GEOFF HOPE

Australian Quaternary Newsletter

No.14 February 1980

CONTENTS

Editors: Jeannette Hope
Department of Prehistory
Research School of Pacific Studies
The Australian National University
PO Box 4
CANBERRA ACT 2600

Bruce Thom
Department of Geography
Faculty of Military Studies
Royal Military College
DUNTROON ACT 2600

EDITORIAL

This issue is in fact the final one for 1979, though it has been delayed. As you can see, we have reduced the format to save on paper and postage costs. The next issue is planned for May; please send any contributions to us by the end of March. We would especially like advance notice of programmes of seminars and excursions from state Quaternary groups. In the past these have arrived too late for inclusion in the first issue of the year.

The circulation of the last issue to Quaternarists in New Zealand has resulted in a number of new subscriptions. Those New Zealanders who indicated that they wanted to continue with the Newsletter, will find a subscription notice in this issue. Please fill this in and forward to Matt McGlone in Christchurch. He will be acting as New Zealand correspondent and editor. One contribution from New Zealand appears in this issue; we look forward to publishing more in the future. Australians and others will receive subscription notices later in the year.

Jeannette Hope
Bruce Thom

A REMINDER AND A PLEA FROM THE NATIONAL COMMITTEE FOR QUATERNARY RESEARCH

Jim Bowler
Chairman

In the last Newsletter a statement outlined plans the National Committee has embarked on for a review of Quaternary research, teaching and applied activities throughout Australia. Accordingly some 150-200 questionnaires went out to subscribers of the Newsletter. To this date a grand total of 12 has been returned!

No-one likes answering questionnaires less than I do. I sympathise with the attitude that consigns them immediately to the WPB. But occasionally they are necessary. In this case let me outline the rationale in a bit more detail.

Firstly, as stated in the last Newsletter, the Council of the Academy of Science has asked each National Committee to submit a report 'on the state of the relevant discipline in Australia with recommendations for action where necessary' (my emphasis).

'So what the hell', you may well ask, 'a toothless tiger?' Let me quote from a memo received recently from the Assistant Secretary of the Academy requesting estimates of funding for activities sponsored by National Committees.

'Examples of activities which might be proposed or encouraged are conferences, scientific discussion meetings, public lectures, reports on matters of scientific and public interest'.

Toothless? I don't think so.

The Committee is already sponsoring the February 1981 CLIMANZ meeting with Academy support (see note elsewhere, this issue), it has been notified of a proposed working group meeting on the Australian Holocene (proposed by Bruce Thom) for which funding will be requested. John Calaby has given notice that he anticipates a meeting-cum-colloquium on Quaternary Vertebrate Palaeontology.

The committee does want to press on with these and other related activities. It wants to have your reactions and expressions of needs, criticisms or whatever. It will be making detailed proposals to the Academy for future activities. If your point of view has not been presented to the committee, don't complain if it is not represented in future activities.

Resurrect that questionnaire, return it, or if already in WPB, write and we will send you another, or simply write on a blank piece of paper outlining current activities and future needs. Remember that what you get from the Academy depends on what you put in.

Department of Biogeography
and Geomorphology
ANU, Canberra

THE AUSTRALIA-CHINA CONNECTION
REPORT TO THE AUSTRALIAN ACADEMY OF SCIENCE

Jim Bowler

Introduction

In April of this year I received an invitation to visit Peking at the request of Academia Sinica to discuss specific aspects of Australia-China exchange in the field of Quaternary research. This arose from my role as coordinator of the international association's (INQUA) attempts to bring together workers of the western Pacific region in a study of wind blown (loess) deposits. Academic Sinica generously invited my wife to accompany me.

In June I undertook this, my second visit to China; the first was with an ANU group of Quaternary scientists in 1975. I was struck forcibly by the great change that has taken place since that first visit, a change associated with the 'smashing of the Gang of Four' and the new lease of life that has given to the scientific communities. That change is both dramatic in its expression and substantial in its implications for us here and now in Australia.

In the light of that experience, I set out below some reflections on our joint relationships with Chinese Quaternary colleagues.

Areas of common interest

There a number of special reasons why Australia-China contacts in the field of Quaternary Research have proved very stimulating in the past and auger to be so profitable in the future. In part this stems from the nature of Quaternary studies themselves. The derivation of evidence necessary to reconstruct events of the past 2-3 million years draws upon a wide range of physical, chemical and biological data. Thus Quaternary practitioners realise their dependence on colleagues working in many different disciplines. Of equal importance is the strength that derives from parallel studies carried out in other continents on related climatic or physiographic regions.

In the systematic study of the Quaternary Period, which encompasses the geological environment of Man, Chinese scientists have a long history of active and productive research. The presence of ancient Man in China is a matter of national pride as well as a focus of special scientific endeavour. The older generation of Chinese Quaternary scholars are skilled and

experienced workers. They have produced results of great importance to the scientific world.

The particular relevance of China to Australian scholars derives additionally from the range of related environments to be found in China as well as from the scientific work already carried out. China and Australia are two large continents lying almost in mirror image of each other in equivalent latitudes on either side of the equator. This is particularly important to studies centrally concerned with aspects of present day climates and to attempts to understand past and future changes in global climatic patterns.

Thus the great riverine plains of inland Australia have parallels in the Red Basin of Zechwan Province, the glaciations expressed in Tasmania and the Snowy Mountains have related expression in the Tien Shan Mountains of northwestern China whilst the great arid and semi-arid regions of Australia occur in latitudes related to those of the Tsaidam, Taklamakan and Ordos deserts of China. For those of us concerned to understand the history and evolution of extensive climatically controlled physiographic regions, their physical expression and biological habitats, the complementary nature of Australian-China geological provinces provides a powerful intellectual link.

Furthermore, in the formulation of specific questions, Quaternary scientists in China are often pursuing lines of inquiry parallel to many of us in Australia. Thus the response of desert and semi-arid regions to Quaternary climates is being intensively studied in both countries, as also all many aspects of vegetation history, vertebrate palaeontology and human prehistory. The need to keep up and to expand the exchange of data on these and other matters is based on these important intellectual links.

Practical aspects

In practical terms, the presence in China of a large, enthusiastic and well organised group of Quaternary scientists provides us with direct contacts for exchange and collaboration. More importantly these groups are led by an older group of well trained and experienced scientists, mostly educated in pre-1949 universities. Now mainly in or approaching their sixties, they are confronted with a major challenge within their own institutions.

All the educational and research institutions that I visited have suffered drastically over the past 13 years. Only now are scientists beginning to talk openly of the devastating impact of the cultural revolution on their staff, students and research equipment (in some places much of it was removed and taken to factories). Whilst many staff members were sent to the fields or factories for years, the universities were effectively closed and even now, when they are getting back onto their feet, the scientific faculties dependent on technical facilities are often greatly handicapped by the lack of both equipment and experienced staff.

Thus the older generation of scientists find themselves leading institutions whose middle ranking men and women have spent years away from their specialities and whose students and graduates are only now returning to properly structured courses. These men, seeking to take full advantage of the increased freedom now available to scientists either to travel abroad or to bring western specialists to China, are exploring every avenue of collaboration to strengthen their own institutional resources. In this way quite new opportunities have suddenly become available for Chinese scientists to work outside China as for westerners to work inside that country.

These comments apply to a wide range of those earth sciences with which I made contact. They have particular relevance in those areas where strong contacts, already established, provide a basis for the immediate strengthening of ties.

Such contacts, now firmly developed between Chinese and Australian Quaternary workers, provide a basis for extending the range of collaboration between the two countries.

The next stage

Developments over the past 4 years have concentrated on group visits. During my recent visit, the Chinese responded enthusiastically to an invitation to send a group next year to examine Australian desert deposits; in doing so they gave notice of their intention of inviting a return visit of Australians and New Zealanders in 1981. As such visits may well become less frequent, they should give place to new kinds of collaboration. This should now begin to take the form of individual collaboration on specific projects, with Australians going to China and vice versa, for longer periods. A few years ago this would have been impractical for a number of reasons one of which was the language barrier. Now this barrier is rapidly diminishing.

