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Native Cat

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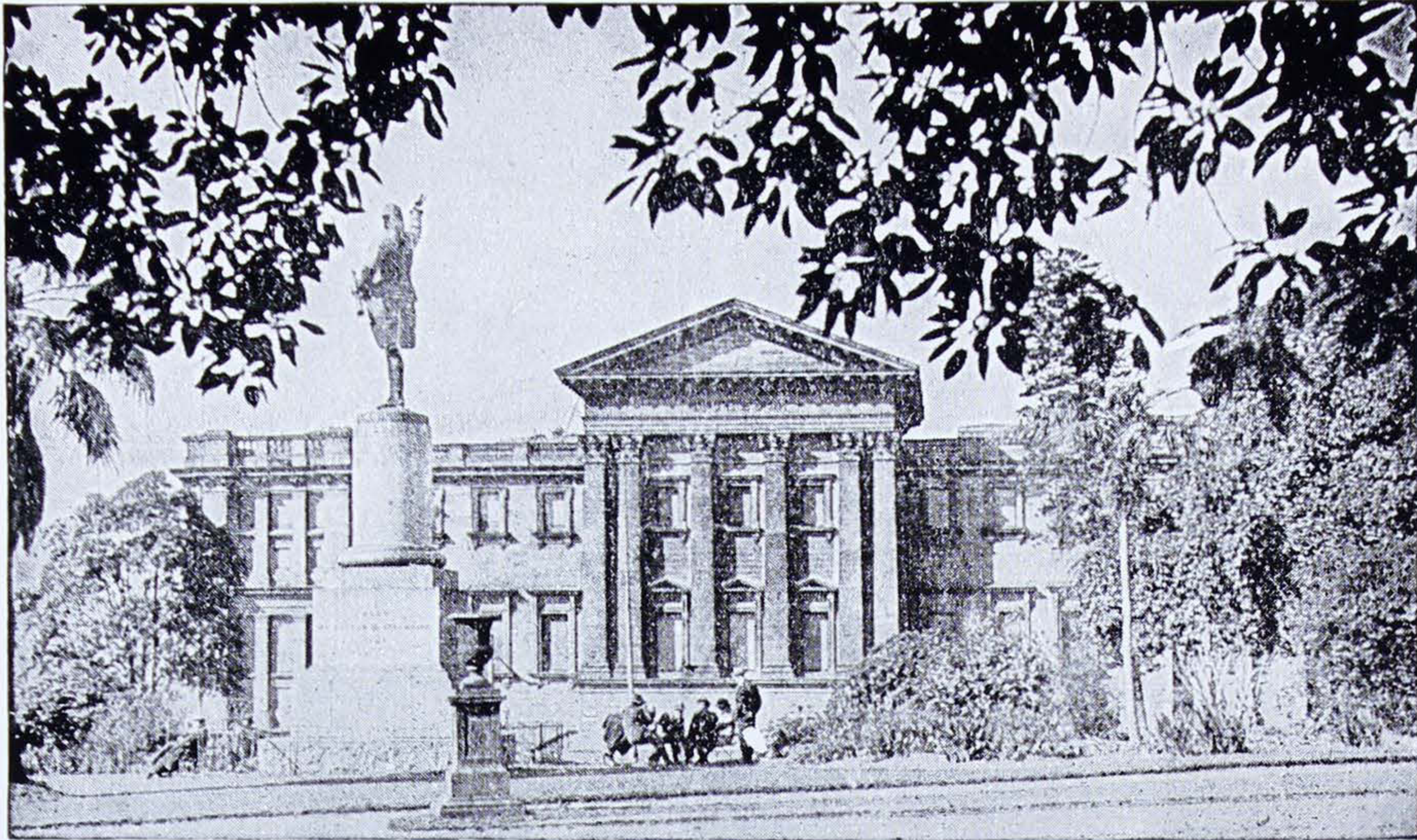
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THE AUSTRALIAN MUSEUM MAGAZINE

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(Photography, unless otherwise stated, is by Howard Hughes, A.R.P.S.)

● OUR FRONT COVER. This appealing “Native Cat,” rescued when young after its mother had been killed by a car, has been successfully reared in captivity and is now an affectionate pet. Turn to page 90 for a descriptive article and a further photograph.



A Fijian woman wearing a necklace of ivory spikes cut from whales' teeth.

(See article on page 95.)

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With the Australian Museum Expedition to Central and North-West Australia.

2. THE TANAMI GOLDFIELD

By H. O. FLETCHER.*

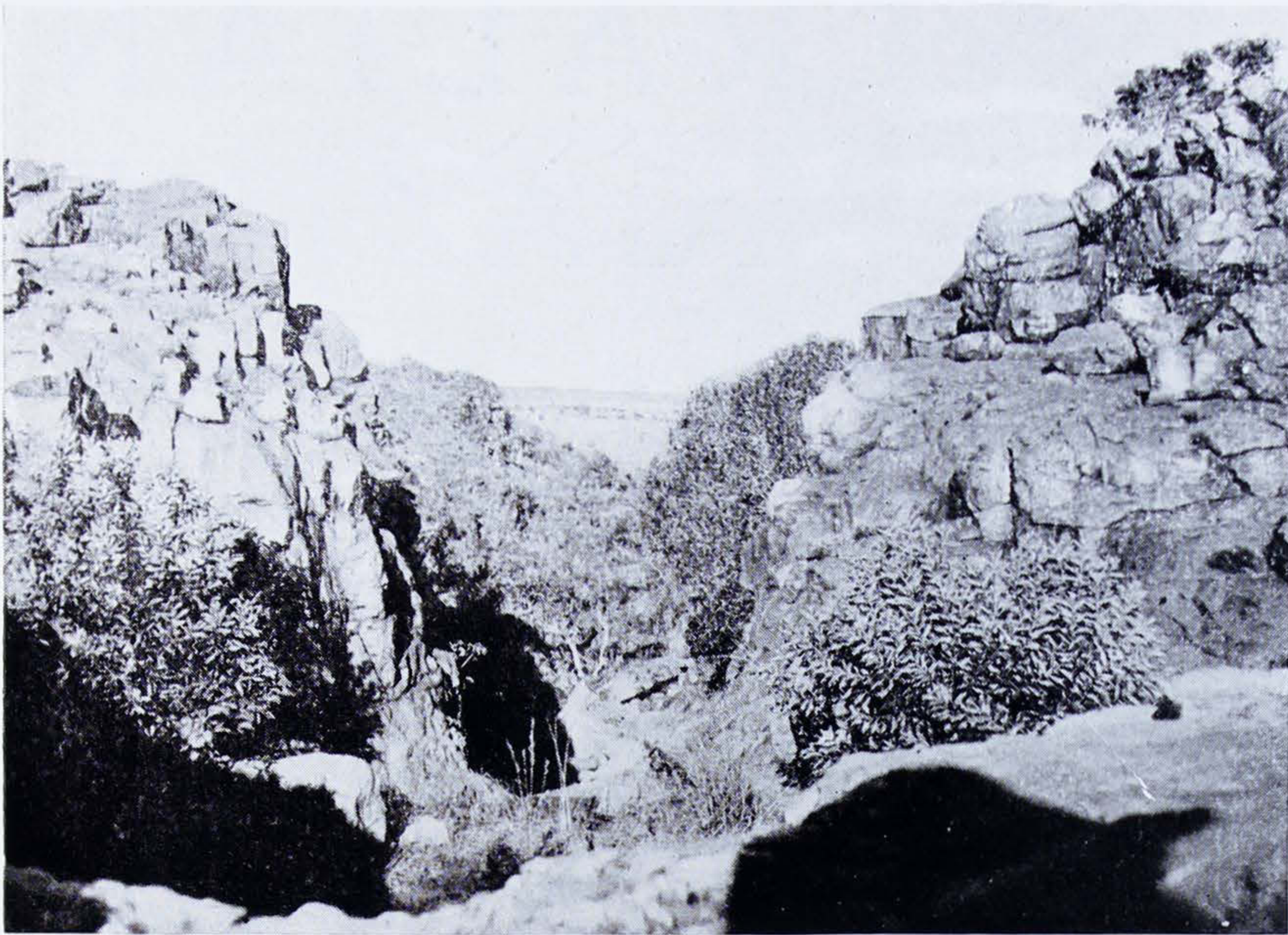
THREE hundred miles west of Tennant's Creek and sixty-eight miles north-west of The Granites is found the now abandoned Tanami goldfield in one of the loneliest parts of the Northern Territory. Although it is on the direct track from Alice Springs to Hall's Creek it is visited by few people as most travellers prefer the longer but more used route through Newcastle Waters and Wave Hill.

The country around Tanami has a general elevation of about 1,400 feet above sea level and consists of a wide plain or plateau with isolated ranges of low elevation, none of them exceeding 250 feet above the plateau surface. The highest and most extensive range is the Gardner Range, which extends south-easterly from Mt. Brophy in Western Australia and extends across the border to the Cargee Rockhole about 30 miles north-west of the Tanami goldfield. The range terminates in a broken series of hills surrounded by sandy desert country.

The first discovery of gold at Tanami, pronounced Tan-a-mee by the natives, was made by Mr. Allan Davidson during an exploratory expedition on behalf of the Central Australian Exploration Syndicate. In 1900 he travelled west from Tennant's Creek and after discovering and naming Granite Hill continued westward into Western Australia for a short distance. Forced to return because of the waterless country he discovered two large rockholes which to his delight contained water. Natives in the vicinity informed him that they called the rockholes Tan-a-mee and that the water "never died". This proved to be incorrect as in 1904 and again in 1910 when more use was made of the water it gave out.

Prospecting was carried out by Davidson and his party on the surface rocks which are mainly slates and sandstones, some quartzites and others tuffaceous in origin. Shortage of provisions made it necessary to curtail any prolonged work and the party returned to Tennant's Creek on the overland telegraph line.

*Photographs for this article by Allen Keast, M.Sc.



Left—The gorge at the Tanami Rockholes with a distant view of the goldfield.

Below — The country north of the Tanami goldfield is covered with ant hills of varying sizes.

It was not long after the news was received that gold had been discovered at Tanami that the first prospectors arrived and in January, 1904, two prospecting parties started operations in the search for gold. Later in the year other prospectors arrived on the field but between them not a great deal of gold was found. A quartz reef, 17 miles south-west of the Tanami Rockholes, yielded prospects of gold while at Davidson's Lode 2 oz. 5 dwt. of gold in specimens and 15 dwt. of alluvial gold were obtained. At this stage the water in the rockholes was exhausted and the field was temporarily abandoned.

In 1906 and 1907 other prospecting parties including some of the original pioneers carried out further work on the auriferous outcrops but with indifferent results. Two good seasons in 1908 and 1909 enabled three prospectors to work continuously on the field for some time and the quantity of gold secured was sufficient to centre public and government interest on the goldfield.

The Government Geologist of South Australia visited Tanami in 1909 for several months and reported that in his opinion the gold discovery was an important one and "that the rich stone found near the surface, and the lodes will continue at depth and can be followed down by proper



prospecting". Shortly after the Government Geologist's report was published two of the original prospectors with a new partner found 21 lb. of rock estimated to contain 180 oz. of gold and also reported the discovery of more alluvial gold.

Following the rather glowing reports of the gold finds at Tanami the number of miners on the field increased and in September, 1909, Mr. Lionel Gee, S.M., who had been appointed Warden and Magistrate at Tanami, left Adelaide to take up his duties. Because of many delays and difficulties in travelling Mr. Gee did not reach the goldfield until 19th December. His party travelled to Tanami from Darwin, leaving the overland telegraph line at Pine Creek and proceeding to Mucka Station, a distance of about 380 miles. Mucka is situated on the Victoria River about 50 miles above Wave Hill and is approximately 170 miles from Tanami.

It is interesting to note that Mr. Gee, in the detailed report of his journey from Mucka Station to Tanami, stated, "I had now been travelling for nine days through country hitherto called 'desert' and was agreeably and patriotically—I think the term fits—surprised and pleased to find so much good pastoral country in it and feel an absolute conviction that it will be utilised some day". He hoped that information embodied in his report would help to dispel "the vague impression or idea, which is so often found to be present in the minds of the general public, that the interior of Australia consists mainly of useless desert".

This rather popular but erroneous conception of inland Australia is slowly disappearing because of an ever-increasing demand for knowledge of these so-called desert areas. The beautifully surfaced bitumen Stuart Highway extending from Alice Springs to Darwin, and the equally good Barkly Highway connecting Tennant's Creek with Mt. Isa in north-western Queensland, have made it possible for tourists to see some of this country for themselves, and not only for its economic potentialities but for its amazing scenic attractions.

Alice Springs is delightfully situated in a valley of the McDonnell Ranges and is now a flourishing town with all the comforts of a city. Negotiations are in progress for the erection of several luxury hotels, swimming pools, bowling greens and other amenities to cope with the inevitable influx of visitors in the future. This would be

hastened considerably if the "western track" extending from Alice Springs to Kingoonya on the Transcontinental line was improved.

The utilization of the pastoral country as envisaged by Mr. Gee has not gone ahead as it should but this fact is due almost entirely to the lack of transport facilities. Central and Northern Australia is the heart of Australia's beef industry with approximately a million and a half head of cattle but it is still undeveloped. Official figures have recently proved that Australia's cattle population has increased by only 3,000,000 in the last fifty-seven years, from 12,300,000 in 1894 to 15,000,000 in 1951. Beef exports have not risen appreciably over the last thirty-five years and have in fact fallen since 1948.

Fast and economic transportation, it is said, would mean increased beef production in the Territory where distances are great and overland droving is, at the present, a necessity. The answer may be in the expansion of air transportation of beef. Results from the air-lift of carcasses between Glenroy and Wyndham are so encouraging that it is possible a great air network will come into being bringing beef from isolated stations to the nearest ports and even to the cities.

Stock route droving, although an integral part of the romance of the country, is now considered to be antiquated, uneconomic and causing an enormous wastage of beef and time. Cattle can be killed at two and three years of age for the air-lift whereas they are usually kept for five years before being overlanded.

Over-production of cattle can result in great losses during drought periods when feed is non-existent or reduced almost to that state. The country then almost possesses all the attributes of a desert. Practically all of the Northern Territory must be considered to be waterless as far as surface water is concerned and although a few waterholes do occur they are widely separated. Underground water is tapped by means of bores and at times deep wells, and rarely has boring not succeeded in producing excellent water even in the driest areas.

