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Asplenium trichomanes : a fern common on limestone.

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SOUTHERN CAVER

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SEA CAVES AND MORPHOLOGICAL KARST ON THE TASMANIAN COASTLINE

Kevin Kiernan

SUMMARY

Sea caves are a prominent feature of the Tasmanian coastline. A morphological approach to the notion of coastal pseudokarst is adopted and some process variables related to its development briefly cited. Inheritance is an important factor in their present distribution. Classification might best be approached on the basis of structural controls. There is only a small body of existing literature although many noteworthy features occur, and there exists wide potential for exploration as a first step into a potentially rewarding new field. Seven sea caves are briefly described, which are developed along joints or faults in sedimentary and metamorphic rocks. Clastic and more rarely chemical deposits are sometimes present. Although their examination is embryonic it has shed some light on the island's past climate, biota and human society.

INTRODUCTION

Although spectacular sea caves are a prominent feature of the Tasmanian coastline there has been little documentation or study of them. Investigation might profitably address itself toward a wide range of questions: where are they; what are their physical dimensions; what are the determinants of their genesis and evolution in terms of coastal exposure, offshore topography, lithology, structure and process; over what sort of time scale did they form; are they related to present or former sea levels; what has accumulated within them and what light might it be able to cast on Tasmania's prehistory and the nature of the physical environment in times past? The purpose of this article is simply to introduce the topic to the Tasmanian speleological literature and to record some better known sites, in the hope that it may arouse interest in this neglected facet of speleology and provide a foundation for future work.

COASTAL PSEUDOKARST?

Analogs for many "true" karst features occur along the coasts of water bodies such as lakes, estuaries and oceans, depending upon climate, lithology, hydraulic energy, time and other factors. The most obvious are linear sea caves, generally consisting of a single passage, but there are many more. Although under certain circumstances surface streams may sink into voids of one origin or another near coasts, the real water body of interest is the sea itself. The bidirectional flow which results from waves and tides means a sea cave is both a swallet and a resurgence. As in "true" karst, stream channel morphology is a product of hydraulic factors superimposed upon structural constraints, but the bidirectional movement on coasts complicates detailed interpretation. There are analogs also to the sink-holes, natural bridges and arches, canyons and karren forms. Stacks might be considered the coastal counterpart of the hum.

The dichotomisation of morphological karst into "true" karst and pseudokarst complicates the concept of coastal karst. Grimes (1975) suggests the term pseudokarst is valid to describe morphological karst where solution is not the dominant process. This emphasises a basic problem; to define pseudokarst one must first define "true" karst. Solution is not an adequate criteria, for the classical karst process does not itself involve true solution. There is not just a single reaction producing a more soluble bicarbonate from a less soluble carbonate. It involves a series of ionic dissociations and reversible reactions, each govered by different equilibria (Jennings, 1971) Grimes regards sea caves as pseudokarstic features involving solid phase removal by hydraulic processes. His model has some utility conceptually but also has its shortcomings. How dominant need "dominant" be? Solution may be supplemented in "true" karst by the mechanical action of allogenic detritus, or climatically induced frost wedging. Biological factors may be especially important through controlling the degree of acidulation of percolating meteoric waters. So too does coastal karstification encompass a broad spectrum of processes depending upon local conditions and it may be difficult to draw a line between karstic and marine processes where limestone occurs on coasts. (Tratman 1971). Solution may be significant in developing morphological karst on limestone coasts. Even in Tasmania the question has been raised as to the relative importance of true karstic and marine processes in shaping the coastal caves in Gordon Limestone at Surprise Bay. (Kiernan 1973a). The question of inheritance also raises its head: in various parts of the world apparent sea caves may owe their origin to "true" karst processes followed by post glacial rises in sea level, and the converse is quite conceivable. Solution of silicates has produced karst in old non carbonate land surfaces, and is responsible for the development of karren on coasts and elsewhere. The writer has observed large scale "rund karren" in association with granite sea caves and stacks at Tonga Bay, south island New Zealand. Wall and Wilford (1966) describe substantial areas of microgranodiorite karren in West Sarawak. Where are the arbitrary lines to be drawn? Otvos (1976) advocates that only processes and forms involving piping and thermokarst be termed pseudokarstic.

Mechanical abrasion by pounding with rocks, the pressure of compressed air, salt crystallisation water layer weathering, aeolian processes and biogenic factors may all comtribute to coastal morphological karst. Climate and latitude plays an important role in shaping the nature of operative processes and may provide just as valid a starting point for discussion of coastal karst morphology as pre-occupation with solution, which reflects man's tendency to compartmentalise often at the expense of the understanding of interrelationship, and in that way is perhaps ultimately dysfunctional. Working from morphology towards process may be more useful than working from preconception and an implied understanding of genesis which may or may not be accurate. A bewildering and confusing terminology for pseudokarst has developed which together with some of the issues involved are beyond the scope of the present article, but which form the basis of a separate item currently under preparation by the writer. For present purposes, "morphological karst on coasts" will suffice.

A COASTLINE UNDER ATTACK

Much of Tasmania's coastline is well suited to the development and preservation of morphological karst. Due to the region's micro-tidal environment (tidal range <2m) marine erosion is concentrated within a narrow range rather than dissapated over a broader zone. Moreover the mid latitudes are a zone of high wave energy and intense quarrying and abrasion. The island lies in open sea subject to the rigours of the Roaring Forties. Hard rock cliffs are common and often well jointed. Sub-antarctic gales from the south-west produce big swells with a fourteen second period which are responsible for concentrating beach sediment, however local storm waves coming from a variety of directions are the main waves responsible for erosion. Uplife of the land surface facilitates preservation of erosional and depositional features in some areas.

Sea level variation

However, despite microtidal conditions, the zone subject to concentrated wave attack has itself migrated in the past with eustatic fluctuations in sea level which have accompanied glacial and interglacial episodes. At present at least three glaciations appear to have affected Tasmania in comparatively recent times, one in the late tertiary or early Pleistocene, and another which had concluded by 128,000 radiocarbon years before present. An inter-glacial 130-100,000 years BP saw the sea last at approximately its present level, subsequent to which it dropped perhaps 100 metres during the most recent glacial 70-10,000 BP, which probably occurred in two phases separated by interstadial retreat. The present interglacial (Holocene) dates from 10,000 BP with the sea at its present level by 6000 BP (Thom and Chappell 1975) and the hypsothermal maximum of slightly higher sea level than at present 4000 BP.

Added to these eustatic fluctuations are isostatic adjustments related to movement of the land surface itself, which do not occur evenly. The Milford level which Davies (1959) attributed to the shoreline at the limit of postglacial submergence in Tasmania occurs at 0.5m in the south-east but apparently at 1.5m on the north-west coast. Little erosion is associated with this shoreline. The status of his Llanherne level, which he attributed to the last interglacial, is more uncertain. Fossil shorelines occur at 69m and 37-46m above present sea level on King Island, above 20m between Circular Head and Port Sorell on the north-west coast, at 17m at the mouth of the Forth River, 22m at Strahan airport on the west coast, up to 30m in north-eastern Tasmania and 61-77m, 30-37m and at several levels below 20m on Flinders Island. A maximum elevation in the south-east of 22m, is attained at Mary Ann Bay. The pre Holocene marine deposits at these sites, with the exception of the possible high levels on King and Flinders Islands are probably of least interglacial age (Van de Geer et al 1979) whereas other studies suggest the highest level attained elsewhere in South East Australia in the last interglacial was 5-10m. - Van de Geer et al suggest differential tectonic and hydroisostatic deformation may be involved. The net result is that coastal features may be preserved due to uplift.

Much of the evidence of glacial low sea levels lies submerged, for instance there exists a mud filled channel cut in bedrock to a depth of at least 40m below present sea level in the Derwent estuary, and a clear mud filled and apparently river cut channel runs E-W from Norfolk Bay into Frederick Henry Bay which reaches a maximum depth of 44m north of Slopen Island. Divers have reported caves in limestone below present sea level off the eastern coastline of Maria Island (M. Wells, pers. comm.).

For the speleologist the implication is that sea caves may be some distance above or below present sea level, which in areas of subdued topography means they may be found some distance inland.

Erosional and weathering processes

Tasmanian sea caves involve primarily mechanical solid phase removal of rock but it may be aided by some chemical action. Under glacial conditions frost wedging has been operative down to sea level, but more important in coastal reduction are a number of other processes, which apart from producing morphologically characteristic coastal land forms, may be operative in cave enlargement.

Quarrying is important under storm wave situations when pressures of up to 132,300kg/m^2 have been measured on the Scottish coast (Kuenen 1950). The wedging action of compressed air and its explosive escape when the wave recedes may loosen and remove rock. This can lead to a shore platform with a seaward slope. Abrasion by sediment in suspension can cause smoothing to produce a wave cut or abrasion platform which may be aligned to structure in coherent rock. Larger material forming the tractional load may produce channels with undercut walls (Moore 1950). Solution activity may also be significant. As the cave enlarges beyond the reach of most waves a variety of weathering processes may come into play, attacking the matrix or susceptible mineral constituents. Water layer weathering involves predominantly chemical processes, salt crystallisation from sea spray, and wetting and drying, and may produce essentially horizontal platforms. Shore platforms are themselves a prominent feature of the Tasmanian coast, and occur in association with many sea caves in sedimentary rocks.

Low rock dips, high primary permeability and water-layer weathering tends to produce a uniform surface providing that lithology is homogeneous, whereas high dips encourage quarrying. Vertical jointing may promote vertical cliffs, for example platforms are rare in Tasmania where Jurassic dolerite occurs at the coast but are more widespread on well bedded sedimentary rocks such as mudstone, on Tasman Penninsula and limestone on Maria Island. Morphologically pseudokarstic features are particularly well developed within Permian and Triassic sediments, but occur also in a number of other rock types including dolerite, granite, basalt, limestone and schist.

CLASSIFICATION OF SEA CAVES AND RELATED FEATURES

Caves owe their existence to the differential resistance of host materials whereby the less resistant are removed at a faster rate. Structural elements may form a weak point, and in view of the difficulties in classifying sea caves on a lithologic or physiographic basis, these structural controls may provide a more adequate means. Moore (1954) lists these controls in two main groups, firstly fractures and fracture structures resulting from deformation, and secondly original structures resulting from deposition or consolidation. In the first group are faults, joints and breccias (with frictional, volcanic and intrusion sub-classes). In the second group, depositional structures include stratification, variations within a given stratum, and unconformities, while consolidation structures comprise irregular cementation and internal structures of lava flows. Tasmanian evidence suggests minor igneous dykes may also serve as a weakpoint and Toomer and Welch (1975) also cite this factor from their investigations in New South Wales. Micro features may be very relevant.

