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Invited Keynote Speakers

Leslea Hlusko

President of the American Association of Biological Anthropologists & Research Professor, Spanish National Center for Research on Human Evolution (CENIEH)

Into the unknown: discovering evidence of human biological adaptation to the Arctic during the last ice age

~

Ronika Power

Director of the Centre for Ancient Cultural Heritage and Environment & Professor of Bioarchaeology, Macquarie University

Biocultural archaeology education, fieldwork and research: interdisciplinary approaches to human experiences of living and dying in the past

~

Amy Prendergast

ARC DECRA Fellow & Senior Lecturer, University of Melbourne

Hominin responses to changing environmental conditions from the Lower to Upper Palaeolithic in the Levant

~

Mike Todorovic

Co-Founder Dr. Matt and Dr. Mike's Medical Education & Associate Professor, Bond University

Power of the post - leveraging social media in medical education

(all abstracts to follow by alphabetical order)

Island South East Asia - a new frontier for human evolution

Debbie Argue¹

¹ Australian National University, Australian Capital Territory, AUSTRALIA

We now have three sets of small-statured hominin bones from islands in South East Asia: *Homo floresiensis* (Flores, Indonesia) the Mata Menge hominins (Flores); and *Homo luzonensis* (Luzon Island, Philippines). Skeletal evidence for hominins on Flores and Luzon is from recent times: around 55,000 and 67,000 years ago, respectively. Where did the diminutive species come from? How do they fit into the human evolutionary story? There is also lithic evidence for hominins 1 million years ago on Flores, and 700,000 years ago on Luzon Island. Who were these hominins?

We have never found early hominins on islands before. The discoveries on Flores and Luzon are remarkable breakthroughs in human evolution. Island Southeast Asia could well be the new frontier in human evolutionary studies.

A historical syndemic? The impact of synergistic epidemics of measles and scarlet fever on life expectancy in Victoria, Australia (1860s-1870s)

Heather T. Battles^{1,2} and Phillip M. Roberts³

¹ Department of Anthropology, The University of Auckland, Auckland, NEW ZEALAND

² Centre for Advanced Study (CAS), Oslo, NORWAY

³ School of Culture History and Language, Australian National University, Australian Capital Territory, AUSTRALIA

To explore whether synergistic epidemics of measles and scarlet fever in 1860s–1870s Victoria, Australia could be characterized as syndemics, we apply the methods of Sawchuk, Tripp, and Samakaroon (2022) to quantify the impact of each of the two major co-occurring epidemic events (1867, 1875) in terms of life expectancy (LE) changes. Sawchuk et al. posit the presence of a harvesting effect, indicated by a statistically significant increase in LE in the immediate post-epidemic ‘fallow period’, as a criterion for identification of a historical syndemic. We test an alternate hypothesis that the same methods can identify a short-term scarring effect.

Using annual age- and cause-specific death statistics and census population data, we constructed abridged period life tables for baseline period, peak ‘syndemic’ year, and ‘fallow year’ for each of the two periods (1860s and 1870s). We compared LE at birth using Z-tests. We decomposed age-cause-specific mortality according to Arriaga’s method to identify age- and cause-specific contributions to LE change.

LE was significantly lower than baseline (1864–1865) in 1867 but not in the fallow year (1869). LE in the 1875 epidemic year and the 1878 fallow year were both significantly below baseline (1871–1873). Age-cause-specific decomposition showed similar patterns for 1867 and 1875 for measles and scarlet fever combined effects.

These results provide evidence of a scarring effect following the 1875 measles-scarlet fever epidemic peak, supporting the interpretation of this event as a syndemic. We suggest the short-term scarring effect can be a useful additional criterion for identifying historical syndemics.

Tracking childhood lead exposure in 20th century Romanians

Maya Bharatiya^{1,2}, Christine Austin³, Manish Arora³, Robin N.M. Feeney⁴, Nicole D. Leonard⁵, Bence Paul^{6,7}, Andrei D. Soficaru⁸, Jian-xin Zhao⁵, Tanya M. Smith^{1,2}

¹ Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

² Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

³ Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai, New York, USA

⁴ UCD School of Medicine, University College Dublin, Dublin, IRELAND

⁵ Radiogenic Isotope Facility, School of the Environment, The University of Queensland, Queensland, AUSTRALIA

⁶ School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Victoria, AUSTRALIA

⁷ Elemental Scientific Lasers, LLC., Montana, USA

⁸ “Francisc I. Rainer” Institute of Anthropology, Romanian Academy, Bucharest, ROMANIA

Lead exposure has been linked to severe cognitive and behavioral deficits, and quantifying dental lead content is an established approach to assess populational exposure to this neurotoxicant. Studies have shown that the teeth of individuals living in lead contaminated environments show higher lead levels compared to individuals living in uncontaminated environments. Here laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) was used to quantify tooth dentine lead (Pb²⁰⁸) in the first ~3 years of life in 16 Romanians born in the late 19th century to early 20th century. This period was characterized by intense industrialization, including increase in mining, coal burning, and oil refining—activities that contaminate air, water, and food with toxic metals such as lead. We hypothesized that individuals born in towns where these activities were taking place at the time (regions of potential industrial exposure: RPIE) would have higher dentine lead levels than individuals not born in these areas. To quantify elevated exposure, a threshold was established as the median of the maximum lead values for all individuals (18.58 ppm). Five individuals from the RPIE group (n = 8) were above this median, while only two individuals from the non-RPIE (n = 8) group were above it. Exposure to lead in early life was considerable throughout Romania at the turn of the century. This could be due to the consumption of exported foodstuffs grown in parts of the country where lead contamination was present, early life migration of individuals, or exposure through nearby industrial activities.

Are there different phenotypes of romantic love?

Adam Bode¹, Philip S. Kavanagh^{2,3}

¹ School of Archaeology and Anthropology, Australian National University, Australian Capital Territory, AUSTRALIA

² Discipline of Psychology, University of Canberra, Australian Capital Territory, AUSTRALIA

³ Justice and Society, University of South Australia, South Australia, AUSTRALIA

Variation exists in the expression of romantic love, but to date, no studies have specifically investigated this phenomenon. This study employed a TwoStep cluster analysis to group 809 partnered young adults experiencing romantic love according to intensity of romantic love, obsessive thinking, commitment, and frequency of sex per week. The results revealed four clusters: (i) benign romantic lovers (20.02%) characterized by the lowest intensity, lowest obsessive thinking, lowest commitment, and lowest frequency of sex; (ii) common romantic lovers (40.91%), characterized by relatively low intensity, relatively low obsessive thinking, relatively high commitment, and relatively moderate frequency of sex; (iii) libidinous romantic lovers (9.64%), characterized by relatively high intensity, relatively high obsessive thinking, relatively high commitment, and exceptionally high frequency of sex; and (iv) intense romantic lovers (29.42%), characterized by the highest intensity, highest obsessive thinking, highest commitment, and relatively high frequency of sex. Each cluster may represent distinct phenotypes of romantic lovers and differ on a range of personal and relationship characteristics. The findings can generate theory and hypotheses about romantic love and provide impetus for future research.

Accuracy of age estimation using CT scans of the pubic symphysis and auricular surface in a Western Australia population

Gabrielle Boisseau¹, Daniel Franklin¹, Zuzana Obertova¹

¹ Centre for Forensic Anthropology, University of Western Australia, Western Australia, AUSTRALIA

Adult skeletal age-at-death estimation is often regarded as one of the more challenging aspects of the biological profile. Available methods generally rely on assessing the rate of bone degeneration, which varies within and between individuals and populations. Consequently, age estimation methods require testing on population-specific samples to account for this variation. Australia lacks repositories of documented contemporary human skeletal collections. Thus, virtual collections based on medical imaging modalities are frequently used to provide the requisite biological data. The auricular surface and pubic symphysis are two regions in the os coxa used in morphoscopic age estimation. The Suchey-Brooks method is widely applied to estimate age in the pubic symphysis, with high levels of concordance and accuracy achieved using CT scans. However, the commonly applied methods for estimating age using the auricular surface have been found unsuitable in CT scans. Therefore, Merritt (2018) proposed a revised criteria based on Lovejoy et al. (1985) and Buckberry & Chamberlain (2002). The present study assesses the reliability and accuracy of the Suchey-Brooks and the Merritt methods in 120 pelvic CT scans, equally divided by sex, aged 25-60 years from Western Australia. Due to the variability of bone degeneration within an individual, a multifactorial statistical analysis is used to assess the accuracy of using combined ageing methods, which has so far received little attention in forensic anthropology. The results of this study will provide insight into the validity of the age estimation methods in an Australian sample.

Effects of early stress and exercise on age at menarche: A systematic literature review

Temitope A Bolomope¹, Hannah Goodman², James S. Chisholm², Jonathan Hodgson¹ & David A. Coall¹

¹ School of Medical and Health Sciences, Edith Cowan University, Jondaloo, AUSTRALIA

² Department of Anatomy, Physiology and Human Biology, School of Human Sciences, University of Western Australia, Western Australia, AUSTRALIA

Early pubertal timing has been associated with a range of adverse social and health outcomes such as early age at first sexual intercourse, and increased risk of cardiovascular diseases and breast cancer. Early life adversity, imposed by childhood psychosocial stress or adverse social conditions have been proposed to influence early pubertal timing in females. Also, recent research has suggested that pubertal timing is influenced directly and indirectly by different contexts of physical activity including energy expenditure and sports participation. Crucially, the early stress and energetics hypotheses are both developed from life history theory and generate opposing predictions. To investigate the effects of childhood psychosocial stressors and physical activity on pubertal timing, we conducted a systematized review to identify studies examining both measures of physical activity (e.g., exercise, sport participation) and early life psychosocial stressors (e.g., family size, family composition, socioeconomic status, parental education) in relation to pubertal timing. 321 non-duplicate studies were identified across MEDLINE, PubMed, Embase, PsycInfo and Google Scholar databases. 13 studies met the inclusion criteria for this review. Within these studies, physical activity and large family size were more consistently associated with delayed pubertal timing, while no association was found between socioeconomic status and, parental education and pubertal timing. Our findings underscore the importance of including physical activity/energetic measures as a crucial factor in future studies of sexual and reproductive health amongst adolescent girls and young women. Future studies should investigate more robustly the impacts of family size on pubertal timing, and its contextualization by socioecological environments.