When Mr. Lionel Gee arrived at Tanami to take over his duties as Warden and Magistrate at the end of 1909 he was faced with the many difficulties brought about by a severe shortage of water. The Tanami Rockholes, 3 miles westerly of the goldfield, were rapidly drying up and a soakage well put down by the miners in a gorge near the rockholes had proved unsuccessful. The rockholes, which have an approximate capacity of 50,000 gallons, consist of two holes, one above the other, and are situated in a deep gorge on part of the south-easterly extension of the Gardner Range. The range has weathered to an amazing extent and is broken up into great masses of boulders with occasional cliff-like formations. During the visit of the Australian Museum Expedition to the rockholes the lower hole was practically dry but the topmost one still contained a fair amount of water. To obtain water from the rockholes is a difficult task as the climb up to them over the broken surface would prevent any great quantities being carried.

Early in 1910 the miners were in such dire straits because of the threatened shortage of water that the search for gold was abandoned. The weather was very hot, registering 112 degrees in the shade, and with only slight relief at night. All stock was ordered from the field with the exception of two camels and two horses which were required for carting purposes, and the remaining water in the top rockhole was carefully rationed.

Many of the miners left the field but those remaining with few supplies immediately organized themselves into well-sinking parties and the search for water feverishly began. A Government well-sinking party which had been deepening the soakage well put down by the miners without success, abandoned the site and began sinking a shaft about a quarter of a mile east of the gorge. Three shifts of men were kept busy on this new site and work continued night and day. A second party of miners started a shaft 6 miles north of the gorge while another party began sinking a shaft in a valley east of the Reward Claim.

Conditions were becoming very serious on the goldfield when water was reached

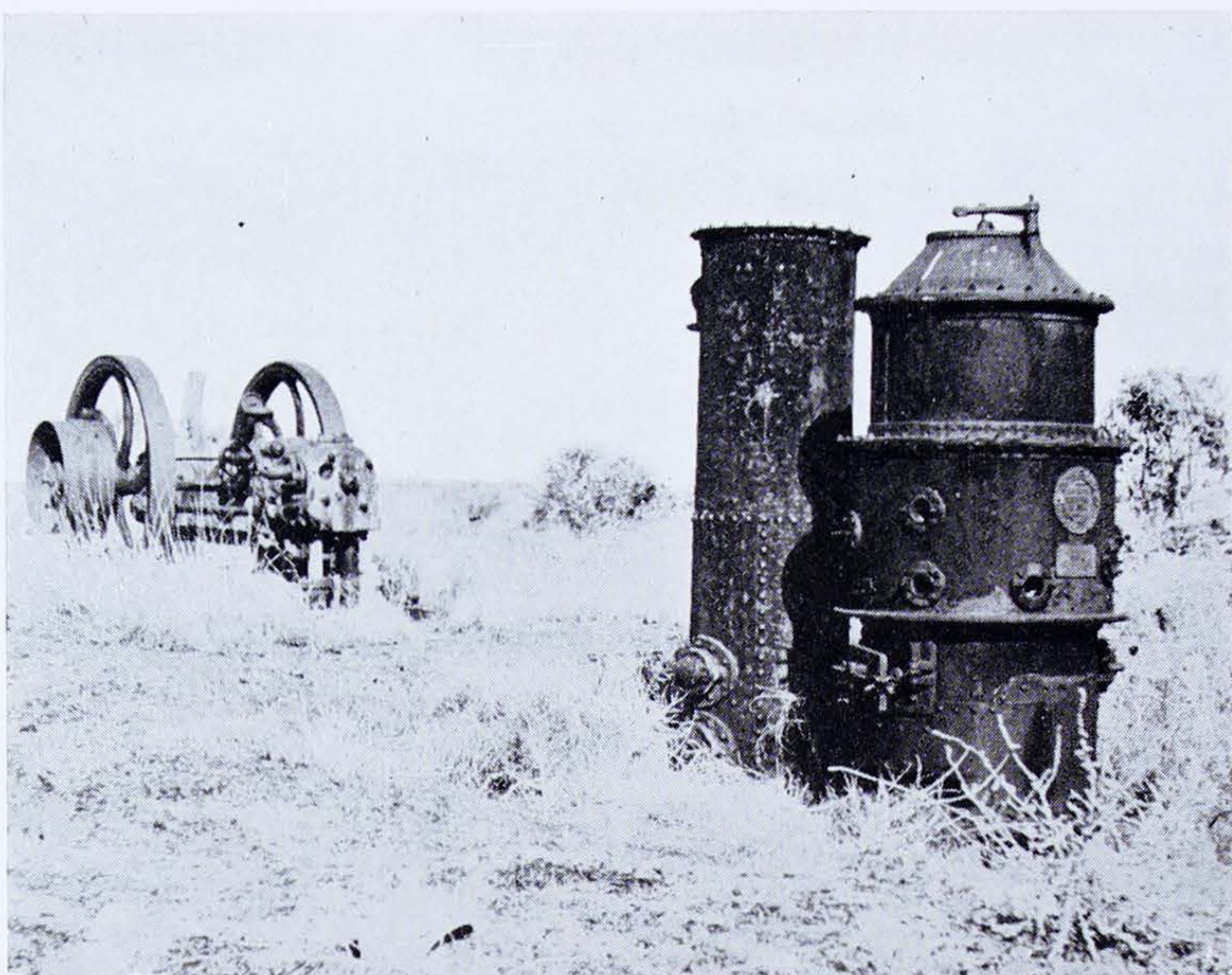
at 52 feet in the shaft north of the Rockholes. This water was secured early in February, 1910, and later at a depth of 60 feet an abundant supply of good water was assured. The Government well at this stage was down 125 feet with only a slight dampness beginning to show, but the work was persevered with and water was struck at a depth of 141 feet. Work still continued and at 163 feet a supply of about 2,000 gallons per day assured a plentiful water supply for the goldfield. The well east of the Reward Claim proved a failure.

Late in February a terrific gale and dust-storm from the east brought heavy rain and in three days 11½ inches of rain had fallen. The wells and the Rockholes were now overflowing and swamps and lagoons covered large areas. Shortly after this the Government well-sinkers put down a shaft 3 miles east of the Rockholes and it produced 4,000 gallons of water a day.

With the advent of good conditions at Tanami there was added impetus to mining operations and the following two years could almost be termed boom years with more than 200 men on the field. A good many of these were not experienced miners and as a result rarely made wages. It was soon proved that Tanami was not a poor man's goldfield as costs were high and expenses in shaft sinking were also high. Very little alluvial gold was now being found and as the gold yield was small many of the miners left the field in search of other employment but always with the full intention of returning when they had earned sufficient funds. The Reward Claim proved to be the richest on the field and at this time good results were being obtained from dry-blowing alluvial debris, from shallow reefing and dollying of the gold-bearing quartz. It was estimated that up to 1911 approximately 2,500 oz. of gold had been won from Tanami.

A large number of shafts were sunk on lode formation and also in the country rock where gold would not be expected to occur. Much of the work was so much waste effort although at times the optimism of the miners occasionally "came good" and gold was found in most unlikely places.

Right — Mining equipment abandoned by early workers on the Tanami goldfield.



Below—An “open cut” at Tanami where early mining operations were carried out.



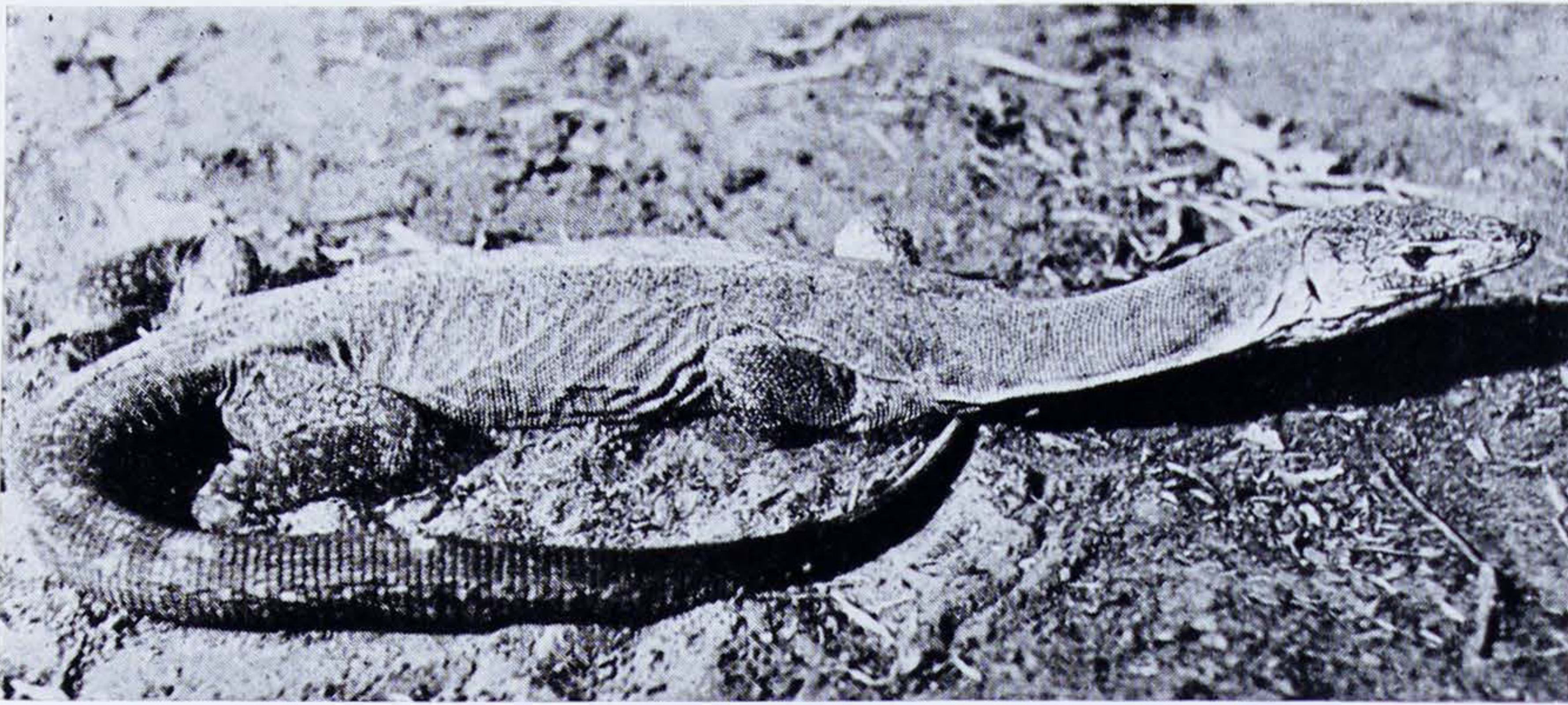
Mining operations were rather spasmodic at Tanami until in 1925 the Tanami Gold Mining Company, N.L., was formed in Sydney and the Reward Claim was taken over. Forty tons of crushing and amalgamation plant and general equipment was purchased in Perth and this was transported by sea to Derby and landed by November of that year.

It was now necessary to transport this heavy equipment overland to the goldfield and within a month motor trucks had suc-

cessfully carried it to Fitzroy Crossing when heavy rain made further transport impossible. The following June it was carried to Soakage Spring Station, about 130 miles from Tanami, although it had already been transported about 487 miles from Derby. It was now found impossible to get the motor vehicles over the sandy country and finally donkey teams were brought into commission to complete the final stage. These teams took 6 tons in each load and they would take about five weeks to do the return trip of 260 miles, an average of about 7 to 8 miles a day—particularly good travelling as the heavy iron wheels of the waggons were sinking more than 6 inches into the sand.

By the end of 1926 this big transport undertaking was successfully accomplished and the five-head stamp battery was then erected. The engines and pumping plant were made ready for use and it was not long before the Company was prepared to start operations. Major difficulties on the field, however, held up work until the early part of 1928 when the battery began operating but after 15 tons of ore had been put through there was insufficient water left for milling and all work had to cease. The Company finally abandoned all operations.

Intermittent work on the Tanami goldfield continued without any outstanding success until in 1938 the Scientific Gold



The Brown or Ground "Goanna," *Varanus gouldi*. This species rarely climbs trees and is found in open country.

Exploration, N.L., conducted a test of the deep laterite formations to the north of the field by sinking deep pits on a grid system. No traces of gold were found and again the field was abandoned.

A report of geologists of the Northern Territory Survey in 1938-39 intimated that the possibilities of obtaining large tonnages of high grade ore from the Tanami field were small. At the present time the field is completely deserted as within the last few months Mr. H. West and his wife, the last remaining Company representatives left on the field to care for the machinery and the only white people in that area, have departed.

The country in the vicinity of Tanami is very interesting from a zoological point of



A donkey team at Gordon Downs Station north of Tanami.

view and during the visit of the Australian Museum Expedition, in 1952, many rare birds and reptiles were met with. The bird life is surprising in its numbers and it was also found that the great majority of the species are very restricted in their distribution. This area has apparently never been a popular one as far as the natives are concerned and, even though the rockholes containing semi-permanent water must have attracted wandering tribes, they apparently did not have any large permanent camps. The early prospectors at Tanami experienced very little trouble with the natives and although there were eleven deaths on the field during 1910 and 1911 they were all due to thirst and exhaustion.

The few natives at Tanami were of great assistance to members of the Museum Expedition in hunting and catching the varied and rather prolific reptilian life found in that area. One of the most interesting lizards was the Mountain Devil, *Moloch horridus*, a most curious and very distinctive species which is restricted to the sandy desert country of the interior. It is about 6 inches in length and the entire surface of the body is covered with tubercles and spines giving the lizard a very forbidding appearance. It is, however, quite harmless. The occurrence of the Mountain Devil at Tanami was rather unexpected and increased its range of distribution to the north as it is more abundant in the southern inland areas. The Mountain Devil lives on ants and its tongue is especially adapted with a sticky extremity so that it experiences no difficulty in picking them up.

Desert living species of "goannas" and "skinks" were also collected. The former have also received the name "Monitor" because of a mistaken idea that in the north they gave warning of the nearness of crocodiles by making a peculiar hissing noise. The "goannas" are well represented in Australia but the rarer inland species are much smaller in size than the species found on the eastern coast. One of these, *Varanus giganteus*, grows to a length of more than 7 feet and this species is small when compared with the 12 feet "dragons" of the Komode Islands of Dutch New Guinea, a form described as *Varanus komodoensis*.