SPELEOLOGY ON THE TASMANIAN COASTLINE

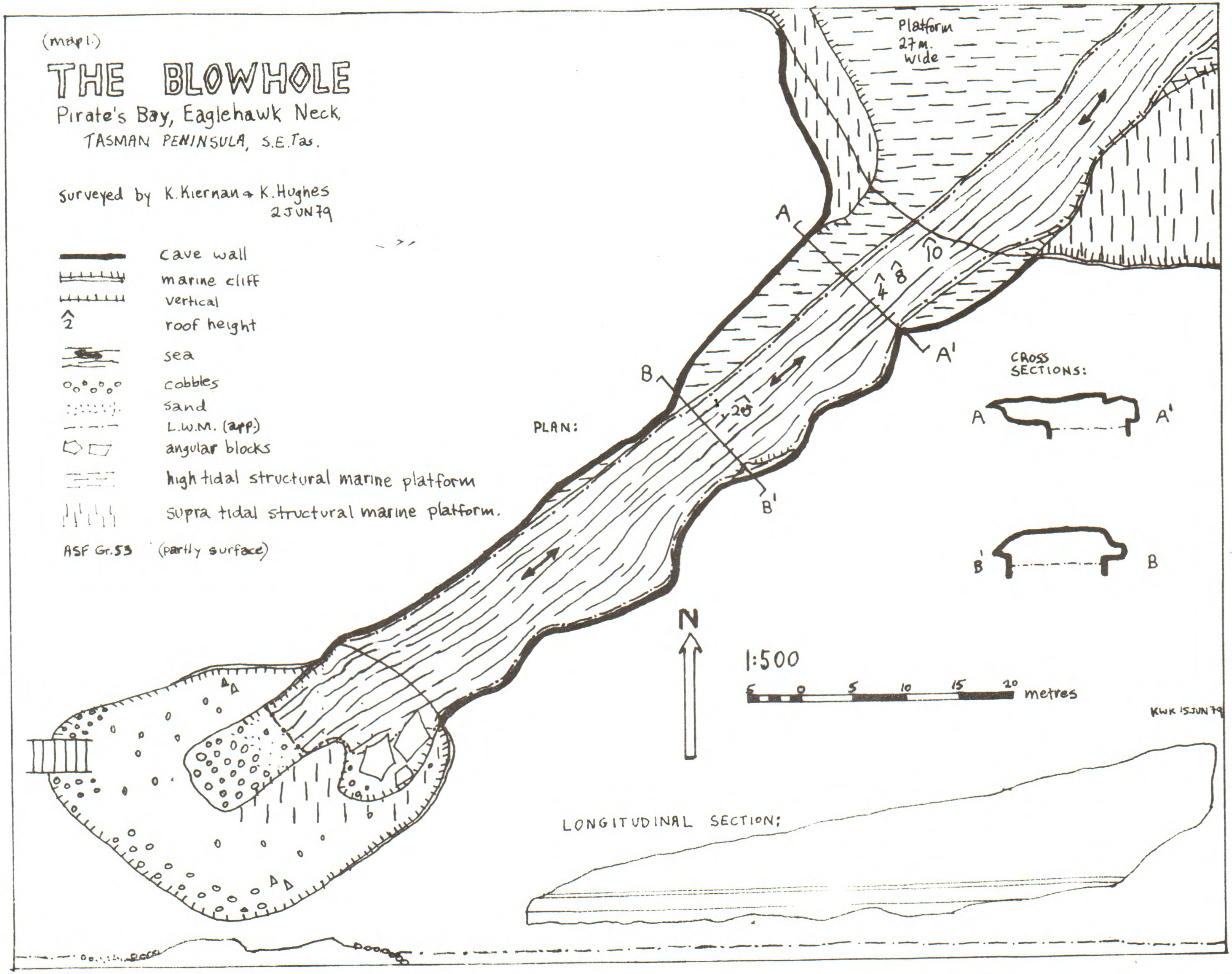
Existing literature on sea caves per se

Even purely descriptive material on Tasmanian sea caves is very sparse. Clemes (1950) described sea caves in the Eaglehawk Neck area. Fish and Yaxley (1966) make some further comment on the caves of Tasman Peninsula and at Blackmans Bay south of Hobart. Jennings (1956) noted two small sea caves from King Island which were developed in non carbonate rock but contained considerable speleothem development which he attributed to overlying calcareous sands. One is described in more detail in this article while the other and a more recently discovered well decorated cave have been investigated recently by Albert Goede and the present writer (Goede, Harmon and Kiernan in prep). On Maria Island sea caves in calcareous conglomerate have been described by Gillieson (1973) and others in Permian limestone by Kiernan (1973b) and Skinner (1973a). The two latter writers have also described caves developed in Ordovician limestone at Surprise Bay on Tasmania's south coast (Kiernan 1973a, Skinner 1973b). A more recent and significant contribution is Eric Colhoun's investigation of Remarkable Cave on Tasman Peninsula (Colhoun 1977). Moody (1974) has recorded other sea caves from Bruny Island.

Wide potential for exploration

A vast number of sea caves occur. The present writer has examined a natural arch at New Harbour in Tasmania's south-west in an area where locality names such as "Black Hole" conjure up visions of the wild and cave bestrewn coastline it is. Particularly enticing entrances occur in the vicinity of Port Davey and South-West Cape where the elements beat uninterrupted since Patagonia. At the Western end of Prion Beach a shallow sea cave a few metres above present sea level contains extensive aboriginal midden deposits, and a substantial sea cave occurs at Granite Beach. In Macquarie Harbour I have examined a small natural arch developed at Sarah Island (Settlement Island) probably under predominantly Nor'westerly conditions. Many islands around the coast are cavernous including Arch Island in D'Entrecasteaux Channel, Ile des Phoques off the east coast, and Ile de Golfe off the south coast, the latter of which is composed of Ordovician limestone. A natural arch occurs in columnar basalt at Don Heads near Devonport and another near Caves Creek on King Island. A very large sea cave is reported on the Southern end of Maria Id. & others on the Tasman Peninsula at sites such as Tunnel Bay, where a cave has been developed along a fault in Triassic sandstone, and another occurs at Koonya. Another occurs at the eastern end of Clifton Beach. Decorated sea caves have been reported from the Variety Bay area of Bruny Island.

The foregoing represents only the briefest resume of the coastal karst features of which I have some first hand knowledge: many many more are known. The cliffs of Tasman Peninsula alone represent a life time's project for someone with the right combination of motivation, boat, weather and time. What follows is a brief summary of a few of the better known sea caves in Tasmania. In building upon this base it ought to be remembered that the price of safety is vigilance, that the coincidence of wave crests of various origin may mean intermittent unexpectedly high waves, and there may have been one sea caving death in Tasmania already (Kiernan, 1974). Exploration is the first step into a potentially very rewarding field.



(map 1.)
THE BLOWHOLE
Pirate's Bay, Eaglehawk Neck,
TASMAN PENINSULA, S.E.Tas.
Surveyed by K. Kiernan & K. Hughes
2 JUN 79
cave wall
marine cliff
vertical
roof height
sea
cobbles
sand
L.W.M. (app.)
angular blocks
high tidal structural marine platform
supra tidal structural marine platform.
ASF Gr.53 (partly surface)
Platform 27m. wide
A
A'
B
B'
10
8
4
20
PLAN:
CROSS SECTIONS:
N
1:500
5 0 5 10 15 20 metres
KWK 15JUN79
LONGITUDINAL SECTION:

SOME TASMANIAN SEA CAVES

EAGLEHAWK NECK (Tasman Peninsula)

A number of spectacular features are developed on the sea coast south of Pirate's Bay near Eaglehawk Neck in South East Tasmania. The coast faces east and is composed of well jointed Permian glacio-marine sediments with a very slight landward dip. Broad shore platforms occur above which cliffs rise up to 60m, beyond which the land surface slopes downward at about 10° - a cuesta form.

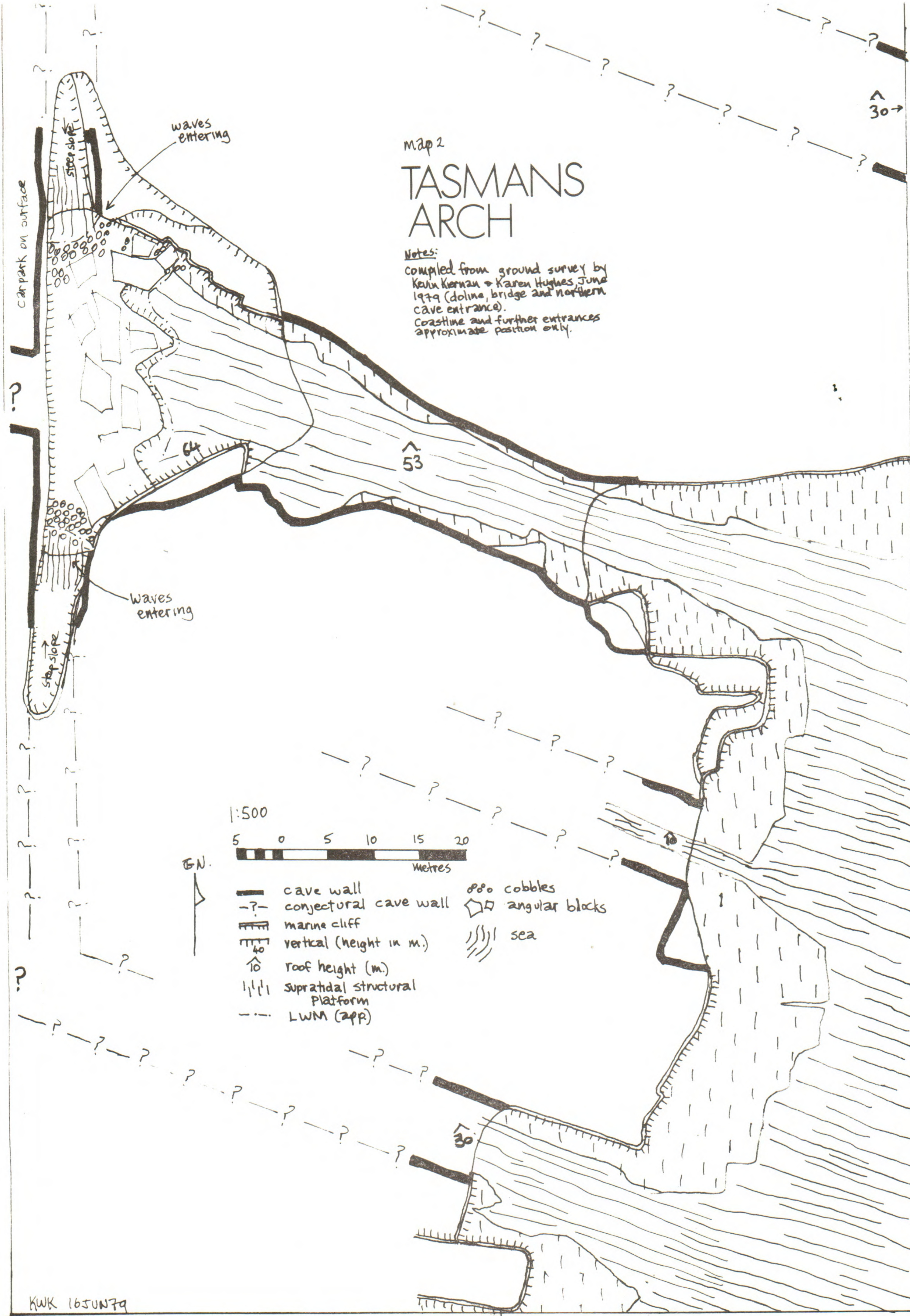
Eaglehawk Neck Blowhole (map 1)

The Eaglehawk Neck Blowhole is a well known tourist feature and occurs near the end of a narrow headland projecting into Pirates Bay from the south. This cave is developed from the antidip side of the coast. To the north of the seaward entrance is a high tide structural platform 18m wide with a slight seaward declination. From this rises a cliff of 18m. Deep potholes have been excavated in the platform by cliff fall blocks or resistant rocks occurring as ice rafted erratics within them. On the southern side is a supratidal structural platform 2.5m above present high tide level. The cave extends 67m through the headland to where the plane of cave development has come sufficiently close to the downsloping land surface to promote collapse of the roof. A sink-hole over 35m in diameter, elongate in the plane of cave development, extends to within about 20m of high tide level on the opposite side of the headland.

