



2021 Conference Program

From Micro to Macro: Exploring the Big Picture in Archaeology

Day 1: Friday 19th March

8:00 AM **Welcome and notices**

Rebekah Kurpiel, La Trobe University

8:15 AM **Keynote:** Uncle David Wandin, Wurundjeri Woi-wurrung

Welcome to Country and Indigenous Land Management in Australia

10:00 AM **Break**

Session 1: Stone and Dating (Session chair: Wenjing Yu)

10:30 AM **Visible reflectance spectroscopy paired with k-NN lazy learning for detection of heat treated silcrete**

Andrew Zipkin and John Murray

10:45 AM **Scales of Investigation and Scales of Production: Researching grindstone production in Channel Country, south west Queensland**

Doug Williams*, Josh Gorringe, Michael C. Westaway

11:00 AM **Direct radiocarbon age determinations of Bidayuh rock art at Gua Sireh, Sarawak (Malaysian Borneo) provide insights into territorial violence between 1672 and 1832 AD.**

Jillian Huntley, Andrea Jalandoni, Paul S.C. Taçon, Fiona Petchey, Emilie Dotte-Sarout, Mohammad Sherman Sauffi William

11:15 AM **Radiocarbon dating and deconstructing myths**

David Thomas, Caroline Spry, Rebekah Kurpiel, Jacqueline Tumney

11:30 AM **Unscrambling Emu Eggshell Racemization**

Maddison Crombie*, Colin Smith

11:45 AM **A new method for dating Aboriginal culturally modified trees in Australia**

Caroline Spry, Greg Ingram, Kathryn Allen, Quan Hua, Brian Armstrong, Elspeth Hayes, Richard Fullagar, Andrew Long, John Webb, Paul Penzo-Kajewski, Luc Bordes, Lisa Paton and Orange Local Aboriginal Land Council

12:00 PM **Break**

* Denotes a student presentation

Session 2: Big Landscapes and Big Data (Session chair: Catalina Labra-Odde)

- 1:00 PM **Leaf Waxes & Lipid Biomarkers: reconstructing the palaeoenvironments experienced by early *Homo sapiens* at archaeological sites across Southeast Asia and Australia**
M.S. McAllister*, M.W. Morley, J.J. Tyler, F.A. McInerney, A.J. Blyth
- 1:15 PM **Building an Australian FTIR reference collection of bone and charcoal and its application to Boodie Cave, northwest Australia**
Nikola Ristovski*, Ingrid Ward, Tiina Manne, Emilie Dotte-Sarout
- 1:30 PM **Hundred words for the fire: An Etymological and micromorphological consideration of combustion features in Indigenous archaeological sites of Western Australia**
Ingrid Ward, David Friesem
- 1:45 PM **Reconstructing the function of archaeological pits in Bronze and Iron Age Anatolia (Turkey) using phytoliths**
Molly Turnbull*, Alison Crowther, Andrew Fairbairn, Sachihiko Omura
- 2:00 PM **It takes a village?**
Nathan Wright, Kelsey Lowe, Michael C. Westaway
- 2:15 PM **Open (Archaeological) Science: considerations for collecting, storing and accessing archaeological science data in a heritage management context**
Rebekah Kurpiel

2:30 PM **Break**

Session 3: Bioarchaeology (Session chair: Georgia Roberts)

- 3:30 PM **New dates and stratigraphy for the Amanzi Springs Area 1 Acheulian deposits, South Africa**
Andy I.R. Herries, Lee J. Arnold, Giovanni Boschian, Alex Blackwood, Coen Wilson, Matthew Meredith-Williams, Martina Demuro, Tom Mallett, Brian Armstrong, Paul Penzo-Kajewski, Matthew V. Caruana
- 3:45 PM **Potential of the petrous part of the human temporal (ear) bone for isotope analysis**
Rachel Wood, Hannah James, Katherine Dunn, Stewart Fallon
- 4:00 PM **A Tale of Three Monkeys: Elemental Insights into Nursing and Health**
Tanya M. Smith, Christine Austin, Manish Arora
- 4:15 PM **From macro to micro to macro: multi-technique approaches to the study of human diet**
Sofia Samper Carro
- 4:30 PM **Investigating Late Quaternary palaeoenvironment in the Central Murray River Valley using amino acid stable isotopic data from freshwater mussel shells (*Alathyria jacksoni*)**
Colin Smith, Jillian Garvey, Alice Mora
- 4:45 PM **Archaeobotanical insights into the life of an ancient Nigeria Village: Excavations Results from Lejja**
Chioma Vivian Ngonadi*

Day 2: Saturday 20th March

Session 4: Bioarchaeology (Session chair: Emmy Frost)

- 9:00 AM **Submerged shellfish middens and marine transgression: post-depositional contexts and preservation potentials**
Jessica W. Cook Hale, Katherine Woo, Nathan Hale, Matthew Newton, Chelsea Wiseman, John McCarthy, Jonathan Benjamin, Ervan Garrison
- 9:15 AM **The Early Medieval Transition: Diet Reconstruction, Mobility, and Culture Contact in the Ravenna Countryside, Northern Italy**
A. Temkina*, R. H. Tykot, A. Vianello
- 9:30 AM **Perspectives from the genomes of the Indigenous Australians in Cape York**
Sally Wasef
- 9:45 AM **Inside human evolution fossil remains - Deciphering signals of the past**
Renaud Joannes-Boyau
- 10:00 AM **Diving into the bone scrapheap: ancient DNA metabarcoding of Holocene zooarchaeological remains in the Papua New Guinea Highlands**
Sindy Luu*, Elizabeth Matisoo-Smith, Glenn R. Summerhayes, Hugh Cross, Gert-Jan Jeunen
- 10:15 AM **Redefining the palaeobiology of *Paranthropus robustus* based on the DNH 155 cranium from Drimolen, South Africa**
J.M. Martin*, A. B. Leece, D.S. Strait, A.I.R Herries

