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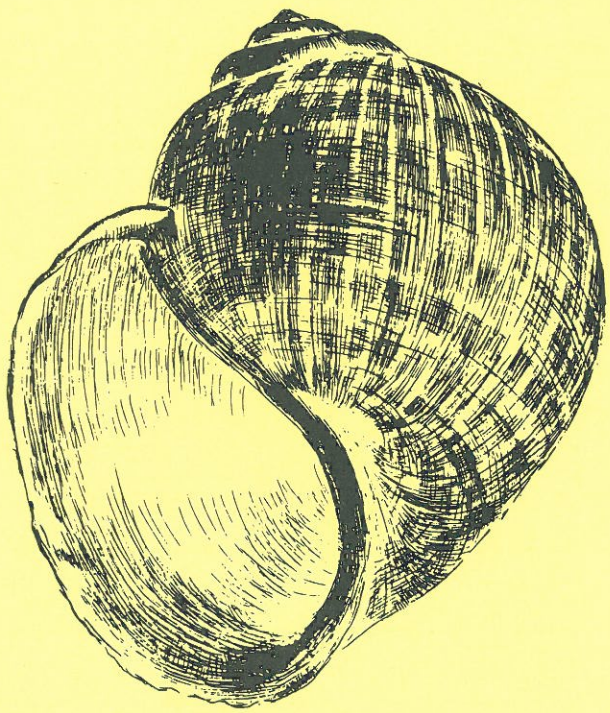

Volume 2 Numbers 1 and 2 May 1984

SPIRIT AND PURPOSE OF QUATERNARY AUSTRALASIA NEWSLETTER

Editorial

The cover says it all: Quaternary Australasia is the newsletter of the Australasian Quaternary Association; it is not, and does not claim to be, a refereed international journal. Our aims are modest; our geographical scope limited mainly to Australia, New Zealand, New Guinea, Antarctica, and adjoining oceans.

Our primary goal is to help Quaternary workers keep more closely in touch with one another's work than would otherwise be possible. We will publicise forthcoming conferences and workshops, new research techniques, facilities and services available, and recent research publications in the general field of Quaternary studies. However, your editor is neither omniscient nor omnipresent, so please help him to help you!

I would welcome news and contributions from New Zealand; short summaries of recent university theses; abstracts of unpublished printed reports (Geological Survey, for example); reviews of new methods or of complex recent topics; new ideas ... I invited authors of the first three items in this issue to send their respective contribution to QA: all three contain food for thought.

Martin Williams

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Cover design: Africa's largest freshwater snail, Pila wernei, (Pilsbryand Bequaert) collected by Dôn Adamson from the lower White Nile, drawn by Betty Thorn, Biological Sciences, Macquarie University.

CONTENTS

QUATERNARISTS IN CONFRONTATION: THE FRANKLIN CONTROVERSY - A REBUTTAL

S. J. Paterson
Chief Geologist, Hydro-Electric Commission, Tasmania.

The August '83 Newsletter contained 18 pages of anti-Lower Gordon Scheme comment, and not one word of rebuttal. It is surprising that publication of the newsletter should commence in such an unbalanced 'political' manner, and it is particularly disturbing that the President should assume that the views expressed represent those of most of us working in the Quaternary. The following notes have been produced at the Editor's invitation, and they are largely restricted to the archaeological aspects as it would indeed take a lengthy article to deal with all of the spurious arguments raised.

Prof. Mulvaney (Mercury, 14/9/83) berated the Hydro-Electric Commission for apparently dismissing prehistroy in six sentences in its Environmental Statement. The environmental studies undertaken for the Lower Gordon Scheme are among the most comprehensive ever carried out for an Australian development, and archaeology was not taken lightly. Officers of the Tasmanian Museum were consulted and the advice received was that aboriginal occupation had been restricted to the coastal fringes and that there was little prospect of finding remains in the study area. This opinion was consistent with the published views of Dr. Rhys Jones (1974) at that time. Nevertheless, an invitation was extended to the Museum Curator to join the Scientific Survey, but this invitation was not taken up. The Commission carried out a cave survey, as a result of which it was noted (Naqvi, 1979) that *"Nothing of archaeological significance has yet been found in any of the caves"*.

During the following summer, the Lowe Labor Government announced a moratorium on any further Hydro-Electric Commission investigations of the Lower Gordon area. This moratorium did not apply to the National Parks and Wildlife Service, to Dr. Rhys Jones or to 'private' investigators. In February 1981 (Kiernan, Mercury 17/2/81) the discovery of Kutikina (Fraser) Cave by *"simply good luck"* was announced as a new discovery by a group fresh from the field, and it was then asserted that Lower Gordon Dam was a threat to the archaeological resources of the area. This announcement caused a political furore. The cave was also discovered by Kiernan in 1977 (Middleton, 1979).

In depositions to the High Court in support of the Commonwealth's case, it was claimed that the archaeological finds in the Franklin Caves were unique and in one declaration Dr. Rhys Jones asserted that *"It is most unlikely that sites providing material of comparable archaeological value will be found in south-west Tasmania outside these (Lower Franklin and Middle Gordon) limestone belts"*. A similar statement by Prof. Mulvaney and Dr. Allen (15/2/83) was reprinted on page 16 of the August Newsletter. This states that *"Virtually no limestone with the possibility of cave sites exists outside the threatened area; therefore it is highly unlikely that such sites will be duplicated in S.W. Tasmania"*.

Any geomorphologist familiar with Tasmania would have advised that these statements were not scientifically objective, because the potential cave forming rock formations, the Precambrian, Ordovician and Devonian dolomites and limestones are widely distributed throughout the western half of the State. The distribution is shown on Fig. 1.

Faced with the deposition before the High Court, the Commission had no alternative but to mount a search for similar caves outside the reservoir area during a two week period in May, 1983. Five caves with contents similar to the Franklin Valley Caves were found in widely separated areas. They are located in the Andrew, Acheron, Florentine, Nelson and New River Valleys. The locations are shown in Fig. 1. If it is true that the inland area was abandoned as a habitat about 15 000 years ago (Kiernan et al, 1983), it is reasonable to assume that these caves were occupied during the same period as the Franklin Valley caves. The archaeological content of the new caves includes large quantities of bones and teeth, split and burnt bones, charcoal fragments, stone artifacts and in one case a flake of Darwin Glass. An additional fifteen caves considered to be of possible archaeological significance were also located. These caves were not inspected by an archaeologist - the Association of Consulting Archaeologists Incorporated advised its members not to take part in any recovery operation. Clearly the Franklin Caves are not unique and the statements made by Prof. Mulvaney, Dr. Jones and Dr. Allen are not scientifically objective.

Prof. Mulvaney (Mercury, 14/9/83) commented on the Commission's activities stating that *"The frantic field survey conducted while counsel prepared briefs for the High Court was a travesty of correct environmental impact procedure"*. What did Prof. Mulvaney expect us to do? Do nothing and let yet another deposition go unanswered and thus undermine years of work!

Archaeological investigations in the Lower Gordon area have been by groups or individuals who, for logistical, motivational or other reasons have concentrated on the proposed storage area to the almost total exclusion of other potentially fruitful areas of search. Our cave study for instance revealed that there are over one thousand known caves and rock shelters in the extensive cavernous formations, and in the coastal and midland sandstone formations. The distribution of these is shown in Fig. 2 and in Table 1. Our enquiries also revealed that very few of the caves have been inspected by an archaeologist. As a specific example, of the 335 known caves in the Florentine Valley, which is outside the Lower Gordon reservoir area, only about 20 have been visited by an archaeologist. Quite obviously the archaeological potential outside the reservoir area is appreciable and awaits field investigation.

The importance of the Franklin Cave discoveries is not questioned, and the value of an area relatively untouched for some 15 000 years is realised, but questioned are the statements by Prof. Mulvaney and Dr. Allen (15/2/83), reproduced on pages 16 and 17 of the August '83 Newsletter, regarding the necessity for preservation of relics in place rather than preservation by recovery. At the risk of being accused of lacking appreciation or concern for cultural values, consider what we are preserving in place and at such cost. The Franklin Caves contain the discards of hunter-gatherers, they have not been shown to contain priceless Palaeolithic cave art similar to the Lascaux Cave of the Dordogne.

The question of the value of the caves themselves as locations of early occupation has also been raised. Consider the fate of the equally important and more readily accessible Cave Bay Site on Hunter Island and Beginners Luck Cave in the Florentine Valley. Not having any political value these have been sampled and abandoned, and there is no evidence of genuine reverence from either the european or aboriginal communities.

Techniques for undisturbed sampling exist in the Geomechanics field, and there would appear to be no major problems in adapting these to recover cave contents, at a cost that is negligible in terms of the cost of the loss of the power scheme. The construction schedule allowed a recovery period of 8 years. Archaeologists should be wary of summarily dismissing (page 17 August '83 Newsletter) a potentially useful technique available from another discipline.

As the Franklin Caves are only a few of a number of similar caves occupied by early man in the southwest, the call for preservation of relics in situ in the Franklin Caves is unreasonable and has driven a wedge deeply into the Tasmanian community. Clearly there must be a balance between the legitimate desire of archaeologists to preserve relics in place and the development needs of society which can specify that some relics be preserved by undisturbed recovery.

The President's article touches upon the Senate Select Committee and the writings of Dr. Wace. There is enough there to fill another article of rebuttal. Suffice for now to correct one of Dr. Wace's glaring errors in his deposition to the High Court. Dr. Wace quotes from Millington et al (1979) *"If the Franklin below Gordon* (sic) *flooding were to proceed, they (Millington et al) calculated that this total area where Huon pine rainforest might be found would be reduced to 46 720 hectares. This is a loss of 24 800 hectares, or 35% of the rainforest flood plain habitat preferred by Huon pine"*. Well the surface area of the proposed Lower Gordon reservoir is 13 300 hectares. If Dr. Wace returns to his source article he will find that Millington et al, arrived at their figure by adding to the Lower Gordon storage, the Upper Franklin, Orange River and Davey River potential storages.

Tasmania stands to lose a substantial block of clean, renewable and very cheap hydro power that will ultimately have to be replaced from a dirty, non-renewable and expensive thermal source. To a practicing conservationist the result is an act of needless environmental violence, an abomination.

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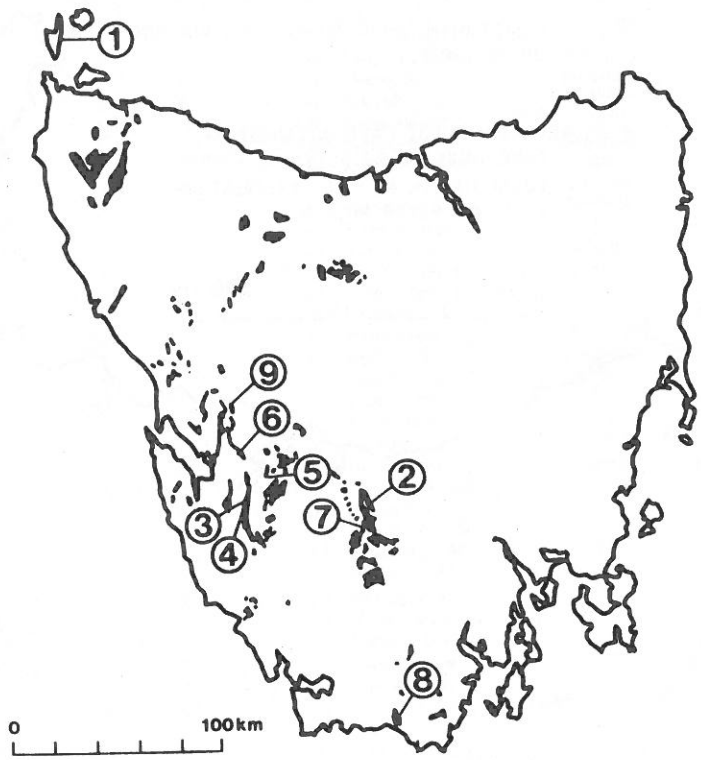

RECORDED PLEISTOCENE CAVE SITE

Radiocarbon Age, Years BP, (Flood 1983 & Harris, in press)

①	Cave Bay – Hunter Island	22 750 ± 420
②	Beginners Luck – Florentine Valley	20 650 ±1790
③	Kutikina (Fraser) – Franklin Valley	19 750 ± 840
④	Deenareena – Franklin Valley	c. 20 000

H.E.C. CAVE SURVEY MAY 1983

⑤	Cardia – Acheron Valley
⑥	Lugra – Andrew Valley
⑦	Nanwoon – Florentine Valley
⑧	Peüniak – New Valley
⑨	Nelson River Cave

Distribution of cave forming limestone and/or dolemite of Devonian, Ordovician and Precambrian age.

