion of thimbles. On shore were species of insects, birds, and bats, either made known a century ago or yet to be described, and perhaps relics overlooked by the many searchers, a collector's paradise in which the only flaw was the limited time for our work.

THE SETTLEMENT AT PÉU.

Despite its reputation as an unhealthy spot the effect is surprisingly agreeable on approaching the settlement, which occupies the only flat ground and sandy beach for miles in either direction. The harbour seems quite busy with the Government Auxiliary Vessel *Tulagi*, labour recruiting, and Japanese trochus-shelling vessels, and red-roofed timber punt at anchor on the tropic-blue water, while the timber company's launch fusses her way to the *Makambo's* side towing a string of giant kauri logs, like a hen with a troublesome brood. About a hundred yards from shore are the picturesque houses, built on piles by native labour, for the manager, doctor, wireless operator, and other officers of the timber company. Known as "house along water" in the pidgin English of natives, and covered with large leaves pinned together, and floored with thin slabs of palm stems, they are weather-proof and cool; reached by long wooden piers, they confer practical immunity from troublesome insects, of which the malarial mosquito is the least welcome.

The Admiralty guide prepares one for the worst in regard to the climate, which is described as "damp, hot, and unhealthy, even to the natives, who are covered with ulcers and are often sick; therefore it is deadly for Europeans." Doubtless it is due only to the provision of a drained and sanitary clearing and the use of modern medicines that the locality is tolerable and safe for white people; the natives of Vanikoro, who are said to have numbered 5,000

odd, are reduced to less than fifty, an insular lack of resistance to disease rendering them fatally susceptible to introduced epidemics. A fringe of mangrove entanglements, buttressed in oozing mud flats, fosters malaria and other ills, so that village after village has been denuded of population and abandoned.



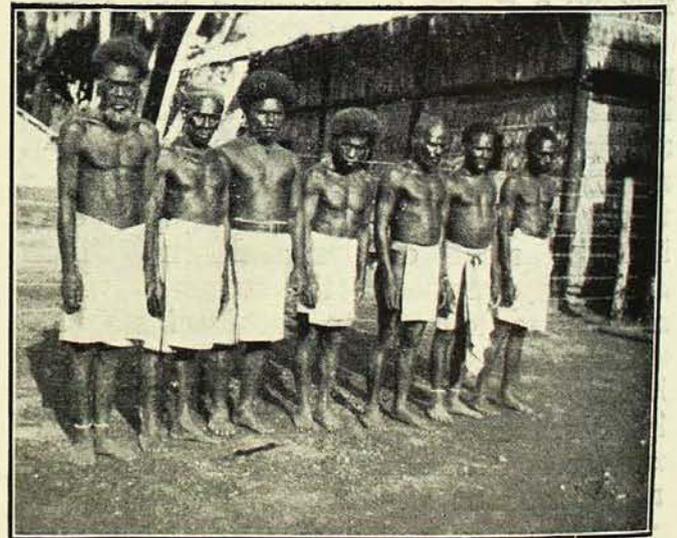
The guard turns out, highly polished and neatly, if scantily, attired. Sentinels are posted over the prisoners and the headquarters, while there is a smartly performed ceremony as the flag is lowered at sunset.

[Photo.—A. A. Livingstone.]

The District Headquarters at Vanikoro, established on the commencement of the timber company's activities, was in charge of our friend, Mr. N. S. Heffernan, until recently stationed at Ysabel in the Solomons, where he had collected keenly for the Museum. Under his command are a fine body of native constabulary, warders of the prison compound or "calaboose," and ship's crew, the smartness of whose training was evident as they brought the District Officer alongside the ship with oars erect awaiting the briskly obeyed commands. Not particularly tall, their well proportioned bodies are clad in short blue denim lava-lavas neatly wrapped around the hips and held at the waist by a band of bright red cloth, over which is a polished belt with a buckle bearing the royal coat of arms; the sun gleaming on skins which almost outshine the leather belt and bandolier, and a mop of carefully trimmed hair completes a striking picture.

Though it was mid July the heat and humidity was comparable to February weather in Sydney and quite oppressive

after a fortnight on shipboard. A rest and some tea under the awning of the A.V. *Tulagi*, our home for several weeks to come, soon revived us for a tour of the settlement, which the combined efforts of the District Officer and timber company had rendered an attractive sight. Well kept paths of sand or broken coral, bordered by hedges of brilliantly flowered hibiscus and other shrubs, connect the neatly built offices and stores. Native prisoners and gardeners of the company are always at work stemming the phenomenal growth of scrub and vines, or tending the vegetable gardens and rows of banana plants, pineapples, and paw-paws. The weeding activities of the prisoners were an excellent example of "slow motion" as they sat down with an old tin or bag and by nightfall cleared the area within reach. To them our frantic dashes after the speedy butterflies was a source of amazement, or amusement if one tripped over vines or missed badly, until imbued with the spirit of the chase they would excitedly join in or beg the use of the net to "get 'em small feller something." As they became used



Types selected from a parade of thirty odd prisoners in the compound or "calaboose." The authors attended the trial of the venerable gentleman on the left for attacking his spouse with a large lump of coral. The central figure was implicated in a murder, and others were involved in thefts and other breaches of the law.

[Photo.—A. A. Livingstone.]

to our eccentricities natives brought many useful specimens such as handfuls of spiders to "put along bottle," or battered butterflies, which they called "small feller pidgin." Indeed, their habit of calling all birds and



The faithful Koviko, a sturdy youth of nineteen, detailed by our host, Mr. N. S. Heffernan, as orderly to the expedition. An excellent shot with gun or bow and arrow, he was a tireless collector in the interest of the Museum.

[Photo.—E. Le G. Troughton.]

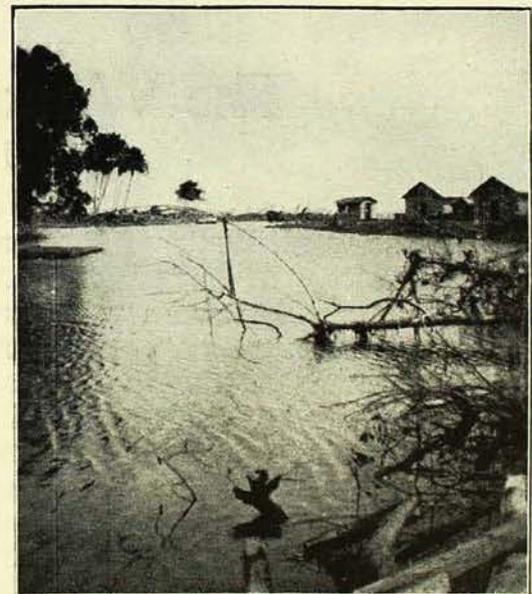
most flying things “pidgins” was quite confusing for awhile.

Most helpful of all was the faithful Koviko, whom our host detailed from the guard as our orderly; a well-set-up, cleanly, and intelligent youth of nineteen, he carried gear and danced attendance tirelessly. When no special duties were on hand he would take a gun and “look all about” for “new feller pidgin” or hunt for camps of the two species of “blying bokus” (flying foxes) or Fruit-bats, which inhabit the island. So great was his zeal that he startled the settlement by shooting an owl at midnight and dashed out to the “house along island” to display the fine specimen, proudly remarking “him he *good feller pidgin, plenty too much.*”

About a hundred natives are employed by the company, including those recruited from the Solomons and New Hebrides as well as the Santa Cruz, and the logging briskly progressed in spite of a shortage of white officers. One gang felled the huge kauri trees, many of which are 110 feet to the first branch, with a girth up to thirty feet, while another gang cleared a track opening up a new section of forest. Kauri grows on hilly country, and the logs are sawn into suitable lengths and pulled to the slippery chutes by cables from a steam hauler

hundreds of yards away. Signals are sent to the engineer by a native pulling a wire attached to a whistle, and great excitement reigns as, amid high-pitched native yells and hooting whistle, the logs wriggle and slide down the muddy track like giant grubs, or bound off ledges to the morass below. From here they are drawn by the hauler to the river bank and rolled with mighty splashes into the stream, down which they are floated to the lagoon.

It was on the bank of this stream, where a sawmill now stands, that La Perouse and his survivors built the small boat on which many sailed to their doom, and nearby is the actual camp site where most of the relics were found, the ground having been so trenched and sieved that, to our disappointment, there was little hope of further finds.



On the bank of this stream, about 139 years ago, the survivors of La Perouse's company built the vessel on which many sailed to their doom. Nearby is now the sawmill, and logs are floated down stream to the lagoon for shipment. The native labourers' barracks are shown.

[Photo.—A. A. Livingstone.]

Almost spanning the historic spot, the wireless aerial stretches between two coconut palms, a symbol of civilisation's advancement with which it is our visible link; presided over by our genial friend Dawe, known as Jack for obvious reasons, the wireless reception of test scores or Dal Monte's Melbourne concert provide a spice of contrast. Here over a century ago La Perouse perished for lack of communication



Mr. Charlie Cowan (right), and another officer of the Vanikoro Timber Company, who displayed great interest in our field work. The huge kauri logs have been drawn by the hauler engine, seen in the background, from adjoining hills; the natives saw them into convenient lengths prior to launching on the river.

[Photo.—A. A. Livingstone.]

with the outer world, which waited forty years for news of his fate, while now a few seconds delivers a message at Sydney, whence he sailed at the beginning of settlement on March 10, 1788.

There was an amazing amount of interesting work in reef and shore collecting by day, and sorting, labelling, and preserving by night, before bedtime on the *A.V. Tulagi*, where the murmur of waves on the reef or distant chanting of native dancers awake memories of childish imaginings, and anticipations of the coming cruise amongst the islands of this little known tropic outpost of our Empire.

The history and zoology of the group will be traversed in subsequent contributions.

EDITOR

The Wandering Albatross.

BY J. R. KINGHORN.

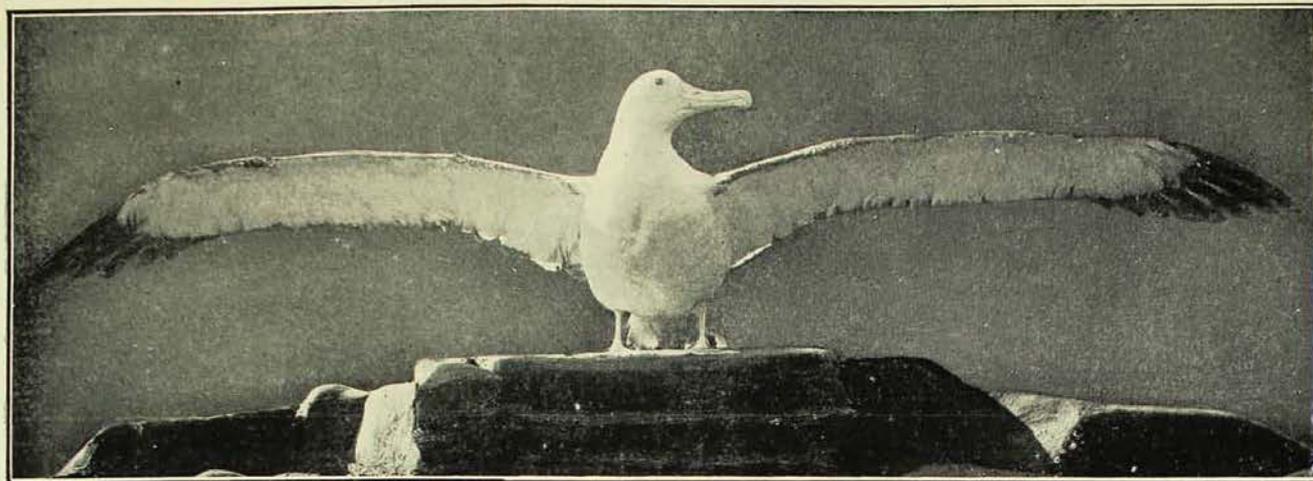
THOUGH the word Albatross is immediately associated with the most majestic of sea birds, probably few know the origin and early application of that name. It is a corruption of the Spanish word *Alcatraz* or *Alcatruz*, originally applied to the pelican, and derived from the Arabic *al-cadous*, meaning a leather water-bucket, similar to those which may be seen, even to this day, on the primitive irrigating machines in use on the Nile. Subsequently the word was transferred to the pelican, because that bird was supposed to use its bill as a reservoir in which water was carried to the young. Later it was applied to any large sea bird, and was used extensively by early English authors as *Alcatros*, but the term eventually became restricted in its application and is now used only for several species belonging to the family *Diomedidae*, the largest of which is the Wandering Albatross.

