

AUSTRALIAN NATURAL HISTORY



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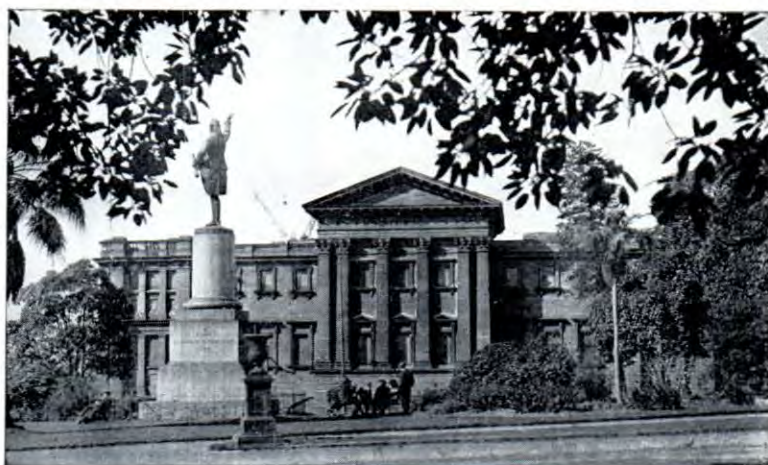
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This issue is devoted entirely to the Australian and Tasmanian Aborigines and their prehistory. It contains seven extra pages of articles and illustrations.

CONTENTS

	Page
THE PREHISTORY OF THE AUSTRALIAN ABORIGINES— <i>F. D. McCarthy</i> ..	233
THE PREHISTORY OF THE TASMANIAN ABORIGINES— <i>Thérèse Belleau Kemp</i> ..	242
ORIGIN AND PHYSICAL DIFFERENTIATION OF THE AUSTRALIAN ABORIGINES — <i>N. W. G. Macintosh</i>	248
ROCK ENGRAVINGS IN WESTERN NEW SOUTH WALES	253
ABORIGINAL RELICS IN VICTORIA— <i>Aldo Massola</i>	254
THE AUSTRALIAN ABORIGINES: THEIR PRESENT POSITION AND THEIR FUTURE— <i>A. P. Elkin</i>	259
THE AUSTRALIAN ABORIGINES AND THE GIANT EXTINCT MARSUPIALS— <i>Edmund D. Gill</i>	263
PLEISTOCENE AND RECENT CLIMATES OF AUSTRALIA— <i>W. R. Browne</i> ..	267
UNIQUE ABORIGINAL STENCIL IN QUEENSLAND— <i>K. B. Redmond</i> ..	271

(Photography is by Howard Hughes, unless otherwise stated)

FRONT COVER: An Aboriginal crew unloading supplies from a boat at Oenpelli, on the South Alligator River, Arnhem Land, for a scientific expedition into Arnhem Land. The photo was taken by F. D. McCarthy. An article on the Aborigines' present position and future, by Emeritus Professor A. P. Elkin, appears on page 259.

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VOL. XIV, No. 8

DECEMBER 15, 1963

THE PREHISTORY OF THE AUSTRALIAN ABORIGINES

By **FREDERICK D. McCARTHY**

THE study of the prehistory of the Australian Aborigines gained little momentum prior to 1930 when its scientific study really began. The belief that Aboriginal culture was indigenous in its development was dominant until as recently as 1949. Prior to 1955, when radiocarbon testing was developed by Dr. Libby, of Chicago, the antiquity of the Aborigines was based on estimates of the age of chance finds of stone implements and skulls like Talgai, Cohuna and Keilor. There was no accurate method of dating these finds and estimates of how long man had been in Australia, one of the key problems for the archaeologists to solve, ranged from the 400 years of Gregory to the 150,000 of Mahony, but, as everybody realized, estimates of this kind are an unsatisfactory approach to the problem. Stone implements were collected and described by many writers, and a classification of these artefacts, published by the Australian Museum in 1946, revealed numerous specialized types made consistently to a pattern, among hundreds of varieties of stone implements.

The most important data on our prehistory has come, and is being produced in ever-increasing quantity today, from stratified deposits of bones, shells, ashes and implements forming the middens left behind at their camp-sites by the Aborigines and their ancestors. Governor Phillip, Governor Hunter and others opened up mound graves near Sydney and the Nepean River in 1788 to find that they contained the ashes and bones of a human cremation. In the 1880's Macpherson dug into some of the great ash mounds of Victoria and the Riverina to find evidence of an occasional burial in the ash of centuries-old fireplaces used mainly for cooking the stock of the rush which supplied a flour-like food. In the same period Etheridge, then Director of the Australian Museum, and Sir Edgeworth David excavated two rock-shelter floors at Dee Why and North Harbour, Sydney, to unearth skeletons and ground edge implements.

An ancient assemblage of stone choppers and scrapers, hammerstones (and anvils) and trimmed blocks has been identified

as the Kartan culture on old Pleistocene land surfaces on Kangaroo Island and at Fulham, in South Australia. Its precise age is not known.

Tula Culture

The excavation of prehistoric deposits on the lower Murray River by the South Australian Museum and by the University of Melbourne, has yielded evidence of the long-sustained use of one basic culture at an open site at Tartanga, and in two rock shelters at Devon Downs and Fromm's Landing, all three sites being on the river bank. The middens, up to 20 feet deep in the rock shelters, consisted of material deposited by the wind, river, weathering of the cave walls and ceiling, and of ash from fires, implements and animal remains which clearly indicated human occupation. The basic industry of stone implements unearthed contained an important specialized tool now called the *tula*. It is a flake or blade with a convex working edge, mounted in gum on a handle or spear-thrower butt, and used as a chisel, adze and knife. Constant use and re-sharpening wears the *tula* down to a fragment which is thrown away. The manufacture and use of this implement have been observed among living Aborigines in central Australia and the Northern Territory. The *tula* was in use from the earliest phase of this culture at Tartanga, and throughout the occupation of the two rock shelters, together with stone flakes and blades used as scrapers and knives. In the middle phase a neatly made spear point, the *pirri*, chipped on one surface, and a series of geometrical microliths, were added to the culture to remain in use for 1,000 years until they disappeared from the tool box for some unknown reason. Pointed bone implements of several kinds were used throughout the occupation of these sites.

The Aborigines who lived along the lower Murray River in ancient times, like those of the present day, were fishermen and hunters, and the bones of many living species of fish, birds and mammals, and mussel shells, were found in the middens. The climate appears to have been stable throughout the period of occupation, and generation after generation of families lived the same kind of life for over 6,000 years. The

early or Tartangan phase has an age of 4,057 B.C. (mid-point), the middle or Pirrian phase 2,887 to 1,793 B.C., and the late or Murundian phase from the latter apparently to the early stages of white occupation. When first described in 1930 the Tartanga-Devon Downs material was divided into four separate cultures, but these have now been reduced to three phases of what I have called the Tula Regional Sequence. Implements of this Sequence occur on surface camp-sites in a vast region of the interior of Australia from the Great Dividing Range to Western Australia, and from South Australia to the Northern Territory. They are not found in the eastern and northern coastal regions. They have been excavated in central and western New South Wales and in central Queensland.

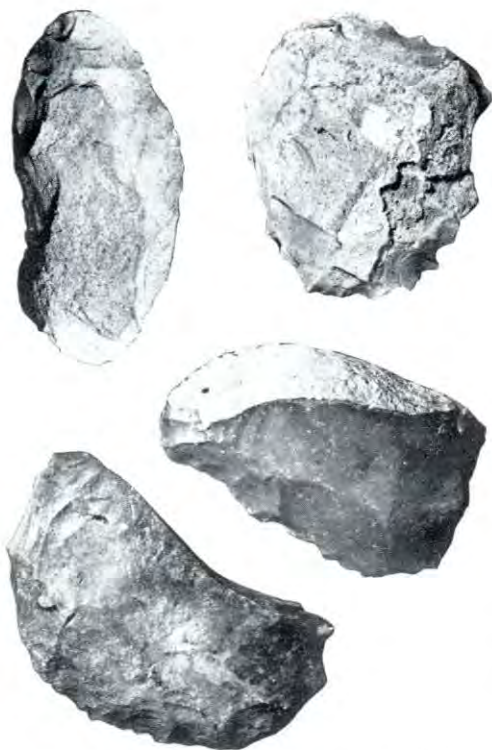
Eastern Regional Sequence

An equally important sequence has been established by excavations of rock-shelter floors in eastern New South Wales by the Australian Museum and other workers. At Lapstone Creek in 1936 two phases of this sequence were discovered. The upper phase was dominated by ground-edge axes and knives and adze flakes known as *elouera*. In the lower phase elegantly-made stone points (believed to have been used as spear barbs and points, and called *Bondi* points after the first locality in which they were collected in 1907), burins, fabricators and

OPPOSITE

Implement types illustrated in chart—Kimberleyan: *Leilira* blade, two biface serrated points, biface point above pointed blade, two scrapers. Oenpellian: Hafted *elouera*, *leilira* blade, with an *elouera*, two biface points, fabricator (top), pigment, scraper, *muduk* bone point (bottom). Milingimbian: Scraper, ground edge axe (top), *Yodda* tanged implement, *riambi* oyster pick (bottom). Eastern Sequence, Eloueran: two scrapers (top), *elouera*, burin (bottom), with ground edge axe. Bondaian: *Bondi* points and geometric microliths (left), burin, flake that has been mounted in gum, ground edge axe. Caperian: Toothed edge knife, four large scrapers, uniface pebble chopper. Kartan: Two uniface pebble choppers, *horsehoof* core. Tula Sequence, Murundian: *Tula* chisel and slug, bone point. Pirrian: *Tula* with *tula* and *Burren* slugs, *pirri* point, two geometrics and two bone points. Tartangan: *Tula* chisel and *Burren* slug, bone point. Tasmanian industry: Four scrapers, hand chopper. [Drawn by David Rae.]





Typical flint implements of the Gambierian assemblage. Top left: Biface hand axe. Top right: Trimmed block with edges prepared for scraping and similar uses. Bottom: Two blades with the long trimmed working edges characteristic of this type of industry.

scrapers were found. There were no animal or human bones, or shellfish, and the homogeneous ashy-sand deposit indicated continuation of the one culture in which the *Bondi* points had been abandoned and the ground edge added to the tool kit. In the Capertee Valley, the *Bondi* points were associated with the geometrical microliths in the top of the deposits, and in the bottom was found an industry of chert blades and flakes, beautifully dentated saws, uniface pebble implements and hammers. Here again was an undisturbed occupation of the sites for some thousands of years.

This Eastern Regional Sequence thus consists of three phases, the early Capertian, the middle Bondaian, and the late Eloueran. Their antiquity and duration are as yet unknown, but the dating of them (by radio-carbon samples awaiting testing) will throw

considerable light on the antiquity of man in the Sydney and Blue Mountains areas. Implements of this sequence have been excavated in many rock-shelter floors in the Sydney-Hawkesbury district, at Lake Burrill on the south coast, in the Hunter Valley, and further north. Among implements of the early Capertian phase are some flakes and blades with Tasmanoid characteristics, highly specialized in the *juan* knife in south-east South Australia and Tasmania.

Northern Assemblages

In the north of Australia the Milingimbian assemblage excavated in 1948 in a huge shell midden near Milingimbi, on the north coast of Arnhem Land, has the ground edge axe as the dominant tool. Further west, the Oenpelliian assemblage, excavated in rock-shelter floors, is notable for the presence of *elouera* and flakes with use-polished working edges, uniface *pirri* and biface points, but the ground edge axe is rare and occurs only in the latest phase of the industry. The Kimberleyan is a term used to describe an interesting assemblage of uniface, biface and biface serrated points associated with the *leilira* blade and a series of well-made scrapers on quartzite blades. It has been excavated at Tandandjal and Delamere, and has exerted a strong influence on the Oenpelliian industry.

Comparison Of Assemblages

Excavations in Arnhem Land in 1948 yielded evidence of links with southern Australian cultures. Thus, on a consolidated dune in north-eastern Arnhem Land, at Oenpelli, Tandandjal, and on the upper Daly River, were found *pirri* points which occur in the middle phase of the Tula Regional Sequence on the lower Murray River. *Pirri* are widely distributed in the Kimberleys and Arnhem Land. At Oenpelli, also, *elouera* and fabricators typical of the Eastern Regional Sequence were abundant, and the *muduk* bone point, known in the Eastern and Tula Sequences. An important link between the two latter sequences is the occurrence of the geometrical microliths in the middle phase of both. Apparently the idea of making these tiny and beautiful little implements spread over a considerable part of the continent, but from where is not as

yet known. An interesting contrast between the two sequences is the occurrence of the symmetrical *pirri* point in one and of the asymmetrical *Bondi* point in the other, both in the same middle phase as the geometrics. The ground edge axe is associated with the late phase of both sequences, although it appears at the end of the middle phase in the eastern sequence. The uniface pebble implements form a link between the Kartan and Capertian periods.

