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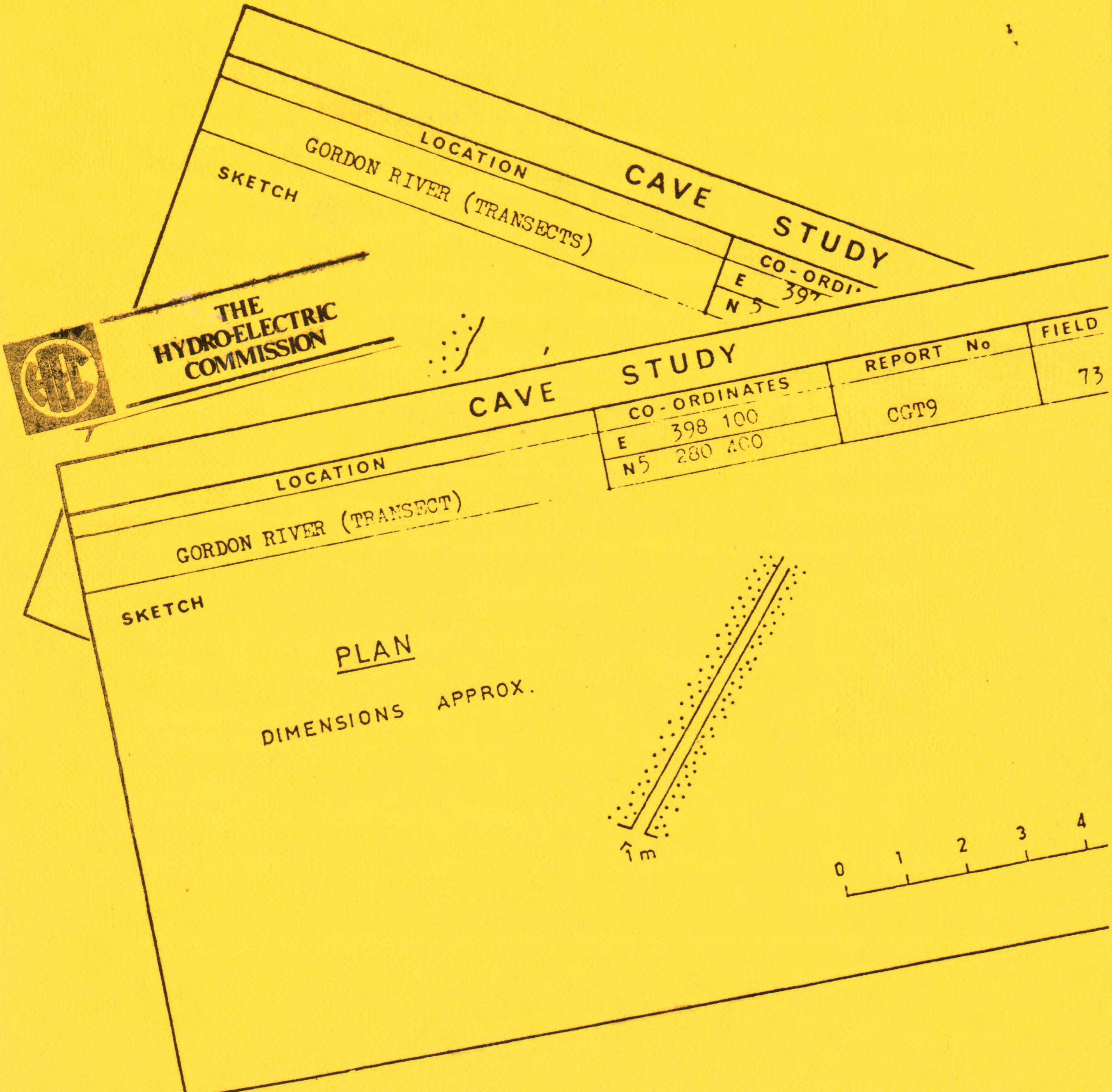

H.E.C. CAVE STUDY....

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THE H.E.C. AND ITS WESTERN RIVERS CAVE STUDY

Kevin Kiernan

> "as a club possessing wide caving experience and knowledge we, together with the other speleos are the experts who must be listened to when decisions involving caves are made. We comprise a select minority who can provide the powers that be with information available nowhere else."
>
> - Aleks Terauds, *Southern Caver* *3* (1) 24. July 1973.

Simply by virtue of the fact that their caving takes them to a variety of places and familiarises them with environments and features of which few people know, there is some truth in our president's words of 1973.

An editorial in the second last edition of this publication concerning the H.E.C.'s study of caves on the Gordon and Franklin Rivers criticised misrepresentation by the Commission concerning alleged input to the study by the Southern Caving Society and the present writer. The editorial completely disassociated the two latter from the study which was condemned as 'incomplete, inadequate, and incompetent" and deplored what appeared an unethical attempt to lend credibility to the document by listing parties who had made no input in a manner suggestive of their having contributed. The purpose of the present item however is to briefly outline some of the inadequacies of the document. It might be noted here in passing that it seems unfortunate that S.C.S. itself did not take a stronger position early in the piece and heeded the urging of Aleks Terauds in 1973.

Rather than repeat the text of the National Parks and Wildlife Service response to the survey, the following hurriedly penned comments by the present writer followed a request by Greg Middleton of the N.P.W.S. for ideas with respect to comment on the H.E.C. study. In modified form almost all these points were used, together with more detailed criticisms on specific matters which these comments do not address. Nonetheless sufficient matters are raised here to suggest some possible inadequacies in the study and in the

Commission's reply. (The only change made from the original form of the draft has been to delete the name of the document's author, and substitute simply "H.E.C." - the Service similarly did not use the name of the cave study author.)