Characterisation of women's reproductive outcomes, household ecology and empowerment in two rural communities of Timor-Leste in 2018

M.A. Paola Borquez-Arce¹, Debra S. Judge¹, Katherine Sanders¹

¹Department of Anatomy, Physiology and Human Biology, School of Human Sciences, University of Western Australia, Western Australia, AUSTRALIA

Background. Predominantly tasked with childcare and food preparation, rural women in Timor-Leste play a critical role in family welfare. Exploring their life trajectories can inform policies to improve their well-being and that of their families. **Objective:** We examine the interrelation between socio-ecological characteristics affecting women in two rural settings in Timor-Leste, focusing on their reproduction, household ecology and empowerment. **Methods:** Data from 116 women in Ossu (OS) and 140 in Natarbora (NB), aged 15+ with at least one birth as of 2018, were analysed using Categorical Principal Component Analysis to elucidate patterns of co-occurring characteristics. We interpret our findings using Life History Theory and Life Course Theory. **Results:** Four components emerged: *Modern* (OS 13.98%, NB 13.06%), *Traditional* (OS 13.11%, NB 12.18%), *Agency* (OS 13.26%, NB 11.95%), and *High Fertility* (OS 11.83%, NB 10.43%). *Modern* women resided in households with more electrical appliances and better sanitation. *Traditional* women lived in households with more residents and livestock. *Agency* women used contraception and received child support. *High fertility* women displayed more child births and deaths, and older age. **Conclusions.** Site-specific variations exist. Education correlated with improved living conditions only post high school. Contraceptive use and independent income from a partner reflect resource scarcity rather than empowerment. In NB, early age at first birth and self-reported good health loaded into Agency, suggesting a link between a better environment and accelerated reproductive timing. High altitude birth region loaded into High Fertility suggesting an association between early-life adversities and later life reproduction.

Hand-wrist forensic age estimation: assessment of skeletal development in Australia

Maddison Bourke¹, Zuzana Obertova¹, and Daniel Franklin¹

¹ University of Western Australia, Western Australia, AUSTRALIA

Age estimation of the hand-wrist is widely recognised as a preferred technique for juvenile age estimation. The advancement of medical imaging has seen these methodologies applied not only to gross bone for age at death estimations of deceased individuals, but also to radiographs for age estimations in living individuals. However, the lack of Australian-specific population standards for the hand-wrist complex means methods based on foreign populations are often being applied and thus the accuracy of the estimation is reduced. Further inaccuracy is introduced from human biases, often the result of factors such as complex methodologies, time constraints, and observer experience. The application of artificial intelligence (AI) is recognised as a technique that may possibly streamline age estimation processes, whilst concurrently reducing human error. Such an age estimation technique, however, has never been trialled in an Australian jurisdiction. Radiographs from all Australian states and territories will be used to document the skeletal development of the left hand-wrist using extant estimation methods from Tanner-Whitehouse and FELS. Statistical modelling will then facilitate the production of contemporary Australian-specific population standards. Classification accuracy of the AI model will be compared to human scoring accuracy of the same dataset. Achieving the highest accuracy and lowest bias possible, is of significant importance for Australia humanitarian and medico-legal processes, ensuring fair and unbiased age estimations of adolescents.

Vitamin D deficiency and breastfeeding: an exploration of Post-Medieval Dutch communities through isotopic analysis

Olivia Cashmere¹, Jason Laffoon¹

¹ Universiteit of Leiden, Leiden, THE NETHERLANDS

Recent developments in serial micro-sampling of dentine have expanded the intricacies in which scientists can understand more about past diets, migration, breastfeeding and weaning practices, and health and disease. Interglobular dentine (IGD), an atypical dentine defect, is a proven proxy for assessing and identifying episodes of severe Vitamin D deficiency in an individual. Certain isotopes, Nitrogen ($^{15}\text{N}/^{14}\text{N}$) and Carbon ($^{13}\text{C}/^{12}\text{C}$), have been demonstrated to show abnormal readings during these periods, particularly in times of stress. From the 17th-19th centuries CE, the Dutch towns of Hattem and Beemster were prospering agricultural farming communities who experienced unusually high rates of Vitamin D deficiency. An innovative isotopic approach was applied to the teeth of five individuals from these communities who showed significant IGD formation. The results can contribute to our understanding of Vitamin D deficiency in the past and what the methodological limitations of such an approach might be. By performing this analysis, we are able to understand the ways in which the body reacts to physiological stress, allowing for a comparison with the isotopic signatures associated with malnutrition. Additionally, isotopic analyses of teeth can provide an individualised, grass-roots approach to understanding how people survived and thrived in the past, while providing unique insights into two groups often neglected in the archaeological record, women and children.

Death in labour: Grave 26 Worthy Park and coffin birth

Christine Cave¹

¹ Australian National University, Australian Capital Territory, AUSTRALIA

In the early Anglo-Saxon cemetery of Worthy Park, grave 26 held an unusual inhumation of a 27-30 year old woman with an infant. The infant lay between her legs, with the head by her knees and the leg bones sitting within the woman's pelvic area. This tableau not only suggests an obstetric calamity but also gives rise to further speculation as the bones of the infant only are covered with a white chalky residue.

Hawkes and Wells (1975) discuss this grave in depth, considering possible obstetric mishaps as the most likely reason for the presence of both individuals. In the final paragraphs of their paper, they raise the rare occurrence of coffin birth, although they do not suggest that this was the case here.

While this paper will not suggest that either, it will discuss this burial in relation to the phenomenon of coffin birth, consider situations in which it might or might not occur, as well as exploring non-medical reasons for the unusual presentation of a dead mother and her infant.

Socio-cultural transitions and oral health: A study of Middle and Late Bronze Age population in Georgia (south Caucasus)

Marine Chkadua¹

¹ Georgian National Museum, Tbilisi, GEORGIA

This study investigates the impact of sociocultural changes on the oral health of the ancient population of Georgia in the South Caucasus. In human history important shifts in subsistence activities like the transition from hunter-gatherer to agriculture and the consumption of domesticated plants changed human oral microbial communities – oral microbiome. The oral health became more susceptible to diseases such as tooth decay-caries. Examination of dental pathologies of the ancient population is one of the important elements to understand the diet and lifestyle of society.

Association of oral health and diet for the ancient Caucasus region is poorly understood, as no comparative studies of dental pathologies have been conducted. This is the first attempt to track changes in diet and oral health of the population during one of the important transitional periods - from the Middle Bronze Age (2000-1500 BC) to Late Bronze Age (1500-800 BC) in Georgia. This is the period when socio-cultural changes and the shift from nomadic pastoralist to sedentary agricultural life-style can be observed.

In the study dental diseases such as caries, periapical lesions, ante mortem tooth loss, and presence of dental calculus have been analyzed and statistically compared between time periods and sexes.

The results of the comparative analysis of dental pathologies from these two consecutive periods revealed deterioration of oral health of the ancient population, which can be linked to the emergence of agricultural activities.

Maternal grandmothers maintain investment in grandchildren who have experienced early adversity

David A. Coall¹, Samuli Helle², Antti O. Tanskanen^{2,3} and Mirkka Danielsbacka^{2,3}

¹ School of Medical and Health Sciences, Edith Cowan University, Western Australia, AUSTRALIA

² Department of Social Research, University of Turku, Turku, FINLAND

³ Population Research Institute, Helsinki, FINLAND

The early environment has established long-term consequences for an individual's reproduction and health. There is growing evidence that an individual's reproductive schedule can be modified by early life experiences. In addition, childhood is when grandparents are likely to have the biggest influence on grandchild development. That being the case, grandparents' inclusive fitness returns on investment in grandchildren may be partly dependent on grandchildren's experiences of early adversity. It may be advantageous, therefore, for grandparents to modify their investment according to grandchildren's early experiences. This may involve increasing investment to compensate for the increased need associated with early adversity or reducing investment if the grandchild's reproductive value is reduced. To investigate whether grandchildren's adverse early life experiences modify the investment by grandparents, data from a nationally representative sample of English and Welsh adolescents (11–16 years of age) was explored. The results showed that grandparental investment in grandchildren who had experienced adverse early life events had a consistent gradient across grandparent types. The association between number of early life events and amount of grandparental investment was the weakest for maternal grandmothers. That is, adverse early life experiences did not change investment by maternal grandmothers. Among paternal grandfathers, at the opposite end of the grandparenting spectrum however, the association between more adverse early events and reduced investment was the strongest. The associations for maternal grandfathers and paternal grandmothers fell in between. These findings highlight grandparental investment, particularly by maternal grandmothers, as a potential buffer against grandchildren's experiences of early life adversity.