To both the north and south large zawns which probably resulted from collapse of similar sea caves parallel the Blowhole. The northernmost penetrates right through the headland and exhibits "karren" development in the form of sandstone "buns" up to 20cm high and 10cm in diameter developed by presumably solution processes on supratidal platform remnants.

The Blowhole cave has resulted from the concentration of marine processes along a double joint which trends at 225°. No displacement is evident. The cave has a flat roof which corresponds to a massive bed of 0.8m, above which a 2m succession of shaley beds are overlain by some 2m of weakly podsolised sands to complete the roof thickness of 5m over the inner entrance. The rectangular passage profile is dictated by bedding planes and the jointing pattern of the rock, prominent joint trends occurring at 225° and 268° with lesser sets at 242° and 188°. The roof approximates the level of the supratidal structural platform 2.5m above high tide level, and a remnant of this occurs in the doline and is being undermined to leave large angular blocks in the south side of the water channel. The channel is of unknown depth. It generally occupies most of the width of the cave at the inner end but a fairly wide high tidal platform occurs in the outer portion.

Today only the landward entrance is visited by tourists, but corroding eye-bolts extending from the northern zawn to the seaward entrance



map 2
TASMANS ARCH
Notes:
compiled from ground survey by Kevin Kiernan & Karen Hughes, June 1979 (doline, bridge and northern cave entrance).
Coastline and further entrances approximate position only.
waves entering
waves entering
steep slope
steep slope
carpark on surface
64
53
30
30
10
1:500
5 0 5 10 15 20
metres
GN.
cave wall
conjectural cave wall
marine cliff
vertical (height in m.)
40
10
roof height (m.)
supratidal structural Platform
LWM (app.)
cobbles
angular blocks
sea
KWK 16JUN79

recall more adventurous tourism which risked the waves until a honeymoon couple were swept to their death in the cave in 1956, since when removal of facilities and the erection of warning signs have deterred most visitors.

Tasman's Arch (map 2)

Tasman's Arch is also a well known feature, visited by thousands of tourists annually who peer down into the depths of this spectacular chasm from the car park on its lip. A sheer sided collapse doline 30m in diameter and 64m deep is linked to the sea by a flat roofed arch 53m high, 35m long and 15m wide. The arch is formed along joints trending at about 131° giving rise to a very rectangular profile, and the back of the arch is defined by a major joint at 184° which roughly parallels the coast. There is no evidence of displacement.

There is more to Tasman's Arch than the tourists' view however, for further passages developed along the 184° joint deliver waves from both sides at the foot of the overhanging back wall of the doline. These passages are apparently unexplored.Clemes (1950) noted:

> "on both sides of the Arch caves have been cut deep into the cliff, and, meeting the North to South fault (sic) have cut along it at right angles, to emerge into the main entrance. If you stand at the back you have waves coming at you from both sides as well as from the front. There are also other minor caves".

These side caves are apparently unexplored, but the most likely sources would add perhaps 125m of passage on the north side of the Arch, and 70-90m on the south side: total passage length may approach 300m.

Of recent years Tasman's Arch has been occasionally utilised by cavers for SRT and ladder practice, although Clemes describes the more adventurous tourist route of earlier years down the outside 70m cliff, successfully negotiated by "many ladies" and even "a large cocker spaniel" without accident, for it is "only from the bottom that one gets a true picture of its grandeur, graceful contours and size. It is hard to realise that the Memorial Church in Brisbane Street, Hobart, with its spire, could stand under the archway."

Other Caves in the Area

In addition to the two caves described here, many more occur. Clemes (1950) describes a few of them, developed "along the many fault (sic) planes that cross the strata in this area . These faults occur at intervals in an approximately East to West direction, but there is another major fault which starts betwen the Blow Hole and the Tasman Arch, and runs in a North to South direction, cutting across the back of the Arch and the Devils Kitchen". (The latter is a spectacular zawn). One cave lies in a gulch "about a quarter of a mile from the Blow Hole. Since fires have destroyed the bushes it is now necessary for inexpert and elderly climbers to have a rope." Continuing around the platform past a small cave where "there is a drop of about 16 ft. to the rubble floor" ("the usual practice is to take along two long poles and construct a ladder on the spot") leads to a cave which "runs in for about 200 ft and has the appearance of a lofty railway tunnel with parallel sides and a flat roof about 30ft high."

Clemes also describes a cave in the Devils Kitchen: "the entrance is quite small, but inside it opens into an immense cave, with roof stretching up into the darkness." But running inland from the back of the kitchen is "the most notable cave of all. The sides run in parallel about a chain across with a flat roof about 100ft high. I have paced out 150yds. without climbing on the boulders which block the end. A small cross gulch blocks the way into the cave. This is crossed by balancing a spar or plank about 10ft long across it. The difficulty is that you have to get along the cliff on a six inch ledge, and somehow poke the pole over and rest the near end on the same precarious foothold". He notes also that "another interesting cave is found on the sea side with a real blow hole in it."

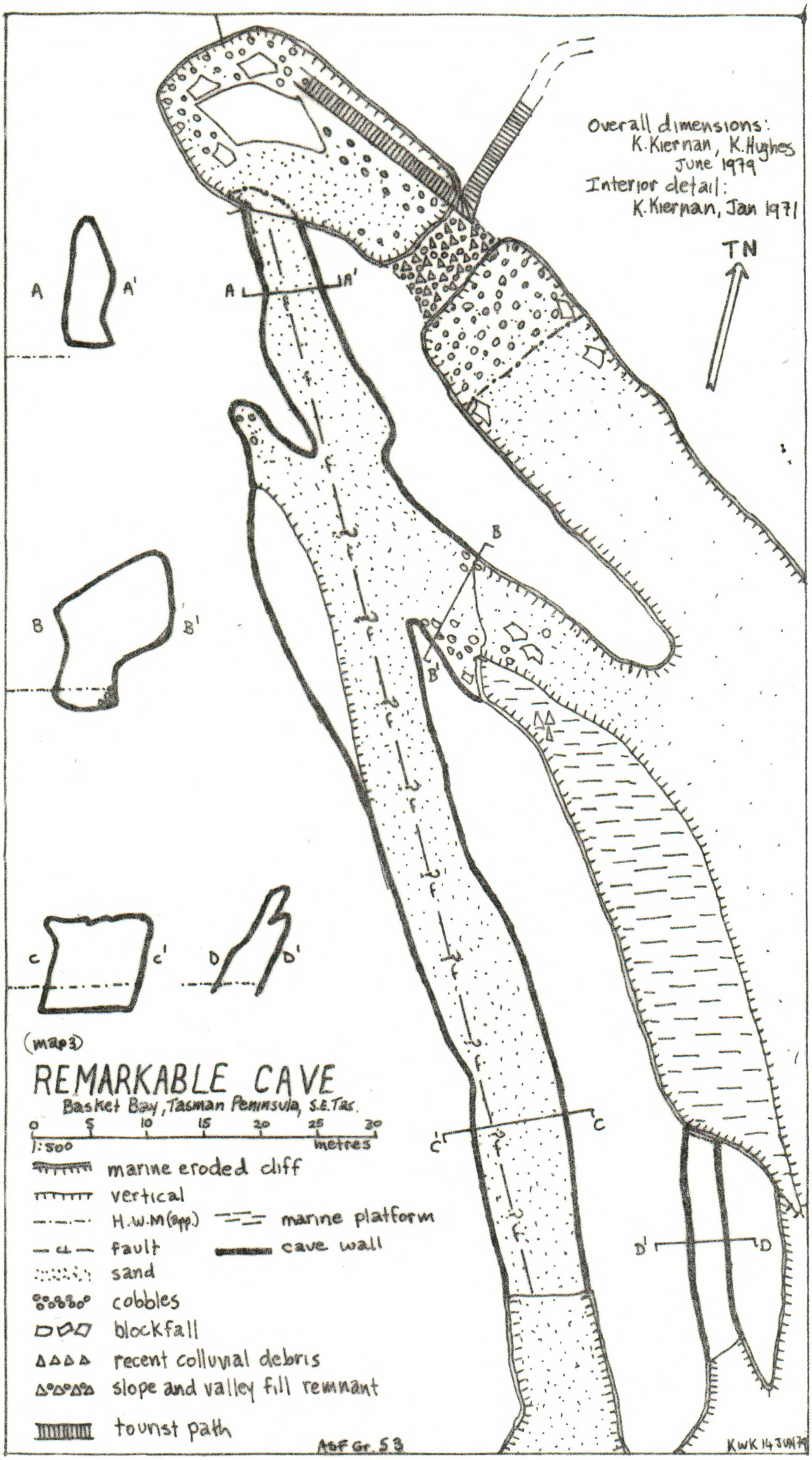
Another well known feature is Patersons Arch, between the Devils Kitchen and Waterfall Bay to the south.

BASKET BAY (TASMAN PENINSULA)

Basket Bay lies some 5km south of the Port Arthur Historic site. Jurassic dolerite is widespread along this south facing sea coast, while well jointed Triassic sandstone occurs in some localities, and has been locally metamorphosed to hornfels. Remarkable Cave is a well known feature visited by many tourists, while rusty posts near another cave further east attest to earlier visits. Many other caves occur, one spectacular and probably unexplored example being near the Brown Mountain end of the bay.

Remarkable Cave (map 3)

This is one of Australia's best known sea caves by virtue of steps which descend to a cobble beach where the inland end of the cave intersects a fossil zawn. Colhoun (1977) has described the remnant of slope and valley fill deposits which occur in the zawn and dated them to not less than 37,000 BP (early last glacial). These include wood, plant remains and charcoal, and overlie the cobble beach deposits which are of last interglacial age.