Fig. 1 RECORDED & POTENTIAL CAVES OF ARCHAEOLOGICAL SIGNIFICANCE (PLEISTOCENE)

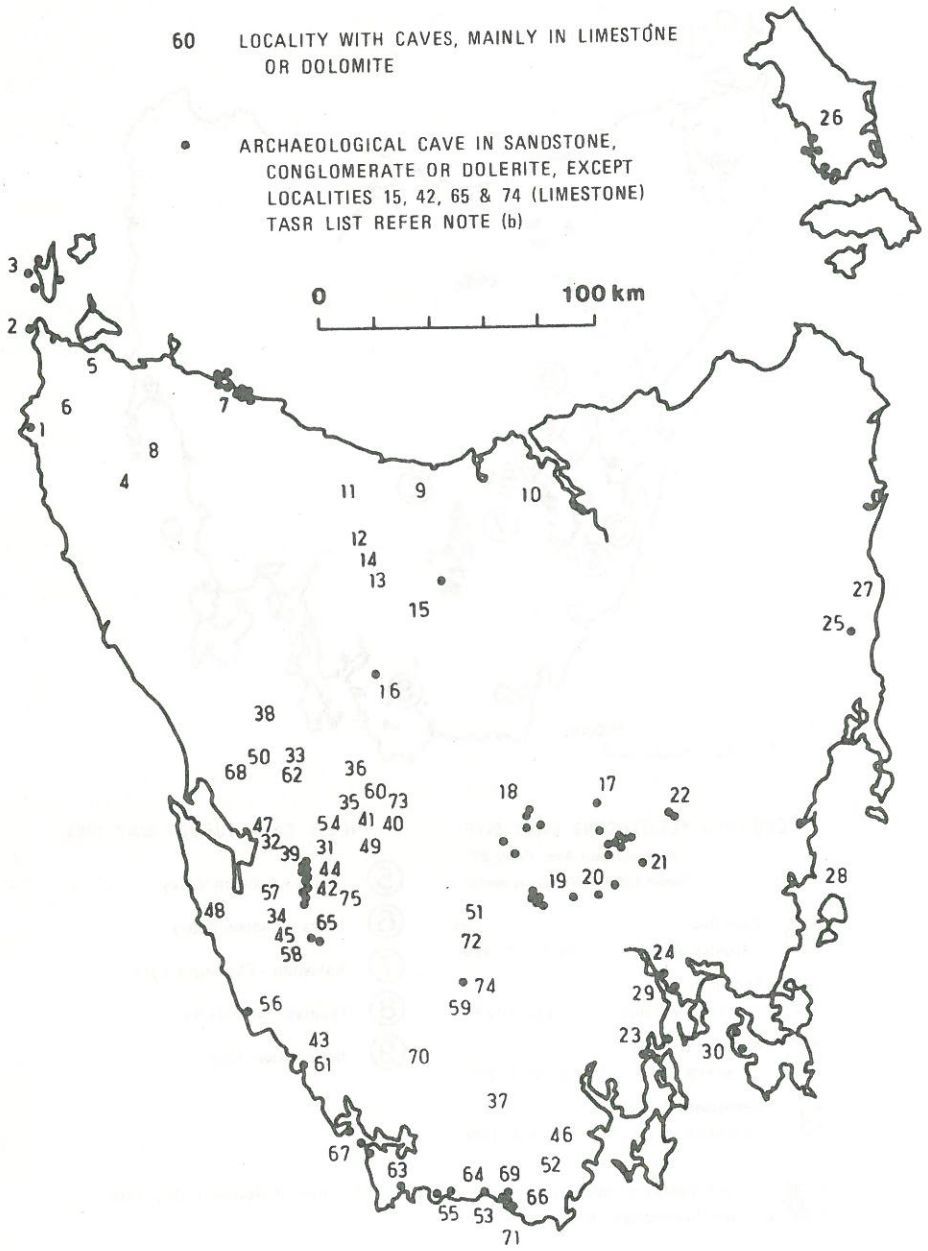

Fig. 2 CAVES & ROCK SHELTERS IN TASMANIA

TABLE 1. CAVES AND ROCK SHELTERS IN TASMANIA.

Locality No.		All Caves *(a)*	T.A.S.R. *(b)*	H.E.C. *(c)*
	N.W. TASMANIA			
1	Bluff Hill	1	1	-
2	Cape Grim	1	1	-
3	Hunter Island	4	4	-
4	Julius River	5*(d)*	-	-
5	Montagu	6	-	-
6	Redpa	11	-	-
7	Rocky Cape	9	9	-
8	Trowutta	2	-	-
	NORTHERN TASMANIA			
9	Eugenana	1	-	-
10	Flowery Gully	13	-	-
11	Gunns Plains	9	-	-
12	Loongana	12	-	-
13	Lorinna	4	-	-
14	Moina	3	-	-
15	Mole Creek	183	1	-
16	Upper Mersey Valley	1	1	-
	MIDLANDS			
17	Bothwell	10	10	-
18	Central Highlands	6	6	-
19	Hamilton	7	7	-
20	Jordon River	2	2	-
21	Mt. Mercer	1	1	-
22	Oatlands	2	2	-
	EASTERN TASMANIA			
23	D'Entrecasteaux Channel	3	3	-
24	Derwent River	2	2	-
25	Douglas River	1	1	-
26	Flinders Island	6	5	-
27	Gray	1	-	-
28	Maria Island	6	-	-
29	Mount Wellington	3	-	-
30	Tasman Peninsula	2	2	-
	S.W. TASMANIA			
31	Acheron River	Reported	-	4
32	Andrew River	Reported	-	10
33	Bubs Hill	13	-	4
34	Butler Rivulet	5	-	-
35	Carbonate Creek	Sinkholes	-	-
36	Cheyne Ra.	Probable	-	-
37	Cracroft	15*(e)*	-	-
38	Danta Rivulet	11*(f)*	-	-
39	Eagle Creek	Sinkholes	-	-
40	Erebus-Denison	Huge sinkhole	-	-
41	Everlasting Hills	Sinkholes	-	-
42	Franklin River	27+	14	-
43	Giblin River	Unlikely	-	0
44	Goodwin Creek	Reported	-	-
45	Gordon-Sprent	11	-	-
46	Hastings	27	-	-
47	Hazell Creek	Reported	-	-
48	Hibbs River	Reported	-	1
49	Jane River and Goldfields	9	-	3
50	Jukes-Darwin	5	-	-
51	Junee-Florentine	335	-	40
52	Ida Bay	133+*(g)*	-	-
53	Isle de Golfe	Reported	-	-
54	Lightning Plains	1	-	-
55	Louisa Bay	2	2	-
56	Low Rocky Point	1	1	-
57	Lower Gordon	10	-	3
58	Lower Olga	Reported*(h)*	1	-
59	Mount Anne	8	-	-
60	Mt. Ronald Cross	10	-	-
61	Mulcahy Bay	1	1	-
62	Nelson River	2+	-	4
63	New Harbour	1	1	-
64	New River (incl. Precipitous Bluff)	2*(i)*	-	3
65	Nicholls Range	4	1	-
66	Osmiridium Beach	1	1	-
67	Port Davey	3	3	-
68	Queen-King	A few, small	-	-
69	Rocky Boat Inlet	10*(j)*	3	-
70	Scotts Peak	3	-	-
71	Surprise Bay	10	-	-
72	Tim Shea	Small	-	-
73	Upper Loddon River	1	-	-
74	Weld River	7	1	-
75	West Maxwell-Algonkian	Sinkholes	-	1

NOTES:

(a) includes sinkholes; information from Matthews (1979) and notes *(b)* to *(j)*.
(b) caves and shelters, sandstone and limestone, on the Tasmanian Archaeological Site Register kept by the National Parks and Wildlife Service, Tasmania, and from Kenneally (1980).
(c) total number of caves entered during H.E.C. caves survey May 1983.
(d) Kiernan, 1980, *Southern Caver* Apr. 1980 : 3 - 9.
(e) Supplemented from Gillieson & Taylor, 1980.
(f) Supplemented from Kiernan, 1981, *Southern Caver* Jan. 1981 : 50 - 59.
(g) Matthews (1979) gives 33 caves; note in *Southern Caver* Aug. 1982 says "As a result of this (survey) over one hundred new entrances have been found....."
(h) Kiernan, 1979, *Journal Sydney Speleological Soc.* 23(8) : 201.
(i) Kenneally, 1980.
(j) Poulter, 1981.

The Swaziland Symposium on Palaeoclimates of the Southern Hemisphere, and Johannesburg Workshops on the Late Cainozoic of Southern Africa.

Between 29 August and 5 September 1983, the South African Society for Quaternary Research (SASQUA) held an 'International Symposium on Late Cainozoic Palaeoclimates of the Southern Hemisphere' in Mbabane, Swaziland, in conjunction with the Swaziland National Trust Commission, followed by concurrent workshops in Johannesburg: 'Evidence for Late Quaternary Climatic Change in Southern Africa' (W1) and 'Evolution and Climatic Change - evidence from the African Faunal and Hominid Sites' (W2).

The Symposium was held in the Royal Swazi Spa, and the careful planning of the meeting prevented most of the participants from indulging in the therapeutic waters of the spa. The Symposium brought together scientists, from 17 nations, actively reconstructing past environments in the Southern Hemisphere. Forty-four papers were presented, eight of which were extended to allow the review of previous work. The Symposium began with four papers dealing with various aspects of palaeoclimatology. Then followed geographically arranged sessions presenting both physical and biological evidence for climatic change from Antarctica, South America, New Zealand and Australia. The remaining half of the Symposium was devoted to Africa, beginning with hominid sites, evidence for climatic change in southern and eastern Africa, and finally aridity in the Namib Desert. Many of the papers presented at the Symposium will be published in a special volume of Palaeoecology of Africa, published by Balkema.

Workshop W1 complemented the Swaziland meeting, concentrating on data that can be interpreted as evidence for climatic change. The Late

Quaternary was split into 6 time zones beginning with the last interglacial defined by stage 5 of the deep-sea oxygen isotope record. Summaries, organized according to both time zone and one of four geographic regions (Cape, Transvaal, Kalahari, Namib), were presented by four rapporteurs. After each summary, individuals who had worked in the various areas were asked to either elaborate on or dispute the summary, and then the meeting was thrown open for discussion. This process was repeated 20 times, the product of 5 time zones (1 and 2 were amalgamated) and 4 geographic regions, all in 2 days. This breathless pace allowed little time for non-locals to digest the data but fortunately a comprehensive book of abstracts was provided. Unfortunately, there are no definite proposals to formally publish the abstracts.

The two days of Workshop W1 were either side of a truly wonderful day spent visiting the hominid sites near Johannesburg. We visited Sterkfontein, Swartkrans and Kromdraai, being directed by scholars actively working on the palaeontology and sedimentology of the sites. Many of the data extracted from these sites were discussed in Workshop W2, and those of us trapped behind the barrage of data in W1 were fortunate to hear a summary by P. Tobias of the important conclusions apparently reached in the 'hominid workshop'. I say apparently because the summary was a little too tidy to truly reflect the outcome of a discussion by a room full of individualists about a controversial topic such as the relationship between hominid evolution and climatic change.

The participants in W2, apparently to a homo, accepted that continental drift was a significant force over the time scale being considered, that there had been some 1700m of uplift on the eastern side of southern Africa since the end of the Miocene, major climatic changes had

occurred, that the molecular clock accurately indicates late divergence between the African great apes and man, and most importantly climatic change is the only trigger for significant speciation. Present estimates for the three major branchings of the hominid lineage are: gibbon divergence 12 ± 3 Ma; orang-utan divergence 10 ± 3 Ma; and man-African ape divergence 5 ± 1.5 Ma. Resolution of the Mid-Miocene time scale makes difficult any correlation between gibbon and orang-utan divergence with temperature oscillations recorded in the behaviour of Antarctic ice sheets. The terminal Miocene cooling appears to correlate with the divergence of man from the African apes.

