

New directions in archaeological science

Foreword

The papers in this volume were presented at the 8th Australasian Archaeometry Conference (AAC) hosted from the 12-15th December 2005 at the Department of Archaeology and Natural History in the Research School of Pacific and Asian Studies of the Australian National University (ANU), Canberra, Australia. The Australasian Archaeometry Conference was initiated in 1982 by ANU archaeologist Wal Ambrose in collaboration with the then Australian Atomic Energy Commission at Lucas Heights. Since its inception, the conference has been an important meeting place for the widely dispersed and diverse community of Australasian archaeological scientists, including both those resident in the region, primarily in Australia and New Zealand, as well as Australasians working around the world. The 2005 meeting at ANU was the first to be held there since 1991 and was the venue for the presentation of 79 papers in 10 sessions covering all aspects of archaeological science from analytical chemistry to GIS, fire histories and ancient technology. The linking concept with all of the sessions was the integration of archaeological science research within broader archaeological projects – in other words forwarding interpretations alongside consideration of method. Over 120 delegates from 6 countries attended the lecture sessions which were accompanied by a poster session, plenary lecture and several workshops. Student participation was especially encouraged and, partly as a result of industry and University sponsorship (see below), subsidised places and travel bursaries helped to boost student delegates to almost one third of the overall total attendance.

One of the key roles of the AAC has been to promote the work of the region's archaeological scientists by producing refereed publications of conference papers. As academic publication has radically changed in recent years so has the publication format and venues for conference publications. Rather than producing a single conference proceedings, papers from the 2005 AAC can be found in a variety of international journals, including *Lithic Technology*, *Internet Archaeology*, *Archaeometry* and the *Journal of Archaeological Science*. This volume presents original research papers from three key subject areas covered in the conference, all of key research interest to Australasian archaeologists, namely geoarchaeology, archaeobotany and archaeometry. In keeping with the aims of the AAC, student papers feature heavily among those published here and we have included papers studying a range of geographical regions. All provide new insights into the past and several herald significant shifts in analytical priorities for their component disciplines.

Geoarchaeology is a key focus of research interest for Australasian researchers often dealing with ancient and eroded landscapes and where dating cultural materials in surface and even stratified contexts can prove extremely challenging. Several of the papers focus on dating and interpretation of surface exposures of artefacts and provide novel approaches integrating studies of geoarchaeology with geochronology to this end. One group of papers tackles these problems in western NSW, an arid region where archaeological sites such as surface stone artefact scatters and hearths have in the past proved difficult

to date and to compare with the archaeological record in other regions of Australia. Many of these studies are not just about new ways of doing or dating archaeology: some of the results presented have significant implications for the inferences archaeologists draw from their data.

A good example of this is the paper by Holdaway, Fanning and Littleton which provides a salutary example of how time and taphonomic processes impact on the sedimentary and archaeological record; a factor often overlooked by archaeologists who use radiocarbon dates as proxies for numbers of people in the landscape to generate inferences about human behaviour in the past. They compare the frequency distributions derived from two different data sets for Holocene western NSW, heat retainer hearths and dated human burials. The heat retainer dates show a dramatic decrease in frequency with age, whereas the burial dates have a more even distribution. Their study demonstrates the impact of differential preservation, not just of cultural materials but also of sedimentary contexts, accessible to archaeologists to study. They conclude that the “accumulative hearth record in northwestern NSW, and, by association, the accumulated record of stone artefacts, increases during the last 2000 years because of geomorphic surface preservation rather than greater numbers of Aboriginal people and/or increases in occupation span”.

Fanning, Holdaway and Phillips contribute a new method of identifying heat-retainer hearths which have been dispersed. These important sites are ubiquitous in the arid landscape of western NSW but as they are exposed on the surface they are highly subject to erosion and bioturbation. The eventually loose the charcoal and spatial patterning is lost and identification becomes problematic. Fanning *et al.* recommend a technique based on a combination of condition, typology and use of a fluxgate gradiometer to detect remnant thermo-magnetism in the heat retainers. If adopted by other researchers this technique will assist with standardisation of descriptions of dispersed hearths and monitoring of changes in their condition over time. Shiner’s paper focuses on stone artefact scatters in the same region, dated by association with the hearth sites to the late Holocene. His paper examines patterning in the lithic artefacts and raises the issue of ‘scale’ in interpretation of data which in effect represents a palimpsest of diverse human activities over several thousand of years. This paper should be of interest to all archaeologists working in Australia where surface stone artefacts form the major component of the archaeological record.

Similar problems of recording cultural materials dispersed over a vast geographic area present themselves to archaeologists dealing with the historic time frame. Artefacts of the 19th and 20th centuries can often be dated with some precision using typology and manufacturing dates, but when spatially dispersed this data can appear unpatterned, is difficult to record and is often neglected by archaeologists. Bolton’s paper describes an effective method of recording archaeological data from historic period sites *in situ*.