10:30 AM Break

Session 5: Metals and Minerals (Session chair: Adam Valka)

- 11:30 AM **An Insight into a lost heritage: Ancient Copper Smelting Technology**
Diya Mukherjee*
- 11:45 AM **A Comparative Study of Lost-Wax Technique of South Indian Bronze Casting and Manipur Brass Casting**
S. Udayakumar*
- 12:00 PM **Quantifying the Intra-Site Elemental Variability of Ochre: A Case Study from Overland Corner, South Australia**
Rachel Popelka-Filcoff, Amy Roberts, The River Murray and Mallee Aboriginal Corporation (RMMAC), Claire Lenehan, Claire Smith, Shane Tobe
- 12:15 PM **The structure and morphology of copper-rich phases in archaeological silver coins**
Liesel Gentelli, Alexandra Suvorova

12:30 PM Break

1:00 PM **Networking Event Hosted by the La Trobe University Archaeological Society**

2:00 PM **Keynote 2:** Anne Jensen, Inupiat History, Language and Culture Commission

3:00 PM Break

Session 6: Geophysics, sediments and landscapes (Session chair: Greg Hil)

- 4:00 PM **Traces in the Sands of Time: A Geophysical Model of Stratigraphy at Soyo in Mongolia**
Michael Everett, Ian Moffat, Julia Clark, Jamsranjav Bayarsaikhan, Rob Koch
- 4:15 PM **Early Human Occupation of Tam Pa Ling, Laos: Preliminary Microstratigraphic Results**
Vito Hernandez*, Mike Morley, Philippe Duringer, Jean-Luc Ponche, Kira Westaway, Anne-Marie Bacon, Laura Shackelford, Viengkeo Souksavady, Fabrice Demeter
- 4:30 PM **Sediment Fingerprinting: Identifying sedimentological characteristics and formation processes at Late Pleistocene archaeological sites in Southeast Asia and Australia**
Natasha Nagle*
- 4:45 PM **Landscape Archaeological Research on Southern Latium (Central Italy) in the Roman Republican and Imperial Era**
Michael Teichmann

5:00 PM **The Society for Archaeological Sciences prize announcements: Best Student Paper and Runner Up Best Student paper**

5:05 PM **Brief conference close and ARCAS committee meeting announcement**

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Abstracts – in order of presentation

Visible reflectance spectroscopy paired with k-NN lazy learning for detection of heat treated silcrete

Andrew M. Zipkin and John Murray

School of Human Evolution and Social Change, Arizona State University, Tempe, Arizona, USA

Recent advances in the study of lithic heat treatment have focused on developing quantitative, non-destructive, and replicable methods to identify this phenomenon in the archaeological record. Improving our ability to distinguish heated stone from unheated permits archaeologists to more accurately determine what lithic technologies relied on this process. Color change has been a major way to qualitatively recognize heat treated artifacts. Here, we present a new approach to identifying heat treated silcrete that pairs portable, non-destructive, and quantitative visible reflectance spectroscopy with lazy machine learning classification.

Silcrete collected from three outcrops in South Africa was cut into blocks, half of which were heat treated in a kiln. Heated and unheated blocks were knapped into flakes. We collected 776 visible diffuse reflectance observations for 49 unheated and 45 heated flakes. We Savitzky–Golay filtered the data, eliminated 30 outliers, and ran multiple iterations of k-Nearest Neighbors classification. k-NN applied to the full 1018 variable data set was the most successful. Neither predictor screening nor dimension reduction via PCA improved results. Our most effective outcome yielded a 4.7% test set misclassification rate at the observation level, and 0% misclassification and 9.1% unassignable rates at the flake level based on observation majority prediction.

Scales of Investigation and Scales of Production: Researching grindstone production in Channel Country, south west Queensland

Doug Williams¹, Josh Gorringe² and Michael C Westaway³

¹ Griffith University, Yugambah Country

² Mithaka Aboriginal Corporation

³ University of Queensland, Jagera and Turrbal Country

Channel country incorporates the Georgina and Diamantina Rivers and Cooper Creek Catchments and form one of the last great unregulated river systems in the world. The overflow from these rivers created vast grasslands which provided both pulses of abundance for short periods and permanent water in places over the longer term. Aerial archaeological survey has not been a common practice in Australia given a perceived absence of visible built environment remains. In Channel Country, application of aerial survey techniques in channel country has allowed us to develop an appreciation for the massive scale of production of grindstones to exploit the seed resources of the region, and recording in micro scale has provided the opportunity to examine sandstone quarry features in detail. The results of this study will make a significant contribution to emergent research on Australian Aboriginal food production systems and associated technologies.

Direct radiocarbon age determinations of Bidayuh rock art at Gua Sireh, Sarawak (Malaysian Borneo) provide insights into territorial violence between 1672 and 1832 AD.

Jillian Huntley¹, Andrea Jalandoni¹, Paul S.C. Taçon¹, Fiona Petchey², Emilie Dotte-Sarout³ and Mohammad Sherman Sauffi William⁴

¹ Place, Evolution and Rock Art Heritage Unit, Griffith Centre for Social & Cultural Research, Gold Coast campus, Griffith University, Queensland, 4222, Australia

² Radiocarbon Dating Laboratory, University of Waikato, Hamilton, 3240, New Zealand

³ Discipline of Archaeology, School of Social Sciences, University of Western Australia, Australia, Perth, Western Australia, 6009, Australia

⁴ Sarawak Museum Department, Jalan P Ramlee 93400, Kuching, Sarawak, Malaysia

The well-known, highly decorated, limestone cave site of Gua Sireh, in the traditional lands of the Bidayuh indigenous people of western Sarawak (Malaysian Borneo), was occupied from around 20,000 years ago until as recently as 1900 AD. The site preserves hundreds of black drawings, which are mostly figurative (85%) and include a number of unique anthropomorphic forms with material culture details such as weapons, cloaks and headdresses. The rock art is arranged in multiple scenes depicting activities like hunting/butchery, fishing, and ceremonial processions. We directly dated the materials used to produce three anthropomorphs, including a graffiti 'stick figure' drawn between 1990 and 2010 as a control. The scenes at Gua Sireh provide rare insight into the cultural traditions of the indigenous Sarawakians who still care for their sites today. Radiocarbon age determinations show that the drawings were made between 1672 and 1832 AD, coincident with Bidayuh peoples' use of the cave during violent territorial conflict with Malay chiefs.