This well known bird is the most powerful of the oceanic species, and, though it often attains a size so great that its wing span may measure from ten to eleven feet, it seldom exceeds seventeen pounds in weight. As its name suggests it is a roamer, and, though its home waters are those of the southern

oceans, it occasionally wanders to semi-tropical parts. These birds, as they follow in the wake of a steamer, ever on the lookout for some morsel of food which may find its way overboard, are a familiar sight to ocean travellers, and bring to mind Coleridge's "Rime of the Ancient Mariner":—

And a good south wind sprung up behind:
The Albatross did follow,
And every day, for food or play,
Came to the mariner's hollo!

When soaring, the albatross moves its wings more frequently than is generally supposed, but the movements are so extremely short and quick that they cannot be seen unless the observer's eyes are on the same plane as the bird. These short movements, with an occasional heavy beat, give such impetus to the bird that it is able to glide for many hundreds of yards before beating its wings again. To the traveller its movements are most fascinating, as the bird circles round and about the ship; now abreast, now far ahead, or sweeping past, soon to be gliding over the waves far astern. It dips into the trough of a wave and is momentarily lost to sight, but it soon reappears, skimming beautifully over the

The Wandering Albatross (*Diomedea exulans* Linne).

[Photo.—G. C. Clutton.

crest of a "comber," and, as it wheels in a short circle, assuming the perpendicular while so doing, the curved tip of its wing appears to pivot on the water as it turns. It drops gracefully into the sea to make a meal from some bread thrown overboard, but does not remain long, for, after raising its wings clear of the water and beating them rapidly, while skipping along the surface of the sea for a short distance, it suddenly, takes off from the crest of a suitable wave and whirls its beautiful form into the air once more, and, as it sweeps past the ship, turns its head as if acknowledging thanks for the meal.

A remarkable story was related some years ago concerning the fate of a party of shipwrecked sailors and a message carried by an albatross. It is an extraordinary coincidence that, several months ago, while removing a quantity of paper packing during the renovation of the albatross shown in the photograph, the taxidermist, Mr. H. S. Grant, found part of an old Queensland journal with the story in it. On the 18th October, 1887, an albatross was picked up in an exhausted condition on Cottesloe Beach, Western Australia. The young man who found it noticed a rust coloured stain round the bird's neck which on examination proved to come from a tin collar. He removed the collar and saw that an inscription in French was punctured on it, the translation of which was to the effect that the French ship *Tamaris* had been wrecked and thirteen of the survivors of the crew were on the verge of starvation on the Crozet Islands; the message was

dated 13th September, 1887. These islands are within seven days steaming of the Cape of Good Hope, and the sailors probably could have been saved had immediate action been taken, but there were delays and six months elapsed before a French transport visited the scene. By this time the tragedy was complete. The bird had done its part, but not without suffering, for the collar was so tight it could not swallow food and was evidently driven ashore by hunger—an involuntary martyr in the cause of humanity.

The nearest breeding grounds of the Wandering Albatross are Chatham Islands, Auckland Islands, and Antipode Islands, which lie to the south of New Zealand. On these rocky places are many rookeries, but the nests there are simple structures, the dry grass being pressed down into a shallow bowl-like depression, in which a single egg is laid.

The more typical nests may be found on Tristan d'Acunha Island and Kerguelen Island, where mud and grass, mixed into a kind of mortar, is built into a cone from six to ten inches in height and about sixteen inches across. The top is saucer shaped, and in this the egg is placed and hatched.

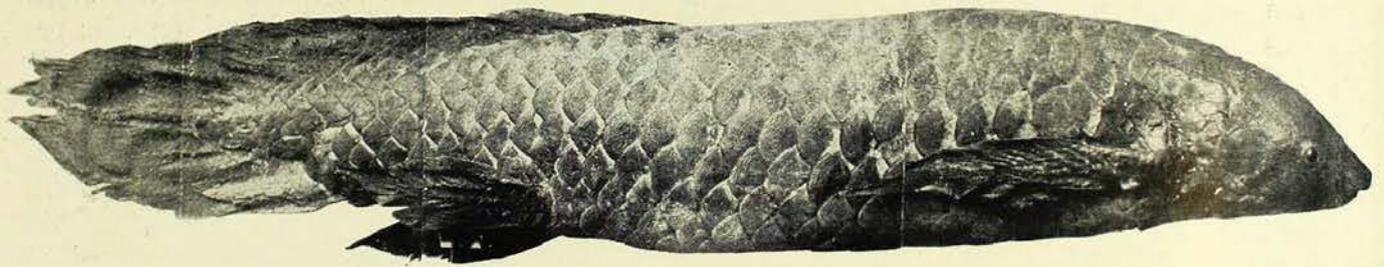
The Wandering Albatross occasionally visits Port Jackson, and only three years ago a large specimen came into collision with one of the Sydney Ferries' steamers, breaking the steering gear and its own neck, eventually finding its way to the storage cabinets at this Museum.

The Queensland Lungfish.

BY GILBERT P. WHITLEY.

ONE hundred years ago, those portions of Queensland watered by the Burnett and Mary Rivers were quite unknown to white men, and in the forties of last century the aborigines there reigned supreme, preventing permanent settlement on the part of the whites. The hardy pioneers who raised their stock in those days little knew that the rivers they encountered were to become famous as the habitat of one of the world's most wonderful fishes, the Queensland Lungfish, and many a bush cook who dressed the fleshy "salmon" of those parts could have made a small fortune, had he been able to introduce his finds to stay-at-home scientists.

Kreffft's paper, in which he described the animal as a new amphibian, naming it *Ceratodus forsteri* after its discoverer, was read before the Zoological Society of London in April, 1870. It created quite a *furore* amongst those present at the meeting and Dr. A. Günther, who was at that time completing his monumental "Catalogue of the Fishes in the British Museum," pointed out that the new animal was a fish and introduced the remarkable find to the scientific world in his book. The distinguishing feature of the novel fish was the lung with which it could breathe air, in addition to the gills with which it could breathe in water. The backbone was cartilaginous



The original photograph of the first Queensland Lungfish (*Neoceratodus forsteri*) known to science. It shows the specimen described by Krefft in 1870, and is therefore of considerable historical and scientific interest.

[Photo.—Harry Barnes.]

DISCOVERY.

Twenty or thirty years later, the tales told by bushmen and blacks of a curious fish in the Queensland rivers were substantiated by the Hon. William Forster, who procured a specimen for Mr. Gerard Krefft, at that time Secretary and Curator of the Australian Museum, Sydney. Krefft was much pleased at this gift, for he perceived from the animal's teeth that it was a living example of *Ceratodus*, a creature, thought to have been like a shark, which had hitherto been known only from fossil teeth. He prepared a description of his unique specimen for publication in England, with a photograph, a copy of which is here reproduced because of its historical interest.

like a shark's, whilst the paired fins were paddle-shaped, and like flippers.

At first *Ceratodus* was known only from a single specimen in the Australian Museum, but a search for more Lungfishes was made, George Masters, who had been collecting in West Australia for Krefft, being sent to Gayndah for the purpose of procuring more. He was successful in obtaining nineteen, some of which were sent to London.

The new fish was encumbered with several inappropriate names. It was stated by Krefft that the blacks called it "*Baramoonda* or *Baramoondi*," that it was reported to exist in the Dawson River, and that it reached fully six feet in length. These remarks, however, apply to a different fish, the "Dawson River Salmon" (*Scerlopages*

leichharati), to which the name Barramundi may be restricted. The native name of the Queensland Lungfish, whose range was confined to the Burnett and Mary Rivers, was according to Masters *Teevine*, or *Djelleh* according to Semon; it was also called "Salmon," probably because of its reddish flesh.

STRUCTURE.

In Europe the foremost anatomists dissected the available Lungfishes and published wonderful monographs, of which that of Semon, an accomplished German, who specially visited Queensland, is superbly illustrated.

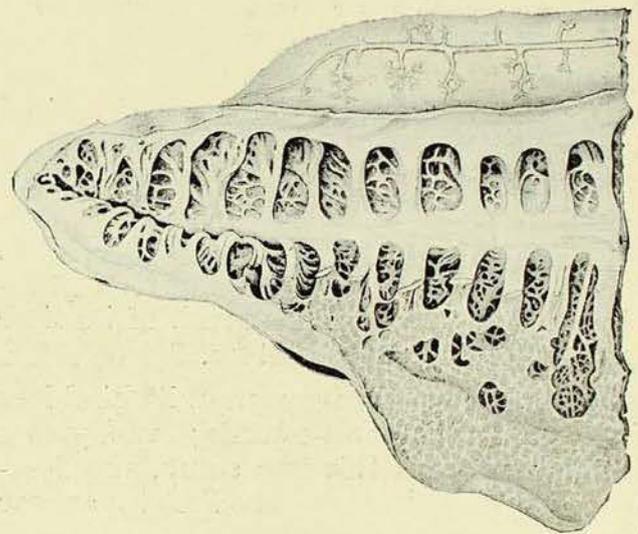
Though outwardly like a fish, the Lungfish was found to have internal structures like those of sharks and of amphibia (frogs, toads, etc.). The swim-bladder possessed by most true fishes was found modified in the Lungfish to form a lung with a special series of blood-vessels in association with it. It seems that the lungs of air-breathing vertebrates are modifications, evolved through millions of years, from the swim-bladders of primitive fishes or fish-like animals. The idea that the Lungfish is akin to the sharks is not accepted nowadays; it is held that the points of resemblance between the two groups are the result of convergent evolution from distinct types.

The Queensland Lungfish may be regarded as a unique survivor of an ancient order of animals intermediate in many respects between fishes and air-breathing quadrupeds.

The Lungfishes, or Dipneusta, as they are called, are represented by but three living genera, *Protopterus*, found in Africa, *Lepidosiren* of South America, and *Ceratodus* (*Neoceratodus*) of Australia. But in previous geological periods the Dipneusta were dominant and occurred all over the world. Teeth very closely resembling those of the existing Queensland Lungfish have been found in the Triassic of South Africa and India, in the Jurassic of Colorado, and in the Cretaceous of North Africa, Montana, and White Cliffs, New South Wales. It has also been recorded from the older Tertiary of Patagonia. The Australian Lungfish is, therefore, a most interesting survivor of a group of fishes which was once highly important and widely spread.

HABITS.