Other interesting links are gradually being revealed as excavation work is extended. Thus, it is probable that the Gambierian industry in south-eastern South Australia, the Capertian phase in eastern New South Wales, and another assemblage excavated in Queensland (by the University of Melbourne), which has an age of some 10,000 years B.C., all represent the Tasmanian-type industry in Australia, and thus form strong evidence that the Tasmanian people occupied this continent before they were finally isolated on that island.

Australian And European Cultures

It must be borne in mind that the early and late stone ages of Europe and Africa do not exist in Australia, simply because man has, to the best of our knowledge, not been in Australia longer than about 20,000 years. The types and techniques of stone working in Australia fit into the classical sequence from the upper Palaeolithic to the early Neolithic periods, with a predominance of Mesolithic traits. Our points, geometrics, fabricators and burins are identical with examples found in upper Palaeolithic and Mesolithic sites in Europe, Africa and Asia, and our Kartan pebble implements probably form a Mesolithic link between Australia, New Guinea, Indonesia and south-east Asia.

Our early stone age consists of the Kartan, Gambierian and Capertian, our middle period of the Tartangan, Pirrian and Bondaian, and our late period of the Murundian, Eloueran, Milingimbian and Oenpelian. The time span for each of these three periods will vary greatly because the rate of spread of the implements of which they are composed over a continent as vast as Australia has varied enormously—the ground edge axe did not reach large areas of South

and Western Australia—and for this reason the point of time at which the various specialized implements came into use in specific localities depends upon their rate of diffusion from the east, west, north or south. Thus, the importance of differential diffusion has to be considered. The interaction of implement types used in the Eastern and Tula Regional Sequences is an interesting archaeological problem, and it would appear from our present data that the *tula* chisel, an Australian invention, was spreading from the interior to the marginal coastal areas.

The radiocarbon method of dating, in which the age of samples of charcoal, burnt bone and shell is measured by the known life of the carbon 14 element they contain, is enabling our archaeologists to build up a picture of how long the Aborigines have lived in some localities, and of how long it has taken their stone and bone working techniques and tool types to develop. Thus, on the lower Murray River the *tula* chisel was in use for over 6,000 years, and although implement making produced the finely made *pirri* and geometrics between 3,000 and 5,000 years ago, the working of stone appears to have degenerated during the later period of the occupation of this area. In central-eastern New South Wales chipped edges on flakes, blades and pebbles served during the early Capertian phase, together with dentated saws made by pressure trimming, but in the Bondaian phase the points and geometrics came into use, flakes were hafted as chisels, and the ground edge blade was adopted, until finally in the Eloueran phase the hafted chisel (*elouera*) and axe became the dominant tools. There was thus a marked advance in tool making in this area during the late portion of the occupation.

The archaeologist in Australia is studying other aspects of Aboriginal culture. The rock engravings and paintings are beginning to yield important data on the development of Aboriginal art and its associated religious beliefs.

Rock Engravings

Galleries of engravings occur in the greatest numbers in the Sydney-Hawkesbury district of eastern New South Wales, the Flinders Ranges of South Australia, with



An example of the black and white period in cave drawings in eastern New South Wales. On the left are a whale, emu and other figures in black. On the right is a series of white human figures superimposed over hand stencils.

which the western New South Wales sites are linked, the Carnarvon and other ranges in south-eastern Queensland, and at Port Hedland, Depuch Island, and many other localities in north-western Australia. (See *Australian Aboriginal Rock Art*, 2nd edition, 1962, by F. D. McCarthy.) Study of them until recently was confined to illustrating the principal motifs in sites, and to hypothetical discussion of the mysteries of their meanings, origin, and how they were made. It is now clear that complete recordings of the motifs at each site (a big task where up to 15,000 or more figures are engraved) is essential to provide information about the distribution of the designs and techniques, the proportion of local to widespread motifs, the symbols used to illustrate religious beliefs in specific localities, hunting and other aspects of the life of the people, and the range of clan totems.

Studies of this kind at Port Hedland, Depuch Island, Mootwingee and Sturt's Meadows by the Australian Museum have extended our knowledge considerably of the changes that have taken place in Aboriginal art during prehistoric times. Thus, it is now apparent that there was probably an early phase of engraving in which grooves were rubbed into the rock surface, in some (probably late) sites being arranged into simple patterns of parallel sets, radiate and other figures. These grooves are widespread in Australia, but much more study of their relationship to other techniques and styles will be necessary before an exclusive period of abraded grooves can be established. They are found consistently under pecked intaglios, proving that they belong to an earlier period, but we need more data on the superimpositions of these grooves in relation to the outline and linear design

Portion of a stone arrangement, showing circles, at Purnanga, western New South Wales. It is not known how old such arrangements are in eastern Australia, but in Cape York, Arnhem Land and the Kimberleys they form sacred centres in the ritual and beliefs of the living tribes. [Photo: Author.]





Superimpositions of rock-engraving styles and techniques at Port Hedland, north-western Australia: left, a barred design over an outline boomerang; centre, a pecked boomerang over an outline fish; right, pecked boomerangs over a linear design. [Photos: Author.]

styles. Their production probably survived much longer in some areas than others.

Three other phases are now definitely established. One is the outline phase in which life-size and larger figures of mythical beings, people, animals, weapons and other things are engraved by hammering overlapping pits into the rock surface to form a continuous groove. This is the only style in the Sydney-Hawkesbury area where some 700 sites incorporating over 5,000 figures have been recorded. At Port Hedland and other places in north-western Australia the outlines known so far depict spirit beings, weapons and marine animals such as fish, whales, dolphins and turtles, obviously the work of coastal-dwelling Aborigines. Outlines occur at Burra, South Australia, of a tortoise and circles, and occasionally in sites elsewhere in Australia, but their distribution, like that of the other styles, is not yet clearly established. To the outline phase in north-western Australia belongs the decoration of the figures with lines

across the body, and this developed into a highly-decorative sub-style which flourished in this region and spread down into the Flinders Ranges in South Australia, where boomerangs, a fish, and a "crocodile" head exemplify it.

The third phase is one in which the figures are all linear designs, such as concentric circles, radiates, grids, meanders, aprons, barbed spearheads and many others. It is really a mixture of naturalism and linear symbolism, with emphasis on the latter. It is believed that the concentric circle and sinuous lines were introduced during the spread of bronze age art motifs from south-east Asia into Oceania, and to this nucleus the aprons and other local motifs were added in Australia. The linear designs spread into central and South Australia, western New South Wales and Queensland.

The fourth phase was another change, this time a return to naturalism. Here we

see human and animal figures, weapons, sacred objects and other motifs up to life-size, but frequently as miniatures, associated with immense numbers of human and animal tracks, in which the whole surface of the subject is covered with pits or cuts to form an intaglio. These occur in immense numbers on Depuch Island and in other north-western Australian galleries, and they, too, spread southward through central Australia into South Australia and western New South Wales, and eastward into western Queensland. Religious cults, such as the Gunabibi, spreading from the desert areas, employed this pecking technique to engrave their dramatically posed men, women and animals on the rocks of sacred sites. The most important point revealed by this approach to the study of rock art is that the linear designs, based on the concentric circle and sinuous lines, survived in central Australia as a living ritual art, even though they were prehistoric in north-western Australia and western New South Wales.

Cave Paintings

Displays of paintings in rock shelters total many thousands in Australia and they are most abundant in areas like the Kimberleys, Arnhem Land and north Queensland, where engravings are scarce. Paintings are scattered all over the continent and are plentiful in New South Wales and South Australia. They occur not uncommonly associated with the engravings. Space will not permit the description of them as an art. Their study until recently, like that of the engravings, merely illustrated the outstanding figures in the site, but the Australian Museum has set a pattern for the full recording of the galleries. The meaning of paintings can still be given by the Aborigines in many central and northern areas, and some interesting work has been done in this field.

From the prehistory point of view, notable local changes, not as widespread as in the engravings, have been perceived. Thus, in central-eastern New South Wales stencils were the earliest art, followed by a red and white, then a black and white, and finally polychrome stages, and in Arnhem Land silhouettes and line figures were followed by phases of stick figures, X-rays of animals

and highly decorative human figures with sex as the dominant theme.

It would appear on present evidence that the stencils which occur practically throughout the continent were the first type of cave art in Australia, possibly allied with simple outlines of animals. They were followed in many places by figures drawn in one colour, as silhouettes, outlines and outlines enclosing patterns of lines. After this phase the art developed differently in various regions



An X-ray barramundi fish painting superimposed over a gracefully posed Mimi spirit figure in white, at Oenpelli, western Arnhem Land. [Photo: Author.]

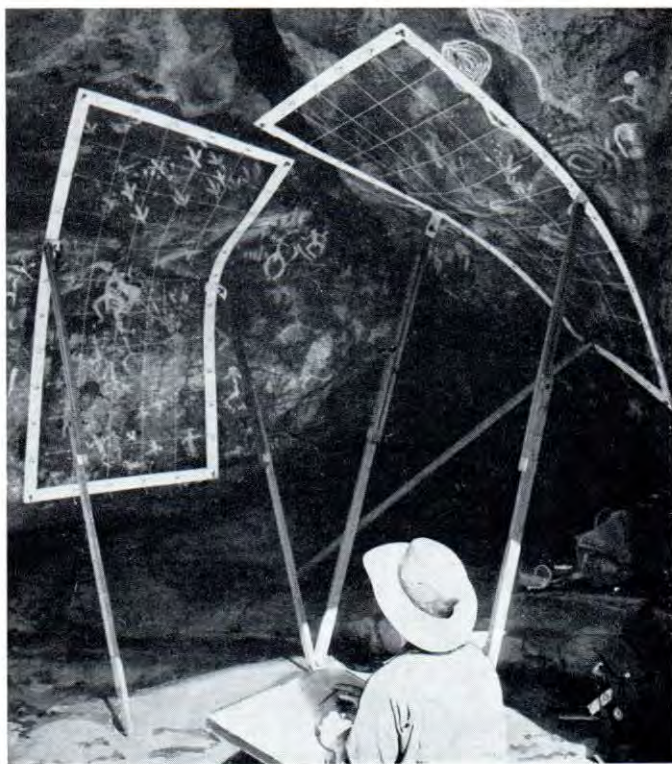
of the continent. The stencils and other earlier styles survived throughout the cave art in some areas, but were supplanted by more elaborate and advanced styles in other areas, like the Kimberleys and Arnhem Land. Much more detailed recording and study of galleries will be necessary before we can hope to understand this problem more clearly.

There are many problems yet to be solved by the archaeologist in relation to the paintings. Some styles occur in both New Guinea and Australia, and some in Indonesia and Malaya, and a possible relationship in the cave art of these places is to be considered; likewise the origin of the great Wondjina heroes painted in the Kimberley caves, believed by many to have been introduced into the north-west from Indonesia, although figures of a somewhat similar style are known thousands of miles away in the Sydney-Hawkesbury paintings and engravings on the south-east coast of Australia. Engrav-

ings appear to occupy a broad diagonal band from the north-west to New South Wales and South Australia, while the paintings are more widely distributed, and this raises the question of which is the older art and, where they occur together, whether one or both were practised at the same time. Archaeologists, too, face the difficult task of relating the various phases of prehistoric implement assemblages with the various phases of painting and engraving, stone arrangements and other customs, to make it possible to build up a composite picture of the development of Aboriginal culture as a whole.

MUSEUM FILM SHOWS CAVE PAINTINGS

This photo was taken during the filming of "White Clay and Ochre," the Museum's recently-completed 16 mm. colour, sound, film dealing with Museum field research on Aboriginal cave paintings in western New South Wales. ("Australian Natural History", Vol. XIV, No. 1, p. 27). Though aimed at secondary and tertiary educational level, the film should, nevertheless, be of interest to a wide range of audiences. Many yellow, red and white cave paintings are shown, and illustrate the hunting of emus and kangaroos and other aspects of Aboriginal life. Three painting methods used by the Aborigines are demonstrated. The Museum anthropologist and artists were filmed while they recorded the paintings and during the excavation of a cave floor for implements and charcoal samples. The photo shows a Museum artist making a scale copy of paintings.—H.H.





Group of Tasmanian Aborigines, a painting by Robert Dowling (1859). [Photo: Queen Victoria Museum, Launceston, Tasmania.]

The Prehistory of the Tasmanian Aborigines

By **THERÈSE BELLEAU KEMP**

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TASMAN'S men thought they heard human voices when, in 1642, they went ashore at Blackman's Bay. They also described tree notchings, designed to assist in the hunting of possums. But they did not see any Aborigines. The first contact occurred in 1772, during Marion du Fresne's voyage. It is recorded that one Aboriginal was shot. Furneaux visited the island in 1773, Cook in 1777, Bligh in 1788, Cox in 1790, d'Entrecasteaux in 1792, Hayes in 1794 and Baudin in 1802. The whalers had been visiting Tasmania since as early as 1798.

The first settlement was established in 1803 at Risdon. The Aboriginal population at that time is unknown. Indeed, reliable figures became available only 30 years later, when all Aborigines were rounded up for removal to Flinders Island. Governor Arthur decided on this step in 1829 and for

the next six years the execution of the policy was the responsibility of G. A. Robinson. At the end of that period the total Aboriginal population was about 200. In 1847, 40 Aborigines, all that survived on Flinders Island, were transferred to Oyster Cove, near Hobart. In 1869 William "Billy" Lanney, the last male Tasmanian, died; he was followed in 1876 by Lalla Rookh, or Trugernanna, the last Aboriginal woman.