Radiocarbon dating and deconstructing myths

David Thomas¹, Caroline Spry², Rebekah Kurpiel² and Jacqueline Tumney²

¹ Aboriginal Victoria, Wurundjeri Woi Wurrung Country

² Department of Archaeology and History, La Trobe University, Wurundjeri Woi-wurrung Country

In an era when factoids go viral through the internet, high quality, scientific data have never been more needed. A veneer of scientific authenticity, however, can be as damaging as 'fake news', if the underlying data are unreliable.

In this paper, we will discuss the efforts of the Radiocarbon Dating Visualisation Project to collate and verify over 1,100 radiocarbon determinations from Aboriginal places (archaeological sites) in the State of Victoria, Australia. The research builds on previous attempts to collate similar lists of dates, but furthers the process, by assessing the reliability of the dates with respect to their archaeological context and laboratory analysis, in collaboration with a radiocarbon dating specialist (Dr Lorena Becerra Valdivia). Revisiting primary sources and interrogating previous research is particularly important when working with data produced by multiple practitioners over a period of nearly 70 years.

The value of systematically assessing the reliability of radiocarbon determinations is particularly evident with respect to the older, Pleistocene determinations. This research highlights a significant temporal gap between the 'oldest' determinations in the complete dataset (52,000-40,000 cal. BP) and those that we have categorised as reliable (~30,000-29,000 cal. BP). This realisation has broader implications for the way such datasets contribute to the debates about when Australia was first settled by Aboriginal people, and how occupation patterns have changed over time.

Unscrambling Emu Eggshell Racemization

Maddison Crombie¹ and Colin Smith^{1,2}

¹ Department of Archaeology and History, La Trobe University, Wurundjeri Woi Wurrung Country

² Laboratorio de Evolución Humana, Departamento de Historia, Geografía y Comunicación, Universidad de Burgos, 09001 Burgos, Spain.

Amino Acid Racemization (AAR) is a chemical process that can be measured in fossil and subfossil proteins to date materials and determine the thermal history of samples (i.e. help in environmental reconstruction). Despite being a relatively affordable and accurate method of analysis, it has not been applied widely in Australian archaeology, where open-air sites and more generally the Australian environment pose a number of problems for accurate analysis. Despite being ubiquitous in the Australian archaeological record, emu eggshell has not been a focus for the use of AAR in Australia, indeed, early studies which used emu eggshell as the substrate for temperature reconstruction employed methods of sample preparation which may have resulted in inaccurate estimates. This presentation will discuss the importance of isolating the intra-crystalline fraction in eggshell samples for AAR analysis, and whether this will change the accuracy of published temperature estimates. Further, this presentation will discuss the use of alternative modelling of racemization data for more accurate temperature and age estimates and how this compares to modelling done for ostrich eggshell.

A new method for dating Aboriginal culturally modified trees in Australia

Caroline Spry¹, Greg Ingram², Kathryn Allen^{3,4}, Quan Hua⁵, Brian Armstrong^{1,6}, Elspeth Hayes⁷, Richard Fullagar⁷, Andrew Long⁸, John Webb¹, Paul Penzo-Kajewski¹, Luc Bordes⁷, Lisa Paton and Orange Local Aboriginal Land Council

¹ La Trobe University, Wurundjeri Woi-wurrung Country

² Central Tablelands Local Land Services, Wiradjuri Country

³ ARC Centre of Excellence for Biodiversity and Heritage

⁴ University of Melbourne, Wurundjeri Woi-wurrung Country

⁵ ANSTO

⁶ University of Johannesburg

⁷ University of Wollongong, Dharawal Country

⁸ Andrew Long + Associates, Wurundjeri Woi-wurrung Country

Aboriginal culturally modified trees (including scarred trees) are a distinctive feature of the Australian archaeological record. They contain scars from the removal of bark or wood for practical and symbolic purposes, or limbs manipulated for cultural reasons. These modifications generate insights into Aboriginal people's interactions with wood and bark, which rarely survive in archaeological contexts, and treed landscapes more broadly. However, there is limited understanding of the age of these trees, and change and continuity in tree-modification practices over time. This paper presents a new method for investigating the age of Aboriginal culturally modified trees. It details a case study from the Lachlan Tablelands in southeastern Australia, on Wiradjuri Country, where this method was applied to a tree with a stone tool embedded in scar overgrowth, as part of a collaborative research project with the Orange Local Aboriginal Land Council. This method offers Traditional Owners and archaeologists the opportunity to investigate the timing of cultural tree modification, and how these modification practices have changed over time.

Leaf Waxes & Lipid Biomarkers: reconstructing the palaeoenvironments experienced by early *Homo sapiens* at archaeological sites across Southeast Asia and Australia.