Overall dimensions:
K. Kiernan, K. Hughes
June 1979
Interior detail:
K. Kiernan, Jan 1971
TN
A
A'
B
B'
C
C'
D
D'
(map 3)
REMARKABLE CAVE
Basket Bay, Tasman Peninsula, S.E.Tas.
0 5 10 15 20 25 30
1:500
metres
marine eroded cliff
vertical
H.W.M (app.)
marine platform
fault
cave wall
sand
cobbles
blockfall
recent colluvial debris
slope and valley fill remnant
tourist path
ASF Gr. 53
KWK 14 JUN 79

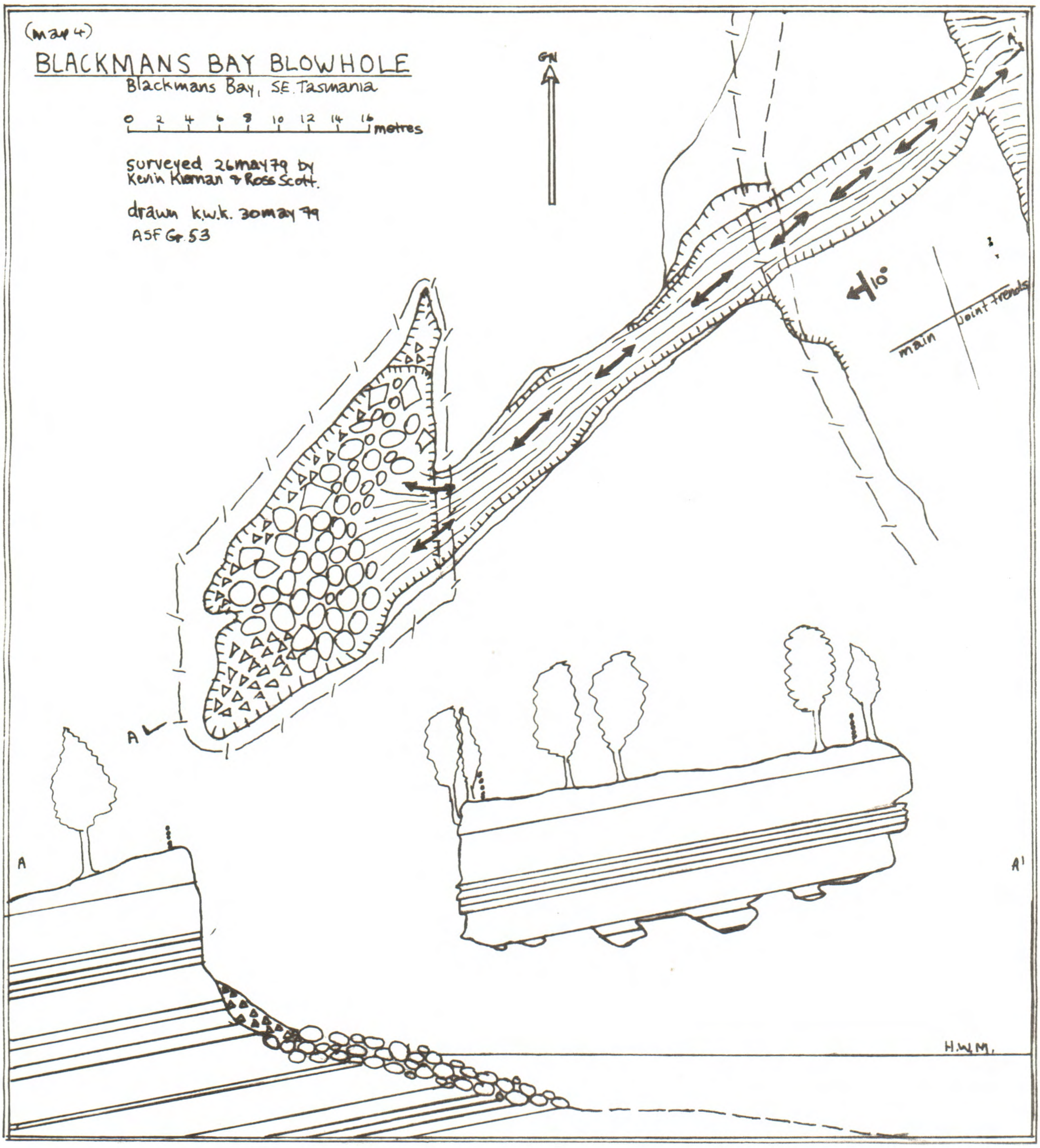
The sea cliff is two-storied and the zawn is formed along a small first order coastal valley developed along a structural weakness. Pollen in the deposits indicate fire maintained a subclimax vegetation and permitted severe episodic erosion of soil and regolith. The cave is developed in deformed hornfels and exploits a fault. Colhoun suggests the present form of the cave is much more recent than the zawn, as evidenced by the comparative smoothness of the zawn walls compared to the jagged cave walls. He attributes re-excavation of the zawn and the development of Remarkable Cave in its present form (the tourist entrance) to the last 6000 years.

Understandably pre-occupied by the deposits however, Colhoun's map of the cave itself is over-simplified and inaccurate. The cave is in fact Y-shaped rather than the single tunnel visible from the tourist steps, for a further entrance exists in the zawn. His map indicates the only passage as one extending from the tourist entrance to the zawn, having somehow confused the latter entrance with the more visible entrance, which is not recorded on his map.

In early 1971 the present author, in company with two mainland speleos, Jim Seabrook and John Holliday, encountered a suitably low tide and sea, and was able to explore right through the cave dry footed. The cave increases markedly in size at the intersection of the two passages. Similar conditions have not been encountered subsequently and much of the interior detail in map 3 comes from photographs and notes taken at that time with more recent observations from entrances and overland survey between them to establish dimensions. The main passage is some 105m long, varying between about 5m wide at the tourist entrance to nearly 10m at the two other entrances and 15m at the intersection. Roof height approaches 15m in places, and the floor is predominantly of sand.

BLACKMANS BAY (Derwent estuary)

At Blackmans Bay 14kms south of Hobart, Permian marine mudstones present a 30m cliff to the open mouth of the Derwent estuary. The rock is strongly bedded and well jointed, dipping inland at about 10°. Further south faulting has resulted in some dolerite cliffs in which a few small caves are developed, but the most noteable coastal karst features occur in the Permian material, which has been altered to calc-silicate hornfels south of Blackmans Bay itself. At least one small cave has been developed along a minor dolerite dyke due essentially to the weakness of this zone and the instability of high temperature minerals, particularly in the electrolyte atmosphere of the sea (cf. Toomer and Welch 1975). Some calcareous deposits occur at the coast, derived from calcareous zones in the Permian mudstones.


(map 4)
BLACKMANS BAY BLOWHOLE
Blackmans Bay, SE Tasmania
0 2 4 6 8 10 12 14 16 metres
surveyed 26may79 by Kevin Kiernan & Ross Scott.
drawn k.w.k. 30may79
ASF Gr 53
GN
10°
main joint trends
A
A'
H.W.M.

Blackmans Bay Blowhole (map 4)

This feature is developed in a coastal cuesta of Fern Tree Mudstone. It consists of a collapse doline 18m long, 12m wide and 16m deep, linked to the sea by a passage up to 5m wide, 8-16m high and 30m long.

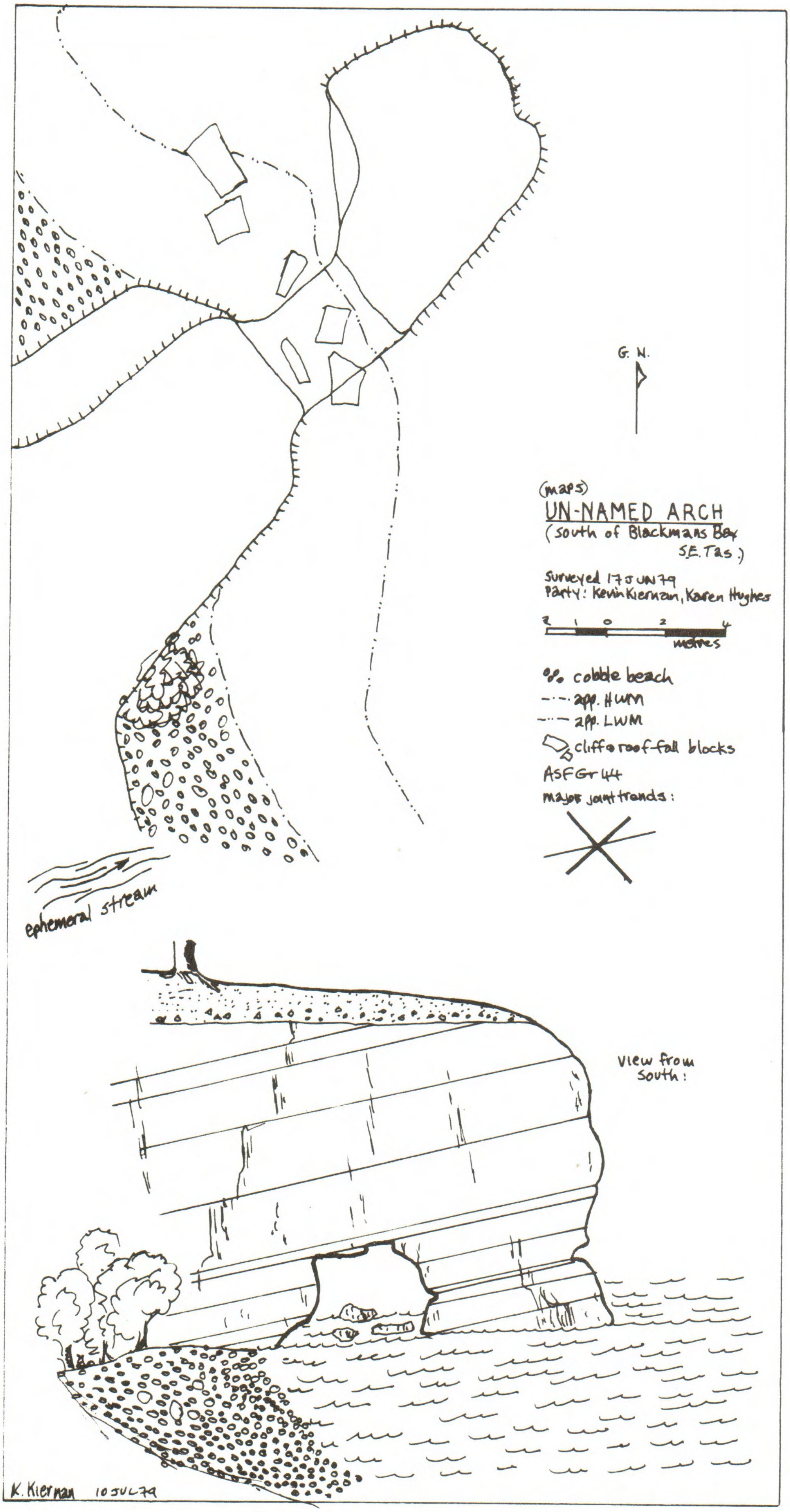
The two most prominant sets of joints are aligned at 170° and 240° and account for the orientation of the cliffs and cave respectively. The cave has formed by preferential erosion of the latter joint set and is assymetrical at its mouth due to broadening on the aspect more directly exposed to the sea, coupled with increased erosion into a major joint. The cliff exposes a succession of shaley and more massive beds, and the shaley beds have been preferentially removed, with the roof approximating the base of a more massive bed, and up to 10m thick.

