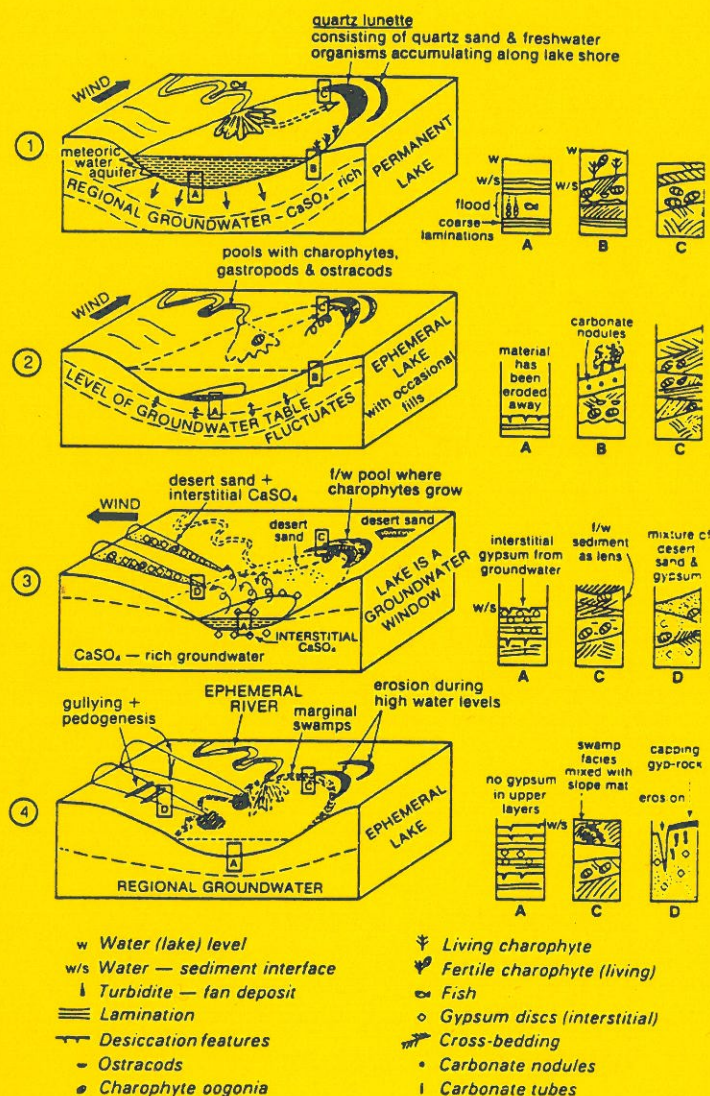


p23-25
 f156

Quaternary Australasia

The Newsletter of the Australasian Quaternary Association



Volume 9, No. 2
 October 1991
 ISSN 0811-0433

QUATERNARY AUSTRALASIA, VOL 9/2, NOVEMBER 1991

Material for the next issue should reach the editor by 31 March 1992:

Bill Boyd
Editor Quaternary Australasia
Faculty of Resource Science & Management
The University of New England - Northern Rivers
PO Box 157
Lismore NSW 2480
Tel.: (066) 203 007
Fax: (066) 212 669

The AUSTRALASIAN QUATERNARY ASSOCIATION (AQUA) is an informal grouping of people interested in the manifold phenomena of the Quaternary. It seeks to encourage research by younger workers in particular, to promote scientific communication between Australia and New Zealand, and to inform members of current research and publications. It holds biennial meetings and publishes the Newsletter 'Quaternary Australasia' twice a year. The annual subscription is \$A20 or \$10 for students, unemployed or retired persons. President 1991 - 1993 is Dr Geoff Hope, Department of Biography and Geomorphology, Research School of Pacific Studies, Box 4 Australian National University, Canberra, A.C.T. 2601. An application form for membership is appended to this issue, and should be returned to Mr Albert Goede, Treasurer, AQUA Box 338 Sandy Bay Tasmania 7005. Members joining after September gain membership or the following year. Existing members will be sent a reminder in December

1991 COMMITTEE MEMBERS

Dr Geoff Hope - President
Department of Biography and Geomorphology
Research School of Pacific Studies
Australian National University
CANBERRA A.C.T. 2601
ph: (06) 249 3283
Fax: (06) 257 1893

Dr Colin Murray-Wallace - Secretary
Department of Geology
University of Newcastle
NEWCASTLE NSW 2308
ph: (049) 215 415
Fax: (049) 602 518

Mr Albert Goede - Treasurer
Department of Geography
University of Tasmania
GPO Box 252C
HOBART TAS 7001
ph: (002) 202 461

Dr Bill Boyd - Editor *Quaternary Australasia*
Faculty of Resource Science & Management
UNE - Northern Rivers
PO Box 157 LISMORE NSW 2480
ph: (066) 203 007
Fax: (066) 212 669

Dr Stephen Gale
Department of Geography and Planning
UNE Armidale
ARMIDALE NSW 2351
ph: (067) 733 115

Dr Tim Flannery
Head of Mammalogy
Australian Museum
PO Box A285
SYDNEY SOUTH NSW 2001
ph: (02) 339 8114

Dr Brad Pillans
Research School of Earth Sciences
Victoria University of Wellington
PO Box 600
WELLINGTON NEW ZEALAND
ph: (04) 721 000

CONTENTS

Editorial (Bill Boyd)	2
Conference and Meeting News	3
- SLEAD Conference 1991	4
- 1993 Inter-INQUA Conference	5
- Fifth ANZ Geomorphology Research Conference	7
Academy of Science National Committee for Quaternary Research	8
Report on INQUA, Beijing August 1991 : Jim Bowler	9
Recent Publications	15
Book Reviews	17
- <i>Owls, caves and fossils</i> (Andrews): Alex Baynes	
- <i>Lessons for human survival: Nature's record from the Quaternary</i> (Bishop, ed.) and	
- <i>The Cainozoic in Australia: A re-appraisal of the evidence</i> (Williams, de Dekker and Kershaw): W. E. Boyd	
- <i>Quaternary Dating Workshop 1991</i> (Gillespie, ed.): W.E.Boyd	
- <i>Quaternary sediments: Petrographic methods for the study of unlithified rocks</i> (Gale and Hoare): UNE Gazette	
Papers	
- Tasmanian speleothems: Progress and prospects for paleoenvironment reconstruction (Goede)	23
- Diet of Diprotodons: A mystery solved (Pickard)	29
- The shoreline of the last interglaciation in Australia - a review (Murray-Wallace & Belperio)	31
- Reconstruction of Late Quaternary environments at Egg Lagoon, King Island, Bass Strait (D'Costa & Grindrod).	32
- Phytoliths from Roonka, South Australia: An introductory report (Boyd, Lynch and Pretty)	33

AQUA New Membership Form (Renewals will be sent to existing members in December)

Next Issue:

- Palaeoenvironmental interpretation from SEM examinations of sand surface textures from a Late Quaternary aeolianite section of Fingal Beach, Nepean Peninsula, Victoria (Liping, Peterson & Williams)

EDITORIAL

Volume 9/2 of Quaternary Australasia sees my first attempt (and judging by the organisational effort required, hopefully the last...) at editing on the road. The critical papers that I have brought with me on study leave turn out to be less than critical, and those left behind, well you've guessed it..... Nevertheless, I trust this issue will reach you more or less complete.

Again we are blessed with many contributions and I already have at least two substantial papers which will grace the pages of the next issue. I should not need to repeat my earlier pleas, but nevertheless, I will: keep the contributions flowing. It is your Association's journal and from the correspondence received, it seems to be working. John Pickard's paper on diprotodon diet suggests that there are at least four people who read the journal! You may notice that some of the papers contained in this issue have been refereed. These have been done on request by the authors and I extend my thanks to the referees who willingly accepted my requests for their opinion.

Somewhere in this issue you will find a new membership form, courtesy of our "new" (I use the word advisedly) President, Geoff Hope. You will note that we have left it blank on the reverse so feel free to pull it out and hawk copies around your department. Also note that we do not charge libraries and other institutions excessive subscriptions (hint, hint). I suspect Geoff will be contacting a few, specially chosen members to help encourage a few more Quaternarists to join AQUA. Please feel flattered when Geoff contacts you, since you have been specially chosen.....!

You will also notice that we have gone glossy and coloured, albeit selectively. The great Quaternary event of the nearest future is the 1993 Inter INQUA Conference, to be hosted by AQUA. I hear rumours that the cost of this meeting to participants will be very moderate, and that the review papers will accompany Trips to Important Places. Already the world had sat up and taken note: the list of interested persons contains several well-known International Quaternarists. Be there and find out who they are!

Having rarely, if ever, said anything outrageous or controversial during my academic career, I have sometimes considered my power as an editor of *Quaternary Australasia* (if you have doubts about editors' power, see a recent review on ethics in geography in *Progress in Human Geography*), should allow me to make, at least, one outrageous or controversial statement. But what about? My early, and remaining impression of the Quaternary community at this end of the world is one in which outrage has little place. Indeed I got told off at my first AQUA meeting for suggesting that, tedious as it is, a constitution should be drawn up for AQUA, since it will only be used in extreme cases, and then be of critical importance, when members of the Association fall out over some matter of politics or procedure. "I think you will find that we are a

happy family here and we do not argue", I was told. Good, I hope so.

Nevertheless a new constitution is being prepared and the Association will soon be incorporated. Details in Q.A. vol 10/1.

Returning to outrage, or at least, controversy, however, I recently read a definition of the word "editorial" in a dictionary (a North American one I must admit; it was the only one in the office I am currently and temporarily occupying). The definition reads: "Editorial: An article in a publication expressing the opinion of its editors or publishers." This was a bit disappointing, since I had hoped it would say something about being a published outlet for something outrageous and/or controversial, which some editorials seem to be. At least I would have had justification for the following, which before you read it I must emphasize, does not express an opinion of mine as editor (I have no opinion, yet, on the matter) or of the Australian Quaternary Association as publishers.

Now that I am in New Zealand, slowly immersing myself in issues of Quaternary environment and the short period of human occupation, I ask you this: Why is New Zealand included in Australasia? I appreciate that this question may seem heretical, but, in defence, I remind you that I am still a newcomer to the region. It appears to me that, at least in Quaternary terms Australasia (in the limited sense of Australia and New Guinea) and New Zealand share little in the way of a common geological, geographical, biological and cultural history. Is there something which intrinsically links Australia, PNG and New Zealand to form a "natural" Australasia Quaternary block? Is it just a common English-dominated (recent) history? Should the Research School of Pacific Studies be moved to Auckland, a very much more Pacific-dominated city than Canberra? These and many other questions come to mind. What do you think? I am interested to hear opinions from all sides of the Tasman sea.

And with that I shall end. Enjoy volume 9/2, and keep sending the contributions.

Bill Boyd,
Editor.

CONFERENCE AND MEETING NEWS

21-23 November 1991 1991 PPAA Field Trip: Cretaceous to Recent Palynological and Scenic Landforms of the Otway Region, Victoria, Australia. Contact Peter Kershaw, Dept of Geography and Environmental Science, Monash University, Clayton, Victoria, 3168, Australia

6-8 December 1991 The "Climate" of Australia. UNE Armidale, (Student Conference); Contact conference Secretaries, G.A.P.S. Dept of Geography and Planning, University of New England, Armidale, NSW 2357, Australia

6-8 December 1991 1991 Australian Archaeological Association Conference; Sahul in Review, Lake Jindabyne Centre NSW, Australia; Contact: 1991 AAA Conference, C/- Dept. Prehistory, Research School of Pacific Studies, Australian National University, G.P.O.Box 4, Canberra 2601, Australia.

9-11 December 1991 SLEADS (Salt Lakes, Evaporites and Aeolian Deposits) Conference: Arid-zone hydrology, geochemistry, biology, stratigraphy and palaeoenvironments; Australian research with global comparisons, ANU, Canberra; Contact: Allan Chivas or John Magee Research School of Earth Sciences, A.N.U., G.P.O. Box 4, Canberra, ACT 2601, Australia. ph: 61 6 249 3247/ 61 6 249 2761

28 - 31 January 1992 Institute of Australian Geographers. Auckland, N.Z. Contact Prof Warren Moran, University of Auckland.

22-25 April 1992. Fifth Meeting of the Australian New Zealand Geomorphology Research Group, Port Macquarie, NSW. Contact Gary Brierly, Biogeography and Geomorphology Dept, ANU, Canberra, Box 4 Canberra, 2601.

5-9 July 1992 International Symposium on Erosion, Debris Flows and Environment in Mountain Regions, Chengdu, China; Contact: Dr. Shang Xiangchao, Inst. of Mountain Disasters and Environment, Chinese Academy of Sciences, PO Box 417, Chengdu, Sichuan, 610015, China.

9-14 August 1992 XXVII International Geographical Congress, Washington, USA: contact Dr. B.Bishop, Committee for Research and Exploration, National Geographic Society, Washington, D.C. 20036, USA, telex 89-2398.

16-23 August 1992 International Conference of Historical Geographers, Vancouver, Canada; Contact Dept Geography, 217-1984 West Mall, Univ. British Columbia, Vancouver, B.C., Canada.

2-12 September 1992 8th International Palynological Congress, Aix-en-Provence, France; Contact: Jean-Pierre Suc, Secretary 8th IPC Laboratoire de Palynologie (case 061), Univ. de Montpellier II, F-34095 Montpellier cedex 5, France.

18-22 January 1993. Southern Temperate Ecosystems: Origin and Diversification, Hobart. Contact Bob Hill, Dept Plant Science, University of Tasmania, Box 252C, Hobart, 7000.