Are osseous changes of treponematosi s systemic or localised? A case-study of Treponematosi s palaeohistopathology

Karen M. Cooke¹, Hallie Buckley², Rebecca Kinaston³, Lawrence Kiko⁴, Marc Oxenham¹, and Justyna J. Miskiewicz^{5,6}

¹ School of Archaeology and Anthropology, Australian National University, Australian Capital Territory, AUSTRALIA

² Department of Anatomy, University of Otago, Dunedin, NEW ZEALAND

³ BioArch South, Waitati, NEW ZEALAND

⁴ Solomon Islands National Museum, Honiara, SOLOMON ISLANDS

⁵ School of Social Science, University of Queensland, Queensland, AUSTRALIA

⁶ Vertebrate Evolution, Development and Ecology, Naturalis Biodiversity Center, Leiden, THE NETHERLANDS

The osseous manifestations of treponematosi s can be extensive with lesions occurring on almost any skeletal element. However, it has never been tested whether these effects are due to systemic changes in remodelling throughout the skeleton as a result of treponematosi s, or whether they are localised, with remodelling only being altered at the site of the active lesion. This study sought to determine any differences in remodelling between bone regions with and without treponematosi s lesions within the same individual.

Histomorphometric examination of bone samples was undertaken on an individual (ID B115) within the Taumako (1510-1800CE, Solomon Islands) skeletal collection. Samples were removed from the left and right midshaft anterior tibia. The right tibia showed no macroscopic alteration, while the left tibia had lesions indicative of periostitis from treponematosi s infection. Eight out of nine histomorphometric variables, including vascular density and osteon area, were statistically significantly different between the left and right tibia. Furthermore, asymmetry in remodelling within this individual was greater than that observed between those with and without treponematosi s in the greater Taumako collection.

These results indicate that the changes in skeletal remodelling, which underlie the appearance of lesions in response to treponematosi s infection, are likely localised, not systemic. Our findings have implications for the selection of bone sampling sites in future studies, and interpretations of treponematosi s palaeohistopathology.

Dissecting student perspectives on a clinical enrichment anatomy short course

Sarah L. Croker¹, Allan Meares², Henry Pleass^{2,3}, Annette Burgess⁴ and Kevin A. Keay¹

¹ School of Medical Sciences, Faculty of Medicine and Health, The University of Sydney, Sydney, AUSTRALIA

² Specialty of Surgery, Faculty of Medicine and Health, The University of Sydney, Sydney, AUSTRALIA

³ Department of Surgery, Westmead Hospital, Sydney; Westmead Surgical Research and Education Centre, Sydney; The University of Sydney, Sydney, AUSTRALIA

⁴ Education Office, Sydney Medical School, Faculty of Medicine and Health, The University of Sydney, Sydney, AUSTRALIA

Many Australian medical schools teach anatomy using prosections of human donors, which has several advantages considering the restricted time allocated for anatomy instruction. Yet some students yearn for the enhanced skills and experiences presented with dissection. We developed week-long dissection courses focussing on one body region, enhancing dissection with clinical context. This study's goal was to explore students' perspectives before and after course participation.

Three separate dissection courses were analysed (two "Lower Limb", one "Neck"). Each comprised 20-30 postgraduate University of Sydney medical students, who self-nominated to participate during vacation. Each day anatomists and surgeons lectured on basic anatomy and clinical applications then supervised students dissecting specimens, in pairs. Students received an anonymised online questionnaire immediately prior, seeking anticipated difficulties; and another after, regarding meeting expectations, positives and negatives. Students were asked to rate their anatomical knowledge before and after.

Between 15-20 students responded to each survey (response rate 60-90%). Prior concerns were chiefly dissecting skills and remembering enough anatomy. The course met/exceeded expectations for 98% of respondents; mean knowledge rating (out of 10) rose from 5.7 prior to 8.0 afterwards. Positives were the dissection experience itself, the contact with clinicians, and the appreciation of anatomical relationships; there were very few negatives.

In the changing world of continually reduced anatomy instruction hours, this example of a multidisciplinary approach to a traditional teaching method remains highly valued - as much for enriching professional skills as for structures learnt.

Creating context: interdisciplinary approaches to (re)humanising curated human remains in a post-excavation world

Alexandra J. Doubleday¹, Hannah Vogel¹, Trish Biers² and Ronika K Power¹

¹ Department of History and Archaeology, Faculty of Arts, Macquarie University, New South Wales, AUSTRALIA

² Duckworth Laboratory, Centre for Human Evolutionary Studies, Department of Archaeology – Cambridge University, Cambridge, ENGLAND

Many human remains are held in archives and collections around the world. Past peoples, via their disinterred remains, have a long history of engagement with scholars and the public. During colonial excavations and collecting practices of the 18th-20th centuries, engagements with human remains would be considered unethical by our current standards. Early historical, archaeological and anthropological scholarship often mobilised human remains for exclusionary purposes and ‘scientific’ racism. These practices often focused on individual elements: bodies were regularly divided and distributed across collections internationally. Concomitant issues with record-keeping have resulted in permanent physical fragmentation of many individuals from the past, and perpetuation of apocryphal accounts regarding their corporeality, lived experiences, and/or funerary treatment. We present the incidence and implications of these processes via a case study of an individual from the Egyptian Early Dynastic period (c.2800 BCE), exhumed in 1921-1922 by W.M.F. Petrie and his team, at Umm-el-Qa’ab (Abydos). We have reconsidered excavation notes, publications, photographs and other archival materials to present an alternative story for their death and interment using modern archaeothanatological, bioarchaeological, and archival methods. We aim to emphasise the ongoing need for investment in contemporary techniques of osteological analysis, computerised-tomography, historiographical review, and dialogues between collections to identify and emphasise individuals in the archive. In our contemporary context which increasingly focuses on existing archaeological conservation, engaging with archives and those who have already been excavated is an opportunity for interdisciplinary research in human biology and museums and archives, and where possible, to afford integrity to those who have been divided after death.

Hemi-hypoplasia: a case study from Plague era Venice (Italy)

Ambika Flavel¹, Zuzana Obertova¹, Megan Price¹, Daniel Franklin¹

¹ Centre of Forensic Anthropology, University of Western Australia, Western Australia, AUSTRALIA

The Island of Lazzaretto Nuovo is of historical importance for its role in Public Health within the Venetian Lagoon from 1468 ACE. The island was used as a quarantine port and hospice for maritime travellers, as well as close contacts of Venetians who died of plague; periods of highest mortality occurred in 1575-7 and 1629-31.

The walled cemetery of Camposanto, located in the southwest corner of Lazzaretto Nuovo, has been the subject of archaeological excavation by the University of Western Australia since 2015. During the 2023 field season, the skeletal remains of a subadult individual were recovered from a communal grave. The child was assessed to be 12 years \pm 36 months of age according to dental eruption, but skeletal development and fusion is delayed by circa four years. In situ skeletal length was 136cm, with shoulder and pelvic widths 18cm and 19cm respectively. The individual presented with limb asymmetry in both the lower and upper limbs (e.g., 21% in femoral head diameter and 8% in maximum radial length), and abnormal development in the pelvis and vertebral column. Acetabular abnormality is consistent with Developmental Dysplasia of the Hip (DDH) which, when untreated, can result in leg asymmetry, avascular necrosis of the femoral head, and osteoarthritis. However, this condition does not fully account for the hypoplasia observed in the right leg and left arm which may result from an additional condition; differential diagnoses are discussed.

40,000 years of Kopi use in the southern arid interior of Australia: evidence from Warraty Rock Shelter in Adnyamathanha Country

Giles Hamm¹, Jillian Huntley^{2,3}, Brandi L. MacDonald⁴, Cliff Coulthard⁵, Peter Mitchell⁶, Birgitta Stephenson⁷, Mark Raven⁸, Don Rowlands⁹, Helen E. A. Brand¹⁰, Linda Prinsloo¹¹, Uli Utrich¹², David Stalla¹³ and John Webb¹⁴

¹ Archaeology, Flinders University, Adelaide, South Australia, AUSTRALIA

² Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

³ Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

⁴ University of Missouri Research Reactor, Archaeometry Laboratory, Missouri, USA

⁵ Iga Warta Flinders Ranges, South Australia, AUSTRALIA

⁶ 42 Tyrell St, Gladesville, New South Wales, AUSTRALIA

⁷ In the Groove Analysis Pty Ltd, Brisbane, Queensland, AUSTRALIA

⁸ CSIRO Land and Water, Centre for Australian Forensic Soil Science, Adelaide, South Australia, AUSTRALIA

⁹ 50 Graham Street Birdsville, Queensland, AUSTRALIA

¹⁰ Australian Synchrotron, Powder Diffraction Beamline, ANSTO, Melbourne, AUSTRALIA

¹¹ Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg, SOUTH AFRICA

¹² Department of Chemistry, Australian National University, Australian Capital Territory, AUSTRALIA

¹³ Electron Microscopy Core Facility, University of Missouri, USA.

¹⁴ Office of Life Sciences, La Trobe University, Melbourne, Victoria, AUSTRALIA

Reported in ethnohistoric records across the arid and semi-arid zones of Australia, Kopi is a sculptural media (plaster) used in a variety of Aboriginal cultural practices including ceremonial contexts, many associated with mortuary. Here we review accounts of Kopi trade and use in Australia, present archaeometric data on the properties and resilience of the material, and discuss technology used to transition (the mineral) gypsum into Kopi. Combining excavation context with portable Raman, LA-ICPMS and SEM analyses, we describe a means of recognising Kopi production in the archaeological record. We conclude that the gypsum rich lenses found in the Warraty Rock Shelter in Adnyamathanha Country likely represent separate, repeated Kopi production events, recording the use of this resilient and well understood material to produce sculptural media over a ~40,000-year period.