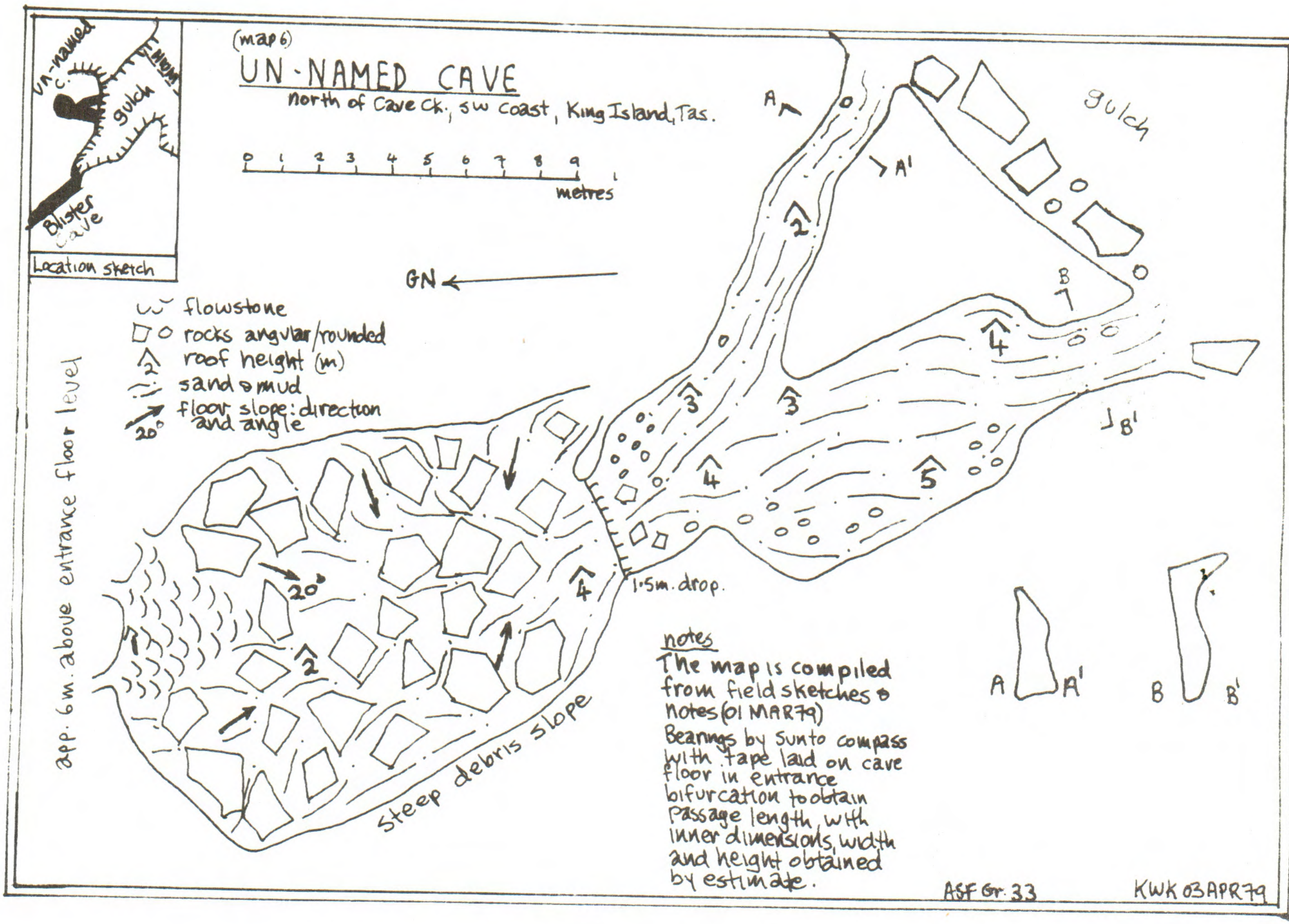
Due to the landward dip of the land surface bringing it closer to the essentially horizontal projection of sea level upon which the cave has been developed, coupled with strong vertical jointing, roof collapse has produced the doline. A wide shore platform has been cut by a channel some 5m deep which permits continued access of the sea into the cave. A substantial boulder and cobble beach consisting primarily of moderately rounded block fall occurs within the doline. More recent colluvial material has accumulated on the blocks. It is possible to swim or climb with only moderate difficulty through the cave on the southern wall and ascend via a rock rib at the back of the doline.

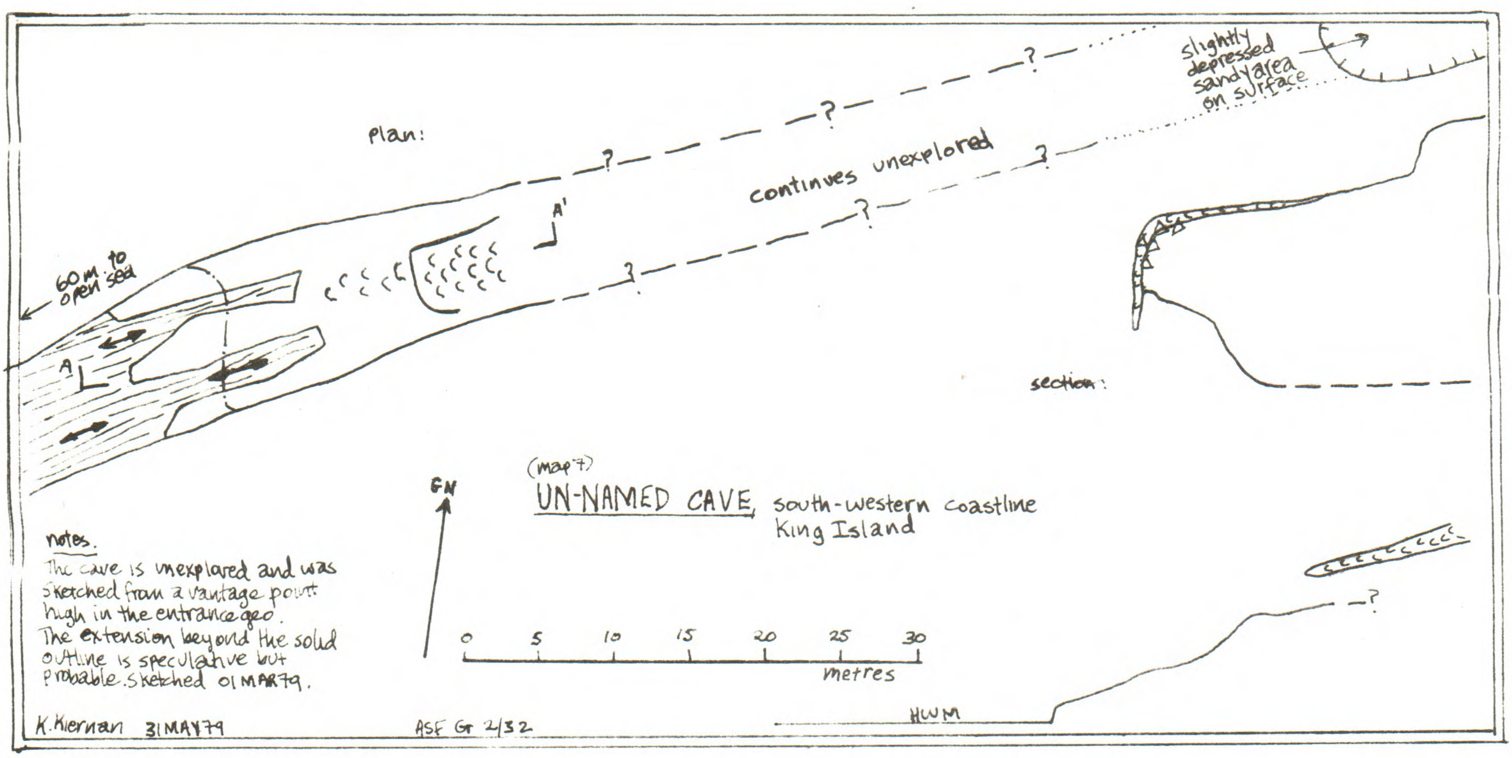
Un-named parallel arch (map 5)

South of Blackmans Bay is a small arch developed parallel to the coast through a small headland. The site is close to the top of a major dolerite sill which further south rises gradually over several hundred metres and has served as the base of cave erosion in the superincumbent hornfels, especially where joints in the two coincide. These caves decrease in size with increasing elevation of the top of the sill above sea level. The hornfels dip landward hence the dolerite sill is near or above sea level for some distance along the coast before finally forming the cliffs, thereby inhibiting wave action while encouraging formation of small embayments in the hornfels in the places it has been breached.

Countervaling this protection is the well jointed nature of the rock and the zone of weakness represented by the valley of a minor stream, leading to formation of a small bay from which the breached headland projects. The rectangular form of the headland is a product of jointing. The bay side is exposed to the estuary mouth. The arch is small, only 3m high, 4m wide and 3m long, through the vertical sided headland which rises 9m above the arch floor. It has been excavated on two prominent joints 1m apart, which trend at 342°. The headland walls are defined by joints trending 252° and a lesser


G. N.
(maps)
UN-NAMED ARCH
(south of Blackmans Bay
S.E. Tas.)
Surveyed 17 JUN 79
Party: Kevin Kiernan, Karen Hughes
2 1 0 2 4
metres
cobble beach
app. HWM
app. LWM
cliff & roof-fall blocks
ASF Gr 44
major joint trends:
ephemeral stream
view from south:
K. Kiernan 10 JUL 79


(map 6)
UN-NAMED CAVE
north of Cave Ck., sw coast, King Island, Tas.
0 1 2 3 4 5 6 7 8 9
metres
Un-named C.
gulch
Blister Cave
Location sketch
GN
flowstone
rocks angular/rounded
roof height (m)
sand & mud
floor slope: direction and angle
20°
app. 6m. above entrance floor level
steep debris slope
1·5m. drop.
gulch
A
A'
B
B'
notes
The map is compiled from field sketches & notes (01 MAR79)
Bearings by Sunto compass with tape laid on cave floor in entrance bifurcation to obtain passage length, with inner dimensions, width and height obtained by estimate.
ASF Gr. 33
KWK 03APR79


plan:
continues unexplored
slightly depressed sandy area on surface
60 m. to open sea
A
A'
section:
(map 7)
UN-NAMED CAVE, south-western coastline King Island
GN
0 5 10 15 20 25 30
metres
HWM
notes.
The cave is unexplored and was sketched from a vantage point high in the entrance geo. The extension beyond the solid outline is speculative but probable. Sketched 01 MAR79.
K. Kiernan 31MAY79
ASF Gr 2/32

set at 282° has probably been significant as a zone of weakness aligned more directly from the estuary mouth into the side of the headland. The arch derives its assymetry from the landward dip of the hornfels and preferential removal of the thinner beds.

A further arch penetrates the minor headland some 150m to the south but this is more difficult of access and has not yet been examined by the writer.

KING ISLAND

In the vicinity of the caves described, the south-western coastline of King Island is cliffed to about 40m above sea level. Numerous zawns, inlets and stacks occur. Wave action may be weakened by refraction as the real break of slope is at 35-65m depth. (Jennings 1959). The caves are developed in schists about 10m above present sea level and predate the Holocene. There are at least four of these raised sea caves. One of these is hitherto unexplored, and is noted here, together with one of two caves described by Jennings (1956). The other cave noted by Jennings (Blister Cave) and a more recent discovery (Iron Monarch Cave) are the subject of a paper under preparation for publication elsewhere which is awaiting possible uranium-thorium dating of speleothem fragments from within them. (Goede Harmon and Kiernan, in prep.).

Un-named cave beside Blister Cave (map 6)

A short distance north of Cave Creek the two caves described by Jennings occur in an amphitheatre about 10m above present sea level. The smaller of the two is developed along structural weaknesses in a Y configuration with a passage aligned at 172° forming the main trunk. The metamorphic rocks in which it occurs dip steeply to the S.S.E., and a small enclosed depression occurs on the surface above. The main passage is up to 5m wide and 5m high, terminating in a steep rubble slope at the foot of which is a 1.5m vertical drop to the flat floors of the entrance passages. The second entrance involves a passage 12m long, 2m wide and up to 2m high.