18-23 April 1993 Sixth International Paleolimnology Conference, Canberra. Contact Patrick De Dekker, Geology Dept ANU, Canberra, Box 4 Canberra, 2601.

19-25 April 1993 Fifth International Conference on Modern and Fossil Dinoflagellates, Zeist, The Netherlands; Contact Jan Willem Weegink, Lab. Palaeobot. Palynol., Univ. Utrecht, Heidelberglaan 2, 3584CS Utrecht, The Netherlands.

24-27 April 1993. Inter-INQUA Conference - The Australian Region in the Quaternary. Contact Geoff Hope, Biogeography and Geomorphology Dept, ANU, Canberra, Box 4 Canberra, 2601.

23-29 August 1993 Third International Conference on Geomorphology, Hamilton, Canada; Contact: 3rd International Conference on Geomorphology, McMaster Univ., Hamilton, Ontario, L8S 4K1, Canada.

SALT LAKES AND ARID-ZONE ENVIRONMENTS



SLEADS * CONFERENCE 1991

- Theme:** Arid-zone hydrology, geochemistry, biology, stratigraphy and palaeoenvironments. Australian research with global comparisons
- Dates:** 9-11 December
- Place:** Research School of Earth Sciences, The Australian National University, Canberra, Australia
- Registration:** \$20; which includes the cost of morning and afternoon tea/coffee and the abstract volume
- Deadline:** For submission of abstracts and payment of registration fee is 1 November, 1991.

To date 42 papers have been offered and there is only a limited number of places for additional presentations. Any further offers of papers should be made quickly to enable scheduling. The length of each presentation will be 20 to 25 minutes plus 5 mins discussion. Papers from the meeting will be published as a special issue of an international journal, subject to the normal procedure of peer review. Palaeogeography, Palaeoclimatology, Palaeoecology Vols 54 and 84** contain the previous SLEADS meetings. For further information contact:

Allan Chivas
Research School of Earth Sciences
The Australian National University
GPO Box 4
Canberra ACT 2601

Telephone: 61-6-2493247
Fax: 61-6-2490738

or John Magee
Department of Biogeography & Geomorphology
Research School of Pacific Studies
The Australian National University
GPO Box 4
Canberra ACT 2601

Telephone: 61-6-2492761
Fax: 61-6-2571893

* Salt Lakes Evaporites and Aeolian Deposits

** Copies of Vol. 84 are available from Allan Chivas for approximately \$50.

1993 INTER-INQUA CONFERENCE,

THE AUSTRALIAN REGION IN THE QUATERNARY

(following the Sixth International Palaeolimnology Conference)

Canberra, Australia, April - May 1993

AUSTRALASIAN QUATERNARY ASSOCIATION

Photo: Pleistocene seif dunes, Lake Disappointment, WA.
Courtesy Dick Smith/Australian Geographic

First Announcement
AUSTRALASIAN QUATERNARY ASSOCIATION (AQUA)

INTER-INQUA CONFERENCE, APRIL - MAY 1993

THE AUSTRALIAN REGION IN THE QUATERNARY

The biennial meeting of the Australasian Quaternary Association will be held in Canberra in May 1993 with three main INQUA themes:

- Correlation of regional events with changes in the Northern Hemisphere and across the Pacific.
- Identification of past episodes of warming and the history of the Southern Oscillation.
- Comparison of the responses of biota and environmental systems to Quaternary environmental change in Australasia and other parts of the world.

Australia has had a radically different Cenozoic history due to its isolation and drift northwards. The Quaternary, largely unaffected by glacial advances, is preserved in lakes, rivers, dunes, caves, volcanics and coral reefs, often set in landscapes of great antiquity. The biota has responded to the rapid spread of deserts with dramatic radiation of endemic groups. Recent results have provided new chronologies in archaeology, faunas, hydrologic regimes, pedogenesis, dune activation and marine change. Australia is also undertaking a major effort at palaeoclimatic reconstruction as a contribution to Greenhouse management.

The AQUA conference immediately follows the separate 6th International Palaeolimnological Conference, which will review advances in lake records and interpretation with an emphasis on arid and tropical environments and global change. The AQUA meeting continues these themes with other types of evidence for the Quaternary of Australasia and relates these to northern hemisphere and Southern Ocean records.

The meetings will be held in Canberra, one of the centres of Quaternary research in Australia and the Pacific. Pre and post-conference field trips will be organised to desert areas, coastal interglacial sites and faunal/vegetational history sites. Trips to the Willandra Lakes World Heritage Area, Victorian basalt province, Central and Northern Queensland to see well studied fluvial, maar lake, reef, faunal, and karst sites will be arranged. Field trips in Central and Northern Australia and New Guinea may be possible.

AQUA Conference Secretary: G.Hope, Dept. Biogeography & Geomorph. (Tel 61 6 2493283 Fax 61 6 2571893)
6th Int. Palaeolimnological Conf. Secretary: P. De Dekker, Dept. Geology. (Tel 61 6 2492070 Fax 61 6 2495544)
Both Australian National University Box 4 Canberra 2601 Australia

I may be interested in field trips to:
Tasmania ☐ Nth Queensland ☐
Central Aust. ☐ Victorian volcanics ☐
Great Barrier Reef ☐ New Guinea ☐
B: I would like more information about the 6th Palaeolimnology Conference, Canberra, to be held just prior to the INTER-INQUA Conference.
Please return this slip to:
Dr Geoff Hope
Dept of Biogeography and Geomorphology
Australian National University, Box 4, Canberra.
A.C.T. 2601 AUSTRALIA

- I would hope to offer a paper or poster in a session:
- ☐ 1. Are Australia's rivers different?
 - ☐ 2. Palaeogeography.
 - ☐ 3. Volcanics, regolith and drainage evolution.
 - ☐ 4. Coastal and desert dunes.
 - ☐ 5. Faunal extinction and vegetation responses.
 - ☐ 6. Human occupation in the last glacial.
 - ☐ 7. The Holocene hypsithermal: what is the evidence?
 - ☐ 8. Tropical, temperate and ENSO correlations
 - ☐ Any other topic? (note here)

Telephone

Fax.

Name

Address

A: Please send me the First Circular for the AQUA Conference (to be issued Sept 1991)

THE AUSTRALIAN REGION
IN THE QUATERNARY
Canberra, Australia, April - May 1993

5TH MEETING OF THE AUSTRALIA - NEW ZEALAND
"GEOMORPHOLOGY RESEARCH GROUP"

AT SEA ACRES RAINFOREST CENTRE, PORT MACQUARIE, NSW
22ND TO 25TH APRIL 1992

THEMES

"AUSTRALASIAN RIVERS: FORM, PROCESS AND EVOLUTION"

PLUS ANY OTHERS SUGGESTED

The time has come for the 5th meeting of this informal group, as the previous meeting held in Buchan was over two years ago. While it was originally intended to hold this meeting on the Atherton Tablelands, we now feel that a place which poses less logistical hassles would be more appropriate.

Accordingly we have suggested the Port Macquarie area, and suitable accommodation is presently being sought. Any local knowledge of the area, with suggestions for accommodation, etc. would be greatly appreciated. We wish to maintain the very open, informal nature of these meetings, and strongly encourage talks on work in progress. We suggest that one day be devoted to a theme of "Australasian Rivers: Form, process and evolution", but the scope for the other days is totally open to suggestion. Offers to co-ordinate short field trips in this area would be welcomed.

Could those who wish to attend and/or present a talk at this workshop please respond to Gary Brierley by 25 NOVEMBER, 1991.

The present working committee for this group constitutes:

Gary Brierley & John Chappell
Bio & Geo, RSPacS ANU,
GPO Box 4 Canberra ACT 2601
Brian Lees
Geography Dept., Faculties
ANU, GPO Box 4
Canberra ACT 2610

Ian Prosser
School of Geography
University of NSW
PO Box 1 Kensington NSW 2033

Could you kindly fill in the form below, and return it to Gary Brierley,
Department of Biogeography & Geomorphology, Australian National University,
Box 4 Canberra 2601

by 25TH NOVEMBER, 1991.

Dear Gazza - Sounds like a ripper to me! Rush details to:

Name:.....

Address:.....

Phone..... FAX.....
Yes No

1. I intend to attend the workshop ☐ ☐

2. I intend to present a paper at the workshop ☐ ☐

3. The proposed title of my talk is:
.....
.....

4. Any suggestions for workshop themes, accommodation, field trips and co-ordinators, etc?
.....
.....

Please photocopy this form and pass it on to others you feel may be interested in this workshop. If you require further information or have suggestions demanding urgent attention, please contact me at 06 249 3153.

ACADEMY OF SCIENCE NATIONAL COMMITTEE FOR QUATERNARY RESEARCH

This group of "faceless persons" (to quote Martin Williams) met on 30 April in Canberra. Among a long list of items discussed, the following are likely to be of greatest interest:

1. It was generally agreed that the Australian community of Quaternarists would be well served by a semi-popular, well illustrated account of the Quaternary of Australia. The success of comparable books (e.g. the *Greening of Gondwanaland*) shows that a market exists. The involvement of the domestic airlines, or a petrol company, might make it possible to produce a book like Frank Mitchell's *Shell Guide to the Irish Landscape*.

WANTED: A well-rounded (intellectually) Quaternarist who could devote 2 years to writing such a book. Must be prepared to talk with a wide range of active Quaternarist, and must have broad shoulders to cope with the insults that will inevitably follow from somebody's work not being mentioned. The Academy of Science is prepared to help, so will the National Committee.

2. Alarm was expressed at the increasing burden of undergraduate Students in University departments in which staff numbers are either static or decreasing. In addition, few students are showing interest in postgraduate training. So who will replace the aging "faceless persons" of the National Committee? Those postgraduates who cannot now get jobs, was the opinion expressed by somebody, with an ironic twist.

3. An Inter-Congress INQUA Meeting will be held in Australia in 1993 in close association with the International Palaeoclimatology Meeting. The organisers, Geoff Hope and Patrick de Dekker respectively, will soon supply more details.

4. Bob Wasson is a member of the Scientific Steering Committee of PAGES (Past Global Changes), one of the core projects of the IGBP. He attended the first meeting of this group in Germany earlier this year, at which an implementation plan was constructed. This plan will soon be available for any one interested.

5. As part of the Australian contribution to PAGES a CLIMANZ IV is being planned. Further news later, but the emphasis will probably be on multiple proxy mapping to support climate modelling.

By the way, the faceless persons of the new committee are:

Eric Colhoun (new Chairman)
John Dodson
Patrick de Dekker
Rodger Bird
Ian Simmonds

Liz Truswell
Bob Wasson
Paul Bishop
Phil Playford
Jim Bowler (ex officio; VP.INQUA)
Geoff Hope (P.ANQUA)
Bruce Thom (invited; P.IGBP Committee)

INTER-INQUA CONFERENCE UPDATE

A committee has been formed to establish the program for the conference, with suggested themes including marine-land records. The First Circular should appear in early 1992, with a call for papers and tentative plans for excursions. About 50 returns of the flier have come from overseas, suggesting quite a lot of interest, so I anticipate about 200 at the conference. ANU has, unfortunately decided to hold its 1st term break in late April, so that will present problems for many and we will try to arrange activities for a weekend and ANZAC day if possible. The planning committee consists of the AQUA executive, plus:

Paul Bishop (Monash)
Doreen Bowdery (ANU)
John Dodson (UNSW)
Dave Gilleson (ADFA-UNSW)
John Grinrod (Monash)
Jay Hall (Qld)
Peter Kershaw (Monash)
Brian Lees (ANU)
John Luly (ANU)
Ted Bryant (Wollongong)
Liz Truswell (BMR)
Karl Wrywoll (UWA)

I hope this represents the main Quaternary interests (other than paleolimnology) and regions.

Geoff Hope.

REPORT ON XIIIth INQUA CONGRESS, BEIJING, Aug 2-9, 1991

Jim Bowler

Summer in Beijing is hot, steamy and packed with people taking advantage of the summer vacation. A dense thick haze, hangs over the city, a stark reminder of human impact, to be cleared temporarily by the regular thunder storms of the summer monsoon that sweep across the area most evenings.

On the northern margins of Beijing, the city fathers have built a substantial, almost ultra-modern complex of apartments, dining halls, playing fields and congress facilities, initially to house the Asian Games held in 1990. Coming soon after the events of Tien Anmen Square (June 4th, 1989), the Asian Games represented a major international, test of China's standing in the world community. The INQUA Congress of 1991, held at the same venue, represented in a comparable way, China's first exposure to a major international community of scholars since June, 1989. That context imposed a subtle, but none the less real, political flavour to the occasion.

Some 700 foreign scientists with approximately 300 Chinese colleagues, enrolled for the Congress. Most were housed in the excellent accommodation provided by the Continental Grand Hotel, a mere 4 minutes walk from the Congress halls. In this context, the logistic organization provided by China was excellent.

Well over 1000 abstracts were presented. Most papers were actually delivered; the absentee rate was relatively low. As usual, the diversity, quality of papers and presentations was variable but certainly comprehensive in the range of topics covered, with a wealth of new data emerging. With 9 sessions running concurrently, it was virtually impossible to keep track of everything that was happening. In this report, I shall summarise the organizational and political aspects of the Congress. I shall leave to others the responsibility of evaluating the scientific content of the meeting.

