

Helictite

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Helictite in
Gem of the South
formation, Temple
of Baal, Jenolan,
N.S.W.



Photo: A. HEALY

" H E L I C T I T E "

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DR. RENÉ JEANNEL (1880-1965)

With the death of Dr. René Jeannel at his home in Paris on February 20, 1965, the world of biospeleology lost one of its most distinguished members. Dr. Jeannel, who was a co-founder of modern biospeleology, was a protégé of Emile Racovitza. His doctoral thesis consisted of an extensive monograph of the European bathysciine cave beetles. Throughout his life he studied many insect groups, particularly the carabid beetles. With Racovitza he assembled the famous Biospeologica collections from caves all over Europe and north Africa. He became Professor in the Faculté des Sciences, and Assistant-Director of the Institut de Spéologie, Cluj, in Roumania. Among his more important publications are "Faune Cavernicole de la France - avec une étude des conditions d'existence dans le domaine souterrain" (1926) and "Les Fossiles Vivants des Cavernes" (1943). From 1947 to 1958 he edited "Notes Biospéologiques". In later years he became honorary professor at the Museum National d'Histoire Naturelle in Paris. In 1952, he was elected an honorary member of the National Speleological Society of America.

BOOK REVIEW

Biospeleology - The Biology of Cavernicolous Animals. By A. Vandel.

Pergamon Press, Oxford, England. 1965. pp 524. Translated into English by B.E. Freeman. (International Series of Monographs on Pure and Applied Biology/Zoology Division/Volume 22).

This authorised English translation of Professor A. Vandel's book "Biospéologie - La Biologie des Animaux Cavernicoles" (published by Gauthier-Villars, Paris, 1964) is a very welcome sight for all English-speaking biospeleologists and workers in related fields, as it is by far the most comprehensive book on the subject of cave biology yet written in any language. At the time of publication, Professor Vandel was Director of the subterranean laboratory of the Centre National de la Recherche Scientifique and Professor, Faculty of Science, University of Toulouse.

The French edition was reviewed in Helictite 2(4), 1964, so there is no need to comment here on the excellent subject matter. For those who can read French, the French edition is recommended as this is the author's own language. Many typographical errors occur throughout the English translation, and in Plate VII the lower picture has been printed upside down. However, the binding and paper quality of the Pergamon edition are superior to the French edition. Once again, this book is highly recommended to all serious students of speleology, in addition to those specifically concerned with cave biology.

OLD NAPIER DOWNS CAVE, WEST KIMBERLEY, W.A.

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and

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Introduction

Although small caves are numerous in the Limestone Ranges of the Fitzroy Basin in West Kimberley, large and long caves are few on the basis of present knowledge, and reasons for this paucity are ready to find (Jennings, 1962). Of all the known caves, The Tunnel has probably the greatest geomorphological interest (Jennings and Sweeting, 1963a), though it offers little apparent prospect for further exploration. The string of caves ending in Cave Spring in Bugle Gap (Jennings and Sweeting, 1963b) seemed more promising in this latter respect when examined in 1959 and D.C. Lowry (Personal Communication) reports finding considerable extension to one of these caves in a recent visit. Although the cave to be discussed here - Old Napier Downs Cave - is not very large in terms of its known dimensions and a brief reference to it has already been made (Jennings and Sweeting, 1963b, p. 27), fuller description in a journal more readily accessible to Australian speleologists and publication of a survey are justified because of the prospects for further exploration that the cave itself and its neighbourhood present.

The Limestone Ranges

The Limestone Ranges derive from a Devonian barrier reef, which stretched for about 180 miles in a NW-SE direction off what was then the southwest coast of a land mass now constituting the heart of the Kimberleys. When uplifted to form land, this reef was not subjected to much folding or faulting, though it has since suffered many vicissitudes, including truncation by erosion in Tertiary time to form part of a planation surface. Subsequently, after further uplift, the reefs were etched out by removal of weaker rocks around them and by encroachment into the limestones through scarp recession, so that they now form flat-topped, steep-walled ranges from half a mile to a dozen miles across and 100-300 feet in height above the surrounding flat plains. The margins of the ranges where they are wide, and their whole width where they are narrow, have been subject to vigorous solutional dissection so that they are extremely rugged in detail, even though their skylines may remain quite level as a whole. It is in these dissected parts that caves are found. The central parts of the wider ranges retain the Tertiary planation surface with little or no modification and have few karst characteristics.

The limestones of the ranges comprise several facies, i.e. they vary in lithology and primary structures through deposition in slightly different environments. In particular they vary in their purity, some of them incorporating much silt and sand derived from the Kimberley land mass behind. Such impure beds do not develop karst landforms and caves to anything like the same degree as the purer limestones. At Old Napier Downs Cave, only one facies is involved, a pure forereef facies. These are rocks which accumulated as submarine talus slopes in front of the growing barrier reef proper and are built of the erosional products of wave attack of the living reef, chiefly calcareous sand. Thus were formed bedded fragmental limestones (specifically calcarenites) with a primary depositional dip, varying between about 10 and 35 degrees. This original dip is retained to this day, and subaerial erosion of the outward margin of the whole mass of reef deposits has worked inwards in sympathy with the primary structure so that the steep walls and scarps of the ranges on their southwestern sides, (i.e. the former oceanic side of the reefs), parallel the strike of these dipping forereef beds.

Since climate and vegetation affect solutional processes, a brief word on these aspects of the environment is necessary. The climate is of tropical monsoonal type, with high temperatures all the year favouring chemical activity. However, annual rainfall averages only 28 inches at Napier Downs Homestead nearby the cave; with annual evaporation estimated at 100-110 inches, this implies semi-arid conditions. To mitigate this generally unfavourable water balance, the rainfall is strongly concentrated in a short wet season, effectively December to March, with falls of high intensity. These characteristics must improve the effectiveness in solutional work of this amount of rain. Soil and vegetation covers in the dissected limestone area are, however, minimal and this reduces the availability of biological carbon dioxide so important for karst development. It is possible that climate and vegetation have been more favourable in the past during the time of dissection, but as yet there is no direct evidence of this from the area; such evidence as there is of climatic change points to drier times in the recent past.