The entrance area is floored with sand and some small cobbles, but larger calibre and more angular debris comprises the debris slope and is derived from roof fall. A substantial bank of inactive flowstone occurs at the top of the debris pile. Jennings (1956) attributes the presence of speleothems in this and Blister Cave, together with other calcareous deposits at resurgences and springs in other localities (in one case in the form of terraces up to 2.5m high and rimstone pools over 1m deep), to the presence of calcareous windblown sands.

Un-named cave north of Blister Cave (map 7)

A very spectacular unexplored sea cave occurs several hundred metres north of Blister Cave and was shown to the writer and Albert Goede by

Pearshape resident Len Sullivan in February 1979. The cave extends from the inner end of a zawn up to 12m wide, 80m long and 40m deep on a very exposed part of the coast. The zawn trends at about 50° back from the cliff edge above the cave. Extensive sand deposits occur over the roof and a flowstone cascade extends down over the roofline and along the southern wall of the cave. This is partly a calcareous breccia with rock fragments of up to 1.5m which represents a remnant of materials funnelled down over the edge.

At the inner end the zawn is about 10m wide with the sea in two main joint controlled gulches. Some 15m inside a major deposit of smooth flowstone issues from a sizeable passage perhaps 10m above present sea level. This may be a false floor but it is not possible to be confident due to the absence of vertical caving equipment which precluded inspection from closer than a ledge 30m above sea level. This cave is in a magnificent setting at the bottom of this spectacular yawning zawn into which the sea crashes, and its eventual exploration will undoubtedly be a very stirring and rewarding experience.

SEA CAVE DEPOSITS AND TASMANIA'S PAST

Davies (1959) suggested few erosional features on the Tasmanian coast relate to the last 6000 years, and it is becoming increasingly evident that most predate the last glacial and relate to the last interglacial with some probably older still. With the fall in sea levels accompanying the last glacial, some sea caves admirably served as shelters for Tasmanian aborigines, and deposits in the caves have been examined at a few sites.

At Rocky Cape Rhys Jones has investigated aboriginal occupation of abandoned sea caves adjacent to interglacial marine deposits which were formed when the sea was 22-25m above its present level. Aboriginal midden deposits provide evidence of changes in culture and economy over the past 8000 years, involving an increase in refinement of stone tools and the use of cherts from as far distant as 60km, a decline in bone tools, and a sudden drop of scale fish from the diet between 3800-3500 BP. (fide Colhoun 1979)

At Cave Bay on Hunter Island investigation of a cave in a prominent cliff forming the eastern coastline about 15m above present sea level has revealed stone artefacts bones and charcoal evidencing human occupation between 20,850-22,750 BP, twice the maximum age from any previous site. The cave was visited only rarely during the last glacial maximum when there was considerable roof fall. More recent deposits are interrupted between 14,750 and 8000 BP and the cave was again abandoned around 4000 BP. The youngest radio carbon date is 990BP. The post glacial decline in usage is related to the rise in sea level which inundated the plains which previously connected Hunter Island to Tasmania, leaving it accessible only by canoe. Pollen remains suggest a vegetation indicative of warmer and moister conditions 28-23,000 BP, then cooler drier grassland with shrubby composites from 23,000-14,750BP during the last glacial maximum. There is a break in the record until 8200 BP after which vegetation substantially similar to that of present times prevailed (Bowdler 1974a, b, 1975, Hope 1978). Hence deposits at this site have also given a clue to past climates and the evolution of the landscape and vegetation of that part of Tasmania.

Vanderwal (1978) has examined caves and other sites at Louisa Bay in S.W. Tasmania revealing deposits accumulated within the last 3000 years. He raises the development of the canoe as possibly enabling the first hesitant exploitation of this area and its intensification as the resources of previously unattainable Maatsuyker Island became available. Another archaeological sea cave site which has attracted some attention is near Shag Bay upstream of Hobart in the Derwent estuary.

The existence, morphology and evolution of Tasmania's sea caves is fascinating in its own right, and their exploration can be very rewarding. Moreover, by documenting these neglected features of the Tasmanian coastline the speleologist may facilitate valuable advances in our knowledge of the island's past climate, vegetation, wildlife and people.

oOo

BIBLIOGRAPHY

BIRD, E.C.F. (1972). Coasts. ANU Press

BOWDLER, S. (1974a). An account of an archaeological reconnaissance of Hunter's Isles, North-western Tasmania 1973/4. Rec.Queen Vic.Mus.L'ton 54 : 1-22.

__________ (1974b). Pleistocene date for man in Tasmania. Nature 252 : 697-8.

__________ (1975). Caves and aboriginal man. Aust. Nat. Hist. 18(6) 216-219.

CLEMES, W.H. (1950). Features of Eaglehawk Neck. The Tasmanian Naturalist 2 (1) : 16-17.

COLHOUN, E.A. (1977). The Remarkable Cave, southeastern Tasmania - its geomorphological development and environmental history. Pap.Proc.Roy.Soc.Tas. 111 : 29-39.

__________ (1979). Quaternary Excursion to Northwest and West Tasmania - field guide. Dept.Geog.Uni.of Tas. 51pp.

DAVIES, J.D. (1959). Sea level change and shoreline development in S.E. Tasmania. Pap.Proc.Roy.Soc.Tas. 93 : 89-95.

__________ (1964). A morphogenic approach to world shorelines. Z.Geomorph 8. (Mortensen Sonderheft) : 127-42.

FYSH, G.J. & YAXLEY, M.L. (1966). Behind the Scenery. Education Dept.Tas.

GILLESON, D. (1973). Maria Island Trip Report. Speleo.Spiel 78

GOEDE, A., HARMON, R. & KIERNAN, K. (in prep.) Sea Caves of King Island.

GOEDE, A., KIERNAN, K., SKINNER, A. & WOOLHOUSE, R. (1973). Caves of Tasmania. (unpub.)

GRIMES, K. (1975). Pseudokarst: Definition and Types. Proc. 10th ASF Conf. : 6-10 ASF

HOPE, J. (1978). The late Pleistocene and Holocene vegetational history of Hunter Island, north-western Tasmania. Aust.Jour. Bot. 26 : 493-514.

JENNINGS, J.N. (1956). Calc-sinter and dripstone formations in an unusual context. Aust. J. Sci. 18(4) : 107-11.

__________ (1967). Cliff top dunes. Aust. Geog. Stud. V (1) : 40-49.

__________ (1971). Karst. ANU Press.

KIERNAN, K., 1973a). The Surprise Bay area. South.Cav. 5(2) : 6-10

__________ (1973b). Maria Island. South. Cav.5 (1) : 17 & 18a.

__________ (1974). A thought on sea caving. South. Cav. 6(1) : 11.

KUENEN, P.H. (1950). Marine Geology. Wiley, N.Y.

MOODY, L. (1974). Sea Caves on Bruny Island. Speleo.Spiel. 87 : 7.

MOORE, D.G. (1954). Origin and development of sea caves. NSS Bul. 16 : 71-76.

OJVOS, E.G. Jr. (1976). "Pseudokarst" and "pseudokarst terrains": problems of terminology. Geol. Soc. Am. Bul. 87 (7): 1021-1027.

SKINNER, A. (1973a). Maria Island. Speleo. Spiel. 81 : 5-6.

__________ (1973b). Surprise Bay. Speleo. Spiel. 86 : 5-8.

THOM, B.G. & CHAPPEL, J. (1975). Holocene sea level relative to Australia. Search. 6 (3) : 90-3.

TOOMER, P.B. & WELCH, B.R. (1975). Investigations of sea caves. Proc. 10th ASF Conf.: 25-34 ASF

TRATMAN, E.K. (1971). The formation of the Gibraltor Caves. Trans CRG (GB) 13(3) : 135-143.

VANDERWAL, R.L. (1978). Prehistory and Archaeology of Louisa Bay (in) Gee et al (eds.). The South-West Book.

VAN DE GEER, G., COLHOUN, E.A. & BOWDEN, A. (1979). Evidence and problems of interglacial marine deposits in Tasmania. Geologie En Mijnbouw 58(1) : 29-32.

WALL, J.R.D. & WILFORD, G.E. (1966). A comparison of small scale solution features on microgranodiorite and limestone in West Sarawak, Malaysia. Z. Geomorph 10 : 1021-1027.

(received 20th July 1979)

oOo

FOOTNOTE

Since the preparation of this article thorium/uranium dating of speleothems from Blister Cave on King Island has demonstrated its origin, and by inference the other caves and shoreline features at the same level, to date from at least as far back as the last interglacial. See GOEDE, A., HARMON, R. & KIERNAN, K. (in prep.). The sea caves of King Island.

AREA REPORTS

Stephen Harris and Kevin Kiernan

FLORENTINE

On the 15th September, Leigh Gleeson and Stuart Nicholas (T.C.C.) set out to survey Owl Pot which exists near Tassy Pot. The spectacular rift entrance was entered but the team was stopped at the 30m pitch because of lack of suitable anchorage for the Bluewater. A future trip will need ladders for which a suitable belay does exist. Three hours was spent scrub bashing west of Reserve Pot but nothing was found.

On 22nd of September, Leigh, Stuart, Chris Rathbone (Climbers Club of Tasmania) and Lin Wilson bottomed Tassy Pot. The round trip to the surface took nine hours. Details of the pitches appear in the next 'Southern Caver'.

Leigh and Mieke visited the Florentine Valley on the 11th of October to show Nichola Harwood the Welcome Stranger Cave. Water levels were relatively low in the cave - three hours were spent underground. The party also visited Tassy Pot to inspect the problem of logs at the top of the shaft. The problem would not be effectively solved by bolting as the rock face is rather shattered.

MAGRA

Sandstone caves supposedly frequented by bushrangers were to be the object of a trip to this area near New Norfolk on the 26th of August by K. Kiernan and S. Harris.

Impressive sandstone shelters were found in cliffs high in the foothills of Mt Dromedary. Handsome Caves (as marked on the 1:100,000 Derwent Sheet) seem to be no more than shallow rock shelters albeit patterned with a remarkable deep honeycomb weathering in which birds nest.

Higher on this particular ridge is the highest and most spectacular cliff. On top was a strange landscape in a hidden miniature valley, of bluffs, castles, clefts, overhangs and strange solutional weathering forms. An old aboriginal hearth was located under one shallow overhang, wherein was found a smooth dolerite stone of about one kilogram.

MOLE CREEK

On the 4th and 5th of August, Leigh Gleeson, Steve Harris, Pete Russell and Kim Darling made a through trip of Kubla Khan, entering at midday and wearily surfacing at 8 p.m. The team combined with another entering at the same time to make a larger party. The other team consisted of Tim and Edward Daniels and Janet. Mieke Vermeulen and Sue Backhouse remained on the surface. Ferns were collected from a crevice near the campsite and these are described elsewhere in this issue.

On the 20th and 21st of October, Leigh Gleeson, Lin Wilson, Louise Mulquinny and Mieke Vermeulen visited Lynds Cave and Ghengis Khan, both of which are lauded for their attractive formations. Moderately high water was encountered in Lynds, making for a sporty trip.