The Queensland Lungfish is evidently somewhat sluggish, living amongst weeds and submerged tree-trunks, near river-banks. Though it usually breathes through gills, it sometimes comes to the surface and takes air into its lung, the passage of used air through the throat and mouth often making quite an audible grunt. The faculty for breathing air in this manner must be very useful to the Lungfish when the water is fouled by decomposing vegetable matter, and it is recorded that, whereas many fishes have been found dead in putrid waterholes, the Lungfishes were still alive and healthy.



The lung of the Queensland Lungfish opened to show the numerous "air cells," the walls of which are supplied with veins and arteries which enable the lungfish to breathe the contained air.

[After Richard Semon.]

The early settlers believed that the Lungfish could travel on land, but such is not the case, for its flippers are incapable of supporting its heavy body, and the fish, despite its lung, soon dies when taken from the water. Neither does it bask in the sun on exposed logs as Carl Lumholtz stated in his book *Among Cannibals*.

FOOD.

The Queensland Lungfish feeds chiefly on vegetable food, eating more or less decomposed leaves which have lain in the river. Blossoms of *Eucalyptus* are eagerly seized and swallowed as they drop into the water. Specimens have, however, been caught with a bait of worms, shrimps, and

other tasty morsels, and a specimen kept as a pet in the Queensland Museum is fed on chopped liver, so that the Lungfish is by no means a strict vegetarian. Some say, indeed, that it swallows leaves and other vegetable matter only for the minute animals which are found on them.

Opinions on the Lungfish as a food-fish differ. Some have stated that its flesh is oily, disagreeable, and coarse, others that the fish is excellent eating; possibly the freshness of the flesh is an important factor.

EGGS AND YOUNG.

Spawning takes place, according to Semon, from April to November and principally in September and October. The eggs are not unlike those of frogs; they are deposited amongst weeds or beside or beneath logs lying in the water. Several weeks elapse before the embryo fish hatches, and it often returns to its gelatinous egg-shell for shelter. The young Lungfish is an inactive grub-like creature which spends much of its time lying on its side at the bottom.

The tadpole of the frog grows its hind-legs first and fore-legs afterwards; the young Lungfish reverses this procedure, the fore-limbs or pectoral fins are the first to appear the hind-limbs or ventral fins are developed when the fish is four or five months old. In eight months the young are about two and a half inches long. Dr. T. L. Bancroft succeeded in rearing two year old specimens which were about five inches long.

Shrimps, small fishes, and aquatic insects and larvae eat the eggs and numbers of the young Lungfishes.

LONGEVITY.

The exact age to which Queensland Lungfishes may attain is not definitely known. They are apparently long-lived creatures. Examples sent alive to England have lived from seventeen to twenty years in captivity and were doubtless several years old when transported.

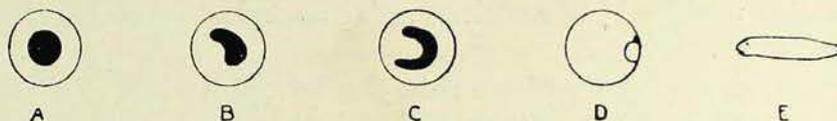
The Lungfish is said to grow to a length of five feet or more, though exact data on this point too are wanting. A specimen which lived in Taronga Park Zoological Gardens,

Sydney, for seven or eight years, weighed 84 pounds.

PROTECTION.

In view of the great interest attached to the Queensland Lungfish, it is pleasing to note that it is rigorously protected by law. If any are caught they must immediately be returned to the water.

Attempts have been made to acclimatise the Lungfish in several southern Queensland rivers, and a young specimen caught in the



The development of the young Lungfish. A. appearance of fresh egg, life size. B. embryo one week old. C. embryo two weeks old. D. empty envelope showing exit hole. E. young lungfish just emerged; if often returns to its gelatinous capsule when disturbed.

[After T. L. Bancroft.]

Coomera River in 1918 proved that the Lungfishes which had been introduced there in 1896 had bred successfully.

THE LUNGFISH GROUP.

A group showing Queensland Lungfishes in their natural surroundings has been for some time a desideratum for the Australian Museum gallery.

Life-like casts were made from good specimens by the Museum preparators, Messrs. G. C. Clutton and J. Kingsley, and coloured very carefully by Miss E. A. King, who also painted the background for the group. Weeds, shells, and samples of the silt from the bed of the Burnett River were kindly sent by Dr. T. L. Bancroft of Eidsvold. The completed group, depicted on the frontispiece, is the result of months of careful work on the part of preparators and artist, and represents an under-water scene in which three Lungfishes are shown in swimming attitudes. Some shells of freshwater mussels lie on the river-bed, whilst little snails climb the stems of the water-weeds. These, as well as the fishes, were specially obtained from the Burnett River for this group, which will shortly be on view on the landing outside the fish gallery.

Further Notes upon Marsupial Birth.

METHOD OF TRANSFERENCE TO THE POUCH AND SUPPOSED HELPLESSNESS OF THE NEWLY BORN.

BY ELLIS LE G. TROUGHTON.

AN article entitled "The Mystery of Marsupial Birth and Transference to the Pouch" recently published in this MAGAZINE¹ has been the subject of considerable comment, and it would appear that such criticism or confirmation, together with discussion upon the points at issue, may prove of interest to readers and shed light upon matters which to some still retain an element of mystery.

Of late years discussion of marsupial propagation has become broadly divided into two sections—birth, and the subsequent transference of young to the teats. The former point, of course, admits of no argument, as it is a fact accepted for over a century in well informed quarters—scientific and otherwise—that marsupial birth takes place in the ordinary way common to all furred animals; indeed that any other method would be impossible. The question of transference, however, not being a mere matter of dissecting dead animals but of the patient observation of shy creatures, is still the subject of discussion, which sometimes develops unnecessary warmth.

The main difficulty arises from the fact that people who are willing to accept scientific records of research upon dead animals are strangely reluctant to accept accounts of the habits of living ones, no matter how highly qualified the observer, or how authoritative the scientific journal publishing the record. In my recent article authentic accounts were quoted of the young of kangaroos making the journey to the pouch unaided, including Dr. Hartmann's personal observations, from the *Anatomical Review*, in which the actual birth of American Opossums was observed, as well as the subsequent unaided journey.

Amongst several letters received is the following interesting one from Dr. T. L.

Bancroft, the well known naturalist of Eidsvold, Burnett River, Queensland.

To the Editor,

THE AUSTRALIAN MUSEUM MAGAZINE,

Sir,

I cannot agree with the writer of the article on the Mystery of Marsupial Birth when he remarks:—"but it is now known beyond all doubt that the young are able to reach the pouch and teats unaided."

A young marsupial, that could crawl about in the fur, would be two or three weeks old.

At birth it would be absolutely helpless. During my life I have collected much marsupial material, both uterine and pouch young, for embryologists and have seen pouch young so small and helpless as scarcely able to move. I have kept possums and wallabies in captivity and they have born young repeatedly.

The young at birth is transferred by the mother's hands to the pouch.

I cannot say that I have actually witnessed a birth but have many times seen the mothers detach the young and lick out the pouch and then put the young on the teat; they do this once a day at first but as the joey grows, many times a day.

The cases of kangaroos, where the pouch young was seen crawling in the fur immediately after the mother was shot can be explained in two ways.

(1) The mother, just before being shot, had detached the joey preliminary to cleaning the pouch.

(2) The young had lost its hold of the teat during the death struggles of the mother.

Eidsvold.

(Signed) THOS. L. BANCROFT.

In regard to Dr. Bancroft's interesting comments it will hardly be necessary to assure him, or readers generally, that the article was compiled with close attention to all available scientific records. I now propose to discuss the points raised and offer some further observations omitted from the article under review.

Dr. Bancroft cannot agree with the idea that the young at birth are able to reach the pouch and teats unaided, maintaining that the young are invariably transferred by the mother's hands, yet he states that he has never actually witnessed a birth, whereas my article quoted several authentic instances of unaided transference. It was over a century ago that the first observation

¹THE AUSTRALIAN MUSEUM MAGAZINE, Vol. II, No. 11, July-September, 1926, p. 387.

of this kind was made, when Professor Barton of Philadelphia (U.S.A.) published in 1806 his account of the birth of the American Opossum. In a recent article on this subject in a Hobart paper, *The Voice of Labor* of Dec. 18th, 1926, Professor T. Thomson Flynn, D.Sc., of the University of Tasmania, points out that there are only two methods by which the young can reach the pouch, either they are put there, or they travel themselves, and the only way to find out is to see, or to believe authorities who have seen the act of transference. He then quotes Professor Barton from the precious pamphlet of 1806, a copy of which is in the University of Tasmania:—

“The young Opossums, unformed and perfectly sightless as they are at this period, find their ways to the teats by the power of an invariable, a determinate instinct, which may, surely, be considered as one of the most wonderful that is furnished to us by the science of natural history. It is not true, as has been often asserted, that the mother, with her paws, puts the young ones into the pouch.”

It was not till one hundred and fourteen years later that further observations upon American Opossums were published by Dr. Hartmann, who wrote, in addition to passages previously quoted in the *MAGAZINE*:—

“A tiny bit of flesh appeared, and scampered up over the entanglement of hair into the pouch to join the other foetuses, which now could be seen to have made the trip without our having observed them.

“Examination of the pouch of the mother showed that it contained a squirming mass of eighteen red embryos, of which twelve were attached, though thirteen might have been accommodated. The remainder were, of course, doomed to starvation. Even some of these unfortunates, however, held on with their mouths to a flap of skin or to the tip of a minute tail, while several continued to move about.”

It was found that any of these young, immediately after birth, could readily find their way to the pouch if taken out and placed on the mother's fur well below it, and that they always crawled upwards, progressing by means of over-arm strokes as in swimming. It may be noted that these observations completely support Professor Flynn's assertion, now generally accepted in scientific circles, that the supposed helplessness of marsupial young immediately after birth is an absolute myth.

THE BIRTH OF KANGAROOS AND WALLABIES OBSERVED IN AMERICAN ZOOS.

I have quoted local observations in my previous article, including one made in the Taronga Park Zoo, but the following additional accounts are interesting. The *Pastoral Review* (Melbourne) of July 16, 1923, prints a letter from Dr. W. T. Hornaday, Director of the New York Zoological Gardens, giving records of observations made on kangaroos and wallabies in America. The following are extracts from his letter, from which only very slight immaterial elisions have been made, to conform with the popular nature of the *MAGAZINE*.

“We have a large and fine collection of kangaroos, and for the past three years in particular our kangaroo keeper has been keenly on the alert to discover how young kangaroos are born and how they are conveyed to the pouch. After long and patient watching, he was at last rewarded by witnessing the process under very favourable conditions.

“The demonstration was afforded by a kangaroo of large size, called Bennett's kangaroo. With considerable enthusiasm he related to me immediately after the occurrence the manner in which he saw it occur. Keeper Riley said that the kangaroo sat upon the floor of her cage. On the flat table of the tail the young kangaroo was born, emerging without difficulty in the usual fashion. He said that it was about as long as the terminal joint of his little finger.

“He declared that the little animal was physically perfect, and within a minute or so after it appeared on the flattened tail of the kangaroo it began to scramble about as if looking for something, and the next instant it rather nimbly scrambled up the hair covering the abdomen of the mother, found the pouch, and quickly entered it.”

This closed the observation until some weeks later, when he saw the head of the little animal protrude from the pouch and take a view of the world.

“I do not undertake to say that all kangaroos are born in this fashion, nor do I venture to assert that kangaroo mothers never assist their young into the pouch. I have been told that some kangaroo mothers do by means of their front paws help their young to find the pouch and enter it, but on account of the tiny size of the newly-born young and the comparatively large size of a kangaroo's front paws it would seem to me rather difficult for the mother to be of much real assistance so far as her front paws are concerned.