During the search for rare species of birds a dusk and night vigil was kept at the Tanami Rockholes by members of the expedition in the hope that rare open country and fast flying birds, including the nocturnal Night Parrakeet, might visit the waterholes. Very little is known of the life-history of the "Night Parrakeet" or as it is sometimes called the "Spinifex" or "Ground Parrakeet". In recent times there has been no authentic record of its occurrence in any of the haunts where it was collected originally and the species is

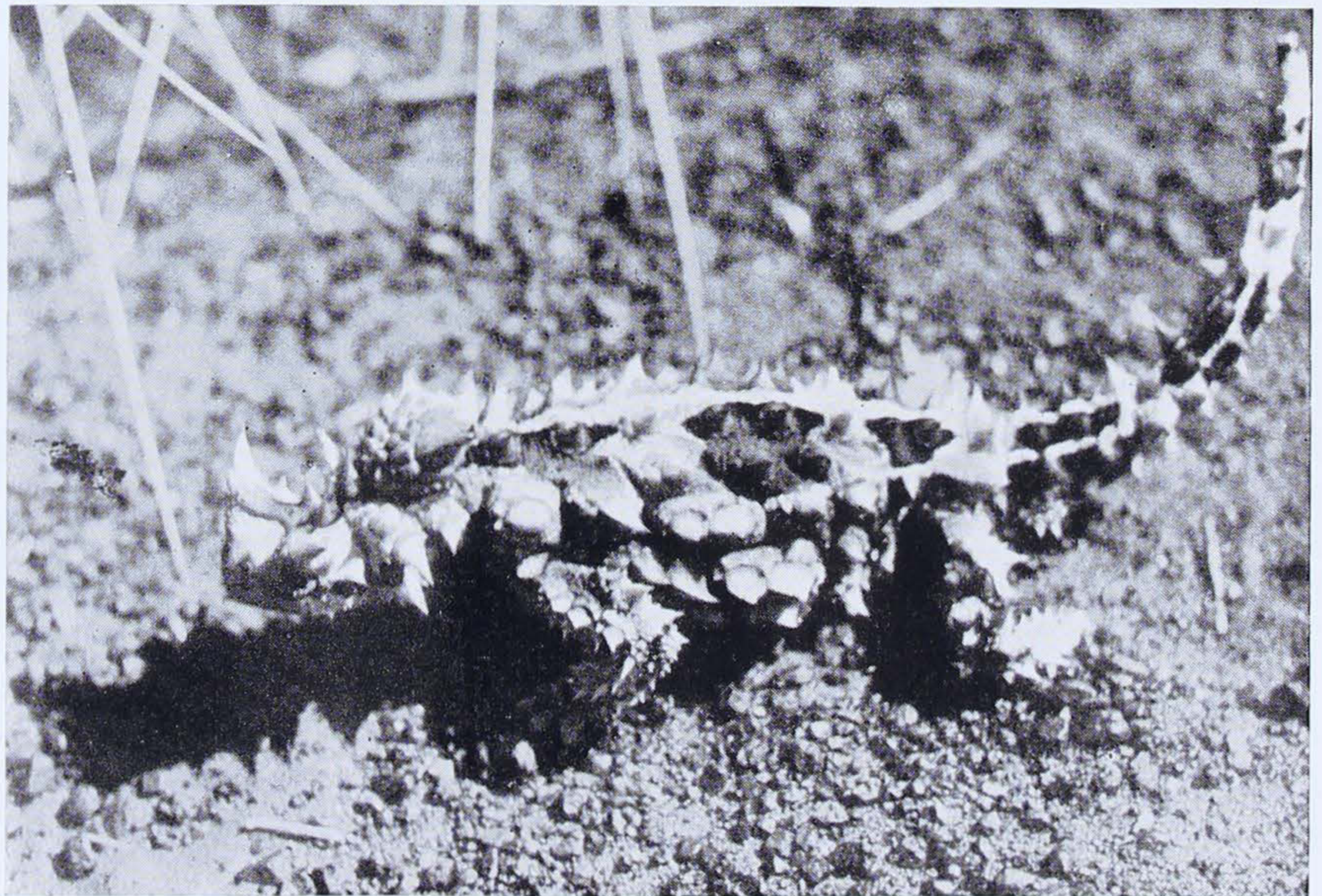
now thought to be almost, if not quite, extinct.

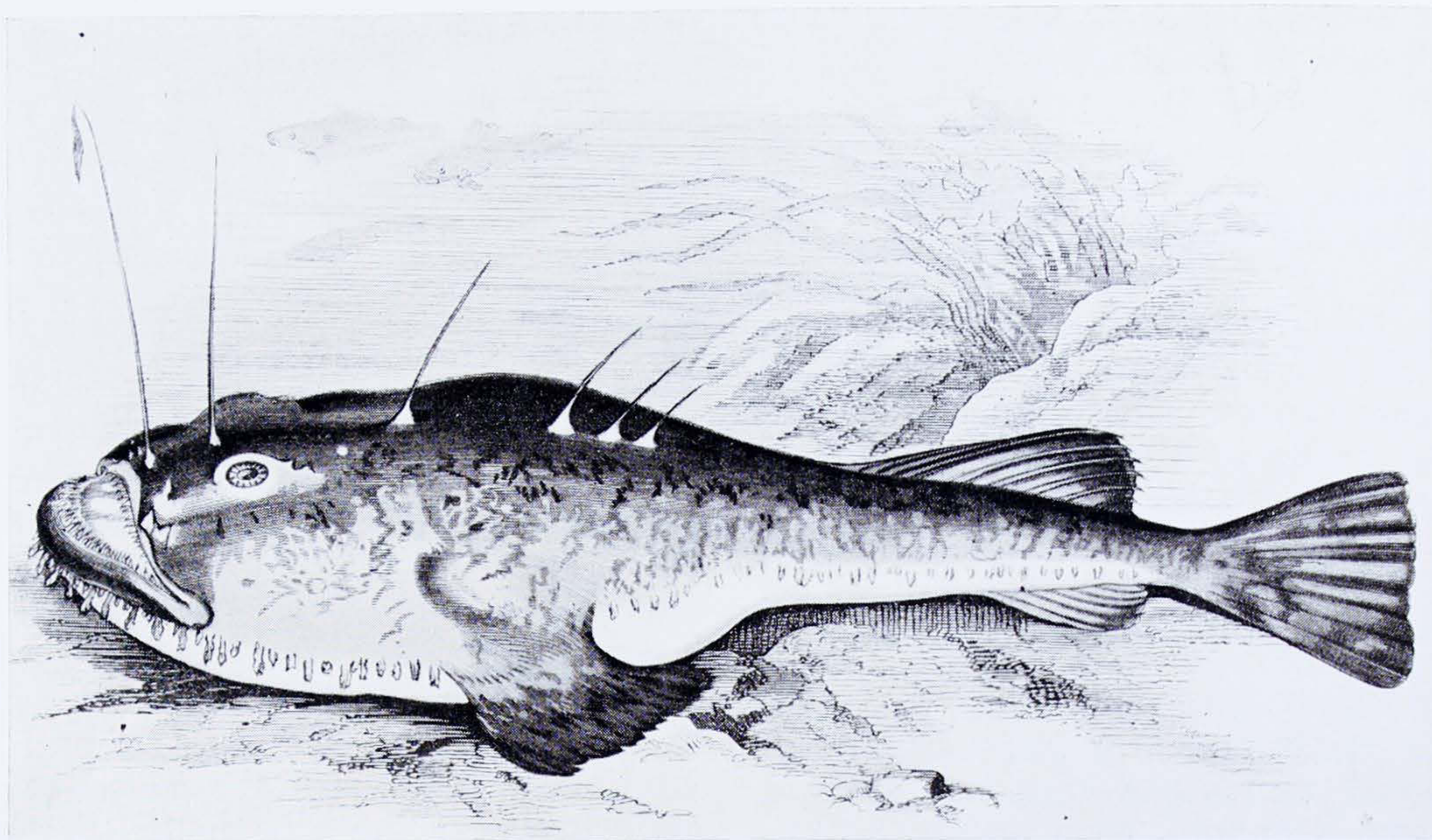
Careful search has been made by many people in many parts of Australia without any great success although it has been reported that specimens have been collected. The most extraordinary feature of the Night Parrakeet is that it is nocturnal, living throughout the day in the rocky caves of ranges and coming out at night to feed. Its general colour above is yellowish-green with dark-brown bases to the feathers and its known distribution was south to southwestern Australia and Central Australia.

Some excitement was caused at the Rockholes when in the darkness the whir of wings was heard approaching and after circling a few times the noise of birds alighting near the waterhole. Several of these birds were captured but they proved to be the common Bronze-wing Pigeon.

The collections made at Tanami included a variety of interesting creatures which have adapted themselves to living in a semi-desert environment. The series is a representative one and is invaluable for comparative purposes in research and there is little doubt that new species or races were found.

The Mountain Devil, *Moloch horridus*, one of the most curious and distinctive of the Australian lizards.





Lateral view of the Angler, showing the dorsal fin rays (the anterior with the lures), the large mouth with the many teeth, the dorsal eye, and the lappets along the edge of the mouth and body.

After Couch.

The Anglerfish, *Lophius piscatorius*

By E. W. GUDGER, Ph.D.,

American Museum of Natural History.

THE Anglerfish is the most out-of-the-ordinary fish in its structure and habits of any on the American Atlantic coast. Its huge sub-circular head is greatly depressed and flattened dorso-ventrally and expanded frontally and laterally and is about as wide as long. The Angler is mostly head and, barring its pectoral fins, its general outline is something like that of a tennis racket or a banjo. The short stubby body is widest at the rear edge of the hand-like pectoral fins. Behind these it falls away rapidly in the hinder section, reaching to the small tail. This gives a tadpole appearance to the Angler—hence the name Frogfish sometimes given to this remarkable fish. It attains a maximum length of about four feet.

Most noticeable is the mouth, nearly as wide as the head. The jaws, each with many backwardly pointing sharp slender teeth, are much in evidence—not unlike

those of a steel trap. The pharyngeal bones of the floor of the mouth bear teeth, also slender, sharp-pointed and backwardly hooked. Any object of prey caught in this complex steel trap has but one path of progress—onward into the stomach. The lower jaw is protrusible and drops down, readily increasing the gape of this great mouth. The upper jaw and head parts can also be raised while the lower jaw remains unmoved on the sea bottom. Thus the mouth becomes truly prodigious, as seen in the photograph on page 79 of a relatively small specimen (about two feet long) in the old New York aquarium. No other fish—not even the Whale Shark, *Rhineodon typus*—has proportionately a more cavernous organ.

These mouth and head peculiarities have led to the application and use of various apropos colloquial names—Frogfish or Fishing Frog, Allmouth, Wide-Gab, and most appropriately, Angler.

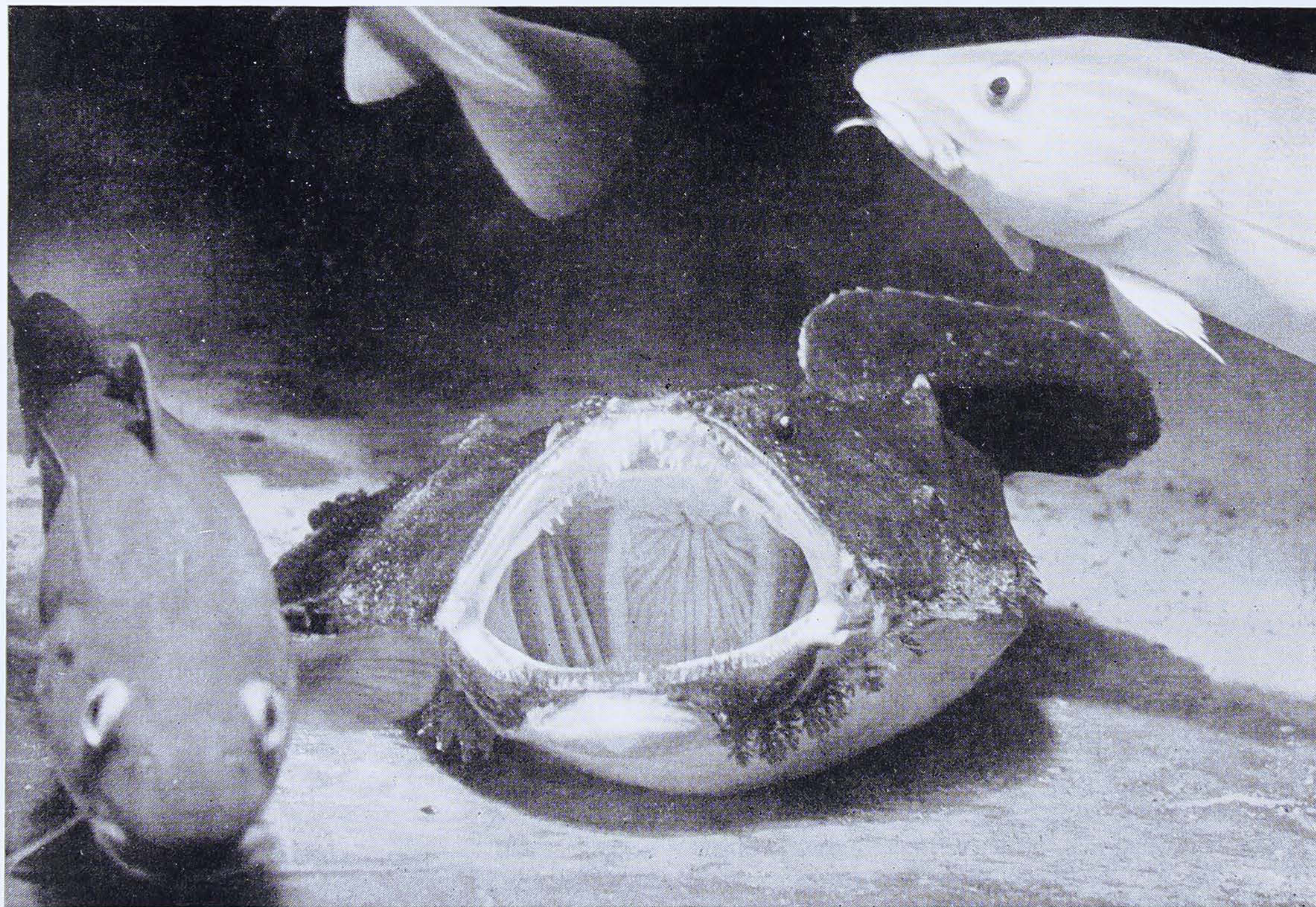
Among the most striking of all the fish's minor organs or structures are the dorsal fin rays. Two are placed far forward. The anterior is of most interest because it has at the tip a fleshy body—the lure—overhanging the mouth, of which more in a moment. These rays are well shown in Couch's figure, 1869 (see drawing on page 78) the only figure found which adequately portrays the body in lateral aspect. Note also here the fleshy lappets along the side of head and body.