The latest divergence, between Homo and the australopithecines between c. 3.2 and 2.6 Ma is correlated with the first appearance of a Northern Hemisphere ice sheet. At the Swaziland meeting J. Mercer had thrown doubt on the accepted date of 3.2 Ma for this ice sheet development and G. Denton presented new data from Antarctica which suggest that we have much more to learn about the Mid-Miocene events correlated with divergences in the fossil record. The climate-controlled divergence hypothesis needs to be kept alive, for as new data come from the polar regions this fascinating idea will need to be re-evaluated.

Rather than attempt either a synthesis of data presented at these various meetings or an exhaustive discussion of the content of papers (many of which will be published), I shall now turn to those aspects of the meetings that had a considerable impact on me.

The lively discussions testify to a vigorous community of Quaternarists working in southern Africa and the Southern Hemisphere more generally. New data are being actively collected and old data being re-evaluated. The exciting archaeological finds of the last century have

contributed to this vigour, and have led to many detailed studies of cave deposits both palaeontologic and sedimentologic. Sites like Border Cave, Boomplaas Cave, Die Kelders Cave, Klasies River Mouth Cave and Wonderwerk Cave have yielded rich faunal and stone tool assemblages, human remains, charcoal, pollen, seeds, and dramatic changes in sediments have been detected. Among the many excellent studies of these cave deposits, the exciting work of D.M. Avery promises to give quantitative estimates of temperature from micro-mammal remains. When combined with isotopic analyses of speleothems (like those at Cango) we may have long and accurate records of temperature from 'onshore'.

The quantitative estimation of Quaternary climates poses the greatest challenge to palaeoclimatology. The exploration of methods for such estimation was a recurring theme at both the Swaziland and Johannesburg meetings. Meridional temperature gradients were discussed as a means of estimating changes in the vigour (and therefore windiness) of the atmospheric circulation, paying special attention to the monsoon system; modern patterns of wind and sand transport acceleration in Australia were presented as analogues of last glacial winds; modern correlations of vegetation and climate were used as ecologic analogues of Late Quaternary conditions over a wide latitudinal range in Chile; and isotopic composition of modern groundwaters provided analogues for past temperatures calculated from carbonates.

One recurring blemish to the various meetings was what we might call 'neo-Alpinism', that is, a search for a universal master stratigraphic column. The four-glacial sequence of The Alps provided a master record for decades. Now the oxygen isotope record of the oceans has displaced the notion of four glacials but is in danger of being uncritically used as a

master log against which every change on land can be confidently correlated. The length of records preserved in core sediments in southern Africa tempts correlation with the equally long records of the oceans but during the W1 Workshop very little attention was given to the value of tying all 'onshore' observations to an offshore record which has been synthesised from cores taken in both tropical and extra-tropical waters. The particular danger does not just lie in the curve-matching exercise but in the assumption that climatic conditions can be accurately read from cave sediments and then correlated with an isotope record that records climate through a number of complex filters.

Some success has been had at Howiesons Poort, in the Southern Cape, where the isotopic composition of midden shell associated with the Middle Stone Age II has been used to correlate the cultural sequence with the $\delta^{18}O$ record from core RC11-120 ($43^{o}31'S$, $79^{o}52'E$), well to the south and east of South Africa. Contradictory results, however, come from palaeoecologic interpretations of MSA midden shells from Klasies River Mouth Caves.

Considerable debate surrounded the use of cave roof spall, sediment interpreted in many cases as plaquettes à gel, the result of ice wedging and frost shattering, in areas that do not now experience freezing temperatures. The spall zones have been correlated with the cold intervals of the oceanic isotopic record. But if the spall zones are the result of salt weathering, as seriously suggested by some who have visited sites such as Border Cave, then 'neo-Alpinism' in this case is in difficulty. The tendency to make correlations with the oceanic record is not particularly common in Australia, perhaps because most of the Quaternary sequences in Australia are short. The uncertain steps being taken in southern Africa

towards a firm chronology which extends beyond ^{14}C should be followed carefully by workers in Australia.

Discussions of the Holocene benefited from a large amount of data from many sites, making it possible to speculate about regional variations of climate at various times. A masterly review by P. Tyson of the variations of modern climate of southern Africa served as a valuable analogue of Holocene climates. Summaries of Pleistocene climates, by contrast, did not emphasise regional differences, perhaps because there are fewer sites and many workers attempt to extract a few long records rather than many shorter ones. The Last Glacial Maximum has been documented exceptionally well, with glimpses of regional conditions in the Kalahari.

The hot-house atmosphere of the various meetings was alleviated by a post-workshop excursion to the Namib Desert. A flight to Windhoek provided an excellent view of the dunes of the Kalahari, near Upington in the south and along the western border of the dunefield where longitudinal forms dominate, very like those in the northern Simpson Desert. When travelling by road through the Kalahari, the similarity with the wetter parts of the Australian dunefield became clear. The life-forms of plants on dunes in the two areas are remarkably similar.

The Namib dunefield, by contrast, presents an entirely different aspect. The very high dunes of this hyper-arid area have an equivalent (i.e. spread out) sand thickness of 10-20m compared with 1-4m in the Kalahari and Australian dunefields. One question recurred during the field trip: given that interior Australia has been much drier and windier in the past, why haven't the dunes of Australia grown to the same size as those in the Namib? Sand supply is only a limit in parts of the Australian dunefield, the dunes of the Simpson being underlain by many metres of

un-deflated sandy alluvium. Perhaps the answer is that Australia has never been as arid or as windy as the Namib. The world's dunes with small equivalent sand thickness occur in areas that are now semi-arid or arid, while the truly grand dunes lie in areas that are either arid or hyper-arid. This difference may have always prevailed even though all dunefields have experienced more arid phases.

There was to be no long-lived respite from meetings while contemplating the Namib, for a half-day drive to the old German town of Swakopmund saw us once again closeted to discuss the Namib's features and antiquity. The Cainozoic geology of the northern and central Namib is not dated absolutely, but the litho-stratigraphy is now well known thanks to the energetic work of J. Ward. Absolute dates from a similar sequence south of the Orange River in the diamond mining area was presented at the Swakopmund colloquim, allowing estimation of the age of events throughout the Namib. It seems that dunes were widespread in the Early Tertiary, represented by the Tsondab Sandstone Formation. This evidence for aridity before the establishment of the Benguela Current suggests that the climate of the area is not simply linked with this cold body of water.

The return journey to Johannesburg gave us a view of the landscape from the stark beauty of the Namib, to the flat high-level dolomite plains of Namaland, the dunes and wildlife of the Kalahari, the exciting archaeological sites of Wonderwerk Cave and Kathu Pan, and the chronologically enigmatic Taung site where the first Australopithecus skull was found.

The meetings and excursions were all held under the auspices of SASQUA, an organisation at least partially responsible for the vigour of Quaternary research in southern Africa. As we traversed a landscape so

similar to Australia's, it was impossible not to reflect that the increasing health of Quaternary studies in this country (and New Zealand) could be enhanced and maintained by the newly constituted Australasian Quaternary Association. There is currently a strong tendency to shy away from formal organisations, a tendency that I endorsed at the inaugural meeting of the Geomorphology Group in 1983. But SASQUA is formal and so attracts funds that chase respectability. Without such funds the highly successful meetings described herein would not have been possible.

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ABORIGINAL OCCUPATION OF THE LAKE MUNGO REGION DURING MID-LATE HOLOCENE TIMES

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INTRODUCTION

The inland Australian Aborigines are well known as a nomadic people. Their movements were never hapless affairs, however, but a mixture of logical and encultured responses to changes in the environment. Often seasonal, the movements of tribes allowed people to exploit a wide range of resources in what the sedentary European culture saw as a harsh environment. This adaptation to a wide range of environments can possibly best be seen at Lake Mungo in western New South Wales where Aboriginal occupation appears to have continued from over 40,000 years ago until the coming of Europeans late last century. During this time the lake itself has changed dramatically. Once 8 metres deep and a rich lacustrine environment, it is now a dry saltbush-covered lake floor in the centre of one of the driest areas of N.S.W. Judging by the amount of archaeological remains which can be found, dating to a period over the last 6,000 years when it has been at its driest, its value as a food providing resource seems to have remained high.

The widely accepted view, that Lake Mungo was only occupied until it became dry 15,000 years ago, is based on studies which concentrated on the lunette. Few appear to have examined the artefacts exposed on the dry lake floor. The existence of artefacts on the lake floor is in itself an indicator of human occupation in comparatively recent times. However, the lake floor artefacts would need to be examined systematically in order to determine their significance. This was our aim.

DISCUSSION

1) Transect of the lake floor

In order to obtain an estimate of relative density of Holocene occupation we completed two partial transects of the lake floor, noting stone artefact distribution, occurrence of hearths, evidence of fossil bones, emu egg shell and molluscs. Each transect was 25 metres wide and extended from the western edge of the lake 5 kilometres into the centre of the lake floor in an easterly direction (Figure 1). The total area covered by one such transect was 12.75 hectares. Over 630 artefacts were found, 80% of them coming from the first kilometre of the transect (Figure 2). These stone tools were generally not retouched but 10 showed evidence of edge grinding. These ground tools were found 300 to 1,000 metres west of the lake edge and were usually associated with deflated scalds. It is possible that grinding stones have been preferentially collected, due to their size and obvious form, by visitors in the camping area on the western edge of the lake.

A large number of cores were seen on the lake floor. Many of these appeared to be large enough to provide more flake material than had been extracted from them. With the source material for the silcrete tools being some distance away, the resident archaeologist Peter Clark suggests that cores were taken to various regularly frequented sites and left there for later use. This practice bears on the positioning of sites in relation to resources - it means that people can afford to live further from source materials and closer to water and/or food, or, more importantly, increase the size of their range. Such a practice has implications for site distribution in all geographical areas, because it sheds light on the priorities given to various resources by a given community. As such it could well receive greater attention from researchers.

The 17 hearthsites found were also concentrated along the western edge of the lake floor, with none more than 700 metres out. These hearths consisted of termite (Drepanotermes perniger) mound material. All hearths made of termite mound in this area are believed to be younger than 5,000 years old (P. Clark, personal communication). The presence of the hearths suggests occupation of the Mungo area during the upper Holocene. The Willandra Creek and lakes region was part of the tribal territory of the Barindji people at the time of European arrival and dried lakes like Mungo would have been major features of the landscape.

2) Scald Survey

The western rim of the lake floor contains a concentration of erosional features known as scalds, where the sandy top soil has been removed by wind and water to reveal a small clay pan. These scalds are typically elongate with their long axes aligned N-S parallel to the edge of the lake, and may be up to 100 metres long. They are not vegetated and lie up to 50 cm below the surrounding soil surface. The surface of the scalds shows an increase in occurrence of both stone artefacts and hearths. These scalds were studied in detail, one of which we describe here. Its location is shown on Figure 1. Figure 3 shows the position of artefacts, hearths and hearthstones on the scald. The scald was 30 m by 12 m, and approximately 30 m^3 of soil material had been eroded from its surface. Table 1 shows artefact numbers and type from the scald. The surface of 100 m^2 of uneroded land adjacent to the scald showed one tenth of the artefact concentration and no hearths.

The two hearths which were present in the scald show little sign of disturbance and are believed to be in situ. Many of the hearthstones and artefacts, however, may have been derived from the overlying 30 m^3 of topsoil and may have been let down onto the surface of the claypan as the overlying soil was removed. The deflation hypothesis suggests that the concentration of artefacts found on this and numerous other scalds is primarily due to their accumulation over time rather than to any association of hearths and artefacts due to human activity. It could equally well be said that concentrations of artefacts are not the product of deflation but simply reflect the naturally greater level of all human activity, including stone tool making, which would take place whilst sitting around a campfire. Excavation of uneroded areas adjacent to scalds would be one way to determine whether the scald surface represents a discrete horizon or not.

A compromise can be reached with the information at hand. It is reasonable to assume that there would be some concentration of artefacts around a hearth as it was being used. About 7 m north of the southern end of the scald (Figure 3) there can be seen a large concentration of hearthstones, spread over about 10 m^2, which are not associated with an in situ hearth. This suggests that the hearth which originally contained these hearthstones may have deflated onto the scald surface, losing much of its organisation on the way. If a concentration of artefacts was originally associated with this hearth then they too would have deflated onto the clay pan. In this way both the real association of tools and hearths as well as the action of deflation can be seen to have acted in increasing signs of occupation in these areas.