Comments on the H.E.C. Report

The H.E.C. report is alright as far as it goes, but it does not go very far. It appears to be written either for an audience who lack knowledge of karst or by someone who lacked knowledge of karst - caves - and in describing them again appeals only to their most obvious and popular characteristics. In doing so little more understanding of caves and karst is displayed than might be expected from a moderately intelligent tourist, however adequate the geological statement may be.

To a degree it is a statement of faith. It rests in its entirety upon a number of questionable assumptions. Implicitly or explicitly these assumptions include:

1. that caves are the prime resource of karst;
2. that recreational use of karst in the tourist sense ought to assume dominance;
3. that the significance of caves can be measured in terms of their size;
4. that the significance of caves can be measured in terms of their decoration;
5. that the significance of caves can be measured in terms of their potential for tourist development;
6. that a brief examination of riverside bluffs and brief excursions to the outcrop margin are sufficient to establish the extent of karst development;
7. that the free-flow aquifer with capping (IIb2) model of White (1969) is adequate to evaluate karst in the area.

The H.E.C. report is in fact an emphatic documentation of the Hydro Electric Commission's total lack of understanding of karst and caves.

THE INADEQUACY OF H.E.C. ASSUMPTIONS AND METHODOLOGY

1. That caves are the prime resource of karst.

Over the centuries caves have served man as storage places, as refuges, as sources of hardy recreation or tourist dollars, for food production, sanatoria and other purposes. Many of these values derive from the total karst as much as from the cave itself, and some may exist in the absence of caves. Uses such as water supply, fish breeding, science, agriculture and forestry spring readily to mind, and there are others less obvious. Surface karst may itself be of use for tourism, or for hardy recreation (e.g. rock-climbing, caneoing). To remove caves from their karst context is not only harmful in management terms, but poor science.

2. that recreational use of karst in the commercial tourism sense ought to assume dominance.
3. that the significance of caves can be measured in terms of their size or ...
4. their decoration or ...
5. their potential for tourist development.

The dominance of the commercial recreation perspective is implicit in the H.E.C.'s adherence to the three previous assumptions. The ten pages of original work in the report is replete with examples. Comparison of the area's caves with those elsewhere in the state is almost entirely on the basis of cave dimension and existence or otherwise of speleothems. The map of Tasmanian karst (figure 2) is atrociously inadequate, and comparison is made with developed tourist caves which in no way illuminates the discussion, for caves are chosen for tourist development on the basis of their decoration only, not on the basis of the myriad other values of caves. Indeed many of the Tasmanian caves most valued aesthetically by cave enthusiasts are "poorly" decorated but are valued for their morphology, streams or physical settings.

6. that a brief examination of riverside bluffs and brief excursions to the outcrop margin are sufficient to establish the extent of karst development.

The Gordon limestone of the area attains the greatest relief in two situations:

(i) former meander cores and similar situations where elevated masses of limestone are being cliffed by the present course of the river.

(ii) towards the valley margin to the east where Silurian and Devonian sediments capping the limestone have been more resistant to erosion. Increasing relief in this area is acknowledged by Fig. 3 yet it appears with the caption: "note low relief of the limestone on the *western* side (my emphasis - it could just as well have said "note higher relief of the limestone on the eastern side" but for some reason did not).

Carbonate relief is obviously a determinant of karst development but many cave systems occur at shallow depth within the host limestone mass. In north western Tasmania interesting caves occur within residuals in flood plain situations at Redpa, Montagu and elsewhere, where the limestone rises no more than 20 metres above the adjacent swampy plain. Relief alone is not an adequate criteria upon which to evaluate the potential karst of an area.

For karst development to occur, a number of other conditions must be fulfilled: there must be a suitable rock type (elsewhere in Tasmania the largest as well as the most spectacular caves to date known in Australia occur in Gordon Limestone). The rock must be dense, highly jointed and preferably thinly bedded, with low primary porosity which might otherwise promote diffuse flow. There must be adequate rainfall and relief (Thornbury, 1957). All these conditions are essentially fulfilled in the Gordon-Franklin area.

Low relief certainly conditions horizontal development and constrains vertical development (Sweeting, 1973) but it eliminates neither. H.E.C. observes that dome pits are scarce, but it might equally have been observed that other morphological features associated with horizontal caves are common, yet it did not. Why should vertical cave elements be common in an essentially horizontal cave area? This is just a red herring. It is at the valley margins that the most substantial caves are likely and there has been no adequate examination of this part of the outcrop.

7. <u>that the free-flow aquifer with capping (IIb2) model of White (1969) is adequate to evaluate karst in the area.</u>

The H.E.C. only say in the body of their report that this geological situation "*may*" apply. White's model (II) implies free flow. His type (b) involves perched water (impervious basement above the river valleys, shallow flow paths, cave streams often having a free surface, with a small water storage). Subtype (2) - capped - involves shafts around the edge of bordering caprock with lateral inflow to produce "*long integrated caves*" (White, 1969), whereas the H.E.C. report concludes, using this model, that "the potential for future discovery of large cave systems is very poor."

Locally, however, perhaps the type (1) - open situation is more adequately descriptive. This implies the karst reaching the surface, with a considerable clastic load and intake through many dolines to produce short cave segments. This might fit the Whitlam cave area. Of course we do not know that there is not confined flow from beneath the silurian and Devonian material to the east or indeed that cave development will be more constrained by an abstract model than the real world conditions of the Gordon and Franklin valleys.

Model IIb2 involves a nearly horizontal gradient with a low water table in a low relief area with the karst extending below valleys to base level. Yet on page 8, the H.E.C. notes that in the Nicholls Range valley there is a "steep overall gradient". It is suggested this indicates

"(a) low primary porosity"
(which as we have seen enhances rather than detracts from the likelihood of karst).