“As a final contribution to this subject, I am now going to enclose a copy of the memorandum that we received on 30th March, 1921, from Mr. George F. Morse, jun., director of the Zoological Gardens in Franklin Park, Boston, Mass.

"It tells its own story, and it is thoroughly confirmatory of the observations of our own keeper.

"In this case, however, the tiny individual failed to find the pouch and the clumsy claws of the mother killed the frail creature, and so the birth operation was a failure. The following is a detailed report:—

"At 2.19 p.m., the young one was born. It appeared to be perfectly formed, without hair, pink in colour, and an inch long. As soon as born it started to climb upward through the hair towards the pouch, with a slow wriggling and snake-like motion. It was evidently side-tracked by a groove in the abdominal hair, and its course was directed towards its mother's right hip. It took twenty-five minutes to climb to the same level as the pouch, and was then about two inches to the right of the pouch orifice, with a thick bunch of hair impeding its progress. Up to this time the mother was apparently oblivious of its presence, and made little movement. At 3.02 p.m. she started to get rather nervous, and kept looking for the young one and opening and lapping her pouch. At 3.07 p.m. she started to scratch with her right foot in the vicinity of the young one, and twice struck it with her claws. At 3.15 p.m. the young one dropped to the ground dead. Post mortem examination revealed severe contusions on neck and sides. Weight, $9\frac{1}{2}$ grains; length, nose to root of tail, $11\frac{1}{16}$ ins.; hind legs, $1\frac{1}{16}$ in., imperfectly formed.

"Needless to say, the testimony of Mr. Morse is to be relied upon as absolutely authentic."

A GENERAL SUMMARY.

When I wrote in a previous issue that the young, beyond all doubt, could reach the pouch unaided, I did not dogmatise that it was the only method, but wrote in the same paragraph "it is reasonable to suppose that maternal instinct may frequently prompt the parent to assist the tiny voyagers." Whether this is the case or not, it must be emphatically reiterated that published records conclusively prove that the young of marsupials, at birth, *can and do* reach the pouch and teats unaided.

Against the assisted passage theory, it should be noted in the Boston Zoo observation that, although the newly born animal was "evidently side-tracked," the "mother was apparently oblivious of its presence," and did not attempt to assist the travelling embryo with her fore paws, in fact it was actually her "right foot" which started to scratch in the vicinity of the young one and eventually dislodged it. It is also a fact, Professor Flynn assures me, that in many years of assembling and studying literature on the subject, he has found no authentic

record whatever of the parent transferring the newly born.

Dr. Bancroft states that young marsupials able to crawl about in fur would be several weeks old, being absolutely helpless at birth, but if this is so, how does the parent persuade the embryo to perform the voluntary act of seizing and holding the teat? Furthermore, observers, scientific and otherwise have shown that marsupial young directly they are born display remarkable powers of instinct and energy, as well as the power common to all young furred animals of immediately finding their way to the milk supply.

The presence of immature marsupials crawling in the fur is explained by Dr. Bancroft as due either to dislodgment from the pouch during the death struggles of the mother, or to her having been shot while cleaning the juvenile, but these explanations cannot in the slightest degree discount the several instances quoted, wherein qualified men have observed the actual birth and journey pouch-wards.

Dr. Bancroft's account of the mother detaching the young from the teat and licking out the pouch, once at first, and then many times a day, is most surprising for the following reasons. Observers have always found it impossible to remove the young, after a few days' attachment to the teat, without risk of serious injury to the juvenile's mouth and to the teat. Indeed it is the bleeding consequent upon forcible removal which has often strengthened the bushman's belief that the young are born on the teat. Furthermore, it is known from scientific investigation that, after attachment, the sides of the mouth grow together so as to be quite immovable, leaving an aperture in front through which the teat passes into the mouth, where it is firmly held and is swollen into a bulb corresponding to the shape of the mouth, and larger than the aperture. This condition of the mouth parts is known to German biologists as "Saugmund" for which term there is no English equivalent, though the condition is familiar to all workers upon the subject. As the animal becomes furred and the teeth appear, the jaws separate and become movable again, and at this stage, several weeks after the first attachment, the animal can leave the teat.

In consideration of the foregoing, Dr. Bancroft's observation of removal by the parent is most interesting and difficult to explain, unless the juvenile is able voluntarily to release and take hold again of the swollen nipple; if this is so it supplies an additional proof that the supposed helplessness of young marsupials is a myth. Another possible explanation, as Dr. Bancroft has never witnessed a birth, is that the young may have been in a comparatively advanced stage of their early growth when he observed the interesting occurrence described by him. It is such points as the latter which Dr.

Bancroft may be able to clear up and which, in association with his original observations, should certainly be placed on record for the benefit of scientific workers.

Many interesting communications upon the subject of marsupial birth have been received which have been answered by letter, space unfortunately not permitting a reply in these columns. To all these correspondents an assurance may be given that in no sense is criticism resented, while any authentic records tending further to illuminate this highly interesting subject will be heartily welcomed.

Lectures.

The 1927 session of Popular science lectures will be inaugurated on April 28th when Mr. T. Hodge Smith will take as his subject "The

Romance of Gold Mining in New South Wales." The complete Syllabus for the session is as follows:—

April 28th—"The Romance of Gold Mining in N.S. Wales"	T. Hodge Smith
May 12th—"Camera Studies of Australian Birds" ...	E. F. Pollock, R.A.O.U.
May 26th—"A Visit to Java"	R. H. Cambage, O.B.E., F.L.S.
June 9th—"Common Objects of the Sydney Bush" ...	F. L. Grutzmacher, F.C.S.
June 23rd—"Gould and His Birds"	Tom Iredale
July 14th—"The Value of Wild Life"	J. R. Kinghorn, C.M.Z.S.
July 28th—"Cruising in the Santa Cruz"	E. Le G. Troughton
Aug. 11th—"In the Macpherson Range, Queensland"	A. Musgrave, F.E.S.
Aug. 25th—"Animal Camouflage"	W. Boardman
Sept. 8th—"Some Native Races and their Customs"	W. W. Thorpe
Sept. 22nd—"Marine Boring Organisms and their Work"	F. A. McNeill
Oct. 13th—"Early Migrations in the Western Pacific"	Prof. Griffith Taylor, B.A., D.Sc.
Oct. 27th—"The Capture of Fish"	T. C. Roughley
Nov. 10th—"Japan"	E. C. Andrews, B.A., F.G.S.

These lectures, which are illustrated by specimens and lantern slides, are delivered in the Lecture Hall at the Australian Museum at 8 p.m. on the dates shown. The doors open at 7.15 p.m., and admission is free.

Recent lectures to various institutions included those to the Sydney Kindergarten Training College by Mr. W. W. Thorpe, who took as his subjects "Primitive Man," "The Aborigines of New South Wales," and

"Ancient Egypt" and by Dr. C. Anderson, who lectured on "Animals of the Past." Mr. Tom Iredale lectured on "The Wonders of the Ocean Depths" to the trainees on board H.M.A.S. *Tingira*.

The Carrier Shell.

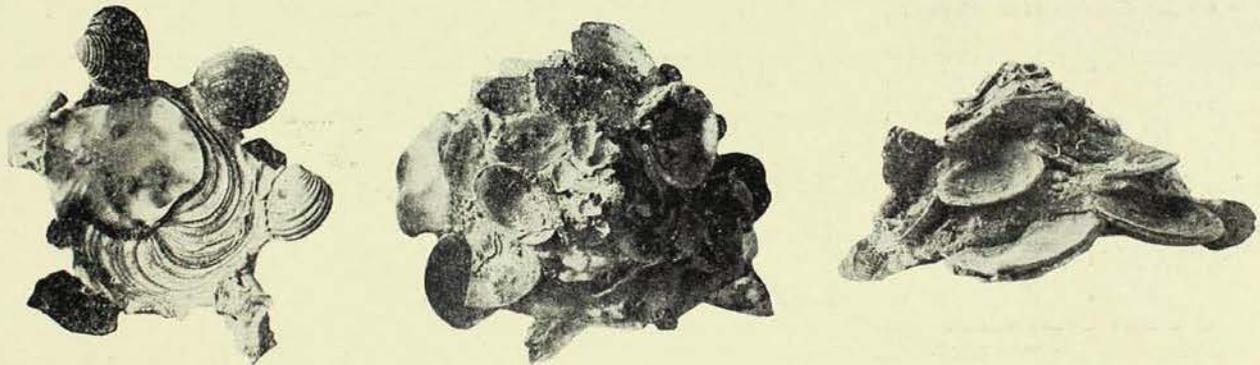
BY JOYCE K. ALLAN.

POSSIBLY in no class of the animal kingdom is the means of defence more pronounced than in molluscs, and the quaint animal here illustrated is one of the best examples of self-protection to be found among the many types of shells comprising the molluscan group.

Living in tropical and sub-tropical seas round the world, and commonly known as the Carrier Shell, this remarkable creature (*Xenophora* sp.) deceives its enemies and protects itself by collecting small shells, pieces of rock-coral, and pebbles, and at-

and sets them with the convex sides down, so as not to further impede locomotion, which at all times is rather laborious. The flat base of the shell is kept entirely free from rubbish, to prevent interference with the animal's chance of obtaining food.

The materials collected are made to adhere to the growing shell by bringing them in contact with it while the shelly matter is still in a softened condition, and though, when viewed from above, it may easily be mistaken for a portion of sea-bottom debris, below, a mollusc with all a mollusc's in-



The Carrier Shell (*Xenophora* sp.) showing under, upper, and profile views.

[Photo.—G. C. Clutton.]

taching them to the surface of the growing shell, some being so completely covered that they appear, as intended, to be only small heaps of shells or pebbles, while others have only a single regular-sized row soldered to the surface.

A decided taste is shown by individual species, probably due to the type of material nearby. Some prefer pebbles, others shells, while a few species use both, intermingled with portions of rock-coral. Both univalves such as Lady Fingers (*Turritella*) and Ladder Shells (*Scalaria*), and bivalves are favoured, and if the latter, which seem to be the more popular, are used, the shrewd mollusc is careful to choose the saucer-shaped ones, such as the Cockle, Venus, and Scallop shell,

and stincts and appetite lurks in the doorway of its home to snatch any food that may come near.

Travel is a slow process to this creature consisting of a series of ungainly jumps caused by the sharp contraction of the foot-muscles, and the gait is anything but a smooth one, possibly due to the irregular surfaces over which it wanders.

The habit of accumulation probably serves to give added strength to the shell, the surface of which, though rarely seen owing to the collecting habits of the owner, is really thin and brittle, with gracefully curved striations, and without this additional protection the animal would probably suffer considerably.

A Visit to Jenolan.