Taphonomy facilities as teaching tools: a student perspective

Sunday Harper Burnett¹

¹ School of Science and Environment, Griffith University, Queensland, AUSTRALIA

Taphonomy is the study of decay: developing an understanding of soft tissue and bone decomposition processes in differing environments, discriminating between ante, post- and peri-mortem disruptions, and estimating post-mortem interval. This research builds foundational scientific knowledge but primarily aids death investigation in civil, criminal, or humanitarian contexts. The last 20 years have seen a marked increase in the popularity of taphonomic research, and forensic taphonomy facilities are recognised as valuable pedagogical tools for discipline students and associated agency practitioners, such as search and recovery canine units. Forensic taphonomy facilities can be seen as outdoor laboratories, fulfilling the pedagogical functions of indoor labs. Although data is collected from human donors and animal analogues, these facilities offer students and learners the critical opportunity of the multi-sensory experience of decomposition. This paper explores these perspectives through case studies from The Netherlands, Canada, and Australia, concluding with a discussion of the benefits of opening a second Australian facility. An additional Australian forensic taphonomic facility offers more than differing environmental research opportunities, as it meets ANZPAA NIFS strategic goals. Australian forensic science's future is in addressing global concerns, particularly DVI surge capacity. Through extending the nation's teaching capacity, students and learners can also engage first-hand in a deeper dialogue between discipline ethics and good practices, particularly regarding osteological collections and the digitisation and repatriation of human remains. Finally, additional teaching capacity allows a review of forensic taphonomy research's probative and evidential value.

Does Blender® correctly represent perspective in synthetic photographs for use in forensic anthropology: a validation test

Sean S. Healy¹ and Carl N. Stephan¹

¹ The Laboratory for Human Craniofacial and Skeletal Identification, School of Biomedical Sciences, University of Queensland, Queensland, AUSTRALIA

Photographs have long been used to record human anatomy, for use in identification techniques such as craniofacial superimposition and photo-anthropometry or to document skeletal remains. Recently, photographs have seen a new use with deep learning models (models which pass information through a network of nodes to make decisions) that are trained to estimate the sex of individuals via their bones in photographs. These models, however, require large volumes of training data, resulting in limited data availability becoming a bottleneck for model development in certain contexts. A posited solution to this issue is to use synthetic images—images that are computer generated, rather than obtained from real world physical observations. Synthetic photographs can be created by rendering a virtual 3D scene in computer software after the placement of virtual cameras and a 3D scan of the anatomy of interest. If these synthetic photographs are to be used for training deep learning models, they should be representative of real-world photographs. This study examines the representativeness of perspective in synthetic photographs of face anatomy generated in Blender®. This was conducted by acquiring real-world photographs of faces and comparing them to renderings of a 3D scan of the same object in Blender®, to determine if the synthetic image replicated the real-world condition. Preliminary analysis shows that the Blender® is capable of accurately replicating perspective distortion, however, the synthetic images did not accurately replicate the field-of-view at focal lengths matching the real-world images (+7% mismatch).

Are there temporal trends in dental health in prehistoric mainland southeast Asia?

Natasha J. Heap^{1,2}, Kate Domett³, Nigel Chang and Anna Willis⁴

¹ College of Medicine and Dentistry, James Cook University, Queensland, AUSTRALIA

² School of Business, University of Southern Queensland, Queensland, AUSTRALIA

³ College of Medicine and Dentistry, James Cook University, Queensland, AUSTRALIA

⁴ College of Humanities, Arts and Social Science, James Cook University, Queensland, AUSTRALIA

The current hypothesis is the late Iron Age (1750-1350 BP) saw the health of the people of mainland Southeast Asia deteriorate as the inhabitants of the region experienced increasing stress due to climate change, the intensification of agriculture and a population explosion. This hypothesis was tested by macroscopic analysis of adult dentition at Non Ban Jak for the prevalence of antemortem tooth loss, caries and advanced wear, which are indicators of overall health. The dental health at Non Ban Jak improved throughout the site's occupation (1750-1350 BP), contrary to the hypothesis of deteriorating health. The results from Non Ban Jak were then compared with other sites in mainland Southeast Asia from the Neolithic (c.3700-3000 BP) through to the Iron Age (2250-1350 BP). No clear temporal patterning of dental health in mainland Southeast Asia was observed. When compared with other settlements that were close in both time and geographic location, it is apparent that socio-environmental dynamics such as the length of settlement occupation are contributing factors influencing health. The hypothesis that dental health universally deteriorated during the late Iron Age is not supported by the regional specific investigation of dental pathologies. Socio-environmental dynamics need to be considered. These findings could alter our understandings of health through the ages.

Forensic archaeology in air crash investigation – an Australian perspective

Natasha J. Heap¹ and Xenia Kyriakou²

¹ School of Business, University of Southern Queensland, Queensland, AUSTRALIA

² School of Human and Social Sciences, University of West London, UNITED KINGDOM

The scene of a mass fatality aircraft accident is forensically complex, requiring the coordination of multiple agencies with, at times, conflicting priorities. Whilst standards and protocols exist for the identification of victims, DVI protocols do not include guidelines for systematic field investigation procedures related to forensic archaeology. Often such protocols do not distinguish between different scenes of disaster, thus leading to the underlying misconception that “one investigation approach fits all”. Australia currently lags behind the rest of the world in the utilisation of forensic archaeological techniques in air accident investigations. Since November 2022 there have been four multi-fatality light aircraft crashes in Queensland, with three people killed near Lowood in November 2022, four people killed in the Sea World Helicopter collision in January 2023, two people killed in April 2023 near Proserpine, and another two killed in a two aircraft collision at Caboolture aerodrome in July 2023. The development and application of standardised forensic archaeological frameworks will improve air crash investigations including the recovery, documentation and analysis of accident scene data, and improved methods of disaster victim identification. This paper will discuss the need for a standardised, best practice approach to contemporary aircraft accident investigation grounded within forensic archaeology focusing on the collection of accident data to both assist in victim identification and improve the subsequent safety investigation specific to the needs of the aviation industry.

Biomechanical relevance of Neanderthal dental anatomy

María Hernaiz-García¹, Ali Najafzadeh^{1,2}, Stefano Benazzi³, Jing Fu², Jean-Jacques Hublin^{4,5}, Ottmar Kullmer^{6,7}, Rachel Sarig^{8,9}, Rita Sorrentino^{3,10}, Antonino Vazzana³ & Luca Fiorenza¹

¹ Monash Biomedicine Discovery Institute, Department of Anatomy and Developmental Biology, Monash University, Victoria, AUSTRALIA

² Department of Mechanical and Aerospace Engineering, Monash University, Victoria, AUSTRALIA

³ Department of Cultural Heritage, University of Bologna, Ravenna, ITALY

⁴ Collège de France, Paris, FRANCE

⁵ Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, GERMANY

⁶ Division of Palaeoanthropology, Senckenberg Research Institute and Natural History Museum Frankfurt, Frankfurt, GERMANY

⁷ Department of Palaeobiology and Environment, Institute of Ecology, Evolution, and Diversity, Goethe University, Frankfurt, GERMANY

⁸ Department of Oral Biology, The Goldschleger School of Dental Medicine, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, ISRAEL

⁹ Dan David Center for Human Evolution and Biohistory Research, Sackler Faculty of Medicine, Tel-Aviv University, Tel Aviv, ISRAEL

¹⁰ Department of Biological, Geological and Environmental Sciences, University of Bologna, Bologna, ITALY

During human evolution changes in diet and food processing caused a remarkable reduction of the masticatory apparatus. This trend was accompanied with marked dental morphological changes. Regarding the anterior dentition in particular, Neanderthals exhibit a high frequency of distinctive dental features compared to modern humans: shovelling shape, labial convexity and marked lingual tubercle. Moreover, their large anterior teeth are characterised by great level of wear compared to the posterior dentition. Why? Were they using their anterior teeth for other purposes different than eating? And, if so, do their special morphological characteristics confer any mechanical advantage for withstanding heavy occlusal loads? Aiming to answer these questions, we propose a new methodological approach that combines dental macrowear information with functional analyses based on finite element analysis. Here we present some preliminary results on the upper left central incisors of the Neanderthal Le Moustier 1 and the early modern human Qafzeh 9. The specific morphology characterising Le Moustier 1 incisor seems to help in concentrating the tensile stress along the grooves of the lingual fossa. In contrast, the reduction/absence of these features in Qafzeh 9 dentition leads to a wider dispersion of stress along the whole tooth structure. This new biomechanical approach, based on individual loading scenarios in reference to teeth interactions, has the potential to help revealing the morpho-functional evolution of hominin dentition and to be applied in modern dentistry.

Microevolution in an early Pleistocene hominin lineage

Andy I.R. Herries¹ and Angeline B. Leece¹

¹Department of Archaeology and History, La Trobe University, Victoria, AUSTRALIA

We recently argued that morphological differences between different samples of *Paranthropus robustus* represented microevolution in a hominin lineage. Our study demonstrated that the ~2.04-1.95 Ma Drimolen Main Quarry (DMQ) *P. robustus* sample is likely ancestral to the ~1.8 Ma Swartkrans Member 1 Hanging Remnant (SM1HR) *P. robustus* sample. However, phylogenies based solely or predominately on cranial traits can differ from studies based solely or predominately on dental traits. Dental size differences between the DMQ and SM1HR also support the microevolution theory. Further, an ongoing study of deciduous qualitative traits has shown, in preliminary analyses, that the DMQ sample shares a suite of overlapping primitive traits with *A. africanus* that is not seen in the SM1HR assemblage. This discovery also has implications for other *P. robustus* assemblages. If the theory of microevolution were to hold, assemblages such as that recovered from the much younger <1.4 Ma Cooper's D should be found to be more derived than even the SM1HR assemblage. The study presented here shows evidence to that affect.