"(b) a widespread, anastomosing pattern of small secondary openings. has not developed."

The high water level in drill holes was suggested to relate to a closed system. Roberts and Andric (1974) suggest clogging of a previously open system by residues.

How does this equate with "the extensive and interconnected systems of cavities in the Nicholls Range valley" of Roberts (1971)

It is all too confused and too soon to make blanket statements such as the conclusion by the H.E.C. that "the potential for future discovery of large cave systems is very poor".

Coverage

The report fails to address the total question of karst areas affected by potential hydro electric development. Kiernan (1979) lists a number of other limestone outcrops, which would be inundated, and some of these are known to contain caves. These areas are:

1.	Goodwins Creek.	caves known
2.	Acheron River	caves known
3.	Lower Andrew	caves known
4.	Upper Andrew	caves reported
5.	Wright River	no karst yet reported but poorly known.
6.	Fincham	" " " "
7.	Governor	" " " "
8.	Upper King	one cave reported but site unknown
9.	Nelson River	numerous small caves with bone deposits.

THE INADEQUACY OF H.E.C. REPORT - CONCLUSIONS

The H.E.C. cites the monoclinal structure, the lack of adequate topographic relief, the low persistence of open discontinuities, the lack of abrasive materials and the surface catchment of tributary streams as factors constraining karst development.

6.2 the low incidence of decoration Speleothem development is intricately linked with soil cover, not with the factors cited. This is acknowledged in section 4.1 but ignored in the conclusion. Obviously speleothem development is likely to be hindered by flooding near river level, but the real question is whether speleothems are an adequate criterion upon which to judge a cave.

Ignored in the conclusion. Obviously speleothem karst is likely to be hindered by flooding near river level, but the real question is whether speleothems are an adequate criterion upon which to judge a cave.

6.3 the low tourist potential For reasons already stated this is not a useful statement and can be ignored.

6.4 nothing of archeological interest has yet been found in any of the caves
An inadequate and misleading statement. See item below.

6.5 the potential for future discovery of large cave systems is very poor
As previously discussed this rests upon strategy foundations and is really no more than a statement of faith.

FUTURE DIRECTIONS

Assessment of karst needs to be much more broadly based that the H.E.C. study and ought to be undertaken by individuals with more first hand experience of karst rather than simply geology. Suitable personnel are not abundant. Two directions are fundamental:

1. A focus on the karst of the area rather than simply the caves;
2. A re-evaluation of the caves from a wider perspective than simply their size, decoration and tourist potential.

The karst itself is deserving of adequate examination, with respect to landforms, their evolution and genetic processes. Parallel to this the plant geography of the karst surface may be of interest in view of the paucity of shallow rooted communities close to limestone bedrock rather than rooted in peat to which attention has been drawn by Harris (1979). Jarman and Crowden (1978) have found unusual communities on limestone in the Olga and Hardwood Valleys.

A number of avenues remain totally unexplored with respect to the caves. Indeed these include probably the most important attributes of the caves.

1. Invertebrate Fauna

There has been little examination of cave fauna of karst areas in south-west Tasmania. The existence of a number of spatially distinct and continuous areas offers the potential for considerable variety. Dr. Barry Moore has remarked of the trogloditic beetle *Idacarabus* for instance, that the cold climate conditions of the Pleistocene may have driven it underground, leading to different species being endemic to each particular karst area in which the genus is found, the surface relatives having ceased to exist.

2. Cave deposits and plaeoenvironmental evidence

In addition to chemical deposits in the form of calcium carbonate and other speleothems, various forms of clastic deposit may occur in caves. To date there has been no description or analysis of the sediments of the caves affected by the proposed project. Essentially sedimentation is due to interruptions in transport and sediments may be endogenetic or exogenetic.

Within caves breakdown material, fluvial materials and clays may occur, while entrance facies may include material of aeolian, glacial, fluvial, glacifluvial, solifluction or other mass movement origin. Sediments which may have been removed from the outside environment by subsequent activity may be preserved in caves. Changes in ventilation, saturation, CO_2 level, water condensation, and precipitation may affect the activity of the entire cave. Hence caves may provide a wealth of palaeoenvironmental information.

Palaeoclimatic data may also be derived from speleothems through use of such techniques as uranium/thorium or O^{16}/O^{18} dating. The former requires adequately dense material low in clay, lacking post depositional recrystallisation, and with a uranium content of > 1 ppm. It is probable that suitable material exists in the area particularly in areas of mineralisation (= Nichols Range??). Oxygen isotope techniques require stalagmitic material which has formed under isotopic equilibrium with cave seepage waters and hence the proximity of entrances in many of the small Gordon and Franklin river caves known to date may mean suitable material is not common.

Pollen spectra may also be available from some cave sediments and aid in the reconstruction of palaeoenvironmental conditions.

3. Palaeontological material

The H.E.C.'s virtual dismissal of this topic ("6.4 nothing of archaeological significance has yet been found in any of the caves") is inaccurate, premature and unscientific.

Even small caves can contain bones. Murray (1975)(*SS* 100:7-11) suggests caves have proved the second best source of bone material after asphalt lakes. Recent bone material has been collected from a cave in the Gordon-Sprent area, a substantial bone deposit occurs in Fraser Cave and a bone breccia occurs in cave F-F. These deposits are to date unstudied, and in view of the size of the karst area in question, other material would almost certainly come to light were thorough exploration possible. Bones arrive in caves due to their use as dens by carnivores, by pit fall and various geomorphological processes. Not only do caves store bones but they provide different kinds of environments for preservation. Changes in temperature, and wetting and drying are conducive to bone breakdown, but constancy of temperature and moisture is characteristic of caves. Moreover there are carbonate solutions for the preservation of bone.