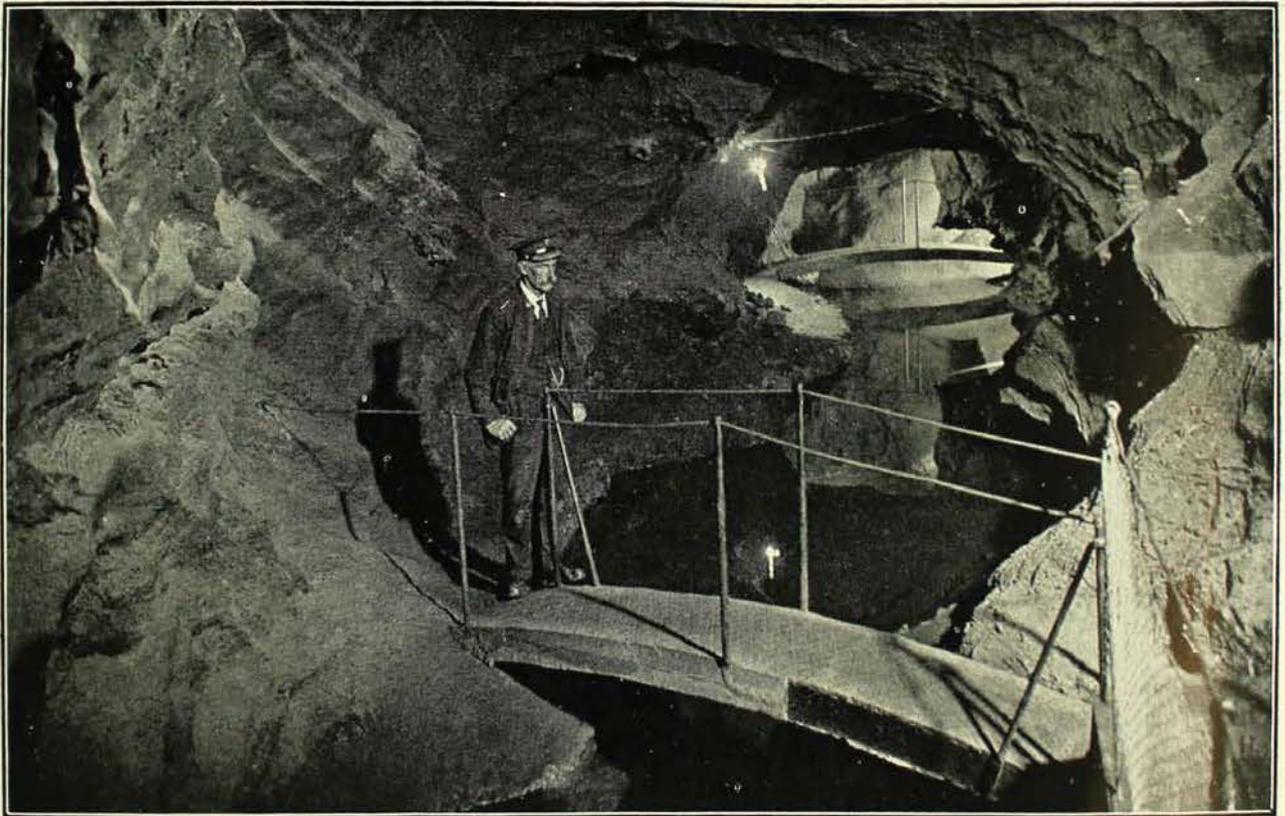
THE SKELETON CAVE.

BY H. E. CRABB.

A GLANCE at the eastern portion of New South Wales will reveal the fact that from north to south there is an abundance of limestone outcrops. In some parts the rock is remarkable for the beauty of its marbles, and in others, such as Jenolan, Wombeyan, and Yarrangobilly, for the wonder of the caves with which it is honeycombed.

however, goes through it by virtue of a great natural tunnel—the Grand Arch. This giant mass of rock cuts off the upper part of the Jenolan River valley from the lower part, the river passing through it by an underground channel.

This herculean lump of limestone is the Mecca of every tourist, for within it are the



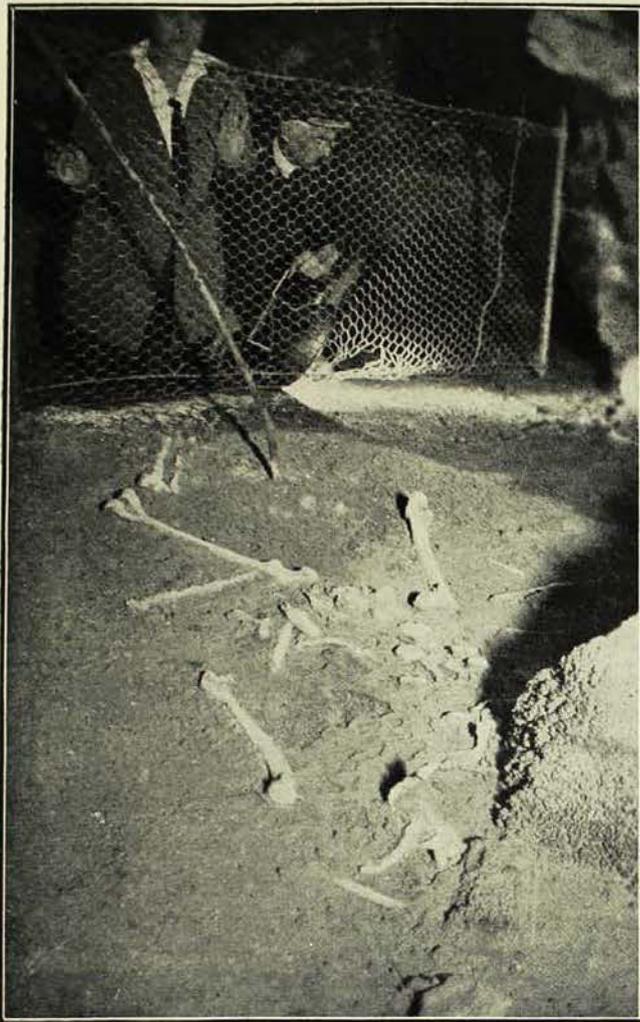
Bridges to Skeleton and entrance to River Caves.

[Courtesy of N.S.W. Govt. Tourist Bureau.]

Those at Jenolan are probably the most famous. Discovered over seventy years ago, they were subsequently protected by the reservation of six square miles of country surrounding them.

The outstanding feature at Jenolan is the great mass of grey rock, about 450 feet thick and tilted at an angle of 60 degrees, which stands athwart the valley and seemingly bars the way. The road to the Caves House,

twelve caves famed for their grandeur. They are found at various levels, from the top of the hill down to the present river level. Each cave-level marks the one-time passage of the river through the limestone. The caves have been formed by the water, impregnated with carbon dioxide, dissolving channels through the limestone, and not by it merely cutting its way downwards through the rock by mechanical erosion. The pre-



The Skeleton Cave.

[Courtesy of N.S.W. Govt. Tourist Bureau.]

sence of coarse water-worn pebbles in all the caves show that the different cave-levels were progressively formed. It follows from this that the highest caves are the oldest the lower ones being younger. As regards the stalactites and stalagmites they were formed later by the dripping of rain-water through the rocks. The water evaporated and left a thin layer of limestone. Needless to say, it takes a very long time to get an appreciable amount by this method. The usual rate quoted is one inch per thousand years, but this can make no pretence to accuracy, because there have been periodic variations in the water supply.

But what was the origin of the great mass of rock in which the caves occur? Whence did it come? To answer this we must turn to geology and in doing so we are reminded of Tennyson's lines :

“ There rolls the deep where grew the tree,
O earth, what changes hast thou seen
There where the long street roars, hath been
The stillness of the central sea,”

for we know that during the Ordovician period this part of New South Wales was covered by a fairly deep sea, the surface water of which teemed with minute organisms called Radiolaria whose siliceous shells, as the animals died, fell to the sea-bottom and built up the thick deposits of black and grey radiolarian chert. Then later in the Silurian period, there existed a warm, shallow sea into which enormous quantities of mud were emptied by rivers, and this subsequently hardened into shale. It seems that the supply of muddy sediment was then cut off, the waters became clear and were peopled by immense numbers of marine invertebrate animals which secreted carbonate of lime from the water and built up hard calcareous structures. Century followed century. The hard structures accumulated on the sea-bottom until a deposit over 450 feet in thickness was formed, thus constituting the bed of limestone in which the caves occur. Then floods of muddy sediment again came sweeping down, killing the lime-secreting organisms, and so again beds of shale were laid down.

From time to time considerable numbers of bones of marsupial animals have been found in the earth which abounds in many places in the caves such as, for instance, those of *Thylacinus*, the Tasmanian tiger, a carnivorous marsupial extinct on the mainland of Australia but still found in Tasmania. A discovery of considerable interest was that of an aboriginal skeleton in a cave in 1904 during exploration by Messrs. J. C. Wiburd and J. C. Edwards. The Skeleton Cave is a very lofty chamber immediately under the Cathedral Cave, 60 feet below the level of the Bone Cave, and about 350 feet from the surface.

The remains are lying ventral surface downwards, and are now cemented to the floor by a thin deposit of stalagmite. A calculation based on the length of the femora indicates that the unfortunate individual was about 5 feet 10 inches high, while the ossification of the epiphyses and the development of the teeth show that he was an adult, in all probability a male, but we cannot



The White Cluster, Skeleton Cave.

[Courtesy of N.S.W. Govt. Tourist Bureau.]

be certain on this point because of the absence of pelvic details.

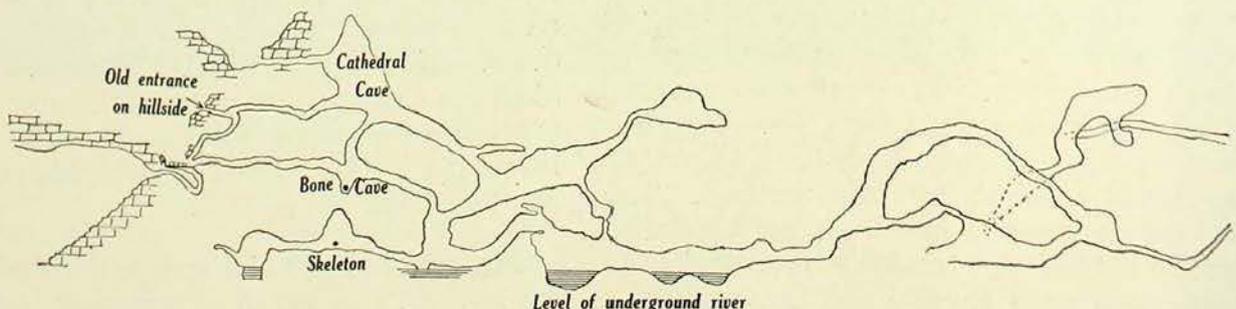
The discovery of this skeleton is one of the rare instances where traces of Australian

aborigines have been found in caves. In Europe it is quite a common thing to find in caves relics of primitive man. Not so in Australia. But we must bear in mind that our aborigines never liked darkness, and then again, the Pleistocene ice-age here was probably not so severe as in Europe, and so they were not forced to take shelter.

What do we know about this unfortunate individual? The supposition is that he gained an entrance into the Cathedral Cave and that in the darkness he stumbled and fell into the Bone Chamber, and finally into the Skeleton Cave where his body found a permanent resting place, his bones to be, in after years, a source of interest for countless thousands of people. Such is fame.

The question naturally rises how old they are. We do not know. Their age is one of conjecture, for there is an absence of an association with the remains of our extinct marsupial fauna. The cave earth and stalagmitic floors of Jenolan, unlike those at Wellington, contain the remains of extant species only. And furthermore, from an anatomical point of view there is nothing in these remains to justify us in postulating a great antiquity for aboriginal man in Australia. We must look elsewhere.

But notwithstanding this negative evidence, the fact remains that the bones are old, very old if we take into consideration the human equation. We are led to this conclusion because the changes that we know have taken place since the introduction of the body into the cave, call for a long lapse of time.



Vertical section of portion of the Jenolan Caves, New South Wales.

[After O. Trickett.]

Organic Evolution.

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

[From a lecture delivered in the Museum, September 2nd, 1926.]