The Executive

The INQUA executive, elected at the last meeting in Ottawa consisted of the following:
Nat Rutter, Canada, President

Christian Schluchter, Switzerland, Secretary
Bob Hageman, Netherlands, Treasurer
with Vice-Presidents
Frank Gullentops, Belgium
Mikhail Alekseev, USSR,
Liu Tungsheng, China
Bowler, Australia, &
Hughes Faure, France, Past President.

In the inter-congress period, the full Executive met only once, viz. at the International Geological Congress in Washington, July 1989. The high cost of travel meant that most of the day-to-day business was transacted by the President, Secretary and Treasurer. Unfortunately, matters that desirably required full executive participation, even by letter, often were not addressed. Thus those of us outside the "inner cabinet" of 3 knew nothing of budgets, expenditure, commission grants nor overall performance of commissions themselves.

On a more serious matter, little information was circulated in the pre-congress period to national Committees for their consideration in preparation for the Congress. This was most apparent in the menus (or lack of them) designed to respond to IGBP agendas such as those being designed by PAGES (Past Global Changes).

On arrival at Beijing, the Executive Committee met twice. We immediately reminded the President of the undertaking given at Ottawa to ensure adequate reporting and evaluation of Commissions in time for consideration by the International Council representing all countries at the Congress. The President eventually took this to heart and, in consultation with the Secretary, spent a couple of busy days going through Commission reports (none of which we had seen, nor have I seen to this day!) to provide initial 2-3 paragraph evaluations.

Additionally, the agenda papers in preparation for the International Council were almost non-existent. This was a matter of considerable concern, particularly for Gullentops and myself, both of whom drew attention to the Executive's lack of responsibility in these matters, noting that we had not been kept informed and certainly had not really been "used" in any meaningful sense.

Meanwhile, Hughes Faure and his colleagues who had been carrying the responsibility for

organizing a response to the Global Change agenda through the Intercongress Committee on Global Change, were busy mustering support for the grand scheme of a major new commission on Global Change. This had been circulated to us just 7 weeks before the Congress, instead of the mandatory 6 months. The Australian National Committee had no chance to respond. Bob Wasson did write to Rutter pointing out major shortcomings in the Faure proposal which, virtually was setting out to cover the whole agenda of environmental change, thus taking out a mortgage on 90% of INQUA's activities. During the early sessions of the Congress, petitions in support of this proposal as a new commission were being passed along benches for delegates to sign. Many signed without the foggiest notion of what it was all about.

In this context, the need for stringent examination and control of commissions took on new urgency. Several strategies were employed.

1. At the Washington Executive meeting, I had been given the responsibility to recommend amendments to the statutes to ensure more effective accountability. Two amendments were offered for submission to the International Council.

2. Although the timing was late, it was essential that evaluations of the Commissions with recommendations on their future status be presented to the International Council as was agreed at Ottawa.

The preparation of this latter task, undertaken over the 2-3 days before the final International Council, was, of necessity, left to the president to prepare. The timing was such, that none of the executive even saw those recommendations before they were submitted to Council. This caused a number of problems.

International Council

The International Council representing the 30 countries present, met on three occasions. The first, on the very first day before Australian delegates arrived, was merely to set the agenda; no formal business was transacted.

At its second meeting, the International Council had one major item on its agenda. In the agenda schedules, the president had deferred evaluation of commissions and consideration of

new commissions, including the Global Change initiative, until late in the program. This enabled Nat Rutter to present a proposal that he and Bob Hageman had raised at Washington Executive meeting. In brief, this was designed to ensure Nat's continuity in liaising with IGBP, even after the Beijing Congress and election of the new executive.

Hageman hastily prepared a paper for presentation to the IC, again not allowing time for evaluation by the Executive. This paper, poorly structured, described the establishment of a "Supra-Commission" under Rutter's control. This, naturally caused considerable consternation, not the least from some of us on the Executive. Eventually a modified version was passed, though just how the minutes will record that decision will be interesting to see.

In a sense, the continuity of Nat Rutter in this role undercut some aspects of the Faure proposal, a feature that came into the open during the 3rd. meeting of the Council.

The 3rd meeting of Council, and certainly the longest (a non-stop 7 hour marathon!) had to deal with the by far the most substantive business items on the whole agenda. These included budgets, amendments to statutes, evaluation of Commissions, new commission proposals, and election of officers. I shall address these aspects separately.

1. Budgets

The reports of the Treasurer and Auditing Committee (S. Porter, T. Partridge and one other) were a cause for concern. Firstly, the finances have run at a deficit in excess of 40,000 Swiss Francs. When we consider that the total annual income is only about 60,000SF, the organization faces real problems.

Secondly, the Audit Committee found little to excite them. Not that there was any misappropriation nor major management errors, but that efficient management, based on 2-yearly reviews and spreadsheet management as recommended at Ottawa, had not been implemented.

To assist in generation of additional funds, Council, agreed to increase affiliation charges, even at the risk of some countries dropping to a lower category. Lower expenditure during the next 4 years seems essential.

2. Amendments to Statutes

Two amendments were proposed and accepted by the General Assembly. The first ensures that Commission reports are furnished to the Secretary, evaluated by the Executive with recommendations circulated to National Committees well in advance of future Congress meetings.

The second specifies that Commission offices of President and Secretary may be held by an individual for no more than two consecutive Congress intervals. This is to prevent the "hardening of the intellectual arteries", an occupational hazard with some of our international colleagues.

3. Commission evaluation

The President, (in consultation with the Treasurer and Secretary) produced in the final Council meeting, draft recommendations for Commissions based on their reports.... most still submitted much too late. These may be summarised briefly:

Stratigraphic Commission....poor performance, no funding unless realistic programs and stringent budget estimates produced.

Tephrochronology....previously a sub-sub-commission...excellent performance Recommended to full commission

Holocene....good record..to continue.

Quaternary map....finished

Africa....no reports for 2 years. Algeria protests, given second chance. Must submit program and stringent budget to next Executive.

Paleogeographic Atlas (N. Hemisphere)....maps published, work concluded....despite protestations from Velitchko and Pecsí who had proposed new extension to do S. Hemisphere....

Recommended as Inter-congress Committee to get S. Hemi act in order.

Early Man....good record. To continue

Palaeoclimate....nosignificant progress. Because of importance to IGBP, second opportunity given to Andre Berger to

get act in order...reprieved.

Quat. S.America....OK

Applied Quat. Science....no progress, no funding until 92, depending on submitting a satisfactory proposal to new Executive.

Committee on Global Change..proposed as new commission. ...decision deferred to later discussion.

4. Evaluation guidelines

To ensure more effective evaluation of commissions and to make all such activities clearly accountable to the international body, Gullentops and I drew up a set of guidelines against which the Executive should now measure performance. Stated briefly, these are:

- i. Specific objectives with realistic milestones and accurate budgets to be provided for approval to new Executive within 6 months of Congress,

- ii. Annual reports to be submitted on activities, targets met, monies spent.

- iii. Final reports within 6 months of next Congress.

Unless these guidelines are adhered to, the Commissions will not qualify for funding.

5. New Commissions

Despite the parlous state of finances and the need both a. to curtail funding and b. to target INQUA's work much more closely to IGBP objectives, 4 new commissions were proposed. These are outlined as follows:

5.1. World Quat. Stratomap....proposed by USSR

This proposal appeared virtually from the floor of the meeting with no data for preliminary circulation. Although Alekseev is a splendid character, I had to object as this clearly fell outside the statutes requiring notice and circulation of proposal well before the meeting.

Although REJECTED, it was linked to proposal 2 as an Inter-Congress Committee.

5.2. New Commission on Palaeogeographic Atlas....Velitchko & Pecs

As indicated above, this was a re-activation of the former Commission.
Agreed to continue as INTER-CONGRESS COMMITTEE.

5.3. Continental Palaeohydrology ..Starkel (Poland), Baker (USA), Gregory(UK)

This has been in the air for some time...was a rejected IGCP project.
Put to vote, it was ACCEPTED 19 with 8 abstentions

5.4. Global Change....the proposal of Hughes Faure was presented verbally by Neils-Axel Morner. This caused great interest with strong feelings, for and against. Opposition was effectively led by USA with Canada and others chipping in. Debate became very intense.

The main opposition rested on the duplication with existing commissions and the danger of this proposition developing into a virtually new INQUA. Beneath the surface, there was a clear feeling of resentment, that the proposal represented too much power politics. This feeling was anything but diminished by Morner's presentation. Australia took the view, adequately expressed by John Dodson, that "we can do all this already under present arrangements."

Eventually put to vote, the proposition was DEFEATED, 13 to 11 with 4 abstentions.

5.0 Election of Officers

Nominations for office within the Executive received before the Congress consisted of the following:

for President,	Liu Tungsheng Christian Schluchter (former Secretary) Bowler
for Secretary	Ed Derbyshire Neils-Axel Morner
for Treasurer	Leon Follmer, USA Brad Pillans Bob Hageman (former Treasurer)

Subsequently, on the day before elections, a separate ticket was proposed by The Netherlands and Greece with Roland Paepe nominated for President. This was rejected by the International Council.

The position of Australia, and myself specifically, was a vexed one. There was considerable pressure to stand; I was most unhappy competing against Liu Tungsheng. Indeed the feelings were mutual, as was conveyed to me by Liu's supporters. However, there were great issues at stake as far as China was concerned. The politics became very intense and somewhat overheated.

Brad Pillans and Bob Hageman withdrew from Treasurer; Bob nominated Ed Mulder to replace him. Morner withdrew from Secretary, leaving Derbyshire.

For the Presidency, I realised Liu and I were splitting the vote, risking that neither would be elected. There was considerable support for Christian from the European block, especially as the next meeting was expected to be in Berlin. Therefore, at the very last minute, having got the nod from John Dodson across the room, I passed a note to Rutter indicating my withdrawal (with an admonition from Bob Wasson advising against such action ringing in my ears!). I was subsequently kept on the lists for Vice-President.

In the final analysis, Liu won (16 to 12 was the 'unofficial' count). I feel sure that Christian would have carried it off had I not withdrawn.

Great was the rejoicing in China and great praise was heaped on Australia for assisting the causes of honour, "face" and final recognition of China's place in international Quaternary affairs.

Next morning, I awoke with a clear conscience and with the relief that a great burden has been lifted. The INQUA Presidency is one chore I could well do without, though I realise that even to get so close was a great honour, both personally and in recognition of Australia's standing.

In the elections for Vice-Presidents, the following were successful:

Andre Velitchko, USSR
Stephen Porter, USA
Horst Hagedorn, Germany
Bowler

Ed Mulder was elected treasurer, with Ed Derbyshire unopposed as Secretary.
Nat Rutter remains as Past President.

I believe this is a very strong group, and one that will support and, where necessary, guide the hand of Liu Tungsheng. Indeed, its strength became apparent in the subsequent meeting held before delegates departed the Beijing scene (see below).

6.0 Meeting of New Executive

After the final plenary session which formally closed the Congress, the new executive met to assess events of the past few days. More specifically, the main item on its agenda was restructuring of Commissions and provision for INQUA to respond more specifically to PAGES and other IGBP objectives.

On this occasion, the proposal from Nat Rutter to establish continuity as liaison officer with PAGES was examined critically. Additionally, the manner in which Global Change programs should be identified, approved as endorsed INQUA activities and forwarded to PAGES was discussed at length. The following decisions were taken:

1. Nat Rutter is to provide to all Exec. members within 4 weeks a detailed outline of how he sees the INQUA connections with IGBP operating. These initiatives should provide an 'umbrella' beneath which proposals may be forwarded to or received from IGBP for action. No action will be approved until these arrangements have been clarified.

2. Specific proposals for Global Change initiatives that fall outside the activities of present commissions should be forwarded to the Executive for consideration. These may be given formal approval under the umbrella of the news links proposed with PAGES.

These arrangements are designed to ensure INQUA has a more effective presence in the IGBP game and to offer individual's the option of identifying projects for which INQUA should provide a home. Additionally, the Executive seeks, not only to soften the blow to those who were carried along by the Faure proposals, but also to salvage the genuine value that was embedded within some of those ideas.

7.0 Future Meetings

INQUA 1995...Germany offered the only invitation. Unanimously accepted.

Next INQUA will be in 1995 in BERLIN.

In accord with a statement from Ottawa, that we should be planning meetings 8 years ahead, notice was given by SOUTH AFRICA to host the congress after Berlin.

The 1993 Inter-congress in AUSTRALIA was fully endorsed. Many delegates declared their interest and desire to attend. I believe we should budget on perhaps 200 overseas visitors attending if we structure and advertise the occasion adequately.

8.0 CONCLUSIONS & IMPLICATIONS FOR AUSTRALIA

Politics apart, several important issues emerged that affect us directly.

8.1 Southern hemisphere correlations

In recognition of the need to synthesize data on a global scale, many scientists are now looking to the southern hemisphere to get its act in order. Indeed the Russians, through Velitchko's Palaeogeographic Group are already doing it for us!

An informal meeting was held with as many southern hemisphere representatives as we could muster to discuss this question. As well as 5 or 6 Australians, this included representatives for Argentina, Brazil and South Africa. Various strategies were proposed, much along the lines of those discussed by the Australian National Committee.

That meeting resolved that Tim Partridge should produce a summary of the notions expressed and fax these to national representatives for consideration with the aim of agreeing on specific objectives within the last glacial cycle. It was further agreed that, where there are major disagreements, such as in the presence or absence of the Younger Dryas in South America, these issues should preferably be resolved by mutual field investigations before committing conflicting data to print.

The Australian Committee should now meet to form its own views on this matter and to distribute them ASAP to South Africa and South America. This project should then be forwarded to the INQUA Executive for formal adoption as an approved INQUA-IGBP initiative.