The Neighbourhood of the Cave

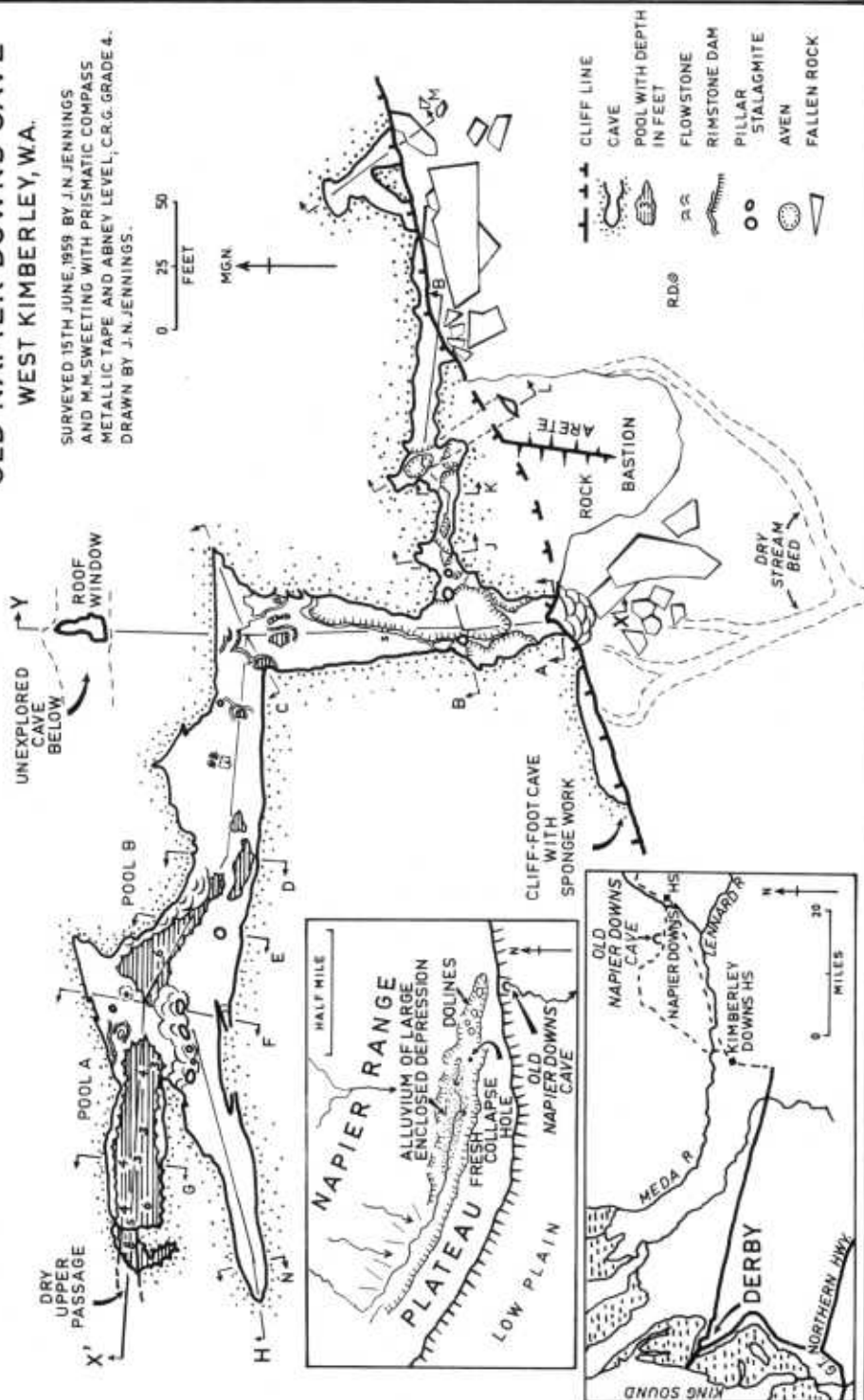
Old Napier Downs Cave is situated in the outer wall of the Napier Range on the southern side of a westward bulge, which follows the strike of the forereef beds (see inset maps on Figure 1). It is about six miles west-northwest of the Barker Gorge where the Barker River flows discordantly through the range. Behind the cave the range is about three miles wide and rises abruptly 200-250 feet above the outer plain.

The middle of this wider part of the Napier Range is undissected plateau, a relict of the Tertiary planation surface, but the outer margin is cut up by solution, along joint planes chiefly, into most jagged relief, which we

FIGURE 1

OLD NAPIER DOWNS CAVE WEST KIMBERLEY, W.A.

SURVEYED 15TH JUNE, 1959 BY J.N. JENNINGS
AND M.M. SWEETING WITH PRISMATIC COMPASS
METALLIC TAPE AND ABNEY LEVEL, C.R.G. GRADE 4.
DRAWN BY J.N. JENNINGS.



called "giant grikelane" after the much smaller "grikes" of the Craven limestone plateau in the Pennines of England. This belt is in foreereef facies with depositional dips here of 20 to 25 degrees.

Immediately within the inner margin of this dissected belt is inset an elongated closed depression a little over a mile long and at most 300 yards wide. For most of its length it is parallel to the outer wall of the range, but at its eastern end cuts obliquely across the strike to approach it more closely. Along its central section the depression has a flat, loamy, alluviated floor about 500 yards long with a maximum width of 150 yards, and which lies about 100 feet above the plain outside the range. To the west, a narrow valley brings runoff down from the plateau in the wet season, and the stream bed from it traverses most of the alluvial floor to lead into small holes in the southern rock margin at the level of the alluvium. From the eastern end, a much shorter stream bed runs west towards the longer stream and sinks into small holes in loam and rubble about ten feet below the flat near a group of rock nubbins. The whole of this flat probably floods at times in the wet season.

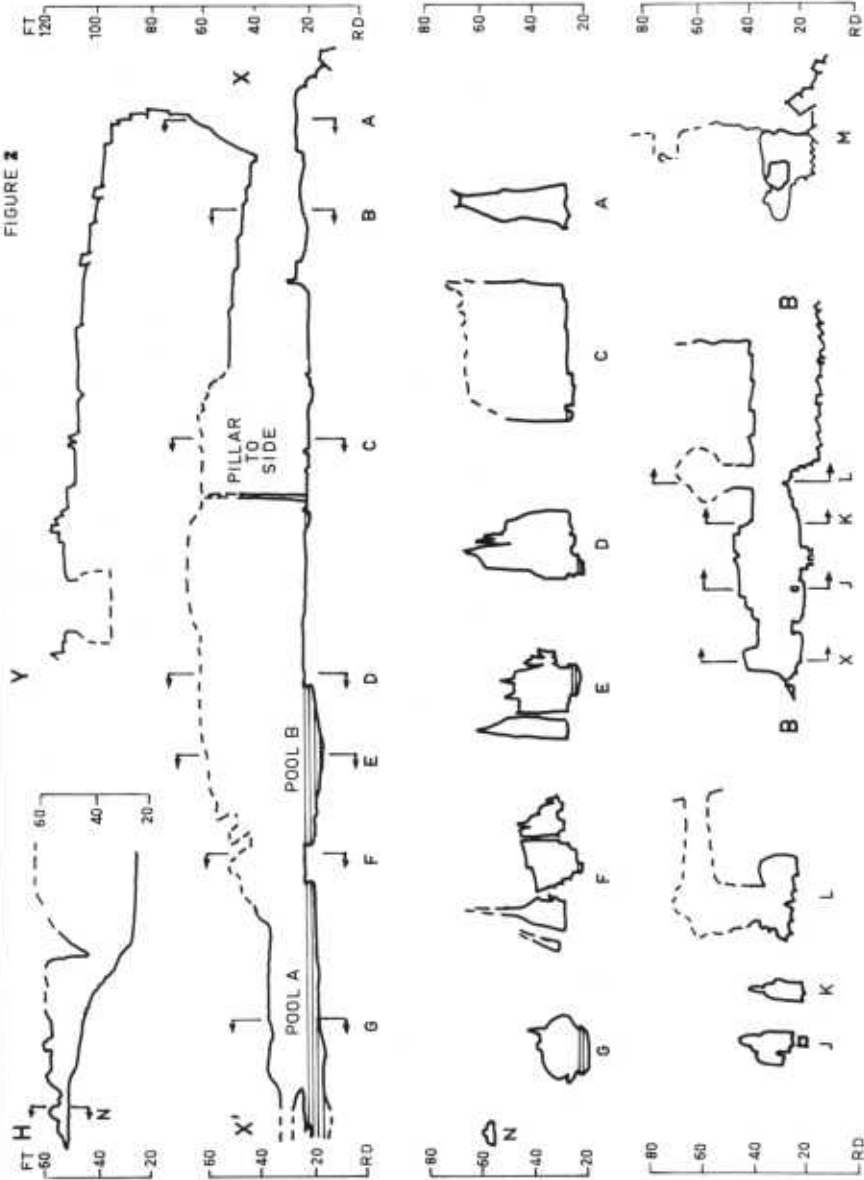
In undulating ground south of the eastern end of the flat, there is a fresh collapse pit about 7 feet across and 25 feet deep; the top part is in rubble, but lower down the walls are in rock and clay, with a clay floor. This pit probably lies near the main underground drainage from the depression because it lies on the line from the water-sinks to Old Napier Downs Cave.