WHEN we look round on animated nature we are struck by the seemingly endless variety and complexity of living things, yet we find that these can be reduced to order and arranged into groups characterised by a fundamental unity of structure. The first and most important division is into plants and animals, which form two great branches or organic kingdoms. In this article we are concerned mainly with organic evolution as exemplified by animals.

CLASSIFICATION OF ANIMALS.

To understand what is meant by evolution it is necessary to have some knowledge of the principles and facts of classification, which depends upon similarity and dissimilarity in outward appearance and internal structure.

Thus animals are first of all divided into two main groups or *sub-kingdoms*, those with a backbone (Vertebrata), and those without (Invertebrata). Among vertebrates there are several *classes*, fishes, amphibians, reptiles, birds, and mammals, each member of a class having the characters of its class. Thus mammals are distinguished by the fact that for some time after birth the young are nourished on their mother's milk. They are moreover warm-blooded, have a hairy covering, a four-chambered heart, and many other skeletal and anatomical features which separate them from the other classes of vertebrates.

Mammals can be divided still further into *sub-classes*. The Monotremes, represented by the platypus and the echidna of Australia, constitute the sub-class Prototheria, the members of which lay eggs from which the young are hatched; the sub-class Methatheria includes the Marsupials, the young of which are born in a very helpless immature condition; the Eutheria or Placental Mammals are born in a more highly developed state, and are distinguished in other ways from the more primitive monotremes and marsupials. In such sub-class there are one or more *orders*; the monotremes and marsupial sub-classes each contain one order only, but the placentals fall into several orders,

ungulates, rodents, bats, carnivores, and others.

The order Marsupialia contains several *families*, such as the Peramelidae (Bandicoots), Dasyuridae (Native Cats), Phascologyidae (Wombats), Macropodidae (Kangaroos). Of these the Macropods are the most numerous and most characteristic Australian mammals; they are distinguished outwardly by their relatively long hind legs and (usually) hopping gait. Of this family there are several kinds, some large, some comparatively small. Of these a number can be grouped together by their close similarity into a *genus*, to which the name *Macropus* is given. Other members of the family receive other generic names such as *Petrogale* (Rock Wallaby), *Dendrolagus* (Tree Kangaroo). But in the process of subdivision we can descend still lower than the genus. The genus *Macropus*, for example, contains several *species*, such as *Macropus giganteus* (Great Grey Kangaroo), *Macropus robustus* (Wallaroo), *Macropus rufus* (Red Kangaroo). The species is the unit of classification, although still smaller groups, sub-species or varieties are sometimes recognized. Animals belonging to the same species are markedly similar in all essential characters and will interbreed and produce fertile offspring. The Great Grey Kangaroo, then, shares the name *Macropus* with several other animals, which resemble it closely yet differ in certain features, but the *specific* name *giganteus* belongs to it alone, and its scientific designation is *Macropus giganteus*, which expresses its zoological position.

Every animal can be pigeon-holed in a similar manner, and we see, therefore, that every animal has a number of relatives, some close, others more remote, relationship being indicated by similarity of structure and reflected in the scheme of classification. It is a very striking fact that animals fall naturally into classes, orders, families, and genera, based on structural features which are used to unite certain forms and to separate them from others. It is one of the problems of the zoologist to explain why this similarity of structure exists.

ADAPTATION.

Another striking feature exhibited by plants and animals is the wonderful manner in which they are adapted to their environment and mode of life. Vertebrates which habitually live and move rapidly in water usually have a torpedo shape and smooth flowing outlines; think of whales, diving birds, and fishes. Birds and bats are wonderfully constructed for lightness and strength to enable them to conquer the air. Climbing and burrowing mammals have well marked characteristics, which fit them for their special spheres.

WHY AND HOW?

For at least two thousand years men have asked themselves these questions. How have species come into existence? Why do animals exhibit similarities in structure which enable us to brigade them into subkingdoms, classes, orders, genera, and species? How have animals acquired the adaptations and fitnesses that excite our wonder and admiration?

There are two answers to these questions. One is that different animals have come into existence by an act of special creation; the other that they are the product of a gradual process of evolution.

If special creation is the true solution, then species are permanent and have always been and will always be the same. If evolution is the master key then species are not fixed but are produced by long continued modification of pre-existing forms. On the hypothesis of special creation animals and plants fit their environment because they were *made* for that environment and for no other. If evolution is true then they have gradually acquired fitness by a long and painful process.

HISTORY OF EVOLUTIONARY THEORY.

The doctrine of special creation is set forth in the first chapter of Genesis; it is a simple and beautiful story. It is also expounded by Milton in *Paradise Lost*, one of the grandest poems in the English tongue. But a story is not necessarily true because it is simple and beautiful, and man always strives after a natural rather than a supernatural explanation of things around him. Long before Milton's time here and there one had pondered the possibility that the different

kinds of animals had originated by the transformation of one kind into another by purely natural processes. Three hundred years before the birth of Christ, the Greek philosopher and scholar Aristotle, one of the most learned men of all time, had glimmerings of this explanation of the complexity and wonder of life. He saw in nature, dimly perhaps, a process of progressive change which we now call evolution.

Aristotle advised men to study nature, but for centuries after his time they ignored nature and sought knowledge only in the works of Aristotle himself. There is probably no parallel in history to this slavish following of authority and consequent halt in the march of knowledge. For nigh two thousand years knowledge of natural phenomena progressed but little, for it was chained to the rock of Aristotelian authority.

So evolutionary theory languished from the time of Aristotle until the middle of the 16th century. But the germ was still alive, and Bacon again proclaimed the mutability of species as the result of variation, declaring that new species could be produced from pre-existing species. By the 18th century the study of nature had advanced considerably, and men like Buffon, Erasmus Darwin, Oken, Goethe, and particularly Lamarck, had formulated and announced the doctrine of organic evolution as an explanation of the formation of species and of adaptation, affirming that new species are derived from old by natural transformation, and that adaptations come by response to environmental needs.

But this was heresy, and all the weight of ecclesiastical authority and of influential naturalists such as Cuvier, then at the height of his fame, were thrown into the scale against acceptance of the transformation hypothesis.

It was not until the publication in 1859 of Charles Darwin's great work, *The Origin of Species by Natural Selection*, that the arguments in favour of evolution were clearly and convincingly set forth. This is one of the most important books ever written, for it transformed the whole outlook of man, and indeed may be said to have inaugurated a revolution in human thought. Sir Arthur Quiller-Couch calls it "the biggest book of this century and a new Gospel for the next to work out."

DARWIN AND EVOLUTION.

The idea of evolution did not, then, originate with Darwin, but it was he who first made a serious and successful attempt to discover a *method* of evolution and gave body to the rather unsubstantial imaginings of his predecessors.

It is interesting to enquire how Darwin was led to make an attempt to solve this age-old problem, and how he was directed to the solution set forth in his work. He had served as naturalist on the surveying vessel *Beagle* on its voyage round the world in the years 1831-6. On the voyage Darwin, at the outset a believer in the permanence of species, noticed certain features concerning the animal inhabitants of different countries, particularly South America, which led him to ponder the question whether species are immutable, or plastic and subject to change. He learned, for example, that the peculiar mammalian fauna of South America was preceded by related but different forms, whose fossil remains are now found buried in the red soil of the pampas. Why should there be this close correspondence between the living and the extinct forms in a given area? Cuvier believed that periodic cataclysms of nature destroyed the living fauna of a country, which was then succeeded by fresh creations, but Darwin could not understand why the newly created forms should show a close relationship to those that had been destroyed. On his return to England this question was still in his mind, and he tells us that in 1837 he commenced taking notes and recording every fact that seemed to him to have any bearing on the problem of the origin of species. For years he continued his observations and accumulation of facts, his notes became voluminous, he continually sifted and abstracted, testing various hypotheses, until in 1844 he was convinced that one species *can* be transformed into another, but for fifteen years more he continued his researches before he felt justified in publishing his conclusions in detail, though the joint abstract by Darwin and A. R. Wallace, an independent discoverer of the principle of natural selection, was given to the world in 1858.

ARTIFICIAL AND NATURAL SELECTION.

Darwin noticed the facility with which man can by selective breeding "create" different races of domestic animals, such as pigeons, cattle, and sheep, the various breeds differing so much in appearance that it is sometimes difficult to believe that they are descended from common ancestors. He set himself to discover some agency which would take the place of the breeder, that is he sought for some process of *natural* selection. Here the key was put in his hand by the reading of an essay by Malthus, who reasoned that as population increases more rapidly than food supplies, population would outrun food production but for the working of factors such as early death, accident, war, pestilence, and other means whereby increase is checked. Darwin, seeking for some check on the increase in animals, found it in the

STRUGGLE FOR EXISTENCE.

It is easy to see that if allowed to multiply without restraint animals would increase so rapidly that the world would soon be too small to afford them room even. For example a pair of birds produce, say, four young in a year. If all the young and the parents survive until next season their numbers would be increased three-fold. But we know that in general there is no such increase. In other animals productivity is much greater than in birds, and the possibilities of increase are enormous. A cod will produce nine million eggs in a season; if every egg hatched and all the young cod reached maturity and in turn produced, in ten years the ocean would be a solid mass of cod. So if all the descendants of a single pair of oysters lived until there were great-great-grand children, which would be only a short time, the mass of shells would be eight times the size of the earth. There must be a tremendous loss of life. Many are born but few survive; of the thousands of seedlings which enter the race only a few become tall timber, and only a fraction of the mosquito larvae that are hatched live to become adults.

It is obvious that the weeding-out process is not a haphazard one, and it must have definite results on the race. On the average the fortunate survivors are in some way better equipped than their companions for

the battle of life. The struggle for existence is so keen that even small variations from the average may turn the scale; a slightly keener sight, a more delicate sense of smell, a little stronger flight, a greater turn of speed, may make all the difference between life and death. No two animals, even of the same litter, are exactly alike, no two blades of grass, even, are precisely similar.

There are various forms of the struggle for existence. Some animals are preyed on by others and so their natural increase is reduced. Animals which have similar food habits are rivals; the rabbit does not eat the sheep, yet, only that its numbers are kept down by its natural enemies and by man, the rabbit would soon make the sheep industry impossible in Australia. Then there is the struggle for shelter, for mates, and for breeding places.

HEREDITY AND DESCENT.

The unfit are weeded out and the fit survive because of some advantage, perhaps very insignificant, that they have over their fellows. The survivors transmit their qualities to their progeny; the unfit leave no descendants, or at any rate a smaller number. Thus the offspring inherit the favourable variations which enabled the parents to win in life's race, these they transmit, re-inforced perhaps, to their descendants. In this manner variations become fixed, and the process goes on through untold ages until the last descendants have varied so much from the original stock that zoologists would no longer class them as the same species, nor perhaps place them in the same genus, or even in the same order. It may be argued that we have no instances of such transformations having been observed in nature. It is true that we cannot point to many cases, though we can instance a few very striking changes which have occurred in relatively short periods of time. But it must be remembered that the span of human life is very short, and that even the whole period during which man has been an intelligent observer is but as a lightning flash in the immensity of geological time.

In general the result of natural selection is an improvement in organization which we may regard as an upward trend, but it must be borne in mind that natural selection

operates merely in the direction of fitting the organism to its environment, and that this process may in certain cases spell degeneration. Parasites are admirably fitted for their peculiar and degraded mode of life; yet they are in many respects degenerate as regards limbs, power of movement, and other characters.

ACQUIRED CHARACTERS.