English is being taught everywhere, by radio, television, in schools and in many research institutions. Whilst the language difficulty has not been solved completely, in a few years I believe that every Chinese scientist that travels overseas will have a reasonable command of English. Thus the prospects of creative collaboration are now ever so much greater than they were only two years ago.

Dept Biogeography and
Geomorphology
ANU

ON THE REQUIREMENTS OF C14 DATING USERS IN AUSTRALIA

Peter Kershaw and Jim Peterson

We are concerned about the increasing difficulty of obtaining radiocarbon dates and consider that it is time for an assessment of existing dating facilities and how these can be upgraded to satisfy future requirements.

At present, there are only two radiocarbon dating laboratories in Australia (at the ANU and at the University of Sydney). The ANU facility is research, rather than service oriented and is not generally available to outsiders - in fact it only caters for a percentage of the demand within the University. The laboratory at Sydney takes only a small proportion of total samples from Australia. This means that most researchers have to go outside Australia for their dates - a situation which is unsatisfactory when regular communication between user and laboratory is required.

In addition to the problem of getting samples dated within Australia is the difficulty of finding a laboratory anywhere which can process samples within a reasonable length of time. A few years ago we began sending samples to Geochron in Massachusetts because of their apparent efficiency and rapid turnover. In 1977 we were quoted a waiting period of six weeks for a date and received the result four weeks later. Unfortunately this kind of service has not been maintained. Early this year we were informed, before submitting samples, that dates were taking about five months. After submitting samples, the waiting period had increased to eight months. This situation, if it continues, will seriously affect our research programs. Most of our dates are required for honours projects which have to be completed within nine months. A waiting period of eight months for dates leaves no time for preliminary analysis of core material to allow selection of the most critical samples for dating, nor does it give time for theses to be structured around dated sequences. This year three students are seriously affected. Other dates, required for projects funded by outside grants, will not normally be available to support submissions in the following year.

We have little influence on the establishment and running of radiocarbon dating laboratories overseas but could help to direct the development of facilities in this country. In recent years, despite the huge increase in demand, our facilities have probably declined. The laboratory at the Institute of Applied Science in Victoria ceased operation in 1970 and the future of the University of Sydney Laboratory is uncertain. One sign of hope is the possibility that a new unit will be set up in Victoria. The proposal for this has received wide support but as this facility,

if approved, will be established through the Victorian Public Service, it is expected to take at least five years and probably ten years before it is operational.

Part of the question involved in the development of C14 dating facilities is the kind of facility whicch will be of most benefit to users. To date, C14 dating has involved the determination of decay rates of C14 using gas counting and liquid scintillation counting techniques which are time-consuming and generally restricted to dating samples younger than about 40,000 years. Recently, the development of what amount to super-sensitive mass spectrometers has allowed the separation of ions of very similar charge-to-mass ratios and it has been shown that it is possible to distinguish between the isotopes of interest in radiocarbon dating (e.g. Muller 1977; Nelson et al. 1977). This direct-detection method applied to radiocarbon dating has the distinct advantages over conventional methods of using a much smaller sample (milligrams as opposed to grams), taking much less time (therefore allowing many more samples to be analysed) and having the potential to extend dating back significantly beyond 40,000 years BP if background effects can be kept low.

Direct-detection also promises new methods of dating and therefore the possibility of 'double dating' (Muller 1977). The early part of the radiocarbon timescale could be calibrated by this means. Calibration is important because reliance on uncalibrated radiocarbon dates ignores some questionable assumptions about the rate at which C14 is created in the upper atmosphere. At present the radiocarbon timescale can be calibrated from dendrochronological studies which stop at about 8000 years BP.

While it is sensible to press for the continuation of the University of Sydney Laboratory and for the establishment of another conventional laboratory in Melbourne, consideration should also be given to establishing a direct-detection facility in the country. Smaller, simpler and less expensive systems than those originally designed are being built (e.g. Doucas et al. 1978; Hedges 1978) and the estimated cost for such a system would be about $500,000, and less if second-hand equipment is available. One suitable location for this facility would be Lucas Heights at the Australian Atomic Energy Commission. Positive action on the proposal to establish a facility here would be achieved by drawing the possibility to the attention of the Australian Institute of Nuclear Science and Engineering (AINSE) representative in each University, together with a recommendation that the Universities jointly sponsor this facility.

It is quite likely that others have already considered this and other proposals, possibly in greater depth, but we feel it is important to bring this information to the attention of interested workers in the hope that some action will be initiated in the near future.

Department of Geography
Monash University
Clayton, Victoria

References

Doucas, G. et al. 1978 Detection of C14 using a small van der Graaff accelerator. Nature 276:253-5

Hedges, R. 1978 New directions in carbon-14 dating. New Scientist, March 2nd, 1978: 599-601

Muller, R.A. 1977 Radioisotope dating with a cyclotron. Science 196:489-94

Nelson, D.E. et al. 1977 Carbon 14: direct detection at natural concentrations. Science 198:507-8

QUATERNARY RESEARCH

Steve Porter, editor of AMQUA's journal, Quaternary Research, reports that the journal is sound and prosperous. The acceptance rate is a healthy 2/3 of the manuscripts submitted. Turn-around time is averaging 8-10 months on acceptable manuscripts, despite the current moderate backlog. Steve particularly solicits manuscripts of high quality on research conducted in non-North American locales (e.g. Asia, Europe, the Pacific, and so on). Manuscripts should be no longer than 15-20 typewritten pages (including bibliography!), and authors are strongly encouraged to consult the 'Editorial Policy' and 'Instructions to Authors' which are printed at the end of each QR issue. Failure to review these notices still constitutes the most common error found in submitted manuscripts.

QUATERNARY STUDIES GROUP OF WESTERN AUSTRALIA

After a lapse of several years, the Group was reformed at a well-attended gathering at the Social Sciences Senior Common Room, University of WA on 9th May 1979. Convenors, who will be available to assist with the organisation of Group activities, were appointed. These are:

Karl Wyrwoll, Department of Geography, University of WA
Peter Denman, Geological Survey of WA
Mancel Lofgren, Western Australian Museum
John Clarke, Western Australian Museum
George Kendrick, Western Australian Museum

The main business of the first meeting was an illustrated talk from Karl Wyrwoll on Late Quaternary climates in Western Australia. Karl's studies were concerned initially with alluvial sediments formed in river valleys of the Geraldton district and considered the mechanics of sediment transportation and associated hydrologic factors. A widespread 'Red Alluvium' is recognised throughout the district; one valley section within the Tamala limestone shows this unit overlying a marine shell bed, considered to derive from the Last Interglacial. No fossil soils are known from within the alluvium, but charcoal has yielded a C14 age of 40,000 yrs BP. Sedimentary structures and textural characteristics of the alluvium suggests high discharge events, with sediment yields much in excess of present rates. The alluvium is likely to reflect precipitation and runoff conditions associated with the early parts of the last major glacial phase of the Late Pleistocene.

Extensive dunefields occupy a wide tract of country between Geraldon-Mullewa and the Exmouth district. Now mostly well-vegetated and stable, these dunes are considered to represent a substantial increase of the inland arid zone during the last glacial maximum. There is evidence that the dunes were last active before the marine transgression of the Middle Holocene but more precise dating of this event has yet to be realised.

Lake lunette dunes on southwestern Australia appear to be more complex structures than has been contended and further studies appear to be needed if these are to contribute fully to the clarification of Late Quaternary regional climates.

Wind-blown sedimentary particles of desert origin have been recognised in sea-bed cores from off the northwest coast of WA (Kolla and Biscaye 1977) and this apparent low-latitude aridity can be correlated directly with the last major episode of global cooling.

Widespread aridity is thought to have been a repeated feature characterising the glacial maxima of the Pleistocene. Evidence for at least two phases of dune building in the Exmouth Gulf-Shark Bay area clearly reflect past arid zone extensions, but no reliable age estimates are so far available for these

deposits.

The position of Western Australia relative to that of the sub-tropical anticyclone appears to exert a profound influence on the climate of the entire state. A southward shift of these anticyclones can result in a deflection to the south of the rain-bearing winter cyclones and a strengthening of the summer monsoon in the north. Conversely a northward shift of the sub-tropical anticyclones would tend to increase winter rain in the south and diminish summer rain in the north. The diversity of present-day weather situations invites a uniformitarian approach to palaeoclimates of the past few millenia, from which approximations of past conditions can be attempted. Hypotheses so derived can then be tested against field evidence, where available.