8.2 The Inter-Congress Meeting in Australia

Geoff Hope's colourful flier and posters distributed at the Congress attracted a lot of interest. Many people indicated their desire to attend. In the light of the southern hemisphere activities outlined above, that meeting will provide an excellent occasion to bring together data from all southern continents, Antarctica included. We must now begin to work systematically towards this end.

8.3 Summary,

I believe Australia gave a strong account of itself. This applied both in the high level of scientific papers presented, from John Chappell's new, precise sea level curves on one hand to Andrew McMinn's coastal pollen sequence on the other (not to mention notable contributions from Kershaw, Williams, Dodson and many others, and of course the ever present Kiwis in Pillans, Eden and Pullan) and through our presence on the various levels of committees and commissions that keep INQUA in existence.

It was a stimulating Congress, even if a bit politically overheated and personally wearing at times. China did a great job in Beijing and certainly justified the Ottawa decision to hold it there. Let us now see what we can do in 1993.

Jim Bowler
21/8/91

RECENT PUBLICATIONS

Arakel, A.V. 1991 Evolution of Quaternary Durienists in Karinga Creek drainage system, central Australia groundwater discharge zone. *Australian Journal of Earth Sciences*, 38, 333 - 347.

Bailey, G. 1991 Hen's eggs and cockle shells: Weipa shell mounds, reconsidered. *Archaeology in Oceania*, 26, 21 - 23.

Bird, C.F.M., and Frankel, D., 1991. Chronology and explanation in western Victoria and south east South Australia. *Archaeology in Oceania*, 26, 1 - 16.

Bishop, P. (ed.) 1990 *Lessons for human survival: Nature's record from the Quaternary*. Geological Society of Australia, Symposium Proceedings 1.

Calf, G.E., McDonald, P.S., and Jacobson, G. 1991. Recharge mechanism and groundwater age in the Ti-Tree Basin, Northern Territory. *Australian Journal of Earth Sciences*, 38, 299 - 306.

Chappell, J. 1990. Some effects of sea level rise on riverine and coastal lowlands. pp 37 - 49 in Bishop (ed.) 1990.

Colhoun, E.A. 1991. *Climate during the last glacial maximum in Australia and New Guinea*. Australian and New Zealand Geomorphology Research Group, Wollongong, Publication 2.

Cull, J.P. 1990 Cultural changes to ground temperature and anomalies in geothermal data. pp 51 - 55 in Bishop (ed.) 1990.

Cribb, R. 1991 Getting into a flap about shell mounds in Northern Australia: a reply to Stone. *Archaeology in Oceania*, 26, 23 - 25.

David, B. 1990 How was this bone burnt? in Solomon *et al.* (eds) 1990.

Douglas, I. 1990. Quaternary legacies and environmental and engineering problems associated with urban and rural development in south-east Asian humid tropics. pp 21 - 26 in Bishop (ed.) 1990.

Gale, S.J. and Hoare, P.G. 1991. *Quaternary sediments: petrographic methods for the study of unlithified rocks*. Belhaven, London, Halstead, John Wiley, New York.

Galloway, R.W. 1990. Will greenhouse put us in the doghouse? - Opportunities and pitfalls in current research. pp 5 - 9 in Bishop (ed.) 1990.

Geering, K. 1990. A taphonomic analysis of recent masked owl pellets from Tasmania. pp 135 - 148 in Solomon *et al.* (eds) 1990.

Gill, E.D., Sherwood, J.E., Cann, J.H. Coutts, P.J. and Magilton, C.J. 1991 Pleistocene shell beds of the Hopkins River Warrnambool, Victoria: estuarine sediments or Aboriginal sediments. pp 321-338 in Williams *et al.* (eds) 1991.

Hall, J., and Jones, R. 1990. Palaeoscatology and taphonomic implications at Rocky Cape northwestern Tasmania. pp 220 - 233 in Solomon *et al.* (eds) 1990.

Head, L., D'Costa, D.M., and Edney, P. 1991 Pleistocene dates for volcanic activity in western Victoria and implications for Aboriginal occupation. pp 302-308 in Williams *et al.* (eds) 1991.

Hiscock, P., 1990 A study in scarlet: taphonomy and inorganic artefacts. pp 34 - 49 in Solomon *et al.* (eds) 1990.

Kershaw, A.P., Baird, J.G., D'Costa, D.M., Edney, P.A., Peterson, J.A., and Strickland, K.M. 1991. A comparison of long Quaternary pollen records from the Atherton and western Plains Volcanic provinces, Australia. pp 288-301 in Williams *et al.* (eds) 1991.

Kershaw, A.P. and Gell, P. A. 1990 Quaternary vegetation and the future of the forests. pp 11 - 20 in Bishop (ed.) 1990.

Kiernan, K. and Hannan, D. 1991. Glaciation of the Upper Forth River Catchment, Tasmania. *Australian Geographical Studies*, 29, 155 - 173.

Machida, H. 1990. Frequency and magnitude of catastrophic explosive volcanism in the Japan region during the past 130 ka: implications for human occupation of volcanic regions. pp 27 - 36 in Bishop (ed.) 1990.

Mollach, W.S., De Launey, W. and Haynes, M.A. 1991. Long-term characteristics of seasonal rainfall at Katherine, Northern Territory. *Australian Geographical Studies*, 29, 71 - 92.

Mountain, M.J. 1990. Taphonomic aspects of faunal analysis from Nombe Rockshelter, highlands of Papua New Guinea. pp 208 - 219 in Solomon *et al.* (eds) 1990.

Page, K.J., Nanson, G.C. and Price, D.M., 1991 Thermoluminescence chronology of late Quaternary deposition on the riverine plain of southeastern Australia. *Australian Geographer*, 22, 14-23.

Peterson, J.A. 1991 Human dispersal from Wallacea to Sahul: a re-appraisal. pp 339 - 346 in Williams *et al.* (eds) 1991.

Pringle (nee Phillips) A.W. 1991 Fluvial sediment supply to the North-east Queensland coast, Australia. *Australian Geographical Studies*, 29, 114 - 138.

Prosser, I.P. 1991. A comparison of past and present episodes of gully erosion at Wangrah Creek southern tablelands, New South Wales. *Australian Geographical Studies*, 29, 139 - 154.

Robins, R.P. and Stock, E.C., 1990 The burning question: a study of molluscan remains from a midden on Moreton Island. pp 80 -100 in Solomon *et al.* (eds) 1990.

Roy, P. and O'Connell J. 1990. Greenhouse effects on atoll islands in the South Pacific. pp 57 - 70 in Bishop (ed.) 1990.

Singh, B., O'Connor, S., Veth, P., and Gilkes, R. 1991. Detection of amorphous alumina silicates by X-ray diffraction and chemical analysis to detect firing in archaeological sediments. *Archaeology in Oceania*, 26, 17 - 20.

Solomon, S., Davidson, I. and Watson, D. (eds) 1990 *Problem solving in taphonomy: archaeological and palaeontological studies from Europe, Africa and Oceania*. Tempus, 2 Anthropology Museum, U.Qld., St Lucia.

Solomon, S., and David, B. 1990. Middle range theory and actualistic studies: bones and dingoes in Australian archaeology. pp 234 - 256 in Solomon *et al.* (eds) 1990.

Stone, T. 1991 Two birds with one Stone: a reply. *Archaeology in Oceania*, 26, 26 - 28.

Wasson, R.J. 1990 Palaeoenvironmental research and global warming. pp 83 - 92 in Bishop (ed.) 1990.

Whetton, P., Adamson, D., and Williams, M. 1990. Rainfall and river flow variability in Africa, Australia and East Asia linked to El Nino - southern Oscillation events. pp 71 - 82 in Bishop (ed.) 1990.

Whitehead, P.W. 1991 The geology and geochemistry of Mt Napier and Mt Rouse, western Victoria. pp 309 - 320 in Williams *et al.* (eds) 1991.

Witter, D., 1990. The taphonomy of meat storage. pp 257 - 260 in Solomon *et al.* (eds) 1990.

Williams, M.A.J., de Dekker, P., Adamson, D.A. and Talbot, M.R. 1991 Eposodic fluvialite lacustrine and aeolian sedimentation in a late Quaternary desert margin system in central western New South Wales. pp 258-287 in Williams *et al.* (eds) 1991.

Williams, M.A.J., de Dekker P., and Kershaw, A.P. (eds) 1991. *The Cainozoic in Australia: a re-appraisal of the evidence*. Geological Society of Australia, Special Publication No 18.

BOOK REVIEWS

Andrews, P. 1990. *Owls, caves and fossils*. Natural History Museum Publications, London.

This book is centred on a detailed description and interpretation of the mammal fauna from the cave deposits at Westbury-sub-Mendip quarry, in Somerset, England. Impinging upon this are chapters providing an introduction to small mammal taphonomy; a general survey of predators, including European owl species, and the process of predation; and a survey of how small mammal bones are modified in predator accumulations. There are chapters on cave formation and taphonomy in general, and the specific deposits at Westbury-sub-Mendip. The final chapters cover the small mammal faunas from the deposits and the detailed interpretation of their palaeoecology. There is a large and comprehensive Appendix providing basic relevant details of natural history of all European owl and raptor and some canid and mustelid species. In general the book is very well produced and provides excellent coverage of the subject matter. The only slight blemish is that the bibliography could have been a little more comprehensive. There is, for example, no reference to the fairly extensive literature on Barn Owls and the taphonomy of the deposits from their pellets in Australia.

Alex Baynes, Western Australia Museum, Perth

Bishop, P. (ed.) 1990 *Lessons for human survival: Nature's record from the Quaternary*. Geological Society of Australia Symposium Proceedings 1. Copies available from the Geological Society of Australia, 1001 Challis House, 10 Martin Place, Sydney, NSW 2000; \$15 for Society Members, \$20 for non-members.

Williams, M.A.J., de Dekker, P. and Kershaw, A.P., (eds) 1991. *The Cainozoic in Australia: A re-appraisal of the evidence*. Geological Society of Australia Special Publication 18. Copies available from The Business Manager, Geological Society of Australia Inc., 606 ANA House, 301 George St., Sydney, NSW 2000; \$45 for Society Members, \$65 for non-members.

The Geological Society of Australia, and its editors, should be commended on the production of these two publication. Between them, the two books offer a wide range of reviews and case studies embracing physical, biological and human aspects of the Quaternary, and providing something of interest for every Quaternarist.

Bishop's Foreword to the *Lessons for human survival volume* provides a useful summary for both the background to the volume and the papers and offers some optimistic comments on the relationships between geologists and geographers. I reproduce that Foreword:

"By and large, this volume presents papers from a half-day symposium in August 1988 during the International Geographical Union Congress at the University of Sydney. All speakers, bar one, submitted manuscripts for this volume, and two authors, R.W. Galloway and J. Cull, did not speak at the symposium. Some authors submitted papers differing in flavour or content from the papers they delivered at the symposium.

Speakers were asked to speak and subsequently write about aspects of using the past ("Nature's Record from the Quaternary") to guide predictions about the future ("Lessons for Human Survival"). This conjunction with past and future is a currently popular theme in the earth sciences and its emphasis is partly a way of highlighting a role for the geosciences in debates and research on future global and local environmental crises.

The value of this approach is examined in two ways in this volume. One type of paper, represented by the contributions of Galloway and Wasson, explicitly examines the practice of using the past to make predictions about future. Both papers offer methodological examinations of the roles and responsibilities of the geosciences in the current investigations of the greenhouse effect and both authors strike a very cautionary note in the discussions. This is why these papers have been placed first and last in the volume.

Galloway brings a long experience of research, in Australia and elsewhere, to his argument that geoscientists must be circumspect in their embracing of research based on the possibilities of global warming by the greenhouse effect. Wasson does not necessarily accept the reality of this effect, but uses it as a context for his consideration of the types and quality of palaeo-environmental data that are suitable and appropriate for the prediction of future climates should the greenhouse effect indeed result in increased global temperatures. Wasson notes that it is often difficult to obtain a match in temporal/spatial scales and detail between the historical data and the requirements for prediction of future environmental trends. One trusts that this issue will be increasingly addressed by historical earth scientists.

The second type of paper takes one or more examples of using the historical approach to provide insight into some aspect of the future of the environment or its use. Case studies are drawn from a range of environments and time scales, including Southeast Asia, volcanic Japan, Pacific and other coral atolls, Africa, India, China and southeastern and tropical Australia, over time periods from the Quaternary to the recent historical.

The papers by Douglas and Machida are studies in the use of Quaternary data as aids in planning human occupancy of Southeast Asia to highlight the necessity of a full understanding of Quaternary stratigraphy and environmental change as a prerequisite to human development of such areas. Machida's stratigraphical, chronological and archaeological data from Japan demonstrate the catastrophic effects of high magnitude volcanic eruptions on human populations during the Late Quaternary. These data suggest that such eruptions virtually obliterated whole civilisations and Machida notes that large areas of heavily populated present-day and future Japan would be no less severely affected by such eruptions.

The role of stratigraphic palynological studies in understanding past and future environmental changes is explored by Kershaw and Gell. They note that such palaeo-ecological data must be interpreted carefully, and that not all data from the past are automatically useful in a predictive way, a point echoed by Wasson, as we have seen. An important use of fine-resolution palynological data may be as a monitoring tool in areas of disturbance such as timber harvesting, although geoscientists must be very careful that their data are not 'adjusted' by authorities to support their own ends.

Several papers explore the predicted global warming attendant on the greenhouse effect. Two papers (those by Chappell, and Roy and Connell) examine the effects of rising sea-level on coastal and atoll environments.