For several decades amateur archaeologists have been actively collecting stone implements from the surface of habitation sites in Tasmania.

In 1938, A. L. Meston carried out investigations on the north-west coast, at a midden (shell heap) called Rocky Cape. At that time the midden partly filled a cave and was thought by Meston to be some 15 feet deep. He commented on the uniformity

of the artefacts found in the deposit. But the midden also contained a variety of shells; these were, in descending order of their importance: warriner, mutton-fish, oyster, duckbill, mussel, limpet, whelk. It also contained the remains of Tasmanian fur seal, wombat, red-necked wallaby and parrot-fish. The presence of parrot-fish remains is particularly interesting, because it had been believed that the Tasmanian did not eat scale fish. Of course, the mere presence of parrot-fish does not necessarily mean that it formed part of the diet. The parrot-fish may have been collected with shellfish by the women, and never eaten. In addition to stone implements some bone tools—spatulae and pointed artefacts—were found at this site.



Map of Tasmania showing localities where stone implements have been found. [By courtesy of the Queen Victoria Museum, Launceston, Tasmania.]

Meston's investigations give no indication of the period during which the Aborigines lived at Rocky Cape, nor of the number of Aborigines who had used the cave. These are questions, however, that archaeologists may properly be expected to answer.

Meston's excavation at Rocky Cape Cave, although the work of an amateur, is the only substantial archaeological investigation that has been carried out in Tasmania.

Cultural Adaptation To Ecological Conditions

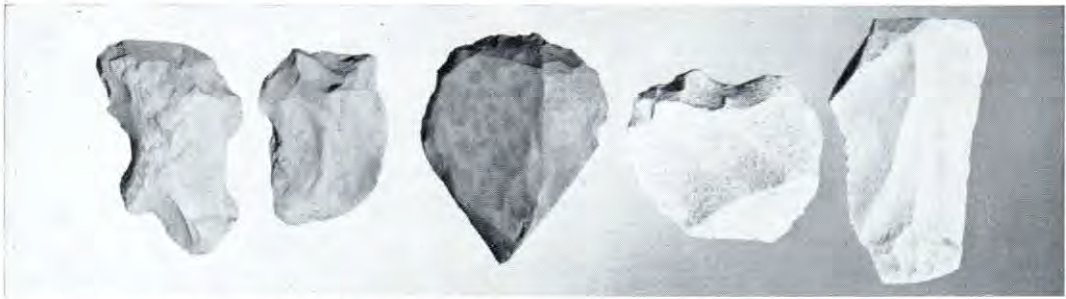
There is in Tasmania a single configuration of culture. Nevertheless the Tasmanian was required to adapt to two quite dissimilar habitats, those of the west coast and of the east coast. The nature of the adaptation may be studied by relating stone implements to ecological variation.

The east coast and midlands areas yield flake implements which are technologically homogeneous. They reveal what I propose to call a sub-culture based on a hunting and gathering economy. Available to the eastern sub-cultures were marsupials, reptiles, mammals and water-fowls. They gathered the eggs of water-fowls, shellfish, crustacea, grubs, ants' eggs, plants and berries. The east coast bands or hordes were nomads, migrating along the coast during the winter months but moving inland and to the mountains during the summer months.

The implements of the west coast reveal a sub-culture based primarily on the hunting of sea mammals. Most of the tools are of the cutting kind used, for example, in the butchering of seals. Some wood-working tools are present, suggesting that spears were made, presumably for the hunting of marsupials and land mammals. Middens are fairly numerous here, as in the east, indicating that the gathering of shellfish formed part of their economy also.

Unlike those of the east coast, the west coast bands seem to have been semi-nomadic. This is strongly suggested by the descriptions of their huts, which were much more than simple wind-breaks. They were semi-permanent, built in the shape of beehives, with bark walls, sometimes decorated, and with "thatch" roofs. The explanation of this relative sedentariness seems to lie partly in the rigour of the west coast winter and partly in the periodic arrival of schools of seals which could be exploited over long periods from a single base.

Cultural adaptation to the ecology of the Western Tiers is reflected in the relative *size* of the implements from that area. Implements from the Great Lake area possess most of the characteristics of implements from the east coast and midlands. But the Great Lake tools are very much bigger.



Stone implements of the Tasmanian Aborigines, from the Australian Museum collection. The three on the left are from Carlton, south-east coast, and are part of the F. D. Maning collection. The other two are from Sandy Cape, west coast, and are part of the R. Turner collection.

There are, in the east and west coasts areas, three major groups of stone implements: (a) scraping implements for cleaning skins and animal sinews and for working wood; (b) cutting implements for scarification and bleeding operations, for cutting *Melaleuca* stems for their spears, for notching their waddies, for cutting the skin and flesh of fur animals, for cutting women's hair; (c) ground pebble mortars.

The Tasmanian had a remarkable control of stone technology. Not only did he manufacture a great variety of stone tools needed in the production of hunting and war equipment but he made them from whatever material was available, including quartzite as well as hornfels and chert. The Tasmanian Aboriginal did not produce as wide a range of implements as the Australian. Spearheads, for example, require techniques of manufacture different from those known to the Tasmanian. Furthermore, as far as is known he did not have the knowledge of hafting—a cultural limitation.

The Tasmanian Aboriginal did not limit himself to stone and wood crafts; he also practised the art of carving. Evidence of the latter is found at several localities on the west and north-west coasts. The most important were described by Meston in 1931: the Mersey Bluff (Devonport) and Mount Cameron West carvings. J. F. Jones described those at Trial Harbour in 1937. According to Meston, the Mersey Bluff carvings were executed on dolorite and fell into two classes: geometric patterns, circles mostly; naturalistic motifs, fish, haliotis shell, a snake and the head of a bird.

Meston's account of the Mersey Bluff carvings was almost immediately opposed by E. O. Scott. Scott denied that they were the product of human activity. The dominant motif here, as at Trial Harbour (granite) and at Mount Cameron West (calcareous sandstone), is the circle. At the latter locality there are, in addition, rows of large dots and groups of three almost parallel straight lines. The circle and semi-circle were common scarification motifs. It may be reasonable to assume that the carvings with geometric patterns were the result of human activity associated with some sort of ritual, and that the naturalistic motifs were not. The Aboriginal might have "touched up" rock markings made, for example, by tree roots.

Other Culture Traits

In the eastern and western sub-cultures the division of labour seems to have been simple. The women were occupied with the gathering of food, and the men with hunting. The women made baskets, and the men wooden utensils and weapons, as well as stone implements.

Men wore their hair long, in ringlets greased and covered with ochre, while the women cropped theirs short with stone cutting implements. Bits of wood, feathers, flowers and kangaroo teeth were inserted in the hair of both sexes. Necklaces of pearly blue shell (*Elenchus irisodontes*), which the Aborigines called *merrina*, were bored with their canine teeth, polished, and strung on the sinews of kangaroos.

Women wore kangaroo sinews around their heads, also collars and anklets made of strips of kangaroo skin. Both men and women wore around their waists several sinews which, according to several authors, they tightened when they had been for some time without food. Both men and women wore also, around their necks, the bones of deceased relatives; the bones were wrapped in pieces of kangaroo skin and strung with sinews. (See lower illustration on this page.)

The form of burial varied from place to place. On the east coast the Aborigines were known to have placed the body upright in a hollow tree. In some bands the body would later be cremated, but the skull would be detached and placed in an ossuary. Other bands left the body in the tree. Some form of inhumation occurred, the body being placed in a hole made by the casual uprooting of a large tree. It was partly covered with leaves.

They believed in an after-life, and in an "evil spirit" which acquired different names in different bands. They believed it to live in caves and dark recesses of dense forests, in clefts of rocks on mountain tops. They believed its powers to be strongest at night.

They used the fingers of one hand to help them count, but they never got beyond five. Some bands did not count beyond three.

Where Did The Tasmanian Come From?

Two theories hold the floor, the "overland" theory and the "drift" theory. The "overland" theory has two variants. According to the first of these, the Tasmanians came to Australia from south-east Asia by a "land bridge", moved southwards across the continent and then crossed Bass Strait by a second "land bridge". According to the second variant, they landed from Melanesia on the north-east coast of Australia, moved south by land, then crossed to Tasmania by water-craft, possibly via Flinders Island. The "drift" theory also has two variants. According to the first, the Tasmanians came directly from Melanesia. According to the second variant, they landed on the east coast of Australia, from either Melanesia or south-east Asia,



Top: A basket (twined weaving). Bottom: A kangaroo-skin pouch in which the bones or ashes of the dead were carried around the neck. [Illustrations from H. L. Roth.]

then proceeded southwards along the coast, and crossed to Tasmania by water-craft.

All possibilities, except that of a direct passage from Melanesia, have been shown to be feasible.

But archaeological evidence tilts the scales of plausibility in favour of the "overland" theory. Our knowledge of Tasmania's prehistoric culture is limited and, in some respects, ambiguous. There are, nevertheless, fundamental similarities between the Tasmanian and old Australian cultures. Thus, in 1962, J. Mulvaney excavated part of Kenniff Cave, near the source of the Warrego, Maranoa and Dawson Rivers in Queensland. At a depth of seven feet Mulvaney found material with "a considerable degree of cultural uniformity" which has been dated, by the radiocarbon method, at $10,950 \pm 750$ B.C. The artefacts of this particular occupational phase are very similar to those found by the author in surface collections from Tasmania.

The following items are common to a phase, not necessarily synchronous, of Tasmanian and Australian culture: simple spears, waddies, twined basketry, skin cloaks, simple wind-breaks, rafts propelled by poles, canoes made with bark, flake stone technology (scrapers, end and side, pyramidal and nosed; chopping tools), hordes or bands as the political unit, with defined boundaries and trespass regulations, a nomadic or semi-nomadic existence with an economy based on hunting and gathering, a social structure with no moieties or sections, polygamy, exogamous marriage, avulsion of upper teeth, scarification, corroborees, twin myth, sky mythology, carvings on rocks.

Thus, the people whose implements were found at Kenniff Cave may well be "draggers on" from tribes travelling southwards to Tasmania. That Kenniff Cave considerably predates the appearance of seacraft in the Pacific further strengthens the "overland" theory.

Why Were The Tasmanian Aborigines Dying Out?

The descriptions of the Aborigines by the explorers and by the early settlers are in striking contrast. The discoverers thought that, in view of the rigours of the climate, the Aborigines were remarkably healthy.



Above: A canoe made of bark. Below: A windbreak. [Illustrations from H. L. Roth.]



They especially admired their adaptation to the cold; in a winter month only an occasional Aboriginal wore a kangaroo skin cloak or apron. The accounts of the early settlers, on the other hand, almost always refer to rheumatism, soreness of the face, scabs and sores on most parts of the body, pulmonary inflammation and catarrh. (The latter two were usually fatal.) In this connection, a report by de Labillardière, who was with d'Entrecasteaux, is of the greatest interest: in February, 1793, Boucher, one of the gunners of the brig *Espérance*, "died . . . of a consumption". The "pulmonary inflammation" that the settlers thought so common among the Aborigines could have been contracted during this visit, or perhaps during that of Marion de Fresne in 1772.

There is other evidence that the Aborigines were already dying out at the time of the first settlement. Thus, de Labillardière described a group of Aborigines around a fire, 48 in all: 10 men, 14 women, 24 children, with, among the latter, as many boys as girls. This stands in striking contrast to the later comment (1878) of Brough Smyth: "the women are seldom accompanied by many children. . . ."

"Pulmonary inflammation" and other "European" diseases no doubt contributed to the decline of tribal population. So did the sealers, who, by appropriating Aboriginal women, disturbed the sex ratio, especially in the north, north-west and north-east.

Finally, there was the effect of settlement. The earliest farms were established in the midlands area. If we may judge from the distribution of localities where implements were found, this was precisely the area of densest Aboriginal population. Settlement disrupted migration patterns and routes and, in particular, denied the east coast Aboriginal his summer hunting and protein diet. As a result, he became an easy prey to disease. (See map on page 243.)

The above is intended to be suggestive only, as to why the Tasmanian Aborigines were dying out. In the light of our present knowledge it can be no more.

Australian Museum Publications

The following Australian Museum publications are available at the Museum:—

AUSTRALIAN MUSEUM HANDBOOK: A comprehensive natural history handbook, as well as a guide to the Museum; 140 pages; 4/-, posted 4/6.

THE NATURAL HISTORY OF SYDNEY: An account of much of the land and marine fauna, topography, geology, fossils, native plants, and Aboriginal relics of the Sydney area; contains articles already published in this magazine, with two others added; sixty-four pages; 5/-, posted 5/6.

EXPLORING BETWEEN TIDEMARKS: An introduction to seashore ecology; forty-five pages; 4/-, posted 4/6.

THE FROGS OF N.S.W.: Thirty-eight pages; 3/6, posted 4/-.

AUSTRALIAN ABORIGINAL DECORATIVE ART: Sixty pages; 6/-, posted 6/6.