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² Department of Earth Science, The University of Adelaide, SA 5005, South Australia, Kurna Country

³ School of Earth and Planetary Sciences, Curtin University, WA 6102, Western Australia, Wadjuk Noongar Country

Current understandings of local environmental conditions that early *H. sapiens* encountered when they first arrived into Southeast Asia (Sunda) and Australia (Sahul) between Marine Isotope Stages (MIS) 5-2 (124-11.7 ka), is incredibly sparse. In this talk I will discuss my doctoral research; the potential of developing a high-resolution, quantitative palaeoenvironmental proxy in and around the local environments of archaeological cave sites through the extraction and analyses of leaf wax lipid biomarkers (n-alkanes). Research findings will contribute to better understand the current debate surrounding the possible existence and extent of a savannah corridor through mainland and island SEA. Improving our understanding of how early *H. sapiens* adapted to a landscape subject to significant sea level immersions and regressions can assist in addressing present uncertainties surrounding adapting to a future of sea level rise. Expected results will form rare and valuable quantitative palaeovegetation reconstructions generated from the study of archaeological sediments from a range of sites in Southeast Asia and Australia. This will allow for cross-site comparison to establish differing spatial vegetation and environment conditions, creating the potential to further elucidate the influence of environmental conditions on early *H. sapiens* migration and settlement patterns.

Building an Australian FTIR reference collection of bone and charcoal and its application to Boodie Cave, northwest Australia

Nikola Ristovski¹, Ingrid Ward¹, Tiina Manne² and Emilie Dotte-Sarout¹

¹ University of Western Australia, Wadjuk Noongar Country

² University of Queensland, Jagera and Turrbal Country

Fourier-transform infrared spectroscopy (FTIR) is a useful microanalytical tool to track structural changes in heated bone and wood. However, it is underutilised in Australian archaeology where there exists a specific need to characterise animal and wood species. Here we question what FTIR and micro-FTIR analyses of burnt organics can tell us about combustion activities and preservation conditions within Boodie Cave, a 50,000-year-old rockshelter in northwest Australia. We begin by building a reference collection of incrementally heated bone and wood from northwest Australian species to be characterised using FTIR and spectral indices. Applying these to macro- and micro-bone fragments and charcoal from Boodie Cave indicate low temperature burning throughout the cave's occupation consistent with fleshed cooking or post-depositional heating of bone. Quantitative FTIR interpretation was complicated by the effects of secondary mineralisation but in the charcoals at least, these could be reduced using acid pre-treatment. Collectively, the charcoals indicate burning temperatures between 300–500°C. Preliminary work suggests FTIR has great potential to provide rapid, quantitative analyses of heated organics at the macro- and micro-scale and can provide some indication toward past fire practice.

Hundred words for the fire: An Etymological and micromorphological consideration of combustion features in Indigenous archaeological sites of Western Australia

Ingrid Ward¹ and David Friesem²

¹ Archaeology, School of Social Sciences, University of Western Australia, Wadjuk Noongar Country

² The Leon Recanati Institute for Maritime Studies, Department of Maritime Civilizations and the Haifa Center for Mediterranean History, University of Haifa, Israel

Fire is a word that holds an enormous variety of human activity with a wide diversity of cultural meanings and archaeological presentation. The word hearth not only has links with fire but also as a social focus both in its Latin origins and also in Australian Indigenous language. There is also a complex language around words associated with fire from the different hearth types and fuel types to the different purposes of fire for cooking, medicinal, ceremonial or controlling the environment. The archaeological expression of hearths is equally complex and nuanced but can be explored through micromorphology. This study explores both language and micromorphic expression around combustion features, and in particular in situ hearths, using some examples from archaeological sites in Western Australia. Our purpose is to demonstrate the complexity around combustion features as observed in archaeological excavation, and discourage the over-ready use of the term hearth to describe these.

Reconstructing the function of archaeological pits in Bronze and Iron Age Anatolia (Turkey) using phytoliths

Molly Turnbull¹, Alison Crowther^{1,2}, Andrew Fairbairn¹ and Sachihiko Omura³

¹ School of Social Science, The University of Queensland, St Lucia, Queensland, Australia, Jagera and Turrbal Country

² Department of Archaeology, Max Planck Institute for the Science of Human History, Jena, Germany

³ Japanese Institute of Anatolian Archaeology

Pits are almost ubiquitous in the urban archaeological record of Central Anatolia, occasionally forming large concentrations at sites in the hundreds or thousands. For archaeologists, the difficulty lies in interpreting the function and construction technology of pits, not just merely assigning rudimentary typologies. Microscopic plant silica or phytoliths can overcome preservation issues when other organic remains are lacking or do not have a secure provenance. Our study analysed the phytoliths from pits from the Early Bronze and Late Iron Age occupation levels of the archaeological site, Kaman-Kalehöyük, in Central Anatolia. The phytoliths recovered likely represent the in situ decay of formerly stored crops and a botanical pit lining feature, constructed to improve storage performance and manage known risks to food harvesting. Identical lined storage pits appear across Bronze and Iron Age archaeological sites in Anatolia, coincident with significant socio-political reorganisation and environmental change, and are even referred to in ancient Sumerograms and Classical records. The storage evidence from Kaman-Kalehöyük reveals the need for integrated, careful investigations of all organic remains recovered from archaeological storage contexts, as phytolith remains can allow us to adequately assess the ancient decision-making processes behind food storage developments.

It takes a village?

Nathan Wright¹, Kelsey Lowe² and Michael C Westaway²

¹ University of New England, Anēwan Country

² University of Queensland, Jagera and Turrbal Country

The concept of Aboriginal 'villages' prior to European contact has recently been the subject of some public discussion following the popular success of Bruce Pascoe's book 'Dark Emu' (Pascoe 2014). The concept seems to have enjoyed some resurgence amongst archaeologists (e.g. Pardoe and Hutton 2020) but we do require more careful investigation in order to understand if 'villages' are a component of Aboriginal socio-economic systems within Australia.