THE FOOD OF *LOPHIUS PISCATORIUS*, THE ANGLERFISH.

The sight of his formidable mouth naturally raises the question "On what does *Lophius* feed and how does he obtain his food?" *Lophius* feeds on fishes, crustaceans, worms—and on various other pelagic organisms. In fact, according to those who

have watched the feeding of the Angler and have examined its stomach contents, almost any marine animal is grist for his mill—his insatiable stomach. In his huge stomach have been found not only the fragments of many kinds of bony fishes, but even the remains of small sharks, rays, and skates. And, strange as it may seem, as will be seen later, he feeds on oceanic birds—gulls, cormorants, widgeons, scoters, loons, guillemots and wild geese—hence the name goosefish. However, he prefers the common run of small bony fishes—small round fishes, devoid of spines, which are easily swallowed, such as eels, herring, alewives, cod, tomcod, hake, haddock, butterfish and flatfishes.

Since the Angler feeds mainly on small fishes, now comes the question, "How does this clumsy fish get close enough to his agile prey—or how do these small fishes come in reach of his huge mouth with its multitude of sharp teeth in each jaw?"



Frontal view of the open mouth of a smallish specimen of *Lophius* (about 2 feet long) taken in the old New York Aquarium.



Lophius in his "bed" of gravel and sand at the bottom of an aquarium tank in the Plymouth Aquarium. The camouflage is so perfect that on the anterior left one cannot make out the outline of the fish.

After Douglas P. Wilson.

HOW LOPHIUS, LYING PRONE ON THE BOTTOM AND USING HIS LURE, FEEDS ON SMALL FISHES.

The answer suggested in the above subtitle is a very interesting one. It is the outcome of four accounts of studies on Lophius from four separate observers, two from classical and two from present-day times. First the classical.

The earliest account of the fishing of Lophius is appropriately from him who is well named the "Father of Natural History". Thus Aristotle (384-322 B.C.) writes, as translated by Sir D'Arcy W. Thompson (1910, p. 620b)¹,

"The fishing frog (*Lophius piscatorius*), sometimes gets its prey as follows: when the animal stirs up a place full of sand and mud and conceals itself therein, it raises its filaments [especially the anterior one with the lure], and when the little fish strike at them, it draws them underneath its mouth."

¹ *The Works of Aristotle*, iv.

It should be noted that there is no indication of a lifting of the head and body to promote ingestion. Aristotle's account stands as the first, but not the last, of its kind.

Couch (*History of the Fishes of the British Islands*, ii, 1869, p. 205) after commenting on the tadpole-like appearance of our big-flat-headed fish, notes some of the "exquisite contrivances" with which he fishes, and the fact that these attracted the attention of various ancient observers. Then he quotes the Roman writer Aelian (fl. c. 120 A.D.) as follows:

"This Toadfish . . . for concealment hides itself in some muddy place, where it keeps its body unmoved, while it lifts up and stretches out its line and bait. Little fishes that are wandering about are soon attracted, and begin to nibble, which the Angler is quick to perceive; and then it proceeds to move the line in a cautious manner, so as to lead the prey, without alarming them, into the gulph of its jaws, which close upon them beyond the power of escape."

Two classical writers have been quoted that *Lophius* with his lure entices small fishes to his closed mouth and opens it just enough to take the little fishes in. Two present-day writers will now be quoted in corroboration of the ancients.

Bigelow and Welsh, in their "Fishes of the Gulf of Maine" (1925), quote on page 528 a correspondent (in whom they have confidence) as follows:

"W. F. Clapp, who has often watched the feeding habits of the goosefish (*Lophius*) at low tide in Duxbury Bay, Mass., where they are very plentiful, describes them to us as lying perfectly motionless among the eelgrass with the tag or "bait" on the tip of the first dorsal ray swaying to and fro over the mouth, either with the current or by some voluntary motion so slight as to be invisible.

"The only fish he has seen them take are tomcod, and when one of these chances to approach, it usually swims clear up to the "bait" but never in his observations actually touches it, for, as soon as the victim is within a few inches, the goosefish simply opens its vast mouth and closes it again, engulfing its victim instantaneously. These observations are the more welcome as no other recent student seems to have seen the feeding habits of this species in its natural surroundings, and they show that it depends mostly on such fish or crustacea as stray close enough to be snapped up from ambush."

The latest account of this peculiar behaviour of this remarkable fish that has come to hand is from the pen of Douglas P. Wilson, Naturalist of the Plymouth Laboratory, England. His long-time observations were made on Anglers in large glass-fronted aquaria, with the bottoms covered fairly

deeply with sand and gravel on which the "fisherman" rests. Specifically he noted that they spend the greater part of their time resting quietly on the bottom. Wilson² notes in careful detail that:

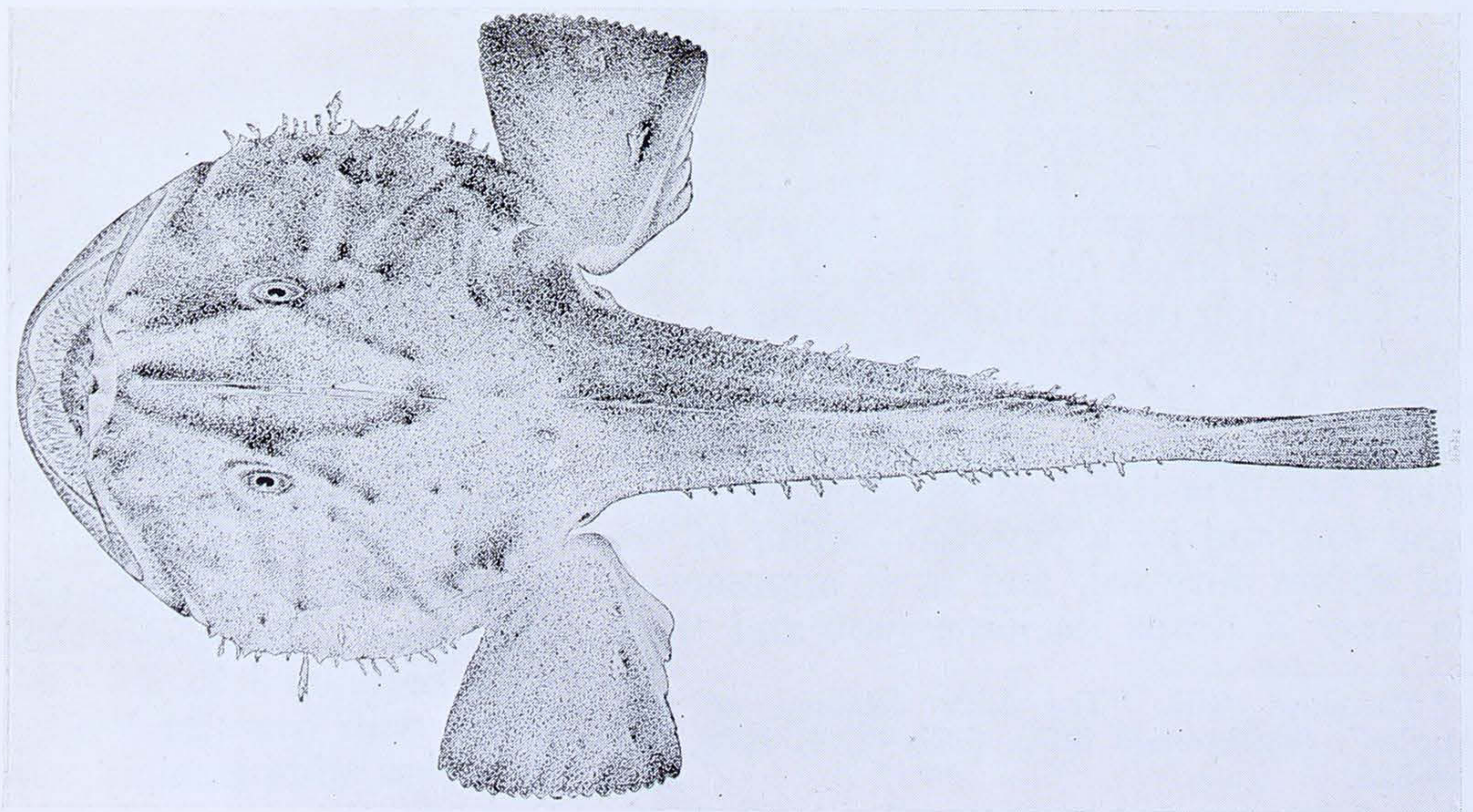
When the angler-fish settles down in sand or sandy gravel it digs for itself a small hollow to accommodate the deep rounded under parts of head and abdomen. The pelvics [which are situated under the middle under side of the head] shovel the sand and any pebbles somewhat forwards and outwards and the pectorals push this material away to either side . . . In a few minutes the hollow is made and the angler backs into it. One or both of the pectorals flick a few grains of sand over the back, as the fish finally settles down, it slightly raises its head and then lowers it rather smoothly. By this action water is driven out from under the fish and, flowing away on all sides, spreads out the irregular tags of skin that fringe the lower jaw and sides of the body. The tags then settle neatly on the surface of the sand alongside. At the same time the pectorals spread themselves flat over the ground. In this position the coloured upper surface of the angler-fish is almost flush with the surrounding surface.

Notable is this detailed statement by Wilson of how the Angler gets himself and his surroundings ready for the fishing. This results in the most remarkable camouflage known to the present writer. This camouflage is so perfect in every detail—colour mottling grades into the tone and texture of the surrounding bottom and the tags break up the outline of the body. Sometimes these make the fish hard to find—as Wilson's photograph (his Plate 1) shows.

² *Journ. Marine Biol. Assoc. U.K.* xxi, 1937, p. 485.

Lophius seen from above. Note the huge, well - nigh round head, the great pectoral fins, the short, stubby body, decreasing to the tail. The general shape is that of a tennis racket or a banjo.

After Goode and Bean.



Even small organisms crawl over the fish without knowing that it is not gravelly bottom and without disturbing the fish. Lophius is now organized for business—the business of getting his dinner. For this he will use his lure for small fishes. Wilson has a section of a page and a half on the use of the lure. The lower jaw is unmoved in taking in this prey. For small fishes the upper jaw and head are raised so slightly as to cause little or no disturbance. The little fish slips easily into the vacuum of the cavernous mouth. Wilson says of the whole process that “It is too quick for the human eye to see”.

These accounts from the ancients, Aristotle and Aelian, and two moderns emphasize the immobility of Lophius—save that when the Angler brings the fishes close to the mouth, this opens a little and the fishes are drawn into it with the water as a partial vacuum. But although the Angler prefers small fishes, he does feed on large fishes (some half his length) and the question at once arises how can he, while lying prone and motionless on the sand, open his mouth enough to admit his larger prey?

HOW DOES LOPHIUS CATCH LARGE FISHES?

Lophius undoubtedly sometimes feeds on large fishes. It has been noted that in the stomach of this fish fragments of sharks and rays (size not noted), also bony fishes half the length of the Angler, have been found. Couch (1869) states that from the stomach of one specimen were taken twenty-one flounders of such size and so uninjured that, when washed, they sold on the market. But how does he catch these large fishes? Dr. Theodore Gill³ (1905) states that when their curiosity aroused by the lure has brought the larger fishes so near the Angler can leap upon them and engulf them in his capacious mouth. To the present writer the *modus operandi* must be the following—when the larger fish come close enough the great fish lifts itself on its hand-like pectoral fins and by a powerful action of its tail drives forward, and as it approaches its prey it drops its lower jaw and thus

opens its cavernous mouth and by suction takes in its larger prey. To effect this, possibly he lifts his upper jaw and the huge head to which this jaw is solidly affixed. How can this be done? The answer is to be found in the abnormal structures of the hinder skull and particularly in the modified anterior cervical vertebrae. This has been explained by Couch, the British ichthyologist (1869). After discussing the capture of oceanic birds by Lophius (of which I shall have more to say in a moment), he goes on to say:

“And, however difficult it may be to imagine how it can happen that such an apparently unwieldy fish has been able to lay hold of the active birds and fishes we have mentioned, some portion of the difficulty will disappear when we know that in addition to the width of gape and stealthiness of approach, by a particular construction of the uppermost [anterior?] portion of the chain of [neck] vertebrae, by which a distance is preserved between the upper processes of those bones nearest the head and the head itself, the head [and attached upper jaw] may be lifted without any motion of the body; which is contrary to what takes place in the generality of fishes.”

In other words, there are, behind the skull of Lophius, vacant spaces between the skull and the dorsal spines of the modified anterior cervical vertebrae. Thus, when Lophius lifts up his head, the back of his skull meets with no obstacle and descends somewhat into the vacant space left by the backward slanting of the dorsal processes of the first two or three spines of the cervical vertebrae. Thus as the saying goes—“It can almost lay its head on the back of its neck.”

WHY LOPHIUS IS CALLED THE GOOSEFISH.

Couch, as we have seen, mentions the capture by Lophius of ocean birds and water fowl and it is this habit which has given Lophius one of its many common names, the Goosefish. Personal knowledge of this most extraordinary feeding of Lophius came to the writer on November 19, 1928, when Mr. Feodor Polevoy of Staten Island came into my office in the American Museum carrying a gunny sack in which was some large, weighty and flexible object. The sack, when emptied, gave up a Lophius 3 ft. 1.5 inches long and 15 inches wide over the head, having a mouth 10 inches wide straight across the interior

³ Theodore Gill, “The Life History of the Angler”, *Smithsonian Misc. Coll.* 47, 4, 1905, pp. 500-516.