The 'Z' criterion developed by Smagorinsky (1969) and subsequently used by Hohn (1964) can be used to locate the position of the sub-tropical high pressure belt. This criterion may serve as a useful first approximation towards developing a 'model' of the dynamic climatology of the Quaternary climates of Western Australia (Wyrwoll 1979).

Suggested aridity in the Swan-Avon drainage basin over the period 6000-4000 yrs BP, deduced from the presence of marine molluscs, etc. at Guildford (Kendrick 1977), may be consistent with a southward shift of the sub-tropical anticyclones at that time which corresponds to the Middle Holocene 'Climatic Optimum' or Hypsithermal Maximum, when global temperatures stood perceptibly above present levels. If this view is correct, summer cyclonic activity should have been more extensive than at present in the north of the state at that time. Field evidence on this question is needed. Warm sea surface temperatures (>26deg.) are necessary for the generation of tropical cyclones.

References

Kendrick, G.W. 1977 Middle Holocene marine molluscs from near Guildford, Western Australia and evidence for climatic change. J. Roy. Soc. W.A. 59:97-104

Hohn, M. 1974 Grundfragen der Palaoklimatologie im hichte einer theoretischen Klimatologie. Geol. Rdsch. 54:504-15

Kolla, V. and P.E. Biscaye 1977 Distribution and origin of quartz in the sediments of the Indian Ocean. J. Geol. Petrology 47:642-9

Smagorinsky, I. 1963 General circulation experiments with the primitive equations I. The basic experiments. Mon. Weather Rev. 91:99-164

Wyrwoll, K.-H. 1977 Late Quaternary events in Western Australia. Search 8:32-4

Wyrwoll, K.-H. 1979 Late Quaternary climates of Western

Australia: evidence and mechanisms. J. Roy. Soc. W.A. 62:129-42

Wyrwoll, K.-H. and D. Milton 1976 Widespread Late Quaternary aridity in Western Australia. Nature 264:429-30

NEW ZEALAND QUATERNARY WORKERS SUPPLEMENTARY LIST

Department of Botany, Victoria University of Wellington, Private Bag, Wellington

P. Kennedy: research into metal deposition in estuarine environments pre-European settlement of New Zealand. Dating is by C-14 and Pb-210 methods.

M.K. Macphail: history of post-glacial forests and climates on the northwest lowlands of the South Island, a region believed to have been a major refuge for forest species during the last glacial. The study comprises pollen analysis of three 8m cores and is reinforced by a study of modern pollen rains across the top of the South Island.

D.R. McQueen: (i) past and present ecology of Nothofagus communities in South America, New Zealand and Australia. This includes analysis of tree rings representing growth over the last 100 years; (ii) quantitative ecology of semi arid and montane grasslands in Central Otago, in relation to climate and soils, and (iii) Quaternary vegetation of the Wellington district.

S. Norton: research includes study of the pollination ecology of Pseudowintera (Winteraceae) and Fuchsia (Onagraceae).

CURRENT RESEARCH IN THE LAKE FROME-CALLABONNA AREA, SOUTH AUSTRALIA

Compiled by R.A. Callen

The Lake Frome-Callabonna region remains one of more than usual interest to Quaternary workers. Not only is it most productive in terms of extinct faunas, but the region preserves a long record of hydrologic changes extending back into the Miocene. For this reason it has become the site of extensive collaborative work; some of the main elements in the developing studies in this region are outlined below. Names and addresses of researchers who are working in this region are listed at the end of the report.

A. QUATERNARY STRATIGRAPHY AND PALAEOENVIRONMENTS

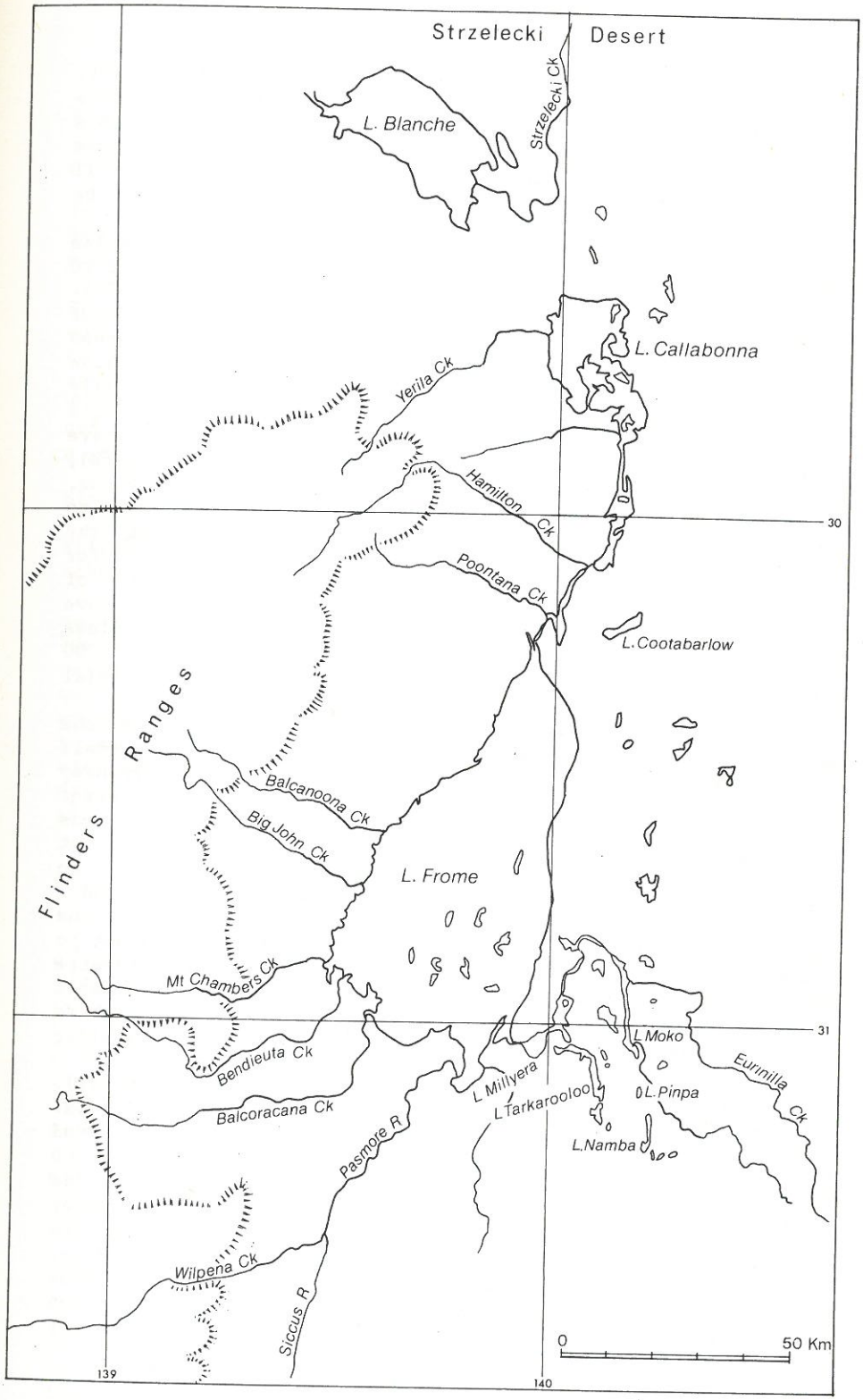
R.A. Callen, R.J. Wasson, R. Gillespie

The stratigraphy of the dunes and related sediments of the southern Strzelecki Desert

Work has concentrated on four sites, these being: (1) south end of Lake Frome, (2) Lake Moko at the junction of Billeroo and Eurinilla Creeks, (3) Lake Millyera at the junction of Billeroo Creek and Lake Frome, and (4) Lake Pinpa to the southeast of Lake Millyera. Sites (2)-(4) are respectively Sections 7, 5 and 8 of Callen and Tedford (1976).