The eastern end of the depression consists of a series of dolines more or less in line. Of these, the western ones are shallow, with small flat rubbly floors. Two of these have small caves leading down from them; these were only examined for a few feet but led onwards. The eastern dolines are larger and deeper, lack central floors and are practically covered by sharp pinnacles and aretes of rock. Since bedrock in situ is exposed over almost their whole area, these dolines are due to surface solution, not cave collapse.

The surrounds of the main depression are for the most part very steep rock walls, especially on the southern side where only one easy col leads to the marginal wall of the range. The northern flank is more broken into pinnacles and separate rock masses by gullies from the plateau.

This closed depression has been described in some detail because it is the largest one known in the Limestone Ranges and approximates more closely to a "polje" than perhaps any other closed limestone depression in Australia. It also possesses caving potential itself and explains the development of Old Napier Downs Cave since all its drainage seems to feed that cave, there being no creek draining from the outer wall of the range in this section other than that issuing from the cave.

FIGURE 2



LONGITUDINAL AND
CROSS-SECTIONS

OLD NAPIER DOWNS CAVE, WEST KIMBERLEY, WA.

The Cave

The cave is situated south of the eastern end of the depression within the range. Its tall, main entrance (section A in Figure 2) opens about 20 feet above the plain. Broken rocks, followed by a flowstone staircase, lead up to it (Figure 1). Small streambeds, dry when the cave was visited in May and June, 1959, lead from this broken rock. Other streambeds issue from a shallow overhang with much spongework at the cliff base to the west of the main entrance, and also from the far side of a projecting rock bastion to the east. They all join to form a creek leading out into the plain.

From the main entrance, the cave runs about 120 feet northwards, then turns practically at right angles and was explored for about a further 250 feet on a WNW trend, with a short rising branch on the south side (section H). The cave varies in width from 12 to 60 feet and in height from 15 feet to an estimated 45 feet (section XX'). A second entrance lies east of the main entrance to the far side of the rock bastion and leads through a narrower passage to join the main part of the cave (section BB'). This side passage includes a steep flowstone barrier of much the same height as that of the main entrance. An aven in this passage appears to lead via an upper level to a small opening in the cliff at about 60 feet above the plain (section LL'). A little further east is a separate small cave (section M) and above this at 60 to 70 feet above the reference datum (R.D.) on the plain is another high level entry.

The strike and dip of the forereef beds have little influence on the plan and cross-sectional form, though the innermost part of the cave assumes the strike trend. Instead, vertical joints are more important in structural control, though several joint directions are involved.

The floor of the main cave and of the side passage inside the flowstone riser is practically horizontal and is very largely composed of flowstone. A succession of rimstone dams encloses basins, the rims being highest at the front of the cave and the basins deepest at the rear so that the profile is a slightly descending one inwards. In May-June, 1959, the forward basins were dry, some small pools survived near the right angle bend, whilst further in there were large, deeper pools. The final pool A led to a watertrap about 8 feet deep, which was not attempted by diving. Above the roof of this watertrap there is a fairly circular dry passage leading on in the same direction; a short scaling pole would be needed for farther exploration here. The surface of the inner pools carried calcite crystals and there are accumulations of such flakes on the floor of the pools in parts.

There is much additional calcite decoration in the cave in the form of stalactites, stalagmites and pillars, particularly around the two innermost pools, the barrier between which may be entirely of flowstone. The margins of the pools are crenulate through the outgrowth of flowstone at water

level forming projecting ledges. No dripping was observed at the time of exploration and the decorations are somewhat dull of surface; there seems little doubt, nevertheless, that water is available in the wet season for their continued development.

A sample of water from the pool B had 120 mg/l of calcium carbonate and 7 mg/l of magnesium carbonate in solution, with a temperature of 71°F and a pH of 8.2 at the time of collection (June 14, 1959). This was a saturated solution with respect to calcium carbonate as might be expected from the presence of the calcite flakes on the surface.

In this part of the cave the dry and wet bulb temperatures were 76° and 60°F respectively, giving a relative humidity of 38%. Such a low humidity would permit substantial evaporation from dripping and flowing films of water, even with little air circulation, and it is therefore possible that this process is contributing to the precipitation of calcite in this cave; it is, however, more common in caves for humidity to be too high for this to happen and for the main cause of secondary precipitation of carbonate to be the release of carbon dioxide from percolating waters rich in carbon dioxide and calcium bicarbonate ions when they enter cave atmospheres with the normal low partial pressure of carbon dioxide.

From the rough, eroded state of the higher rimstone dams in the front part of the cave, it is inferred that stream flow right through the cave occurs during the wet season. However, the pattern of the streambeds joining to form the creek leading away into the plain, suggests that the flow at this level through the cave relates to times of exceptional discharge and that the more persistent wet season flow occurs by way of the smaller tubes and spongework closer to plain level. The pedimented plain may have become regarded to a slightly lower level than it originally possessed when the main cave was the regular means of discharge from the closed depression.

The projecting rock bastion provides an easy means of ascent onto a lower part of the dissected range above the cave. Here, at an altitude of 110 feet above the reference datum on the plain, there is a narrow roof window revealing a substantial cave passage 15 to 20 feet below. This high level certainly should be examined by any future caving party, for there may be a second subhorizontal cave relating to another higher stillstand in the degradation of the outer plain from the Tertiary planation level to the modern surface.

Access

The Old Napier Downs Cave is best approached by taking the track from Kimberley Downs Homestead to the new Napier Downs Homestead as far as the entrance to Barker Gorge, where the track branching west to Old Napier

Downs Homestead is followed along the front of the Napier Range until the cave entrance comes into view.

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A B S T R A C T

REPRODUCTION AND BREEDING FLUCTUATIONS IN HYDROCENA MONTEROSATIANA, A MALAYAN LIMESTONE ARCHAEOGASTROPOD. By A.J. Berry. Proc. zool. Soc. Lond., 144(2), 1965 : 219 - 227.