A very large *Lophius* trying to engulf a large loon at the surface of the water.

L. B. Hunt, *del.*

from angle to angle, with a vertical gape of only 6 inches.

On November 18, 1928, Mr. Polevoy and some friends were out duck shooting on Raritan Bay, New Jersey. In the faint light of early morning, when some five miles off shore, they saw something thrashing about at the surface. On drawing near they found a large (and to them unknown) fish with a bunch of feathers protruding from its wide mouth. The fish seemingly could not dive, so they got their boat alongside, caught the fish and with their hands pulled it aboard and found that it had a good-sized seagull stuck in its throat. This

the fish could neither swallow nor disgorge. Possibly the stomach was filled with air, while the bird, anchored by the inwardly projecting pharyngeal teeth, was held in the throat and plugged it. Incidentally, it would seem that the bird must have been caught while it was floating at the surface where the engulfing of such bird by the fish would be made possible by the dropping of the lower jaw. For the complete story and for a brief review of similar occurrences noted in the literature, see my article published in *Natural History Magazine* for March-April, 1929. One of the artist's illustrations from that article is reproduced on this page.



Panoramic view of dumps on the "Three-Mile."

Photo.—V. Bolton.

New South Wales Opal Fields

2. LIGHTNING RIDGE

By O. le M. KNIGHT.

BLACK opal was unknown until Charlie Nettleton, in 1902, found some specimens while prospecting on what is now called the Six Mile at Lightning Ridge. Buyers in Sydney refused his first parcel and later a well-known London dealer in gems expressed doubt as to whether black opals were, in fact, a product of nature.

To the uninitiated, the name Lightning Ridge suggested a desolate and forbidding country where men are held only by the lure of jewels, but it received that sinister name because a mob of sheep was destroyed there by lightning. The native name is the euphonious Wallangulla, the meaning of which is not clear, but it has never been revived and the black opal centre has remained Lightning Ridge.

The first visit to Lightning Ridge soon dispels any thought of desert. On the 46-mile stretch of road from Walgett (430 miles north-west of Sydney) the traveller

passes over black and red soil plains through long stretches of country timbered with Box, Belah, Mulga, Leopardwood and the beautiful shady Wilga. The rainfall is not great and watercourses are broad, shallow and dry. But one does not associate a desert with a 15-inch rainfall, and even the watercourse known as the Big Warrambool, which one crosses by a long, low-level, timber bridge, about 13 miles from Lightning Ridge, occasionally lives up to its name.

Lightning Ridge lies about 5 miles north of the road from Walgett to Angledool, the turn-off being 41 miles from Walgett. After leaving Walgett and following the Barwon upstream for 8 miles, the well-surfaced highway turns off to the north-west. In dry weather it is a speedway, in wet, portions of it become impassable.

Thirty-three miles after leaving the Barwon the romantic signpost of Lightning Ridge points to the north and 3 miles pass



before the first sign of a ridge appears. The rise is almost imperceptible; it is only when the crest is reached at a height of 60 feet and one looks back over the tree-covered plain that there is any impression of being on a ridge. The horizon extends in a uniform and unbroken line in all directions. Here for the first time appear the "dumps"—mounds of white opal rock that proclaim the labour that has gone into the search for gems. Through these dumps, sometimes scattered and sometimes so closely grouped as to blend into one another, the road passes groups of diggings whose local names record the history of the early days: Nobby's, Dry Rush, Cleared Line, Telephone Line, etc., and after a couple of miles descends a rather rough stretch into the town of Lightning Ridge.

In the middle of the one intersection stands the Tree of Knowledge; on the corner to the right is the Imperial Hotel, and next to it the Store. Across The Street is the Post Office and scattered up and down The Street perhaps twenty wooden buildings which comprise the new town. The old town of the "rush" days was about a mile to the east. Nothing of it is now to be seen excepting the old slaughter yards, still in use.

The unnamed main street runs north-east and south-west. To the north-east, within a radius of about 2 miles, lie the old diggings known as Potch Point, Bald Hill, Angledool, Old and New Chum, Sim's Hill, and Canfell's Hill. Mick Canfell, who made the strike at the hill named after him, still adorns the town and can entertain with stories of nearly fifty years ago. To the south-west, just beyond the town, lie the Newtown diggings, and further south the celebrated Three Mile. All of these areas have produced black opal but when one asks where the best came from no two answers are alike.

The Three Mile is the dominating feature of Lightning Ridge—the Mecca of the traveller's pilgrimage—so one turns to the left down the main street which comes to an end in about a quarter of a mile. Here a track leads away to the south-west. Immediately to the south a slight rise is dotted with the dumps of the Newtown diggings, while just ahead lies the Government Tank, the main water supply for the town.

Passing these the track veers towards the south and soon enters country timbered with thick scrub. In a mile the timber begins to thin out and the first of the Three Mile dumps are sighted. These multiply as the main ridge is reached, until

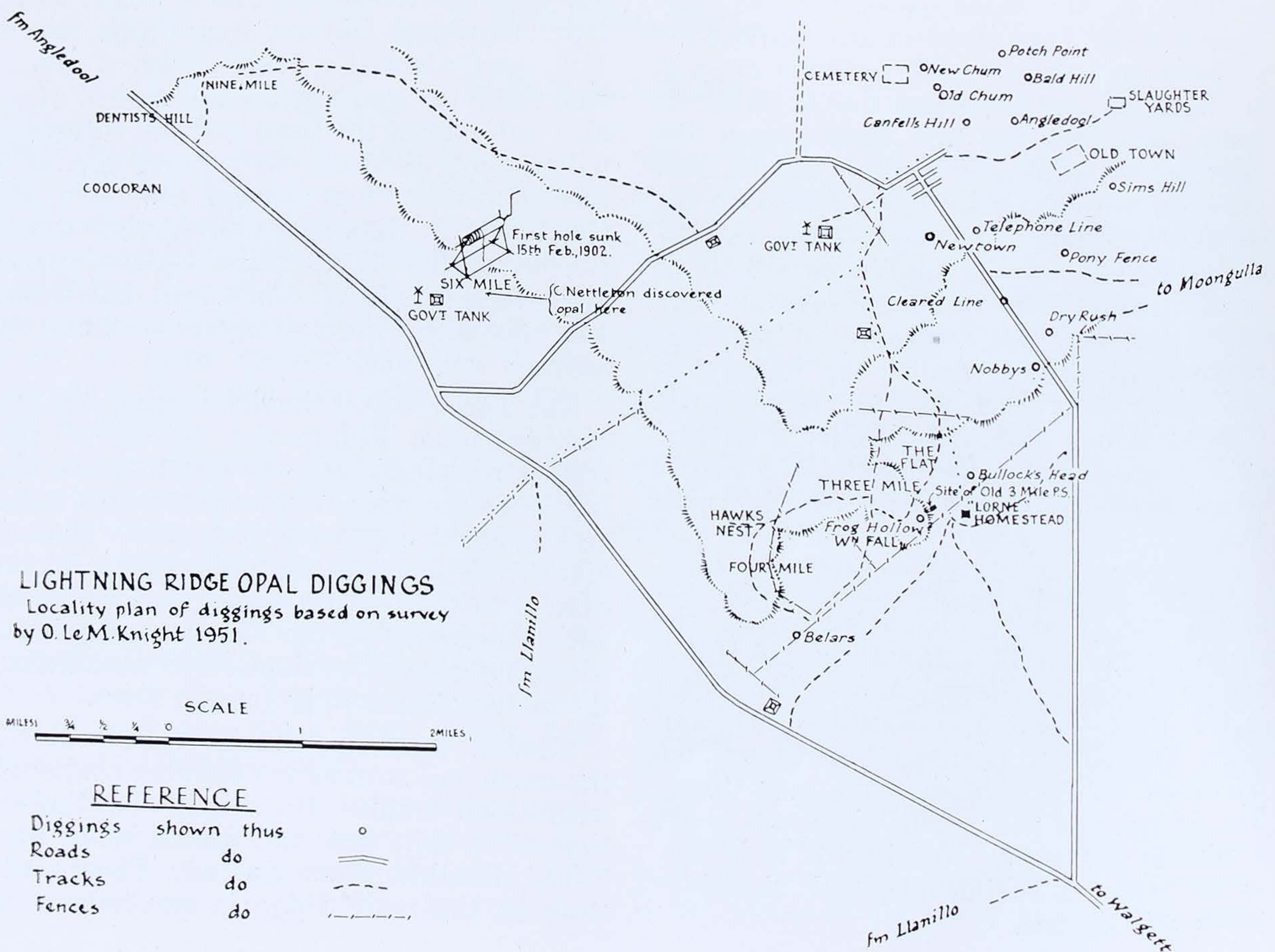
the roads winds in and out amongst dumps of white opal dirt and sandstone whose height, even now up to 15 feet, reflects the depth of the shafts. Here the sinking was 60 feet and more through two layers of opal dirt. It would be difficult, if not impossible, to estimate the number of these dumps and it is a weird sensation to drive through them.

On this practically deserted field a stray windlass proclaims that someone is still working. One might even come across George Bowles trucking dirt from one of the old rich dumps to his washing plant in the Gully, for some of these dumps still contain precious opal missed in the old days and awaiting the lucky "noodler". "Noodling", or scratching over the old dumps, is still popular, particularly after rain, and many a valuable gem has rewarded this back-breaking and eye-straining pastime. Incidentally, the term "noodling the dumps" appears to be peculiar to Lightning Ridge. At White Cliffs and in

Queensland the term "lousing the dumps" is used.

Among these dumps tracks radiate in all directions; south to The Flat and The Gully, south-west across the Western Fall to the Belahs and the New Four Mile, and west to the Four Mile and the Hawk's Nest. Here and there are dotted huts in styles of architecture varying from packing cases and galvanized iron to clay bricks made without straw. George Pile's home with its bough shelter and palisade marks the top of the Three Mile and, further south on The Flat, Fred Bodel and Jim Richards, two of the old-timers, with a few others, are all that is left of a settlement of 3,000 that once ran its own public school, and other utilities, and still boasts the post office address of Nettleton. Here and there an old fireplace speaks eloquently of the pride some of the old diggers put into their architecture.

Trees are scarce on the Three Mile. They disappeared in the "rush" days when



needed for logging up the tops of the shafts. But as one gets away from the main workings scrubby timber is plentiful. Belah, Wilga, Rosewood, Whitewood, Leopardwood, Boonery, etc., supply the larger trees and the undergrowth, relatively thick, includes a number of very prickly varieties including Nepan and the ubiquitous Galvanised Burr which looks its name and feels like barbed wire.

Water can be found in many of the old shafts where the ground water finds its way through the workings. One can choose between quite a variety of flavours. Generally the clearer looking water is to be regarded with suspicion as it owes its clearness to the presence of Kopi (gypsum), while some of the water is plentifully charged with sulphur. If the water does not look too good and harbours mosquito "wigglers" it is probably all right. There is usually no shortage of good drinking water in these holes, and the unpotable kind is perfect for daily showers with the aid of bucket and stirrup pump.

The writer has spent many pleasant holidays camped between the Belahs and the New Four Mile where water and timber have always been plentiful and Wilgas have provided a much-appreciated shade. Here emus and kangaroos passed the camp every day and bower birds, the twelve apostles and galahs were constant visitors. Large areas of bare ground are covered, here as elsewhere, with pebbles of all descriptions including many very attractive agates. Here, too, the sinking to opal dirt is only 3 to 15 feet and the enthusiast has a chance to "bottom" a few holes during a short holiday. Not that he expects to strike it rich, but there is always the cheering fact that George Graham, compositor, writer, digger and bushman, bottomed on a "jeweller's shop" at the Belahs about two years ago and took out £1,500 worth of beautiful black opal in a few weeks. Such finds, however, are rare and dozens of holes were sunk around George without anyone having his luck. But there are hundreds of square miles of opal country surrounding the Ridge, all identical in appearance and geology, that have hardly been prospected. It needs hundreds of prospectors to make



The author in a hole at the "Four-Mile". The canopy shields him from a temperature well over the century.

Photo.—D. Walker.

a field. Then every individual find starts another rush and more and more country is prospected. This was brought out during the depression when an embarrassing amount of opal was obtained after the field had practically closed down.

Mining for opal at the Ridge is a simple, even primitive process and essentially an individual one. First the capping of soil, and perhaps some conglomerate, to be removed; then a varying thickness of hard sandstone to be penetrated. Generally, this is done with hand tools only. "Shooting" is likely to shatter any nearby opal. Beneath the sandstone lies the opal dirt, a fine-grained clayey rock, sometimes white and sometimes stained with iron. This always weathers into small white cube-like fragments resembling starch, that provide the snow-like appearance of the dumps.

The opal rock always lies immediately under the sandstone, separated sometimes by a soft brownish "biscuit" and sometimes by a hard siliceous layer known as steel band—or the band. On the fall from the ridges the sandstone covering thins out and may be absent altogether. In such places the opal may have weathered badly



Above — The well-constructed fireplace is all that remains of one of the old-timer's huts.

Right — Dumps on the Grawin.

Photo.—O. le M. Knight.



to enable him to "gouge" into the opal dirt at the sides of his shaft. When he finds traces he follows them into the wall until he has excavated a chamber that might take him many feet under the sandstone roof. Occasional diggers have no great liking for "driving" and if they don't bottom on gem opal they start another hole.

The gouging is done with a small, light, double-ended pick having a short handle. One end of the pick is pointed, the other chisel shaped and about half an inch wide. With this pick the digger gouges away the opal dirt with a downward scraping stroke removing a thin shaving of opal dirt at each blow. When the pick strikes a nobby the feel and the sound is something like striking a piece of porcelain. Sparks are sometimes given off and if the digger is lucky he might even see a flash of red or

and the old diggers generally like a good "roof".

When sinking through the sandstone great care has to be taken when approaching the opal rock. Opal, if present, is likely to be in the upper layers of the opal dirt, and a heavy hand with the pick when bottoming can easily, and often does, shatter a "nobby" worth a small fortune. The opal occurs mostly in isolated nodules known as "nobbies". The Ridge has little seam opal such as is found on other fields.