We have commenced research in Mithaka country where there is a rich ethnohistoric record that identifies clusters of Aboriginal gunyahs in large numbers, for example Thunderpurty lagoon had some 103 huts while Goosewing Lagoon had some 60 huts. Ethnohistoric description of these structures indicate that they were pit dwellings, and built with branches from gidgee and clad with branches and clay.

We have developed a methodology in order to see if we can identify the signatures for gunyahs in the landscape, and in this paper provide an outline of research to date (Westaway et al accepted) incorporating approaches in geoarchaeology and archaeobotany.

Open (Archaeological) Science: considerations for collecting, storing and accessing archaeological science data in a heritage management context

Rebekah Kurpiel

Department of Archaeology and History, La Trobe University, Wurundjeri Woi-wurrung Country

The 'open science' movement is delivering a multitude of benefits with respect to sharing and developing knowledge in many disciplines, including archaeology. These days, most archaeological investigations are undertaken in the context of heritage management, and specialist analyses are being incorporated into these investigations at an increasing rate. Heritage management projects typically produce reports that are never published or disseminated beyond those directly involved in the project. This means that other researchers and interested parties remain unaware of the research and opportunities to build on these studies are lost. As the role of archaeological science in heritage management increases, it is important for us to consider the factors that determine what constitutes best practice in terms of collecting, storing and accessing the archaeological science data that is produced in this context. This cannot involve simply encouraging practitioners to be more open – there is a need to be respectful of cultural sensitivities and abide by the commercial-in-confidence nature that is a common characteristic of heritage management projects. There is also a need for consistency in data reporting. This paper will discuss these considerations along with possible pathways for progressing the open (archaeological) science agenda with respect to heritage management projects.

The Early Medieval Transition: Diet Reconstruction, Mobility, and Culture Contact in the Ravenna Countryside, Northern Italy

A. Temkina, R. H. Tykot and A. Vianello

University of South Florida

This research project evaluates the effects of increased mobility and culture contact on dietary practices, and on dietary variation among people buried at two northern Italian sites, Chiunsano di Ficarolo and Chiesazza di Ficarolo, located near the ancient Roman capital of Ravenna and dating 4th-7th century CE. The Early Medieval period was a time of change, political instability, migration and invasion of the “barbarian” tribes, and diet was not unaffected. In particular, it is hypothesized that a new staple crop, millet, was introduced and that pork consumption had increased. Bone samples from over 100 individuals excavated around Ravenna were obtained and represent individuals of different age and gender. In this study, human bone samples from these sites were used for stable isotope analyses of bone apatite and collagen with the goal of reconstructing the diet of the individuals who lived in the transitional period between Late Roman and Early Medieval times. Through dietary analysis, this research asks how local and migrant populations interacted with each other, examines potential power struggles, and explores if there was hybridization or segregation of cultural practices.

Potential of the petrous part of the human temporal (ear) bone for isotope analysis

Rachel Wood^{1,2}, Hannah James¹, Katherine Dunn¹ and Stewart Fallon²

¹ School of Archaeology and Anthropology, Australian National University, Ngunnawal Country

² Research School of Earth Sciences, Australian National University, Ngunnawal Country

The petrous bone contains boney tissues that remodel at different rates. The exceptionally dense otic capsule is thought to form during the first two years of life, and not remodel during later life. This is surrounded by cortical and spongy bone that are expected to have faster remodeling rates. Therefore, this single bone could be used for assessment of date of birth in forensic studies, and in archaeological skeletal remains to reveal isotopic life history. The latter is particularly significant where tooth enamel does not survive, for example in cremations, when the otic capsule can be used to reveal childhood location. Before using this bone, it is important to confirm that the otic capsule does not remodel after early childhood.

Petrous bones from recently deceased cadavers born in the 1940s have been radiocarbon dated. Samples were taken from the dense bone of the otic capsule, the cortical bone surrounding the internal acoustic meatus, and spongy bone surrounding the otic capsule. The results demonstrate that turnover in the otic capsule after the age of 10 is limited. As expected, the spongy bone turns over during later life. Strontium isotope analyses in cremated archaeological bone are presented as a case study.

A Tale of Three Monkeys: Elemental Insights into Nursing and Health

Tanya M. Smith¹, Christine Austin² and Manish Arora²

¹ Australian Research Centre for Human Evolution & Griffith Centre for Social and Cultural Research, Griffith University, Yugambah Country

² Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai

Structural defects in teeth are frequently examined for insights into prehistoric disease, malnutrition, and weaning, despite their multifactorial nature. Here we detail how developmentally-informed trace element mapping of tooth thin sections reveals accurate ages of physiological disruptions and weaning in captive macaques. One sick infant required multiple hospitalizations, showing elevated bands of calcium-normalized barium and strontium that corresponded with marked weight losses, leading us to conclude that trace elements were inadvertently released from skeletal stores due to calcium regulation during acute illness. Another sick infant showed marked decreases in barium, strontium, and lead at the exact age that it underwent a blood transfusion. Several months later strontium and lead levels spiked during a whipworm infection that was ultimately severe enough to mandate euthanasia. When these two infants were hospitalized, artificially ending nursing, barium levels dropped to prenatal levels. A similar decrease in barium was also seen in a third bottle-reared macaque at the exact age when formula supplementation ended—demonstrating the sensitivity of this method for weaning age determination. The majority of these events corresponded with internal accentuated lines in teeth, but not external hypoplasias, suggesting that dental defects should be paired with elemental analyses to discern their underlying etiology.