Besides natural selection there is another possible explanation of evolution, an explanation first clearly advocated by Lamarck and hence called Lamarckism, just as evolution by natural selection is called Darwinism. Lamarck believed, for example, that the giraffe acquired its long neck because it was constantly straining upwards to reach the highest leaves on the trees upon which it browsed. Thus its neck became longer during its lifetime by a purely mechanical process, and Lamarck reasoned that this acquired character could be transmitted. Whether or not the effects of use and disuse, or of characters acquired during life, can be transmitted is doubtful. It is more generally believed that the germ cells, which are the agents of heredity, are not affected by acquired bodily or somatic characters. The Darwinians, therefore, believe that the giraffe is long necked because those individuals which *happened* to have longer necks than their fellows had an advantage in food-getting, they lived longer and left more descendants than those with shorter necks. Long-necked giraffes became the fashion as it were.

EVIDENCE FOR EVOLUTION.

Now what is the evidence for the truth of this process of organic evolution? The evidence may be marshalled under various heads.

(1) *Morphological (structural)*. The fact that numbers of animals can be grouped together because of an underlying similarity of structure, a common architectural plan, surely indicates kinship and descent with modification from a common ancestor.

The presence of *vestigial structures* is a common feature throughout the animal kingdom. These are the much reduced relics of structures which were useful in the ancestral forms but have suffered reduction and will ultimately be lost. They are

therefore of historical importance, and act as signposts along the path of descent. Present day snakes are limbless, but the python and its relatives have vestigial hind limbs, which are mere spurs externally, but on dissection they are seen to contain several of the bones normally formed in a fully developed limb. We infer, therefore, that snakes are descended from limbed ancestors. Whales are the descendants of land animals which have become adapted to an aquatic existence, during which process they have lost their hairy covering and external relics of hind limbs, the organ of locomotion being the tail. But embryo whales have a hairy covering; at birth, however, all the hair is shed, with the exception of a few bristles round the mouth and there is usually no external trace of hind limbs, though a few bones may be found, as in the python, deeply buried in the flesh. In man there are about 180 vestigial structures in various parts of his anatomy.

Special creation offers no explanation of the occurrence of vestigial structures, but if existing animals have evolved we should expect to find such structures.

(2) *Embryological*. Early stages in development throw much light on the past life of a race. All animals pass through comparable phases in embryonic life and the embryos are very similar in appearance. All start from a one-celled condition, the cell divides, forming a solid aggregate or *morula*, from which a hollow embryo, the *blastula* results, and later a two-layered sac or *gastrula*. From this point development differs in different groups. The human embryo, for example gradually assumes the characters appropriate to vertebrates, and of course shares these with other vertebrates. For example it shows four *gill-slits*, and the tail is not only present in the embryo but is free and movable. In the adult human the degenerate tail is concealed beneath the flesh, but dissection reveals its presence, and also rudiments of the muscles which were once used to wag it.

(3) *Palaeontological*. If the animals of to-day are the product of evolution, we should find ancestral forms buried in the rocks which were laid down in mud, sand, or ooze, at the time when these ancestors lived; we should also expect that, under

favourable conditions, we might be able to trace the gradual transformation of series of forms into others, and thus to construct genealogical trees. We do find such evidence, in spite of the lamentable gaps and imperfections in the geological record. Thus we can trace the evolution of the one-toed horse of to-day from ancestors with several toes on each foot¹; we have learned the pedigrees of the camels, of the crocodiles and of several other kinds of animals, vertebrate and invertebrate, by a study of the fossil remains of their forerunners. Indeed geological history offers perhaps the best proof of evolution.

(4) *Zoogeographical*. The facts of geographical distribution of plants and animals afford strong proof of the truth of evolution. If animals were specially created their present distribution would be difficult to explain. Why for example are the animal populations of two countries such as Great Britain and New Zealand so very different, though the climates and physical conditions are very similar? Special creation offers no reasonable explanation. But if we suppose that the course of evolution has been different in the two places owing to the fact that their geological history has been different the difficulty disappears. Why again does the mammalian population of Australia differ so markedly from that of the nearest continent? The characteristic mammals of Australia are the monotremes and marsupials, for the reason that, when Australia was colonized by mammals, the higher forms as we know them did not exist. They were evolved later, but by that time Australia had become an island and higher mammals were unable to enter, except the bats, which can fly, rats and mice, which perhaps crossed the intervening sea on floating logs, and the dingo, which was probably introduced by man. The marsupials, finding no formidable rivals here, evolved in many different directions by a process of what Professor H. F. Osborn calls *adaptive radiation*, so we have a great wealth of marsupial forms in Australia, while in other countries they have become extinct or greatly depleted by the severe competition of higher forms better fitted for life's battle.

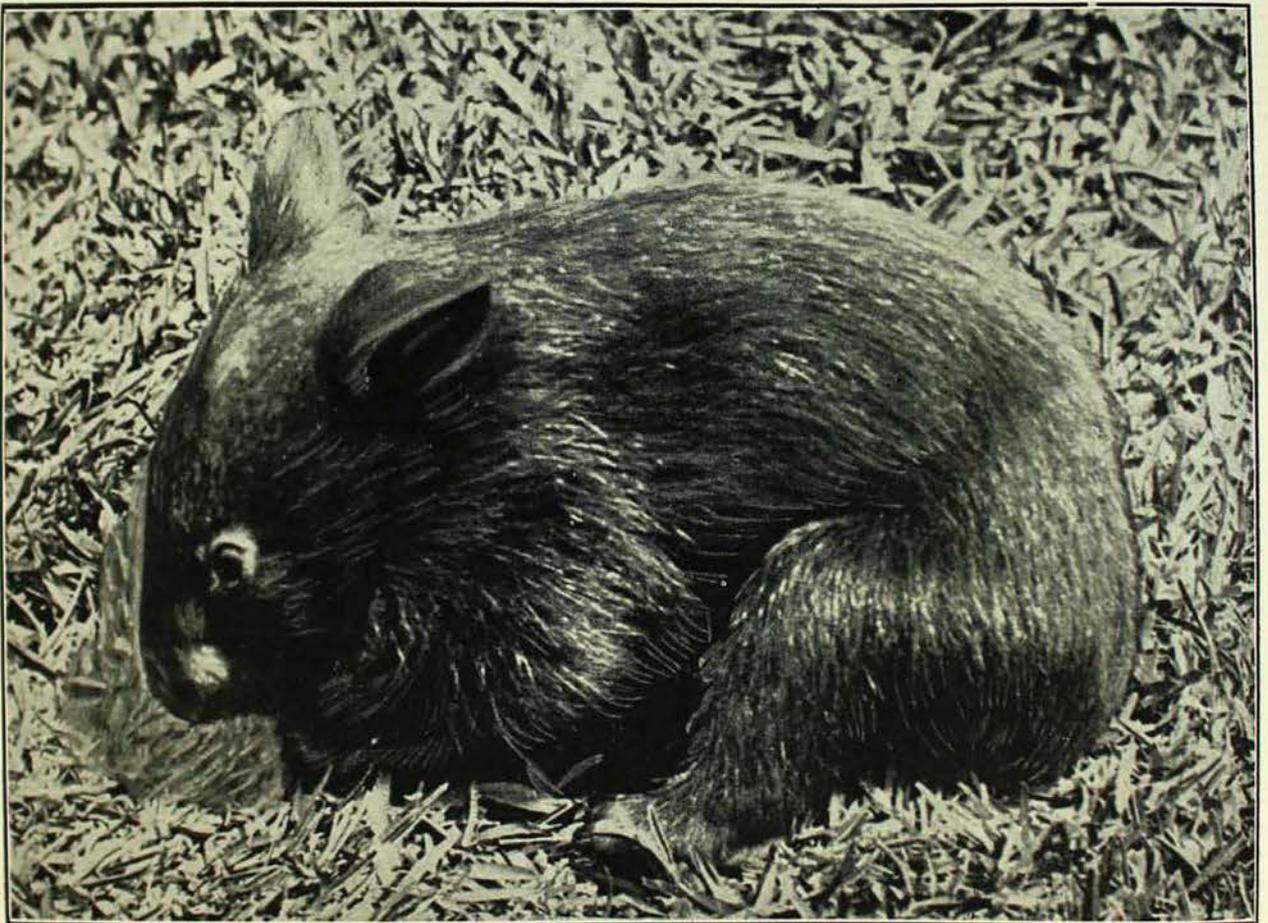
¹See *Austr. Mus. Mag.*, vol. ii., No. 8, pp. 260-265.

Wombats and their Ways.

BY CHARLES BARRETT, C.M.Z.S.

PIONEER settlers — who had perhaps never heard of Bo-bo, son of the swineherd, Ho-ti—enjoyed “roast pig,” or at least an aboriginal dish as delicious to their palates as that which delighted the lubberly Chinese boy. Charles Lamb’s essay is thus linked reminiscently with the wombat. Meat-hunger of families on some remote selections in wombat country, even now,

hilly parts of south-eastern Australia, is notable for differences; none of the other marsupials resemble *Phascolomys*, familiarly known to bush men as the “badger.” He is strong as his form denotes; a mighty digger, and of very independent nature. He is well able to endure hardship, for wombats have been observed standing in deep snow on a mountain slope in Victoria.



Young Wombat, about two months old.

[Photo.—C. Barrett.]

may be satisfied by roasts of *Phascolomys mitchelli*. It is certain that in old colonial days wombat hams, smoked in the wide chimneys of many bark and log huts, eked out scanty food supplies.

But edibility is the least among the wombat’s claims to consideration. Nor does any grace commend it. Our sturdy, unsociable marsupial, still abundant in many

Life above the snowline, in winter, agrees with the wombat, apparently, though his preference may be for haunts where the spartan in him needs no stirring. I have met with wombats chiefly in the ranges, thirty to fifty miles from Melbourne, and have found their burrows where snow falls rarely, if at all. Signs of their presence are plentiful enough, but not often are wombats



The Pit-trap. [Photo.—C. Barrett.]

seen in daytime, when, generally, they remain at home, or rest close to the "door-way," ready to disappear down the burrow at the approach of an intruder.

Since it is a nocturnal animal, we have no complete biography of the wombat: its ways after dark are rather conjectured than known. Of course we are aware that it shuffles from its burrow, on little excursions or long ones, in quest of food—succulent native plants, or the farmers' crops maybe. We know that it breaks through fences, that it has a liking for new hay, and is not a craven when cornered. These, and a few other facts concerning it are familiar to all nature lovers, and the bush naturalist has more knowledge of the wombat's ways. Yet, there is need still for much observation. I attempt an outline sketch only of my subject, and invite others who have opportunities to note and record what they see.

TRAPPING FOR THE ZOO.

Recently I was afield with Mr. Dave Orchard, of Kinglake, Victoria, a keen naturalist, who has lived for many years in country where wombats are numerous. He

has trapped many fine "badgers" for Melbourne Zoological Gardens. The pit-trap is "set" beneath a fence, where wombats have been in the habit of entering the farm land through a large hole broken through wire netting. The pit is hidden by nicely balanced boards. Stepping on to one of these the wombat shoots down an incline about six feet and is trapped. This may happen at night or very early in the morning. The captive, in any case, has no long stay in the pit, a few hours at most. He is raised by means of stout ropes, looped about his body, and carried to comfortable quarters, there to remain until the Zoo lorry arrives: then comes a motor trip to Melbourne.

Another method of capture is to place a large and strong trap of wood and wire-netting in the mouth of a tenanted burrow. The wombat cannot leave home without entering the trap-cage, and when he has passed the "swing-door," he can neither advance nor retrace his steps. He has space to move about a little, and though confined, is not cramped. Scenting danger, a wombat may decline to come out for a day or two until hunger makes him venturesome. Occasionally, the trap is butted away by an angry determined "badger."