Several other sites were also used, covering a wide area in the northern part of the CURNAMONA and southern FROME geological sheets (1:250,000). Investigations concentrated on those sediments dateable by radiocarbon methods. As no charcoal in usable quantities was found, it was necessary to rely upon calcareous paleosol material and shell. The usual collecting precautions and laboratory examinations and analyses were applied to assess the meaning and reliability of the dates. The 34 dates and our comments are soon to be submitted to Radiocarbon.

The oldest sediments studied were those of the 12-15m (asl) strandline around Lake Frome. Shell from site (1), a locality at the southern margin of Lake Frome, gave a date of 36,800 + 700 yrs BP and another along Billeroo Creek, north of site (3), was beyond the range of the dating method. As for all shell from the


Strzelecki Desert
L. Blanche
Strzelecki Ck
L. Callabonna
Yerila Ck
Hamilton Ck
Poontana Ck
L. Cootabarlow
Flinders Ranges
Balcanoona Ck
Big John Ck
L. Frome
Mt Chambers Ck
Bendieuta Ck
Balcoracana Ck
Pasmore R
L Milliyera
L Tarkarooloo
L. Moko
L. Pinpa
L. Namba
Eurinilla Ck
Wilpena Ck
Siccus R
30
31
139
140
0
50 Km

area, small quantities (mostly 0.8-2.0?) of calcite were present. This was taken as a guide to contamination by younger calcite derived from the overlying calcareous paleosols. The age of this latter material probably ranges from c.24,000 years BP to more than c.40,000 years BP, and the carbon of the shell itself still showed some activity, hence its radiocarbon age is thought to be around 50,000 years BP.

These sediments can be traced laterally into both lacustrine and fluviatile facies. The former are thought to be equivalent to the 'Diprotodon-bearing beds' of Lake Callabonna (Tedford 1973). The fluviatile facies is the base of the Eurinilla Formation of Callen and Tedford. At the top of this Formation is a widespread well-developed calcareous paleosol, which has been dated at sites (2), (3), (4), and three other sites. At site (4), radiogenically 'dead' carbonate was found in the centre of nodules, causing a reversal in age at the top of the sequence. It is thought to have been derived from older nodules in the sediment. At site (2), dates on the uppermost soil layers appeared anomalously young, and vary significantly in the same horizon. This is thought to have resulted from percolation of younger groundwater along the top of the Eurinilla Formation. There was some evidence for recrystallisation in these samples (though we doubt the value of sparite versus micrite in assessing this). Most samples gave results between c.28,000 and c.35,000 years BP, so unless reconstitution of old carbonate is a problem everywhere, c.28,000 years BP can probably be taken as the approximate time of burial of the paleosol.

The first aeolian phase is recorded at site (2), where the eastern end of a sand lunette extends from the margin of a small lake to the west, and is exposed in the upper part of a breakway adjacent to Lake Moko. Two phases of lunette material are present (Units 2 and 3 of Coonarbine Formation Section 7). Calcareous paleosols on these suggest burial at about c.21,000 years BP. At Lake Millyera (site (3)), a soil of similar age is developed on Unit 2 of the Eurinilla Formation in Section 5. Units 1 and 2 have been re-interpreted as a lunette deposit within the Coonarbine Formation by Callen, and are considered equivalent to the lunette at Lake Moko. In Lake Frome, a gypsum lunette investigated by Bowler and Callen (Bowler 1976) suggested deposition in a period of c.15,000-20,000 years BP. Hence there appear to be two phases of lunettes, the extent of the earlier being unknown at present.

Two other aeolian phases have been identified at site (2), both of which constituted part of the longitudinal dunefields. These phases have been recognised also at sites (1) and (3), and indicate dune building between c.21,000 years BP and c.15,000 years BP, and between the latter and c.15,000 years BP. The former corresponds to the lunette phase in Lake Frome. Younger dates of c.8150 and c.7170 years BP have been recorded from the top of Unit 4 of the Coonarbine Formation, Section 7, Lake Moko, and the top of the same Formation, Section 5, Lake Millyera. They may represent the c.10,500 year BP soil, which has probably been exposed for a long period at these sites, or possibly younger soil intervals.

A strandline located by Bowler close to the present Lake Frome shoreline contains charcoal dated at c.11,000 years BP (pers. comm. J.M. Bowler 1979) suggesting the younger aeolian phase was short, unless it accompanied dune construction.

The age of sediments in Lake Frome is reported by Draper and Jensen (see report by Ralph Jensen). Callen believes their older dates (c. 17,000-13,000 years BP) may represent soil organic matter developed in the lake when it was dry.

G. Williams reports on some preliminary work on the Chambers Creek fan of the Flinders Ranges, and Wasson (1979) has reported on the Barrier Ranges fans to the east of Lake Frome. An attempt to establish physical correlation with Wasson's Mundi Mundi fans and the desert sequence was unsuccessful. Although there were physical an geomorphic similarities between the Belmont Paleosol and that developed on the Eurinilla Formation, there proved to be a great disparity in age.

R.H. Tedford records a c.2500 year BP age for eggshell from his 'bird-bearing beds' at Lake Callabonna.

These results correspond reasonably well with Bowler's Willandra Lakes history, but not with the older part of the scheme presented by G. Williams (Williams and Polach 1971).

Seven preliminary C13 PDB values were determined on the sequence of calcareous paleosol dated at Site (2) by Tony Milnes (CSIRO Soils, Adelaide). They suggest possibly half the samples dated have C13 outside the range -5 ± 2 ‰ used in correcting the quoted dates. Most of them are less enriched in C12 than expected, ranging from -2.1 to -4.1, with one value -7.4, which is more enriched. Thus up to half the dates will be 100 years too old, with a few being too young. It is of interest that the two dates that appeared too young from geological reasoning were from samples with the highest C13 values (-2.1 and -2.4).

R.A. CALLEN

A series of preliminary geological sheets for CURNAMONA map area have been prepared at 1:100,000 scale ready for reduction and simplification for presentation in the 1:250,000 scale Geological Atlas Series of the South Australian Department of Mines and Energy. Approximately 18 Cainozoic units will be distinguished. A colour-rough at final scale is expected to be ready at the end of 1979.

Work is proceeding on the age and origin of arcuate claypan patterns of the Southern Strzelecki Desert.

A revised and updated version of the FROME explanatory notes will also be available at the end of 1979, to be published in 1980.

J.M. BOWLER and R.A. CALLEN

The type section of the Millyera Formation has been cored for palaeomagnetic work, as was the sequence around 'Theta' Island in Lake Frome (southeast corner). Shell samples from the 15m strandline were taken to check what appears to be an

anomalously young date obtained from here (c.23,500 yrs BP). Trenching showed this young shell sediment was not to be correlated with the ?lunette material report above (units 2, Eurinilla Formation, Section 5, Callen and Tedford), but was part of the strandline deposit estimated at c.50,000 years BP.

R.J. WASSON

Has reported in the previous newsletter on his Strzelecki Desert work, which has been extended into the Coopers Creek area to establish relationships with fluviatile sediments. Sedimentology of dune materials and associated sediments is proceeding, and excellent sections through dunes have been measured along seismic tracks in the Moomba area. A large leeside mound north of Lake Blanche has been examined.

J.M. BOWLER and R.J. WASSON

In March-April 1979 Bowler and Wasson undertook two field trips in the Frome-Callabonna region. The first of these was concerned to obtain a stratigraphic sequence through the river transverse strandline features to identify the aeolian-lacustrine components.

The second, in association with Roger Callen, was directed towards the recovery of cores in the lake sediment. Using a fat-tyred Honda 'Odyssey', access to islands in the southern portion of the lake permitted the recovery of cores to 4m. Jim Juvic, participating in this exercise, carried out an assessment of plant species diversity on islands of differing sizes investigating in an 'inland island' situation the validity of the biogeographical thesis that species number is proportional to island size.

Cores from Lake Frome are now being subjected to laboratory analysis to determine age and environments of deposition. Depending on preliminary results, Wasson and Bowler plan an additional digging-coring exercise in March-April 1980 to complete their work in the area.

M.F. BUONAIUTO and R.A. CALLEN (written by R.A.C.)

Non marine molluscs were collected by R.A.C. M.F.B. is responsible for identification and paleoenvironmental deductions, and carried out the work during 1977 whilst in a consulting capacity to the South Australian Department of Mines and Energy.