AUSTRALIAN ABORIGINAL ROCK ART: Describes engravings and paintings on rock faces and in caves; seventy-two pages; 6/6, posted 7/-.

N.S.W. ABORIGINAL PLACE NAMES AND EUPHONIOUS WORDS, with their meanings; thirty-two pages; 1/6, posted 2/-.

AUSTRALIAN ABORIGINES: A booklet of special interest to school children; 6d., posted 1/-.

THESE ARE INVERTEBRATES: A folder, illustrated in colour, explaining how to use the Museum's unique exhibit "These Are Invertebrates"; 1/6, posted 2/-.

LIFE THROUGH THE AGES: A coloured, illustrated chart (34in. deep and 24in. wide), showing the progress of life from the primitive invertebrates of more than 500 million years ago to the present. The durations of the geological periods are shown and examples of the forms of life that existed in each are illustrated. Designed for hanging in schools; 6/-, posted 6/9.

LEAFLETS on natural-history and Aboriginal topics: Free of charge.

Also on sale: **AUSTRALIAN ABORIGINAL CULTURE**, published by the Australian National Advisory Committee for UNESCO. A handbook of the life, arts and crafts of the Aborigines; 2/6, posted 3/-.

Origin and Physical Differentiation of the Australian Aborigines

By N. W. G. MACINTOSH

Challis Professor of Anatomy, University of Sydney

THERE is no serious debate that the Aboriginal Australians came from the direction of south-east Asia on their migration to Australia. During the glacial stages of the Pleistocene Period, sea level was lower than it is today. More dry land was exposed and distances between adjacent land masses were reduced accordingly. Land so exposed in the vicinity of the south-east Asian coast and of Java is referred to as Sunda-land; in the vicinity of northern Australia and New Guinea as Sahul-land. Any migration from Sunda-land to Sahul-land had to negotiate Wallace's Line, which is eastward of Java, and Weber's Line, which is westward of Australia and New Guinea. Each of these lines indicates an ocean deep and it is firmly believed that no dry land crossing of these lines has been possible within the last 75 million years. The complex of islands between Wallace's and Weber's Lines is referred to as Wallacea.

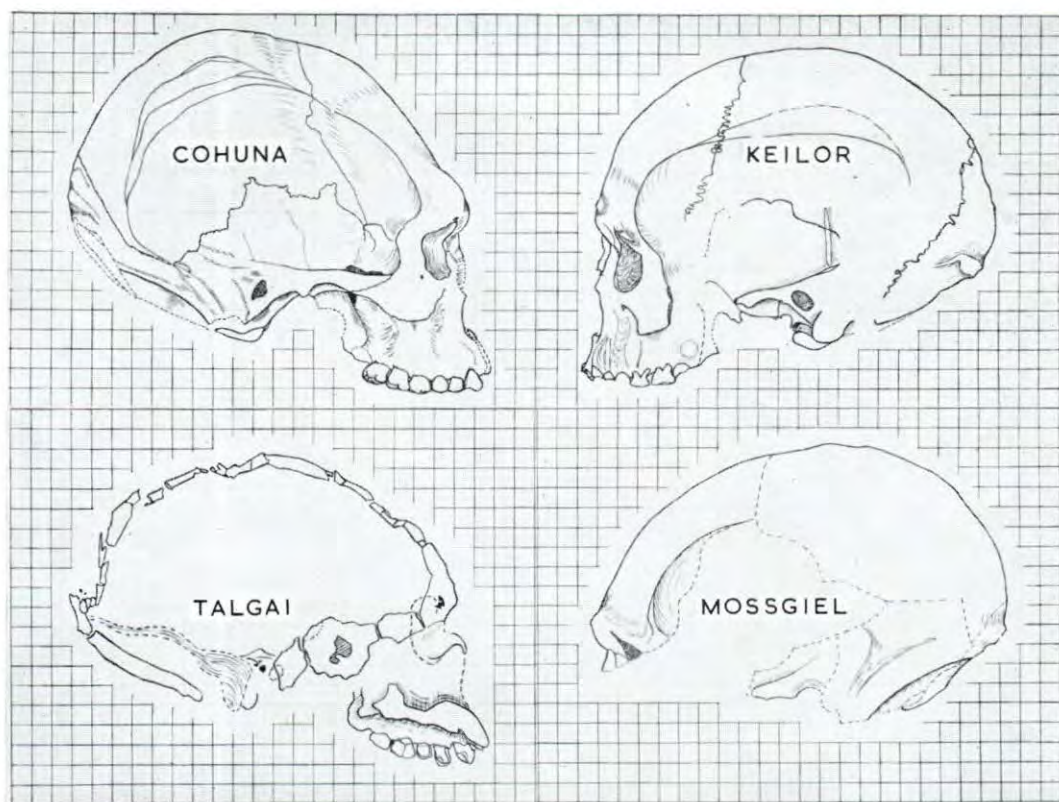
Potential routes therefore from Java or Borneo would have crossed the sea at Wallace's Line, moved along the Lesser Sunda region to Timor, crossed the sea again at Weber's Line to Australia, or alternatively have traversed a Tanimbar-Ceram-Aru route, crossed Weber's Line and then moved along the northern shores of New Guinea, or along the southern shore where the Sahul Shelf would provide dry land continuity with northern Australia and Cape York. Majority opinion considers that before 35,000 years ago the sea had fallen to 450 feet below its present level. Between 18,000 and 16,000 years ago, the sea was only 270 feet below present level. Oscillations occurred between 16,000 and 7,000 years ago, giving levels varying from approximately 210 to 140 feet below present levels. A steady rise then occurred to the present level, attained some 3,000 years ago.

Irrespective of whether Australia was populated by a single, large or small initial

migratory group, or by a series of successive waves, any or all had to cross a seaway at some stage of the migration. How this was achieved is completely unknown, although indirect evidence now strongly suggests that man was a water traveller at a much earlier period than formerly believed. It has been customary to visualize migrations at the time of glacial phases, because sea distances were then so much shorter, and adjacent land masses, because of their greater elevation above sea level, were brought within visual range. Factual proof by archaeology that migrations to Australia did occur at such specified times has yet to be produced.

In Java, the earliest evidence of man, or of man's precursors, is represented by an infant skull, known as the Modjokerto skull, found by Duyfjes in 1936. Geologically it belongs to Lower Pleistocene beds. The next evidence of man in Java is *Pithecanthropus* of the Middle Pleistocene, i.e., early in the Second Glacial Stage, approximately 500,000 years ago. *Homo soloensis* is a later representative of early man in Java, from the middle Upper Pleistocene and corresponding with the Third Interglacial Stage. *Homo sapiens wadjakensis* appears in the late Upper Pleistocene, during the Fourth Glacial Stage. The Dutch scientist Dubois thought in 1920 that Wadjak man might be a type ancestral to the Australians of today.

The German-American scientist Weidenreich in 1939 went further and postulated a continuous line of descent from *Pithecanthropus* to *H. soloensis* to Wadjak man to present Australians. The British anatomist Keith had in 1936 quite independently elected a similar opinion and regarded this direct line of descent as being particularly instanced by the fossilized Australian Talgai skull. The discovery of the Keilor cranium in 1940 convinced Weidenreich that his theory was correct, when he



Orthogonal surveys have been plotted on centimetre graph paper. Irrespective of the published size of this illustration, scale for each of the four crania remains identical. Measurements from the crania can therefore be determined by the use of dividers applied to the centimetre grid surrounding the survey drawings. The Cohuna, Keilor and Talgai crania are oriented in the Frankfort Plane. The Mossiel calotte is oriented in the glabella-inion plane; shattered fragments of its face and jaws have not yet been cleared of mineral encrustation and their reconstruction to fit the calotte has not yet been made; attempts to orient the calotte in the Frankfort Plane at this stage would give only an approximation rather than an exact result. The Talgai cranium is drawn from the inner aspect of its left side after sagittal or midline section. This illustration indicates how extensively the cranium has been fractured; it is practically a mosaic of fragments. In making a comparison of the four specimens, note that the Keilor cranium presents a modern looking human pattern; it has very little prognathism, its frontal and temporal regions are full and rounded, its eyebrow ridges are not very prominent, its infraglabellar notch is shallow, and so on. Birdsell nominated it as a classic example of his "Murrayian Type". Weidenreich pointed out that it is identical in size and shape to Wadjak Man. Gill believes it has an antiquity of 10,000 to 15,000 years. (The author is indebted to John McNally, Director of the National Museum of Victoria, for permission to make this survey drawing and other studies of the Keilor cranium). Cohuna, Talgai and Mossiel support Weidenreich's (1943) opinion that special features of the *Pithecanthropus*—*H. soloensis* forehead have undergone very little change in the Australian. As a whole they are morphologically much more "primitive" in appearance than Keilor. This does not necessarily imply that Keilor has a lesser antiquity.

observed that Wadjak and the Australian Keilor crania were practically identical.

The problem arises whether Wadjak stands in cousin, rather than in ancestral relationship, to Keilor: the geological age of Wadjak man is uncertain, von Koenigswald believing he is contemporary with Sampoeng fauna and not exceeding 5,000 years in antiquity; but De Terra stated that Sampoeng fauna belongs to the Last Glacial Period and Wadjak's cranial structure indicates such an earlier period. The Sampoeng fauna contains unfossilized human remains described by Mijsberg as having affinities with Vedda, Dravidian, Australian and Papuan populations. Hence the true status of Wadjak man remains vague.

Weidenreich further pointed out in 1943 that, even after allowing for phylogenetic development, surprising likeness to *Homo soloensis* could be detected in recent Aboriginal Australians. He instanced an Aboriginal cranium described by Professors Burkitt and Hunter, of Sydney University, in 1922 as Neanderthaloid in type. Weidenreich pointed out that its affinities were much closer to *Homo soloensis*. He concluded that the original special forehead features of *Pithecanthropus-H. soloensis* had undergone very little change in the recent Australian, despite transformation of the skull as a whole into a modern human pattern.

Professor Birdsell, of California, has put forward quite a different theory. He believes the Aboriginal Australians have a trihybrid composition. He visualizes a first wave of migrants, referred to as Oceanic Negritoids, Barrineans or Tasmanoids, spreading to Australia early in the Fourth or Last Glacial Period and extending into Tasmania. His theory says a second wave called Murrayans, who were derived from an archaic Caucasoid stock, came to Australia in the middle of the Fourth Glacial Period and progressively absorbed the earlier Negritoids, save in some isolated regions such as the rain forests on the Atherton Tableland and in Tasmania. A third and final wave he calls Carpentarians or Australoids, who were related to Veddoid or pre-Dravidian elements. He claims they arrived late in the Fourth Glacial Period, prior to the subsidence of the Sahul Shelf. It is interesting

to note that Birdsell believes his second wave or Murrayan people has closest affinity with a mixed *Homo sapiens* population from the Choukoutien Upper Cave in China, and in particular with the cranium of an elderly male in that series. He therefore considers that Soloensis and Wadjak are "retarded island descendants of a common and more progressive mainland ancestral stock from which the Murrayans developed". Weidenreich, however, was of the opinion that the skull of the Choukoutien Upper Cave Old Man differed appreciably from recent Australian and from the Wadjak and Talgai skulls and had to be equated with a primitive Mongolian type; and that skulls such as Wadjak, Keilor, Talgai and Cohuna differ from Upper Palaeolithic European Man in the direction of living Australians and Melanesians, not in the direction of modern Europeans.

What might be regarded as a third broad theory was summarized by Wood Jones in 1935 when he affirmed that over the whole continent of Australia the native is of the same well marked racial type and represents the advance guard of pre-Dravidian migration which, starting probably in the Mediterranean region, spread across India into Ceylon and to the Malayian region, and that with the Veddas of Ceylon and other scattered remnants of this migration the Australian has very real affinities. In Wood Jones's opinion there was no preceding stratum on the Australian continent, the Tasmanians being pure but aberrant members of the Melanesian group, modified from the original type by isolation, not by hybridization.

Professor Abbie, of Adelaide University, from recent annual field studies of living Aboriginal Australians, says a uniform racial type occupies the entire continent and such variations as occur do not present clines or gradients, and can be explained adequately by varying ecological pressures. Thus, with so many debatable theories the origin of the Aboriginal is still an open question and absolute conclusion probably will be determined only by future archaeological revelation.

Archaeological results are scanty at present. First, not one of the very small series of prehistoric Australian skeletal relics has

been positively dated; second, significant skeletons from Java and other islands between south-east Asia and Australia are very few, particularly for the later part of the Fourth Glacial Period; third, features more primitive than those of Keilor and Wadjak persist in recent unmineralized skulls and in living Aborigines, making an evaluation of the relics which do exist hazardous.