Prendergast, Bowler and Cupper employ a multidisciplinary approach to study the environmental evolution and human occupation of the Victorian Mallee region. They show the while humans were present in this landscape from at least 15,000 years ago the fluvial regime and climate of the region were substantially different to that of today. They emphasise that the recognition of changes in fluvial and aeolian environments through successive humid-arid cycles is necessary for interpretation of the sedimentary and archaeological record and human adaptation in the Murray Basin.

Six papers focused on archaeobotany and related studies in Australasia and elsewhere. Four detailed research into plant microfossil taphonomy and analysis, which continues to be an important focus for Australasian researchers. Lamb’s paper builds on recent results confirming the utility of Congo Red to identify cooked starch, with details of contamination experiments. Haslam’s paper details an experimental observation of starch movement in soils as a result of water percolation and provides unsettling evidence that even large starch grains may be subject to lateral and vertical post-depositional movement. As with the subsequent paper by Crowther on raphide identification, the paper’s conclusion demands the routine investigation of site formation processes when evaluating microfossil occurrences in archaeological strata and thus closer integration between archaeobotanists

and geoarchaeologists. Crowther's paper is a significant contribution to the Pacific microfossil debate, critically evaluating the reliability and methods of raphide identification, which has become an important indicator of prehistoric aroid cultivation. Raphides are calcium oxalate crystals, and Crowther's work shows that light microscopy may confuse commonly occurring calcite crystals with raphides. Globally, archaeological starch analysis has produced significant new results in recent decades and the papers here, along with recent publications (e.g. R. Torrence and H. Barton 2006 *Starch Analysis*), suggest that Australasian practitioners, who were among the first in the field, are entering a stage of consolidation and necessary critical evaluation of methods and results.

Longford, Drinnan and Sagona's paper provides a good example of integrated macrobotanical research, utilising both seeds and wood charcoals, providing important environmental, economic and behavioural information about Sos Höyük in northeastern Turkey. The paper presents preliminary data from the Late Chalcolithic to Iron Age, periods whose archaeobotany is poorly understood in Eastern Anatolia and under-represented in southwest Asia as a whole, especially when compared to the Neolithic. The paper serves to illustrate how wood charcoals can serve to provide much more information than simply radiocarbon dates and presents results from an important Australian field project in Turkey. Macrofossil analysis is part of an integrated suite of techniques critically evaluated by Denham, Haberle and Pierret as a source of information for understanding a key topic in the region: the emergence of tropical agriculture. Once again, the Kuk site provides the focus for an engaging and well-supported exploration of how integrated archaeological science can provide novel and vital information about past agricultural and land-use practices. Concurring with a theme repeated through this volume, the paper argues strongly for even greater integration of tailored geoarchaeological and archaeobotanical methods if archaeological studies of Australasian plant use, and perhaps those of tropical regions across the Asia-Pacific as a whole, are to overcome taphonomic and classificatory problems to provide the depth of data that has revolutionised understanding of agricultural origins in the Americas and the Old World. As with all of the papers in this section, this final study hints at a methodologically and theoretically healthy future for this area of archaeological science.

The third and final section includes papers covering a variety of archaeometry disciplines beginning with Petchey's review of marine shell dating in Oceania. The paper provides an up-to-date review of the subject, with guidance on date selection and a call for the construction of more shell-terrestrial (charcoal) paired date sequences to help improve Oceanic marine calibration, which is highly variable in time and space. Bourke and Hua's paper provides such a calibration series from the Beagle Gulf in the Northern Territory of Australia, providing a terrestrial-marine sequence that concurs well with near by data.

Rhodes *et al.* present the preliminary results of a novel application of the Optically Stimulated Luminescence (OSL) dating technique for estimating the age of heat-retainer hearths exposed in surface contexts in arid Australia. The comparisons with radiocarbon ages derived from charcoal from the same hearths suggest that the technique holds promise. This technique had the advantage that it does not require excavation of the hearth so provides a good substitute for radiocarbon dating in situations where non-destructive dating measures are called for.

The two following papers by Grave and Craig and Grave provide important new insights into the potential of chemical characterisation techniques to investigate both the production and use of pottery. Graves' paper presents a novel approach to statistically and mathematical analysis of ICP-OES results from a 'closed group' of shipwreck ceramics from South and Southeast Asia, which allows the distinction of firing technologies and provenance, providing a significant new approach for disentangling the complexity of ancient technology. Craig and Graves' paper identifies the underused method of HPLC-MS as a means of helping to identify some food residues, in their case using experimental samples and pots from ancient Gordion, Turkey, home of the famous King Midas. Moving to yet another geographical region, Herries' paper uses examples from South Africa to illustrate the potential of archaeomagnetism to investigate issues as diverse as fire histories and palaeoclimate. The techniques

have clear potential for further understanding aspects of Australasian prehistory and we hope to see more local studies in the future. The final paper by Macgregor brings us closer to home with a discussion of conservation of megafaunal bone remains from the famous Cuddie Springs site in New South Wales, Australia. The paper details the planning, field and laboratory methods applied to the megafaunal bone from this important site, ensuring that are available for detailed future study and curation. Conservation is a key discipline in global archaeology and is alive in Australasia still, though now without the University of Canberra's internationally renowned conservation program, which we note with dismay was closed several years ago.

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