From macro to micro to macro: multi-technique approaches to the study of human diet

Sofia Samper Carro^{1,2}

¹ Archaeology and Natural History, College of Asia and the Pacific, Australia National University, Ngunnawal Country

² ARC Centre of Excellence for Australian Biodiversity and Heritage (CABAH)

The study of human diet in prehistoric times has been a key focus of research for decades. From the analysis of food refuse in the form of animal bones, to the study of bone microstructure and bone surface modifications, there is a plethora of techniques that permit us to address this topic from different fields of observation. This presentation will introduce three case studies where the macroscopic analysis of zooarchaeological assemblages is combined with: experimental studies on human bone surface modifications on rabbit bones; dental microwear analysis to discern the role played by non-animal products in human diet in Wallacea; and paleoproteomics to improve the resolution of Neanderthal faunal assemblages in European sites. These case studies illustrate how micro approaches can provide clues to interpret human diet in a macro scale.

Investigating Late Quaternary palaeoenvironment in the Central Murray River Valley using amino acid stable isotopic data from freshwater mussels shells (*Alathyria jacksoni*)

Colin Smith^{1,2}, Jillian Garvey¹ and Alice Mora¹

¹ Department of Archaeology and History, La Trobe University.

² Laboratorio de Evolución Humana, Departamento de Historia, Geografía y Comunicación, Universidad de Burgos, 09001 Burgos, Spain.

Stable isotope methods applied to shellfish are well established as ecological and archaeological (palaeo)environmental proxies, however, they rely on well-preserved mineral to allow the biogenic signal to be analysed. We present here a method that does not require perfect mineral preservation, demonstrating the feasibility of analysing compound specific carbon stable isotope ratios from amino acids preserved in modern and archaeological shellfish using liquid chromatography isotope ratio mass spectrometry (LC IRMS). This technique has been applied to the freshwater river mussel *Alathyria jacksoni*, that lives along the Murray River and has been a common prey species for humans for millenia. This is evidenced by large late Pleistocene and Holocene Aboriginal shell middens on Ngintait and First People of the Millewa Mallee Country at Neds Corner Station and the adjacent Yanga Nowie (Murray Sunset National Park) near Mildura in northwest Victoria. The results of our analysis indicate clear differences in the carbon isotope values of modern and archaeological shells and we will discuss these differences and their implications for palaeoenvironmental reconstruction for the region.

Archaeobotanical insights into the life of an ancient Nigeria Village: Excavations Results from Lejja

Chioma Vivian Ngonadi

Department of Archaeology University of Cambridge

This paper presents the results of archaeological and archaeobotanical research in the Lejja, southeastern Nigeria. The primary focus is to understand the human landscape relationship, with particular attention paid to the plant foods exploited. Despite the evidence suggesting human activity from at least the Early Stone Age in this region, archaeobotanical studies on ancient plant food producing societies are rare. Previous scholarships are mostly derived from hypothetical assumptions, oral traditions, ethnographic data and indirect archaeological evidence. Macrobotanical results derived from the flotation of all excavated contexts of three test units and its analysis yielded few but sufficient plant remains which were based on oil palm, legumes and tubers. The deeply stratified deposits from excavations demonstrate different phases of settlement which shows that these communities locally sourced for their food and were not part of any food exchange network.

Submerged shellfish middens and marine transgression: post-depositional contexts and preservation potentials

Jessica W. Cook Hale^{1,2}, Katherine Woo³, Nathan Hale², Matthew Newton^{2,4}, Chelsea Wiseman⁵, John McCarthy⁵, Jonathan Benjamin⁵ and Ervan Garrison^{1, 6}

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Coastal zones have played a critical role in human evolution but much of that history now lies submerged on continental shelves that were drowned after the last glacial maximum. The presence of shell midden deposits, created where people exploited coastal resources, provides a key indicator for human occupation of coastlines. These appear in the archeological record by the mid - late Holocene, though some older offshore examples have been documented. Questions remain about the nature and quality of preservation of older coastal deposits given that most sites were along coastlines subject to marine transgression and ravinement. Here we discuss the Econfina Channel site (8TA139), as a representative case study, located offshore of northeastern Florida in the Gulf of Mexico. Longitudinal research, focused on sediment sampling, has yielded results that allow comment on preservation potentials in a marine basin subjected to intermittent tropical storm and hurricane activity. Our results have far reaching implications for the study of coastal archaeology and deep time and suggest that while exposure to marine transgression and ravinement would have destroyed many sites, some submerged midden deposits do exist and can be identified by archaeologists working in marine environments.

Perspectives from the genomes of the Indigenous Australians in Cape York

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While across the globe the integration of genomics with archaeological investigations is quietly producing important new insights into the past, Australia has lagged behind in initiating such collaborative research. The reasons are closely aligned with the disturbance of Aboriginal ancestral remain in the past, and the initial cavalier approach to DNA research by international scholars. The intellectual landscape is changing, and through collaborative research with Aboriginal communities there is much potential to investigate old questions in archaeology through a new lens. In this paper we review the question relating to diffusion of culture and genes from the Torres Strait and Papua New Guinea into Cape York following on from the completion of our Cape York ARC linkage project.

New dates and stratigraphy for the Amanzi Springs Area 1 Acheulian deposits, South Africa.

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Amanzi Springs is an Acheulian site in South Africa that was first excavated in the 1960s and is one of only a handful of sites in Africa to preserve wood in association with Acheulian technology. Our recent excavations at Amanzi Springs have allowed us to confirm this association, to provide the first reliable radiometric ages for the site, and to establish a much longer archaeological sequence, including a transition to the Middle Stone Age. This paper will outline this recent work as well how we have tied this work to the legacy data and old excavations through 3D scanning, photogrammetry and augmented reality.