Australian Fossil Relics Of Possible Significance

The Talgai cranium was found in 1886. It came from the wall of a storm channel some 12 feet deep near Dalrymple Creek on the south-eastern Darling Downs in Queensland. The late Professor Sir Edgeworth David visited the site in 1914 and gave an almost, but not quite, conclusive opinion that the relic genuinely belonged to a particular geological stratum and that its antiquity might be anything between 20,000 years and Early Pleistocene. Keith in 1931 said an antiquity of 12,000 to 15,000 years would probably be an underestimate. The late Dr. S. A. Smith extracted the skull from its massive mineral encrustation and in 1918 described it as a "primitive Proto-Australian" with no Tasmanian traits or affinities in face or vault. A few of the primitive characters referred to by Smith have been challenged by Dubois in 1920, Campbell in 1925, Burkitt in 1929, Wood Jones in 1934, Hellman in 1934 and Macintosh in 1952. It nevertheless still remains morphologically the most primitive Australian cranium on record. Study this year by Edmund Gill of the National Museum of Victoria and myself establishes beyond reasonable doubt the planar and vertical provenance of the cranium and its genuine *in situ* status. Radiocarbon dates of samples from related strata are expected presently, and it is hoped will permit an accurate statement of the cranium's antiquity.

The Cohuna cranium was found in 1925 embedded in the margin of Kow Swamp near Cohuna township in Victoria. Macintosh in 1952-3 published some data on the cranium and its site. It possesses some very primitive characters, but not the totality exhibited by Talgai. Its antiquity is almost

certainly no less than Mid-Holocene and may be much greater, but further field work is needed to establish its real age.

The Aitape relic consists only of a fragmented frontal bone found in 1929 on the north coast of New Guinea by Dr. Hossfeld. Professor F. J. Fenner published a minute anatomical description in 1941, but did not detect any startling features in its structure. Further work on the site by Hossfeld in 1962 indicates the relic is from a mangrove mud scour lenticle, not from a stratum. Its morphological affinity remains enigmatic.

Tartanga and Devon Downs are sites on the lower Murray River excavated by Hale and Tindale and described by them in 1930. Skeletal remains were recovered from each site. Unfortunately the Devon Downs remains are all infantile, and the Tartanga remains are juvenile, the oldest having an age of 12 years. Assessment of racial affinity from such youthful material is extremely difficult. Campbell has referred to primitive characters in the teeth and palates of these items and has suggested their similarities with Talgai. The 12-year-old youth referred to as "Tartanga i" apparently has an antiquity of between 5,700 and 4,700 years.

The Keilor cranium was found in 1940 in a sand pit in a river terrace near Melbourne. Gill, in 1953-6, estimated antiquity of 10,000 years, and Birdsell claims that anatomically it is "a classic representative" of his Murrayian type. The genuine *in situ* status of the cranium has been attacked, though Gill now believes he can attest its provenance beyond doubt and that its antiquity may range up to some 13,000 years. My own anatomical study of the cranium this year indicates a modernity of structural pattern contrasting markedly with the more primitive-looking Talgai, Cohuna and Moss-giel remains.

The Moss-giel skeleton was found in 1960, in an eroded claypan in western New South Wales. Its skull possesses features which resemble those of *H. soloensis*. Even if its antiquity proves from radiocarbon dating to be quite low, the relic will add significance to Weidenreich's opinion that *H. soloensis* traits persist in recent Aborigines.

Each of these relics exhibits large size and massiveness or ruggedness. But these

features are exhibited in equal or greater degree by a small percentage of modern specimens. None exhibits Tasmanian traits. Differences between these relics and skulls of the present Aborigines are not great; indeed, cranial form has remained surprisingly constant during the last 10,000 years. All the relics show individual or combined features which can be spoken of as primitive; and a morphological sequence can be detected ranging from Talgai at the more primitive extreme, through Mossiel (tentatively), Cohuna, Tartanga, and finally the most modern-looking, Keilor.

Blood Groups

Numerous publications over the last 10 years by two teams under R. J. Walsh, of Sydney, and R. T. Simmons, of Melbourne, provide a relatively clear recognition of the blood-group patterns of Aboriginal Australians and Melanesians. Present opinion indicates with considerable certainty that there is a characteristic pattern for Australia, another for Melanesia, and they differ radically from one another.

Dermatoglyphics

Far too little work has been done to allow a conclusive statement. At present it can only be said that Melanesia and Australia have somewhat similar high intensity patterns in fingerprints. Their nearest similarity is to Mongol intensity; they diverge markedly from European and Ainu, and still further from the African pygmoid low intensity of pattern. This agrees in a very broad way with some conclusions derived from studies of blood-group patterns.

Hair Colour And Form

Very little work is on record but one item based on data collected recently by Dr. Kirk, of Perth, indicates significant differences between coastal and inland Aboriginal hair.

Comparison Of Australian And New Guinea Indigenes

Recent work on the structural composition of New Guinea Highlanders which I will soon be publishing does not dispute, and to some extent confirms, the conclusions derived from analyses of blood group gene

frequencies. No physical indices resembling Australian Aboriginal indices were found in the New Guinea Highlands.

In this article, I have tried to present a range of viewpoints without bias. My own view is that the Australian Aborigines constitute one basic pattern, and the Papuo-Melanesians another; but that each had already been somewhat hybridized in their Wallacean homeland, and subsequently entered the Oceanic region as small migrant bands towards the latter part of the Fourth Glacial Stage.

NOTES AND NEWS

BRITTLE-STAR STINGS?

A recent painful and possibly toxic sting, apparently from a common New South Wales Brittle-star, has been reported to the Australian Museum. Information on "stings" or "bites" from Brittle-stars (Ophiuroidea) is urgently required by the Museum. Reports on past experiences of this type or information on any similar happening this summer would be most welcome. It is most important to retain the actual animal responsible and to report to the Museum as soon as possible. Similar information on venomous octopus bites would be welcomed.

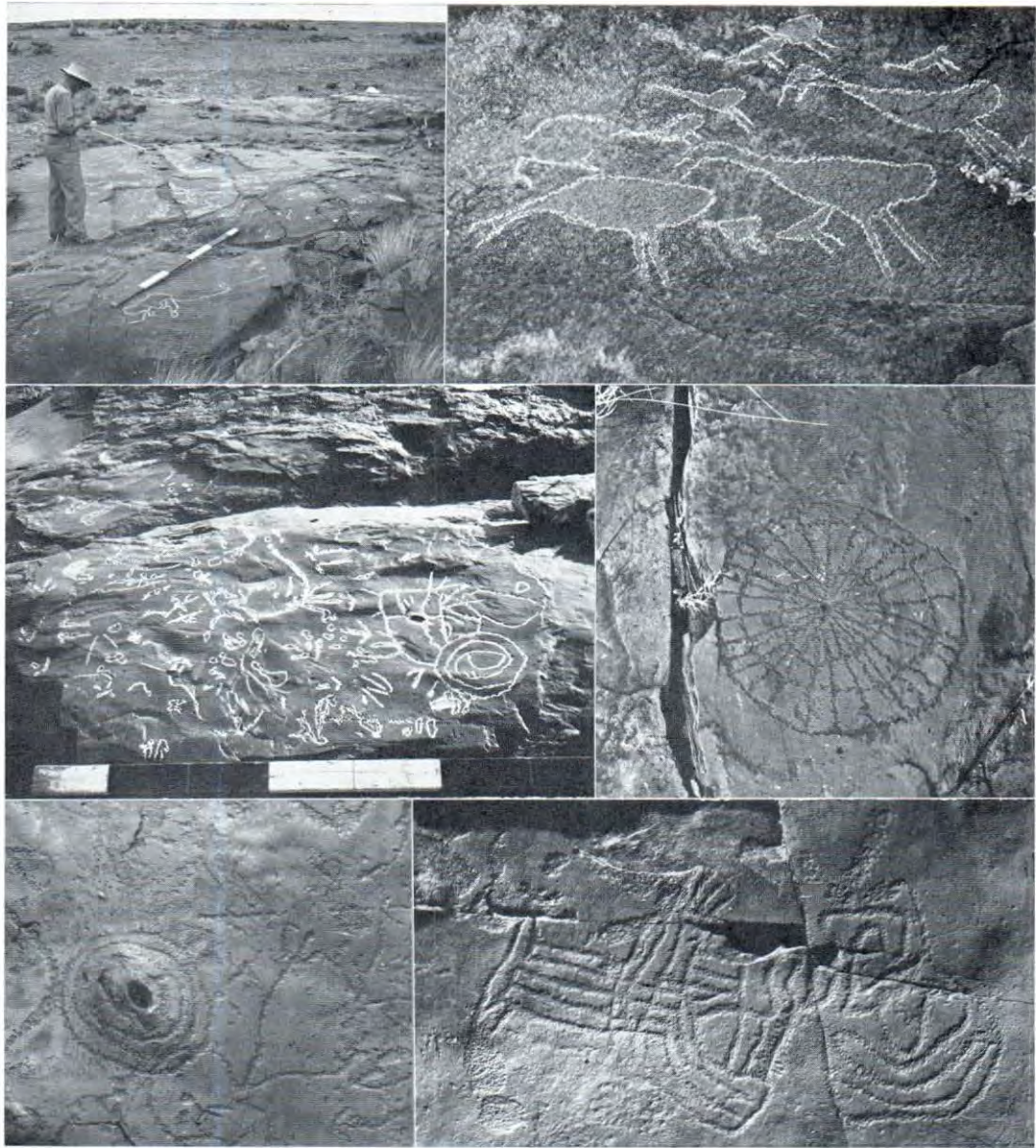
SURVEY OF PRAWN RESOURCES

The Queensland and Commonwealth Governments have joined in a survey of prawn resources in the Gulf of Carpentaria. Most of the survey work, which began in July, 1963, and will continue for two years, will be carried out in the south-eastern corner of the gulf, using Karumba as a base. Mr. I. S. R. Monro, of the C.S.I.R.O. Division of Fisheries, is technical director of the project and has discussed proposed work on biological collections from the area with scientists at the Australian Museum. The basic task of the project is a survey of the prawn resources, but at the same time it is proposed to record other fauna which will be collected by the survey ships during the project. Dr. J. Yaldwyn and other Museum officers will take part in the survey and work out of Karumba for short periods.

EXPEDITION TO NEW GUINEA

For the first time for many years, the Australian Museum has sent a collecting expedition to New Guinea. It comprises the Curator of Reptiles and Amphibians, Mr. H. G. Cogger, and the Assistant Curator of Insects and Arachnids, Mr. D. K. McAlpine. Mr. Cogger and Mr. McAlpine left Sydney early in September, and will return at the end of January.

Rock Engravings in Western N.S.W.



During the past decade the Australian Museum has made detailed records of the three major sites of rock engravings in western New South Wales. Two phases of engraving are represented. The earlier linear design phase (shown in most of these photos) is a symbolic art in which concentric circles and spirals, elaborate line designs, tracks and a wide range of smaller figures are featured. It is a prehistoric phase the motifs of which cannot be interpreted in this region. In the later pecked phase, shown well in the flock of emus (top right), the entire surface of the figure is hammered, or dressed with a sharp-edged tool. Human and animal subjects predominate, and always overlie the older linear figures. All these engravings were done before white settlement of the area in the 1860s.



The "Cave of Ghosts" in the Grampians, an example of the western Victorian style of rock art.

Aboriginal Relics in Victoria

By ALDO MASSOLA

Curator of Anthropology, National Museum of Victoria

THE early history of what is now the State of Victoria presents many unique aspects. Two abortive attempts at official settlement, and the use of its coastline by sealers and escaped convicts, preceded the almost piratical occupation of the site of Portland by the Henty brothers, and of the sites of present Geelong and Melbourne by Batman and Fawcner, the two pioneers who remained enemies to the grave. The drawing-up of Batman's famous treaty with the natives, by virtue of which immense tracts of territory, including the sites of Geelong and Melbourne, were ceded to him by the Aborigines, and the subsequent rejection of this treaty by the Colonial Office, who declared it illegal, are not the least incredible episodes in this story. The occupation of the land by the "overlanders" from "Sydney side", and by the "Vandiemelanders" from Tasmania, acting against Colonial Authority, soon followed by the discovery of gold, and the "invasion" of the colony by thousands of

people of all races and colour, all intent on getting rich overnight, are facts which border on fiction.

But what of the Aborigines of Victoria? History is silent. These people, dispossessed of their tribal territory, ordered away from their ancestral waters and hunting grounds, their ceremonial grounds dug up, their elders ridiculed and their women prostituted, saw their world collapse about them. The remnants of the tribes were collected into Government Stations, but this did not protect them from disease and debauchery which finished what the first settlers had begun.

The demise of tribal government and the virtual extinction of the tribes in Victoria over the short space of 20 years precluded the possibility of any detailed study of the natives' way of life, while gold-diggers, and the hooves of sheep and cattle, destroyed almost every sign of their occupancy of the land.



A fish trap, in the form of a channel, at Toolondo, Wimmera.

Perhaps, for this reason, Victoria is relatively poor in Aboriginal antiquities. Actually the existence of two painted shelters in the Grampians, and of one stone arrangement in the Western District, had been known for many years, but, with the exception of a large number of oven mounds and camping sites, no other relic was known to exist and, with the passing of the years, even these disappeared. Browsing cattle displaced the stones in the arrangement, vandals wrote their infamous names all over the paintings in the shelters, and the farmers, in an effort to get rid of the rabbit menace, ploughed over the oven mounds. Many of the coastal camp sites were either built upon, or the sand quarried and taken away, even the sea helping in this work of destruction by undermining and eroding the cliff middens.