Bone deposits also occur in other karst areas affected by the proposed development but not included in the report. Human remains have been reported but not investigated from a cave in the Goodwins Creek area (Meerding pers.comm.) while at Nelson River bone material is also present. The burnt nature of the bone and faunal assemblage at the latter site are suggestive of an anthropogenic origin which on stratigraphic evidence (cryoclastic sediments) may be of late Pleistocene age, but the deposit is unstudied (Kiernan, 1979). Just as there are probably further deposits within karst areas where bones have already been reported, there may well be others in the other limestone areas where speleological investigation is yet to penetrate and no karst features are to date known.

SUMMARY

The H.E.C.'s lack of enthusiasm for the caves of the area despite conscientious effort is understandable, for it is evident that the geological background of the report's authors have left them less than prepared to know what to look for. H.E.C. investigation has been shallow, focusing on the caves to the exclusion of their karst context and adopting more the perspective of an intelligent tourist than cave scientist. The maps for instance are grossly simplistic and betray an ignorance of the very purpose of cave maps, while the use of dimensions, decoration and tourist potential as sole gauging criteria confirm it. Less than 10 pages of the report consist of original written work, there being a 10 page tabulation of previously published material, 6 pages of area maps, 14 new cave maps of very low standard and 49 pages of plagiarised text and maps. The result is a document impressive in weight and appearance but nothing else.

AFTERMATH - THE H.E.C. REPLY

On the basis of submissions made to it, the Co-ordinating Committee recommended to the Premier that the Gordon-below-Franklin dam not go ahead, and that instead a scheme on the Gordon-above-Olga, which would leave the Franklin intact, but still flood the Nicholls Range area and the largest cave known on the western rivers be linked with a thermal station in the north of the state. The Premier's support was indicated at a State A.L.P.

convention the weekend before the Government was to make its decision. The day Cabinet was to decide the future of the western rivers, the Commission presented (nicely timed - too late for response) its reply to the Co-ordinating Committee, and to the submissions of individual departments including that of the National Parks and Wildlife Service, which it criticised for "emotional verbosity".

In response to the 19 pages the Service devoted to caves and karst, the Commission's only reply was:

"<u>Caves and karst</u>

Information provided by the National Parks and Wildlife Service on additional caves adds to the knowledge of the area and this is now available in recent papers by Middleton (1979)[1] and Kiernan (1979).[2] Both these papers were published since the H.E.C. report. (The references are those listed in the National Parks and Wildlife Service's Submission.)"

And that was it! What finer admission of the truth of the criticisms of the study. The Commission claimed that as its immediate proposal was only the Gordon-below-Franklin, and that the implications of its proposed companion project on the King and Upper Franklin were irrelevant - but even if that point is accepted it pertains only to a tiny fraction of the N.P.W.S. response.

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1. A compilation of caves on the western rivers.
2. An inventory of limestone outcrops in the areas with some data drawn from the Commission's own records.

DISCOVERY OF LINK BETWEEN JF210 and JF211

Stefan Eberhard

A connection has been established between Sesame I (JF210) and Sesame II (JF211) caves in the Junee area. Sesame I is a small talus cave situated in the base of a large doline and with a surveyed depth of 18.5m. Sesame II is located on the western rim of the same doline and is considerably more extensive with a depth of 229m.

Sesame I was visited by a party of three in early September. A tight squeeze in a narrow fissure at the surveyed "end" of the cave was negotiated and a small dry steam channel followed for a distance to a rubble-strewn chamber. There appeared to be no route on; however, one enterprising member pursued a long low crawl to where it bisected the normal route through Sesame II in a sizeable chamber. The final 10m. crawl is not obvious but it is the most logical for it simply involves following the dry stream channel.

Although the alternative route through JF210 effectively bypasses three of the pitches in JF211 it cannot be recommended, for it involves strenuous and time-consuming work hauling the gear through the awkward crawls.

PIPING AS A PSEUDOKARST PROCESS

Kevin Kiernan (20 November 1979)

The process of piping may produce caves and karst-like features of similar morphology and hydrological function to their counterparts in carbonate karst terrain. Piping involves the grain by grain removal of clastic particles in suspension. Features generally evolve at a faster rate than in true karst. Conduits develop along planes of weakness of structural or lithological origin. Piping is particularly prevalent in weakly consolidated tuffs, löess, clay, silt, gravel and conglomerate under dry climates, and also in deep peats.

A related term, suffosion, is apparently of Russian origin and incorporates piping in association with solution affects. Parker *et al.* have reviewed the many other terms which have been used: natural tunnelling (Fuller 1922); subcutaneous erosion (Guthrie Smith 1927); gullies-by-sinking (Rubey 1928); rodentless rodent erosion (Bond 1941); pothole gullying (Cole *et al.* 1943) tunnel-gully erosion (Gibbs 1945); sinkhole erosion (Cockfield & Buckham 1946); tunnelling erosion (Downes 1946); soil piping (Caroll 1949); piping (Otvos 1976); 2nd tunnel erosion (Colclough 1970a, b).

Landforms produced by piping include caves and enclosed depressions fulfilling a fundamentally karstic hydrological function. Cockfield and Buckham (1946) suggested their development involved water percolating into silts until reaching a temporary water table, whereupon it travelled more horizontally. Fletcher *et al.* (1954) outline five conditions for development of this form of pseudokarst: a source of water; a surface infiltration rate exceeding the permeability of the subsoil; an erodible layer just above the subsoil; the presence of a hydraulic gradient permitting lateral flow; and an outlet for this flow (fide Grimes, 1975). Downes (1946) suggested three states in the development of tunnels, the first involving severe sheet erosion, loss of vegetation and surface cracking; followed by diversion of water beneath the surface. The third stage involves collapse.