In Malaya, Hydrocena monterosatiana appears to be the only common land archaeogastropod. It is found in large numbers on the limestone outcrops of central and north Malaya, and in smaller numbers on other rocks and soil where conditions are not too acid. Its "niche" is far less well defined than in other limestone hill snails which keep more strictly to moss or dead leaf litter, or burrow in small pockets of soil. Hydrocena is found on mossy rock, on bare rock, on soil, and even on tree trunks near limestone hills. Like most limestone hill snails, individuals of H. monterosatiana are very small, none being taller than 2.7 mm. For this paper, specimens were collected from Batu Caves and Bukit Takun, two limestone outcrops near Kuala Lumpur, for investigation of the reproductive system. Evidence of fluctuating reproductive condition is given, although breeding appears to persist throughout the year. Breeding fluctuations are related to changes in rainfall, and their nature is compared with that in other gastropods from the same locality. - A.M.R.

HAND PAINTINGS IN CAVES

With Special Reference to Aboriginal Hand Stencils from Caves
on the Nullarbor Plain, Southern Australia

Edward A. Lane* and Aola M. Richards, M.Sc., Ph.D.**

Summary

This paper discusses hand stencils and imprints found in caves and rock shelters throughout the world, and considers their possible origin and significance. It discusses the paleolithic hand paintings of France and Spain, and presents some of the meanings attributed by various authors to this form of art. Particular mention is made to mutilation found in many of the hand stencils. Reference is made to historic and recent examples of these hand paintings.

Australian aboriginal hand paintings in limestone caves and rock shelters are also considered and their meanings discussed. The similarity of Australian and European hand imprints is pointed out. Special reference is made to hand stencils found in caves on the Nullarbor Plain, Southern Australia. It appears that stencils in Abrakurrie Cave show the deepest penetration of aboriginal art yet recorded inside caves in Australia.

Paleolithic Art

Paleolithic man was an artist, and the brilliance of his engravings and paintings, particularly in the many painted caves of France and Spain, is extraordinary. The symbolism of Paleolithic art and its interpretation must be supplied partly by guesswork, partly by reference to the records of far more recent civilisations, and partly by comparison with the art and magic of recent and present-day primitive tribes.

Ice Age man was a hunter, and must certainly have believed in magic and practised magical rites and ceremonies. His cave paintings present an art apparently not meant to be seen, or seen only with difficulty by the light of flickering fire-brands and blubber or vegetable wicks. Paleolithic paintings were not art for art's sake, although pure delight in beauty should not be excluded; but ultimately, as was the case also in later epochs,

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they existed against a background of religious and social obligations and interests of the community to which the artist belonged. It is presumed by some writers that Stone Age artists, who were trained in a kind of "art school", were simultaneously the tribal magicians and the only men privileged to have access to the subterranean art stations. Here they performed the magic rites essential to the survival of the tribe. The method and style of cave painting must have been a slowly growing tradition with an historical sequence (Breuil and Berger-Kirchner, 1961; Mellersh, 1959).

This prehistoric art had its beginning in the Upper Paleolithic, some 30,000 years ago during the last great glaciation in Europe and continued to about 12,000 years ago. Most research workers believe the Paleolithic hand-prints to be the oldest of the paintings, predated only by the lines scratched into the cave walls or scraped in mud with the fingers - lines running in serpentine parallels and aptly named by modern workers "macaroni." Next came hand imprints and hands outlined in paint or spray. This belief cannot be proved, but is based on the most likely evolution (Lissner, 1961).

These all date from the Middle Aurignacian, a culture named after the site of its discovery in a cave at Aurignac in the south of France, and first excavated in 1860.

Another impetus towards artistic creation may have come from the realm of hunting. Every day the Ice Age hunter came across the tracks left in the soil by wild animals which could be imitated artificially. This may have induced man first to reproduce his own hands, and this may have in turn given him the idea of drawing lines on the clay with his fingers, or painting on a rock wall with fingers steeped in clay (Breuil and Berger-Kirchner, 1961).

Hand Paintings

The form of the hand-prints in caves varies from short linear impressions of fingers in clay, to abstract representations of hands, and to the more common direct images of hands painted upon the rocks with the aid of colour pigments.

The hands were painted either in positive or in negative. In the "positive impression" the hand apparently was covered with colour and pressed upon the rock surface. In the "negative impression," or silhouette, the hand was placed on the wall and colour spread or blown around the outline of fingers and palm to make a stencil. In this way the light colour of the hands stands out cleanly against the brightly-coloured background. This latter type of imprint was the more favoured, as colour used in this way has greater visual impact and covers a greater area. The colour is intense near the stencil and gradually decreases in strength with distance from the outline (radiation). This produces an iconlike effect of the hand image,

often with a magical, invocative force. The "aerograph" technique was also employed during the Paleolithic in the execution of some of the animal figures, for example, at Lascaux.

The rare, positive hand-prints are always red, whereas negative prints are normally black. Positive prints invariably are incomplete or faded, and it has been postulated that they are probably older than the negative type and could have appeared initially by accident on the walls (Lissner, 1961).

This practice of making hand-prints was widely distributed in the Paleolithic and was probably the first use of colour in the history of art (Giedion, 1962). It is difficult for us today to realise the magnitude of this leap forward for mankind. This was the known beginning of the art of painting.

Sometimes in the French and Spanish painted caves the hands appear singly, sometimes massed, and sometimes in conjunction with animals or indecipherable symbols. In combination with animals, the meaning can be interpreted as a symbolic possessive power. However, in cases where the hands are from an earlier period, it seems that a reverent awe has prevented their being covered over by later animal paintings. Towards the end of the Aurignacian period the custom of reproducing negative or positive hand impressions came to an end. Magdalenian cave art followed other paths.

Among the most famous of the caves containing hand paintings is El Castillo in north-eastern Spain. All periods of prehistoric art are represented here. Once again, an abiding reverence for the earlier hand paintings seems to have protected them from destruction (Giedion, 1962). At Pech-Merle (Lot, France) there is a red encircled left-hand print on a boulder, in contrast to hand-prints which normally appear on walls. The hand-prints in the French and Spanish caves are predominately left hands.

Survival of the Paintings

That European cave art has survived over thousands of years is due to the protective environment of the caves. The paintings were applied to limestone walls, varying in type from one area to another. Only in exceptional cases do other types of rock serve as a surface. Even in the caves, many destructive forces undoubtedly acted upon painted and engraved figures, such as rock collapse, changes in temperature, and moisture. Coloured stains and fragments of engravings today recall the existence, in earlier times, of figures that have since disappeared. Water acts in a cave in two ways - by infiltration, and by condensation on the walls. Condensation attacks the calcareous walls and is one of the chief reasons for the destruction of Ice Age mural paintings. Groundwater can deposit calcareous layers on cave walls, covering paintings to various thicknesses. This has provided evidence of antiquity and also contributed to the preservation

of paintings in some known instances. Cave walls are also exposed to biological and chemical processes. Lichens, algae and mosses may grow on the walls of caves in certain circumstances and can often help to destroy the paintings; a process still occurring today.

On a completely dry wall, oxydization is always found on the surface causing the natural colour of the rock to change, often to a darker colour. This may limit the extent to which the paintings are visible, but it also indicates great antiquity (Breuil and Berger-Kirchner, 1961).