Non-marine mollusca are found in the following units: the Millyera Formation (facies as in its type section), associated with a Chara limestone horizon; the upper part of the Millyera Formation, in both the beach and lacustrine facies (the beach corresponds with the 15m strandline); as aeolian deposits in the base of the Coonarbine Formation; and in the uppermost units of the same Formation, associated with soils. Samples from all but the lowest units were examined. M.F.B. has described a number of

new species and carried out an extensive literature review.

The fauna can be divided into the following groups or assemblages:

1. A possible assemblage, represented by only two samples, dominated by Coxiella striata, Coxielladda gilesi and Corbicula desolata.

2. A diverse assemblage with Potamopyrgus sp., Neopisidium sp. nov., Coxiella striata, and Corbicula desolata dominant.

3. An almost monospecific Coxielladda gilesi assemblage.

4. Thersites aversum and other land snails.

Assemblage (2) was described from the 15m beach deposits at three widely separated localities around Lake Frome. Assemblage (3) occurs in marginal facies associated with this beach, and also in younger deposits. The possible assemblage (1) at the north end of Lake Frome is in lacustrine deposits beneath a coquinite containing assemblage (2). However, a similar horizon dominated by Coxiella striata was recently located by R.A.C. at Lake Millyera in about the same stratigraphic position. Assemblage (4) is found only in the Coonarbine Formation and younger deposits.

M.F.B. indicates assemblage (2) could be attributed to salinities of 2-4 ? probably in the brackish water stage at the end of a fresh water lake stage. The monotypic group (3) indicates arid saline conditions, or at least ephemeral lakes. Group (2) probably lived in the main lake, where extensive quite thick deposits of shell accumulated in beaches and bars, whereas group (3) may have existed in seasonally dry lagoons behind the strandline. However, the bars at the south end of Lake Frome contain essentially Coxielladda gilesi with no bivalves, and few other species. M.F.B. believes (2) and (3) are incompatible, with (2) representing the drying stage of the lake, and of older age, and (3) representing an ephemeral playa stage. Further detailed stratigraphy is required to test this idea. Shell, (minus land snails), from assemblages (2) and (3) was used to give the dates of the beach deposits reported above.

Assemblage (1) may indicate a short phase of somewhat more saline water prior to development of the 15m beach, or may represent a different facies.

Assemblage (3) is also present in the base of a gypsum lunette on an island in Lake Frome, and in the base of a sand lunette at Lake Moko. Here it must be about c.21-28,000 years BP, from paleosol data presented above, though the shell itself has not been dated.

The land snail assemblage (4) is typical of semi-arid conditions, and is found in the Lake Frome area today. It is associated with aeolian deposits near what may have been old waterholes. These snails are also present in some of the older beach sediments.

E. WILLIAMS

Alluvial stratigraphy, Mount Chambers Creek Fan, Southwestern Frome Plain

Radiocarbon dates were obtained for two charcoal samples from alluvium exposed in section near the apex of the Mount Chambers Creek fan on the southwestern Frome plain (30deg.58'S lat., 139deg.17'E long.). At this location an upper alluvial unit about 60m thick, comprising unconsolidated silts, sands and gravels, overlies a 2.5m thick lower unit of better consolidated clayey silts, sands and coarse gravels. Charcoal fragments which occur extensively at the contact between these two alluvial units may indicate a scrub fire; charcoal from this level dated at 1340 ± 80 years BP (ANU-221). Charcoal from a possible hearth, in clayey silts and sands 1.4m below the level of ANU-221, dated at 12,500 ± 170 years BP (ANU-222). These dates were reported by Polach et al. (1970:6). Soil carbonate is only very weakly segregated in the lower unit, and is absent in the upper unit.

The two dates indicate that this portion of the Frome plain was aggraded during the latest Pleistocene and the late Holocene. The apparent hiatus in alluviation spanning most of Holocene time is noteworthy, since a comparable hiatus is not revealed in the alluvial stratigraphy of the Torrens plain on the opposite (western) side of the Flinders Ranges (Williams 1973). As discussed by Williams and Polach (1971:3075), ANU-222 may provide a younger age limit for the Motpena soil-forming episode.

GURDIP SINGH

Palynology

In Lake Frome, the top 1m of sediment so far analysed at 2cm intervals (from the middle of the lake basin), is representative of at least the last 10,000 years BP. Fossil pollen, derived mainly from the water catchment, has been found at all levels without any break, and shows a series of changes in the plant assemblage which can be ascribed to regional changes in the surrounding vegetation. There is a distinct alternation between periods of woody tree-shrub and ephemeral herbaceous vegetation, but it is not yet possible to date any of these events with precision. Broadly, the mid Holocene appears to have supported a greater degree of woody growth than the period before and after. The incidence of fire has been uncommon, as at present, and was invariably related to periods of high pollen production showing that the fire activity was primarily related to the production of fuel, which in turn was probably dependent on periods of good rainfall.

B. GEOCHEMISTRY

D. GALANOS

Aqueous geochemistry and chemical evolution of lake and groundwaters, Lake Frome area. Aquisition, transport and deposition of 1st, 2nd and 3rd period transition metals, lanthanides and trans-uranium metals.

Stream sediment and water samples are being analysed. Very low levels of base metals and trace elements exist in concentrated NaCl waters. Salinity increases from the Flinders Ranges towards the lake, as expected.

A.R. JENSEN

Sediments and brines in Lake Frome were studied to determine if the movement of fluids and sediments into an internal drainage basin in an arid environment could concentrate metal ions through evaporation or the action of sulphate reducing bacteria. Secondary objectives were the study of continental brines, playa sedimentation, and mound springs.

Stratigraphic analysis based on samples from a series of shallow auger holes shows that over the last 17,000 years medium to fine sand accumulated on the margins of the lake and mud in the centre. The sediment has issued from streams entering the lake on all but the eastern sides, mainly in delta fans. Three informal stratigraphic units were recognised - upper and lower sandy units, and a muddy unit which is regarded as a lateral equivalent. A salt crust up to 20cm thick overlies the clastic sediment in the centre of the lake.

At the time of the survey about 10 % of the lake was covered with water. Both surface and sub-surface waters are hypersaline (26-34 ‰) and characterised by high concentrations of sodium and chloride ions. The major ions have probably been derived from marine sediments. No enrichment of minor elements was detected in the brines, but lead appears to be leached from the sediments as soluble chloride complexes.

Clastic sediments from the lake have been analysed for major and minor elements. Statistical analysis of the results indicates that the upper and lower sands are geochemically similar and that they differ from the muds, which have higher concentrations of organic carbon and certain minor elements. There is no evidence of concentration of metal ions although manganese appears to have been concentrated on the surface of the lake by algae.

Mound springs in the northeastern part of the lake differ from those of the southeast in composition of the mound and the water. The composition of the water reflects mixing of artesian water with lake brines (Draper and Jensen 1976).

C. VERTEBRATE PALAEONTOLOGY

A group consisting of T. Rich, M. Archer, M. Plane, N. Pledge and P. Rich has been working on the Miocene vertebrate deposits, mainly around Lake Namba, Billeroo Creek, Lake Pinpa and Lake Tarkarooloo. This group continues work begun earlier by Dr R.H. Tedford of the American Museum of National History. A complete report on the Miocene material is available from any of these contributors, with some additional comments by Pledge.

The Billeroo Creek Sthenurine fauna is yet to be described, and is similar to others from L. Callabonna. Several small mammals, primarily rodents, were also discovered. Tedford and R.T. Wells, are working on Sthenurus, including a large new species collected from L. Callabonna in 1970-3.

R.H. TEDFORD

Stratigraphic studies at Lake Callabonna, South Australia

The famous fossil deposit at Lake Callabonna was discovered in 1893 and explored by parties from the South Australian Museum in that year. Several parties visited the deposits in this century including the Australian Museum (1948) and the University of California and South Australian Museum (1953). No intensive work was undertaken until 1970, when the American Museum, Smithsonian Institution and South Australian Museum spent nearly four months making a sizeable collection of fossil remains and studying the Quaternary stratigraphy of the central part of the lake floor. The following brief account presents the geological conclusions reached by the author during the field work of 1970 and subsequently revised in light of the Quaternary stratigraphy developed for the Lake Frome region (Callen and Tedford 1976).