Tunnel erosion of soils is common in S.E. Australia (Downes, 1946; Colclough 1970a, 1970b) particularly in duplex profiles. That human activity may significantly increase the likelihood of such features is emphasised by both Downes and Colclough, the latter of whom draws attention to the importance of more intensive timber harvesting and burning in the development of tunnels in Tasmania. Brown (1962) also considers sparse vegetation important.

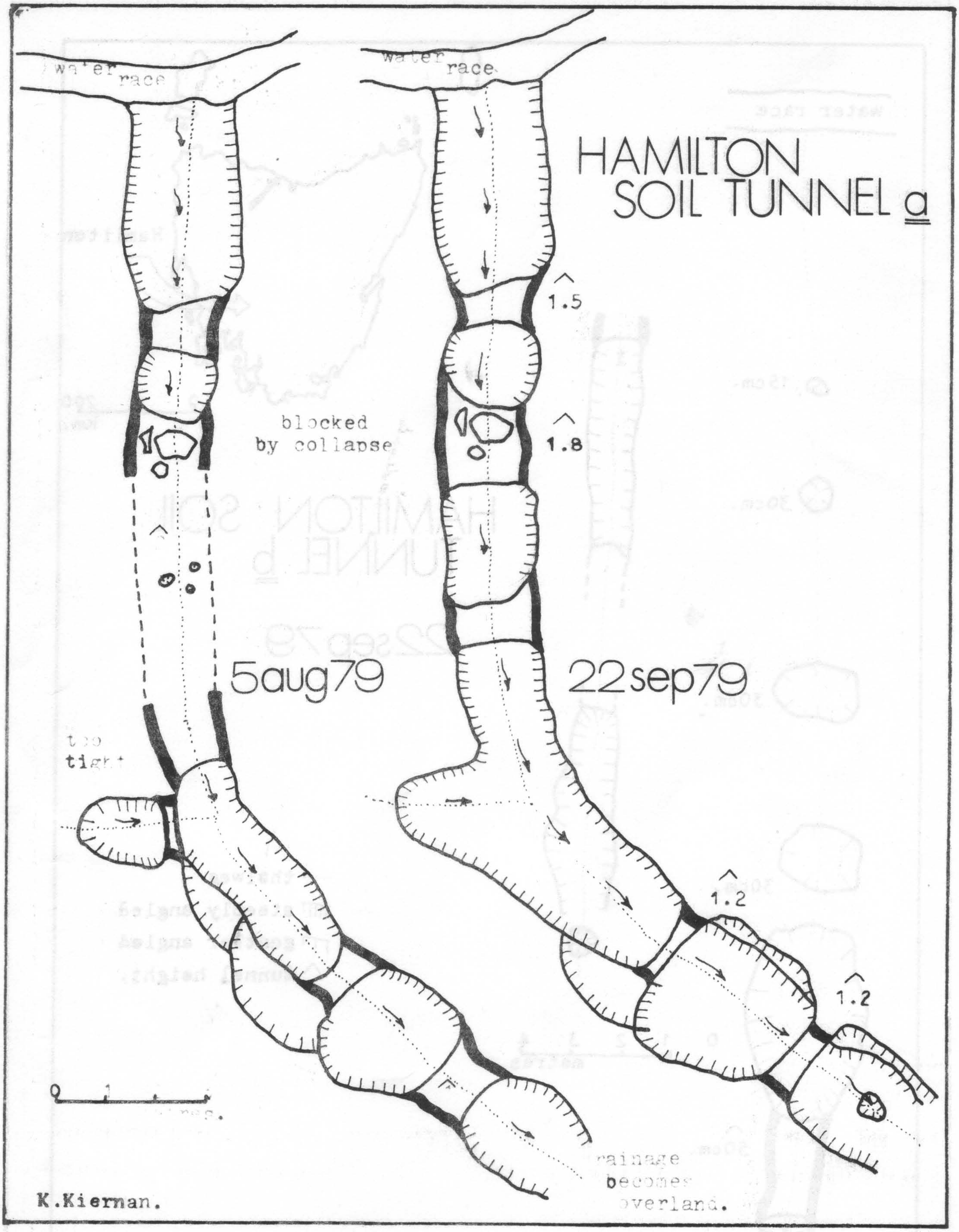
Some caves and morphological karst developed by piping.

Some quite substantial cave systems developed by piping have been recorded. In Uganda, Ollier and Harrop (1958 fide Wood 1976) have described karst-like features in volcanic agglomerate interbedded with lava flows. The agglomerate had been baked and was relatively impervious, and solution of sodium salts and piping had developed significant voids.

Perhaps the best known cave of this origin is Officers Cave in Eastern Oregon, where Parker, Shown & Ratzlaff (1964) demonstrated solution was not necessarily of great significance. This system comprises 214 m. of passages developed in clay and silt, and associated with dry, blind and hanging valleys, pipes, sinkholes, natural bridges and other caves. The entrance chamber is 11 x 13 x 30 m. in extent, sloping at 45° east into a narrow linear ridge. Parker *et al.* compute an average enlargement rate of 8230 m^3/yr. over 48 years. The cave is associated with montmorillonitic and illitic clays which crack when dried after wetting, which together with joints provide a plane for water penetration and dispersion and disaggregation of particles when wet. Cave enlargement is accomplished by spalling and removal of the breakdown material by the running waters of an ephemeral stream.

In the Chuska Mountains of N.W. New Mexico, Wright (1964) has examined hundreds of small depressions in siliceous Tertiary material of aeolian origin, cemented by chalcedony and opal due to unusual groundwater conditions. The depressions appear to be of collapse origin and are up to 1 km in diameter but generally less than 1 m. deep. Wright postulated collapse after piping out of uncemented sand from beneath the sandstone, the pipes originating at springs and extending headwards. The Chuska Mountains are believed to have had approximately their present form since the Pliocene, with crestal topography dating from the Pleistocene.