Grazioso (1960) suggests that at least some forms of art - e.g. low and high relief - were executed on rocks in the open, but none of these have reached us owing to the destructive effects of external agents. Durant (1935) had already suggested that the examples of Paleolithic art - statues, bas-relief and paintings - numerous though they are, might only be an infinitesimal fraction of the art that expressed or adorned the life of Ice Age man. It has not been proven that prehistoric men were artists only when they were in caves.

Painting Methods and Materials

Colouring materials used in Paleolithic paintings were limited. Most frequent use was made of ochre, or oxides of iron, from which were obtained shades ranging from yellowish-red through red to brown; in addition red chalk was used. Manganese oxides and charcoal provided blacks. White was extremely rare, while green and blue are entirely lacking. Violet tones have only been observed at Altamira in Spain. Red ochre has been found sharpened into crayons which were probably used as pastels. Usually the colours were ground to a fine powder to which oily or greasy substances were added later. Blood serum, vegetable juice, albumen, animal fats, and water may have been used as binders. The paste thus made was then applied to the rock surface. Tools probably consisted of fingers; some sort of a brush made of frayed twigs, reeds, hair, or tufts of feathers. A tube may have been used to apply colour in dry or liquid form. Occasionally paint was blown directly on to the wall with the mouth, a practice still found among Australian Aborigines today. Palettes appear to have been used in some instances (Breuil and Berger-Kirchner, 1961; Graziosi, 1960; Hawkes, 1963; Moore and Nicholas, 1964).

Mutilated Hands

The Gargas cavern in the French Pyrenees contains over 150 massed painted hands near the entrance. The hands, painted in red, black and yellow, are the only paintings to be found in this cave, which is almost permanently damp. Those in red are frequently superposed by black ones, and are inferior in execution; they certainly date from an earlier period. With the hand silhouettes, it is generally the left hand that is shown,

whereas in the case of positives, it is generally the right hand. One explanation for this could be that when making a negative the pigment or container for it was held in the right hand - assuming that Ice Age man was right-handed as we mostly are today - and thus only the left hand was free for application, whereas to make a simple impression the free right hand could easily be used (Breuil and Berger-Kirchner, 1961).

In the centre of the Gargas cavern is a hollowed-out rock column. Here, as Giedion (1962) puts it, a few hands grasp at the curtain folds of the rock formation. Most of these hands and others in the cave are mutilated, with the joints of one or more fingers missing. In some only the three middle fingers remain, in others only the middle finger itself remains. Graziosi (1960) notes that the same mutilated hands appear to be reproduced several times in the cave. Lissner (1961) suggests that the missing fingers or joints at Gargas could have resulted from "close contact between man and beast", or that the mutilation could have been deliberate for magical purposes, or as a form of sacrifice designed to ensure success in hunting; or even as a sacrifice to avert sickness and death. "The cloud of mutilated hands at Gargas stands there like a tragic chorus, eternally crying out for help and mercy" (Giedion, 1962).

This custom of mutilation is also found among certain primitive peoples, who cut off parts of their fingers as a sacrifice to ward off evil, request protection from dead spirits seeking vengeance, avert an accident, signify mourning, or act as an initiation pledge. Breuil and Berger-Kirchner (1961) claim that representations of mutilated hands have even been found in southern Australia.

In reply to the oft-quoted suggestion that the Paleolithic mutilated hand-prints were made by doubling fingers under, Sollas (1924) experimented and concluded that it was difficult "to pretend." He also refers to hand mutilation among the Bushmen of Africa, the Dravidians of Mysore, and the North American Indians. He includes as reasons for mutilation among these primitive people: a badge of tribe or caste; a mark of chastity or betrothal rite for young women; a bribe to the gods to grant a wish; a symbol of grief for a dead relative at a funeral. Catlin (1841) described an annual religious ceremony of North American Indians in which a finger joint was lopped off initiates.

Armstrong (1963) quotes a letter from Abbé André Glory, Technical Director of Lascaux. Glory stated: "When a woman has lost her husband she cuts off the joint at the end of a finger among the Bushmen tribes in Africa and Australia - the toes of a foot if a Fijian - so one supposes at Gargas prehistoric man did the same thing." Miss Armstrong also quotes explorer John Goddard who said he had not seen "finger chopping" among the African tribes, but had heard of it being done formerly to express great sorrow.

Nicholas (1965) reports that American caver Russell Gurnee visited French and Spanish caves in 1960 in company with Norbert Casteret. Many of the caves visited in the Pyrenees had mutilated hand outlines. Gurnee concluded that these apparent mutilations were evidence of some mystical rite, because in some of the Spanish caves they always involved the last two phalanges of the little finger. In French caves, the fingers appeared to be less expertly amputated, many of the scars showing ragged edges, cutaneous retraction and exposure of the bone segment. Many variations occurred in the number of digits missing. In some cases the hands appeared to be horribly mutilated.

Nicholas refers at length to a paper by Dr. A. Sahly (Medical World News, 4(22) : 118-119, 1963). Sahly, after studying the Gargas hand paintings, analysed them from the viewpoint of modern medicine. He believes the mutilations resulted from frostbite and Raynaud's disease, aggravated by malnutrition, and rejects the theory that the mutilations, frequently found even on children's hands, were ritual. He noted also that the Gargas "amputations" never involved the thumb and that they always occurred between joints, but never intra-articularly. On this evidence, Sahly ruled out leprosy and a number of other pathological conditions.

Sahly indicates that an advance of the ice sheet began about 30,000 years ago and reached its peak about 17,000 B.C. He believes that Upper Paleolithic man evolved under tropical conditions and so was ill-adapted to the increasing cold and resultant change in available food supplies. Their lives in cold, damp cave areas, coupled with a precarious living, including a lack of vitamins, constituted an etiology for endemic frostbite and Raynaud's disease.

Raynaud's disease is a vascular disorder marked by recurrent spasms of the capillaries, and especially those of the fingers and toes, during exposure to cold. It is characterised by intermittent attacks of pallor and cyanosis of the extremities. It continues for two years or more, and is accompanied by superficial gangrene. Persistence of the disease can bring about the loss of fingertips and eventually reduce the hands to mere stumps. However, it never affects the metacarpus, or thumb. It chiefly afflicts children and young adults and produces a clinical picture similar to the Gargas Grotto prints.

Sahly adds that the mutilations observable in the Spanish caves seemed to be deliberate, in contrast to the diseased hands at Gargas. This does not rule out the likelihood that the actual prints are evidence of some mystical rite, the rite dealing with the print, not the mutilation.

Giedion (1962) has published a photograph and given a description of massed negative hand impressions from Kap Abba Cave at Darembang (West Irian). The cave, which was discovered by a Frobenius Institute (Frankfurt)

Expedition, presents a phenomenon parallel to the cavern of Gargas, but the hands are not mutilated. The hands are spread everywhere, even upon the ceiling of the cave, and are interspersed with negative silhouettes of feet. The hands form an amorphous accumulation of imprints which Giedion considers could hardly represent a single period of time.