However, there was a resurgence. The closer settlement of the land necessitated by the new immigration policies, the opening up of timbered areas, and the pushing through of Forestry Commission tracks into the more inaccessible places where the pastoralist and the gold-digger had not penetrated, revealed new hunting grounds for the anthropologist, the prehistorian, and, not the least, the field naturalist. Many important sites were thus discovered, each adding

to our knowledge of the prehistory of Victoria. These include painted shelters in western and north-eastern districts, diabase outcrops which were quarried by the natives for axe making, rocks on which the axes were sharpened, water holes excavated in dry areas, and even a fish trap. This last is a channel, designed somewhat like a maze, excavated in order to connect two lakes. The fish, in travelling between one lake and the other, would lose themselves in the shallow waters of the maze, and thus become easy victims for the natives. The lost stone arrangement in the Western District has been replaced by the finding of another, in an amazingly good state of preservation, in central Victoria. Its perfect condition is due to its having been kept hidden by a tangled mass of variegated thistle growing all over it. This thistle, introduced with seeds brought in by the early colonists, was, this year, destroyed by aerial spraying, and the stone arrangement, hidden for over a century, revealed.

Rock Engraving

Even a rock engraving has been found. The absence of rock engravings in Victoria has always been a puzzle, as they are numerous in the adjoining States of New South Wales, South Australia and Tasmania.



The western style of rendering human figures (above) and the north-eastern style (below).

The Victorian example is merely the representation of a kangaroo track, about 10 inches long, carved on a flat rock which also bears many grinding grooves, and was, therefore, used for axe grinding. While not spectacular, it is, nevertheless, an example of Aboriginal rock carving, and we may now look forward to finding others.

Many more painted shelters, or "art galleries" have been discovered, some in entirely new districts. The paintings on the walls of these have been executed in a number of distinctive styles, and both red and white pigments have been used. Some have been superimposed on older paintings, and it is hoped that a chronological sequence will be established. In the case of one shelter we have been very fortunate in possessing, long before it was discovered, a tradition of it and of the identity of the personage figured on its walls. The existence of this shelter, but not its exact whereabouts, had been revealed to the whites by a native, almost 100 years ago. He had stated that the figure represented Bunjil, the All-Father. In the shelter he is depicted as a fat person, seated Buddha-like, and accompanied by two dogs.

To combat vandalism it has been found necessary to withhold as much as possible the locality of the painted shelters, and to have them protected by a strong wire-netting enclosure. The placing of a "Visitor's Book" in the proximity of the shelter, so as to supply "visitors" with somewhere



to write their names other than on the walls or on the paintings, proved a great success. These "books", complete with attached pencil, are replaced at frequent intervals.

To combat the havoc wrought by the elements is rather more difficult, and the experience of such bodies as the C.S.I.R.O. and the Council for the Preservation of Ancient Monuments (UNESCO) has

been called to the rescue. The results, unfortunately, have not been good to date. The problem is not only to preserve the fading ochres, but also to prevent the rock face from flaking. In the meantime tracings of the actual paintings, as well as colour photographs, have been taken from every site. These are preserved in the National Museum.

Vandalism At Water Holes

Another class of relic which suffers considerably from vandalism is the rock wells or native rock water-holes. These are usually found in dry country. Close inspection of outcropping rocks often shows one or more holes worn into them; generally these holes are only a few inches in diameter and are small enough to be easily covered by a flat stone. However, these apertures are deceptive, because, in many cases, they open into a much wider, and certainly quite deep, underground cavity where rain water is stored, cool and clear, and kept clean by the stone cover. The underground chambers are not entirely made by the natives, very often originating in the natural weathering and wearing away of softer impurities in the rock; however, the Aborigines certainly accelerated the work of nature by deepening the holes with fire-hardened sticks and with stone tools. These rock holes are valuable indications of routes

taken by the natives when moving from one place to another. Some of these water holes have been declared special reserves by the Government, but this does not protect them from vandals. The localities are now sometimes used as picnic grounds, and often litter, plus broken bottles, finds its way into the holes, necessitating periodical cleaning out.

There is not much that can be done to prevent the destruction of camping places or kitchen middens either by the elements or through sub-division by building companies. However, site record cards have been instituted; every known camp site is now mapped, and the class of implements or any other relics found upon it is entered. A permanent record is thus kept; this will outlast the destruction of the sites.

The entering of the number and varieties of stone implements and other material found on the camp sites on the cards is helping to solve the problem of the private collector. This class of person can be of great service to anthropology if controlled, but otherwise can become a real menace. Having found it impossible to prevent him from collecting on these sites, he is now being trained to know what he is collecting, and to send lists of his finds, as well as samples of the material, to the Museum for entering on the cards. Particularly interesting artefacts are often donated by him and

A rock water-hole, known as "The Mouth", at Whroo. This hole has been enlarged by gold miners to enable them to insert their billy-cans. [Photo: H. S. Parris.]





A burial place excavated on the River Murray.

added to the Museum collection. If, on the other hand, the collector does not wish to donate his unusual find, a cast of the implement is made. Private collectors have also been strongly urged to clearly mark on their implements, in Indian ink, the name of the locality where they were found. This prevents some important artefacts in private collections becoming useless through forgetting where they were collected.

Excavation Of Camp Sites

Information about the life of earlier Aborigines is also being obtained through excavation of rock shelters and other camping places. So far no proof of great occupational antiquity has been obtained from any of these sites, but much valuable information on natives' food, revealed by the remains of their meals, has been collected. The finding of these, and of certain types of stone implements on the several occupational strata composing the floor of the shelters, is often a valuable indication of time-sequence changes in weather conditions, affecting food supplies as well as the typology of the stone artefacts, while the materials from which the

implements are made reveal ancient trade routes and tribal contacts.

Much information is also obtained from the proper excavation of native burials by observing the way the body was placed in the grave, and by the study of the implements sometimes buried with it. Totemic relationships and intertribal affinities can be discerned.

One of the problems confronting the professional archaeologist is his relationship with the amateur. The professional is jealous of his sites, and yet is torn by the desire to teach, and to impart to the amateur the techniques of excavation. He knows that the amateur often becomes over-enthusiastic, and is too impatient, or has not the time, to wait for the proper organization of a "dig" of the shelter he may have discovered. He thus often proceeds to do the job himself, forgetting that by so doing he could irrevocably destroy any evidence which may have been forthcoming. Once a site has been "dug", it has been dug for all time.

[Photos in this article are by the author, except where stated otherwise.]



An Aboriginal family in front of their house at Milingimbi Mission, Arnhem Land. The head of the family, the late Mahkarolla (centre), was notable for the great amount of information on Aboriginal lore he gave to anthropologists.

The Australian Aborigines: Their Present Position and Their Future

By EMERITUS PROFESSOR A. P. ELKIN

THE Australian Aborigines depended for their sustenance on food-gathering and hunting. Each tribe in its own region had evolved in the course of centuries an adequate means of living in, and being adjusted to, the environment. They knew its natural features and climatic variations; the life-cycles and habits of the plants, insects, birds, reptiles, fish and marsupials in it; they knew where, when and how to obtain food and water; and they had developed skill in making and using weapons and implements to aid them in the food quest. In addition, they possessed a social organization consisting of both local and descent groups (such

as clans) on a basis of unlimited genealogical relationship; this ensured order in the search for and division of food, in the use of hunting and camping areas, and in arranging marriages and all social occasions. And finally, through their doctrine of the pre-existence of the spirits of men and all living things, and through their myths and their rituals associated with sacred, heroic places, they sought to forestall, or to meet the contingencies of, life and death.

This all-round adaptation was well, but delicately, balanced. It could be quickly undermined by external factors. Thus, wherever European settlement occurred

from 1788 onwards, the Aborigines were denied the free use of their tribal lands for food-gathering, social and ritual purposes. They became trespassers in the eyes of the settlers. Clash was inevitable, and many Aborigines lost their lives. The rest became pauperized hangers-on around the settlements and towns—a prey of unhygienic conditions and of diseases to which they had no immunity. Depopulation was rapid.

In the less fertile and semi-arid regions of the continent, however, where white settlement was slow and sparse, the Aborigines had time and room to work out a new equilibrium to the environment, which now included some white men and their flocks and herds. The young men worked for the intruders and obtained in return goods which they had come to desire, and which they shared around the native camps at the homesteads. Clashes still occurred occasionally, and unbalanced diet (of damper, beef and tea) and the sedentary life which had replaced their continuous, nomadic hunting and food-gathering took their toll. Consequently, the Aborigines decreased also

in these interior regions but at a slower rate than where European occupation had been fast and dense.

Protection Policies

Clash and depopulation were inevitable. Food-gatherers and hunters on the one hand, and farmers, pastoralists and town-dwellers on the other hand, cannot exist together. The former has to give way or else make a new and rapid adjustment. The Aborigines' failure to do this was interpreted as a sign that they were inferior in mental as well as in cultural endowment. But even if this were correct, the picture was still a sad one: for here was a race dying out in what was its own country, and the cause was the usurpation of that country by a civilized people. Emotions of pity and some stirrings of conscience were aroused. As a result, from the 1860's onward, Protection Policies were put into operation in the several Colonies and finally in the Northern Territory. The purpose was to protect the Aborigines from the abuses that occurred on the frontiers of settlement, and to provide



Women making a twined mat (left) and basket (right) from pandanus leaf fibre on an Arnhem Land mission station.

Aborigines in western Arnhem Land skinning a water buffalo. These animals, which are plentiful there, are killed for their hides.



them, where necessary, with rations, clothes and blankets. These policies, however, were negative. Governments accepted the view that the Aborigines would die out. In the meantime, "Smooth the Dying Pillow" was the slogan.

In the 1920's, under the influence of the League of Nations Mandate concept and of our responsibility for New Guinea, a few thinkers and humanitarians began to question whether we were doing all we might, not only for the protection of the Aborigines, but also for their welfare. And in the early 1930's a campaign was begun for a positive policy based on the conviction that the Aborigines need not die out if we planned adequate health, education and employment measures.

About this time, too, a series of killings and atrocities, and of "unjust" trials in the north and centre, resulted in the mobilizing of public opinion through meetings and the Press to such an extent that the Commonwealth Government in the lead, and then State Governments, accepted the demands and arguments for positive policies. During the late 1930's Aboriginal Protection Acts were amended. In four cases, the heads of the Aboriginal Departments became Commissioner or Director of Native Affairs or Superintendent of Aboriginal Welfare. In all, welfare became the objective; in New South Wales it was stated to be assimilation, i.e., citizenship.

The new outlook was expressed in the post-war years in varying degrees in the several States and the Northern Territory: in the employment of special welfare staff; in medical and dietary surveys; in housing schemes; in the assumption by Government Education Departments of responsibility for the education of Aborigines (including, in some cases, on Missions); and in the establishment in the Northern Territory of settlements on the borders of regions still occupied by nomadic Aborigines, to serve as buffers and as training centres for their eventual assimilation.

Depopulation Stopped

One very effective measure in stopping the depopulation of the Aborigines was the Commonwealth decision to make Social Services benefits available to Aborigines; and, in particular, the decision to grant Child Endowment to Missionary, Government or other institutions concerned with Aboriginal children, to be paid according to the weekly average number of children being cared for. The regular income thus ensured made possible the services in such institutions of a trained nurse, and the provision of supplementary foods and anything else of value for the health of expectant and nursing mothers and their children. As a result of this and of other welfare measures, the full-blood Aborigines have shown an increase throughout the 1950's and continue to do so. The full-blood Aborigines

will not die out. The problem will soon be: what will they do to make a living? Educated in well-staffed schools, they must not drift into a parasitical existence on Government Settlements or on Missions. They are being educated away from the food-gathering and hunting life, and therefore must be trained to make a living in other ways. But in what ways? The answer is bound up with the future development of the central and northern regions of Australia, and this in turn will depend on the success of scientific research there and on the industrial application of the results of that research. Much thinking and planning are necessary, for the pastoral industry, with its increasing use of mechanization, will not require the numbers of Aborigines who could be available. Mining, in the long view, is a temporary avenue of employment. Making curios will only keep a few occupied, and the odd-jobs in the towns are dead-end jobs.

Problem Of Full-blood Aborigines

There is the problem of the full-blood Aborigines. They now number about 40,000 and are increasing. What will they do?

In addition, there are over 52,000 mixed-blood Aborigines who are counted as such. Many other persons of part-Aboriginal descent are simply numbered in the general community. But all of them are now, almost everywhere in Australia, full citizens, with the franchise and all Social Service benefits. Even the prohibition on obtaining and drinking "alcoholic beverages" has been removed, except in a few declared areas in a couple of States, with excellent results. Drunkenness and its effects, as a method of protest, have been greatly diminished. Where there is special welfare legislation for Aborigines the purpose is to help them assimilate themselves in the general community, that is, to become part of its economic, social, religious and political life, both as individuals and as groups, in the same way as we ourselves are or as immigrants from Holland, Italy, Greece and other countries become.