Badger baiting, an old English sport, is in my opinion, cowardly and hateful. Wombat hunting with dogs is not much better, though where the animals are very destructive raiding campaigns against them are perhaps justifiable. Hunting them for sport alone is—well, not sport at all.

A wombat, given fair play, may win in a fight with dogs. Many a hound that has ventured deep into a burrow, intent on ejecting the owner, has returned to his master, yelping and limping—the would-be biter has been bitten by *Phascalomys*. A young naturalist, in capturing a wombat desired as a pet, was bitten on the knee, and suffered for weeks afterwards. When, with the valour of ignorance, I put my hand on the head of a newly-captured wombat, Mr. Orchard uttered a warning in time.

Naturally of a grumpy disposition, wombats are not difficult to tame, if captured when young; did not Rossetti, the poet, have a pet wombat which astonished friends who came to dine with him? Mr. Orchard told me of tame wombats that would "live about the house," entering rooms casually, and wandering here and there, like spoilt



The entrance to the Wombat's burrow. The heavy timber in the vicinity had to be shifted by the animal prior to the commencement of the burrowing operations.

[Photo.—C. Barrett.]

dogs. When one was "kicked out," it merely turned and complacently walked indoors again.

A day after its capture, a young wombat at Kinglake, let out for a run, ate grass amongst bracken while being held by a hind leg. It seemed to be perfectly content with its lot, but when released it lumbered toward a big log, and tried to burrow beneath it. Was it cunning that made it feed while being held, and show signs of contentment? Certainly it was off the mark smartly when a chance to escape occurred.

Wombats may appear to be stupid, but they "reason" sometimes I believe. A wombat with two dogs hanging to it made for a fallen gum tree whose branches raised the trunk a few feet above the ground and literally scraped the dogs from its broad back as it shuffled under the "archway."

It was done deliberately, an eye witness declared.

A dog that had been bitten ever afterwards went in fear of another encounter with the "badger." Its terror caused it to shun journeys at night, when, it seemed to know, wombats are abroad. Sometimes it would sleep outside a hut, distant from its master's home, fearing to return before daybreak, when the wombats would retire to their burrows. This was in the early days, when wombats were so abundant in the district that hundreds were shot, to be converted into hams or roasted joints.

The dog story was told to me, and vouched for, by a resident who said also that, had wombats been called "wild pigs," they would have been "eaten out" years ago. Fresh meat was not easily obtained by the pioneers in country where neither sheep nor cattle prospered.



Another view of the burrow showing the "lead-in" track.

[Photo.—C. Barrett.]

UNDERGROUND HOMES.

The wombat's hind feet are provided with strong claws for digging and it has strong teeth that easily cut through roots when the animal is excavating its dwelling, a long tunnel ending in a cosy chamber with hollowed roof, a "cubby" just large enough to fit in, with no room for an intruder.

A rapid skilful tunneller, the wombat, even in ground where rocks and roots offer obstruction, makes long burrows. Some are so extensive that the wombat has a long journey to bed. Burrows explored by "the open-cut" method, have measured more than one hundred feet in length. Through some burrows a child might crawl to the sleeping-cavern; a man might go several yards from the entrance.

Cool places are chosen by the wombat for its burrow. It has summer haunts near a stream, perhaps, and when autumn

comes or is waning, it migrates to higher ground. When rain floods its burrow a wombat will seek temporary quarters in a hollow log, or a deep and roomy rock crevice. It will be comfortable if it can.

Wombats are not fond of company, and, except during the breeding season, live alone. Should two fall into a trap, one is likely to be killed by the other, if they are not removed from the pit fairly soon. The breeding season, Mr. Orchard states, extends through April and June. Each mother has only one infant to rear, and more females than males are born.

Clearing a site for its underground home, the runway, and entrance, the wombat may move heavy logs and other debris. Piled around one burrow-mouth, in Kinglake district, I found logs that were heavy weights for me. Wombats are not afraid of work, though they do doze away many hours. They are built for underground labour.



Wombats seek shelter in or under logs.

[Photo.—C. Barrett.]

They are animal artisans, whose trade is tunnelling and nature has equipped them thoroughly. Examine a wombat's skeleton, it indicates strength and the hind-foot claws are clearly for digging in the ground.

CLUES AND A QUEST.

I have been writing of the common species, the Hairy-nosed Wombat, *P. latifrons* of South Australia. The Tasmanian Wombat, *P. ursinus*, deserves "special mention" and I had something to do with its re-discovery. It is smaller than the common wombat, being about six inches shorter, and it is of slighter build than *mitchelli*, though sufficiently sturdy, and, in my experience, the island dweller is more desirable as a pet than its ally of the mainland.

The Tasmanian Wombat was for long believed to be extinct on the Bass Strait

isles from which it had been recorded. But, in 1908, when a party of naturalists visited Flinders Island, evidence of its survival was obtained. We entered an old hut habitation of a Cape Barren Islander who had an "estate" on Flinders, and on the floor noticed two ragged, moth-eaten fur-mats. They were "badger" skins. These clues were collected for the National Museum, Melbourne, by Mr. J. A. Kershaw, the Curator. Search was made for living wombats, which were said to exist in fair numbers on the island, but none were seen. Subsequently, however, several fine specimens were captured by an islander, and sent to Melbourne. I saw them soon after their arrival, in an enclosure in the museum yard. They were quite friendly.

When in 1909 I landed again on Flinders Island, in Endeavour Bay—named after the ill-fated Commonwealth Fisheries In-

vestigation vessel—I continued the quest for wombats. Fresh footprints, clearly those of a badger, were followed from the beach, above high-tide mark, to the mouth of a low cliff-cave. This was the end of the trail for me. The cave was too small to be entered, so I had to be content with sketching the exterior of the first island wombat's home seen by a naturalist perhaps for many years.

SECURE RETREATS.

In some of their haunts on the mainland, in wild and rugged country, wombats will

survive for a century or longer, if future generations are wiser in conserving native fauna in large sanctuaries than we have been. Settlement is driving wombats further back, but wide areas of rocky hill and dale still remain as nature made them.

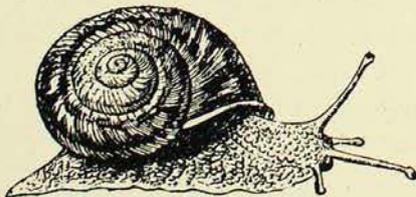
Wombats have little charm for Australians, none at all for the great majority. In other countries they excite interest as curious animals from overseas. Here a live wombat is worth less than £1, but a pair may be valued at £25 or £30 in Africa, America, or Europe.

The "Resurrected" Snail.

BY TOM IREDALE.

THE recent report regarding the snail that had forgotten that it was dead was not exaggerated, but much belated. As the event took place some seventy odd years ago, yet was deemed of sufficient public interest to find a place recently in the cables of our daily papers, the true facts may still be acceptable.

The incident became a classic in scientific circles and similar instances have occurred since. Snails depend largely upon moisture for life, being comparatively recent adaptations to land life. The sea numbers thousands of kinds of sea snails of varied form and beauty, generally with strong calcareous



The Animal of *Helix desertorum* Forskal, drawn after its four years' sleep.

After Baird.

coverings which constitute the "shells" of the seashore. A considerable number have wandered inland, some passing their lives in fresh waters, others boldly taking to a terrestrial existence, and developing air-breathing lungs in place of water-circulating gills. However, they still require a great

deal of moisture for life, frequenting damp places and feeding only after rain or when dew lies on the ground. Through circumstances, probably beyond their control, some of these have become isolated in desert regions, and have acquired the habit of aestivation or dormancy during heat and dryness.

In the cold, wet, and wintry North these land snails developed hibernating habits; that is, at the approach of winter they retire into sheltered crevices and nooks, and, sealing up their mouths with a thin epiphragm, go to sleep. The heart stops beating, and they practically stop breathing too; very slowly and weakly air is respired through this epiphragm. If the weather becomes too cold they compress themselves into a still smaller space in their shells, and probably many die during this season. In the tropics this process is reversed, the snail living in the wet wintry season and sleeping, or aestivating as it is called, in the summer or dry season. In certain places such as deserts, the drought may be prolonged, but the snails continue in their sleep during the dry season whether it be short or long, and thus came about the episode referred to at the beginning of this note.

Some shells were collected in the Egyptian desert, and, as they showed no signs of life, they were, without examination, regarded as

dead. An aestivating snail can be recognized by its weight and coldness, if the epiphragm be out of sight. One of these specimens was mounted on a glass tablet on March 25th, 1846, and placed in a show case in the British Museum. On March 7th, 1850, a mark was noticed on the tablet as if the snail had been trying to move out. The shell was soaked off the tablet, placed in tepid water, and the snail crawled out. A drawing was taken of this animal and is here reproduced.

As confirmative evidence some snails were collected in Egypt and were placed in a sealed box and deposited in the British Museum in February, 1904; others were similarly treated and kept by the collector, the Revd. Dr. A. H. Cooke. Nearly six years afterwards some of the latter were found to be alive, so on January 17th, 1910, the British Museum box was broken open,

and, on the shells being placed in tepid water, some of the snails revived. This gives a definite record of nearly six years' sleep, but in a scientific periodical of about one hundred and fifty years ago a very circumstantial account was given of a snail's reviving after fifteen years' torpidity.

No experiments have yet been carried out in connection with Australian snails, but it is possible that a record-breaker could easily be found here. In the dry interior snail shells are found, and in some cases snails have been seen after rain where previously they had been unknown for many years. Parts of Australia are subject to dry spells lasting perhaps for years, and the snails would continue torpid throughout the period. As a matter of fact such snails have been sent to England by post and have revived, and they commonly live for months in tin boxes in this Museum.

Review.

Mono-alu Folklore. By GERALD CAMDEN WHEELER, B.A. (George Routledge & Sons Ltd., 1926). From Dymock's.

The author spent four and a half months in the Solomons, and for two months sojourned in Alu and Mono, Bougainville Strait, Western Solomons. This fine volume, which was submitted as a thesis for the degree of Doctor of Science (Economics) in the University of London, is the result. The work is arranged into summary, texts, translations, notes, and glossaries. For the most part the stories were taken from dictation by Bitrai, a blind man of Mono-alu, son of the late chief "Big" Gorai.

Folk-tales are an indispensable help to the ethnologist, for they give an insight into the inventive powers and the spiritual and ethical evolution of races, and throw many side lights on primitive customs. The time is not far distant when uninfluenced legends will no longer be obtainable, and Dr. Wheeler deserves the thanks of all ethnologists for the valuable collection of legends and stories presented in the book. The volume also contains an important contribution to Melanesian linguistics.

There is some resemblance in these tales to the sagas of the Norsemen; there is the

same tendency to repetition, the same dramatic quality and staccato style. For example (p. 210) "Mother look up here" said she (daughter). She looked up: the daughter tipped down lime; she killed her. The daughter married. It has been told: it has ended. She killed her mother.

It has been told: It has ended
It is the end."

There is more than a touch of pathos in the following legend (p. 224).

"Once upon a time a woman went: as time went on and went on, she became an old woman: her body got weak.

She went to a river: she took off her skin; she threw it into the river. She came back to the village. Her grandchild was frightened.

'Oh! What art thou afraid for? See, I got old: I have taken off my skin.'

It (the child) was afraid; it cried.

She went there again. She put on her skin: she came back again.

'U, Ue,' she hummed. She became an old woman. She died; men came to their end; we go on dying.

That is the end; it is over."