After bottoming on opal dirt the digger takes it out carefully to a depth sufficient

green. When this happens he proceeds to dig out the nobby carefully with the pointed end of his pick. He may even call to his aid the pointed end of the "spider". This spider is a pointed piece of iron bent into a circle at one end just the right size to hold a candle. For when the digger starts to drive away from the light in his shaft he soon finds himself in the dark. So he lights the candle fixed in the spider and sticks the pointed end into the wall near where he is working. A digger might take hours removing a nobby that shows signs of being a good gem; gouging under it and

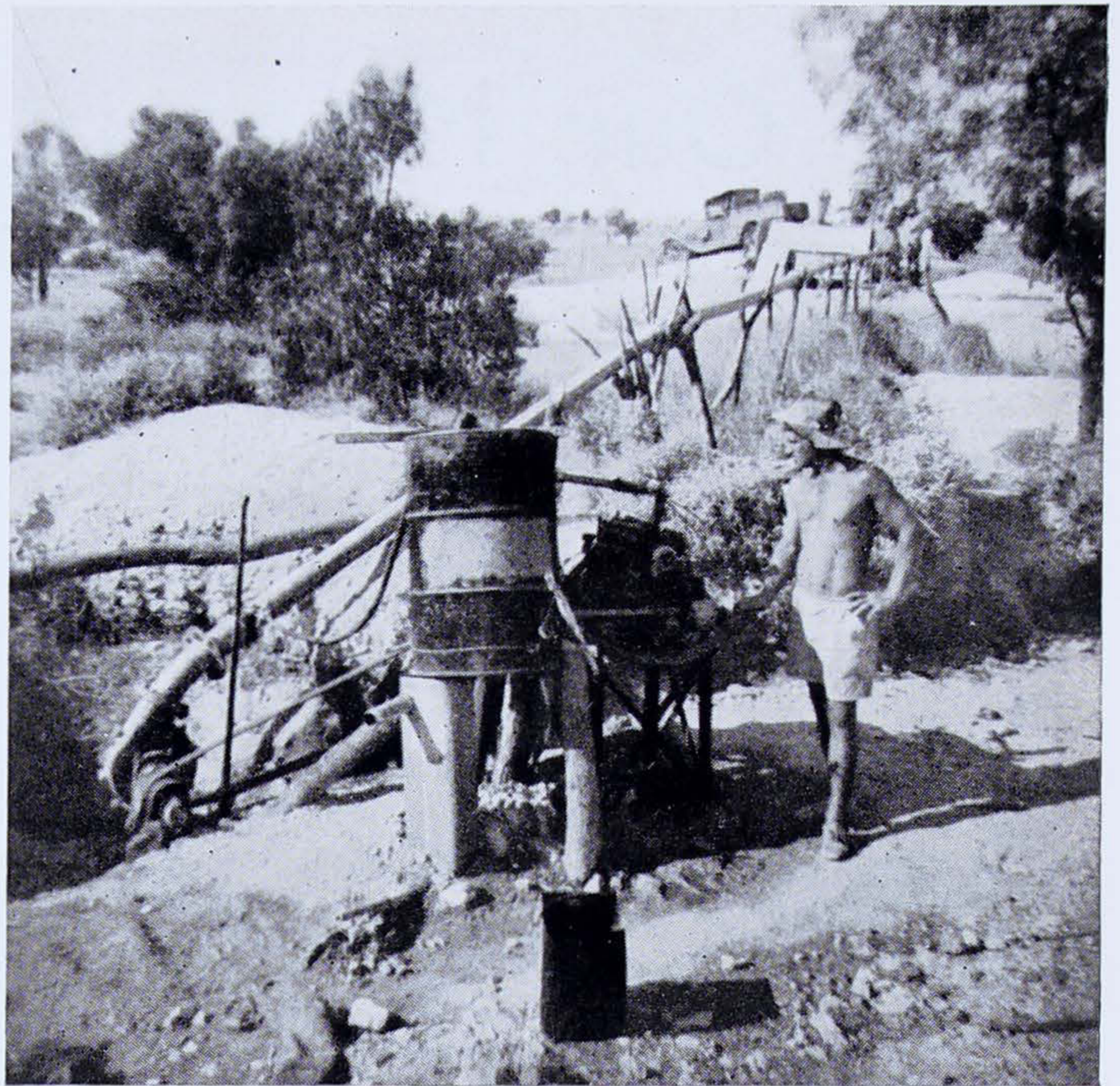
around it until it can be prised out without fear of breaking it. Frequently the blow that discloses the nobby shatters it at the same time and a gem is lost or greatly reduced in value. This usually happens when the opal dirt is very hard or when a digger has been gouging for some time without luck and starts to "belt" the dirt out.

It should be remembered that gouging is only part of the work. All the dirt removed has to be hauled up the shaft or the hole soon becomes "mullocked up". The amount of dirt to be "pulled" is strikingly seen in the acres of surrounding dumps.

Nobbies are comparatively plentiful but most of them are common opal or "potch". Gems are very rare. Potch may be clear or opaque, the clearer varieties being white to brownish and the opaque kinds white, grey, bluish, or black. It is black potch that is responsible for the term black opal. Precious opal occurs generally in bands in the potch and differs from it only in its brilliant colouring. Why opaque potch should carry these kaleidoscopic bands has puzzled the brains of scientists and, indeed, the cause of colour in opal is still a matter of conjecture.

Every nobby has to receive the same careful handling until it has been removed and "snipped". This snipping brings into use the one tool that the digger is never without, the snips. These are similar to carpenters' pincers and with them the digger removes a tiny corner of the nobby to see if it carries any colour. If it does, it is put aside for careful examination by grinding on the wheel. Some diggers are rather heavy handed with the snips and it is an education to hear their mates telling them what they deserve for "murdering" a stone.

Nobbies frequently have the perfect form of shells and even when this is not immediately apparent the rounded shapes and curved lines suggest that they are the replacement by opal of the material of shells and other forms of fossil life. Shark and alligator teeth, bones, and wood converted to precious opal are not uncommon, though Lightning Ridge has not produced the extraordinary opalized remains of dinosaurs and other forms of life for which White



George Bowles' washing plant on the "Flat" at the "Three-Mile".

Photo.—V. Bolton.

Cliffs was so famous. It is very difficult to resist the conclusion that practically all the nobbies found at Lightning Ridge were once some form of life, imprisoned in the sandstones and shales laid down in the seas of a past geological age.

Such is Lightning Ridge. Such also are the Six Mile, the Nine Mile, the Coocoran and other fields skirting the road to Angledool. Incidentally the Nine Mile was discovered when excavating gravel for surfacing the road. The same description applies to the Grawin, a field 20 miles to the south-west, whose low ridges can be seen from the top of the dumps at the Three Mile.

Half a million pounds' worth of opal has come out of these fields in the past and only the easiest and most accessible areas have been worked.

There is plenty of opal left for future generations, but they will have to work harder to get it. How they will succeed without the help of the old prospectors, whose ranks are thinning rapidly, is another matter. It is to the old fossickers like Charlie Nettleton and those that followed him that we owe the discovery of black opal and the supplies of it which have delighted the world.

Our Marsupial "Native Cat"

By ELLIS TROUGHTON.

THE spotted marsupials known as native and tiger "cats" are actually more like American opossums and the non-marsupial weasels in bodily shape as well as in their habits. They have a similar liking for the blood of poultry and once having formed the habit will return many times, killing more birds than are required for food, in the manner of the foreign weasel. As pouched mammals they resemble the American or true opossum family in having a number of lower incisor or front teeth, as typical of their mixed-feeding habits, instead of the paired lower incisors of the mainly vegetarian phalanger-possums and the kangaroo family. They also resemble the American opossum in having the same kind of primitive separate-toed hindfeet and, although lacking the prehensile tail, are more or less very active climbers. Together with a great number of marsupial-mice and the bear-like pouched Tasmanian Devil, these spotted "cats" make up the dasyurid family of Australian marsupials, based on the original genus-name *Dasyurus*, referring to the more or less brushy coarse-haired and non-prehensile tail.

The delightful photographic studies, of the cover and this article, represent the smaller and less fierce Native Cat of the south-eastern mainland and Tasmania. The scientific name of this first-described species is based on the aboriginal one "Quoll" which was quoted in the 1773 edition of the *Voyages* of Captain Cook, referring to a specimen from Bare Island in Botany Bay. As noted by early settlers, and the great naturalist, John Gould, several colour varieties may occur in the same litter, irrespective of sex, varying from olive greyish-brown with creamy-white spots, to black spotted with white. The strikingly contrasted spotting of the dasyurid species, with marks ranging from mere flecks to blotches about the size of a shilling, is

unique amongst mammals in having the spots white to the skin while the rest of the underfur is slate to dark grey.

The Eastern Native Cat, with head and body averaging 18 in. and the tail about 12 in., is at once distinguished from its much larger and fiercer relative the "Tiger Cat" (*Dasyurops maculatus*) by not having the white body spots continuing along the darker brush of the tail. It is also a less agile climber than the Tiger Cat, and therefore is less of a menace to poultry and other arboreal wildlife. Its more terrestrial habit is shown by its lack of the strongly granulated sole-pads and small first toe possessed by the larger relative. Though nocturnal in habits, the native cat has all the bold intelligence of the truly carnivorous mammals, but in captivity it is by no means difficult to handle, seeming to appreciate the human association and making an attractive and affectionate pet. Though killing poultry, it is satisfied with much smaller game and probably depends mainly on insects, mice, and small reptiles as the main source of food. Sleeping for most of the day, with ears folded down, in a nest under rocks or in a hollow log, it becomes active at dusk when after a careful approach it springs with astonishing speed on a victim, usually making the kill by a bite across the back of the head.

The Spotted-tailed Dasyure or "Tiger Cat" of eastern Australia and Tasmania, attains a length of 4 ft. from nose to tail-tip, and in its sturdy build and arboreal habits resembles the martens of the Northern Hemisphere. Captain Phillip, who saw the marsupial near Sydney and first recorded its existence, named it the "Spotted Marten", and described it as not only very ferocious but also exceedingly stubborn. One is reported to have kept two Irish Terriers at bay from a hollow tree-trunk, and another to have killed a large tom-cat after a terrific battle. Climbing



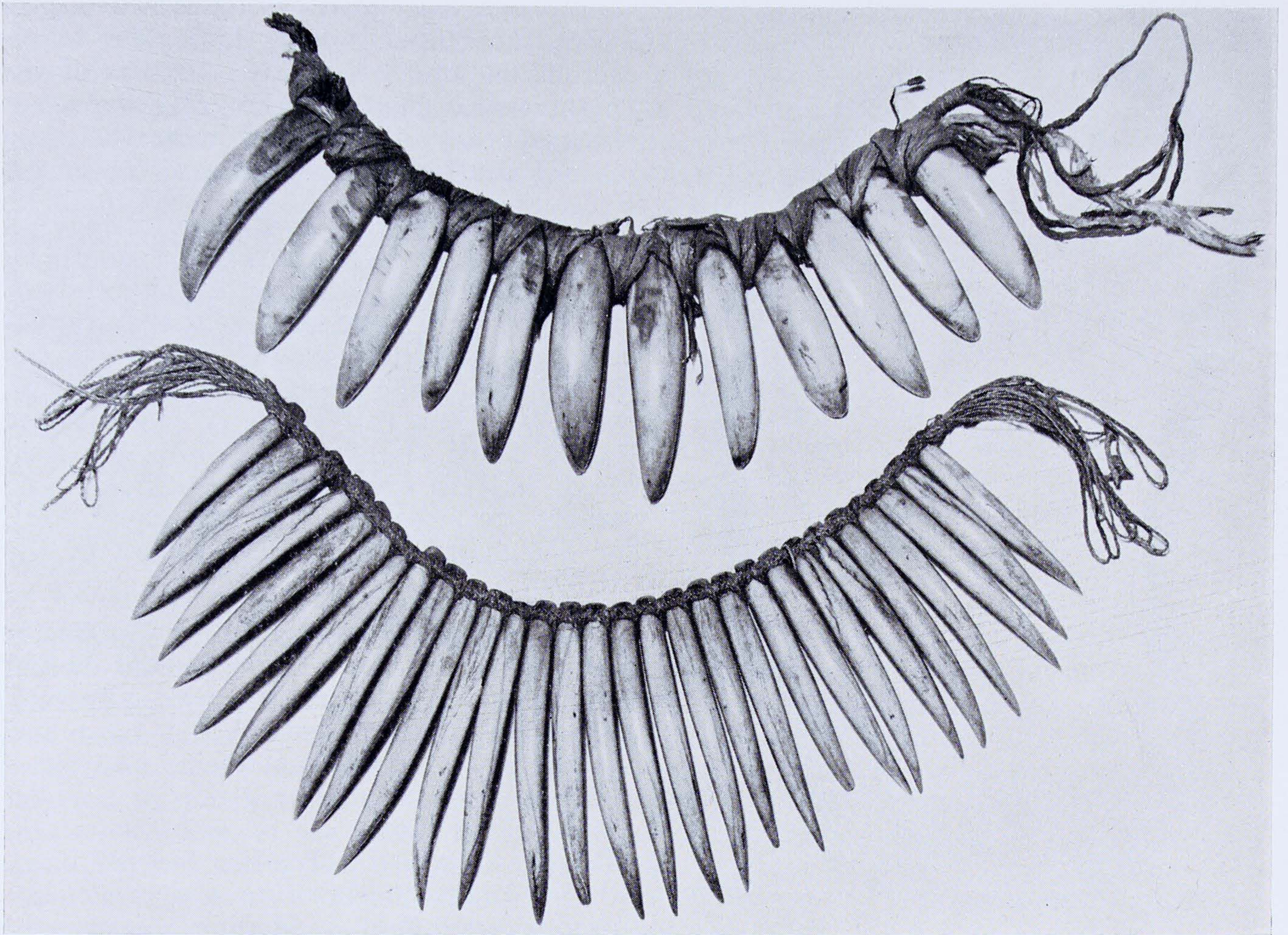
The Eastern Native Cat (*Dasyurus quoll*), which differs from the larger Tiger Cat in not having the spots continuing along the tail. In the tapered snout, general appearance and habits, these marsupial "cats" more nearly resemble American Opossums and the non-marsupial foreign weasels.

ability is such that an individual has been reported as killing two dozen tree-roosting fowls in a few nights by launching itself from a higher branch to seize a bird by the neck, killing it in the act of falling with the body to the ground. Despite the widely-gaping jaws with their slashing canine teeth, its secretive fear of man hardly warrants a comparison with the feline tiger-cats, while it is quite tamable in captivity, like the native cat.