Painted hand-prints are also found in the art of the American Indians, and are thought to range from recent times to some hundreds of years ago. Giedion quotes E.W. Haury (Painted Cave, Northeastern Arizona, Arizona, U.S.A., 1945) and gives a description of a 20 ft long cliff wall containing more than 150 prints. Many of the hands are entirely out of proportion, and some even have six fingers. They are thought to date from pre-Columbian times.

The Meaning of the Hands

Despite all the research work that has been carried out, the meaning of Paleolithic hand-prints has never been satisfactorily explained. The suggested meanings are merely guesses, or have been based on known reasons for similar hand silhouettes made by recent or present-day primitive tribes. This very ancient custom of depicting hands is not restricted to European Ice Age art, but is also found in numerous hunter cultures in America, Africa and Australia. Stencils of ages varying from prehistoric to present-day have been found in caves and rock shelters in South Africa, Palestine, Egypt, Arabia, Mexico, Babylonia, Phoenicia, India, U.S.A., Australia, Patagonia, West Irian in the McCluer Gulf region, and at Espiritu Santo in the New Hebrides.

Verbrugge (1957) suggests that Paleolithic man may have believed that an invigorating or curative power emanated from the walls of caves and could pass into his body if he pressed his hands against the walls and left his prints behind. He quotes examples of many subsequent races who believed that the strength of objects could be tapped by a laying on of hands.

Thorpe (1925) considers the hand is supposed to record some mystic ceremony or to symbolise an ancient deity. Amongst the Red Indians, he says, it denoted supplication to the Great Spirit, and in Mexico it was a symbol of power and strength. Amongst the Semitic people it typifies Divine Might. The red hand in ancient Ireland was a symbol of good luck known as the "Iann dergerina", or red hand.

The hand - the member of the body that reaches farthest - shapes those things which give man a power exceeding his innate strength : tools, weapons, in short all artefacts which distinguish his life from that of mere animal existence. That the representation of the hand, the limb capable of the highest formative skill, should simultaneously express special strength and magical significance seems almost self-evident. As well as being a

gesture denoting or imparting strength, the raised hand could have been a gesture to ward off spirits or evil. In brief, the hand in every age from prehistoric to historic times seems to have had a magical and esoteric significance (Giedion, 1962).

Giedion agrees that the meaning of painted hands cannot be determined exactly, and that the meanings must also be manifold. However, he believes that the images, whether mutilated or complete, always express a supplication to invisible powers, no matter how various the immediate appeals may be. He considers there must have been a reason why some of the Paleolithic hands are outlined in red and others are black, often side by side. Pleasure in colour variation seems to be too poor a reason.

The hand placed in relation to animals might have signified both a wishful seizure (or taking possession) of the desired quarry, and an invocation for fertility, for an increase in the numbers of the animals themselves. At Pech-Merle, for example, two pregnant ponies are surrounded by six hands stencilled in black. Some are right hands, some are left.

The more common frequency of left hands in Paleolithic art provides scope for further speculation. The left hand, also, seems to have dominated in the art of many later civilisations. From earliest mythology it has been known that the right hand signified good and the left hand evil. Thus the left hand was something to be feared and supplicated. Today we still retain the latin words "sinistra" and "dextra" as "sinister" and "dexter" for left and right, evil and good. Some magical significance was attached to the left hand, as the tribal magician, who was feared and looked up to, always had to be left-handed.

Giedion (1962) believes that the common explanation that man, even in Paleolithic times, was predominantly right-handed and could therefore use his right hand more easily to paint, is all too facile. He gives examples to show that through many civilisations the left side of the body has been considered female and the right side male. "The astonishing domination of the left hand, not confined to the Aurignacian-Perigordian era, may well be related to the meaning later attributed to it. The Aurignacian-Perigordian is renowned as the period of female figures - from the Venus of Brassempouy to the Venus of Savignano, from the bird-headed goddess of Pech-Merle, to the high relief of the Venus of Laussel."

Yet, beyond reasons and meaning, the hands are an intimate link between today and yesterday. After visiting the newly-discovered PechMerle in 1927, the painter Ozenfant (1928) wrote: "Ah, ces MAINS! Ces silhouettes de mains qui se posèrent en pochoir, grandes ouvertes sur fond rouge. Allez-y, je vous promets la plus forte secousse de votre vie! L'Homme de Toujours vous attend."

AUSTRALIAN ABORIGINAL HAND PAINTINGS

Stencilling of hands has been practised from the earliest period of painting in Australia up to the present day. The human hand is the commonest subject in aboriginal art, and is found throughout the Continent.

The navigator, Matthew Flinders (1814) was one of the first Europeans to record the discovery of aboriginal rock paintings in Australia. He says that he landed on Chasm Island, just north of Groote Eylandt, on the western side of the Gulf of Carpentaria, on January 14, 1803. "In the steep sides of the chasms were deep holes or caverns, undermining the cliffs; upon the walls of which I found rude drawings, made with charcoal and something like red paint upon the white ground of the rock. The drawings represented porpoises, turtle, kangaroos (sic), and a human hand..." W. Westall's sketches of these paintings are among the earliest records of aboriginal art in Australia. Most of his sketches are now in the Mitchell Library, Sydney. Westall was the landscape painter in the Investigator from 1801 to 1803.

Etheridge (1892) made several references to aboriginal hand paintings and these are of historical interest. The following remarks are derived from his paper with his references in brackets.

"Among the back-country blacks at the Barrier Ranges there is a custom of making rock-paintings. That is, the figure of an outstretched hand, sometimes coloured, sometimes plain on a coloured ground. When the former, the hand is daubed with red ochre or pipeclay and printed off. The latter mode is to place the extended hand on the rock and to squirt colour over it out of the mouth; on the hand being removed, the print is left on a coloured ground." (A. Howitt, "Notes on the Aborigines of Cooper's Creek", Smyth's Aborigines of Victoria, II, 1878, pp 300-309). A similar reference is made to black hand-prints in Western Australia.

E.M. Curr is quoted as follows: "As I have often myself seen the blacks imprint their hands stained with red ochre on suitable surfaces in this way, I cannot accept such marks as a proof of antiquity." (Australian Race, III, 1886, p 679).

Etheridge says that while many later hand-prints may have been simply a matter of sport and pastime, evidence did exist of the antiquity of the practice and the paintings were too important to dismiss hurriedly.

J. Bonwick had described a cave at Rylstone, N.S.W., in which were impressions of red hands, some with the forefinger cut off, others crossing one another. (William Buckley, The Wild White Man, Melbourne, 1856, p 87).

Etheridge also quotes G.F. Moore in an 1842 reference (Descrip. Vocab. Language Aborigines W. Austr. etc., 1842) in which Western Australian

Aborigines, when questioned about a crudely carved figure and several impressions of open hands in "a cavern near York", could give no rational account of the works. They had little curiosity about them and paid them no respect in any way. "In short, it appears as if it did not concern them, or belong to their people," wrote Moore.

The rarity of right-hand prints is commented on by Etheridge. He quotes Dr. A. Carroll (Centennial Mag., I(3), 1888, pp 189-191) as saying "comparative mythology has established the fact that the impression of the left hand was the sign-manual of a wizard or sorcerer."

C. Barrett (1929) says the Great Cave of Mootwingee (north of Broken Hill, N.S.W.) is rich in red hands which are all stencilled in red ochre, and have been fixed so indelibly that not even the most vigorous rubbing with a hard-bristled brush will erase them. "It has been attempted and vandals have tried to scrape them off with a knife."