The Quaternary succession at Lake Callabonna is notably thin over much of the lake floor. The Miocene Namba Formation crops out in several places beneath the basal sands and local gravels of the Millyera Formation (the Diprotodon-bearing beds). Above the basal sands, the Millyera Formation is represented by laminated clays and sands occurring in cyclic couplets of about a centimeter in thickness consisting of thin medium to fine sand (often ripple marked and desiccation cracked) overlain by thicker laminated clay. A few thin limestone bands break the sequence in places and a clay unit crowded with arrow-head twinned selenite forms one of the few beds of any areal extent. These rocks record the fluctuating water level of a major lacustrine phase that is beyond the range of radiocarbon dating.

Disconformably overlying the Millyera Formation are the deposits of a lake confined to the present perimeter of Lake Callabonna. These lake deposits and their associated beach and fluviatile facies are equated with the Eurinilla Formation. Basal pebbly sands, gypsiferous lacustrine clays and silts, stream gravels, strandline gravels and a sand lunette comprise the principal deposits. These deposits bear a carbonate soil in places and contain only molluscs. They have not been dated at Lake Callabonna.

Younger deposits, correlated with the Coonarbine Formation, record an arid phase with clay dunes adjacent to the lake and the Strzelecki dunefield to the east. Much of the underlying Quaternary deposits on the lake floor were deflated during this episode. Active mound spring discharge was underway during this time and continues to the present day. The ephemeral lake conditions of the present were in evidence by 2-3000 years BP as indicated by radiocarbon dates on charcoal and egg shell (Buckley 1973) from a waterbird nesting site on a mound spring supported island near the centre of the lake. Lake-full conditions have apparently occurred repeatedly in the recent past as Lake Callabonna is the focus of much of the drainage of the Lake Frome Embayment.

D. WILLIAMS

Late Pleistocene marsupial fossil sites on Billeroo Creek east of Lake Pinpa

The fossils are derived from the Eurinilla Formation (Callen and Tedford 1976), a fluviatile deposit overlying about 1m of alternating green clays and fine quartz sands. In a few cases, partial skeletons have been found intruding from the Eurinilla Formation into these clayey sediments (Rich pers. comm.) indicating that animals were sometimes trapped whilst the clay was wet. Otherwise, fossils are found as fragments in the gravelly basal part of the Eurinilla Formation.

The older clayey sediments are interpreted as marginal lacustrine, associated with the larger Pleistocene Lake Frome (Callen 1977). So far they are not known to yield fossil vertebrates. The red, sandy sediments of the Eurinilla Formation represent intermittent stream flow, with at least seasonally high water tables.

The late Pleistocene fossil assemblage from Billeroo Creek is now known to include Thylacoleo carnifex and Lasiorhinus sp., as well as the previously recorded species of Diprotodon, Sthenurus, Macropus, Procoptodon, and probably Bettongia. Rodents are also represented.

Further work is planned, to refine the local stratigraphy and to search for fossils in the older green clayey sequence that underlies the Eurinilla Formation.

D. MODERN ECOLOGY

J. JUVIK

Has briefly examined the modern flora and fauna of the islands in Lake Frome in the context of island biogeographic theory, viewing it as an environment in which substrate age and variability can be eliminated as factors affecting colonisation and species diversity (all the islands are of gypsum lunettes, with some later beach material, formed around 18-21,000 years BP). Floristic composition varies greatly from island to island,

and well developed avifaunas are present on the larger isolates.

J. GLOVER

Has summarised data on fish species from the Lake Frome Drainage basin, including those that could conceivably enter the basin. The report is available to those who wish to study Quaternary fossil fish or the general ecology of the region.

E. ARCHAEOLOGY

Pleistocene archaeology in the Flinders Ranges-Lake Frome-Strzelecki Desert areas

P.J. HUGHES and R.J. LAMPERT

We have recently begun two separately conceived but related long-term research projects into Pleistocene archaeology in the above areas. Lampert is primarily concerned with extending northward his earlier work on Kangaroo Island and adjacent parts of the South Australian mainland of the early stone industry known as 'Kartan' (Lampert 1979). Hughes' research is aimed initially at seeking evidence for Pleistocene occupation of the now-arid zones of the southeastern part of the continent and its immediate semi-arid fringe.

In October 1979 we undertook a brief reconnaissance of the study area and found enough archaeological material in situ in, or highly likely to have been derived from, Pleistocene deposits to warrant further investigations. Areas of particular archaeological interest were Cooper Creek, near Nappa Merrie in Queensland; Lake Merteree, to the east of Strzelecki Creek in SA; Balcoracana Creek, near the southwest shore of Lake Frome; Hookina Creek and Hawker Lagoon, on the western side of the Flinders near Hawker; and Mt Chambers Gorge on the eastern side of the Flinders Ranges.

LIST OF RESEARCHERS WHO HAVE WORKED IN THE LAKE FROME AREA ON THE QUATERNARY

Mike Archer
Department of Zoology
University of New South Wales
KENSINGTON NSW 2033

Jim Bowler
Department of Biogeography and
Geomorphology
Research School of Pacific Studies

Australian National University
PO Box 4
CANBERRA ACT 2600

Massimo Buonaiuto
Department of Geology
University of Adelaide
North Terrace
ADELAIDE SA 5000

Roger Callen
Regional Mapping Division
Dept of Mines and Energy
PO Box 151
EASTWOOD SA 5063

John Draper
Geological Survey of Queensland
2 Edward Street
BRISBANE QLD 4000

Jon Firman
Regional Geology Section
Dept of Mines and Energy
PO Box 151
EASTWOOD SA 5063

Demetrius Galanos
c/- Dept of Geology
LaTrobe University
BUNDOORA VIC 3083

Richard Gillespie
c/- PO Stoker's Siding
NSW 2484
(formerly Sydney University
Radiocarbon Laboratory
University of Sydney
SYDNEY NSW 2006)

John Glover
Curator of Fishes
South Australian Museum
North Terrace
ADELAIDE SA 5000

Philip Hughes
Dept of Prehistory
Research School of Pacific Studies
Australian National University
CANBERRA ACT 2600

Ralph Jensen
Regional Mapping
Bureau of Mineral Resources

Geology and Geophysics
Box 378
CANBERRA CITY ACT 2601

Jim Juvik
Dept of Biogeography and
Geomorphology
Research School of Pacific Studies
Australian National University
CANBERRA ACT 2600

Ron Lampert
Curator of Archaeology
The Australian Museum
PO Box A285
SYDNEY SOUTH NSW 2000

Tony Milnes
CSIRO Soils Laboratory
Waite Road
URRBRAE SA 5064

Mike Plane
Bureau of Mineral Resources
Geology and Geophysics
PO Box 378
CANBERRA CITY ACT 2601

Neville Pledge
Curator of Fossils
South Australian Museum
North Terrace
ADELAIDE SA 5000

Pat Rich
Dept of Earth Sciences
Monash University
CLAYTON VIC 3168

Tom Rich
Curator of Mammals
National Museum of Victoria
285-321 Russell Street
MELBOURNE VIC 3000

Gurdip Singh
Dept of Biogeography and
Geomorphology
Research School of Pacific Studies
Australian National University
CANBERRA ACT 2600

Richard Tedford
Chairman
Dept of Vertebrate Palaeontology

American Museum of National History
Central Part West at 79th Street
NEW YORK CITY, NY, 10024, USA

Bob Wasson
Dept of Biogeography and
Geomorphology
Research School of Pacific Studies
Australian National University
CANBERRA CITY ACT 2601

Rod Wells
School of Biology
Flinders University
BEDFORD PARK SA 5042

Andrew White and Surrenda Chaku
Comalco Pty Ltd
31 Deeds Road
Flinders University
BEDFORD PARK SA 5042

Dominic Williams
School of Biology
Flinders University
BEDFORD PARK SA 5042

George Williams
BHP Melbourne Research
Laboratory
PO Box 264
CLAYTON VIC 3168

SOME RELEVANT REFERENCES

Bowler, J.M. 1976 Aridity in Australia. Earth Sci. Revs. 12:279-310

Buckley, J. 1973 Isotopes' radiocarbon measurements X. Radiocarbon 15:280-98

Callen, R.A. 1975 The FROME 1:250 000 scale geological map. Geol. Atlas series geol. Surv. S. Aust.