Into the unknown: discovering evidence of human biological adaptation to the Arctic during the last ice age

Leslea J. Hlusko¹

¹Spanish National Center for Research on Human Evolution (CENIEH), Burgos SPAIN

Human evolutionary genomics has revealed episodes of intense adaptation in modern human populations. While many of the gene variants identified align with known episodes of human biological adaptation, such as sickle cell trait and malaria, others present conundrums. In this presentation I share the research my colleagues and I have undertaken to investigate one of these mysterious gene variants, the V370A variant of the *Ectodysplasin A Receptor* gene (*EDAR*) that experienced an episode of intense selection approximately 20,000 years ago. The pattern of modern-day allele frequencies suggests that the episode of selection occurred in northern China. However, human populations have migrated dramatically over the last 20,000 years ago. We tested the hypothesis that V370A was selection for in northern China using an unusual proxy for genetic variation: dental variation. The EDAR pathway has shared genetic (pleiotropic) effects across a wide range of epithelially-derived traits, including teeth, hair, sweat glands, and mammary glands. A significant amount of variation in the shape of maxillary incisors, a trait called “shoveling” is influenced in an additive manner by the presence of one or two copies of V370A. Therefore, we assessed the pattern of incisor shoveling across ancient populations in order to estimate a much more likely geographic region for the positive selection of *EDAR V370A*. From there, we investigated the most-likely selective pressure, ultimately unraveling a fascinating scientific journey that goes from the molecular mechanism of cell:cell adhesion to breast milk to fatty acids, and, ultimately, to a hypothesis about the function of the innate immune system in the extreme environment of the Arctic during the last ice age.

Understanding the role of body mass on sexual dimorphisms of facial soft tissue thicknesses in children aged 5–17 years

Te Wai Pounamu T. Hona¹ and Carl N. Stephan¹

¹Laboratory for Human Craniofacial and Skeletal Identification (HuCS-ID Lab), School of Biomedical Sciences, The University of Queensland, Queensland, AUSTRALIA

In the craniofacial identification literature, males are universally reported to possess larger facial soft tissue thicknesses (FSTTs) than females, however, these trends ignore body scaling factors. In children, FSTT variation by sex has been reported across all ages, but are typically larger post-puberty. In this study, we use a mixed-longitudinal radiographic sample from the Bolton-Brush Growth Series to explore the relationship between FSTTs and body mass in children aged 5–17 years. A total of 464 lateral cephalograms from 79 children (32 females, 47 males) were assessed. FSTTs were measured at 11 cephalometric landmarks in Adobe®Photoshop®CS6 (Adobe Systems, USA). Corresponding body mass data were extracted from historical records for each participant. Males and females exhibit statistically significant FSTT correlations with body mass ($p < 0.05$, r range=0.12–0.87, mean $r=0.55$ [male]; r range=0.08–0.80, mean $r=0.45$ [female]). Sex differences were calculated before and after FSTT normalisation by body mass. Overall, compared to raw mean differences (F<M, -5%), females displayed thicker FSTTs than males when normalised for body mass (F>M, +32%). When the sample was separated into age groups (5–9 and 10–17-years) to approximate pre-and-post-puberty, similar trends were observed, with a raw mean difference of -2% and -7%, respectively (F<M). The body mass normalized trends again reversed and were larger: +20% and +40%, respectively (F>M). Similar to adults, female children possess larger FSTTs than their male counterparts owing to their relatively smaller bodies. This study highlights the importance of considering body scaling and relative body size in the craniofacial domain to not overlook important trends.

A discriminant function to assist anatomy school evaluations of alleged medical-teaching skeletons from public sources

Jithya Joshy¹, Joseph T. Hefner² and Carl N. Stephan¹

¹ Laboratory for Human Craniofacial and Skeletal Identification (HuCS-ID Lab), School of Biomedical Sciences, The University of Queensland, Queensland, AUSTRALIA

² Department of Anthropology, Michigan State University, Michigan, USA

Prior to the introduction of anatomy acts that prohibited trade in human tissues, medical students in Western countries often purchased commingled skeletons originating from India to assist in their studies. The now inconvenient and ethical complexities of ongoing curation, often sees medical doctors wishing to relinquish their curation duties (without a repatriation mechanism). Increasingly, university anatomy schools are being asked to accept former medical-teaching skeletons (MTS), however, authentication of these skeletons as part of medical-teaching materials from India is not always straightforward (risk also exists that publicly donated skeletons come from elsewhere). Craniometric data from MTS are not part of present-day analytical methods for determining the ancestral origins of skulls. In this study, we aim to add this functionality to the existing forensic anthropology software FORDISC, to assist universities. Craniometric measurements were taken from 68 skulls belonging to MTS in Australia and combined with pre-existing data from 84 MTS from the USA. Discriminant analyses were conducted using this Indian sample and six other FORDISC samples (American Black [n=119], American White [n=318], Indigenous Australian [n=188], Native American [n=102], Japanese [n=319], and Chinese [n=79]) to generate regression equations that could be used for the classification of future unknown skulls. Discriminant functions performed with leave-one-out cross-validated classification accuracy of 79% (50 craniometric measurements, n=92 MTS) or 63% (19 craniometric measurements, n=152 MTS). These results show that quantitative methods can assist with the recognition of Indian MTS donated to universities, aiding in the authentication of provenance.

Maternal, gestational, and family associations with early child growth: Why does the growth of rural Timor-Leste children continue to lag?

Debra S. Judge¹

¹ School of Human Sciences, University of Western Australia, Western Australia, AUSTRALIA

Unlike extant foragers, tropical subsistence farmers experiencing seasonal food shortages cannot relocate. In Timor-Leste, food shortages co-occur with peak labour requirements and inclement conditions, imposing seasonal selection pressures on children's growth trajectories. In Timor-Leste, gestation of boys in the food scarce (rainy) season is reflected in poorer, early-childhood growth. Short interbirth intervals suggest poorer maternal condition and increased sibling competition. Herein, I examine the role of maternal, gestational, birth order and birth spacing effects on children's growth (standardized growth measures) from birth to 10 years. I look at the aggregated patterns over multiple rural communities in Timor-Leste as well as comparing communities that differ in socioecology, and suggest the potential impacts of various findings on NGO's aid provision practices.

Better children's Z-height over the first 10 years is associated with mother's height, longer IBI, and being firstborn (weakly). Z-weight is associated with mother's height, being firstborn, and IBI (weakly). Children's Z-height from birth to two years is not associated with maternal or sibling effects, but those factors increase in importance in 2-5, and then 5-10-year-olds. Sex differences express first in the 5-10-year-olds. Preceding interbirth interval has the most significant impact from age 2 to 5 when growth is poorest, corresponding to weaning and later-born siblings. Very young children appear to be buffered from sibling competition. After controlling for these relationships, child growth still varies across communities.

Association between seasonal influenza and COVID-19 vaccines in the post-pandemic community

Shantha Karthigesu¹, Rebecca Bullingham¹ and David Coall¹

¹Edith Cowan University, Western Australia, AUSTRALIA

Evidence shows a reluctance and hesitancy towards seasonal influenza vaccination especially among older adults who are more vulnerable to serious illness and mortality from influenza. This sentiment mirrored the COVID-19 situation in Australia for most of the pandemic with low rates of community transmission compared to the rest of the world. The anti-vaccine campaigns were more pervasive and explicit than usual, and it was unclear how this impacted individuals' attitude towards COVID-19 and influenza vaccinations. This study assessed the knowledge, belief and attitude towards seasonal influenza and COVID-19 vaccines and whether there was a correlation in attitude towards the two vaccines. Questionnaires comprising of validated scales on health perception and vaccine knowledge, belief and attitude were disseminated online via Qualtrics. Of the 154 respondents included in preliminary analyses, the overall attitude towards vaccines was positive. Although nearly 50% of the cohort reported knowing someone who had an adverse reaction to a vaccine, 85% of the participants felt that everyone should get the recommended vaccines. Only 10% and 12% of the respondents reported refusing the COVID and influenza vaccines respectively. Over 60% of the participants ranked their health as being good or excellent, which suggests that perceived health may be a good predictor of vaccine acceptance. The general sentiments towards anti-vaccine campaigns may deter participation in studies such as this making it difficult to explore the rationale behind vaccine hesitancy and refusal. Further analysis on this data is underway.

Aquatic human body decomposition in Victoria, Australia: 10-year review of domestic and pool-based taphonomy

Vienna C. Lam^{1,2}, Gail S. Anderson^{1,2}, Melanie S. Archer^{3,4}, Gemma Carter³, and Samantha K. Rowbotham^{3,4}

¹ Centre for Forensic Research, Simon Fraser University, Burnaby, British Columbia, CANADA.

² School of Criminology, Simon Fraser University, Burnaby, British Columbia, CANADA.

³ Victorian Institute of Forensic Medicine, Southbank, Victoria, AUSTRALIA.

⁴ Department of Forensic Medicine, Monash University, Victoria, AUSTRALIA.

Drowning incidents remain a critical public health concern worldwide, with domestic environments (i.e., bathtubs, spas, swimming pools, and rainwater catchments) serving as one of the major contexts for such tragedies. Unlike drownings that take place in vast open spaces, these types of environments are enclosed with clear boundaries, which allows for more in-depth cross-comparisons of taphonomic changes of the deceased. This study aimed to investigate patterns of body decomposition in aquatic deaths that have taken place in domestic or built settings. Cases between 2010 and 2019 were retrospectively identified using the Victorian Institute of Forensic Medicine's iCMS database. For each case included in the study, police, Coroner, and autopsy reports were reviewed and observations of decomposition were made using mortuary and police photographs of the deceased. Macroscopic signs of putrefaction were evaluated, which included the presence and patterning of skin discolouration, marbling, bloating, skin slippage, and skin blister/blebs. There were 116 domestic aquatic deaths. These comprised bathtubs (n = 47), spas/hot tubs (n = 8), private pools (n = 42), and public pools (n = 19). Together, domestic deaths accounted for 20.1% (116 / 577) of all recorded aquatic deaths in Victoria, Australia. Overall, many deceased adults who died in bathtubs were partially submerged, which may have caused differential and localized decomposition changes like variable signs of skin slippage and presence of cutis anserina. In cases involving more advanced stages of decay, early indicators of a drowning event, like foam cones, were potentially obscured by fluids from putrefaction.