Actually, tamed examples of both dasyures have recently been seen and photographed at the Museum, emphasizing the fact that even the flesh-eating marsupials are susceptible to human companionship, especially when reared from pouch-young. The subject of the photographs was not fully-haired when taken from the mother, killed when dazzled by headlights. Fed with milk from a dropper, it is now almost fully-grown, feeding from all kinds of table-scrap, and showing a most appealing affection for its captors. Only because of this

was it possible for our photographer to obtain such delightful "shots" and then, owing to its tense and sprightly movements, an exposure of 1/1000 of a second was necessary to reproduce the needle-sharp crispness of the soft dense fur. With the approval of the Fauna Protection Panel a male and female tiger cat, caught in the act of raiding poultry, are being kept for scientific observations. Since their capture about two months ago, five young were born and are now growing lustily on the teats, while the mother is quite tamely handled by her captor, allowing him to caress her face and even put his finger in her mouth!

Because of its insistence on its own warm-blooded kills, the powerful tiger cat is in more danger of ultimate extermination than the native cat owing to its suicidal habit of returning to clear-up poultry-roosts, when it may be caught in a nest of rabbit-traps not even concealed in the ground. The smaller native cat will squeeze under or through small openings between palings or



The upper necklace consists of small whales' teeth and the lower one of spikes cut from the teeth. They are worn by men and women of high rank.

The Whale's Tooth Tambua of Fiji

By FREDERICK D. McCARTHY.

IN both Melanesia and Polynesia the natives have a concept of socio-religious value in which an intangible magical power called Mana, the source of life, skill and success, is symbolized in objects exchanged for various reasons. The whale's-tooth Tambua of Fiji is an excellent example of these symbols. The teeth used are obtained from the sperm or cachalot whale. They vary in shape from slim to thick crescents pointed at one end, to thick teeth with a rounded or pyramidal end. In size the thirty-five specimens in our collection are from $2\frac{3}{8}$ to $7\frac{3}{8}$ inches long, and

weigh up to $1\frac{1}{2}$ lb. At the butt end is a hollow with sharp irregular edges. An unique specimen in the British Museum is made up of two complete teeth and seven other pieces, perfectly shaped and fitted together into the form of a single large tooth 11 inches long and 4 lb. in weight.

The majority of Tambua are rubbed and polished until the natural longitudinal grooves are either entirely eliminated or are left showing only at the butt end. On many of them, handling for over a century has given their surface a perfect smoothness. The rough butt end is left untouched



The Tambua are carried by neatly plaited cords.

as a rule, but on several it has been cut off straight across. On the two finest specimens, on which the sides of the hollow end are close together, the latter have been cut and smoothed to a shape symmetrical with the pointed end. Some of the teeth are pale cream in colour, others display the attractive yellowish shade or mottled surface to which old ivory changes. Some are lightly coloured by the use of turmeric, a bright yellow powder obtained from the rhizome of a tuber, *Curcuma longa*. The surfaces of eight of our Tambua are stained to a patina in which yellow, orange and rich browns produce a beautiful marbled pattern.

The intrinsic value of Tambua, in the native's eyes, depends upon size, the larger ones being preferred, freedom from blemishes, quality of surface polish and colour, and good shape. Old Tambua known to

have been associated with successful projects, those used in very important transactions or which belong to families of the highest rank command the greatest respect because they are imbued with the most sacred and powerful qualities of Mana.

The carrying cord is attached through a hole, which tapers inwards to the middle on the older specimens, bored in both ends of the tooth. On some specimens the original hole has broken away and a new one has been bored. The finest carrying cord consists of a four-row chain of coconut-fibre twine called sinnet plaited into one cord from half to one inch in thickness. To others are attached a two-ply sinnet cord, or one made from the inner bark of the Hibiscus.

An interesting feature of the Tambua is the variety of names and symbols incised upon them. In our series the names Ravono, Ana, Sola, Imusi, Kusik, Worio, Lawe and others are recorded on them, sometimes with a plain X, star or group of parallel lines. The names are of men, clans and districts to which a Tambua has belonged. One displays an elaborate scrimshaw pattern consisting of a whaling schooner in full rig, and three boats at sea from one of which a whale has been harpooned. This example thus dates back to the early nineteenth century when the whalers, and those seeking sandalwood and beche-de-mer for the Chinese market, were active in the Pacific.

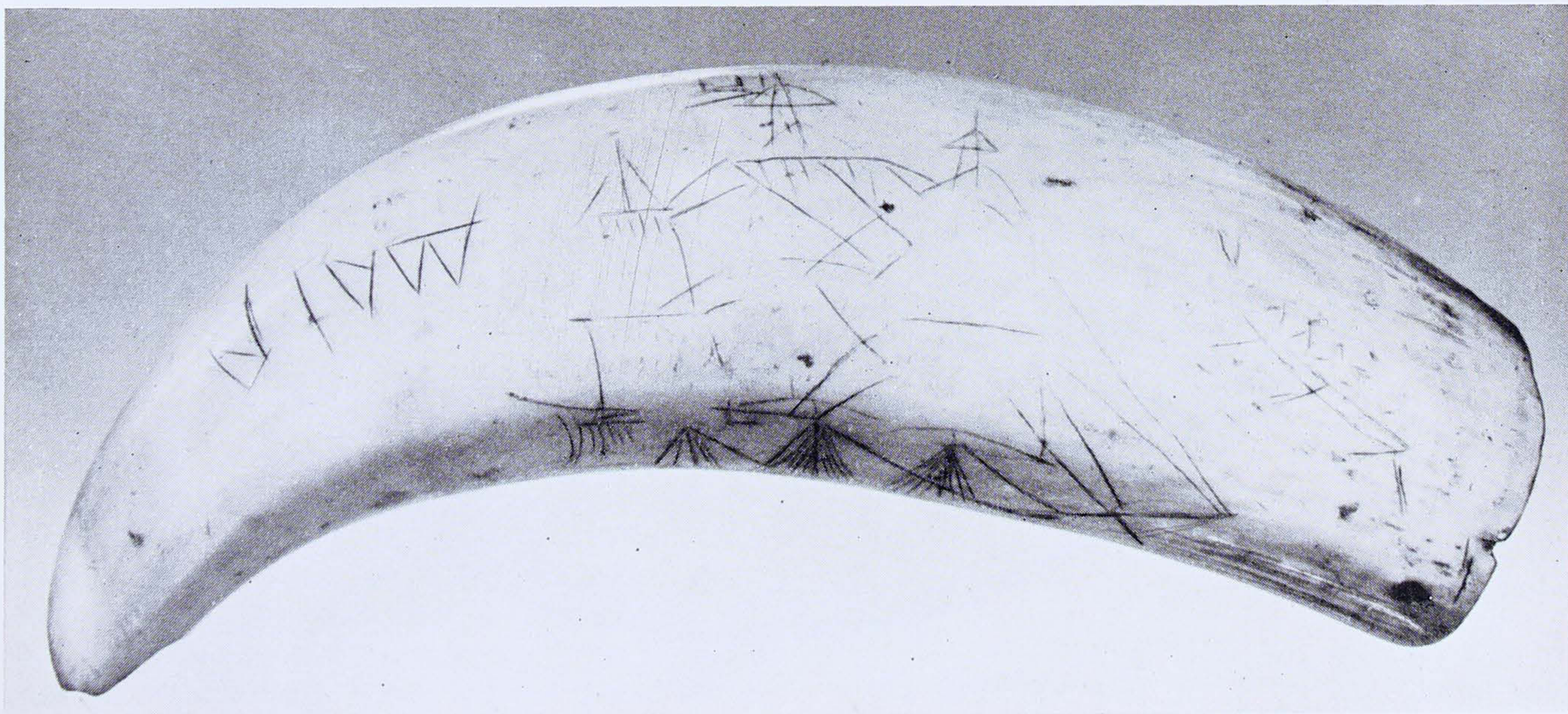
The use of whales' teeth as Tambua is widely but erroneously believed to have begun during the above period. The actual practice of using Tambua symbols is an ancient one. Thus two kinds of shells were so used along the coast of Viti Levu, while clubs and other objects were given this status on some occasions. The Hill tribes in the interior of Viti Levu made wooden replicas of the teeth because they could not get the real ones when required. The name Tambua is thought to have originated in the *tabu* or *tambu* meaning forbidden and sacred when applied to any article or place. *Tambua* is also the name for the collarbone, but whales' teeth are called *bati ni tavuto*. In pre-white times in Fiji the teeth could

only be obtained when a whale was stranded. Mariner stated that the teeth were held in such high esteem that the life of a man was in grave danger, unless he was a great chief, even then if he was a foreigner, if he were known to have one about him. The high chiefs were ruthless in their determination to possess these symbols. Mariner also instances the killing of a man and his wife who concealed the teeth of a stranded whale from Finau, chief of Hapai and Vavau in Tonga. The Tongans exchanged the teeth for logs or canoes with the Fijians, but they also inlaid with ivory some of their head-rests and bowls. In Hawaii tooth-ivory hooks were attached to human hair necklets worn only by the highest nobles. When the schooners caught so many whales the teeth became the generally recognized and widely used Tambua in all classes of Fijian society.

One Fijian, Pita E. Tatawaqa, in 1912, quoted legends which led him to believe that the custom of using whales' teeth was an ancient one. One story is about two goddesses who stole the chief Takala's bananas for food. His people dug the culprits out of the cave in which they lived, and to atone the goddesses offered firstly a branching Tambua to which they added their daughter before the chief was satisfied. Another legend concerns Turakawa whose calling to awaken the god Tui Nubu-

levu so attracted two brothers that they gave the god a whale's tooth and a dwarf pig for Turakawa whom they wanted for the awakening of themselves. Tatawaqa mentioned also that it was the custom to drop a Tambua tooth at a spot selected for a new village. Tambua have been left at the old Nanga temples of stone in these islands.

The Tambua are treasured in a special basket in which a pebble, called *tinai ni tambua*, the mother of the Tambua, is placed to comfort the latter. The stone is oiled and polished, and the Tambua taken out and admired whenever the opportunity permits. Similarly, when a man acquires a new Tambua he hangs it up in his hut and sits admiring it for several days, taking it down and polishing it with a leaf for a period of a month or so. A traditional procedure is followed in the presentation of Tambua. The chief or person presenting it stands or kneels before the recipient, holding the tooth in one hand and the outstretched cord in the other, makes a short speech embodying his request, belittling the quality of the tooth, eulogizing the character of the recipient, and expressing wishes that the latter, his people and their lands will prosper. Should the Tambua be accepted, the chief takes it in both hands, rubs his nose on it, makes a very short speech of acceptance and passes the Tam-



A Tambua on which is incised a whaling scene. Here are shown the schooner and one of the three boats.

hua to his Matanivanua, or spokesman, who also rubs his nose on the tooth and replies at length in formal language. According to Deane, the Tambua is "led" by the person carrying it, a cry of honour greets its presentation, and after the ceremony the members of the group giving it call out Mana. On important occasions kava is drunk at a presentation rite, and in some cases kava-root or drink is offered where a Tambua cannot be secured. A man carrying a large number of the heavy teeth has to struggle unaided to the spot where he will present them, and anybody attempting to assist him would be knocked down.

Although the Tambua is held in such high esteem it is not to be regarded as currency or as a measure of value, even though it served as a payment in the form of a gift for services rendered, or as an equivalent for something received such as a pig. Roth said that the use of a Tambua will obtain success for a demand or request where all else fails, because it is a lasting, permanent sacred thing. For this reason, a Tambua seals a peace offering between warring communities, and the granting of permission to settle or plant crops on land belonging to a conqueror. It is a symbol of loyalty from a community or district to the ruling chief, and Tambua are presented to his successor when he dies. Tambua is given to a craftsman who builds a house or canoe for a chief or clan.

One episode in the past illustrates well the binding power of the acceptance of a Tambua request. In 1867 a chief of the lower Rewa river in Viti Levu sent a request with a Tambua to the people of Vatusila to kill the Rev. Thomas Baker when he passed through their territory. They accepted the Tambua and killed the missionary. Thirty years later the son of the Vatusila chief responsible for the murder confessed his father's crime in an act of atonement to the Wesleyan Church and presented a string of three Tambua to the church elders.

Tambua are sent as gifts of acquiescence to communities desired as allies in war, and they are given by a law-breaker's family or clan to atone for his crime. At the birth of her baby, the mother gives Tambua to certain friends to signify the taking in arms of the child. At the death of his wife a man gives her father a Tambua, but at the death of a high chief his people give large numbers of Tambua to his family as a mark of respect and sympathy. A Tambua placed upon the breast of a dead man is taken by his spirit who throws it into a special tree near the entrance to the abode of the dead. The man who strangled a widow at the death of her husband received a Tambua, and the gift of one usually pacifies an angry chief. Visiting chiefs and nobles receive Tambua as gifts. When there was any question of disloyalty a high



A stained and evenly shaped whale's tooth Tambua presented by Mr. S. R. Mort. It was presented by Thakombua, King of Fiji, to Mr. R. M. Isaacs of Sydney in 1862.

chief visited a village, refused the Tambua offered by its emissary, who had to swim out to the canoe, and then ordered his warriors to attack the community to teach it a lesson. In marriages Tambua are given by the bridegroom and his clan to the bride's clan and to her mother and friends, they are exchanged by the man and woman to be married, and both clans exchange them until the stock of one is exhausted; finally one is given by the bride's folk to the husband's clan with a request that she will be looked after properly. Where members of noble families are married large numbers of Tambua are exchanged, as the high social status of the families and clans involved make it essential for them to display their

great wealth by the possession of many Tambua.

When a Tambua is offered it must not be touched unless the accompanying request is to be agreed to. The request, whether it be to murder, marry, to be generous or mean in any way, to grant permission or to refuse it, must be carried out. The Tambua is a guarantee of sincerity, and it possesses a sacred quality that must not be defiled by failure to act. The only way in which an obligation so imposed can be avoided is by the return gift of a finer Tambua. The whale's tooth is, in effect, a symbol of a custom, the Tambua, which maintains integrity, by insisting upon the carrying out of obligations, in Fijian social and religious life.

Stocking Your Vivarium

By J. R. Kinghorn.