Callen, R.A. 1976 Tentative correlation of onshore and lacustrine stratigraphy Lake Frome area. BMR J. Aust. geol. Geophys. 1:248-50

Callen, R.A. 1977 Late Cainozoic environments of part of northeastern South Australia (paper presented 25th International Geological Congress, Sydney). J. geol. Soc. Aust. 24:151-69

Callen, R.A. (in prep.) Explanatory notes for FROME geological map. Geol. Surv. S. Aust.

Callen, R.A. (in prep.) Origin of arcuate landform patterns and related dunefields, northeastern South Australia

Callen, R.A. (in prep.) The CURNAMONA 1:250 000 scale geological map. Geol. Atlas Series geol. Surv. S. Aust

Callen, R.A. and R.A. Tedford 1976 New Late Cainozoic rock units and climate, Lake Frome area, South Australia. Trans. R. Soc. S. Aust. 100:125-68

Draper, J.J. and A.R. Jensen 1976 The geochemistry of Lake Frome, a playa lake in South Australia. BMR J. Aust. Geol. Geophys. 1:83-104

Firman, J.B. 1971 Regional stratigraphy of surficial deposits in the Great Artesian Basin and Frome Embayment in South Australia. Dept Mines S. Aust. Rep. Bk. 71/16 (unpublished)

Firman, J. 1978 Report on INQUA IGCP project 129 (includes summary of work by Callen)

Glover, C.J.M. and T.C. Sim 1978a Studies of Central Australian fishes: a progress report. S. Aust. Nat. 52(3):35-44

Glover, C.J.M. and T.C. Sim 1978b A survey of Central Australian ichthyology. Aust. Zool. 19(3):245-56

Lampert, R.J. 1979 The great Kartan mystery. PhD thesis, Dept Prehistory, ANU

Laut, P., P.C. Heyligers, G. Keig, F. Loffler, C. Margules and R.M. Scott 1977 Environments of South Australia Handbook, Commonwealth Scientific and Industrial Research Organization (Canberra), Aust.

Loffler, E. and M.E. Sullivan 1979 Lake Dieri resurrected: an interpretation using satellite imagery. Z. Geomorph. 23:233-42 23:233-42

Polach, H.A., J.F. Lovering and J.M. Bowler 1970 ANU radiocarbon date list IV. Radiocarbon 12:1-18

Rich, P.V. 1979 The Dromornithidae, an extinct family of large ground birds endemic to Australia. Bull. Bur. Min. Res. Geol. Geophys. 184:194pp.

Tedford, R.H. 1973 The Diprotodons of Lake Callabonna. Aust. Nat. Hist. 17:349-54

Wasson, R.J. 1975 Evolution of alluvial fans in two areas of southeastern Australia. PhD thesis, Macquarie University

Wasson, R.J. 1978 Desert dunes - research activities. Australian Quat. Newsletter 12:25-6

Wasson, R.J. 1979 Sedimentation history of the Mundi Mundi alluvial fans, Western New South Wales. Sediment Geol. 22:21-51

Williams, G.E. 1973 Late Quaternary piedmont sedimentation, soil formation and paleoclimates in arid South Australia. Z. Geomorph. 17:102-25

Williams, G.E. and H.A. Polach 1971 Radiocarbon dating of arid-zone calcareous paleosols. Bull. geol. Soc. America 82:3 069-3 086

LAKE DIERI: TO BE OR NOT TO BE?

Ernst Loffler and Marjorie Sullivan

The existence of a large lake in arid central Australia has been postulated for some time and early explorers even dreamt of sailing on it. Alas, they may have been only a bit too late.

The study of satellite imagery from the Simpson and Strzelecki Deserts shows that there is a distinct alignment of saltpans and claypans transverse to the general trend of the longitudinal dunes. The alignment is, however, also approximately parallel to the arcuate shape of the chain of salt lakes fringing the deserts to the south and west. The parallel alignment of the pans is interpreted as a reflection of former shorelines and the maximum extent of the aligned pans as the possible maximum extent of an enlarged lake encompassing the present salt lakes of Lakes Frome, Callabonna, Blanche, Gregory and Eyre and large parts of the Simpson and Strzelecki Deserts. The multitude of aligned pans also indicates that the lake gradually diminished and that successions of littoral dunes were developed along the downwind side. As new littoral dunes developed the older ones were gradually blown out and their sand incorporated into the longitudinal dunes that now extend across the deserts.

The age of the postulated lake is not known but the multitude of the aligned pans and the great size of the reconstructed lake (110,000km2) suggests that it must have existed over a long period of time possibly extending into the Tertiary.

Division of Land Use Research
CSIRO, Canberra

Department of Prehistory
and Anthropology,
ANU, Canberra

Reference

Loffler, E. and M. Sullivan 1979 Lake Dieri resurrected: an interpretation using satellite imagery. Z. Geomorph. 23:233-42

COMMENT ON R.J. WASSON:

'The identification of relict periglacial slope mantles'
Australian Quaternary Newsletter 13, May 1979

Jane Soons

Congratulations to Dr Wasson on his discussion on this topic in the recent issue of AQN! Soon after my arrival in New Zealand, I reviewed the extent of possible periglacial phenomena in this country (Soons 1962), and in so doing highlighted certain anomalies, in particular the distribution of deposits considered to be of solifluction origin. Interpreted as such, they imply a remarkably severe climate in the Wellington area, at times when there is no strong evidence of similar deterioration from more southern parts of the country outside glaciation limits and at similarly low altitudes. After publication of the review, I began investigating the distribution of possible periglacial solifluction slope deposits, especially in the Marlborough Sounds. This study was eventually abandoned on the grounds that no real advance could be made until a sure criterion (or preferably more than one) could be established for distinguishing mass movement deposits related to frozen ground from those resulting from a complex of environmental changes including a reduction in vegetation cover. To the best of my knowledge, no such distinction can be made, and I would strongly support Dr Wasson's conclusion that 'palaeoclimatic deductions based upon slope mantles must be viewed as speculative'. Only phenomena which can undoubtedly be tied to a frozen ground condition should be employed in climatic reconstruction.

Incidentally, in the 17 years since publication of my review, and in spite of the great increase in studies of the Quaternary, no more evidence of genuinely periglacial cold climate conditions in New Zealand has come to light than was available in 1962.

Department of Geography
University of Canterbury
Christchurch 1

Reference

Soons, J.M. 1962 A survey of periglacial features in New Zealand. In M. McCaskill (ed.) Land and Livelihood: Geographical essays in honour of George Jobberns. NZ Geographical Society

RESULTS FROM POTASSIUM ARGON DATING OF PAPUA NEW GUINEA HIGHLAND VOLCANOES

Ernst Loffler

Over 30 rock samples from six highland volcanoes were radiometrically dated in order to obtain a better control over the volcanic and geomorphic history of the PNG highlands. The results of this work will be published shortly (Loffler et al. in prep.). In summary the results are as follows.

The highland volcanoes show a wide spread of ages from 1.6m.y. (possibly 1.9m.y.) to about 200,000 years BP which indicates that there has been intermittent if not continuous volcanism in the highlands for the last 2 million years. Each volcanic centre with more than one dated sample shows a clear bimodality in ages but whether this is real or simply due to the limited sampling cannot be established at this stage.

On Mt Giluwe where most of the dated samples come from, glacial activity was interspersed with volcanism around 280,000-290,000 years BP and also possibly at about 700,000 years BP. The first date is consistent with results from other parts of the world in particular Hawaii (Porter et al. 1977) and Mt Kilimanjaro (Downie and Wilkinson 1972).

On Mt Hagen the volcanic activity may have spread over 1 million years. The oldest date is 1.2m.y. and the youngest 200,000 years BP. For Doma Peaks for which recent activity has been suggested, two dates of 500,000 and 880,000 years BP have been obtained, while for Bosavi the ages were 1.93 and 0.54m.y. Mts Kerewa and Ne gave ages of 1.18m.y. and 1.60m.y. respectively. These results show that the development of the highland volcanoes is more complex than previously thought and that no single age tag can be given to any of the volcanoes.