The latter is probably something of a milestone in publications by the Geological Society of Australia because it discusses in some detail the effects of a sea-level rise on both physical and social, including economic, environments of low and coral atolls. The physical nature of the atolls is considered in terms of their geology, geomorphology and ecology, an important element of the latter being the human occupants of the atolls. The authors note that a new class of refugee, the "environmental" refugee, may count among its number victims of the greenhouse effect, should the predicted sea-level rise come to pass.

Chappell takes a different approach and uses late Quaternary environmental history to investigate the effects on tropical coastal plains of the predicted, greenhouse-induced sea-level rise. The study aims both to set out a methodology for, and give results from, such an approach. Chappell shows that the pattern of events during sea-level rise on the coastal plains investigated depends critically on sediment flux to the coast and the tidal range, and not just on simple elevation data from the coast and the projected rise in sea-level.

Cull's paper is the third in the volume that examines data related to greenhouse warming. This paper shows that informative and quite precise information on past surface temperature regimes may be obtained from geothermal data. Interestingly, Cull's data from southeastern Australia do not show any evidence of surface warming during the last century, and will add to the ongoing debate about the reality of recent global warming.

The remaining paper, by Whetton, Adamson and Williams, takes a shorter-term view of the past and presents data on the variations in the El Nino over the last 100 years or so. The historical data indicate important global linkages between El Nino and floods and droughts. Unfortunately, it is not yet possible to predict the future pattern of El Nino occurrences, but the establishment of the reality of these weather and climate linkages at the global scale means that research effort must continue to be devoted to this predictive work. Certainly, much of human and other ecological well-being depends on moderate frequency, moderate magnitude events of the El Nino type, rather than on slower events to which adaptation may be made."

Bishop continues his foreword to comment on the relationships between geographers and geologists, suggesting that traditionally in Australia, the subject matter of this volume has been largely the reserve of stratigraphic geomorphologists based, or trained in Geography departments of the country's universities. This probably reflects partly the situation in British earth sciences and partly the concentration, historically on pre-Cainozoic geology by the State Geological Surveys and the university Geology departments.

The obvious lack of interest of many practising geologists in areas of "Quaternary alluvium" on geological maps is well known.

The current pre-occupation with the Quaternary on the part of earth scientists hitherto little interested in this part of geological time is therefore both interesting and welcome. This interest may, in small part, be opportunistic, but it is also part of a genuine concern for the future of global environments. This interest and concern are also reflected in the mushrooming of inter-disciplinary programmes concerned with global, physical issues.

It is a pleasing sign to see the convergence of interest between two branches of Australian earth sciences that the symposium of "Lessons for Human Survival: Natures Record from the Quaternary" was sponsored by the International Geographical Union whereas the Proceedings volume is published by the Geological Society of Australia.

The *Cainozoic in Australia* volume differs somewhat from the *Lessons* volume. The emphasis is on the scientific rather than the human, and the time frame is from the Paleocene through to the present, with more-or-less equal balance of papers covering Paleogene, Neogene, and Quaternary issues. The editors suggest that this book provides a critical overview of Australia's Cainozoic history.

The studies published here cover much of the range of environmental conditions present in Australia from the semi-arid through to the shelf. Williams, de Dekker and Kershaw provide a Preface which neatly sets the context for this volume and summarises the content of the papers. Part of that Preface is reproduced here (I have taken the liberty of omitting the commentary on the Palaeogene and Neogene papers).

"The Cainozoic era spans the past 65 million years of geological time and was of critical importance in earth history. It was during this time that the now familiar geographical distribution of land, sea, and ice was achieved as a result of Cainozoic sea-floor spreading and lithospheric plate movements. Associated with these global tectonic events were a number of major regional episodes including uplifts in the Himalayas, northward movement of Africa and Australia, closure of the Panama isthmus, continental desiccation and cooling, reduction in tropical rainforest cover, expansion of deserts and emergence of bipedal, tool-using hominids in the rift valleys of East Africa. In brief, the fashioning of the world environment in which we now live, together with the emergence of the plants and animals upon which we depend for food and shelter, was principally effected during the Cainozoic.

Much of the evidence of these events is still well preserved, especially in a continent as dry and tectonically stable as Australia, where the erosional and depositional evidence from rivers, lakes and dunes has not been obscured or obliterated by the great ice sheets which periodically covered much of north America and north-west Europe during the very late Cainozoic.

A critical re-examination of the evidence from land and sea involves a re-appraisal of the time of past tectonic and volcanic activity around Australia, as well as careful scrutiny of the correlative depositional record offshore.

A willingness to help achieve this re-appraisal of Australia's Cainozoic record brought together seventy earth scientists from all around Australia to take part in the Cainozoic conference which was held at Warnambool in Victoria in the second week of December, 1987. A similar spirit provides the *raison d'être* for this special publication of the Geological Society of Australia, which includes revised and expanded versions of many of the papers delivered and debated at Warnambool, together with a number of additional contributions."

Six chapters round off this book and are the subject of the Quaternary section. Williams *et al.* consider the low gradient desert margin environment of central western NSW, and conclude that many of the landforms which are characteristic of this region are not forming there today, but are a legacy of late Quaternary climates which have no modern counterpart. They also note the very close integration between fluvial, lacustrine and aeolian depositional systems. In the next chapter Kershaw *et al.* compare two of Australia's longest and most detailed pollen records, one from the tropical Atherton Tableland of northeastern Queensland, the other from volcanic lakes in western Victoria. The timing of late Quaternary volcanic eruption in western Victoria is the subject of reconsideration by Head *et al.*, who offer both palynological and radiocarbon dating evidence to extend the age of certain prehistoric artefact concentrations from Holocene to Pleistocene. Whitehead's account of late Quaternary volcanism in this area is essentially geochemical in approach, but his chronology may require revision in the future. A tantalising set of marine shell beds near Warnambool in coastal western Victoria were considered by the late Dr Edmund Gill as possible Aboriginal middens. If so they would double or treble the known antiquity of human occupation of Australia. Sherwood and colleagues take up the challenge in a paper which is exemplary as a study in method. The concluding chapter by Peterson is also an example of lateral thinking and draws attention to a hitherto neglected mechanism for possible human entry into northern Australia.

This book provides a critical review overview of Australia's Cainozoic history both on land and offshore.

Analysis of the terrestrial record proceeds from a re-evaluation of major tectonic and volcanic events through more detailed studies of regional and local sedimentary and volcanic microfossil analysis supplement the inference drawn from the litho-stratigraphic sequences preserved in our sedimentary basins, ocean floor, and continental shelves.

Against this background of long-term tectonic, volcanic and climatic change, the volume concludes with some intriguing new data and fresh ideas relevant to the nature and timing of late Quaternary environmental changes and associated prehistoric human settlement in Australia.

Review compiled by W.E. Boyd, The University of New England - Northern Rivers

Gillespie, R. (ed.) 1991. *Quaternary Dating Workshop 1990*. Department of Biogeography & Geomorphology, Research School of Pacific Studies, A.N.U., Canberra.

This slim, and moderately-priced, book presents extended abstracts (some more extended than others, virtually short papers) based on papers presented to the Quaternary Dating Workshop held at the Australian National University in October 1990. The stated purposes of the workshop were to i) examine the present state of the art of various dating techniques applied to Quaternary materials, ii) discuss correlations and comparisons between different methods, and iii) address problems of apparent age for radiocarbon dating of shell material. The publication could well have borrowed the subtitle used by Lyons for her discussion of ESR dating of speleothems: "Applications, problems and progress".

Twenty-two papers are presented under the headings "Radiocarbon" (7 papers), "Amino Acid Racemisation" (1 paper), "Electron Spin Resonance" (4 papers), "Thermoluminescence" (6 papers) and "Uranium and other nuclides" (4 papers). The emphasis in some is to provide cautionary tales, in others to illustrate realised or potential fields of application, and in yet others to highlight areas of progress in what appears to be an expanding field of increasingly-sophisticated methods.

The radiocarbon section yields most of the cautionary tales, with reminders, which ought to be familiar to most Quaternarists, of the limitations of technology, stratigraphy ("... the [stratigraphic] problems are still with us and will never be resolved by advances in dating technology." Lees, p.11), potential contamination from old and young carbon alike, and sedimentary effects such as mixing. These tales, however, should not be taken as an excuse for inactivity and despair: the call is for practitioners to be ever-attentive to the contexts of the samples that they wish to date.

The sections on amino acid racemisation and electron spin resonance offer indications of the progress being achieved in the understanding and application of these techniques. The impression one gets is of techniques in their relative infancy ("We are optimistic about this method [ESR dating of gypsum] for dating semi-arid zone deposits ..." Chappell *et al.*, p.28; "When the problems of ESR dating are clarified, it will hopefully become a more powerful technique in Quaternary geochronology." Ikeda, p.30).

The growing application of thermoluminescence dating is undoubtedly fired by enthusiasm: its practitioners clearly see its assured place in the methodological core of Quaternary science. The papers presented here review a range of applications from Australia and New Zealand -- studies of fluvial and aeolian sediments, of archaeological sediments and artefacts, and of climatic change.

As well as being alerted to progress in applications of this method in the region, we are also gently warned of the stratigraphic problems which can beset any dating programme, and given advice regarding sample collection and laboratory checks. Comparison is made of dating sequences derived from thermoluminescence and radiocarbon methods; it is apparent that, in some cases, especially those involving the dating of recent (post-1,000 years ago) and old (pre-30,000 years ago) materials, thermoluminescence may provide more reliable dates than radiocarbon. Careful selection of methods, however, is in order: Roberts (pp 38-40) aptly entitles his comparative study of thermoluminescence and radiocarbon dating of water-lain deposits, with the colloquial "Horses for courses" ...

The final section, on the use of uranium and other nuclides, again provides examples of recent developments and applications of a range of decay series techniques. With fine-resolution studies of, for example, vegetation change becoming increasingly fashionable, Olley *et al.*'s discussion (pp 51-55) of nuclear weapon testing fallout nuclides provides useful material for recent dating possibilities. Applications such as dating periods of mineral induration in soils, dating fossil bones, and establishing sediment accumulation rates, are briefly discussed. Again optimism shines through: statements such as "The future looks very exciting for applications of U-series techniques" (Short, p.57) cannot be more unambiguous.

All-in-all, this book provides a useful compilation of papers. The summaries are, by and large, clearly written, although some require more working knowledge of the techniques than others. Nevertheless, they all make this field of Quaternary dating easily accessible to the general Quaternarist; this publication will be of particular interest to students, providing easily-digested, potted versions of a wide range of issues. Beyond the immediate review of dating techniques -- Barbetti's summary (pp 5-7) of late Pleistocene radiocarbon calibration, and Gillespie's summary (p. 15) of the Australian marine shell correction factor, for example, will be of widespread interest to Quaternarists -- several papers also provide useful summaries of recent Quaternary understanding. Nanson *et al.*'s review (pp 45-50) of major episodes of climatic change in Australia during the last two glacial-interglacial cycles, and Readhead's summary (pp 35-37) of recent thermoluminescence dates from Lake Mungo and Nyah West, are two such useful reviews.

W.E. Boyd, Faculty of Resource Science & Management, University of New England Northern Rivers, Lismore, N.S.W.

Quaternary Dating Workshop 1990

The proceedings of this meeting, edited by Richard Gillespie, are now available from:

Secretary
Department of Biogeography and Geomorphology
RSPacS, Australian National University
PO Box 4, Canberra ACT 2601
Phone (06) 249 4361, Fax (06) 257 1893

Price \$10 per copy, prepaid orders only, cheques, etc. payable to Dept of Bio and Geo.
Overseas orders \$15 including postage, cheques in Australian dollars only.

Gale, S.J. and Hoare, P.G. 1991. *Quaternary sediments: petrographic methods for the study of unlithified rocks*. Belhaven, London, Halstead (John Wiley), New York.

The analysis of sediments, soils and weathering products is the most powerful means available of reconstructing the environmental history of the Quaternary Period. This volume brings together many of the physical and chemical methods employed in this field. It describes their purpose, the equipment needed and its use. It evaluates the strengths and the weaknesses of each method, and discusses how results are obtained and interpreted. Explanations are clear and straightforward, and detailed case studies and full references are included.

The *UNE Gazette* recently reviewed the book (or rather its senior author, Stephen Gale). Here is a copy of that interview from *UNE Gazette*, 3 (16/7/91).

Past throws light on global future

SCIENTISTS need to consider the global changes of the past two million years when assessing the implications of recent environmental alterations, according to the co-author of a book on changes in the natural environment.

Dr Stephen Gale, a geomorphologist in the Department of Geography and Planning at UNE-Armidale and co-author of *Quaternary Sediments*, believes scientists undervalue the relevance of past environmental changes in their quest to preserve the planet and ensure human survival.

"Instrumental and documentary records of environmental change extend back only a few centuries and even these cover only a limited part of the world," Dr Gale said.

"And we cannot assume that the trends of the past few decades will continue into the future.

"A better approach involves the investigation of the environmental history preserved within the thin layer of sediment on the Earth's surface. This enables us to extend these limited records back in time and gives us a more reliable basis to predict the future," he said.

The study of sediments allows scientists to extend back records of natural phenomena such as floods, storms, droughts and soil erosion.

Sediments laid down during the past two million years, the "Quaternary Period", range from stalagmites in caves and muds from lake beds to accumulations of polar ice and the remains of beetles.

Quaternary Sediments, which was co-authored with Dr Peter Hoare of Cambridge, brings together for the first time the wide range of these investigations and applications of the results.