EVERY year the Museum receives many questions concerning the keeping of reptiles in captivity but, as we do not keep live specimens, answers have to be sought from those who do.

The keeping of live snakes is not encouraged, because bites from them can lead to quite a lot of serious trouble.

There are many ways of making vivaria, some being very elaborate, but for the cost of a few pieces of timber, anyone can make the simplest kinds. An ordinary box frame, about 18 inches deep, can be set a few inches in the ground so that lizards will not be able to burrow their way to freedom, and the ground can then be covered with sand and plenty of leaves, and so on, to resemble the natural surroundings. This type may be flooded in continuous wet weather, so perhaps the easiest vivarium to make is from an ordinary shallow box, with a few small holes bored in the bottom, and then set on bricks to prevent it contacting cold and damp earth. Cover the floor with a good thickness of sand and leaf mould, with some shelter of raised stones or bark in a corner.

The tops of these vivaria should be covered with fine mesh wire and provided with a sloping glass roof, so that rain can run off. Place them in partial shade and cover with a bag during hot sunny weather, because too much sun will kill the inhabitants.

For indoors, an old, cracked, or disused aquarium tank can be used for small lizards such as geckos, skinks and legless lizards, provided there are plenty of hiding places.

In all vivaria you must have drinking water, the receptacle must not be too deep, and it must also be easy for a lizard to climb out of should it fall in. Don't throw food on the ground but have one or two very shallow tins or trays so that the surplus can be removed, because your vivarium must be clean.

Any lizards found in your district can be kept and studied but they must be fed regularly and not left to forage for themselves.

At first all will be timid and some may be aggressive, but don't frighten or annoy them, and always handle gently to give



A Frilled Jew-
Lizard.

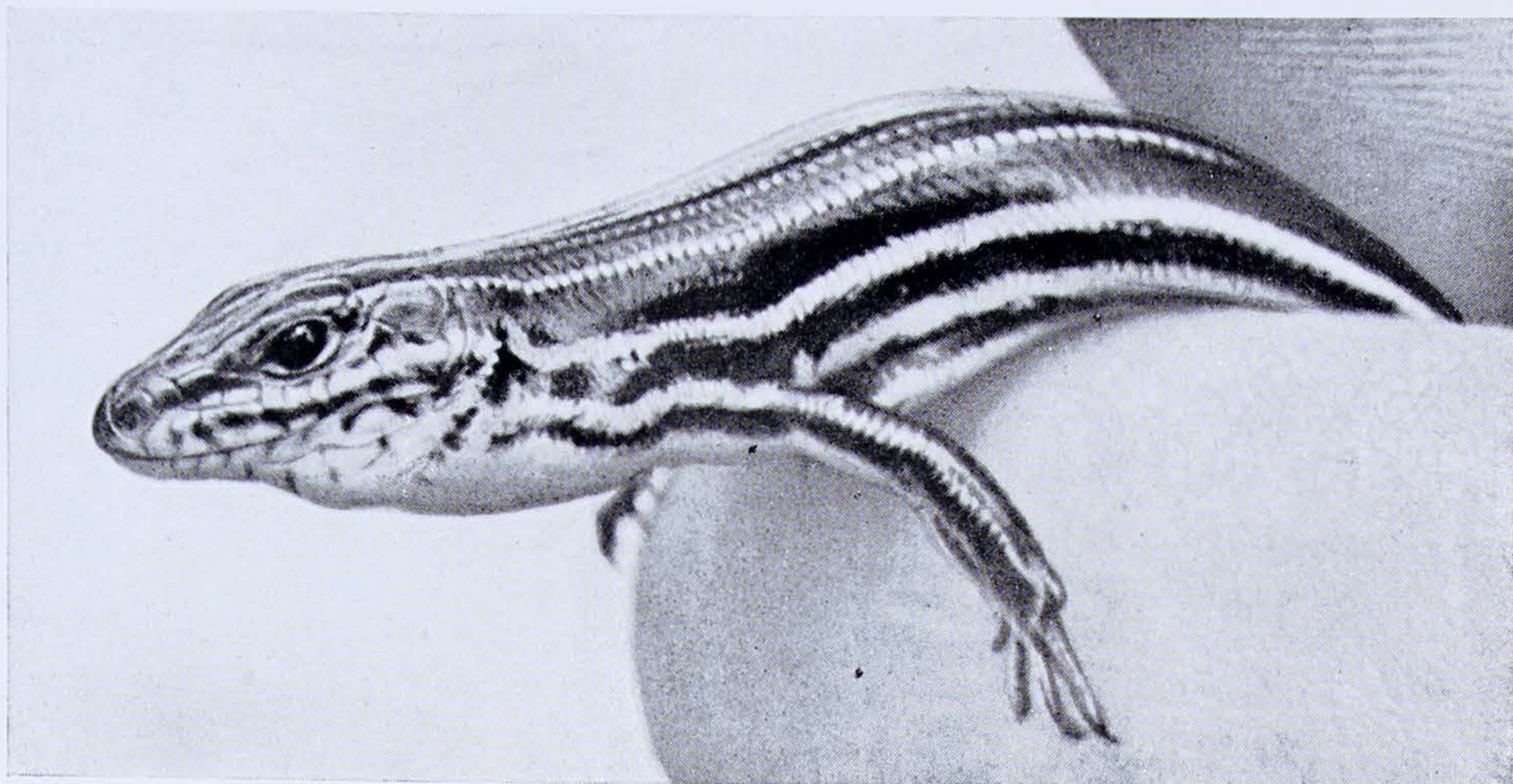
them confidence in you. If you treat them kindly they will respond and make quite good pets, and in this regard perhaps the blue-tongue lizard should be considered first. You can handle it quite freely, and, as it has very blunt teeth, it would give only a strong pinch if it happened to bite. Feed blue-tongues on snails, or chopped up meat, either raw or cooked—raw for preference. You can vary the diet with hard boiled egg chopped up, or raw egg, but, as the lizard will not break a shell to get at the contents, you must pour the yolk into a saucer. For variety you can give it some fruit such as bananas which it will often eat from your hand. Of course, it must have clean drinking water.

The blue-tongued lizard has a very wide distribution but in the country a better known one is the jew lizard, or as some call it the "jewie" or "frillie". Be careful of this fellow at first when hand feeding, because it may rush at you and bite and tear your finger rather badly. Later it will become more docile, but never as tame as the blue-tongue. The jew lizard does not thrive very well in captivity. It is fond of beetles, cockroaches, grasshoppers and insect larvae such as grubs and caterpillars, but scorns meat. A friend of mine kept jewies for months and, even though they almost starved, could never get them to eat meat. You should be able to find plenty of beetles and grasshoppers under stones in the grass and under logs. You can vary its diet with an occasional raisin and, strange to say, it will eat the flowers and sometimes the leaves of the common dande-

lion; in fact, when tame it will rush this food. It also likes the flowers or seed heads and leaves of the weed known as Cobblers Pegs.

In the mountains and near west you might find that peculiar lizard known as the Stump Tail or, as some of you call it, the "double headed" lizard. In general shape it resembles a blue-tongue, but has large scales, so that it looks like an elongated pine cone. Put a couple in the vivarium as they make very good pets. They are not as hardy as blue-tongues, especially when kept in coastal areas, but might be easier to keep in the country or on the mountains. They may be fed on well chopped up meat, raw or cooked, and many kinds of insects especially beetles, in addition to slugs and snails. They will take occasional milk and raw egg, and for sweets they are fond of dandelion flowers, bananas, plums and sultanas; in fact, you could try other fruits with these lizards and any others that show any desire for sweets. There are some attractive little relatives of the jewie known as "jacky" lizards. Some are quite brightly coloured, others brown or grey with darker markings, and they run on their hind legs almost as fast as the larger jew lizard does. Because of their small size they will not bite you, and are well worth adding to your vivaria. Try feeding them on small beetles and slaters from the garden and, for a change of diet, various fruits and dandelion flowers. The largest member of this family is the "Water Lizard", found mainly along the streams of the mountain and

"Stripy," the Copper-tailed Skink, *Sphenomorphus taeniolata*, one of our commonest lizards, is held here between finger and thumb.



coastal areas. In general shape it resembles a jew lizard, but has a much larger tail, and more slender body. Be careful of this "dragon" because, like the jew lizard, it is nervous and also very wild and aggressive. Being a water lizard it likes to feel the rain beating on it at times, but it may sunbake also for very long periods. It will eat most kinds of insects, caterpillars, beetles, moths and probably is the only lizard except the goanna that will eat mice, so for good measure you can give it chopped up meat, with a second course of pears, bananas and flowering heads of dandelion.

Some of the small skinks, the rock geckos and wood geckos, may be experimented with, but these are difficult to feed and they must have plenty of cover to hide under. If you find they will not eat within a few days, you had better turn them loose rather than allow them to die from starvation. If you have a pet fresh water tortoise you can try feeding it on grasshoppers, beetles, small frogs, chopped up beef or mutton

and fruit, though some have been coaxed to vary their diet with occasional lettuce leaves. Tortoises are rather fussy feeders at times, some eat this and others eat that, you never know until you try. You can keep small tortoises in the aquarium, but you must provide a resting place for them if they wish to get out of the water.

I would not advise keeping goannas unless you try some very small ones, because they are difficult to tame and may turn on you when you are least expecting it.

You should keep a note book and write down from day to day how each one is feeding, what you gave it, and make a record of the temperature of the air. You will find that lizards eat less during the colder days, whilst during the winter they may not eat at all, and some may hibernate, so that is the time you must look to their comfort, by moving the vivarium to a warmer spot where it can be protected from frosts, and covering it with a bag at night.

Review

THE FACE OF AUSTRALIA. By C. F. Laseron, F.R.Z.S. 244 pp. with 39 photographs and 31 sketches and maps. Angus & Robertson Ltd., Sydney, 1953. £1 1s. 0d.

Mr. Laseron's book has already grasped the public imagination and has revealed exciting glimpses of the geological past. His accounts of some of the more spectacular happenings such as the vast outpouring of lava in Tertiary time or

past periods of intense glaciation, more or less commonplace to the geologist, have opened a new world to the general reader. The author is most successful in the way in which he has conveyed the immensity of the canvas required to portray the building of our vast continent. It is a colossal subject and would have suffered if the author had attempted the Jane Austen method of cultivating a very small plot with meticulous attention to detail. It is a picture that must be painted

in broad strokes and in this the author has succeeded admirably. It would be unreasonable to expect a detailed treatment such as we find in Trueman's "Geology and Scenery in England and Wales", where the governing influence of underlying geological structure is shown in the shape of every hill, dale, crag and tor. We are not at this stage yet in Australia but none the less it is the geological background to scenery that is the life-blood of this book. The sense of the dramatic that the book conveys, and it is by no means inconsiderable, is derived mainly from the giant sweep of geological history itself. It is disappointing, therefore, to find that the author adheres to some rather out-of-date geological concepts and even more disappointing to find that he has done so purposely. The author may retort that a geologist has no business to peruse a book on scenery with a jaundiced professional eye. None the less had the author extended his manifestly considerable geological reading to include the most up-to-date material, which would not have meant much more effort, the book would have gained considerably in value. No apology therefore is made for having reviewed the book through the eyes of a Museum worker who throughout the years has had some experience in attempting to present popular science per medium of lectures and articles.

Considering some of these matters in more detail, the exact dividing line between the upper pre-Cambrian (Proterozoic) and the Cambrian may not be firmly defined, but it is quite erroneous to include all the vast thickness of sediments of the Adelaide system in the Cambrian. As a consequence of not accepting the most recent information, the author mistakenly mentions two very early ice-ages, one in the pre-Cambrian and the other in the Cambrian. Actually there was only the one and that was in pre-Cambrian time. Incidentally, in speaking of ice-ages the author in several places refers to the late Palaeozoic glaciation as being Permian in age, whereas in Australia it had its maximum development in the Carboniferous, the preceding geological period.

On the subject of Lake George, Griffith Taylor's "fault-scarp" theory seems to be quite outmoded and according to "The Geology of the Commonwealth" (David and Browne) the scarp, against which the lake has formed, can be "more reasonably explicable by differential erosion". Adherence to the older view leads the author to state that movement along the fault plane has been the cause of earthquakes at Gunning. This, of course, is quite untenable. Gunning is some 20 miles north of Lake George and work in recent years has shown that the centre of the disturbances causing the recent earthquakes was not far from Gunning itself and that the shocks were very

much localized. In his foreword the author anticipates criticism on these matters but that doesn't render the criticism any less valid.

When the bristly subject of palaeogeography is touched upon, the scientist and indeed the layman too, who wishes to be correctly informed, is entitled to the latest viewpoint on the subject. An author should use all available data on which are based current conceptions of the distribution of land and sea in past geological ages and, if he is not prepared to do so, it would be better not to touch on the subject. After all, some account of scenery could be given without any mention of palaeogeography. The map showing the ancient land surfaces of Australia is full of errors. The Broken Hill district for example is included as an area supposed to have been a land surface since the upper pre-Cambrian whereas to be consistent the author should have regarded it as having been submerged till the end of the Cambrian. According to David and Browne not only Cambrian seas, but Devonian and Jurassic Lakes also, in much more recent time, submerged this area. On the other hand the Flinders Ranges which are not included at all by the author amongst the ancient land surfaces have most likely been dry land since Cambrian time and therefore should be shown on his map.

Sometimes geographical and personal details, and items of general information, are incorrect. For example, the "Kattung" river in the Blue Mountains should be the Kowmung. The incorrect impression is given that the Warragamba River is joined by both the Cox and the Wollondilly in different places. Actually the river is known as the Warragamba immediately the Cox and the Wollondilly unite. The gorge a little to the south of Penrith is the gorge of the Nepean and not the Hawkesbury. The principal minerals mined at Zeehan and Mt. Read (not Reid) in Tasmania are ores of silver, lead and zinc, not copper. Incidentally, Dr. H. I. Jensen is still very much alive.

No one, of course, could possibly expect an author to have detailed first-hand knowledge of every part of Australia and no doubt this accounts for many of the minor errors. Once again let it be said that the author is to be congratulated on having been the first to present a broad, overall picture of the subject. This book, with its most excellent illustrations and numerous clear line drawings which should not escape mention, will certainly stimulate in its readers a desire to travel more, to read and write more and therefore to understand more the vast territory in which we live.

—R. O. Chalmers.