There is a clear discrepancy between the isotopic ages of the volcanoes and their state of dissection. Two of the most dissected volcanoes, Mt Hagen and Doma Peaks, are in fact the youngest. This shows that the erosional state of a volcano is not necessarily a good indicator of its age and that great caution is needed when estimating such complex things as erosion rates from volcanoes.

Division of Land Use Research
CSIRO
Canberra

References

Downie, C. and P. Wilkinson 1972 The Geology of Kilimanjaro. Department of Geology, University of Sheffield

Loffler, E., D.E. Mackenzie and A. Webb (in prep.) Potassium Argon ages of the Papua New Guinea highlands volcanoes and their relevance to Pleistocene geomorphic history. J. Geol. Soc. Aust.

Porter, S.C., M. Stuiver and I.C. Yang 1977 Chronology of Hawaiian glaciations. Science 195:61-3

MORE ON SLOPE MOVEMENT

Dr M.J. Knight is continuing his detailed studies on slump-mudflow landslides near Camden. Fabric analysis techniques are being applied to rock fragments and internal cracks, in a program aimed at developing predictive and mechanistic models. A parallel program of triaxial testing of oriented core samples is being used to assess standard soil mechanical theories of slope failure.

Fabric criteria are being developed that may enable the relative position of a landslide to be assessed when surface morphology has been removed by erosion.

School of Applied Geology
University of NSW
Kensington, NSW

CLIMANZ

Climatic change of Australia and New Zealand -
Late Quaternary events of the last 40,000 years

Date: February 8-13, 1981

Place: Howmans Gap, National Fitness Camp, Falls Creek, Victoria. Sponsored by the Australian Academy of Science (Joint Sponsorship is being sought with the Royal Society of New Zealand)

Theme

The reconstruction of Late Quaternary Australian and New Zealand environments in discrete time zones.

The conference will bring together data from a wide area, from tropics to southern ocean and from Western Australia to New Zealand. Data will be assembled into five time zones covering the period from 5000-35,000BP by focussing on

1. periods of climatic extremes, and

2. transitional periods between extremes, we aim to provide a spatial array of data critically evaluated in terms of chronology and environmental interpretation.

Seen in terms of the different climatic and physiographic regions represented, such an evaluation provides a first step towards the reconstruction of changes in the general circulation over this large region of the southern hemisphere.

Conference organisation

The time zones selected jointly by the Australian and New Zealand committees in consultation are designated in terms of 'spikes' and 'series'.

'Spike' is designed to identify extremes; 'series' seeks to focus on transitions between extremes.

Spikes - 32 ± 5K - extreme wet
18 ± 2K - glacial maximum, extreme dry
7 ± 2K - wet Holocene maximum

Series - 25 to 20K
15 to 10K

Contributors are asked to submit papers from each of four regions.

1. Tropical Australia and Papua New Guinea (summer rainfall region)

2. Southern Australia and Tasmania (winter rainfall region)

3. New Zealand

4. Tasman Sea and Southern Ocean to Antarctica.

Contributed papers should be organised as follows. A paper on any of the four regions should aim to summarise published and new data into an extended abstract. Each individual paper should present not more than one typed A4 page on one or more of the time zones represented. Each time zone from any one region should be presented on a separate page.

A contributor may submit more than one paper using data based on different regions or different areas within any one region.

Papers may cover any number of the time zones identified. Thus we could have:

Burrows, Colin: The vegetation record 35,000-5000BP from the North Island, NZ. (Discussion of all 5 time zones - 5 pages of text.)

Burrows, Colin: Reconstruction of 18K evidence from Canterbury Plains. (One page.)

All contributed papers will be pre-distributed to participants well in advance of February 1981. The conference will commence with one day given to technique and evaluation of data limitations and reliability of interpreted parameters. These will be invited contributions.

The main presentation and discussions will take the form of workshops. Two persons (one a physical or biological scientist, the other a climatologist) will be invited to summarise data and lead discussion on each of the five time zones. After workshop discussion of the summaries, the two leaders will attempt to produce an outline consensus for report back to a plenary session. The production of the consensus statement, including dissenting views where necessary, will provide a basis on which climatologists will be invited to speculate seeking unifying climatic theory. Such speculation will include suggestions for

testing current palaeoclimatic hypotheses, for assessing input to climatic models and will help point the way towards identifying research needs for the next decade.

Other details

The venue

Howmans Gap is a Victorian State Government National Fitness Camp near Falls Creek and Mt Beauty on the northern margin of the Bogong High Plains. At an elevation of 1240m it provides a favourable summer climate; swimming is available nearby.

Registration and accommodation

To keep costs to a minimum we aim to provide full accommodation for $15 per day. A registration fee of $40 will entitle participants to receive a copy of the conference publication. As numbers at Howmans Gap are limited to 80 it may be necessary to give preference to participants actively involved in presentation or invited discussion of papers.

Transport

Access to Falls Creek is by way of Wangaratta and then via Beechworth or Bright. For those delegates arriving by air or by train to Albury-Wodonga, vehicle transport will be provided to Howmans Gap.

Call for papers

Deadline for extended abstracts - 1 November 1980. Abstracts received after that date may not be distributed to all delegates before the meeting thus defeating the purpose of the exercise. All intending participants are asked to fill in the form included and return it not later than 30 August.

EVOLUTION OF THE FLORA AND FAUNA OF ARID AUSTRALIA

This symposium is being held in Adelaide from Wednesday 7th to Friday 9th May, 1980 (the week before ANZAAS).

It includes reviews by invited speakers and contributed papers. The main topics to be covered are:

Background: geomorphology, climatic history, soils, palaeobotany and zoology, vegetation of arid Australia.

General biota: evolution, biogeography and Quaternary history, influence of Aboriginal man.

Plants: genetic systems, adaptations and origins of the flora of the arid zone; regeneration and adaptation to fire; evolution, radiation and biogeography of selected families.

Vertebrate animals: evolution, biogeography, physiological, behavioural and other adaptations.

Invertebrates: radiation, adaptations and ecological strategies.

For further information, contact

Dr W.R. Barker
State Herbarium of SA
Botanic Gardens
North Terrace
Adelaide SA 5000

AMQUA SIXTH BIENNIAL MEETING

The sixth Biennial Meeting of the American Quaternary Association will be in Orono, Maine, August 18-20, 1980. Hal Borns, Department of Geological Sciences, University of Maine, is chairman of the meeting. William R. Farrand, Department of Geology, University of Michigan, has agreed to organise the programme theme.

INTERNATIONAL PALYNOLOGICAL CONFERENCE

The fifth International Palynological conference will be held in Cambridge, England, from June 29 to July 6, 1980. The first circular (3500 copies) was mailed in 1978, the second was mailed in January 1979 to the approximately 600 respondents who suggested they plan to attend. Three kinds of presentations will be available (selected formal papers, 30 minutes each; poster sessions; demonstrations). Abstracts are due by 1 December 1979, with all correspondence addressed to Mrs G.E. Drewry, Department of Geology, Sedgwick Museum, Downing Street, Cambridge CB2 3EQ, England.

Paper sessions of particular interest to the AMQUA membership include 'Pollen/vegetation relationships and vegetation reconstruction (Session 8; H.J.B. Birks and C.R. Janssen); Quaternary vegetational history (Session 9; 9A, North America, W.A. Watts; 9B, Tropics and Southern Hemisphere, J.R. Flenley; 9C, Eurasia, R.G. West; 9D, Arctic and Alpine areas, J.H. Dickson; 9E, Pollen analysis and human history, A.G. Smith; 9F, Pollen analysis and reconstruction of past climates, B. Huntley); Distribution and transport processes (Session 13, W. Pennington [T.G. Tutin]).

Relevant field trips will include Quaternary vegetational history of the Lake District (Trip A7, Preconference, W. Pennington [T.G. Tutin] 7 days); Quaternary vegetational history of East Scotland (Trip C8, Postconference, H.J.B. Birks, 7 days); Quaternary vegetational history of Western Ireland (Trip C9, postconference, W.A. Watts, 6 days); and the Quaternary of East Anglia (Trip C11, postconference, C. Turner and R.G. West).