"This is essential information if we wish to understand our impact on the environment and the behaviour of the global system in the future," Dr Gale said. The past two million years have seen the Earth locked into an Ice Age, in which glaciers have expanded thousands of kilometres from the poles and sea levels have fallen more than 150 metres on many occasions.

"Although it may not seem to be the case from our viewpoint in Australia, the globe is still locked into this cycle of ice advance and retreat, although at present we are basking in what may be a relatively short-lived warm phase between long, cold episodes," Dr Gale said.

"We don't know what initiates an Ice Age and we don't know what is going to take us out of this one.

"Human intervention in the natural environment may be sufficient. Changes in the greenhouse effect could be enough," he said.

TASMANIAN SPELEOTHEMS : PROGRESS AND PROSPECTS FOR PALAEOENVIRONMENT RECONSTRUCTIONS

A. Goede
Dept of Geography and Environmental Studies
University of Tasmania
HOBART 7001

INTRODUCTION

The recent paper by Francey and Cook in *Quaternary Australasia* Vol. 8, no. 2 made it obvious that many Quaternarists are not familiar with the palaeoenvironmental studies of calcite stalagmites in Tasmania that have been in progress since 1979. The research is reaching a stage where very detailed information may be obtained about environmental change, which clearly has considerable value for comparison with similar information from other sources, e.g. Tasmanian tree rings.

PAST RESEARCH

The project commenced in 1979 with the collection of monthly precipitation and cave drip samples for stable isotope analysis ($^{18}\text{O}/^{16}\text{O}$, D/H) from three sites. The sites were located in major karst areas known to contain speleothem material suitable for analysis. The isotope values and their seasonal variations were reported by Goede et al. 1982.

Speleothem material suitable for isotopic analysis consists of uniform diameter stalagmites which tend to grow continuously over time periods ranging from 10^3 to 10^5 years at a uniform long term rate. Longitudinal sectioning reveals a layered structure with cusate layers that are normally convex upwards.

One half of the stalagmite is set in plaster. It is used for the drilling out of small samples for isotope and electron spin resonance (ESR) analysis. The other half is cut up to provide larger core samples for radiometric dating ($^{230}\text{Th}/^{234}\text{U}$, ^{14}C).

During 1979-81 seven calcitic stalagmites were collected from four different caves. Age determination was carried out by radiometric dating of multiple core samples. Details of the location, physical nature, dating techniques and average growth rate of each specimen are shown in Table 1.

Table 1 - Location, height, age ranges and growth rates of Tasmanian uniform diameter stalagmites.

Code	Cave Name	Area	Height (mm)	No. of dates		Age Range (ka BP)	Growth Rate (mm ka)	Oxygen Isotope
				Th/U	^{14}C			
KK	Kubla Khan	MC	1070	8	-	127 - 97	36	No
LT	Little Trimmer	MC	1420	7	-	109 - 76	43	Yes
LX	Little Trimmer	MC	550	3	-	95 - 69	21	No
LY (l)	Lynds Cave	MC	1180	1	4	12.6 - 8.1	262	Yes
LY (u)	Lynds Cave	MC	800	-	3	6.9 - 2.8	200	Yes
LC	Lynds Cave	MC	867	3	4	15 - 11	215	No
FC	Frankcombe C.	JF	720	-	5	4.3 - 2.9	500	Yes
FT	Frankcombe C.	JF	860	3	1	98 - 55	20	Yes

Area codes : MC - Mole Creek; JF - Junee Florentine

PALAEOENVIRONMENTAL INFORMATION

Both $^{18}\text{O}/^{16}\text{O}$ and $^{13}\text{C}/^{12}\text{C}$ isotope measurements can provide useful information about palaeoenvironmental conditions as long as deposition of calcite takes place under conditions of isotope equilibrium (Hendy & Wilson, 1968). Sometimes equilibrium is not maintained due to rapid degassing of CO_2 or to partial evaporation of drip waters during deposition.

Oxygen Isotope Ratios $^{18}\text{O}/^{16}\text{O}$ changes in calcite reflect variations in cave temperature. The present day value of the ratio is determined for each cave site by sampling the tips of a number of active, rapidly growing straw stalactites (Goede et al., 1982; Goede & Hitchman, 1984). If the isotopic composition of drip water has been determined and the cave temperature has been measured it is also possible to calculate a theoretical value for the ratio.

The ratio is controlled by two opposing effects: the temperature of the cave site and the mean isotopic composition of the drip water. Temperatures in most karst caves show little seasonal variation ($<1^\circ\text{C}$) and usually approximate closely to the mean annual temperature above ground. If the mean annual surface temperature changes the cave temperature will adjust accordingly.

Taking the example of a fall in temperature it is found that two opposing processes come into play.

1. A fall in cave temperature will cause a larger proportion of the heavier ^{18}O isotope to be incorporated into the calcite being deposited. This would cause the value of the $^{18}\text{O}/^{16}\text{O}$ ratio to increase.

2. The fall in surface temperature will cause the $^{18}\text{O}/^{16}\text{O}$ composition of precipitation to become isotopically lighter causing a similar effect in cave drip water. This would cause the value of the $^{18}\text{O}/^{16}\text{O}$ in the calcite to decrease.

Whether $^{18}\text{O}/^{16}\text{O}$ ratios in speleothem calcite have a positive or negative relationship to temperature depends on which of the two opposing processes has the larger effect. In most parts of the world where speleothems have been analysed the first process appears to dominate and $^{18}\text{O}/^{16}\text{O}$ ratios bear a negative relationship to temperature. The two well documented exceptions are found in Vancouver Island and Tasmania where the relationship has been shown to be a positive one (Gascoyne et al., 1981; Goede et al. 1986; Goede et al. 1990). Model isotope values for Mole Creek are shown in Fig. 1.

Tasmania appears to have experienced an unusually large glacial-interglacial shift in the isotopic composition of precipitation. The most likely explanation is a marked poleward shift in the oceanic moisture source under glacial conditions associated with strong latitudinal airflow patterns. Under the present (interglacial) regime it receives much of its moisture supply from tropical sources.

Palaeotemperature curves based on $^{18}\text{O}/^{16}\text{O}$ ratios have been published for four Tasmanian speleothems and have given valuable information about the timing and magnitude of past temperature changes (Goede & Hitchman, 1984; Goede et al. 1986; Goede et al. 1990).

Carbon Isotope Ratios They are more difficult to interpret. If no fractionation occurs during deposition they should appear to be closely related to the nature of the vegetation cover. Soil CO_2 plays a dominant role in the solution of limestone by seepage water because of its high concentration. It is depleted in ^{13}C ($-27 \text{‰} \leq \delta^{13}\text{C} < -13 \text{‰}$ vs PDB) giving rise to isotopically light calcite.

Groups of plants have different biochemical pathways for their photosynthetic processes (C_3 , C_4 and CAM metabolisms) leading to different fractionation effects (Smith & Epstein, 1976). The isotopically lightest values in calcite ($\delta^{13}\text{C} < -10 \text{‰}$) may be associated with moist forest vegetation rich in C_3 plants, heavier values ($-10 \text{‰} \leq \delta^{13}\text{C} < -8 \text{‰}$) may be associated with a vegetation dominated by grasses (C_4 plants). Limited deposition of calcite can take place with little or no contribution of biogenic CO_2 ($\delta^{13}\text{C} > 8 \text{‰}$). See Goede et al. (1990) for a possible example.

Variations in the $^{13}\text{C}/^{12}\text{C}$ values of Tasmanian stalagmites studied so far are clearly not random but show little relationship to $^{18}\text{O}/^{16}\text{O}$ variations even during major climatic transitions. In some stalagmites there is a strong correlation between $\delta^{13}\text{C}$ and uranium content (Goede, 1989) which may suggest that variations in the amount of organic impurities are responsible.

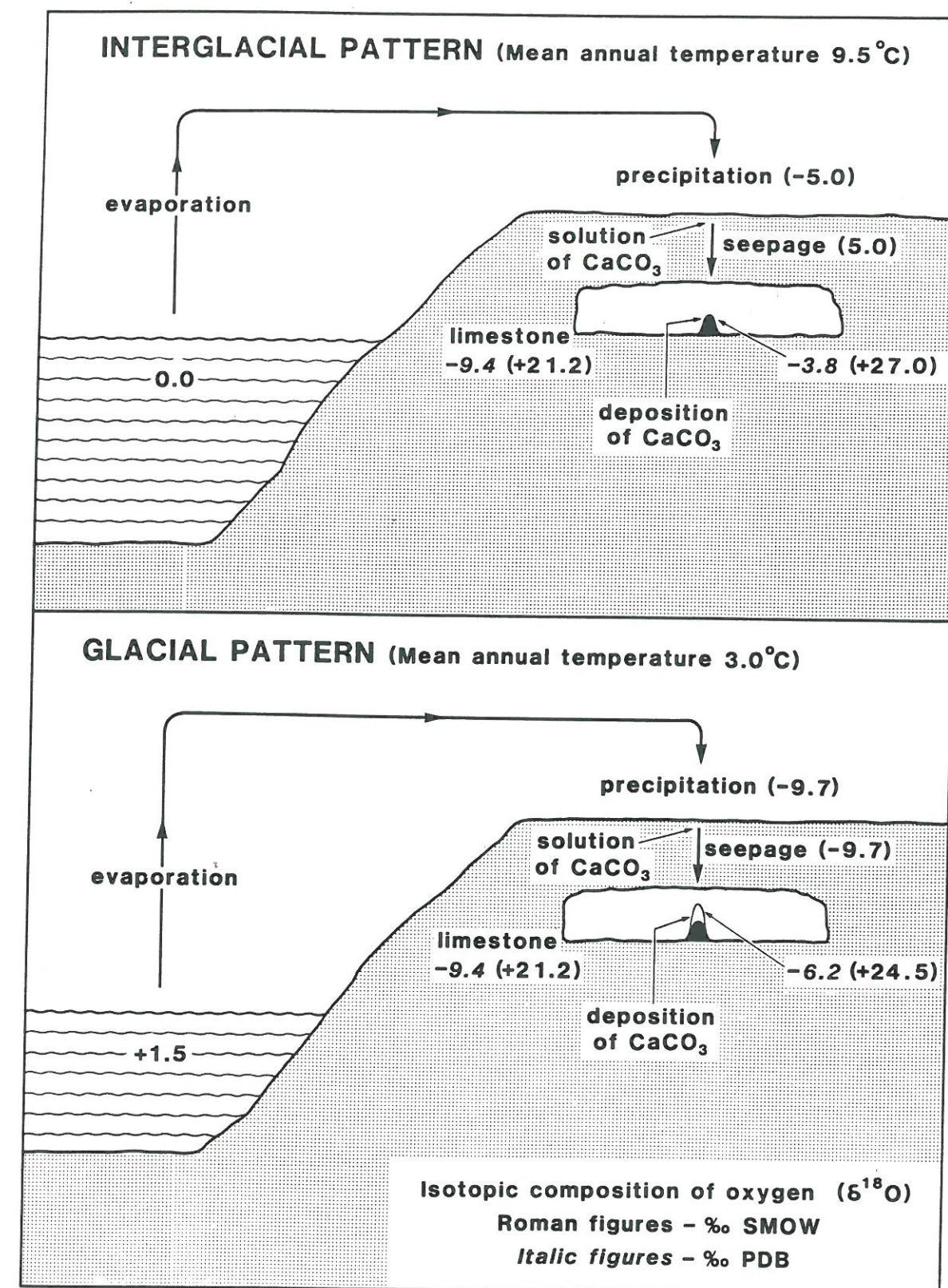


Figure 1 - Model of oxygen isotope composition of precipitation and cave calcite for both interglacial (present day) and glacial conditions based on research in caves at Mole Creek, Tasmania.

All terrestrial figures, except the mean values of precipitation and seepage at the glacial maximum, have been obtained by laboratory measurement of samples collected in the field. The two glacial maximum values can be calculated since mean annual temperature can be estimated from other information sources (Colhoun, 1985), the isotopic composition of the calcite has been measured and the fractionation effects of calcite deposition are well known (Friedman & O'Neil, 1977). The mean isotopic composition of ocean water is equated with the SMOW standard and the change for full glacial conditions has been estimated from isotope studies of deep sea cores (Hays et al., 1976).

Deuterium Hydrogen Ratios They are determined on fluid inclusion water after its extraction from a calcite sample. Before being measured the water has to be converted to hydrogen using techniques first published by Schwarcz et al. in 1976.

Since D/H ratios of mean annual precipitation are temperature dependant they are influenced by changes in climatic conditions. Values should correlate with $^{18}\text{O}/^{16}\text{O}$ in calcite which are also temperature dependent (Goede et al., 1986). In theory D/H values can be used to reconstruct the $^{18}\text{O}/^{16}\text{O}$ values of drip water from the same stratigraphic horizon because in meteoric water there is a close statistical relationship between the two (meteoric water line). The $^{18}\text{O}/^{16}\text{O}$ ratios of drip water can then be used to calculate the $^{18}\text{O}/^{16}\text{O}$ of calcite deposited from the water at different temperatures since the fractionation effect between the water and the calcite deposited from it is well known.

Considerable efforts have been made to determine reliable D/H ratios from fluid inclusion water. However, due to the very small quantities of water involved and the complexity of the extraction procedure and conversion of the sample to hydrogen the analyses were found to have a low degree of reproducibility. The results tend to give a qualitative indication of temperature only. For an example see Goede et al. (1990).