Inside human evolution fossil remains - Deciphering signals of the past

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In this talk we will discuss the crucial role of fossil teeth to advance our understanding of human evolution in particular the ecology of our ancestors. We will present briefly how we maximise information and minimise the destructiveness. First by introducing direct dating techniques and their importance in defining the sequence of events. We will then follow our discussion with the recent advance made in investigating early-life record of our ancestors. The mineralization of dental tissues is extremely valuable for reconstructing the early life records. Each day the ameloblast and odontoblast cells, responsible for the formation of enamel and dentine respectively, deposit a new layer of tissue, thus creating a sequential record. The elemental intake and mineralization pattern of the dental tissues are strongly influenced by the individual interaction with their immediate surroundings. Dental tissues therefore present a unique temporal record of the paleoecology of the individual early-childhood development.

Diving into the bone scrapheap: ancient DNA metabarcoding of Holocene zooarchaeological remains in the Papua New Guinea Highlands.

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Prehistoric human and animal interactions in Near Oceania (Australia, New Guinea, Bismarck Archipelago, and Solomon Islands) are understated and complex. The corpus of zooarchaeological literature of this region can be divided into four interconnected themes: resource utilisation, resource depletion, translocation, and trade. In these studies, zooarchaeological research often relies on standard osteological approaches to understand past human and animal interactions. My research aims to complement these techniques by using ancient DNA methods on faunal remains recovered from Kiowa, a hunter-gatherer campsite in the highlands of Papua New Guinea. I performed a DNA metabarcoding pilot study on a subsample of morphologically undiagnostic postcranial animal bones – otherwise known as the ‘scrapheap’ of the quintessential midden – to profile utilised rainforest taxa in context of significant cultural shifts across the region. Overall, my findings support the continuity of specialised hunting, despite the development of a Neolithic culture in the highlands by c.5000 cal. BP, and the later arrival of Lapita along the coast from 3300 cal. BP. My analysis also identified the remains of the exotic pig (*Sus scrofa*). The presence of this species at Kiowa will add to long-standing discussions surrounding the timing of its dispersal in Near Oceania.

Redefining the palaeobiology of *Paranthropus robustus* based on the DNH 155 cranium from Drimolen, South Africa

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Paranthropus robustus is an extinct, megadontic hominin known from ~2.0 - ~1.6 Ma contexts in southern Africa. Crania have been recovered from the sites of Swartkrans and Drimolen, and less well-preserved specimens have been recovered from Kromdraai. Morphological differences between the DNH 7 cranium from Drimolen and *Paranthropus robustus* specimens from Kromdraai and Swartkrans have previously been attributed to sexual dimorphism, as DNH 7 is a putative female. However, the discovery of the male DNH 155 *Paranthropus robustus* cranium from Drimolen makes this view untenable. Because Drimolen predates Swartkrans and Kromdraai, a more parsimonious explanation for the variation evinced within the *Paranthropus robustus* sample is that there has been a phyletic increase in size in this lineage over time. This microevolutionary change between *Paranthropus robustus* palaeo-populations provides an insight into the tempo and mode of evolutionary processes within a hominin lineage. The recognition of diagnosably distinct sub-populations within hominin species lineages also challenges conventional criteria for recognising distinct species in the fossil record. Thus, we propose additional criteria beyond ‘diagnosable distinctiveness’ as requisite to recognise a new species; specifically, falsification of the null hypothesis that a new fossil samples part of an already recognised species lineage.

An Insight into a lost heritage: Ancient Copper Smelting Technology

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Pyrotechnology has always been an integral part of Harappan culture and the metallurgical activities of that particular culture have been identified to be a consequential factor for branding it as first urbanization. The remains of metallurgical activities are found in form of ores, slag, crucible fragments with metal prills, chisel and so on. Based on these shreds of evidence attempts have been made to understand the ancient technology. Experimentation can make it possible to recover the means of appropriation of thermic transition phenomena in antiquity. A comparison of the attitudes of the current, scientific and protohistoric craftsman in the field of metallurgy shows all the misunderstanding that can emerge from these two approached which are such different ways to practice the same technique. These terminologies often restrict our perspective of understanding the past technologies but in this paper, the focus is rather on attempting to understand the process of past technology through trial and error method. The methodology adopted for this paper is to review literature (review of previous experiments by eminent scholars) and also an ethnographic survey. The process and the results of the experiments will be discussed in detail during the presentation.

A Comparative Study of Lost-Wax Technique of South Indian Bronze Casting and Manipur Brass Casting

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Indian artisans one of the best masters at extracting and shaping metals and alloys, as proven by archaeological finds from the 2nd- 3rd millennia B.C., for example, two well-known artifacts casting of the dancing girl of Mohenjo-Daro and the mother goddess of Adichanallur, Tamil Nadu. Indian artisans not only expert in the bronze image but also, they were expert in making of other objects such as utensils, bells and lamps in lost-wax technique. As regard to lost-wax technique research, many of the research have focused only on South Indian, but lost wax technique has spread all over the country from generations to generations This research has brought out the lost-wax techniques in Manipur which no one has looked out in ages. This is time to understand and compare the same technique which is used in different regions. In this paper, we have taken the comparative study of two different regions of their lost wax technique and speak about the different materials using same technique (Lost wax technique). Here the interesting aspects of these two regions are, in South India the lost-wax technique is using for making Bronze images and in the Manipur same lost-wax technique is using to making bronze utensils and methods of making brass image and utensils are same but the materials, de-waxing process and structure of furnace are different.

Quantifying the Intra-Site Elemental Variability of Ochre: A Case Study from Overland Corner, SA

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Natural mineral pigments such as ochre are a complex cultural heritage material frequently utilised in Australia, and therefore commonly found in archaeological contexts. Understanding ochre pigments relative to their geological source sites can provide important data on the use and exchange and provenance of the original materials and thus help to address questions on the cultural uses of ochre. Ochre has been demonstrated to fit the provenance postulate; however consideration must be taken due to its inherent compositional variability. Often, studies do not take into account the intra-site variability and rely only on small sample sets. As part of our Archaeomicrobiology project (and in collaboration with RMMAC) we are characterising the intra-site profile of Overland Corner, an ochre site in the South Australia's Riverland region. The samples were collected with community permission, using sampling methods across the site for use for multiple complementary analytical approaches, in particular elemental (ICP-MS) and microbial analysis. The elemental results demonstrate variability within the three areas sampled across the site, potentially reflecting different geological and cultural mining histories. This case study demonstrates that a small sample set may not be representative of a cultural ochre site and further sampling and analyses are potentially needed to confidently provenance ochre.