3) lunette transect

A transect across the Lake Mungo lunette is shown in Figures 1, 4 and 5. The dunes in the transect area are heavily gullied with exposed dipping aeolian strata. The western lower area is now covered with aeolian sands and the upper west-facing slopes are channelled and filled with detritus, by fluvial processes. Between D and E on Figure 4, an episode of channel filling with aeolian clay sands later than the formation of the exposure shown in the transect is visible. This episode occurred before the most recent aeolian sand and may be contemporaneous with the Zanci Unit.

A stone tool assemblage for an area of 200 m^2 of the Mungo Unit was investigated (Figure 5). Stone density was 0.62/m^2 which is significantly greater than the tool density on the claypan which was 0.22/m^2. The relative proportion of tool types was also different (Table 1). This would reflect the different ages of the sites, with the lake-floor claypan less than 5,000 years old and thus contemporary with the 'small tool tradition', whereas the Mungo Unit is older than 17,000 B.P. and correlates with the 'core and scraper industry'. Absence of cores on the Mungo Unit may be due to pilfering by visitors to the Mungo National Park.

On the Mungo Unit, fish bones, emu egg shells, shell fish and small mammal bones were found, indicating that the diet of the Aboriginals of Lake Mungo was varied. Some of the food could only be exploited seasonally. Emu eggs are available only in late winter and young golden perch in late spring and early summer. It is therefore suggested that the site was at least occupied during late winter and also in late spring to summer.

CONCLUSION

The results of our field work make it possible to say something about human occupation of Lake Mungo over time. Our results are consistent with the notion proposed by Peter Clark, that Lake Mungo was regularly occupied during at least the latter part of the Holocene. The possibility that the lake was more heavily occupied during Holocene than Pleistocene could not be demonstrated by our fieldwork, yet it warrants further investigation.

From ethnographic sources, the economy and diet of the Darling River Aborigines may have been similar to that of the Pleistocene inhabitants at Lake Mungo, with the important exception of seed grinding. During the winter the Aborigines would move from their river based camps, split into smaller groups and cover vast areas, hunting animals and gathering seeds from the salt bush and other edible species. Judging from this evidence it is unreasonable to make the assumption that Lake Mungo is only of significance as a Pleistocene site.

The Holocene occupation of Lake Mungo would have an important implication. Since Lake Mungo has the earliest well dated evidence of human existence in Australia, it may well have the longest record of continual occupation of one place. If so, it may be possible to trace cultural developments over extremely long periods of time.

ACKNOWLEDGEMENTS

We are grateful to the National Parks and Wildlife service Staff at Lake Mungo National Park, especially Peter Clark, Resident Archaeologist, who encouraged us to attempt this exercise.

Table 1

Percentage Composition of Stone Artefacts

Artefact type	Scald/ Claypan	Lunette/ Mungo Unit	Lake floor Transect
Flakes	59%	80.5%	-
Cores	9%	-	-
Scrapers	27%	3.3%	-
Others including Points, ground tools etc.	5%	16.2%	-
Density m^{-2}	0.22	0.62	Total transect: 0.005 First 1000 m 0.02

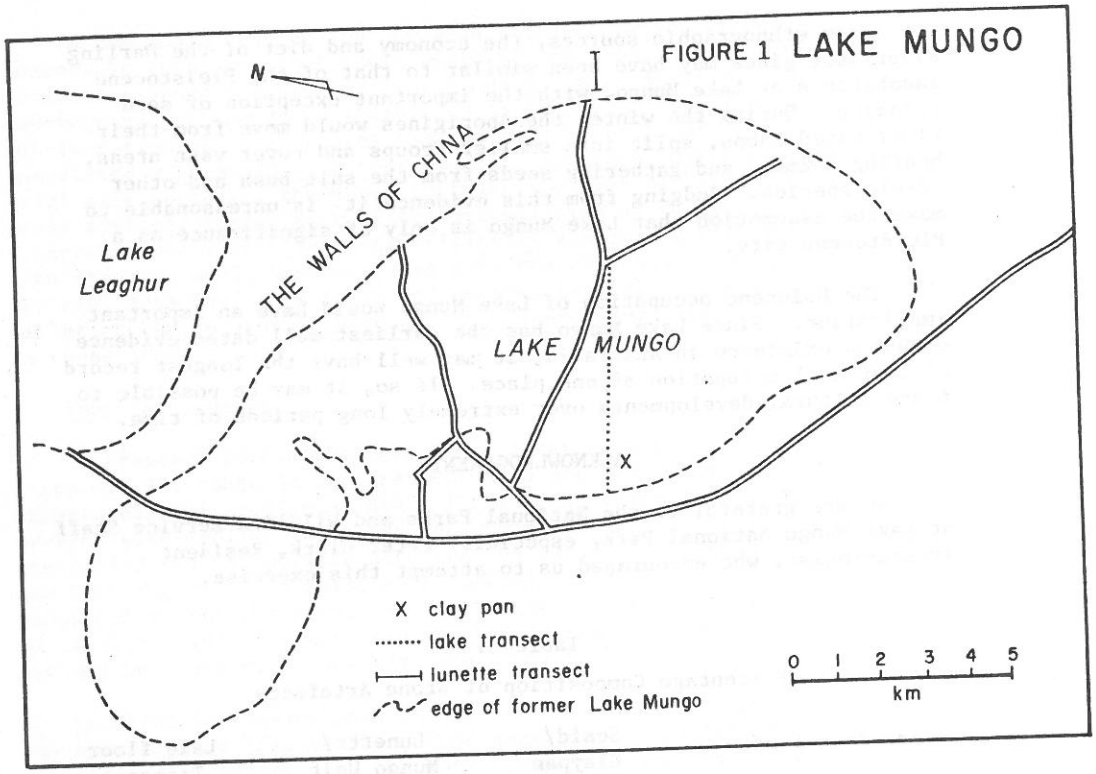


FIGURE 1 : Lake Mungo

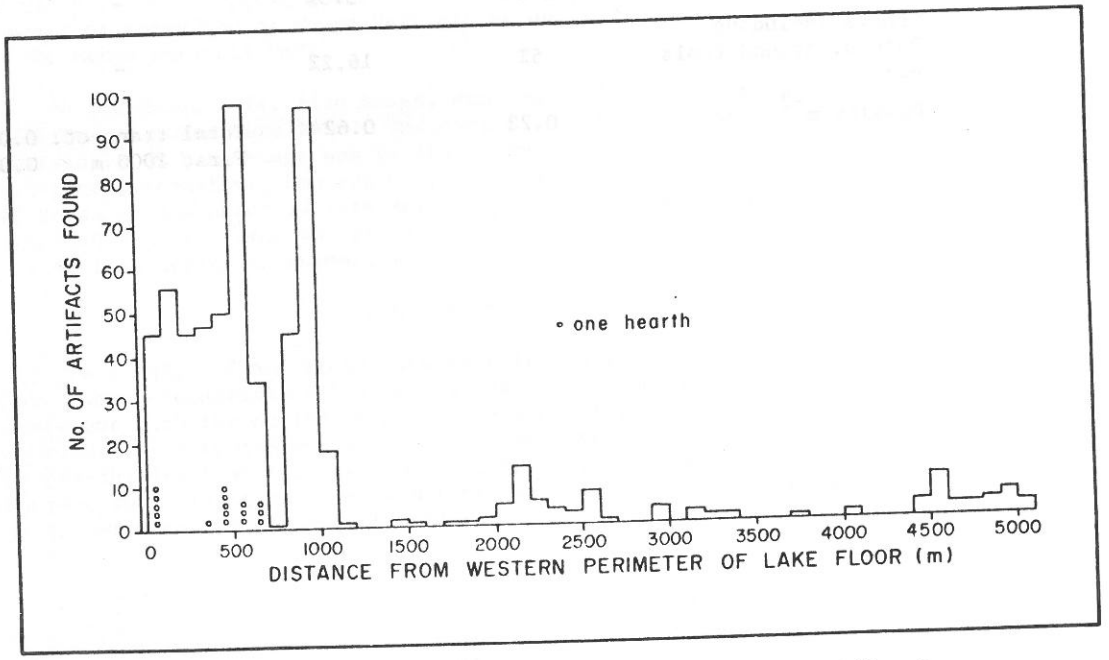


FIGURE 2 : Concentration of artifacts and hearths per 100 metres along lake floor transect.

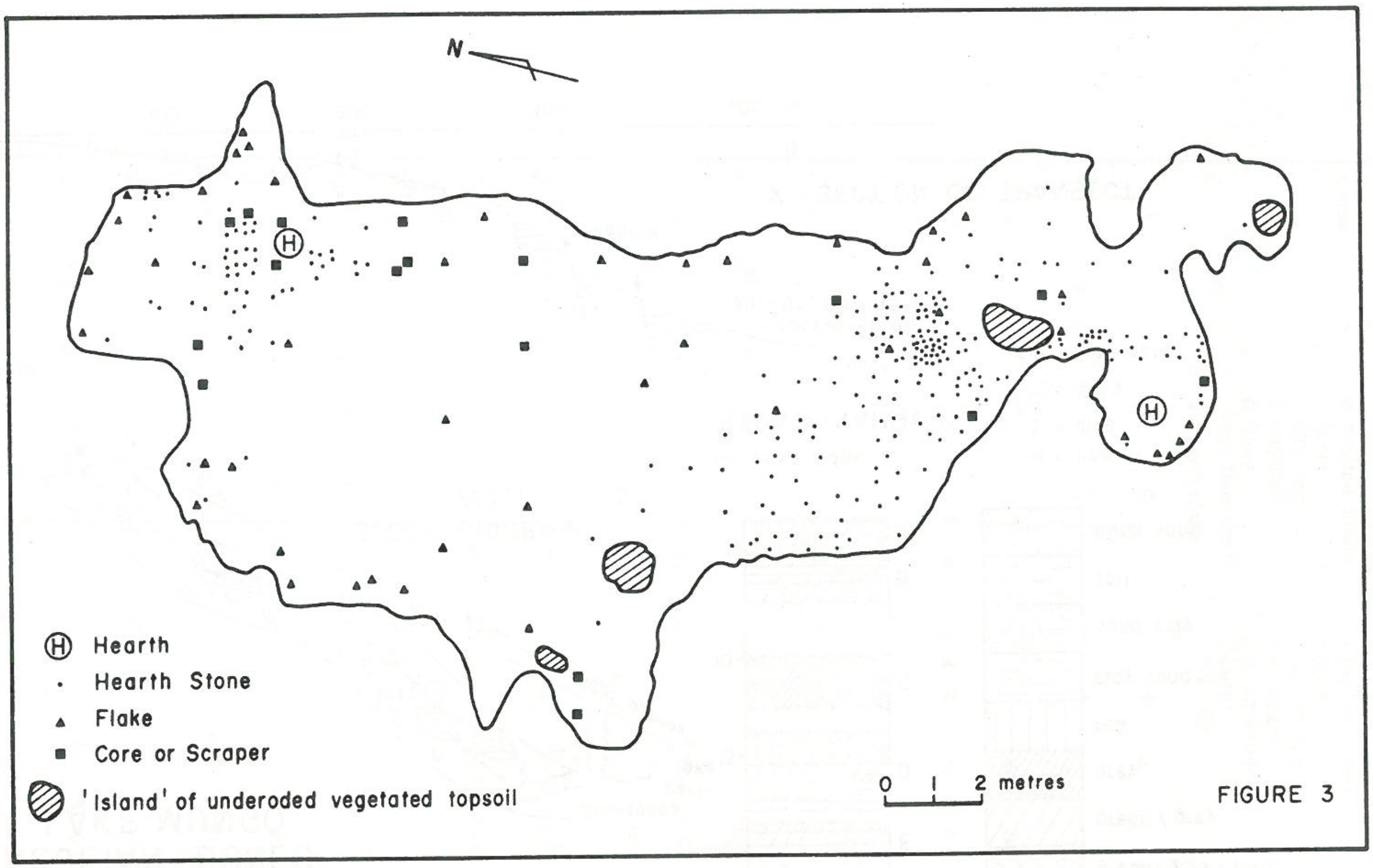
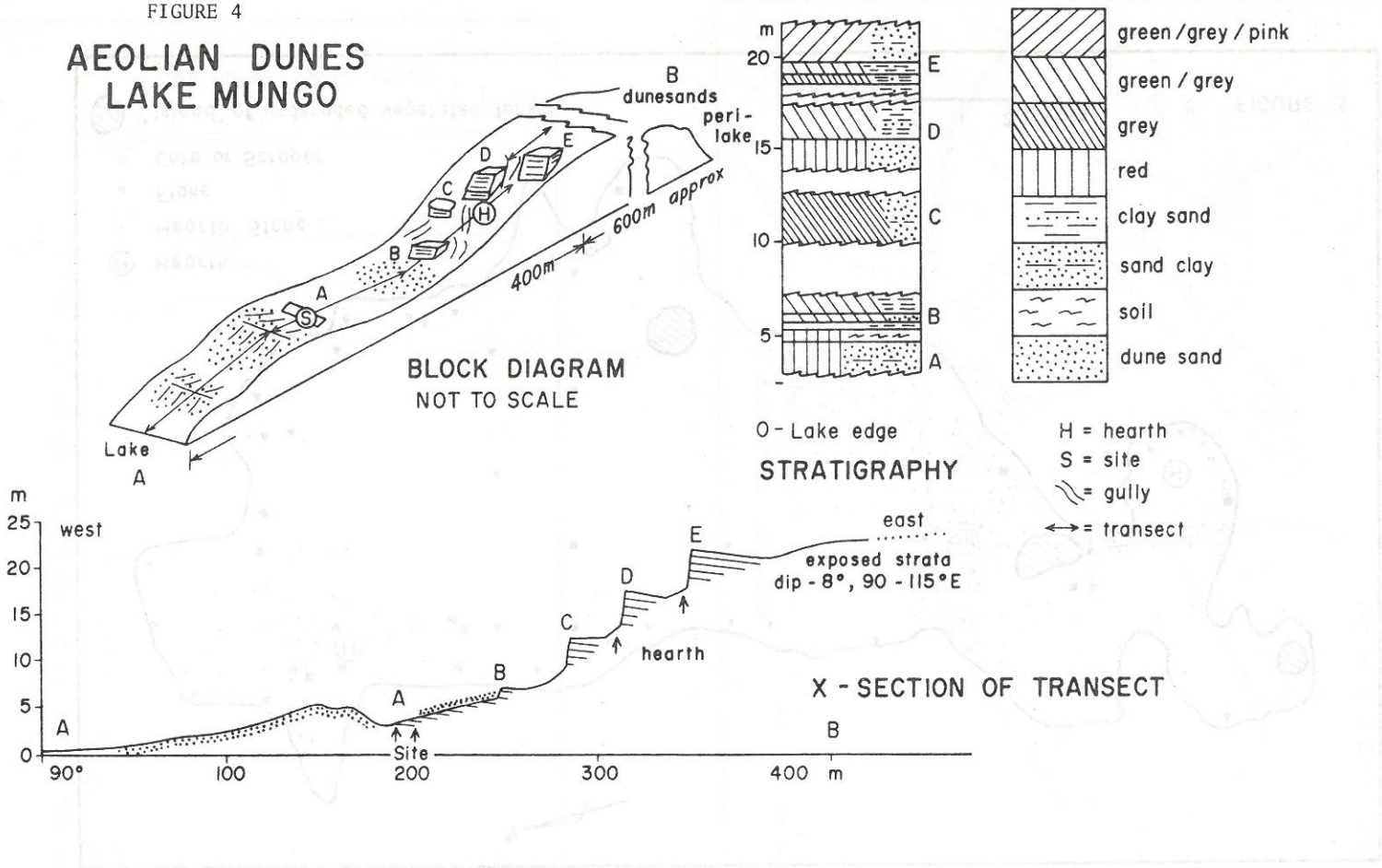