Trace Element Variations Recent work (Goede & Vogel, in press) on one Tasmanian stalagmite (LC) has demonstrated that many trace elements exhibit significant variations over time and that they are not random but show trends or cyclic patterns probably related to aspects of environmental change. The LC stalagmite has been deposited from 15 to 11 ka BP, a period known to be one of rapid warming. Magnesium and bromium are two elements that show significant trends over the period, as does the ratio Mg/Sr. This suggests that these values may be temperature related. Variations in sodium may indicate variations in dripwater salinity which in turn may reflect variations in rainfall amounts and evaporative effects at the surface.

Electron Spin Resonance ESR spectra of powdered speleothem calcite contain several peaks - their presence, size and sensitivity to gamma radiation can be related to some organic and inorganic impurities (Hennig & Grün, 1984; Smith et al., 1985).

In the case of the LC stalagmite the sensitivity to gamma radiation of one of the peaks (g value = 2.0005) shows highly significant correlations with Br and Mg concentrations. It suggests that it may be usable as a surrogate variable for temperature changes. Peak intensity is much more easily measured than sensitivity to gamma rays. The disadvantage is that peak intensity is also dependant on the radioactive content of the sample (principally its uranium content) and the age of the sample.

An age correction is easily made for each peak intensity value (Fig. 2), while in this case variations in uranium content can be disregarded as the content and the range of variation are quite low.

The peak intensity is rapidly measured in powdered samples drilled from the stalagmite core at approximately 100 year intervals. All values were adjusted to an age of 11 ka and are plotted in Fig. 2. The Mg/Sr values are also illustrated. Both variables show a significant increase over time which is believed to be largely temperature related.

Because of the ease of sample preparation and the rapidity of measurement of peak intensity, a detailed curve is readily obtained. Figure 2 shows a cool period lasting about 500 years at a radiocarbon age of 11.5 ka BP (cf evidence from Chile in Heusser, 1989) while another cold period appears to have occurred at a radiocarbon age of 9 ka BP.

PROSPECTS FOR FURTHER RESEARCH

Interest in palaeotemperature determinations from speleothems has declined in recent years because of:

1. The difficulty of matching isotope records obtained by discontinuous sampling.
2. Problems associated with establishing deposition under conditions of isotopic equilibrium.
3. Availability of suitable material due to the growth of the conservation movement and a dawning of environmental ethics amongst researchers.

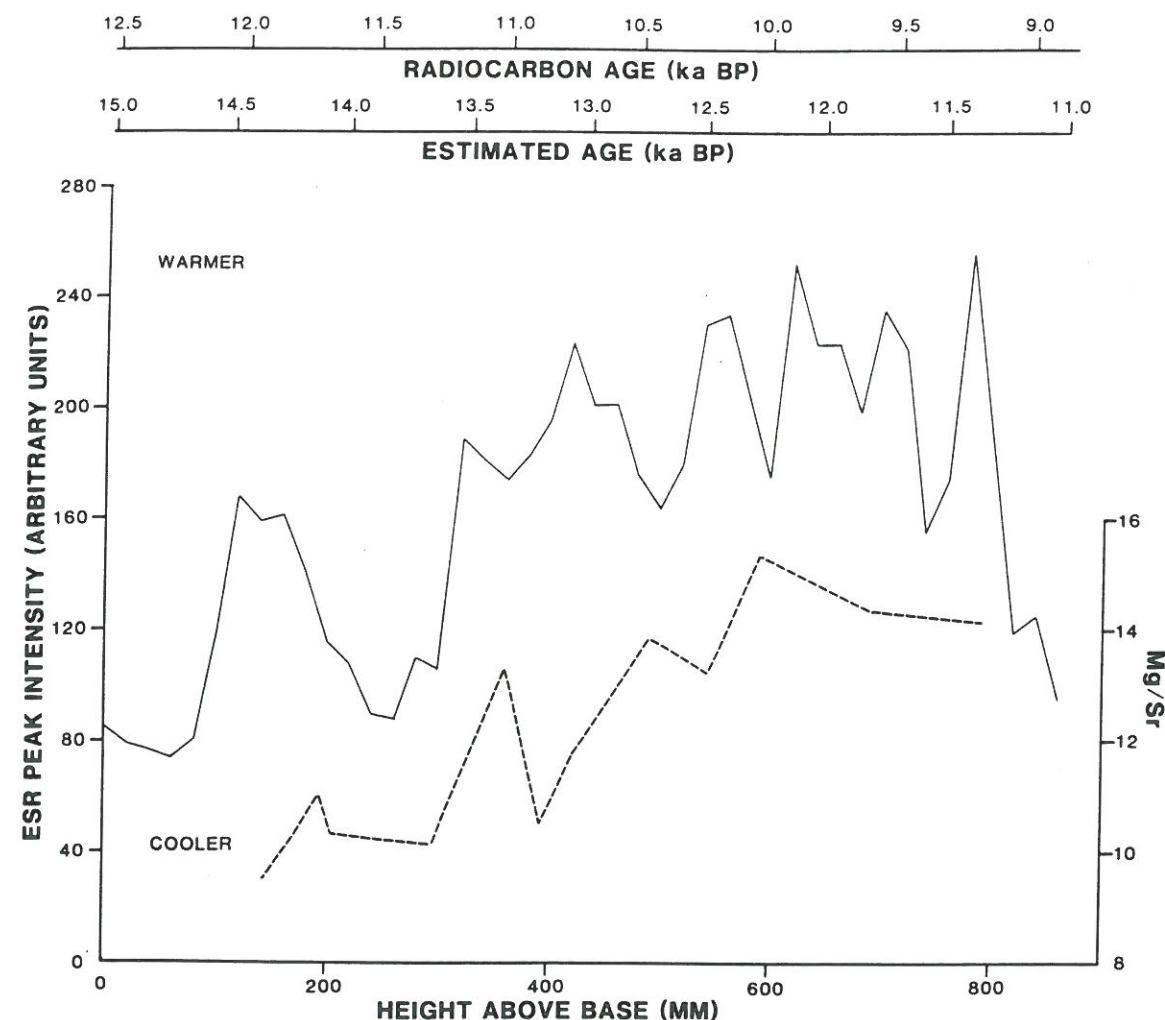


Figure 2 - Profile of age adjusted ESR peak intensities (g value = 2.0005) for LC stalagmite. Increasing intensities are believed to be associated with higher temperatures. Also shown is trend for Mg/Sr ratio which is also believed to be temperature dependent.

However, a number of recent developments make it imperative that stalagmites be re-examined as source of palaeoenvironmental information.

1. Many stalagmites appear to have grown continuously at a uniform rate over tens of thousands of years (see Table 1) and some at least have growth rates of 200-500 mm/ka allowing the possibility of a very high level of temporal discrimination.
2. Speleothem calcite, like coral, is a reliable material for uranium series dating. With recent advances made in mass spectrometry techniques (Bard et al., 1990) very high precision uranium-thorium ages can be obtained. This has also allowed calibration of ^{14}C dates beyond the range of tree-ring chronologies.
3. A new generation of automated stable isotope mass spectrometers makes it much cheaper and quicker to process large numbers of samples for $^{18}\text{O}/^{16}\text{O}$ and $^{13}\text{C}/^{12}\text{C}$ determinations. Instead of sampling at intervals it is now practical to carry out continuous sampling on stalagmites. This should make matching of isotope curves much easier, not only between stalagmites, but also with other isotopic records, e.g. those obtained from ice cores and tree-ring sequences.
4. A recognition that trace element variations sampled along the axis of a stalagmite are not random but appear to be related to environmental changes such as temperature, salinity and vegetation (Goede, 1989; Goede & Vogel, submitted).

5. The discovery that some peak characteristics of ESR spectra are closely related to trace element variations and can be used to sample stalagmites either continuously or at very close time intervals.

REFERENCES

- Bard, E., Hamelin, B., Fairbanks, R.G. & Zindler, A. 1990. Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th ages from Barbados corals. *Nature* 345, 405-410.
- Colhoun, E.A. 1985. Glaciations of the West Coast Range, Tasmania. *Quaternary Research* 24, 39-59.
- Francey, R. & Cook, E. 1990. Tasmanian tree rings : prospects for palaeoenvironment reconstructions. *Quaternary Australasia* 8 (2), 22-24.
- Friedman, I. & O'Neil, J.R. 1977. Compilation of stable isotope fractionation factors of geochemical interest. *U.S. Geological Survey Professional Paper* 440KK.
- Gascoyne, M., Ford, D. & Schwarcz, H.P. 1981. Late Pleistocene chronology and palaeoclimate of Vancouver Island determined from cave deposits. *Canadian Journal of Earth Sciences* 18, 1643-1652.
- Goede, A. 1989. Stalagmites as monitors of environmental change in Gillieson, D. & Ingle-Smith, D. eds. *Resource Management in Limestone Landscapes : International Perspectives*, pp 133-148. Proceedings of the IGU Study Group : Man's Impact on Karst, Sydney, 15-21 August, 1988.
- Goede, A., Green, D.C. & Harmon, R.S. 1982. Isotopic composition of precipitation, cave drips and actively forming speleothems at three Tasmanian cave sites. *Helictite* 20, 17-27.
- Goede, A., Green, D.C. & Harmon, R.S. 1986. Late Pleistocene palaeotemperature record from a Tasmanian speleothem. *Australian Journal of Earth Sciences* 33, 333-342.
- Goede, A. & Hitchman, M.A. 1984. Late Quaternary climate change - Evidence from a Tasmanian speleothem in Vogel, J.C. Ed., *Late Cainozoic Paleoclimates of the Southern Hemisphere*, pp 221-232, Balkema, Rotterdam.
- Goede, A., Veeh, H.H. & Ayliffe, L.K. 1990. Late Quaternary palaeotemperature records for two Tasmanian speleothems. *Australian Journal of Earth Sciences* 37, 267-278.
- Goede, A. & Vogel, J.C. in press. Trace element variations and dating of a late Pleistocene Tasmanian speleothem. *Palaeo-3*.
- Hays, J.D., Lozano, J.A., Shackleton, N. & Irving, G. 1976. Reconstruction of the Atlantic and Western Indian Ocean Sectors of the 18,000 B.P. Antarctic Ocean. *Geological Society of America Memoirs* 145, 337-372.
- Hendy, C.H. & Wilson, A.T. 1968. Palaeoclimatic data from speleothems. *Nature* 219, 48-51.
- Hennig, G.J. & Grün, R. 1984. ESR Dating in Quaternary Geology. *Quaternary Science Review* 2, 157-238.
- Heusser, C.J. 1989. Polar perspective of Late Quaternary climates in the Southern Hemisphere. *Quaternary Research* 32, 60-71.
- Schwarcz, H.P., Harman, R.S., Thompson, P. & Ford, D.C. 1976. Stable isotope studies of fluid inclusions in speleothems and their paleoclimatic significance. *Geochim. Cosmochim. Acta* 40, 657-665.
- Smith, B.N. & Epstein, S. 1971. Two categories of $^{13}\text{C}/^{12}\text{C}$ ratios for higher plants. *Plant Physiology* 47, 380-384.
- Smith, B.W., Smart, P.L. & Symons, M.C.R. 1985. ESR signals in a variety of speleothem calcites and their suitability for dating. *Nuclear Tracks* 10, 837-844.

QUATERNARY AUSTRALASIA PAPERS

Paper: Quaternary Australasia 9/2 (1991)

DIET OF DIPROTODONS: A MYSTERY SOLVED

John Pickard
Graduate School of the Environment
Macquarie University
NSW 2109

Recently I requested information on the source of a tantalising reference by Gentili (1961) to diet and stomach contents of *Diprotodon* from Lake Callabonna (Pickard 1990). I received several responses, complete with photocopies of relevant literature, and I summarise it below.

The stomach material was found during the 1893 expedition to Lake Callabonna subsequently described in *Memoirs of the Royal Society of South Australia*. The relevant papers are Stirling and Zietz (1899) and Stirling (1900). As these are probably not held in many libraries I will give extended extracts.

".....as indicated by the diagnosis of Professor Radlokofer, of Munich, to whom, through the instrumentality of the late Baron von Mueller, the remains of the food (or excrement) were sent for examination, the diet of *Diprotodon* consisted of small stems and twigs belonging, chiefly, to the order Salsolaceae, or to the allied orders Amarantaceae, or Nyctaginaceae," (Stirling & Zietz, 1899: 36).

"FOOD REMAINS

Associated with the skeletons of *Diprotodon*, in a relative position which corresponded with that of the abdominal cavity, were occasionally found loosely aggregated globular masses of what were judged to be the leaves, stalk, and smaller twigs of some herbaceous or arboreal (*sic*) plants. The fragments are very uniform in length, thickness and character, rarely exceeding an inch in length or a line in thickness. They are solid, often irregularly branched, frequently retaining portions of the bark, and have their ends often frayed or crushed, as if by the action of teeth. Microscopic examination showed the structure of sclerenchyma tissue to be well preserved, and gave clear indication of the existence of dotted ducts, but I could find no traces of leaves that have suggested a diagnosis. * Judging from this entire absence of leaves and from the degree of maceration, or entire absence, of the bark, these masses probably represent the contents of the intestines. No traces of coprolites, were, however, anywhere met with.

* As mentioned elsewhere in these *Memoirs* (vol. 1., p. 36), samples of these remains of food (or excrement) were, at the suggestion of the later Baron von Mueller, submitted to Professor Radlokofer of Munich, who reported of them that they consisted of the stems and twigs of plants belonging, chiefly, to the order Salsolaceae, or to the allied orders Amarantaceae, or Nyctaginaceae," (Stirling & Zietz, 1899: xii-xiii).