CRACROFT

On the first weekend in September, Lindsay Wilson, Leigh Gleeson, Pete Russell, B. Wilson and C. Wilson, undertook an eight hour march through myrtle forest to *Judds Cavern*. Some time was spent relaxing at the delightful campsite after exploring the cave as far as could be easily reached with hands in pockets (i.e. 800m).

SCOTTS PEAK

On the 21st October, Kevin Kiernan, Sue Backhouse and Steve Harris travelled the long H.E.C. scar to *Scotts Peak* where a previously known cave (with a number tag : 1) was surveyed. Further downstream on the Huon River, behind a curtain of foliage, was found a new cave about 18m long, flat, wide, containing a thick bed of sediment and much brown formation. The formation mainly comprised stalactites with leaves and twigs cemented on them.

Ferns were collected from the entrances of both caves and these will be listed in the next issue of this journal.

NELSON RIVER

On 22nd September 1979 Kevin Kiernan, Karen Hughes and Greg Middleton investigated a new route to this area in abysmal weather. They did not reach the limestone.

BUBS HILL

On 23rd September Kevin Kiernan and Greg Middleton visited Quarry Cave. This is perhaps Tasmania's most accessible cave, for it is possible to park a car within 4m of the entrance. The stream was flowing strongly. Lighting problems forced a premature retreat.

HAMILTON

On 5th August Kevin Kiernan examined a small cave system developed by tunnelling in a duplex soil near Hamilton. (see pseudokarst section, this issue). An examination of its continuing development was made by Karen Hughes and Kevin Kiernan on 22nd September 1979.

FLOWERY GULLY

Kevin Kiernan, Karen Hughes, Mrs L. Hughes and Sandra? visited Vanishing Cave and the old tourist cave in late September. How many people take their prospective mother-in-law caving then, eh? The owner of the caves, Mr Bob Beams, is growing increasingly wary of permitting unaccompanied parties into them due to increasing vandalism. Vanishing Cave in particular has suffered badly since the last visit.

ELIZA PLATEAU

On 25th October Kevin Kiernan and Karen Hughes found a small meltwater cave in a residual snowbank developed by a small stream flowing from a sun-warmed pool. Spectacular refractive effects and well developed wall scalloping was a notable feature. Subsequent work in this cave will be reported in a forthcoming issue of *Southern Caver*.

ARCH ISLAND

Arch Island lies in D'Entrecasteaux Channel near the mouth of the Huon River, and takes its name from one of two sea caves which penetrate through this exposed rock. On 22nd July Kevin Kiernan, Karen Hughes and Greg Middleton visited the caves. A fuller report will appear in the next issue of this publication.

CLIFTON BEACH

A significant sea cave was examined by Kevin Kiernan at the eastern end of Clifton Beach on 6th May 1979.

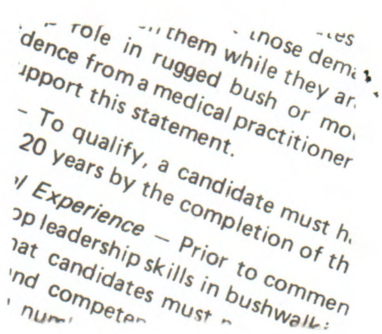
IDA BAY

Kevin Kiernan, Karen Hughes, Alison Davies and David O'Brien visited Exit Cave early this quarter.

THE BUREAUCRATISATION OF THE BUSH

Kevin Kiernan

Reading that dear old newspaper "The Mercury" is always such a thrill that in the interests of keeping my heart intact I do not do it too often, but today my eyes were caught by the announcement of a new training course for experienced bushwalkers, leading to their certification as jolly good chaps allowed to lead parties in the bush. The tragedy of the matter, I feel, is that we are going to have to take notice of it.



The training course is an exercise in bureaucratic convenience applied to places many of us go to escape bureaucrats. It arose from the desire of the Education Department to find someone to blame when one of their parties of schoolchildren arrives home with more than the fifty per cent allowable loss. I suspect we are witnessing the start of something which will have ramifications until the last tree has fallen to the Forestry Commission, the last mountain been shoved into a river to dam it and the last cave area converted into little green garden gnomes.

I don't know if I've invented it or not, but in case I am first I'll claim to be and reveal to the caving public "Kiernan's Law of Voids". Briefly stated, this holds that in informal passtimes such as the scrub-sports many "administrative" voids exist simply because there has never seemed to be any need to fill them. Yet eventually voids of this nature tend to get filled simply because people are always looking for a niche to develop, but are sometimes too old mentally to physically participate in a certain passtime yet too bored or insecure to let go of it. The role may continue to seem irrelevant to active participants, but in the absence of any apparent countervaling advice, officialdom, the media and sundry others come to view the void filler as the font of wisdom, until his own often very narrowly based standards are foistered upon all, one way or another.

So now we have a body which has decided it is competent to adjudicate on the matter of leadership and has endeavoured to legitimise itself on the basis of a series of pseudo-participatory gestures involving those already of the mind, who really represent the viewpoint of only a tiny minority. It will prosper because bureaucrats will have no-one else to turn to, because trainee physical education teachers and the like will have to become certified if they want to be involved in outdoor education, and because some freelance scrub lovers with nothing better to do with their time or a burning desire to do something "useful" will involve themselves. In a way it is all remarkably akin to the manner in which lovers of nature are drawn towards working amid nature, and to do that they must join agencies like the Forestry Commission or Hydro-Electric Commission where paradoxically they are engaged in its destruction. And so some will promote outdoor sports and by pressure of numbers help love our wilderness to death. And they will help breed, a generation of scrub users who have never known the real dangers and errors which are the stuff of experience and the root of true adventure simply because authority has never been able to allow them to, but who sooner or later will confront the real world and expect it to conform with their expectations of safety and comfort. And so wilderness will be diminished amid pressure for tracks, huts, and all manner of safety precautions.

What has it got to do with cavers? Plenty! I suspect we shall see from the bureaucracies which govern us (as opposed to the politicians we elect) a continuing string of such convenience measures. Today we are fed platitudes about the intent of leadership training courses, tomorrow we may find ourselves debarred from a trip because we do not ourselves possess some relevant piece of paper or perhaps even the leadership certificate we are now told not to worry about. The spontaneity and informality of a group of friends deciding on the spur of the moment to go bush is being threatened.

If you think it impossible let me tell you of a friend who was pounced upon by a roving park ranger at Mt McKinley, Alaska, who demanded to see his permit to be in the area. Or the comment in *Caving International* that caving has been effectively banned in Canadian national parks. Or of the (probably cigarette smoking) park authorities whose concern with the possible lung cancer risk associated with radon gas in caves may have far reaching consequences for caving in the U.S.A. And if you think it only happens overseas, do not forget we are in the throes of having a permit system established right here in Tasmania restricting caving in State Reserves, and while there are benefits in that, there are also many dangers. We have already seen what a handful of misguided bureaucrats have been able to do to speleobiology in Tasmania, and every day we let them get away with it compounds the problem. And elsewhere, as pressure of numbers grows and trips to sensitive areas have to be limited, park authorities give the lions share of the allocation to commercial tour operators and virtually none to individuals because it is easier to police the former - its completely logical if you are a bureaucrat, but then we are not all bureaucrats.

So what should we do, ignore the Bush and Mountain Walking Leadership Training Board of Tasmania and hope it goes away? If we do that it will grow anyway and eventually overwhelm us. Alternatively, we can involve ourselves, but that will only compound its credibility and consume our time helping fill a void we never thought serious enough to bother with before. Or we could get very drunk. Or alternatively we could fight like hell, the Board, the concept, and every other attempt to bureaucratise the bush and hamstring spontaneity and adventure with a load of bullshit that has no place in our mountains, valleys and ultimately, caves.

A SURVEY SYMBOL TO REPRESENT JOINTING

Kevin Kiernan

Recent surveying of sea caves has underlined the need for an economic and readily comprehensible map symbol to indicate the jointing pattern which frequently dictates their morphology. Such a symbol would also have application for caves of other origins.

Three factors to be taken into account : the direction of strike of joints, the size of the joint; and joint frequency. Following discussions with several people the following suggestion is raised for comment by anyone interested.

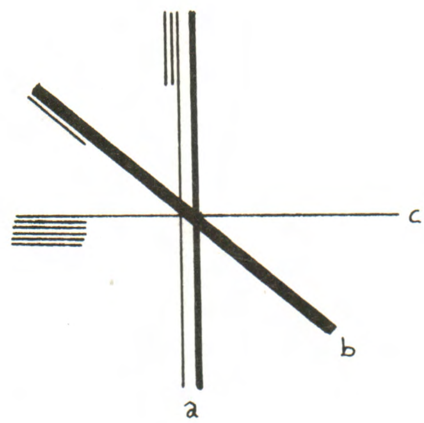


Figure 1

The symbol envisaged (Figure 10) would be in the form of a compass with joint strike trends represented by lines of equal length at appropriate orientations. The width of the line would represent the width of the joint relative to some appropriate scale (as in line b). Where some joints were atypically wide, a parallel line extending to the maximum width would be added (as in line a). Finally, joint frequency would be represented by an "arrowhead" of lines representing the number of joints at the orientation over some standardised distance (in the above example trend a = 4/m, b = 2/m and c = 6/m). This might be derived by averaging over a broader distance depending upon particular circumstances. (received 8/11/79)

some back issues of SOUTHERN CAVER are still available. Please write for a detailed list of available issues and their prices.

FERNS OF A LIMESTONE FISSURE

Stephen Harris

A complete collection of ferns was made on the 5th August 1979 from a limestone fissure set amidst semi-wet sclerophyll forest near Caveside.

The fissure is a probable solution enlarged joint approximately 2m in width, 10m in length, 6m in depth, and aligned north-south. Sloping ramps comprising rock and soil debris, rotting logs and vegetation are at either end of the fissure. Constricted openings occur along smaller intersecting joints. One or two large limestone boulders span the fissure near the top.

The bedrock is a compact, light blue-grey limestone of Ordovician age (Gordon limestone).

The vegetation surrounding the fissure comprises a *Eucalyptus viminalis* - *E. obliqua* open-forest with an understorey regenerating after a fire in December 1977. Blackwoods sassafras and dogwoods are more prominent members of the understorey while *Polystichum proliferum* provides a fairly dense ground cover amidst fallen timber. *Belchnum wattsii* occurs 15m downslope on the banks of the Mole Creek.

Eight species of ferns from six genera were collected from the fissure, and only a filmy fern remains unidentified. The annotated list of ferns is given below. Specimens are in the possession of the writer. Nomenclature follows Jones and Clemesha (1976) : Australian Ferns and Fern Allies. Reed.

Asplenium bulbiferum Forst.f.

This fern was found growing prolifically on the ramps of the fissure.

A. flabellifolium Cav.

Found especially on the walls near the top of the fissure.

A. trichomanes L.

This species was found as a lithophyte on the walls. Jones and Clemesha claim that the species is uncommon in Australia and is usually associated with limestone.

Blechnum chambersii Tindale.

A few clumps were found on otherwise unvegetated mud banks, under an overhang where little light would penetrate. These specimens were the most remote from the surface of any of the plants in the fissure.

Dicksonia antarctica Labill.