N
Hearth
Hearth Stone
Flake
Core or Scraper
'Island' of underoded vegetated topsoil
0 1 2 metres

FIGURE 3

FIGURE 4


AEOLIAN DUNES
LAKE MUNGO
B
dunesands
peri-
lake
600m approx
400m
BLOCK DIAGRAM
NOT TO SCALE
Lake
A
m
20
15
10
5
E
D
C
B
A
green / grey / pink
green / grey
grey
red
clay sand
sand clay
soil
dune sand
0 - Lake edge
STRATIGRAPHY
H = hearth
S = site
= gully
= transect
m
25
20
15
10
5
0
west
east
exposed strata
dip - 8°, 90 - 115°E
hearth
Site
90°
100
200
300
400 m
X - SECTION OF TRANSECT

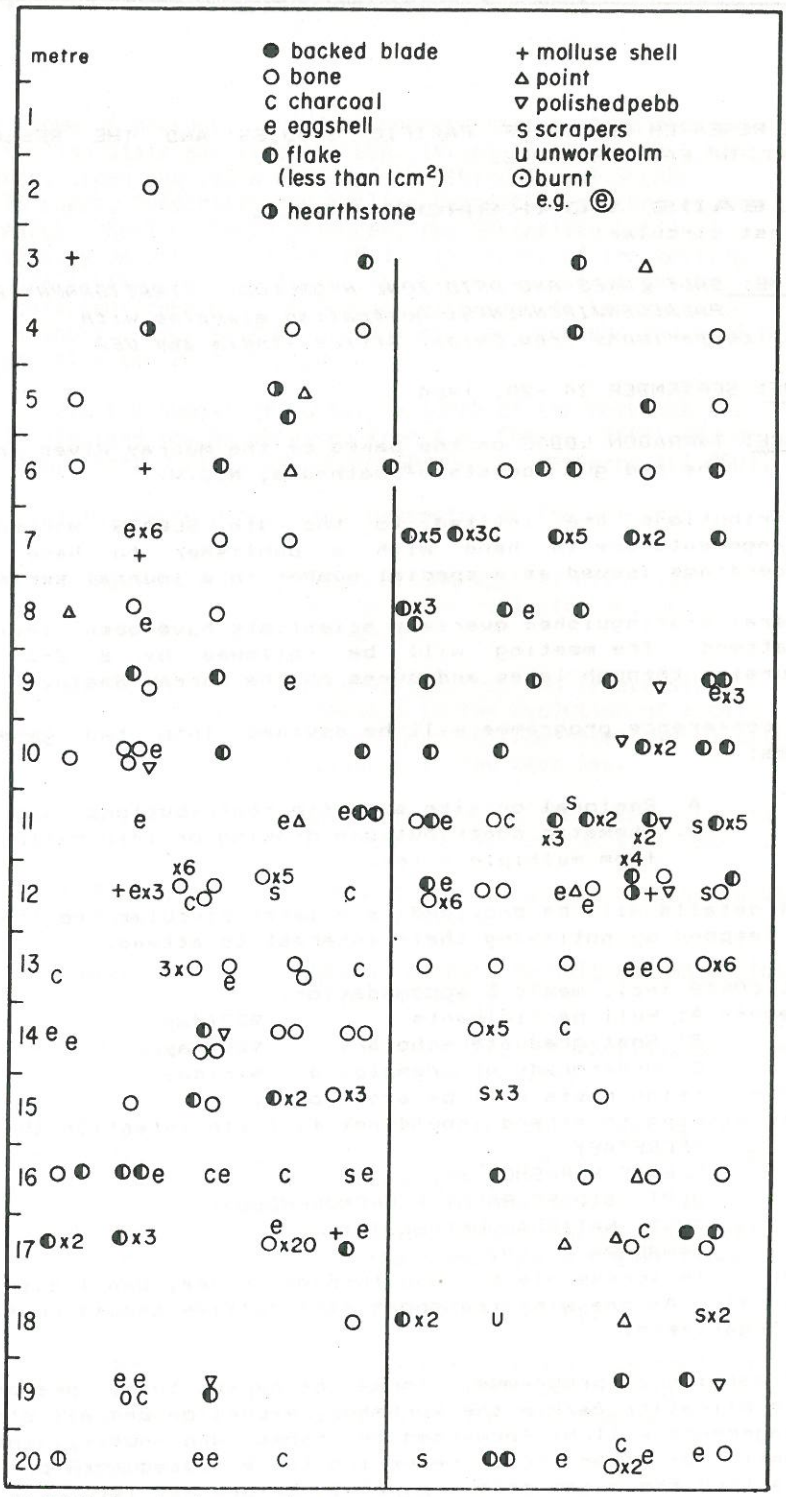


FIGURE 5 : Archaeological remains from 200 square metres of the Mungo Unit.

Salt Lakes, Evaporites and Aeolian DepositS.

THE RESEARCH SCHOOL OF PACIFIC STUDIES AND THE RESEARCH SCOOL OF EARTH SCIENCES

SLEADS WORKSHOP 84..

(First circular)

THEME: *SALT LAKES AND ARID ZONE HYDROLOGY, STRATIGRAPHY AND PALAEOENVIRONMENTS: Australian examples with comparisons from China, Africa, India and USA.*

TIME: SEPTEMBER 24 -28, 1984

PLACE: TARRAGON LODGE on the banks of the Murray River in the red gum forests of Mathoura, N.S.W.

Contributions are invited to the 4th SLEADS Workshop. Arrangements are in hand with a publisher to have the proceedings issued as a special number in a journal series.

Several distinguished overseas scientists have been invited to attend. The meeting will be followed by a 2-3 day excursion through lakes and dunes of the Murray Basin.

The conference programme will be divided into two general parts:

A. Regional or site specific contributions, and,
B. Thematic contributions drawing on information from multiple sites.

Full details will be provided in a later circular to those who respond by notifying their interest to attend.

FULL COSTS incl. meals & accomodation:

Category	A: Full participants	$27/day
	B: Post-graduate scholars	$20/day
	C: Undergrads or unemployed	$16/day

NOTE excursion costs will be additional.

Those wishing to attend should notify their intention to :

SECRETARY
SLEADS WORKSHOP 84,
DEPT. BIOGEOGRAPHY & GEOMORPHOLOGY
AUST. NATIONAL UNIVERSITY
CANBERRA 2601

Mathoura is accessible by road through Echuca, Deniliquin or Tocumwal. Anyone with transport difficulties should contact the Organizers.

Full details of programme, format of papers to be prepared for publication *before* the Workshop, excursion and all other arrangements will be forwarded to those who notify their intention of attending by returning the enclosed form or by contacting the organizers separately before May 1st.

Phone inquiries to the organizers:
T Torgersen 497407; D.Williams 492153; J.M.Bowler 494361

SLEADS Workshop 1983

Some 65 persons, including representatives from each Australian state and from the USA, Israel, Switzerland, China, France, Japan and India attended the third annual SLEADS (Salt Lakes, Evaporites and Aeolian DepositS) workshop at the Research School of Earth Sciences, the Australian National University on October 17-18, 1983. The theme of the meeting was "Salt Lakes in Arid Australia: hydrology, stratigraphy and palaeoenvironment". A one-day excursion to Lakes George and Bathurst, organised by Jim Bowler, Joe Jennings and Gurdip Singh attracted 20 participants.

A limited number of summary volumes of the workshop are available, and may be obtained from A.R. Chivas, RSES, ANU or P. De Deckker, RSPacS, ANU (both GPO Box 4, Canberra ACT 2601).

The following papers were presented at the workshop:

J.M. Bowler	Temporal and spatial diversity: key to basin evolution and modern dynamics.
J. Gat	Regular (cyclic) and irreversible features in the evolution of a salt lake - lessons from recent meromicitic episodes in the Dead Sea.
W.D. Williams	Why do regional differences occur in the fauna of Australian salt lakes ?
H.R. Burton J.R. Ferris	Calculations of in situ density values for salt lakes.
T. Torgersen	Dynamic effects on salt and water loss in playa lakes.
P.G. Macumber	Groundwater-lake interactions and some economic implications.
W. Ullman H. Baadsgaard	Transport of solutes in saturated saline soils: evaporation rate from Lake Frome.
G. Allison C. Barnes	Estimation of the rate of evaporation from the normally 'dry' Lake Frome.
R. Schmid	Lake Torrens hydrology.
T. Torgersen M.R. Jones A.W. Stephens D.E. Searle W. Ullman	Low-latitude hydrologic changes during the last glacial cycle: evidence from Quaternary Lake Carpentaria.