The Great Cave is actually a large rock shelter. The loose use of the term "cave" in the literature is often confusing. Most aboriginal art is found in rock shelters; paintings in true caves are extremely rare.

Barrett also tells of the discovery of "The Cave of the Red Hands" in the Grampians, Victoria. Here, the hands are associated with figures and markings painted on the rock.

W.E.H. Stanner (1960) writes that in his experience only four colours are used by the Aborigines in their paintings - red, yellow, white and black, but the hues vary greatly. The painting methods used are, broadly speaking, those still used in the graphic arts. On some rocks wet paint has been used, and in a few instances layered on, but the great majority of figures and symbols have been made with dry colours in the piece or in powder. He adds that the living Aborigines are as puzzled as anyone to identify the subjects of many paintings and reported "meanings" must be treated with reserve. Opinion is not evidence.

Stanner says that hand stencils in caves and rock shelters around the southeast of Joseph Bonaparte Gulf, Northern Territory, are usually white and may be either right or left hands. A few prints are filled in with block colour. Stanner also stressed the difficulties in determining the age of aboriginal paintings. He says, too, that the human hand is at the centre of some very involved systems of symbolic thought in the aboriginal culture; "various metaphors make use of it to signify personality, will, freedom, and other such conceptions." He notes that entities painted by the Aborigines are not seen or conceived in the same way by Europeans. "They are depicted under the sway of ideas coming, quite literally, from another world."

Mutilation of the hands was very common throughout Australia, particularly those of women and children, and this is reflected in the hand stencils. In the Sydney-Hawkesbury area of New South Wales, it is very common to find stencils of women's hands showing the little finger missing. The finger was taken off in childhood by means of a cobweb. This was bound so tightly round the finger that it turned gangrenous and fell off. Women did the fishing for the tribe, and it is thought the little finger was removed because it got in the way.

Thorpe (1925) believed the hands were painted white in rock shelters to ward off death. Red hands protected the Aborigines from the evil eye, red ochre or human blood being used as pigments. He says the Aborigines usually depicted the hand in an uplifted position and seldom horizontal. However, numerous stencils have been found pointing in all directions. In many instances part of the arm is shown as well as the hand.

Unlike Ice Age man, the Aborigines are known to have painted over the hand stencils, or put hands on top of other paintings quite indiscriminately.

Mountford (1956) says that his research into the art of the Australian Aborigines has convinced him that their art was predominantly non-magical; that is, they painted because they wanted to, and not for some material advantage. In a number of parts of Australia, however, magic was definitely associated with some aspects of the art.

The natural ochres of red or yellow, white clay, black manganese and charcoal are in universal use in aboriginal art. Human blood was used occasionally, and brown, purple and blue have been recorded in the north. On the whole, red is the predominant colour in Australian cave art; white is widespread; black is common in some areas and uncommon in others; yellow appears to be the least favoured, being most popular in Arnhem Land. These colour preferences are not due solely to the availability of the pigment, because changes have taken place on Groote Eylandt and Chasm Island and in eastern N.S.W. where all of the colours used occur naturally (Berndt, 1964). Usually red is used on a plain rock surface (Figure 1, Plate 1), and white or yellow on a naturally-stained rock surface (Figure 2, Plate 1) or on a smoke-blackened rock surface. Red could represent blood, because blood was thought to be sacred, but there is no real proof of this. White and red were most used for body pigment in ceremonies, and were the commonest ochres.

Hand-prints were either stamped or stencilled. According to McCarthy (1962), the stencils may be made in one of the following ways. Powdered pigment may be blown from the mouth, or from a little sheet of bark on to a wetted surface; or liquid pigment may be blown from the mouth on to a dry surface around an object held against the rock. This leaves a spotty

PLATE 1, FIGURE 1.

Red hand stencils on roof of low passage
off entrance doline, Murrawijinie Cave,
Number 1 (N7), Nullarbor Plain, 1957.

Photo: E. A. Lane.

PLATE 1, FIGURE 2.

White hand stencil on right-hand wall
of Abrakurrie Cave (N3), approximately
300 ft from entrance at lower end of
collapse valley, Nullarbor Plain, 1964.

Photo: E. G. Anderson.



colouration on the rock, thickest near the outline of the subject. In addition to the above, it is reported that stencils are also produced by flicking pigment from a brush. When the object is removed, the area of rock wall which had been covered is left clear producing a stencil. The human hand, usually the left one, is the commonest subject stencilled, but human feet also occur, as well as stone axes and spear throwers.

Many writers have pointed out the magical role of the hand as the symbol of Man's power over objects, and this appears to be the case with the Australian Aborigines. In some areas the Aborigines know nothing of the stencils, or credit them to the Dreamtime spirit people. At Port Stephens, in northern N.S.W., a native is supposed to have claimed the stencils in the area represented a number of people and the direction in which they were travelling. In Central Australia they represent prints left by spiritual ancestors. In the Worora tribe, northern Kimberley, members of a certain rank leave their hand stencils in caves in which their ancestors' bones are buried so they will not be tormented by the spirits of the dead (Basedow, 1925). Another tribe in Central Australia regards the stencils as a representation of their identity. At Gwambygine, in Western Australia, the hand cave is regarded as a place of worship visited by the moon, and regarded by the local Aborigines as the home of Jingi Jingi, an evil spirit. Because of this, they are reluctant to visit these caves. It has also been suggested that the hands were meant to be a visible sign to all who followed that the owner of the hand had visited the sacred places.

Basedow (1925) says it is beyond dispute that the natives possess the faculty of being able to recognise the hand-marks of their relatives and tribesmen, even though they may not have been present when the marks were made. However, Massola (1964) says that although Aborigines easily recognise hand-marks and foot-prints as belonging to a particular individual, he would rather think the shelters were not pilgrimage centres, as this idea is foreign to the Aborigines. Sacred places were only visited for specific purposes, such as during initiation and totem-animal increase ceremonies.

From the foregoing, it would seem an Aborigine makes a stencil in the hope of deriving some spiritual benefit from it, and also in the hope of leaving some record of himself in the rock shelter or cave selected.

However, both in Australia and many other parts of the world, hand stencils occur in caves which do not appear to have been used for ceremonial purposes. In Australia, as well as stencils of men's hands, those of women and children are found in ordinary occupied shelters. So far there is no satisfactory explanation of their occurrence.

Nullarbor Plain

Hand stencils from limestone caves on the Nullarbor Plain, in southern Australia, have been known to speleologists for some time and were referred

to by Lawler (1953) and Lane (1957), both publishing monochrome pictures of hands from Murrawijinie Cave, Number 1 (N7) - though of different hands. Lane also published a photograph of the entrance to Murrawijinie. However, the pictures published in this paper are believed to be the first hand stencils from the area reproduced in colour.