Identifying catastrophe in Sassanian tombs from Bahrain: the importance of revisiting data

Judith Littleton¹ and Caitlin Bonham Smith¹

¹Department of Anthropology, The University of Auckland, Auckland, NEW ZEALAND

The analysis of legacy data not only brings new life to older research but allows for a re-evaluation of the assumptions underlying these datasets. In this paper, we reanalyse mortuary and demographic data from the burial mound site of DS3 in Bahrain, which was a major part of Littleton's PhD dataset.

The opportunity to reanalyse these data was a by-product of Smith's PhD work when we submitted some samples for radiocarbon analysis. The resultant dates were not studied closely until early this year when a third radiocarbon date from the same site was produced by another project. While the site as a whole was assumed to date to 300 BCE – 300 CE, the new dates from three co-mingled tombs are later (c400-600 CE). These dates radically shift how we think about this site and its use.

In this paper we analyse the radiocarbon determinations, demography and burial practice to argue for catastrophic mortality at DS3 at this later date. The causes of the catastrophe are explored along with their implications for interpretation of the site.

Exploring the impact of animal herding, mobility, violence, and social inequality on injury patterns: A case study of the Neiyangyuan Site

Yan Liu¹

¹ Department of Anthropology, The University of Auckland, Auckland, NEW ZEALAND

In the eastern Eurasian Steppe, the transition from mixed farming-pastoralism to nomadic pastoralism and heightened conflicts has sparked scholarly interest. This study examines the interplay of these dynamics through the Neiyangyuan Site in Shanxi Province, a transitional zone between agriculture and pastoralism, bridging northern and central China.

The site's human remains, primarily from 770-480 BCE, offer insight. Horse implements, animal bones, isotopic analysis, bronze weaponry, and potential burial size and diet variations suggest animal husbandry, mobility, violence, and inequality. This corresponds with anticipated nomadic pastoralism, specialized warrior elites and advanced weaponry during the late first millennium BCE changes.

Consequently, this research aims to ascertain the extent and manner in which these factors influenced injury patterns and to identify those factors most closely associated with such patterns. The analysis of human skeletons reveals a notable prevalence of distal radius fractures (prevalence value) and indicators of indirect force trauma on vertebral centra (Schmorl's nodes) and joint surfaces (minor fractures). The former possibly results from fall on out-stretching arms, and the latter is likely associated with long-term forces on axial and weight-bearing limbs.

Although not completed yet, I will report the demographic composition of individuals by injury category. I also plan to report whether or not associations exist between sources of risk for skeletal injury and the pattern of injuries found within and among individuals at the Neiyangyuan site.

Siapa mau beli? Discrete supply and online demand for illegally traded wildlife in Indonesia

Nicholas Malone¹

¹ Department of Anthropology, The University of Auckland, Auckland, NEW ZEALAND

The scale of the live-animal trade is consequential for not only the viability of endangered species, but also for human health as live-animal markets provide ample opportunities for cross-species pathogen transmission. Even when digital platforms are used for the purchase and display of wildlife species, live-animal markets remain a significant and risky node in the trade network. In May and June 2023, I made repeated visits to two animal markets in Denpasar, Bali, Indonesia. Here I report the results of those market surveys including the lack of a conspicuous trade in long-tailed macaques (*Macaca fascicularis*). However, preliminary observations indicate that, under the right circumstances, transactions between vetted buyers and sellers of protected primates could be arranged within the markets. I contextualise these findings against historical changes in the discretion of animal traders and emerging trends in online demand for endangered wildlife.

Treponemal disease in a commingled assemblage from Papua New Guinea

Phoebe Meyrick¹

¹ Department of Anatomy, University of Otago, Dunedin, NEW ZEALAND

Treponemal disease is present throughout modern-day Australasia, including Papua New Guinea (PNG). Eriama (AVC), is a large assemblage from southern PNG that has been comingled twice and has not yet undergone comprehensive paleopathological analysis. Identification of disease in comingled assemblages is difficult as most conditions do not leave diagnostic lesions and differential diagnosis usually requires knowledge of lesion patterning across an individual. However, tertiary treponemal disease leaves characteristic lesions, gumma, that allow for diagnosis of the disease from individual elements. A total of 1,574 post-cranial elements were analysed, representing an MNI of 40 based on the left femora. For evidence of tertiary treponemal disease an adapted Hackett (1976) method was used. The comingling made it very difficult to pair-match many individuals, although the bones were preserved well which allowed for macroscopic lesion observation. There were five key elements, a radius, an ulna, a scapula, a fibula and one whole skull on which gummatous lesions were definitively observed, and hundreds more with lesions that could be attributed to secondary treponemal disease. Although specific individuals suffering from treponemal disease could not be identified, this study has shown that this condition was present in the community that interred their dead at Eriama. We discuss the implications of our findings at a regional and community group level and compare them to other studies of treponemal disease from contemporary primary burial sites in the region.

Morphometric analysis of pelvic CT scans to estimate sex in an Australian population: A comparative study of diagnose sexuelle probabiliste 2 (DSP2) and Franklin et al. (2014) methods

Natasha Mullard¹, Zuzana Obertová¹, Daniel Franklin¹

¹ Centre for Forensic Anthropology, The University of Western Australia, Western Australia, AUSTRALIA

Sex estimation is one of the key components of the biological profile used by a forensic anthropologist to help assist with identification. The pelvis is widely considered as the most accurate skeletal element for sex estimation due to the high degree of sexually dimorphic characteristics observed because of functional differences. It is generally accepted that methods developed for metric sex estimation using the os coxae are population-specific due to differences in size between populations, and as such are not advised to be applied to individuals from populations outside of the original reference sample. However, the Diagnose Sexuelle Probabiliste 2 (DSP2) has been developed on a global reference sample, not including Australia, and claims validity across different populations. It is important to test the applicability of existing methods in current contemporary populations, particularly when data are acquired in virtual (e.g., CT reconstructed models) compared to physical specimens. The aim of the present study is, therefore, to apply the DSP2 method to an Australian population. The sample comprises 120 pelvic CT scans from three Australian States/Territories, representing 60 males and 60 females, 30-49 years of age. The CT scans were deidentified upon collection and the necessary ethical approval has been granted for this study. The means of four DSP measurements tested were larger in an Australian population compared to the DSP mean. Thus, the results of this study will help provide Australian forensic anthropologists with statistical information regarding method accuracy and thus facilitate selection of appropriate morphometric reference data that represents the individual being examined.

The postmortem interval in juveniles in an Australian temperate environment

Ellen Murphy¹, Laura A. B. Wilson^{1,2} and Stacey M. Ward¹

¹ School of Archaeology and Anthropology, Australian National University, Australian Capital Territory, AUSTRALIA

² School of Biological, Earth and Environmental Sciences, University of New South Wales, New South Wales, AUSTRALIA

There is currently a lack of research around the forensic estimation of the post-mortem interval (PMI) in juveniles. This highlights the need to advance our understanding and methods in this area. This study evaluates the accuracy of adult PMI estimation methods when applied to juvenile remains with the aim of improving current knowledge around decomposition and PMI estimation in human children. We assess the "Total Body Scoring" (TBS) method developed by Megyesi et al. (2005) and its revisions by Moffat et al. (2015) and Smith et al. (2020), as well as the "Degree of Decomposition Index" (DDI) method introduced by Fitzgerald and Oxenham (2009) using a porcine proxy (*Sus scrofa*) within a temperate Australian environment. Proxies were selected to match the average weight (40kg) of a 12-year-old child. Preliminary findings reveal distinct differences in the decomposition processes between the pigs in the sample (N=2), with pig 1 (41.9kg) experiencing an extended bloat time and desiccation. In contrast, pig 2 (39.9kg) decomposed at a more accelerated rate with the head being preferentially affected. These variances may be attributed to differences in internal body temperatures between the pigs (an average of 1°C - 2°C difference over the first two months of deposition) and variation in insect activity across individuals. These preliminary insights underscore the limitations in conventional body scoring methods for child models in Australia and highlight the critical need for updated methods for use in Australian death investigations.

Biocultural archaeology education, fieldwork and research: interdisciplinary approaches to human experiences of living and dying in the past

Ronika K. Power¹

¹ Department of History and Archaeology, Centre for Ancient Cultural Heritage and Environment, Faculty of Arts, Macquarie University, New South Wales, AUSTRALIA

Biocultural Archaeology is a sub-discipline of Bioarchaeology. It focuses on data derived from the scientific analyses of human remains, interpreted in conjunction with every other aspect of the archaeological record, including artefacts, ecofacts, grave architecture, texts, temples, etcetera. This methodology facilitates a more holistic approach towards (re)constructing and understanding the lived experiences, lifeways and world views of individuals and groups from past populations. It also endorses an ethical standpoint through which human remains can be engaged in research and curated, conserved, and protected in cultural and scientific institutions. This paper will present case studies of current research being undertaken by the Biocultural Archaeology Research Group at Macquarie University and explore areas of potential collaboration across the Human Biology research community of Australia.