D. Williams	Pleistocene stratigraphy of the southeastern Lake Eyre Basin.
J.A. Dulhunty	Evidence of salina-bed instability at Lake Eyre North.
J. Bye	The hydrology of Lake Eyre during the great flooding of 1974-1979.
J. Bye	Film on Lake Eyre.
R.W. Galloway	Some aspects of closed lakes in Patagonia.
J. Bowler Yuan Bao-yin	Palaeoclimate, tectonic relief and Quaternary processes: constrasting examples of evaporite production from NW China and central Australia.
J.A. McKenzie G.P. Eberli	Carbonate sedimenation in Great Salt Lake, Utah and the Late Pleistocene-Holocene climatic record in the oxygen-isotope stratigraphy.
R.M. Forester	Ostracode records of lake-level changes and palaeoclimate during the last 30,000 years in the Great Basin, USA.
J.P. Peypouquet P. Carbonel	On some fundamental principles for the determination of hydrological palaeoenvironments based on ostracods from non-marine sediments of Africa.
A. Chivas P. De Deckker	Chemical composition of ostracod shells as environmental indicators.
G. Taylor P.H. Walker	Some aspects of Miocene climates in the Cooma region.
T. Moulton	Water chemistry of Hutt Lagoon, W.A.: a seasonally-dry coastal salt lake.
M.E. Longmore B.M. O'Leary J.G. Luly	Redistribution of modern sediments and pollen on the floor of Lake Tyrrell, NW Victoria.
S. Kokot R. Frost A. Arakel	A preliminary study of the application of modern techniques for characterisation of silicified calcretes.
J. Bowler	Hydrologic control and evolution of arid-zone facies; evidence from a transect, Lake Frome to Lake George.
C.L. Adamson	Economic aspects of saline lakes in Australia with particular reference to gypsum.
C. Jacobson R. Abell	The groundwater factor in lake water-balances: evidence from three lakes in SE Australia.

QUATERNARY RESEARCH AT JAMES COOK UNIVERSITY OF NORTH QUEENSLAND

David Hopley

The Department of Geography at James Cook University of North Queensland is maintaining a strong interest in the Quaternary development of the Great Barrier Reef. A four year programme funded by AMSTAC-FAP (MST) has just been completed during which some 32 holes have been drilled into 12 different reefs to an average depth of 13.5 m. Most were in the central Great Barrier Reef where the Holocene thickness appears to be greater than elsewhere and the Pleistocene was encountered on relatively few (7) occasions even though a number of holes reached depths of between 20 and 30 m. Results are being written up in part with Dr P.J. Davies (Bureau of Mineral Resources Canberra) who has operated a comprehensive parallel programme over the same period (see Davies and Hopley 1983, BMR J of Austral Geol and Geophys, 8, 237-251).

Mr Frazer Muir completed a pilot study on the use of Strontium: calcium ratios in corals to establish water temperatures, a technique successfully developed in Hawaii (Smith et al., 1979). Results from the GBR were all neagative and it is thought that the mainland influence is sufficient in this shelf reef complex to mask the temperature effect. Work may continue on the use of Sr:Ca to determine a freshwater index.

The research is continuing in modified form in 1984:

i) as part of a PhD programme Mr Trevor Graham is conducting research in the Innisfail area which involves reconstructing the palaeogeography of the outer reefs, shelf, fringing reefs and mainland barriers on this, the wettest part, of the Australian coastline. He is particularly interested in the reef-mainland interaction, i.e., the possibility of a mid Holocene high energy period prior to complete reef growth and the effects of mainland sedimentation and freshwater runoff on reef growth;

ii) Mr Roger Barnes is examining the structure of a windward fringing reef in the Palm Islands as part of an honours thesis;

iii) closely spaced drill holes are being put down on nearshore Pandora Reef to establish horizontal variability in reef structure and inner shelf growth conditions.

Australian Working Groups for:

IGCP 200: Sea Level Correlations and Applications
INQUA Commission on Quaternary Shorelines: Indian and Pacific Oceans Subcommissions

Dear Colleague

Over the last few years in Australia the above working groups have operated with the same personnel on an informal basis, a development from the original ANZAAS Quaternary Shorelines Committee. Our contribution to both international programmes has been significant and culminated in the publication last year of our monograph "Australian Sea Levels of the Last 15,000 Years". This has been extremely well received overseas. Over 50 complimentary copies were sent out. In addition sales within Australia and overseas have been good and it is possible that a reprinting will be necessary soon.

Over the last few months a number of changes have taken place in both programmes. In addition a number of recent queries from members of the working groups indicate that not everyone is clear as to the structure and affiliation of each of the programmes. Clarification would appear useful.

IGCP 200: Sea Level Correlations and Applications

This is one of the UNESCO sponsored International Geological Correlation Programmes, and is a direct continuation of IGCP 61 (Sea Levels of the Last 15,000 Years). The project leader is Dr PA Pirazzoli, Laboratoire Le Geomorphologie, EPHE, 1 rue Maurice Arnaux, 92120 Montrouge, France. The secretary is Dr I Shannon, Department of Geography, University of Durham, Uk. There is an executive board of 12 members onto which I have been elected, giving Australia representation at the executive level for the first time. In addition I have also been appointed regional co-ordinator for Oceania and Antarctica.

The Australian participation with the same structure as for IGCP 61 has been approved by Professor JF Lovering, Chairman of the Australian IGCP Committee. The final report for the project is planned at the XII INQUA Congress at Ottawa, Canada in 1987. I hope that Australia can produce another co-ordinated publication similar to last year's monograph for this meeting.

INQUA Commission on Quaternary Shorelines

This is a continuing commission within the International Quaternary Union. The president is Dr Douglas R Grant, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada. The Commission is organised into 5 regional subcommissions. Australia belongs to the Pacific and Indian Ocean subcommission whose office bearers are:

President: Dr Torao Yoshikawa, 17-5 Wakaba-cho 2, Chofu-shi, Tokyo, Japan;
Vice President: A/Prof David Hopley, James Cook University;
Secretary: Dr HD Tjia, Dept of Geology, Universiti Kebangsaan Malaysia, Beg Barkunci 13, Bangi, Malaysia.

Professor Bruce Thom is the Australian correspondent for the subcommission. Bruce is also giving me great support in all the Quaternary shoreline activities.

Hopefully this clarifies the present structure of each body. If you have any further queries please write to me. I propose that the Australian working groups continue to work on an informal basis, with as many Quaternary shoreline researchers as possible involved. To that end if you have knowledge of anyone you think would be interested in our activities, please let me know. I shall try to provide a newsletter at least twice a year.

There are a number of news items for which some documentation is attached. The first item is the most important.

1 Doug Grant is keen for an 'informal' field meeting of the Quaternary Shoreline Commission (probably jointly with IGCP 200) in 1985. A meeting of IGCP 200 is being held at the end of May 1985 at the 5th International Coral Reef Symposium meeting at Tahiti. As a group of sea level workers will be in the S Pacific at this time a meeting in Australia could be opportune. I am tentatively suggesting that the meeting be after the Coral Reef Symposium and should start in Victoria making its way up the coast to Queensland, participants leaving for their overseas destinations directly from Townsville by Qantas. Arrangements are currently very tentative. Let me know your reaction. Offers of help are sought!

2 Indian and Pacific Oceans Subcommission: Inventory of Quaternary Shorelines. Prof Yoshikawa is proceeding to update the Indo Pacific data. The original shorelines map, produced by Don Colquhoun contains very dated (no pun intended) Australian data. Our 1983 report suggests that an update is required. Choice of sites and dates is important and it is best that the actual workers or at least the state representatives provide this information themselves. Please forward the data as soon as possible to either myself or Professor Yoshikawa (see enclosures).

3 As mentioned above an IGCP 200 meeting is planned for 1985 in Tahiti. Details are enclosed.

4 A number of other shoreline meetings are planned, including 1984 meetings in Argentina and Mexico. Details are enclosed.

5 The next INQUA Congress will be held in Ottawa, Canada in 1987. A field meeting centred on the Bay of Fundy is currently being considered.

6 New journal. Details are enclosed of a new journal, Litoralia which will be the official news agency of the INQUA Shorelines Commission. It will cover a wide range of coastal research. Its editor in chief will be Dr Charles Finkl of the Centre for Coastal Research in Florida. A number of the executive committees for the Shorelines Commission, and the IGCP 200 board, including myself, are on the editorial board. Please consider this journal for your future publications.

David Hopley

Review

INTERNATIONAL SYMPOSIUM ON COASTAL EVOLUTION IN THE HOLOCENE

Abstracts of Papers of this Tokyo Conference held August/September 1983 are available and consist of 159 pages of valuable information (Y5,000 including surface postage from Dr. Yoko Ota, Yokohama National University, Yokohama 240, Japan).

Two Keynote Addresses were given. Dr. P.A. Pirazzoli concluded that "a fossil notch may indicate both the position and approximate duration of a sea-level stand as well as the speed of the sea-level change." Dr. A.L. Bloom presented a mathematical analysis for separating Holocene tectonic movement from sea-level change in relative sea-level curves.

The other 30 papers deal with areas around the globe, but for this review those dealing with Australasia are chosen. In alphabetical order:

Kelvin Berryman (N.Z. Geol. Surv.): "Assuming that the terraces found at Mahia Peninsula are all that were formed with no intermediate terraces having been destroyed and that sea-level fluctuations are not responsible for the formation of small risers, then a co-seismic uplift model fits the data fairly well."

Eric Bird(Univ. Melbourne) and K. Koike (Japan): "Studies of coastline advance and retreat in relation to sea-level changes over the past few thousand years are extremely interesting, but nothing is likely to concentrate our attention more effectively than the prospect of a world-wide sea-level rise accelerating into centimetres per year and metres per century."

Jeremy Gibb (N.Z.): "Over the last 6.5 kyr sea-level has oscillated by a few decimetres reaching a 0.7 m maximum at 4.6 kyr with diminishing positive peaks at 3.4 kyr, 2 kyr, 1.4 kyr and 0.6 kyr. Possible negative peaks occur at 5.1 kyr, 4.2 kyr, 2.5 kyr, 1.6 kyr and 0.8 kyr."

Alan Hull (N.Z.) with five other authors headed by Yoko Ota of Japan deal with Holocene marine terraces on the N.E. coast of the North Island of N.Z. "Based on height distribution of Te Araroa Terrace dated c. 6000-7000 yBP, three tectonic regions can be distinguished. Regions A and C are characterized by high rate of uplift up to 3-4 m/1000 yrs. and interpreted as co-seismic uplifting area, related to subsidiary faults parallel to the trench axis. After the culmination of postglacial transgression, sea-level intermittently lowered to the present, accompanied by major earthquakes. It is very likely that minor sea-level rise took place c. 4500 yBP, resulting in Karaka Terrace over the whole area."

Bruce Thom (A.C.T.): "A recent attempt has been made to revise the envelope of relative sea-level prepared in 1975 by Thom and Chappell (1975). The revised envelope (Fig. 1) involves a shift to the left indicating relative sea-level for a given depth was older than previously thought prior to 6000 years ago (Thom and Roy, 1983)." "A zone of ±1 m is used in Figure 1 to bracket any oscillations since 6500 radiocarbon years B.P. This is a most conservative estimate and will undoubtedly be revised when new data are available."

N. Yonekura and seven other Japanese authors studied the southern Cook Islands. "There is no positive indication of higher holocene sea-levels than the present in Rarotonga and Aitutaki. Mangaia uplifted 2 m during last 3,000 years and Rarotonga and Aitutaki have been stable relative to Mangaia. The sea rose slowly from 6,000 to 3,000 years ago and reached the present level round 3,000 years ago in the southern Cook Islands."

Edmund D. Gill

N° 184 PALAEOHYDROLOGY OF LOW LATITUDE DESERTS

C.R. Lawrence, Geological Survey of Victoria, 107 Russell Street, Melbourne 3000 Vic., Australia.

Description. This Project is to investigate the deserts of the low-latitudes, between 35° N and 35° S, which include the Kalahari and Sahara deserts of Africa, the Atacama, Mojave, and Sonora deserts of the Americas, the Arabian, Gobi and Great Indian deserts of Asia, and the Australian desert, as well as some peripheral semi-arid regions. The overall objective firstly is to establish tight stratigraphic chronologies at local scale, particularly of lakes, playas, alluvial fans, spring deposits, and calcrete deposits. Proceeding to broader correlations and identification of international and global patterns in the evolution of desert regions and thereby identify the direction and magnitude of past changes in hydrologic systems and the climates that controlled them.