Clausen (1970) has examined badland caves in four areas of Wyoming, where chambers up to 24 x 9 x 6 m. were found. Rubey (1928) first advanced a subsidence origin for numerous U shaped valleys in the Madden area of Wyoming.



HAMILTON
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water race
blocked
by collapse
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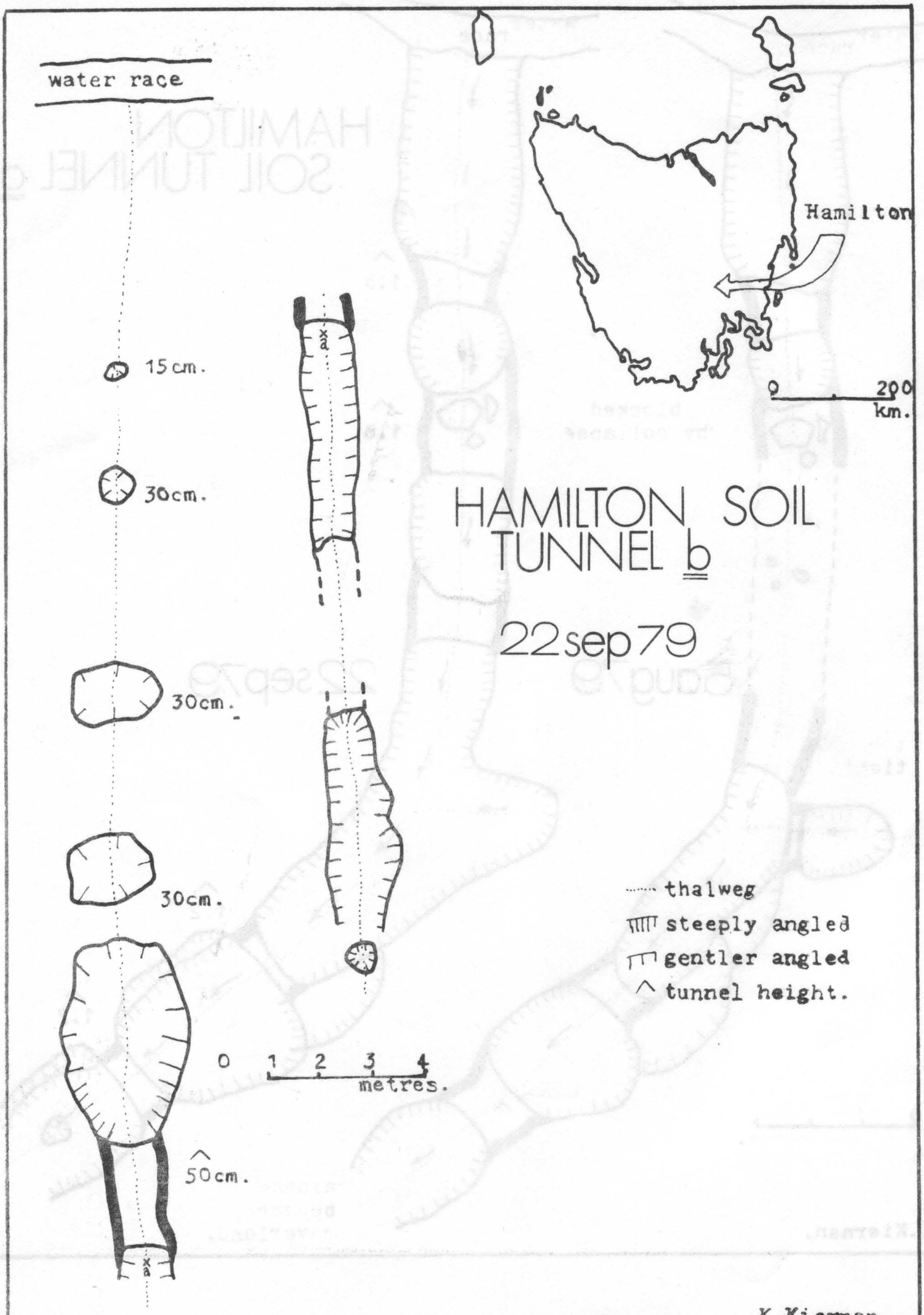
K.Kiernan.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HAMILTON SOIL TUNNEL b
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tunnel height.
0 1 2 3 4 metres.
K.Kiernan

Miniature tunnels are suggested to have formed just below the temporary rainy season groundwater level, with enlargement leading to subsidence and further concentrating runoff. In the Mason Draw area Clausen visited one cave with a chamber of 46 x 15 m. extent. Most caves were developed along bedrock-debris contacts, with their roofs supported by the adobe common to many badlands areas, the claystone beneath which was washed away.

Mears (1963) has described other pseudokarst features from badlands in Arizona, attributing sinkholes to disaggregation of swelling clay minerals and noting evidence of deep piping.

On Easter Island the overflow stream from the crater lake of Rano Aroi sinks into volcanic ash and reportedly reaches the sea several kilometres distant after heavy rain. Water from such sources used to be collected at shallow depths along the coast by the native people (Bandy 1937). Part of the Rano Aroi conduit has collapsed to produce a deep gorge with four large natural archways remaining in 1976 (Kiernan 1976) the largest of which was over 5m. in diameter. Bandy (1937) and the Naval Intelligence Division (1943) record earlier stages in its demise recording tunnels through which it was possible to ride a horse. It is possible the clearing of vegetation by the native peoples accentuated tunnel development.