Stencils were noted in 1957 by members of an Australian Speleological Federation Expedition in Murrawijinie Cave Number 1 and Number 3 (N7, N9), and Knowles Cave (N22), north of Nullarbor Homestead on the South Australian part of the Nullarbor, and in Abrakurrie Cave (N3) on the Western Australian part of the Plain. The majority of stencils are of the left hand. The eastern Nullarbor hands are in twilight zones at the darkest, and are red in colour. The white Abrakurrie hands are normally in complete darkness, although at certain times of the day faint light is reflected off a wall opposite. The two areas referred to above are about 150 miles apart, with numerous caves including the huge Koonalda and Weebubbie Caves intervening.

Dr. A. Gallus, of Victoria, has discovered signs of aboriginal activity in the first great cavern of Koonalda (about 400 ft from the entrance) and is still carrying out extensive excavations in the area. The Australian Institute of Aboriginal Studies Newsletter (1965) gives Gakushuin Laboratories, Tokyo, C 14 datings for samples from the excavation of 13,700 and 18,200 B.P.

Lane (1957) published a photograph of Dr. Gallus examining a large piece of chert from which Gallus believed Aborigines had broken pieces to prepare tools. Despite the apparent extensive penetration of Koonalda by the Aborigines, no hand paintings have been discovered in the cave.

The 1957 A.S.F. Expedition also found extensive working of thinly-banded decorative rock on the roof of Koomoolooooka Cave (N6), roughly half-way between Murrawijinie and Abrakurrie, but south towards the Bight. A large pile of discarded chips was heaped on the cave floor. No paintings or hand stencils were found in this cave. The rock workings may or may not have been done by Aborigines, the cave having been known to the white settlers since 1880 at least.

Mr. T. Draper (personal communication, 1957) counted 47 red hand stencils in Murrawijinie Cave No. 1 (N7), and reported five faint red hand stencils in Murrawijinie Cave No. 3 (N9). Many of the hands in N7 have been vandalised by visitors, and some have European names written across them. The hand in Figure 1, Plate 1, was found on the roof of a low chamber, about 3 ft high, off the entrance doline.

Knowles Cave (N22), a short distance northwest of Murrawijinie, has hand paintings in the cave and also in its entrance doline

Abrakurrie Cave (N3) is the only known Nullarbor cave containing white hand stencils (Figure 2, Plate 1) and about 12 were noted here in 1957 and

1964, some apparently showing missing joints. The hands are divided into two groups about 30 ft apart and approximately 300 ft inside the cave entrance on the right-hand wall (Hamilton-Smith and Sexton, no date; E.G. Anderson, I.D. Wood - personal communication, 1966). The distance inside the cave is measured from the bottom edge of the entrance overhang, approximately 80 ft below the Plain level. The approximate depth of hands below the Plain level is 180 ft. That is the hand stencils are about 300 ft inside the cave and 100 ft below the entrance. This appears to be the greatest known penetration into an Australian cave for aboriginal paintings (CEGSA map : Abrakurrie Cave, Nullarbor Plain (N3). From survey made 1956-57. CRG Grade 6).

Hamilton-Smith and Sexton quote Captain J.M. Thomson, who conducted five expeditions to the Nullarbor caves between 1932 and 1947, as claiming that the paintings in Abrakurrie were executed with rabbits' blood by a local sheep station owner. However, since the outlines in the cave are in white, and fairly well obliterated, the hands may be taken to be genuine aboriginal art (Figure 2, Plate 1). One group of stencils is 10 to 12 ft above the existing floor. These prints could have been executed by one man standing on another's shoulders. The rest of the stencils are about 25 ft above the floor, but on the same level as the first group. It is highly unlikely that the Aborigines could have constructed long ladders to reach this area. The marks are possibly old enough for the cave floor to have been lowered or collapsed some feet. Hamilton-Smith and Sexton refer to two sets of prints in red ochre in rock shelters around the entrance. (Could these be the forged prints referred to above?). Artefacts have been found spread over several acres surrounding the cave valley. Jennings (1961) published plans and descriptions of Abrakurrie and Murrawijinie (N7) and included a locality map.

The Nullarbor hand stencils are particularly interesting because, in general, the Aborigines do not like true caves, especially deep, dark caves such as Abrakurrie. They thought of such places as the abode of evil spirits. The reason for selecting these particular caves on the Nullarbor for hand stencils is impossible to guess. The caves are completely different in type, Abrakurrie being of considerable cross-section and leading down from the end of a deep collapse valley, and Murrawijinie No. 1 being a smallish, shallow doline with the cave largely surrounding it. Knowles Cave is shallow, about 70 ft long, and running off a collapse. All are normally dry, although Abrakurrie has signs of an intermittent stream well into the dark zone. Furthermore, other caves which have had apparent use by Aborigines, have no hand-prints or other forms of aboriginal art.

It is known that Aborigines in the Western Desert and right up to the Central Ranges, dug wells and made ladders in order to reach water. Thus, it is possible that they entered caves on the Nullarbor Plain in search of water and occupied dolines for the shelter they provided. The Nullarbor Plain is one of the world's great limestone areas, with virtually no surface features and little vegetation. That the Aborigines were prepared to enter

zones of total darkness is known from Koonalda, where the need for chert, and probably water, apparently overcame fear of evil spirits. Koonalda contains a number of lakes deep in the cave. All are highly mineralised at the present time.

As can be seen from the two parts of this paper, a great deal of similarity exists between the European cave hand imprints and stencils and those of the Australian Nullarbor Plain. In the case of the Nullarbor hands, the reason for their existence seems to be even more obscure than for the French and Spanish caves. It seems strange, too, that they should exist in reasonable numbers unaccompanied by any other form of aboriginal art. Could this imply that Aborigines formerly inhabiting the Nullarbor were of an extremely primitive type? Possible aboriginal habitation of the Nullarbor comparable with the period of Paleolithic art in Europe (a carbon dating of approximately 15,000 B.P. has been obtained from Lascaux (Laming, 1959)) seems likely from the Koonalda carbon datings. However, no conclusions can be drawn as to the age of the hand-prints.

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A B S T R A C T

NOTES ON THE SKULLS OF TWO WESTERN AUSTRALIAN RODENTS WITH A KEY TO THE SKULLS OF THE RODENTS OF SOUTHWESTERN AUSTRALIA. By Ernest Lundelius Jr. J. Roy. Soc. W. Aust., 47 (3), 1964 : 65 - 71.

Remains of two species of Western Australian rodents, Pseudomys (Gyomys) occidentalis and Pseudomys (Pseudomys) rawlinnae hitherto known from small samples and few localities, have been found in several caves along the west coast of Australia and along the south edge of the Nullarbor Plain. Samples for this paper were collected from Murra-el-elevyn, Madura, Webb and Snake Pit, and Abrakurrie caves. Pseudomys (Gyomys) occidentalis is reported for the first time from the southern Nullarbor Plain. This new material not only adds to the known geographic range of the species, but also shows that the species varies morphologically over its range. It appears that in the very recent past the species had a very wide distribution in the southern part of western Australia. Pseudomys (Pseudomys) rawlinnae is shown to vary in the presence of an accessory cusp on the anterior edge of M¹, the degree of interorbital constriction and the degree of development of the spine on the zygomatic plate. This variation makes it difficult to distinguish this species from Pseudomys (Thetomys) nanus on the basis of fragmentary material. Statistical tables on each species, and a key to the skulls of the rodents of southwestern Australia are given. - A.M.R.