1982 **Summary of activites.** With respect to the objectives, it is too early to draw conclusions, but some important new data sources common to a number of countries have become apparent; interpretation of geology, geomorphology and in some situations, hydrology of remote-sensing imagery has been made at national and continental scale. These include mapping of relic aeolian features, which can be used to indicate their force and direction during arid periods, to help in determining past atmospheric circulation patterns; also mapped are the "depressions" (salinas, lakes, and playas).

For a number of the "depressions" in each continent there are recent detailed studies of the geology and hydrology related to their evaporative capacity: to intercept groundwater before it is lost by evaporation in the depression;to determine the feasibility and environmental effects of draining sea water for electric generation or disposal of excess saline groundwater from irrigated areas where rising water tables is a problem. As well as mining of evaporates and brines of these depressions.

It is apparent that some earlier interpretations have misunderstood the role of groundwater in lake-level changes and changes in lake salinity. Models are being developed within the Project for simulation of more complete hydrology of lakes to assist in palaeohydrologic interpretation.

Techniques of radiocarbon dating, fission-track dating, pollen analysis, isotope analysis, palaeomagnetism have been used somewhat sporadically in desert regions. An assessment of the most rewarding sites for intensive studies using these techniques is being made; which deep lake deposits, deserts with Upper Cenozoic lave sequences and Upper Cenozoic stranded coastal dune sequences being prominent amongst these.

In this the first year of the Project - it has gained global dimensions with some 60 participants from 16 countries. Two national committees have been formed: Australia and the Sudan. The Australian National Committee is preparing for the first major meeting to be held in Australia in 1982.

C.R. Lawrence presented a statement and poster session on the Project a the "Symposium on variations in the Global Water Budget" held at Oxford University, United Kingdom, on 10-15 August 1981. He visited Egypt on 16-21 November 1981. Very rewarding discussions were held with Egyptian participants. Field studies took on Upper Cenozoic Evolution of the Nile Valley, various desert types, groundwater discharge zone of Wadi el Natrun, cultural changes in response to climatic change and groundwater development schemes and the stranded coastal dune sequence. There is a wealth of information in Egypt relevant to the current Project; whist there are active groups in remotesensing interpretation, groundwater development and Quaternary stratography.

Activities planned. At present, preparation is in hand for the first major meeting of the Project to be held in Australia on 11-27 August 1982. It is planned to have workshops in Melbourne and Canberra where local specialists will demonstrate and describe techniques of dating, isotope analysis, palaeomagnetism, groundwater dynamics and climatology. In general, participants at the meeting will be drawn from Quaternary stratigraphers and hydrogeologists. The opportunity will be given for each of the international participants to present a paper on the "state-of-the-art" for his country and case studies.

An important item of the agenda will be future planning of the Project and terms of organization, meetings, favoured directions of research and areas where some special support may be given. There will be an excursion of one-week duration in arid and semi-arid south-eastern Australia to visit reference sections for the different types of dune systems, lake sequences and alluvial terraces, examples of each of the relic landforms, observations bore networks in areas of groundwater development and a vicinity of lake systems, and salinised areas where there is a problem of rising water tables.

1983 **Summary of activities.** The first meeting of the Project was held in Australia on 11-27 August 1982, and was attended by 56 participants, including ten from overseas. The meeting was divided into two conferences, one held in Melbourne and the other at Canberra, with an eight-day excursion through the Murray Basin of south-eastern Australia.

The excursion examined the geology of the exposed Neogene regressive marine sand with lateritic weathering, sequences of lakes and playas and their adjacent lunettes, accretion sequences of longitudinal dunes and alluvial forms and sequences. Also examined were the change in hydrologic regime as a result of settlement by man and the subsequent changes due to native clearing of vegetation, to irrigation and to artificial stream storages. In general, as a result, the groundwater store has increased and soil salinity and stream salinity problems are widespread.

The conferences at Melbourne and Canberra were directed along two main themes: comprehensive studies of the palaeohydrology of arid or semi-arid regions and selected techniques and concepts considered fundamental to the Project.

Specialists discussed sampling, methods of calculation and limitations concerning certain dating techniques, illustrated with examples in desert regions. These techniques included palynology of lake sediments, K/Ar dating of volcanic rocks, ^{14}C dating of carbonaceous sediments, groundwater and calcrete, U/Th dating of calcrete and shells, and thermoluminescence dating. Also presented were a reconstruction of past climates for the upper Quaternary based on variation of radiation in response to the eccentricity of the earth's orbit, and statistical techniques to handle the variability and paucity of precipitation and stream flow data of desert regions.

Comprehensive studies were presented on the Sahara Desert, the desert in Saudi Arabia, the Atacama Desert, the deserts of the western United States, and the desert and semi-arid regions of central and south-eastern Australia. For Australia, the following sequence of events is based principally on data from the Murray Basin: marine regression during the Pliocene and subsequent laterization of sediments, with widespread lacustrine deposition terminating at 700,000 BP, followed by the onset of arid conditions in the period up to 14,000 BP, alternating with more humid episodes.

North Africa features a Miocene marine regression, a dated Pleistocene sequence of stranded coastal dunes and the development of negative landforms, for example, the Qattara and Bahariya depressions, which had very important effects in internal surface and subsurface drainage. Two moist periods, covering 40,000 - 20,000 BP and 8,000 - 3,000 BP, are reflected in archaeological sites and alluvial deposition.

Detailed studies in conjunction with ^{14}C dating of lakes in the western parts of the United States indicate a detailed history. At 25,000 BP levels began to rise, there were three fluctuations between 14,000 and 10,000 BP when they were dry or drying, and between 5,000 and 4,000 BP water levels rose again.

The Acatama Desert, Chile, has an undated complexe history which includes such palaeohydrologic features as large salinas surrounded by calcrete-capped lake terraces, and extensive nitrate deposits.

Both the conferences and the excursion demonstrated that a knowledge of past changes of semi-arid and arid environments is an important aid to understanding and management of salting problems and groundwater resources as well as to exploration for secondary minerals. A full report on the first meeting is being prepared and will be distributed to participants.

Activities planned. Next meeting is planned for October, 1983. It will comprise a conference and an excursion to part of the Sahara Desert and the Nile Valley

WANTED - INFORMATION ON THE WHEREABOUTS OF

TREES, STUMPS AND OLD LOGS

Huon, Celery-top, Pencil and King Billy pines have annual growth rings. Ring widths are influenced by environmental conditions at the time of growth. Studies of centuries-long records in many trees can yield information on past climatic changes. Carbon and oxygen isotope measurements on dated rings may give information on tree physiology or changes in atmospheric composition.

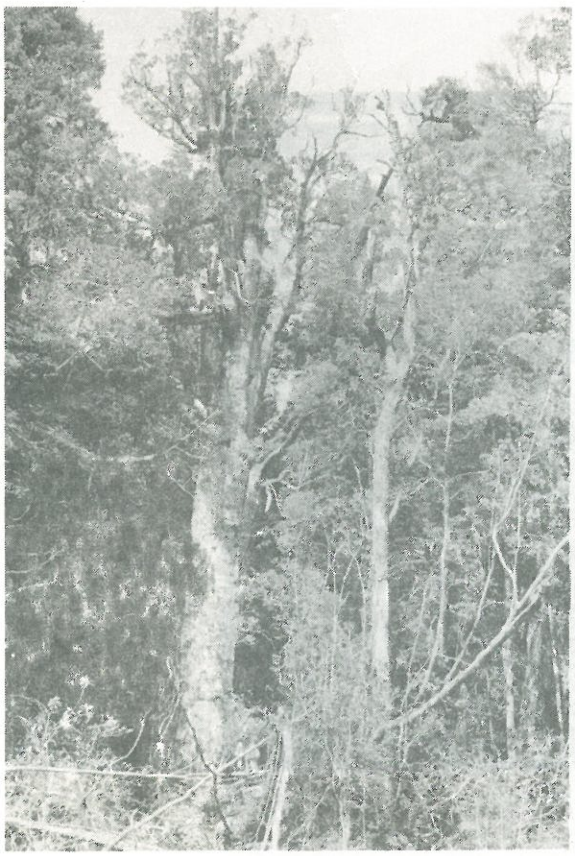
The photographs below will give you some idea of the kinds of wood we have found along the Stanley River.

We'd like to hear about similar situations in other areas.

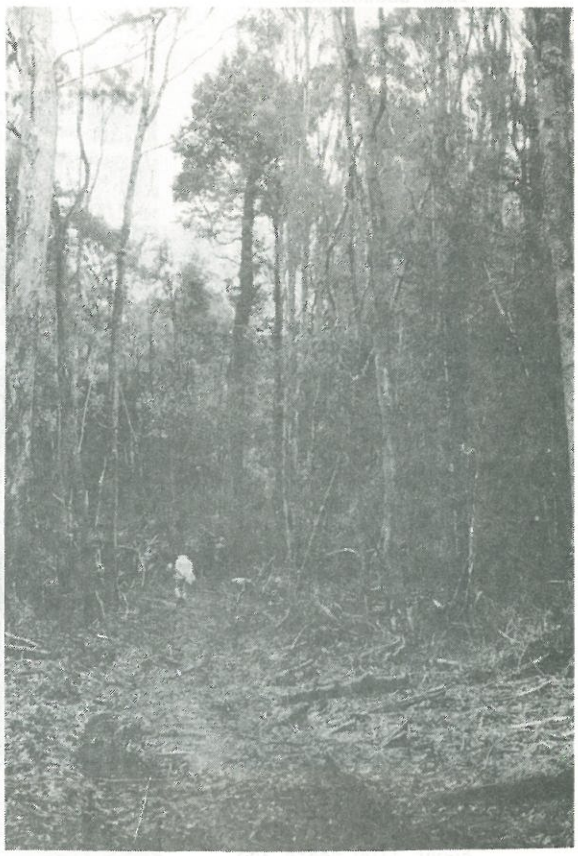
1. Living trees

Huon pines This one has a diameter of 154 cm, and more than 1000 annual rings.

Celery-top pines, with leaves like celery. This one is over 300 years old; larger ones can be 800 years old.



(Catalogue SRT-20)



(Catalogue SRT-49)

2. Stumps and 'downers'

Stumps from logging operations, and logs lying on the forest floor. Both may be covered with moss, or have saplings or even substantial trees growing over them. With Huon pines that have toppled, former branches may become trunks. This tree was felled last century, then abandoned.

(Catalogue SRT-42)

3. Driftwood and buried logs

Waterworn logs in rivers, and logs protruding from riverbanks with signs of wear and abrasion. The Huon log in the foreground died about 1100 years ago.

(Catalogue SRT-105)

Whole rafts of logs may occur, covered by sediment on which maturing trees are growing. The log sectioned on the right has rings from the interval 2000-1500 years ago.

(Catalogue SRT-44 on left and SRT-43 on right)

Well-worn driftwood may be strewn on the riverbed, or partly buried. The piece in the middle has rings from 2200-1700 years ago.

(Catalogue SRT-110 in centre,
SRT-109 in foreground)

Logs buried under flood plain sediment in the Stanley R. area are (so far) all older than 4000 years. The stump end of this one is several metres away, and covered with 3 metres of sediment.

(Catalogue SRT-117)

Logs may be found in excavations and road cuttings. The one sectioned at the bottom has rings from 5700 to 5300 years ago while rings in the driftwood log (higher in the left-hand wall) span 5050 to 4550 years B.P.

(Catalogue SRT-161 sectioned, SRT-163 on left)

Contacts	and	their specialties

Dr Mike Barbetti,
Macintosh Centre,
Madsen Building F09,
University of Sydney,
SYDNEY, N.S.W. 2006

(02) 692 3993
(02) 798 5985 (a/h)

Radiocarbon dating
(old logs)

Mr Trevor Bird,
C.S.I.R.O.,
Division of Forest Research,
Stowell Avenue,
HOBART, TASMANIA 7000

(002) 23 5555

Dendrochronology
(living trees, stumps, old logs)

Dr Roger Francey,
C.S.I.R.O.,
Division of Atmospheric Research,
P.O. Box 77,
MORDIALLOC, VICTORIA 3195

(03) 580 6333

Stable isotopes, physiology
(living trees, stumps)

Dr Gerald Nanson,
Department of Geography,
University of Wollongong,
P.O. Box 1144,
WOLLONGONG, N.S.W. 2500

(042) 27 0631

Sediment structure (post glacial)
(near old logs)

Dr Eric Colhoun,
Department of Geography,
University of Tasmania,
G.P.O. Box 252C,
HOBART, TASMANIA 7001

(002) 20 2466

Pollen analysis, glacial sediments
(near old logs)

THE AUSTRALIAN ROCK ART RESEARCH ASSOCIATION

An association promoting the study of prehistoric rock art is being established in Australia. Any person or organisation (in Australia or abroad) interested in this area of research is encouraged to request memberhip.