Hominin responses to changing environmental conditions from the Lower to Upper Palaeolithic in the Levant

Amy L. Prendergast¹

¹School of Geography, Earth and Atmospheric Sciences, The University of Melbourne, Victoria, Australia

Today and into the deep past, humans have responded to changes in their local environment on daily to seasonal timescales. Therefore, robust assessments of the impact of environmental change on human behaviour requires an understanding of local environmental change at seasonal to sub-seasonal resolution. Sclerochronology is the study of the physical and chemical variations in the accretionary hard tissues of biogenic material such as mollusc shells, fish otoliths, and teeth. Sclerochronology can provide some of the few sub-seasonal resolution palaeoenvironmental proxies from the mid to high latitudes. In many cases these proxies provide quantitative palaeoenvironmental time series. Obtaining sclerochronology records from archaeological sites enables the reconstruction of a more detailed picture of how humans responded to changing climatic regimes in the past and allows an assessment of hunting and foraging seasonality. In this talk, I will present an overview of some of our latest research in applying sclerochronology to understand human-environment interactions from deep time archaeological sequences. This includes assessing the role of rapid environmental changes in the expansion of early modern humans and the extinction of Neanderthals during the Middle to Upper Palaeolithic, and the application of sclerochronology to understand the environments encountered by *Homo erectus* as they spread out of Africa. This research is providing nuanced understandings of how humans and our hominin ancestors have responded to local environmental changes through time, and how these changes have shaped the evolution of our species.

Assessment of first molar enamel thickness in humans with different subsistence methods

Georgia Rolls¹, Hallie Buckley², Jelmer Eerkens³, Robin N.M. Feeney⁴, Akiko Kato⁵, Rebecca Kinaston^{6,7}, Marc Oxenham⁸, Andrei Soficaru⁹, Kamil Sokolowski¹⁰, Arakadiusz Soltysiak¹¹ and Tanya M. Smith^{7,12}

¹ School of Humanities, Languages and Social Science, Griffith University, Queensland, AUSTRALIA

² Department of Anatomy, University of Otago, NEW ZEALAND

³ Department of Anthropology, University of California Davis, California, USA

⁴ School of Medicine, University College Dublin, IRELAND

⁵ School of Dentistry, Aichi Gakuin University, JAPAN

⁶ BioArch South, Waitati, NEW ZEALAND

⁷ Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

⁸ School of Archaeology and Anthropology, Australian National University, Australian Capital Territory, AUSTRALIA

⁹ Francisc I. Rainer Institute of Anthropology, Romanian Academy, ROMANIA

¹⁰ Preclinical Imaging Facility, Translational Research Institute, AUSTRALIA

¹¹ Faculty of Archaeology, University of Warsaw, POLAND

¹² Australian Research Centre for Human Evolution, GU, Queensland, AUSTRALIA

This paper explores the association between modern human subsistence type and enamel thickness. We hypothesized that Holocene hunter-gatherers and foragers consumed more mechanically-challenging foods, and would thus have thicker enamel than people with marine-intensive, agricultural, and industrialized diets. This hypothesis was derived from nonhuman primate studies detailing an evolutionary trend towards greater enamel thickness in diets with foods which are more difficult to process. A total of 75 upper and lower unworn or lightly worn first molars originating from a range of geographic regions over the past 11,000 years were utilized, making this the broadest comparison of this aspect of human evolution. After micro computed tomographic imaging, the resulting virtual samples were processed with VG STUDIO MAX software to create standardized sections through the mesial cusps, from which their average enamel thickness was then measured in ImageJ. The results were consistent with previously noted significant differences in average enamel thickness between upper and lower molars. Comparisons amongst the five subsistence groups did not reveal any significant differences. Complexities in the modern human diet, including a broadening of food sources due to improved storage and processing with cooking and tool use - which involve new mechanical processes of mastication, may mean that previous explanations cannot be used. Overall, the study is scientifically significant as it challenges the understanding that increased enamel thickness is an evolutionary adaptation to mechanically-challenging foods in modern human populations.

Primate teeth are robust proxies for understanding climate change in the past

Tanya M. Smith^{1,2}, Janaína N. Ávila^{1,3}, Daniel R. Green^{2,4} and Ian S. Williams⁵

¹ Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

² Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

³ School of the Environment, University of Queensland, Queensland, AUSTRALIA

⁴ Department of Human Evolutionary Biology, Harvard University, Massachusetts, USA

⁵ Research School of Earth Sciences, Australian National University, Australian Capital Territory, AUSTRALIA

Scholars have long endeavored to document past environmental variation at a finer time scale than those available from sediment layers or ice cores. Teeth record dietary inputs throughout their formation and do not remodel during life, yielding the natural environmental variation of ingested water via isotopic analysis. Here we review key findings from six years of Sensitive High-Resolution Ion Microprobe (SHRIMP SI) measurements of oxygen isotope compositions ($\delta^{18}\text{O}$), which are related to daily increments to facilitate sequential weekly sampling over multiple years of enamel growth. Studies of wild baboons and chimpanzees demonstrate that enamel $\delta^{18}\text{O}$ values track concurrent rainfall amounts with good fidelity, and are accurate predictors of bimodal and annual rainfall patterns. Such records can be extended to establish birth seasonality, and even season at death in some instances. Moreover, primate teeth appear to record meteorological events such as sustained droughts, extreme rainfall events, and supra-annual ENSO cycles. Our studies of fossil apes and humans have led to inferences of increasing aridification 17 million years ago in eastern Africa, colder and more seasonal climates in southeastern France 250,000 years ago, and drier environments with reduced monsoon intensity in eastern Malaysia at the start of the Holocene. Similar analyses can now facilitate tests of whether increasing climate variability was a driving force behind the origins of our species 300,000 years ago, our genus several million years earlier, and our more ancient great ape ancestors.

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Opportunities for engagement and outreach linked to the Australian Curriculum

Georgia L. Stannard¹

¹ Department of Archaeology and History, La Trobe University, Victoria, AUSTRALIA

In July 2022, the Australian Curriculum and Assessment and Reporting Authority (ACARA) released the new National Australian Curriculum (AC Version 9). While not mandatory across Australia, the National Curriculum but at the least, form the basis for and 'adopt and adapt' strategy by other States and Territories. Excitingly, AC v9 offers many new opportunities for researchers within the disciplines of biological anthropology and associated fields to contribute to student learning outcomes, including introducing new and cutting-edge techniques, interdisciplinary approaches, and exciting regional case studies. In this presentation, I will introduce relevant components of the AC v9 science, geography and history curricula and discuss opportunities for outreach and engagement with students and teachers.

Humid periods and human dispersals in Arabia

Mathew Stewart¹ and Michael Petraglia¹

¹ Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

The last decade has seen a dramatic transformation in our understanding of the role of the Arabian Peninsula in human evolution and dispersals. Once thought to have been an unchanging desert, recent palaeoclimatic research has shown that at times in the past (i.e., interglacials) Arabia experienced substantially wetter and more humid conditions than characterise the region today. These climate shifts periodically transformed the Arabian deserts into well-watered grasslands suitable for hosting a wide array of fauna, including large herds of antelopes, hippos, and elephants. Human groups also took advantage of the wetter conditions as evidenced by the archaeological record which indicates a recurring pattern of human dispersals tied to interglacial periods dating back at least half a million years. In the subsequent glacial epochs, deserts once again returned, leading to the displacement of human populations from the area and the reformation of the Saharo-Arabian region as an arid barrier separating Sub-Saharan Africa and Eurasia. Naturally, these climate cycles had significant evolutionary and biogeographical impacts on human populations by facilitating the movement of groups between Africa and Eurasia via ancient hydrological routes during interglacial periods, while isolating them during glacial periods. This climate-forcing pattern endured until the mid-Holocene when the combination of livestock and water harvesting technologies provided the means for groups to establish more permanently in the deserts.

Stress, nitrogen balance and stable isotope analysis of dentine: a review of bioarchaeological applications

Emma L. Sudron^{1,2} and Tanya M. Smith^{1,2}

¹ Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

² Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

Immunological or nutritional stress in early childhood can impact development, health and well-being long into adulthood. In recent years, bioarchaeologists have collected stable isotope data from tooth dentine, interpreting specific elevated patterns of nitrogen isotopes ($\delta^{15}\text{N}$) as being due to “stress.” However, several interrelated physiological and behavioural co-variables can impact nitrogen balance ($\delta^{15}\text{N}$), including growth, nursing, and nonmilk dietary changes. We developed a framework to review foundational studies of $\delta^{15}\text{N}$ in hair, bone, and dentine, evaluating the strength of bioarchaeological interpretations when considering the type of evidence (i.e., empirical vs. associative study, sampling approach), study population, and how each study controlled for the influence of co-variables on $\delta^{15}\text{N}$. We found a dearth of empirical studies on hard tissues, particularly dentine, despite this being the primary subject of fine-scaled bioarchaeological analysis. Childhood stress, and the influence of co-variables on nitrogen balance is also not well understood in foundational studies of $\delta^{15}\text{N}$ in hair. This same framework was used to evaluate eight bioarchaeological studies listed as “evidence of physiological stress in dentine profiles” from Table 4 in O’Donoghue, Walker, and Beaumont (2021: *International Journal of Paleopathology* 35, 61-80). Ultimately, temporally-poor sampling methodologies, inconsistencies in interpretation of isotopic data, and a lack of control of co-variables across these studies undermines the identification of “stress” in dentine isotopic profiles. Research using the teeth of populations with documented clinical and nutritional histories is needed to assess if physiological stress can be seen with meaningful time resolution in dentine isotopic profiles.

Tomb IGN 97 from Hegra: Preliminary analysis of a highly commingled skeletal assemblage

Lauren Swift¹, Ambika Flavel¹, Laila Nehme², Daniel Franklin¹

¹ Centre of Forensic Anthropology, University of Western Australia, Western Australia, AUSTRALIA

² Centre National de la Recherche Scientifique, Paris, FRANCE

Hegra (Madâ'in Sâlih), the second city of the Nabataean Kingdom, is in AlUla, within the Medina Province in the Hejaz region, of the Kingdom of Saudi Arabia. The historical and archaeological record attests a rich tapestry of human occupation at the site. Most of the visible archaeological features are Nabataean in origin, including more than 100 monumental tombs, dating between 1st Century BCE and 1st Century AD. Of specific relevance to the present paper is Tomb IGN 97, excavated in 2014 which contained commingled human skeletal remains, along with a single partial primary burial (in-situ). The aim of the present paper, therefore, is to describe the burial context and the process of establishing the minimum number of individuals (MNI) represented in Tomb IGN97.