This information was subsequently repeated by Anderson (1924: 116):

"THE FOOD OF DIPROTODON

Associated with the skeletons discovered at Lake Callabonna were found the remains of leaves, stalks and twigs, the ends of which were often frayed or crushed, as if by the action of teeth. These vegetable remains were submitted to Professor Radlokofer of Munich, who pronounced them to belong to various shrubs allied to the saltbush, which even today furnishes much of the food supply for the stock which pastures in the district around the Lake."

This then is the source of the statement in Gentili (1961: 491). There never was any mystery about the information. It was simply based on old records of which I was unaware. However, the story does not end here. There are two more aspects to consider. One arises from more recent work by Tedford at the Lake Callabonna site in 1970. In a general account he described the general vegetation that existed around the lake at the time of *Diprotodon*.

"Dr Singh, of the Australian National University, also found abundant pollen in the clays, which, along with the wood and fruits, indicated that the shores of the lake once supported a saltbush steppe with scattered wattles and native pines, while the watercourses joining the lake were lined with gum trees." (Tedford 1973, 1984: 1002)

There is some disagreement about the interpretation of the data and the cause of the large numbers of fossil *Diprotodon* at Lake Callabonna. Tedford considered that it did not result from the catastrophic effect of a protracted drought, but rather was a slow accumulation of individual or small groups of animals that tried to cross those boggy flats during periods of low water (Tedford, 1984: 1002).

The second point that arises from these references is that some of the material collected almost a century ago by Sir Edward Stirling still exist in the South Australian Museum. In his letter to me, Neville Pledge (Curator of Fossils, South Australian Museum) says: "I do not know how much vegetable matter there was originally but we still have about a cupful, some of which would be available for reanalysis if necessary." Before you deluge Mr Pledge with requests for the material, you should know that Dr. D Christophel and Dr. A Rowitt (Department of Botany, University of Adelaide) have started to reanalyse the material.

Acknowledgements

Many thanks to Neville Pledge (South Australian Museum), Dr Jon Luly (Department of Geography, James Cook University), Dr Alex Baynes (Earth Sciences, Western Australian Museum), a post-graduate from the the University of Wollongong whose name I have since lost (my apologies). All provided essentially the same information with details or photocopies of the literature.

References

- Anderson, C. (1924) The largest marsupial. *The Australian Museum Magazine*, 2, 113 -116.
- Gentili, J. (1961) Quaternary climates of the Australian region. *Annals of the New York Academy of Science*, 95, 465 - 501.
- Pickard, J. (1990) Diet of diprotodons, a mystery of the sands. *Quaternary Australasia*, 8 (2), 25.
- Stirling, E.C. and Zietz, A.H.C. (1899) Description of the manus and pes of *Diprotodon australis* Owen *Memoirs of the Royal Society of South Australia*, 1 (1), 1 -40 Plates I - XVIII.
- Tedford, R.H. (1973) The diprotodons of Callabonna. *Australian Natural History*, 17, 349 - 354.
- Tedford, R.H. (1984) The diprotodons of Callabonna. pp 999 -1002 in Archer, M. and Clayton, G. (eds) (1984) *Vertebrate zoogeography and evolution in Australasia*. Hesperian Press, Perth.

QUATERNARY AUSTRALASIA PAPERS

Paper Abstract: Quaternary Australasia 9/2 (1991)

THE SHORELINE OF THE LAST INTERGLACIATION IN AUSTRALIA - A REVIEW

C.V. Murray-Wallace
Department of Geology
University of Newcastle
NEWCASTLE NSW 2308

A.P. Belperio
South Australian Department of Minerals and Energy
PO Box 151
EASTWOOD SOUTH AUSTRALIA 5063

Abstract of paper presented at the Institute of Australian Geographers 24th Conference, September 1990, Armidale.

Marginal marine strata of last interglacial age occur in a range of morpho-stratigraphic settings around the Australian coastline. The lithofacies are similar to their Holocene equivalents but are variably lithified, elevated and laterally displaced inland. Uranium-series ages for corals and molluscs from widely separated localities around Australian coastline are generally in accord with values typically obtained for oxygen isotope substage 5e (125, 000 +/- 10, 000 yr BP), the value generally accepted for the last interglacial maximum. Amino acid racemisation has principally been applied to correlation of last interglacial sequences with benchmark sites dated by the uranium series method.

Shoreline elevation evidence from the last interglaciation reinforces the notion that Australia is a relatively stable continent. Significantly neotectonic anomalies include Cape Cuvier (+10.5m), Fleurieu Peninsula (+6m), the Coorong Coastal Plain (+10m) and Tasmania (+32m), each indicating contrasting degrees of uplift. The Tasmanian sequences are the highest occurrences on the Australian continent and have been attributed to uplift as a result of mantle hotspot processes. With the exception of these tectonically uplifted sites, the height of the last interglacial sea surface around the Australian coastline is consistently below the 6m sealevel globally attributed to this high sea level stand.

In Australia, the most reliable data is from western Eyre Peninsula where a level 2m above present mean sea level is consistently recorded. The more southerly limit of coral growth and wider distribution of molluscan fauna of warmer water affinity are in accordance with warmer ocean waters during substage 5e (approximately 2°C). The extent of racemisation of molluscan fossils from southern Australia supports the presence of former latitudinal gradients of Mean Annual Temperature (MAT) and indirectly excludes the possibility of a more equable latitudinal distribution of MAT during substage 5e. The marginally warmer waters and slightly higher glacio-eustatic sea level of the last interglacial provide an ideal basis for modelling possible changes that may accompany Greenhouse-induced global warming in the future.

QUATERNARY AUSTRALASIA PAPERS

Paper Abstract: Quaternary Australasia 9/2 (1991)

RECONSTRUCTION OF LATE QUATERNARY ENVIRONMENTS AT EGG LAGOON, KING ISLAND, BASS STRAIT

Donna D'Costa and John Grinrod
Department of Geography and Environmental Science
Monash University
CLAYTON VIC 3168

Abstract of paper presented at 1991 AQUA Conference, Mallacoota, February 1991.

Egg Lagoon lies at northern King Island in western Bass Strait, halfway between western Victoria and northwestern Tasmania. The lagoon is approximately 8km long and 3 km wide. A preliminary geomorphological investigation of the site by Jennings (1959) reveals freshwater swamp and lake sediments to a depth of about 10m overlying raised, shell-rich marine sediments. The remains of at least 3 extinct giant marsupials are identified from Egg Lagoon and similar nearby sites. These have been previously unearthed as drainage canals were cut and deepened through the lagoon. Archaeological evidence suggests that King Island was not occupied by people between about 7,000 years ago until European intervention, although people were certainly in occupation 14,000 years ago, and probably much earlier (R. Sim, pers. comm.).

The aims of our project are to elucidate, primarily through pollen analysis, the late Quaternary environments at Egg Lagoon in terms of -

- a. sea-level reconstruction based on underlying, raised marine sediments;
- b. reconstruction of estuarine environments at the marine to freshwater transition;
- c. reconstruction of a detailed vegetation and climate record from the freshwater units for comparison with the long records from western Victoria and mainland Tasmania;
- d. potential reconstruction of vegetation and fire free from human influence for the period approximately 7,000 to 200 years before present; and
- e. dating and analysis of sedimentary units which include extinct fauna.

Three field trips for sample collection have been conducted through 1989/1990. Seventeen auger holes and cores have been collected for stratigraphic description and pollen analysis. Pollen and charcoal analyses of approximately 50 samples have concentrated on the upper five metres of a core from a site central to the lagoon. Five radiocarbon dates of organic remains and four amino acid racemisation (AAR) dates on shell remains (by Colin Murray-Wallace) have been obtained. These indicate that a substantial proportion of the Quaternary may have been covered by the Egg Lagoon record. Identification of bone fragments retrieved during coring have been obtained (Monash University Zoology and the Australian Museum, Sydney). These include one species (*Mastacomys fuscus*) not previously recorded for King Island. Fossil shell assemblages are presently being analysed by Ralph Ogden (Department of Biogeography and Geomorphology, ANU) to provide a record of depositional environments, as the site developed from marine estuary to freshwater lagoon.

QUATERNARY AUSTRALASIA PAPERS

Paper abstract: Quaternary Australasia 9/2
(1991)

PHYTOLITHS FROM ROONKA, SOUTH AUSTRALIA: AN INTRODUCTORY REPORT

W.E.Boyd, H. Lynch
University of New England Northern Rivers
Lismore, N.S.W. 2480

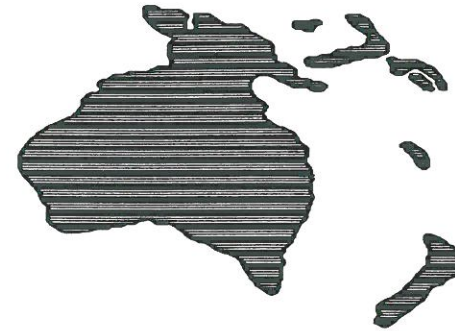
and

G.L.Pretty
South Australian Museum,
North Terrace, Adelaide, S.A. 5000

Abstract of paper presented to the Australian Archaeological Association 1990 Conference, Burdekin, Townsville, Dec. 1990.

This paper presents an introduction to the use of phytoliths in archaeological investigation in the Australian context. Phytoliths are microscopic siliceous plant remains which have a high preservation potential in archaeological deposits. The results used to illustrate some of the general aspects of phytolith analysis are from the examination of sediment samples from the archaeological site at Roonka, on the lower Murray, South Australia, where initial results confirm that these plant fossils can survive in a dry-environment site, and that they have a high survival capacity. The analysis of fossil phytoliths recovered from Roonka suggest that these fossils are archaeologically significant, and that emplacement of a specific plant, namely *Phragmites australis* (reed grass) within tombs was practiced, probably throughout the Holocene and perhaps since the late Pleistocene. That emplacement must have had some cultural significance, and an approach to establishing that significance is briefly described; these latter comments are currently being debated, and a full publication discussing these will shortly be submitted for publication.

AUSTRALASIAN QUATERNARY ASSOCIATION (AQUA)



President: Geoff Hope
Department of Biogeography and Geomorphology
Research School of Pacific Studies, A.N.U.
Box 4, CANBERRA, ACT 2601
Tel 06 2493283, FAX 06 2571893

Secretary: Colin Murray-Wallace
Department of Geology, University of Newcastle
Rankin Drive, NEWCASTLE, NSW 2308
Tel 049 215415, FAX 049 216925

APPLICATION FOR MEMBERSHIP

The **Australasian Quaternary Association** is an informal grouping of people interested in the manifold phenomena of the Quaternary. It seeks to encourage research (by younger workers particularly) to promote scientific communication in its region, and to inform members of current research and publications. It holds biennial meetings, the next being an inter-INQUA international conference in Canberra in May 1993. The Association publishes the newsletter *Quaternary Australasia* twice a year. The annual subscription is A\$20 or \$10 for students and unemployed or retired persons. Return this membership application to the **Treasurer**, Mr Albert Goede, AQUA, BOX 338 Sandy Bay, Tasmania 7005

TITLE	GIVEN NAME	ALL INITIALS	SURNAME
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

POSTAL ADDRESS

DEPT AND
INSTITUTION,
(If not included above)

STATE

POSTCODE

COUNTRY
(If not Australia)

TEL

FAX

E-Mail

AMOUNT
PAID

\$

DATE

PAID

Member M \$20
Concess
-ion C \$10
Retired R \$10

OTHER INTERESTS

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Please Circle Your Major Interests

- 1 Quat geol & stratig.
- 2 Landscape evolution
- 3 Sedimentology
- 4 Marine
- 5 Coasts & sea level
- 6 Glacial
- 7 Fluvial
- 8 Dunes & dust
- 9 Soils
- 10 Volcano-tectonic
- 11 Karst
- 12 Palaeoecology
- 13 Vertebrates
- 14 Invertebrates
- 15 Limnology
- 16 Vegetation
- 17 Archaeology
- 18 Palaeoclimates
- 19 Climate modeling
- 20 Groundwater
- 21 Dating

COVER ILLUSTRATION

The figures on the front cover shows schematic presentations of conditions during successive stages in the Late Quaternary history of Nulchara Lake between Wilcannia and Cobar, Western NSW. Approximate ages for each stage are c. 40 to c. 25 ka for stage 1; c. 25 to c. 20 ka for stage 2; c. 20 to c. 12 ka for stage 3 and c. 12 ka to present for stage 4. This sequence of events is based on detailed field levelling supplemented by five trenches and over twenty deep auger holes. According to the authors of this study, the Late Quaternary history of the gypseous lunette and Nulchara Playa Lake is of special interest because it illustrates very effectively certain key features of the desert margin environment of the central-west of NSW, in that i) there are links between the aeolian, fluvial and lacustrine systems throughout this area, ii) that the groundwater system, and especially its seasonal fluctuations, are of importance for activating sediment deflation at the lake margin, and iii) that the conditions of low relief allow integration of these three systems (aeolian, fluvial and lacustrine) within one landscape, a condition not met in many other semi-arid desert margin regions. From Figure 6 in Williams, M.A.J., de Dekker, P., Adamson, D.A., and Talbot, M.R. 1991 Episodic fluvial, lacustrine and aeolian sedimentation in a late Quaternary desert margin system, central western New South Wales. pp 258-287, in Williams, M.A.J., De Deckker, P., and Kershaw, A.P. (eds) *The Cainozoic in Australia: a re-appraisal of the evidence*. Geological Society of Australia, Special Publication No. 18.