The principal objectives of the Australian Rock Art Research Association (AURA) are as follows: to provide a forum for the dissemination of research findings; to promote Aboriginal custodianship of sites externalising traditional Australian culture; to co-ordinate studies concerning the significance, distribution and conservation of rock art, both nationally, and with individuals and organisations overseas; to institute a Code of Ethics regarding research in this field and to generally promote awareness and appreciation of Australia's immovable cultural heritage.

Whilst AURA is concerned principally with the Australasian region, it also strives for international contact, communication and involvement. The Association intends holding regular general meetings at locations yet to be determined. It encourages the formation of State or regional chapters and will assist in the operation of these. A newsletter is already being issued, reporting current developments and matters of immediate importance, and serving as a direct communication channel. A journal will be published twice yearly, commencing in May or June 1984. It will feature research papers, short reports, reviews, letters, and a current bibliography.

Applications for membership or Journal subscription are invited from all interested parties, and should be sent to the Editor, Archaeological Publications, P.O. Box 216, Caulfield South, Vic., 3162, Australia. Membership fees will be kept to an absolute minimum, and are not expected to exceed $A 10.00. None, however, will apply before 1984.

R.G. Bednarik
Convener

THE N.W.G. MACINTOSH CENTRE FOR QUATERNARY DATING
The University of Sydney
MADSEN BUILDING
N.S.W. 2006

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(02)692 2353
DX 1154

FROM THE UNIVERSITY OF SYDNEY NEWS, 17 APRIL 1984

Radiocarbon Dating Laboratory renamed

The renaming of the Radiocarbon Dating Laboratory to the N.W.G. Macintosh Centre for Quaternary Dating was approved by Senate at its April meeting.

The Centre is named after Neil William George Macintosh, who graduated from the University of Sydney in 1933. He returned to teach in 1944 and was Challis Professor of Anatomy from 1955 until his retirement in 1973.

His wide ranging research interests in the physical anthropology and prehistory of Australian Aborigines continued until his death in 1977. He was a pioneer in research and, as a Foundation Member of the Australian Institute of Aboriginal Studies in 1961 and Chairman from 1966 to 1974, he contributed greatly to his profession.

His widow has made generous donations to the University over the past few years for the development of a Quaternary Dating Centre, using the existing Radiocarbon Dating Laboratory as a nucleus. Foremost among the research interests of the late Professor Macintosh was the dating of the Australian fossils, both human and animal, and the dating of associated materials, such as soils, pollens and shells.

The Radiocarbon Laboratory was established fourteen years ago (see the *News*, 4 May, 1982). It undertakes dating for archaeologists, prehistorians, geographers, geologists and botanists at the University of Sydney and many other institutions throughout Australia.

As well as being renamed the N.W.G. Macintosh Centre for Quaternary Dating the unit has recently been relocated from the Department of Physical Chemistry in the Chemistry building to the ground floor, Madsen building.

Prices for radiocarbon dating at the University of Sydney are set out overleaf. With new facilities, we are aiming for increased productivity to offset the inevitable rises in costs and salaries. Both labour and consumables will, as in the past, be funded directly from the fees we charge.

We will continue to process samples on a first-come first-served basis, though special samples may be given priority in our laboratory at no extra charge (see over).

If our turnaround time is unacceptably long, we recommend you to contact Beta Analytic Inc., University Branch, P.O. Box 248113, Coral Gables, Florida 33124. We can, if you wish, make the necessary arrangements to forward your samples. The charges (including our handling fee) are set out overleaf. Note the new additions marked **.

Visitors are welcome at our new laboratory, next to the Electron Microscope Unit. We look forward to seeing you soon.

Mike Barbetti

THE NWG MACINTOSH CENTRE FOR QUATERNARY DATING

Madsen Building, University of Sydney, NSW Australia 2006
Telephone (02) 692 3993

RADIOCARBON PRICE LIST

April 1984

Samples processed in our laboratory:

Samples submitted between now and 30th Nov '85 .....$250
Surcharge for samples with less than 1g carbon $150
Surcharge for bulky samples containing 1 - 5% carbon ...$150

Notes: (i) Bone and other double-fraction samples are charged at double rates.

(ii) Turnaround time fluctuates with demand. It is presently about 6 months.

(iii) Priority turnaround may be granted without extra charge; for criteria, see Aust Quaternary Newsletter, no 15, pp 2-5, 1980, or contact Mike Barbetti.

Samples we forward to Beta Analytic:

Straightforward samples, 3 weeks delivery.....$350
Straightforward samples, 8 weeks delivery $250
** Groups of 5 or more straightforward samples, 8 weeks delivery .....each $210
Supplementary fees for bones, small samples, and soils or sediments containing less than 10% carbon $130
** Very small (0.3 to 0.001g carbon) by accelerator mass spectrometry $550
$^{13}C/^{12}C$ analysis $40
Calcite/aragonite ratio $45

Notes: (i) Delivery times include normal postage between you and us.

(ii) Prices are in Australian dollars, subject to change at short notice, and include our handling fees.

(iii) You will be invoiced by the University of Sydney; if possible, please send a Purchase Order to the Macintosh Centre.

AUSTRALIAN RADIOMETRIC LABORATORIES

Director Steve McPhail B.Sc., Ph.d.(Syd) Telephone (02) 704759
Postal Address PO Box 342, Drummoyne, New South Wales 2047, Australia

Radiocarbon Information Sheet and Price List

(Use one Sample Submission Sheet per sample. This document may be photostated. 01Jan84)

Price List (as at 1st January 1984)

It is the policy of this laboratory that all submitters will be dealt with in an equitable manner : there will be no disincentives for submitters with difficult samples. Hence, as at 1st Jan 84 our price will be :

(A)$200 per sample

with a standard turnaround time (excluding postage times) of

30 working days. (*)

There will be only a few exceptions to the above conditions.

(i) A series of samples which require little or no pretreatment may attract a discount of 5%. This will be negotiable and should be discussed with the lab personnel at the time of submission.

(ii) Difficult samples which require lengthy pretreatment may not be able to be processed in the standard time. Muds and peats may fall into this category. If delays of this nature are encountered or suspected the submitter will be contacted and all steps to minimise the delay taken.

(iii) A slightly more rapid turnaround time may be possible in exceptional circumstances although we would hope that our standard rate would satisfy the majority of submitters. Requests of this nature should be discussed at the time of submission.

Sample submission

ARL advices that submitters should supply the following sample sizes for maximum dating accuracy :-

Type of sample	Ideal sample size
Bones (+)	300 g
Charcoal	10 g
Muds, peats	500 g
Shells	40 g
Wood (good condition)	20 g
Wood (rotting)	50 g
Other materials	4 g of carbon

Smaller samples sizes will result in larger uncertainies in the final date but every effort will be made to minimize this effect. Absolute minimum sizes are of the order of 5% of the above. It should be noted that the table is intented as a guide only. If submitters are concerned about carbon content, then more sample should be submitted, or ARL staff consulted.

(*) Breakdown of equipment under service contract to ARL which is hence outside the control of ARL may make the time condition unattainable. Submitters will be immediately advised of this in the unlikely event of it occuring.

(+) Submitters of this type of sample should consult ARL staff regarding the most suitable fractions to date.

CLIMANZ

The convenors of CLIMANZ plan to hold an informal meeting next year (1985) in New Zealand, probably in February. For details please contact Professor Jane Soons, Department of Geography, University of Canterbury, Christchurch, New Zealand.

LITORALIA

Dr Charles W. Finkl is Editor-in-Chief of Litoralia, a new coastal science journals. He is at the Center for Coastal Research, P.O. Box 2473, Colee Station, Fort Lauderdale, FL 33303, U.S.A.

INSTITUTE OF HUMAN ECOSYSTEM

Details of this recently established institute may be obtained from Asok K. Ghosh or from the Director, Dr P.G. Chatterjee, 320, Jodhpur Park, Calcutta-700 068, India.

RADIOCARBON USERS HANDBOOK

by Richard Gillespie. 27pp, 2 Figs, bibliography. (Quaternary Research Unit, Macquarie University, 1982). (Available free, on request to editor).

ROCK ART RESEARCH

Vol. 1, No. 1, May 1984 is now out (see also p.38).

SOME RECENT PUBLICATIONS

(a) Chronology

Callen, R.A., Wasson, R.J. and Gillespie, R. 1983. Reliability of radiocarbon dating of pedogenic carbonate in the Australian arid zone. Sedimentary Geology 35, 1-14.

Goede, A. and Harmon, R.S. 1983. Radiometric dating of Tasmanian speleothems - evidence of cave evolution and climatic change. J. Geol. Soc. Aust. 30, 89-100.

Hewgill, F.R., Kendrick, G.W., Webb, R.J. and Wyrwoll, K.-H. 1983. Routine ESR dating of energent Pleistocene marine units in Western Australia. Search 14, 215-217.

(b) Pollen

Salas, M.R. 1983. Long-distance pollen transport over the southern Tasman Sea: evidence from Macquarie Island. New Zealand J. Botany 21, 285-292.

(c) Dunes and alluvium

Ash, J.E. and Wasson, R.J. 1983. Vegetation and sand mobility in the Australian desert dunefield. Z. Geomorph. N.F. Suppl.-Bd 45, 7-25.

Wasson, R.J. n.d. Dune sediment types, sand colour, sediment provenance and hydrology in the Strzelecki-Simpson dunefield, Australia. In M.E. Brookfield and T.S. Ahlbrandt (eds), Eolian Sediments and Processes, 165-195. Elsevier, Amsterdam.

Wasson, R.J., and Hyde, R. 1983. Factors determining desert dune type. Nature 304, 337-339.

Wasson, R.J. Rajaguru, S.N., Misra, V.N., Agrawal, D.P., Dhir, R.P., Singhvi, A.K. and Kameswara Rao, K. 1983. Geomorphology, late Quaternary stratigraphy and palaeoclimatology of the Thar dunefield. Z. Geomorph. N.F. Suppl.-Bd. 45, 117-151.

Wasson, R.J. 1984. The sedimentological basis of the Mohenjo-daro flood hypothesis. Man and Environment 8, 88-90.

(d) Sea level

Hopley, D. (ed.) 1983. Australian Sea Levels in the Last 15 000 years: A Review. (Geogr. dept., James Cook Univ., occasional Paper No 3).

(e) Antarctica

Adamson, D. and Pickard, J. 1983. Late Quaternary ice movement across the Vestfold Hills, East Antarctica. In R.L. Oliver, P.R. James and J.B. Jago (eds) Antarctic Earth Science, 465-469. (Aust. Acad. Sci. and Camb. U. Press).

Pickard, J. 1983. Pingos in Antarctica. Quaternary Research 20, 105-109.

Pickard, J. 1983. Surface lowering of ice-cored moraine by wandering lakes. J. Glaciol. 29, 338-342.

Pickard, J. and Adamson, D.A. 1983. Perennially frozen lakes at glacier/rock margins, East Antarctica. In R.L. Oliver, P.R. James and J.B. Jago, op. cit., 470-472.

Wellman, P. 1983. Origin and subglacial erosion of part of the coastal highland of East Antarctica. J. Geol. 91, 471-480.

(Once again, this list is very partial. I will always be pleased to publicise relevant recent work, provided you send me appropriate details. Ed.)

(b) Pollen (ctd)

Kershaw, A.P. 1983. A Holocene pollen diagram from Lynch's Crater, North-eastern Queensland, Australia. New Phytol. 94, 669-682.

Kershaw, A.P. 1983. Considérations nouvelles sur la flore et la végétation australiennes. L'Espace Géographique 3, 185-194.

Selkirk, D.R., Selkirk, P.M. and Griffin, K. (1982) 1983. Proc. Linn. Soc. N.S.W. 107(1), 1-17.