The burial chamber of measures 5.0 x 4.5 m, with fill 0.3 m deep. In 2023 a total of 2,521 identifiable bones (complete and fragmented) were examined; an equivalent number of non-diagnostic bones was also present in the assemblage from IGN97 but were not documented. MNI is estimated based on duplication of recognisable elements and/or non-concordance relative to age and sex. The latter approach resulted in the identification of 47 individuals, based on repetition of left adult talus and the inclusion of an infant right talus. Some preliminary description of sample demographics are thereafter presented, which for the first time will be incorporated into a broad-scale project that is investigating the ancient inhabitants of north-west Arabia.

Power of the post - leveraging social media in medical education

Mike Todorovic¹

¹ School of Medicine, Bond University, Queensland, AUSTRALIA

In today's digital landscape, social media has emerged as a powerful tool for educators to engage an expansive and diverse audience of learners. With approximately 65% of Australian university students falling into the Generation Z category (12-26 years), this cohort represents the first true digital natives, having grown up during the Web 2.0 era. Over 50% of Generation Z dedicates four or more hours daily to social media. This time is not only spent connecting with others, but also for learning and information gathering.

While surveys conducted during the COVID-19 pandemic indicated a student preference for face-to-face learning, a significant proportion of students expressed a desire for a blended approach to education. Social media platforms such as YouTube, podcasts, Instagram, Twitter, and TikTok offer valuable avenues to effectively reach this audience and others.

When leveraged appropriately, social media not only facilitates engagement but can also boost academic credibility. It enables content dissemination, integration into learning management systems, publication of research findings, presentation opportunities, and collaborations with esteemed organisations. This presentation explores opportunities and strategies that academics can adopt to leverage the potential of social media in biology education.

A preliminary analysis of the effectiveness of online practical laboratory delivery using 3D models for higher education courses in biological anthropology

Stacey M. Ward ¹, Katharine L. Balolia ¹ and Laura A. B. Wilson^{1,2}

¹ School of Archaeology and Anthropology, Australian National University, Australia Capital Territory, AUSTRALIA

² School of Biological, Earth and Environmental Sciences, University of New South Wales, New South Wales, AUSTRALIA

Online practical training is becoming increasingly common in hands-on disciplines like biological anthropology, but little is known about its impact on student outcomes. We present the preliminary findings of an ongoing study exploring the effectiveness of online practical training using 3D resources in biological anthropology. Through a participant survey of osteology and palaeoanthropology students (n=27) from an Australian university, we assessed 1) whether differences in delivery mode impact student comprehension of practical concepts, and 2) whether student perceptions of learning vary between in-person and online modalities. Preliminary results, assessed using Wilcoxon rank-sum exact tests, show that there are no significant differences in test of knowledge scores between online and in-person learning modes for either discipline ($z \geq 0.744$, $p \geq 0.143$). However, in-person students experienced an increased feeling of learning relative to the online students in our combined discipline and osteology-only cohorts ($z \leq -3.338$, $p \leq 0.001$). Feeling of learning scores were also significantly lower among the online osteology cohort, relative to palaeoanthropology students ($z = -2.383$, $p = 0.024$). Our preliminary results suggest that the effectiveness of online learning may vary across anthropological sub-disciplines and indicate the need for more nuanced investigations into the efficacy of online learning.

What can the shapes of frequency distributions of biometric traits tell us about evolutionary selection pressure?

David Waynforth¹

¹ School of Medicine, Bond University, Queensland, AUSTRALIA

When conducting statistical analysis of data measuring biological traits, a usual precursor to hypothesis testing is to view histograms to determine the amount of skew and kurtosis present in the frequency distributions. Their presence and extent may affect analysis decisions. Beyond these considerations, most researchers probably don't give much thought to skew and kurtosis. However, the concepts and mathematics of skew and kurtosis were expressly formulated by Karl Pearson in the late 18th and early 19th century in part to address the fact that evolved, biological traits do not generally show normal, symmetrical frequency distributions. But Karl Pearson did not have perspectives from evolutionary life-history theory to work with, and his focus was not on what distributional shapes might indicate about evolutionary processes that have shaped a trait. In my presentation I will explore frequency distributions through a modern evolutionary lens. My focus will be on applying evolutionary life-history theory to data distributions of traits typically measured to assess child development. In conclusion, I will discuss the possible utility in clinical medicine of applying this evolutionarily-informed perspective on data distributions to reassess which infant growth-related traits are likely to be the most important indicators of disordered child development.

Evaluation of 3D scanning tools for the recovery of clandestine burials

Eden Whittaker¹, Selena Huf², Carney Matheson¹, Donna MacGregor^{1,2}

¹ School of Environment and Science, Griffith University, Queensland, AUSTRALIA

² Forensic Service Group, Queensland Police Service, Brisbane, Queensland, AUSTRALIA

Crime scene scanning is used to create an accurate, three-dimensional (3D) representation of a scene that can be used to take measurements, inspect objects and provide a visual aid for presentation in Court. Currently, the Queensland Police Service (QPS) employs a FARO Focus S150 laser scanner to create photorealistic reconstructions of crime scenes. FARO laser scanners operate using LiDAR, are highly accurate and have consistently demonstrated high levels of performance in crime scene scanning. However, using FARO to collect digital scans can be exceptionally time consuming and while transportable, a FARO kit can be bulky and cumbersome. This limits the locations that a FARO scanner can be transported to, especially if those locations are rural, or in rough terrain.

This research aimed to determine the efficacy of alternative LiDAR and photogrammetric technologies in scanning clandestine burials. This was achieved by assessing the affordability, portability, accuracy and usability of these technologies in the field in comparison to the FARO scanner. In alignment with these objectives the LiDAR and photogrammetric capabilities of the most recent generation Apple iPad Pro, iPhone 12 Pro and iPhone 13 Pro were assessed using the applications (apps) Polycam – LiDAR & 3D Scanner, Scaniverse – LiDAR 3D Scanner and Trnio Plus 3D Scanner. The Hovermap HF-1 scanner, a mobile LiDAR scanner was also evaluated.

This research found the Apple iPhone 12 Pro to be the most affordable, portable and accurate option of all alternate devices evaluated in this study. In terms of accuracy, Polycam and Trnio performed best.

Proteomics of archaeological materials

Shevan Wilkin^{1,2,3}

¹ Institute of Evolutionary Medicine, University of Zurich, Zurich, SWITZERLAND

²Max Planck Institute of Geoanthropology, Jena, GERMANY

³Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

Ancient protein research in relation to archaeological questions has greatly expanded over the last 10 years. Primarily due to advances in mass spectrometry, new technologies now allow us to determine the amino acid sequences of peptides which allows for tissue and species-specific taxonomic identifications. For example, protein analysis has recently shown species-specific caprine and bovine milk use in Neolithic East Africa, that horse milk drinking became common by the Late Bronze Age in Mongolia, and how ruminant milk consumption enabled Yamnaya steppe migrations. While dental calculus has been a commonly used archaeological material in dietary assessments, innovative studies are expanding the field by applying this method to new materials. The ability to identify species- and tissue-specific plant and animal proteins has illuminated our understanding of ancient subsistence, but has also proven to be a useful method to understand evolutionary trends and ancient health as applied to human remains. This talk will detail the diverse applications of ancient protein analysis, and touch on new directions as applied to novel archaeological materials.

New protocol for measurement of nitrogen isotopes in dentine at high temporal resolution

Ian S. Williams¹, Emma Sudron^{2,3}, Yue Wang¹ and Tanya M. Smith^{2,3}

¹ Research School of Earth Sciences, Australian National University, Australian Capital Territory, AUSTRALIA

² Griffith Centre for Social and Cultural Research, Griffith University, Queensland, AUSTRALIA

³ Australian Research Centre for Human Evolution, Griffith University, Queensland, AUSTRALIA

Nitrogen isotopes ($\delta^{15}\text{N}$) are widely used to study human nursing and weaning patterns. Current analytical protocols involve sequentially sampling dentine from ca. 1mm thick sections. This produces an averaging effect where $\delta^{15}\text{N}$ isotopic values of each section integrate months of dentine formation. Here, we detail a new protocol for $\delta^{15}\text{N}$ measurement of dentine at high temporal resolution with a Sensitive High-Resolution Ion Microprobe (SHRIMP). We sampled $\delta^{15}\text{N}$ on a weekly- to monthly-basis in the first molar of a healthy Australian child. By relating spot position along the enamel-dentine junction to incremental enamel formation, we identified prenatal dentine, as well as the approximate ages of postnatal positions over more than four years. Our results show a rapid postnatal isotopic increase of 2 per mil, during which time the child was exclusively breastfed, followed by a gradual decline of 6 per mil from ~ 7 - 23 months of age as the frequency of breastfeeding decreased. The child consumed a largely milk and meat-free diet from ages 2 - 3, after which point chicken and soy milk were consumed; $\delta^{15}\text{N}$ values varied cyclically by 1-2 per mil starting at ~2 years of age. The overall isotopic difference between complete maternal dependence and nutritional independence is consistent with trophic-level differences amongst mammals. The high spatial resolution of our measurements minimizes time averaging and can thus be precisely related to an individual's early life history; when combined with similar measurements of oxygen isotopes the seasons of birth and weaning can also be determined.