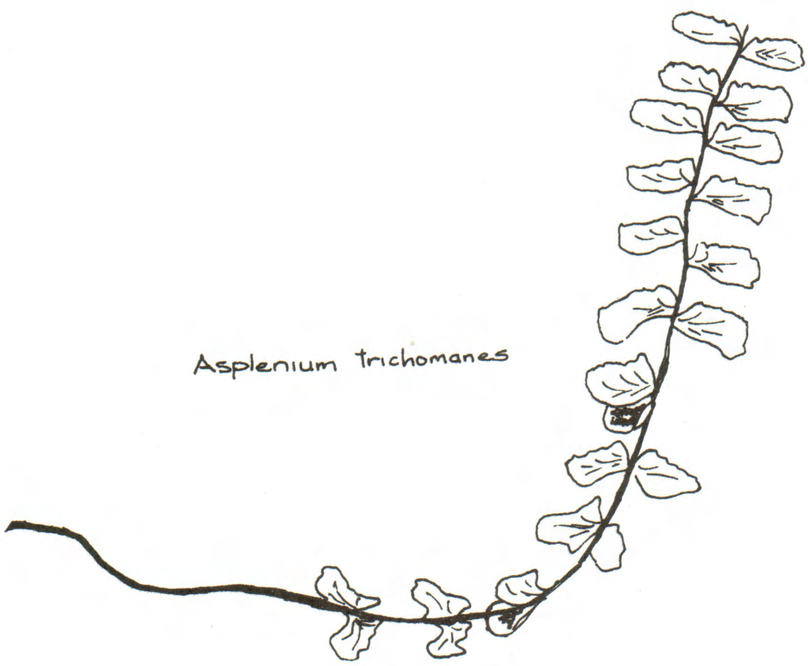
One specimen only with a short trunk. Treeferns are common in dolines in the area where they exist in refuge from fire.

Microsorium diversifolium (Willd.) Copel

This species was found to be dense on the large boulders near the top of the fissure.

Polystichum proliferum (R. Br.) Pesl.

Grows profusely on the debris ramps.



A SMALL CAVE SYSTEM FORMED BY SOIL EROSION

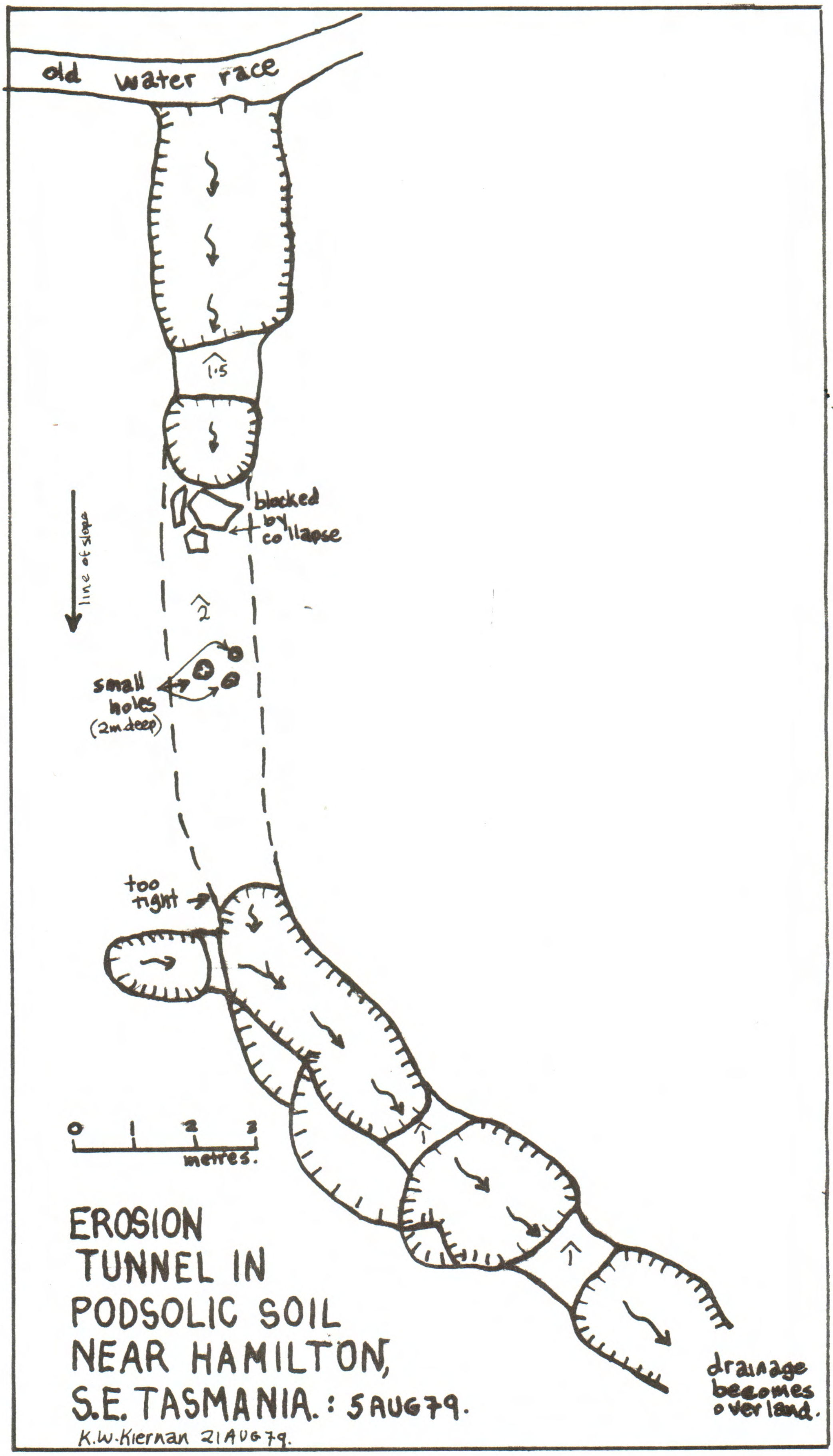
Kevin Kiernan

A small cave system of unusual origin was examined near Hamilton in South-eastern Tasmania in August, 1970. This comprised an unusually large and partially collapsed soil erosion tunnel. Such tunnels are fairly common features in S.E. Australia, however only the larger examples attain sufficient dimensions to be penetrable by humans.

The system extended over a distance of about 30m in a treeless slope, with a gradient of some 20° to a break of slope where the gradient diminished substantially. The roof varied from 10-50cm in thickness. A degraded sinkhole at the upper end led to a bridge one metre long spanning a passage of slightly over one metre diameter. From 6.5m from the upper end, the passage was roofed for 7m. This section was not entered due to blockages at both ends, but midway along it a series of small holes of a few centimetres diameter in a depressed and very thin soil roof which appeared to be held together only by the grass mat, permitted a view into a tunnel 2m high. At 14m a small tributary channel was roofed by a 10cm bridge at the confluence. At 18.5m a further bridge spanning 50cm of the conduit was depressed by broader subsidence to one side, with another of 1m at 21.5m. (see map on opposite page).

The tunnels are developed in shallow grey podsolic soil~~e occurring over a finer~~ A2. The profile is duplex with an abrupt change to a clay B2 horizon with blocky peds. There may be an aeolian component in the A horizon, the high silt content of which leads to high bulk density and hard setting.

In such situations, drainage is concentrated at the junction between the A horizon and the clay subsoil. The conduit is gradually enlarged by predominantly mechanical removal of material by running water. Whereas other soil erosion features tend to occur in depressed surface features related to surface runoff, tunnels may occur anywhere in a slope. In this instance leakage from an old contour water race initiated the tunnel, which was in the process of collapsing to form an erosion gully, and had developed into a feature morphologically resembling a carbonate karst system but on a much reduced scale, and fulfilling a similar hydrological function. Soil erosion tunnel systems are generally fairly short lived. (received 7/10/79)


old water race
1.5
blocked by collapse
line of slope
2
small holes (2m deep)
too tight
1
1
0 1 2 3
metres.
ERPOSION TUNNEL IN PODSOLIC SOIL NEAR HAMILTON, S.E. TASMANIA. : 5AUG79.
K.W. Kiernan 21AUG79.
drainage becomes overland.

LOST OR FOUND?

Kevin Kiernan

"At the 4½ mile there is a development of caves in the limestone and these are regarded by the people in the district as being of great beauty."
- Loftus Hills, 1914[1]

The reference by prominent early Tasmanian geologist Loftus Hills, to caves 4½ miles from Kelly Basin on the old rail line linking the defunct Crotty smelter of the North Mt Lyell Co. to its port on Macquarie Harbour has been repeated in a number of publications.[2] The reports stimulated a visit to the area by John Morley, Steve Harris and the writer in 1970. This followed an earlier trip in 1966 by members of the Tasmanian Caverneering Club in association with West Coast Outdoors Club, when a small stream cave was explored.[3]

It seems probable that this was one of two small caves, Hamoik I and II, explored by our subsequent party, one passing under the old railway formation to an entrance which had been deliberately blocked, at a spot which from our map we figured to be about where the old 4½ mile peg would have been located. The decoration had seen better days but a few glow-worms were present. Other caves downstream of the Bird River Gorge[4] were reported to us by a Gormanston resident on a subsequent trip but we remained fairly happy that the Hamoik system was that to which Hills referred.

Now a Melbourne film-maker, Chris Long, may have thrown a spanner in the works, by turning up an old map which not only indicates the 4½ mile peg to lay somewhat further down the railway formation at the confluence of the two rivers near which we camped, but which also indicates, without explanation, a small five acre reserve at that site.

Chris has turned up old references in the "Mt Lyell Standard" of 16th March 1899 and in 1898 referring to a cave system beside the Bird River "large in extent but still unexplored" (!!). The *Handbook of Tasmania* published by a tourist association in 1914 records (p. 232) that "A few miles from the Basin, along the railway, are some five caves in the Silurian limestones. It is proposed to have these explored and made available for tourists." At Hamoik we have found only two caves, although there are five entrances - then again "five" could be "fine" misprinted.

The nomenclature attached to streams in the area does not help. The Hamoik system lies beside the Nora River which a short distance downstream is joined by the Aron (which is Nora spelt backwards incidentally) according to older maps, which then jointly flow to Kelly Basin as the Bird River. Newer maps attribute the name Bird to the Aron as well. Either way it is hard to reconcile the Hamoik system with "Bird River caves".

Chris has also met an old lady who remembers some caves behind Farm Cove, and a limestone belt does extend from there to downstream of the Bird gorge.[5] These caves could be the Hamoik system and/or those reported by Hills; the caves reported lower on the Bird; or perhaps more likely a totally different set.

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[1] HILLS, L. (1914). The Jukes-Darwin Mining Field Geol. Surv. Bul. 16 (Tas. Dept. Mines)

[2] eg FYSH, G.J. & YAXLEY, M.L. (1966). Behind the Scenery. (Tas. Dept. Education) or HUGHES, T.D. (1957 Limestones in Tasmania, Geol. Surv. Min. Res. 10 (Tas. Dept. Mines).

[3] GOEDE, A. (1966). Kelly Basin. Speleo-Spiel 9:3.

[4] See KIERNAN, K. (1979). Limestone and dolomite in and adjacent to the King and Lower Gordon basins, South-West Tasmania: an inventory and nomenclature. Jour. Syd. Spel. Soc. 23 (8) : 198.

[5] CORBETT, K.D. & BROWN, R. (1974). Queenstown 1:250,000. (Tas. Dept. Mines).

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