In India, Verma and Ramesh (1977) have described caves formed by spring flushing in a massive coarse grained sandstone interbedded with conglomerate near the hilltown of Pachmarhi. These occur along joint planes, joint intersections with bedding planes, and along the intersections of lithological discontinuities and contrasted lithologies, each having a characteristic morphology. Caves 5-6 m. wide at the mouth and 15 m. long occur, with occasional speleothems at the inner end perhaps in speleogenesis, although the carbonate may be allogenic. Occasionally there is interplay between the piping process and lateral stream corrassion against the scarps in which they occur.

On the Gazelle Peninsula, New Britian, Papua New Guinea, Bourke (1975) has described several caves in volcanic pumice ash deposits. Disconformities interrupting downward percolation of water were frequently palaeosols and occasionally bedrock. The largest cave described was 73 m. long, with a passage diameter of several metres. Streams were present in several caves, and some evidence of upward enlargement by bats. A radiocarbon assay on preserved remains of trees buried in the ashfall gave a result of 1475 ± 80 years B.P.

Johnson & Blake (1972) are reported by Bourke to record volcano karst erosion of moderately welded pryoclastic flow deposits south of Waissi in the Cape Hoskins area of New Britain and "include a photograph of a cave containing boiling mud pools on the flank of Witori volcano" (Bourke 1975).

In New Zealand piping is prevalent where overgrazing of soils formed on loess permits deep cracking (Gibbs 1945). Water percolates down the cracks to beneath massive, compact fragipan layers where it may be diverted laterally by palaeosols.

Piping Pseudokarst in Australia

In Central Queensland, Australia, Sharmon (1975) has described three caves up to 67 m. in length developed within and beneath an indurated colluvial sandstone capping granite. The granite-sandstone contact was the most common disconformity guiding development, but occasionally it was an internal disconformity in the sandstone. The caves were attributed to dispersal of the clay component into colloidal suspension. All caves were in hanging valley situations. The Flagstone Ck. caves have been described by Gilleson (1971).

In Western Australia Lefroy and Lake (1972) have described a cave in laterite apparently of piping origin. It comprises an extensive system of passages of 1525 m^2 extent lying 1-2 m. below the surface in an area where there are indications of further caves. Beneath the duricrust hardcap is pisolitic and nodular bauxite in which the caves are developed. Solution may have played an early role but piping is probably the principle agent (Grimes 1975) while erosion by animal inhabitants may also have contributed.

Some Tasmanian examples

Pseudokarst development by piping is observable in Tasmania. While the features so far known are on a less spectacular scale than some overseas examples they are nonetheless illustrative of the same processes as have led to features like Officers Cave. For instance, in almost any alpine area small caves and sinkholes can be found developed in peat. During times of heavy rain or thaw such conduits convey large quantities of runoff through the landscape. By no means the only example but nonetheless a typical one consists of the underground stream network downstream of the Dixons Kingdom hut in the Walls of Jerusalem area where mechanical erosion has frequently been guided by the disconformity between the base of the peat and underlying regolith.

However probably the only item in caving club records on piping induced pseudokarst in Tasmania pertains to a small cave system developed by tunnel erosion at Hamilton in the southeast of the State (Kiernan 1979). This was developed in a podsolic soil with highly dispersive clays and originating from concentration of subsurface drainage along dessication cracks at the boundary between the A horizon and clay subsoil. In this instance maximum tunnel diameter was nearly 2 m. and the erosion commenced after breaching of an artificial contour water race at the head of the slope.

An indication of the speed of development of such features may be adduced from Fig. 1. The earlier map (Kiernan 1979) indicates the situation at 5 August 1979, while the latter shows the situation only seven weeks later on 22 September 1979. Enlargement of sinkholes and the development of new ones is apparent, while the initiation of deeper conduit development at the downstream end is also evident. Fig. 2 depicts evidence of a further tunnel 10 m. to the east at 22 September 1979 where only a slight depression had been evident at 5 August 1979, and is indicative of the early stage in the development of such a feature. This latter tunnel had been initiated from the same water race, and while no obvious breach in the race was evident, the presence in it of old planks immediately above the tunnel seemed suggestive that a makeshift farm bridge foundation was probably responsible. On 1 December 1979 the tunnels were found to have been infilled in an effort to stem their development. Such an initiative is highly unlikely to prove to be the end of the matter.

In conclusion

Hence although there is not an abundant literature on piping pseudokarst phenomena, some very interesting features have been recorded. Isolating caves as being due solely to piping phenomena and solid phase removal (Grimes 1975) is not always easy, for arbitrary boundaries are the imposition of man, not the reality of nature. Frequently there is interplay between agents, and solution may be involved in some apparently piping situations. Where true solution is predominant, as in many duricrust situations, the karst morphology represents parakarst rather than pseudokarst.

BIBLIOGRAPHY

Bandy, M.C. (1937) Geology and Petrology of Easter Island. *Bull.Geol. Soc.Am. 48:* 1589-1610.

Bond, R.M. (1941) Rodentless rodent erosion. *Soil Conservation 10:*269.

Bourke, R.M. (1975) Pseudokarst caves of the Gazelle Peninsula, New Britain, Papua New Guinea. *Proc.10th ASF.Bienn.Conf.:* 16-19.

Brown, G.W. (1962) Piping erosion in Colorado. *J.Soil & Water Conserv. 17:* 220-222.

Caroll, P.H. (1949) Soil piping in southeastern Arizona. *U.S.D.A. dup.repr.* 21pp.

Clausen, E.N. (1970) Badland caves of Wyoming, *Bul.Nat.Spel.Soc. 32*(3): 59-69.

Cockfield, W.E. & Buckham, A.F. (1946) Sinkhole erosion in the white silts at Kamloops. *Roy.Soc.Canada.Trans.* 3rd Ser. *40* (4): 1-10.

Colclough, J.D. (1970a) Background to Tasmanian soil erosion. *Tas.J.Agric. 41:* 176-182.