Many part-Aborigines are very diffident about leaving the sheltered life of Government Settlements, as in New South Wales, Queensland, Victoria and South Australia. Many are unwilling to undertake the responsibilities of rented houses and permanent employment. They have imbibed from the older generation the fundamental kinship responsibility of sharing with relatives what one has, and of only going out to work (as in former days, to hunt) when needs must. In their view, life consisteth not in an abundance of possessions, but in providing for the day's needs and its social and ritual occasions. In any case, so they argue, "why do more?" because the general community does not welcome them into its social and religious life and only grudgingly into its economic pursuits, and superficially into its sporting arenas. "Education", therefore, is not worth the struggle. However, Government Departments and also several service organizations and local assimilation groups are doing their best to help part-Aborigines realize their citizenship with its privileges and possibilities, and also its responsibilities—that is, to make a self-satisfying adaptation to Australian society. One sign of progress is that a small, but increasing, number of their children are finishing the secondary school education and a few are at universities. Already, some have been through Teacher's Colleges and a goodly number of girls have qualified as fully-trained nurses.

The success of such assimilation will depend not only on the efforts and attitudes of the part-Aborigines. It will depend also on the removal of any obstacles of race prejudice which are present in our social environment. These obstacles, low barriers and sharp spikes, are not very pronounced—not in the same degree as 70 years ago, but they still discourage and hurt those who would pass by. Unless this be done, the part-Aborigines will be rebuffed and become an ever-increasing minority group with a bitter grudge against the general community. This *need* not, and *must* not, occur.

[The photos in this article are by Frederick D. McCarthy.]



A skeleton of *Diprotodon*, the largest marsupial ever known to have lived. The length of this specimen when alive was about 10 feet 6 inches.

The Australian Aborigines and the Giant Extinct Marsupials

By EDMUND D. GILL

Curator of Fossils, National Museum of Victoria

MAN has been on the earth for about a million years, but in Australia for only a comparatively brief period. Africa was probably the continent on which man evolved, but soon after he migrated into Asia, as the fossils of primitive men in China and Java prove. The million years that man has been on the earth also comprise the Ice Age (Quaternary), so man is an Ice Age creature. Never in the world's history has there been a greater variety of habitats than in this period, or a greater speed or degree of climatic change, or a greater amount of variation in sea level. The great and rapid variation in the environment led to rapid evolution. During

the low sea levels (caused by removal of water for ice caps) Sumatra, Java and Borneo became part of Asia, while New Guinea and Tasmania became part of the Australian mainland. Then why did not man move earlier into the Australian continent? Deep waters separated the enlarged Asia from the enlarged Australia; there was no land bridge and early man was not equipped for ocean voyages.

Another characteristic of the Quaternary was the presence of many species of exceptional size. Probably as a protection against the cold, many species evolved to sizes larger than known before or since for the genera to which they belong. Larger size

meant smaller surface area per unit volume and so less loss of heat. Like the placentals of other continents, the marsupials of Australia developed giant species. For example, there were giant kangaroos, a giant wombat, a giant koala, and the extinct nototheres which included the largest marsupial that ever lived—*Diprotodon*. It has often been denied that man was in Australia during the time of the giant marsupials, but it has now been proved that he was. The antiquity of the Aborigines has been extended, and the time of extinction of some giant marsupials brought nearer to our time.

Antiquity Of The Australian Aborigines

Evidence of time of entry to the continent must be expected to be tenuous, and the actual date of coming to be greater than any that can be demonstrated. In Australia there are radiocarbon dates for sites associated with Aboriginal implements and/or skeletal remains reaching back to nearly 13,000 years. A date of 10,950 years B.C. has been recorded for a sample at a depth of seven feet at Kennif Cave in Queensland. The base of the occupation site has not yet been excavated and dated.

There are still older sites not associated with implements or skeletal remains. In the Maribyrnong River valley at Melbourne, Victoria, the fluvial terraces and their relationships with the marine strata of the Yarra Delta have been studied. The present flood plain, graded to present sea level, is the surface of the Maribyrnong Alluvium, which has Aboriginal sites on it and in it. The next older terrace is the Doutta Galla Silt, the surface of which (Keilor Terrace) is not now reached by flood waters. This formation is graded to a level of the sea far below the present level, and its oxidized sediments pass below the unoxidized marine sediments deposited during the Flandrian Transgression. A characteristic break in the sedimentation (diastem) can be followed right down the valley, making a useful marker. At Braybrook, charcoal from two feet six inches above this diastem gave a C14 date of 8,500 years. At the Keilor cranium site, charcoal from a short distance below the diastem gave a date of the order of 15,000 years, while charcoal from six feet nine inches below the diastem gave a date of 18,000 years.

Above the diastem, artefacts have been found associated with hearths consisting of burnt ground, wood charcoal, bone charcoal and bones of food animals. As the diastem occurs between the 8,500 and 15,000 year levels, it may well belong to the Alleröd and Bölling climatic oscillations of 11,000 to 13,500 years ago which have been intensively studied in Europe and North America. The 15,000 year level is approximately that from which the Keilor cranium came. The nature of the attached sediments, the degree of deposition of carbonate incrustation, and the nature of the mineralization of the cranium (including fluorine content) agree with its reported provenance from this horizon, which is an incipient soil. The sediments are apparently re-deposited loess, and are so distinctive that the cranium could not possibly have come from any other terrace; indeed, it must have come from the upper half of the Doutta Galla Silt. This part of the formation has been excavated at many sites in the valley because its very even grain size is useful for "molding sand". Furthermore, the cranium must have come from that part of the upper half of the formation where there has been considerable accumulation of secondary carbonates, which is the level of the incipient soil just below the diastem. Then was the Keilor cranium deposited with the silt by the river, or was it buried there during the time of soil formation? If the latter, then it must have been at the beginning of that process because it has collected so much carbonate. The former is the probable explanation because it is an isolated cranium, and shows slight but definite signs of wear. Either explanation makes it a very ancient cranium. So there is likelihood of skeletal evidence going back to something like 15,000 years.

The 18,000 year deposit was rounded in outline (judging by the part remaining), about four feet in diameter and over three inches thick in the middle, tapering away to the sides. There is burnt ground underneath, wood charcoal, bone charcoal, and bones of food animals associated in exactly the same way as those higher in the terrace that had implements with them. This is accepted by the writer as adequate evidence of human occupation, and Professor F. E. Zeuner has kindly agreed that I should

A skull of *Thylacoleo*.



quote him as supporting this. There is thus evidence (although some may question it) of the presence of the Aborigines as much as 18,000 years ago which was the time of lowest sea level and greatest cold during the last glaciation. If we accept this evidence, then we must add to this date sufficient time for the Aborigines to cross the continent to the south-east corner, and we may round the figure off by saying that the Aborigines came to Australia at least 20,000 years ago. That is the position until further evidence is forthcoming.

Time Of Extinction Of The Giant Marsupials

Extinction of marsupial species is a process that has been going on for a long time, and man has undoubtedly speeded it up. The process is still going on. About 500 years ago, the Tasmanian Devil was still present on the Australian mainland, as its remains have been found in a midden of that age. Fossil bone assemblages have been described that also show remarkable recent changes in both the content and distribution of the marsupial fauna. Similarly, marked changes of distribution in Western Australia in recent times have been shown. A date of 6,570 years approximately was obtained for freshwater mussels from Layer B at Lake Menindee, which yielded giant extinct marsupials and also some indication of Aboriginal occupation; further study of this site could advance the present

subject. Dentine from the lower jaw teeth of *Diprotodon* from Orroroo in South Australia gave a radiocarbon date of approximately 6,700 years (Fergusson and Rafter 1959), while a *Diprotodon* molar from four miles north-east of Yalpara Station home- stead in the same area gave a date of 11,100 years. Evidence is building up to show that many of the giant extinct marsupials survived much later than previously thought.

A C14 date of 13,700 years has been obtained for a lenticle of fossiliferous gravel at Lake Colongulac, Victoria, that contains the remains of giant extinct kangaroos, of the curious extinct animal (perhaps a large marsupial tree sloth) called *Thylacoleo*, *Diprotodon*, a species of Tasmanian Wolf (*Thylacinus*), and other marsupials. The Colongulac Bone is a cut bone belonging to this horizon because, although not found *in situ*, it is the fourth metatarsal of a giant extinct kangaroo, has the same mineralization as the giant kangaroo bones found in place, and was cut before fossilization. Some have tried to explain this cut as due to a marsupial predator. The late Mr. H. V. V. Noone and the writer made a close study of this bone and came to the conclusion that it could only have been done by man. Two wedges of bone have been cut out, there is no crushing, there are scours such as would be made by a sawing action, and the side of one incision is undercut. From the nearby Pejark Marsh a husking stone has been

reported from the same or a similar horizon. It is anticipated that before long an indisputable Aboriginal site will be found in one of the stratified deposits round the Western District lakes. It is this undeniable stratigraphic evidence that is wanted for the further study of the antiquity of the Aborigines and their relation to the giant extinct marsupials. However, the evidence given so far is sufficient to prove that the Aborigines were in Australia at the same time as many (though not all) of the extinct giant marsupials. Association of giant marsupials and evidence of Aboriginal occupation at Parkes, N.S.W., has been claimed, but as it has generally been believed in the past that the Aborigines were not here at the time, little notice has been taken of the record. A re-investigation would be worthwhile. In 1959 H. M. Cooper recorded an association of *Diprotodon* bones and a native hearth west of Port Augusta, South Australia.

Petroglyphs in central Australia have been claimed to represent extinct marsupials, and this may well be so. An anatomical study of the petroglyph from 25 miles southeast from Yunta leaves one in no doubt that a crocodile is portrayed. Fossil crocodiles are common in central Australia in rocks of both Tertiary and Quaternary age.

Implications For The Aborigines Of The Changing Fauna

When early man in Europe killed a mammoth, or Africans killed a rhinoceros, they secured a couple of tons of food in one act; so when the early Aborigines secured a *Diprotodon* they acquired a vast amount of food in one hunt. When such giant marsupials became extinct, the Aborigines had to adjust their methods of hunting and their manner of feeding. It is usual for the Aborigines to make use of many of the materials made available by their capture of food animals. They use fats, skins, sinews, bones and other materials for various purposes. As the giant marsupials became extinct, the Aborigines would be cut off from these sources of supply for technological raw

materials. It is plain from what is known of the art, religion and daily habits of the Aborigines that the animals that provided their food were so important to their way of life that they became part of their legends and figured in their sacred places. Some legends handed down to the present day may refer to some of these extinct animals, but there is no way of being certain of this. However, it is safe to conclude that the great *Diprotodon*, by far the largest animal known to the Aborigines, and the great kangaroos that made a man feel so small, must have had a significant place in their legends and have been associated with special sites across the countryside. With the passing of these animals, the way of life, legends and religion of the Aborigines must have been affected. The very passing of these animals must have been an important fact that they would endeavour to explain. It will be interesting when the succession of cultures on this continent is known, to look for evidence of changes associated with the climatic and faunal changes.

Since the Australian Aborigines have been in this continent for more than 13,000 years and probably as much as 20,000 years or more, and have suffered the changes in climate, fauna and flora brought about from the depth of the last glaciation, through the postglacial thermal maximum to the present, we need to develop a new perspective that takes all this into account. During this time the continental margins were flooded by rising sea level so that much tribal territory was lost and the land bridges severed to New Guinea, Tasmania, Kangaroo Island and many other islands. The mean temperature rose so that glaciation disappeared from the highlands but also wide areas of the inland became desert. The distribution of plants and animals was drastically changed in some areas; two families and many genera and species of animals became extinct. Over considerable areas the Aborigines had to modify their way of life to match their changing environment.



Palm Valley, one of the few small areas in central Australia where vegetation did not wither and die when the great sand-ridge deserts of the interior came into being. [Photo: South Australian Govt.]

PLEISTOCENE AND RECENT CLIMATES OF AUSTRALIA

By **W. R. BROWNE**

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THE Quaternary division of geological time, in which we are living, started about a million years ago and has been notable for great climatic fluctuations. Since these were synchronous all over the earth it will be useful to review briefly what is known about them in Europe and North America, where they have been intensively studied.

The Quaternary is subdivided into Pleistocene and Recent. The former included the Great Ice Age and ended about 10,000 years ago with the recession of the last of the great ice-sheets that had covered much of the earth; the Recent embraces the last 10,000 years.

The Ice Age consisted of periods during which temperatures sank low enough to permit of the formation of glaciers, alternating with interglacial periods when the glaciers vanished almost or quite completely and high temperatures, sometimes exceeding those of the present day, prevailed. In Europe five glacial periods occurred, with four interglacials; the last (Würm) glacial probably began some 75,000 years ago. Ice-sheets extended south to lat. 50°N. and in the unglaciated areas the climate of the glacial periods was probably in general moister and cooler than now. Superimposed on the main climatic oscillations there were smaller ones.

Minor fluctuations persisted into Recent time, of which the most notable were a warm interval—the Thermal Maximum—between 4,000 and 7,000 years ago, and the Little Ice Age, some 3,000 or 3,500 years ago. Since then world temperatures, though fluctuating, have been generally higher. The range of climatic oscillation was greatest in the higher latitudes, diminishing with nearness to the equator.