The structure and morphology of copper-rich phases in archaeological silver coins

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The structure and morphology of copper-rich phases within the silver/copper alloy of archaeological silver coins is investigated using electron microscopy. The structure and morphology of these phases can be indicative of the method of manufacture of the coins, which from an archaeological perspective, is an important aspect in understanding the artefact. The copper-rich phases were imaged using SEM-EDS, TEM and FIB-SEM, resulting in a three dimensional reconstruction of the morphology of copper-rich phases. The phases were found to be situated in sheets between flattened grains of silver, indicative of extensive cold-working of the coins, interpreted as hammering. This research represents the first time a three dimensional reconstruction and investigation of the structure and morphology of archaeological silver has been performed, and has applications in archaeology and beyond.

Traces in the Sands of Time: A Geophysical Model of Stratigraphy at Soyo in Mongolia

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The pre-Bronze periods of Mongolian archaeology are not well understood. In particular the timing of the transition to pastoralism is unknown despite it being a prominent question in the archaeology of the Eurasian steppe. The site of Soyo in Khovsgol Aimag, Mongolia provides a great opportunity to answer this problem due to its unusual stratigraphic depth for Mongolian sites (up to 2.5 m) covering 11,000 years. However, the complex stratigraphy hinders our efforts to understand the chronology. In 2016 and 2019 extensive geophysical surveys were carried out at the site. Ground penetrating radar, electrical resistivity tomography and magnetometry data was collected over an area of approximately 50,000 m² and supported by a series of test pits. The aim of this survey was to investigate ancient landscapes at Soyo, to date the process of site formation, and to give the archaeological finds there a topographical and temporal setting. A 3D geophysical model of Soyo's geological structure based on the GPR and ERT and supported by test pitting is presented here. This result will be informative for finding the highest priority areas of archaeological interest and will be a crucial step towards being able to date the site history and archaeological layers.

Early Human Occupation of Tam Pa Ling, Laos: Preliminary Microstratigraphic Results

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The Cave of Monkeys (Tam Pa Ling) in north-eastern Laos has yielded the earliest *Homo sapiens* fossils from continental Southeast Asia (Demeter 2012). Their presence in the area ~64-46ka supports an early wave dispersal of modern humans out of Africa, eastwards into Southeast Asia and beyond. Despite the key role of the cave site in helping us understand the nature and timing of modern human movements into the region, no artefacts or occupation horizons have been identified during the excavation of the fossil-bearing layers. To aid the contextualisation of the skeletal remains a program of microstratigraphic (micromorphological) analyses was initiated, which forms a component of a doctoral research program that is investigating some of the oldest fossil sites in Southeast Asia and Australia. Five intact blocks from Tam Pa Ling's stratigraphic sequence dating from MIS 3 (~57ka) to the Terminal Pleistocene (~12ka) were prepared for thin-section analysis. Preliminary results reveal distinct changes in sediment depositional environment, and human activity is confirmed throughout the cave sequence via microarchaeological evidence. Combustion biproducts and possible hearth features comprise most of the evidence so far identified. Further analysis of the microstratigraphy complemented by other geoarchaeological analyses will better elucidate the Tam Pa Ling sequence as a key early human occupation site in continental Southeast Asia.

Sediment Fingerprinting: Identifying sedimentological characteristics and formation processes at Late Pleistocene archaeological sites in Southeast Asia and Australia

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Sediment fingerprinting utilizes a combination of Earth Science-based techniques to identify specific characteristics of—and reconstruct processes related to—the sourcing, deposition, and subsequent alteration of sediments related to past environmental changes. Utilized widely in the environmental sciences, sediment fingerprinting has been largely underutilized in archaeological contexts. Moreover, wider explorations of this technique in the context of humid tropical climates have yet to be conducted. My doctoral research, as part of the Disperscapes geoarchaeology project, seeks to utilize sediment fingerprinting to generate unique identifiers for sediments found at several key Late Pleistocene archaeological sites in Southeast Asia and Australia to answer questions of archaeological interest - specifically in regards to identifying how local landscape change affects the way archaeological sediments are formed and deposited. This also helps provide robust and localized data for use in reconstructions of the types of environments these Late Pleistocene hominins would have interacted with, thus placing our ancestors back into their associated environmental contexts. In doing so, we can better interpret past human behavior, thereby further equipping archaeologists to accurately understand past peoples and their cultures.

Landscape Archaeological Research on Southern Latium (Central Italy) in the Roman Republican and Imperial Era

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The present paper investigates the complex relationship between men and their surrounding landscape as well as settlement patterns and settlement history in southern coastal Latium. From a historical perspective the study area is most important as it was closely tied to Rome. The project focuses on the time-frame of the late 4th century BC to the early 4th century AD. An interdisciplinary research approach is chosen to assess landscape transformation processes and strategies of land use: Besides historical data, archaeological, epigraphic, geoarchaeological, palynological, anthracological, archaeozoological, anthropological and paleoclimatological data is considered. Descriptive site location modelling is conducted for villas and hamlets in various landscapes to evaluate the importance of cultural and environmental variables, which may have been decisive for the choice of settlement sites. Further quantitative analyses focus on the spatial distribution patterns of various site types and luxury indicators using the kernel-density-estimation method. Viewshed analyses assess the role of visual connections between different site types.