Colclough, J.D. (1970b) Causes and control of soil erosion. *Tas.J.Agric. 41:* 286-293.

Cole, R.C.; Koehler, L.F.; Eggers, F.C. & Goff, A.M. (1943). The Tracy area, California. *U.S.D.A.Soil Survey Serv.*, 1938, 5 Dec. 95 pp.

Downes, R.G. (1946) Tunneling erosion in North-East Victoria. *C.S.I.R.O.J. 19:* 259-262.

Fletcher, J.E.; Harris, Karl; Peterson, H.B. & Chandler, V.N. (1954), Piping. *Am.Geophys.Union.Trans. 35:* 259-262.

Fuller, M.L. (1922) some unusual erosion features in the loess of China.

Geog.Review 12: 570-584.

Gibbs, H.S. (1945) Tunnel-gully erosion on the Wither Hills, Marlborough (New Zealand). *N.Z.J.Sci.& Techn.* August 1945: 135-146.

Gilleson, D.S. (1971) Flagstone Creek Caves. *Down Under 10* (4): 93-4.

Grimes, K.G. (1975) Pseudokarst: Definition and types. *Proc.10th ASF. Bienn.Conf.*: 6-10.

Guthrie-Smith, H. (1926) *Tutira* (2nd edit.) W. Blackwood & Sons Ltd., London and Edinburgh. 405 pp.

Johnson, R.W. & Blake, D.H. (1972) The Cape Hoskins Area, Southern Willaumez Peninsula, The Witu Islands, and associated volcanic centres, New Britain: volcanic geology 2nd. petrology. Bur.Min.Res.Geol.Geophysics Record 1972 (133) Unpublished.

Kiernan, K. (1976) The Caves of Easter Island. *Southern Caver 8*(1): 7-106.

Kiernan, K. (1979) A Small cave system formed by soil erosion. *Southern Caver 11*(2): 34-35.

Lefroy, T. & Lake, P. (1972). A laterite cave system in the Chittering region, West Australia. *Western Caver 12*(3): 68-77.

Mears, B. (1963) Karst-like features in badlands of the Arizona petrified forest. *Contrib.to Geol. 2:* 101-104.

Naval Intelligence Division (1943) Easter Island. (in) Pacific Islands, Vol.2, Eastern Pacific Geographical Handbook Series, BR 519B (Restricted).

Ollier, C.D. & Harrop, J.E. (1958) The caves of Mount Elgon. *Uganda J. 22* (2): 158-163.

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

Parker, G.G. (1968) Officer's Cave, Eastern Oregon, Revisited. *Geol.Soc. Am.Spec.Pap. 101:* 415 (Abstr.).

Parker, G.G.; Shown, L.M. & Ratzloff, K.W. (1964). Officer's Cave, a pseudo-karst feature in altered tuff and volcanic ash of the John Day formation in Eastern Oregon. *Geol. Soc.Am.Bull. 75:* 393-402.

Rubey, W.W. (1928) Gullies in the Great Plains formed by sinking of the ground. *Am.J.Sci. 15:* 417-422.

Shannon, C.H.C. (1975) Pseudokarst caves in duricrust/granite terrain, Banana Range, Central Queensland. *Proc.10th Bienn.*

A.S.F. Conf.: 20-24.

Verma, V.K. & Ramesh, V. (1977) Speleologic Aspect of Pachmarhi (upper Gondwana) sandstone, Central India. *Proc.7th IUS Conf.*: 408-410.

Wood, C. (1976) Caves in rocks of volcanic origin (in) *The Science of Speleology* (T.D. Ford & C.H.D. Cullingford eds.) Academic Press, London.

Wright, H.E. Jr. (1964) Origin of the lakes in the Chuska Mountains, North-Western New Mexico. *Geol.Soc.Am.Bul.* 75: 589-598.

AREA REPORTS

Stefan Eberhard

MOLE CREEK

On the 12th July Leigh Gleeson led a party consisting of Aleks Terauds, Pete Russell, Stefan Eberhard and Rolan Eberhard to this area. The purpose of the trip was to survey the recently discovered link between Georgies cave and Dangerous cave. Unfortunately the route linking the two caves could not be found, possibly due to high winter water levels, so Dangerous cave only was surveyed. On the following day the popular through trip from Georgies cave to Wet cave was completed.

JUNEE/FLORENTINE

On the 3rd August Stefan Eberhard and Rolan Eberhard bottomed Owl Pot in a very enjoyable six hour trip.

On the following Saturday the same party visited Three Falls cave and explored a narrow muddy cave exposed in a road cutting. A scrub bash on the Sunday failed to reveal any caves.

The 23rd August saw a fruitless search for caves in the dolomite on the extreme south-eastern slopes of Tim Shea by Phil. Jackson and Stefan Eberhard. A late start on the next day only afford enough time for a brief visit to Bone Pit.

In late August Stefan Eberhard led a party of Rolan Eberhard and a visitor on an extended trip to this area. They were accompanied by Phil. Jackson and Compton Allan on the 30th when the F4 area was investigated but no caves were found.

Sesame I and Sesame II caves were the focus of attention on the following two days. A link between both caves was established (see report elsewhere in this issue) but a bottoming trip to Sesame II was failed by abnormally wet conditions and insufficient time. On the final day a search was conducted in the vicinity of the F9 road. A small entrance was finally located which dropped some 20m. vertically into a series of large decorated chambers.

IDA BAY

Roland Eberhard was a member of a party which visited Mystery Creek cave in early August.

Over the 6th and 7th September a team consisting of Lindsay Wilson, Stefan Eberhard and Rolan Eberhard under the leadership of Leigh Gleeson undertook a successful trip to Mini Martin. The descent and ascent of this spectacular pothole was completed with single ropes and took twelve hours.