The sequence of glacial and interglacial periods has been determined through the study of successive deposits of glacial till and moraine left by the vanished glaciers (the lowest being the oldest), seasonally-banded (varved) clays laid down in lakes by melt-water, and interglacial deposits.

In unglaciated areas climatic variation is indicated by organic remains contained in swamps and peat-bogs, lake-muds, river-terraces and shoreline deposits. Remains of large animals like the mammoth, reindeer, rhinoceros, etc., give important clues; shellfish embedded in coastal deposits may be of cold-water or warm-water types; and vegetation, represented by wood or pollen-grains, may indicate various kinds of climatic environment. Wind-blown deposits or dried-up lake beds with salt and gypsum betoken aridity.

By these and other means it has been possible to recognize a climatic succession related to the Pleistocene glacial and interglacial periods, and some half-dozen climatic phases in Recent time. Moreover, by radiocarbon assay of contained wood, charcoal, bones or shells, many deposits have been dated in terms of years before the present (B.P.); this method, however, is applicable only to material less than 50,000 years old.

Changing Sea Levels

By the locking-up of water in glaciers during glacial periods and its release during interglacials, sea-level all over the world was alternately lowered and raised; it may have ranged from about 300 feet below to 200 feet or more above its present position. Lowering would result in deepening of river-valleys at their mouths to the new base-level, and a subsequent rise would drown their lower courses and cause deposition of marine sediment for many miles upstream as well as on beaches and in shallow water

along the open coast; on a further lowering of sea-level some of these deposits would be left as terraces and raised or emerged beaches. Similarly, wave-cut rock-platforms would be laid bare by a subsequent drop of sea level. Movements of this kind are termed *eustatic*.

In the northern hemisphere a succession of eustatic movements has been recognized, superimposed on a gradual lowering of sea-level the cause of which is unknown. Thus shore-lines, river-beds and shallow-water marine deposits have been submerged, and terraces, raised beaches and wave-cut platforms appear at varying heights above sea level. Coastal terraces are very widespread, the principal being at approximately 300, 190, 60 and 25 feet respectively above sea level; these are thought to have been formed during interglacials, the lowest two being assigned to stages of the last (Riss-Würm) interglacial, possibly 100,000 years ago or more. There is also a 10-foot terrace, referred to the Recent Thermal Maximum.

Away from the coast old flood-plains now above flood-level are found along rivers, and lakes are bordered by terraces at varying heights above water-level. In part, at least, these indicate glacial periods when rainfall was greater, rivers flowed with increased volume and lake-levels stood higher than now.

Climatic Changes In Australia

Australia experienced the world-wide climatic oscillations, though not so markedly as places in higher latitudes and of greater elevation, but our knowledge of them is still very incomplete. Glaciation was confined to Tasmania and the Kosciusko plateau (lat. 36° S.). In part it was of Würm age, as indicated by radiocarbon dating, but earlier glaciations may also be represented; there were no glaciers during the Little Ice Age. Minor glacial advances and retreats are recorded but no interglacials, though climatic fluctuations must have occurred. In unglaciated areas the climate, during glacial maxima at least, was moist and cool even in what is now the arid interior, and during interglacials the sea may have spread far inland over low-lying country, producing local climatic

effects. For example, during one interglacial, possibly the Riss-Würm, an arm of the sea penetrated 150 miles northward to the northern end of Lake Torrens, and possibly even as far as Lake Eyre. The arid inland of Western Australia was a land of large rivers in the Pleistocene, and Lake Eyre, a great salt lake now usually dry, was a vast sheet of deep water draining south to the sea and fed by great silt-laden rivers. Vegetation, including rain-forest, flourished everywhere, and supported a population of herbivores including the Giant Wombat, Giant Emu and many others now extinct.

A radiocarbon dating of 19,000 B.P. indicates a Würm age for some deposits at Lake Eyre, but probably the record of events enshrined in the lake-silts covers the glacial and interglacial periods of the Pleistocene and several climatic changes.

A period of aridity ensued. Lakes and rivers dried up and their sediments were transported by wind to form dunes. This was the time when the great sand-ridge deserts of the interior came into being. Except for small remnants still surviving in favoured spots like Palm Valley (central Australia) the vegetation withered and died, and the animals whose lives depended on it perished.

After a time rainfall gradually increased, the hardier vegetation crept back towards the centre and some of the animals which had survived in the less arid coastal belt migrated inland. The climate of the interior is still arid, but there is evidence that the desert was formerly much more extensive than now.

The period of desiccation, known as the Arid Period, coincided with the Thermal Maximum of the northern hemisphere. Soil studies in central Australia have suggested that it comprised three distinct climatic cycles.

Around the shallow and often empty Lake Colongulac in south-western Victoria are cliffs cut in the old lake-silts and in volcanic ash beds overlying them, indicating a water-level much higher than at present. The cliffs are in part covered by wind-blown deposits, in which further cliffs have been cut. The lake-silts enclose abundant remains of extinct marsupials and of shells of a

New Subscription Arrangements

Payments by post for subscriptions to "Australian Natural History" should in future be addressed to the Government Printer, Harris Street, Ultimo, Sydney, who prints this magazine, instead of to the Australian Museum.

This new arrangement is to facilitate handling of subscriptions, and will not, of course, result in any change to the magazine.

Visitors to the Museum will still be able to take out subscriptions there, and single copies of the magazine, both current and "back" numbers, will continue to be sold there.

tiny brackish-water gastropod, for which a date of 14,000 B.P. has been determined. Clearly there was a time of high rainfall and high lake-level in the Würm, succeeded by desiccation and dune formation probably in the Arid Period. There was high water in the lake again in the Little Ice Age, when the dunes were cliffed, and since then the climate has become distinctly drier and presumably warmer.

It is possible that others of our inland lakes now permanently or intermittently dry could yield similar evidence of climatic changes.

Along many rivers there are terraces or remnants of old flood-plains at varying heights above present river-level. In Queensland, New South Wales and other States these contain remains of extinct mammals, and some of them were formed when the rivers had greater volume, probably at or near times of glacial maxima. In Victoria a number of these terraces, dated at approximately 18,000, 8,500 and 3,100 B.P., were evidently laid down during the Würm, the early Recent and the Little Ice Age respectively.

Marine terraces and emerged beaches are numerous around our coasts, appearing at approximately 200, 100, 40-60, 20-25 and 10-15 feet above sea-level; some of them are probably equivalent to the Quaternary coastal terraces of the northern hemisphere. The higher terraces are on the whole unfossiliferous but some are capped with beach-gravels, and their persistence and general constancy of elevation suggest that they are eustatic. The three lower terraces may enclose marine shells, and their deposition under warm-water conditions is attested by the presence of types which now inhabit more northern coastal waters. For a Victorian deposit corresponding to the 10-foot terrace a date of 4,800 B.P. indicates the Thermal Maximum, while the 25-foot terrace, older than 35,000 B.P., is tentatively assigned to the Riss-Würm interglacial. To this time also, or to a warm interval during the Würm, may belong the shell-bearing raised beaches of the Lower Hunter Valley near Maitland.

The drowned valleys and estuaries along the coast afford evidences of eustatic lowerings of sea level. At least three of these are indicated by repeated valley-in-valley structure in Broken Bay, Port Jackson and elsewhere. The deepest valley-floor, about 300 feet below present sea level, is probably assignable to the Würm glacial maximum of 18,000 B.P. and the others to earlier maxima. All these features were, of course, gradually submerged when the Würm glaciers began to melt away.

Thus, though the record is not nearly as full as in the northern hemisphere, it is clear that Australia has experienced marked climatic changes in the last million years. The equatorward movement of the west-wind rain-belt during glacial maxima and its recession during interglacials affected the incidence of rainfall and temperature, particularly in the temperate coastal belts east and west. The climatic changes did not affect the whole continent to the same degree; nevertheless, the effects of the Würm wet period, the Arid Period and the Little Ice Age were felt over a considerable range of both latitude and longitude.

The periods of low sea-level were of especial importance, because at such times

Australia must have been joined to Tasmania and New Guinea by continuous land or by shallow water dotted with islands, affording migration routes for plants and animals. It may have been during one of these periods, corresponding to a glacial maximum, that the first Aborigines entered the continent.

BOOK REVIEW

ATOLL ENVIRONMENT AND ECOLOGY.
By Herold J. Wiens, 1962. Yale University Press. Price \$15.00.

This large, fact-filled volume, running to more than 500 pages, is the first ever to deal with the ecology of coral atolls in detail. Its author is an associate Professor of Geography at Yale University who prepared the volume at the request of the Pacific Science Board, a branch of the National Research Council of the United States. The author explains in the preface that he found the task difficult because of the lack of really comprehensive studies in this field, and specialists looking for details concerning their own groups in this book will soon find gaps and inconsistencies. None the less, if the book is taken as a whole, Professor Wiens has achieved a real success in bringing together in one work a mass of factual information on coral atolls which will be of enormous value to scientists concerned with every aspect of coral reefs, and of their fauna and flora in particular.

Of course, it is easy to criticize such a volume. Some may feel concerned that the author has restricted his remarks exclusively to atolls as distinct from other coral or coral-ringed islands, but no doubt a line had to be drawn somewhere. The difficulties of making distinctions are amusingly indicated when we read of "almost-atolls". One editorial feature annoying to biologists is the fact that when scientific names, consisting of both genus and species, are cited, they are correctly italicized, but the names of genera without cited specific names are not printed in italics—a pointless distinction. A few inevitable misspellings occur and Australian geologists will be unhappy at finding the name of Professor T. W. Edgeworth David, leader of the pioneering expedition to Funafuti Atoll in 1896, incorrectly cited in the text and bibliography as David T. W. Edgeworth.

However, these minor criticisms must be related to the excellence of the work as a whole. It will have immense value as a reference source and a guide to the present state of knowledge in many fields which relate to the atoll environment and to the ecology of the organisms inhabiting them.
—Donald F. McMichael.

UNIQUE ABORIGINAL STENCIL IN QUEENSLAND

To the west of the Carnarvon Range National Park in eastern Queensland, Mt. Moffat Station occupies part of a watershed which forms the headwaters of Meteor and Marlong Creeks and the Maranoa River. It is an area of fertile valleys, admirable for cattle grazing, some 2,000 feet above sea level. The peaks of the sandstone ranges rise to about 3,000 feet. The sandstone has eroded into a variety of remarkable formations, which bear such names as the Cathedral, Lot's Wife, Chimneys, Looking Glass, Arch, Tombs, Kenniff and Kookaburra Caves. These formations rise hundreds of feet above the valley floors, in which *Zamia* palms, wattles, pines and eucalypts are growing. At the bases of these sandstone masses are numerous rock shelters in over 100 of which are stencils and rock markings made by the Aborigines.

The stencils are of human hands and feet, weapons, lizards, kangaroo, emu and other animal tracks, and some unidentifiable subjects. Many of the human hands have one or more digits or several fingers turned down; they appear to be cut off the fingers, but amputation of digits on the little finger (only) was restricted to the east coast and stencils of this type occur all over Australia.

One of the stencils at The Tombs is unique. It is of a full-sized man, with his back to the wall and arms outspread. It is surrounded by stencilled tracks and hands.

The state of preservation of the stencils varies from the faintest impression to bright, fresh

examples, but those in the more exposed positions are weathering rapidly. Visitors to several of the accessible caves in the past have scribbled and cut their initials, names, and dates of visits over the stencils, but the present manager, Mr. Dayne Vincent, a keen conservationist, has put a stop to this vandalism.

At a number of the sites rock engravings of a simple but unusual kind occur on the vertical walls. They include linear marks, emu tracks, and oval depressions in haphazard, confused array. They are all abraded or rubbed into the sandstone, not hammered or punctured as elsewhere.

In this area the body of a dead person was wrapped in wallaby skin, or in a rug of smaller skins sewn together with bark fibre (Budgeroo) twine, the bundle being placed on a bed of threshed and twisted bark and again bound up with a cord made from the Budgeroo bark. This bundle was placed in a rock crevice, and such things as weapons, tools, digging stick, hair rope, squares of netting, reed necklets, and the skeletons of small animals wrapped in paper bark have been found with them. The relationship, if any, between the stencils, engravings and bundles is not known.

The University of Melbourne excavated the Kenniff and Tombs shelter floors, where the occupational deposits were 12 feet deep. From a nine-foot level in Kenniff Cave the radiocarbon age of Aboriginal occupation proved to be as long ago as 10,000 B.C.—*K. B. Redmond, Orange, New South Wales.*

The unique human-figure stencil at Mt. Moffat Station, Queensland. The scrawlings of vandals are clearly seen.

[Photo: Author.]



Australian Aboriginal Decorative Art

By F. D. McCARTHY, Dip. Anthropol.,
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To students and pupils of schools and colleges special facilities for study will be afforded if the Director is previously advised of intended visits. A trained teacher is available for advice and assistance.

Gifts of even the commonest specimens of natural history (if in good condition), and specimens of minerals, fossils, and native handiwork, are always welcome.

The office is open from 9.30 a.m. to 1 p.m. and 2 to 4.30 p.m. (Monday to Friday), and visitors applying for information there will receive every attention from the Museum officials.

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