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Quaternary AUSTRALASIA



Remembering John Chappell

Tajikistan expedition

SHeMax at Stradbroke

Australasian Quaternary Association Inc.

AQUA



2018 AQUA Biennial Conference

10-14 December
Acton Peninsula
Canberra

Pre-conference
Field Trip:

High altitude environments of eastern
Australia - 5 to 8 December

Icebreaker:

Sunday 9 December

Conference sessions:

Monday 10 to Friday 14 December
Crawford Precinct, Acton Peninsula

See <http://aqua.org.au/conference/aqua2018> for more details and deadlines.

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Front cover photo:

The loess profile at Karamaidan, southern Tajikistan, preserves a continuous record of aeolian response to climate over at least the last million years. The site was created by a series of landslides in the 1930s and 1940s, exposing the >100 m thick sequence of alternating primary loess and paleosol units reflecting glacial-interglacial cycles. Sampling at this site was undertaken in the 2018 boreal summer by the Research Group for Terrestrial Palaeoclimates at the Max Planck Institute for Chemistry (Germany), in cooperation with the Tajik National University. (Photo credit: Kathryn Fitzsimmons).

Below:

Professor John Chappell, who passed away on 3 October 2018. We reflect on his legacy and contribution to Quaternary science in this issue. (Photo credit: Australian Academy of Science).



EDITORIAL

Dear Quaternarists,

The world is currently 1°C warmer than pre-industrial levels and the world's leading climate scientists warn that we have a dozen years in which global warming can be kept to a maximum of 1.5°C. This statement, in the recently released 5th IPCC report sends a stark reminder to the global community that that climate change is a reality; and that any increase greater than 1.5°C will only worsen the impact on global communities (IPCC, 2018).

The relevance of studying past climate to help inform our planning for a future warming world has never been clearer. In this issue of Quaternary Australasia, we hear from Kat Fitzsimmons on her recent expedition to sample the >100 m thick package of alternating loess-paleosols at Karamaidan, nestled in the foothills of the Pamir mountains in southern Tajikistan. Kat notes: "The -impact of an increasingly unpredictable future climate on our landscapes – the land on which we grow our food, our water supplies, our ecosystems – is even less well understood than our models for future climate themselves and we know that conditions in marginal regions, such as the edges of deserts, will become increasingly unstable and unable to support human populations (IPCC, 2018)."

We also hear from David Lowe on the IFG INTAV workshop, in deepest Transylvania, in the southern Carpathian Mountains. Martin Williams reports on two workshops with an arid theme: 5th Southern deserts in Karratha and the Nile workshop in Paris. Daniel Ellerton reports from Stradbroke Island, from the last SHeMax workshop. This IFG will have a session at INQUA next year, as will SHAPE, another IFG initiative. This proactive research from the Australasian Quaternary community will have global visibility at INQUA in 2019.

While we read about the recent research initiatives in these areas, we also reflect in this issue on the recent passing of two eminent Quaternary scientists: John Chappell and Pat Quilty. Both these scientists made significant impacts in the Quaternary field, and left notable legacies. Further opportunities to remember and reflect on this science and legacy are planned for Canberra in December.

Many of you will be reading this at the biennial AQUA conference in Canberra. We thank the organising team (and in particular, Scott Mooney, our Past President) for the hard work in drawing together a thought provoking and stimulating programme. A pre-conference field trip to the high altitude environments of eastern Australia, centred around Kosciuszko National Park will set the scene for Quaternary debate back in the ACT.

We look forward to seeing you in Canberra.

Yours Quaternarily,

Carol Smith and Sanja van Huet

Co Editors

REFERENCE

IPCC (2018). Special report on global warming of 1.5°C. Intergovernmental Panel on Climate Change, Geneva.



PRESIDENT'S PEN

Dear fellow AQUA members,

It's a privilege to be writing as incoming President to AQUA and I would firstly like to thank the outgoing executive for all their hard work in keeping AQUA strong and vibrant. As a Quaternary scientist and geomorphologist I look forward to AQUA promoting our discipline more broadly, fostering new opportunities and bridging our community with other geoscience organisations. I think the current executive is a great mix of new and old hands hopefully guiding AQUA into a successful 2019.

Quaternary science in Australasia and globally has recently lost a great scientist and individual, Professor John Chappell, who died in Dunedin in early October. John was a remarkable individual who started his PhD research on the Huon Peninsula, Papua New Guinea in 1965; started a lectureship at ANU 1967 and completed his thesis in 1973. His work on Quaternary sea level change was ground breaking and this was only one of many scientific achievements. He made a huge contribution to Australian Quaternary science and the study of Australian landscapes and he will always be remembered for his enthralling conference presentations, his arrival in a VW beetle and his ability to engage and teach junior scientists.

Professor Bruce Thom has written a very nice obituary which can be accessed here:

<https://australiancoastsociety.org/blog/2018/october/07/vale-john-chappell-faa-1940-2018/>

As we go to press, we are planning to pay tribute John at the forthcoming AQUA conference. This conference is being held on the 10 – 14 December (icebreaker on Sunday the 9th) in Canberra at ANU:

<https://aqua.org.au/aqua-2018-conference>

This meeting is a great opportunity to get together with colleagues in an informal atmosphere hearing about the latest and greatest in Quaternary science in our region. It's an excellent opportunity for post-graduates and ECRs to present their work. Please see the AQUA website for further information. Look forward to seeing you there.

Best wishes

Tim Cohen
AQUA President



CAPTION COMPETITION

Cleaning back a 20m profile on the abseil proved to be dusty work in 40 degrees heat for Kat Fitzsimmons and Post Doc Charlotte Prud'homme at Karamaidan, nestled in the foothills of the Pamir mountains in Southern Tjikistan in 2018. Read the full report in this issue.

Please help your editors with an appropriate caption for this photo. The winning entry will appear in the next issue of Quaternary Australasia.



NEWS

PRIME MINISTER'S PRIZE FOR SCIENCE 2018 GOES TO 'EARTH-WATCHER' KURT LAMBECK

Sarah Keenihan

(This article reproduced under Creative Commons Licence from The Conversation; full online article available here <https://theconversation.com/prime-ministers-prize-for-science-2018-goes-to-earth-watcher-kurt-lambeck-105040>)

October 17, 2018 5.05pm AEDT

Professor Kurt Lambeck has won the 2018 Prime Minister's Prize for Science. The award recognises Lambeck's 50-year contribution to Australian and global science through his research "watching" planet Earth – it's a specialist field known as geodesy.

His work enables more accurate guidance of satellites and space missions, helps track changes in sea levels over time, and facilitates detailed understanding of the deep structure of Earth. Lambeck's research also underpins the GPS technology on which we rely for accurate navigation. "The Earth is remarkable. It has this wonderful record of its history going back to almost its very beginning. Almost everywhere you look, you learn something new about what's been going on in our planet," Lambeck said.

Kurt Lambeck's work has been vital for developing GPS systems we all rely on for navigation. (Photo credit: Prime Minister's Prizes for Science/WildBear.)



LOCATION TRACKING TO THE CENTIMETRE

Structural geologist and University of Melbourne Research Fellow Tim Rawling says the award confirms the importance of Lambeck's work for Australia and the world. "Lambeck is very highly regarded internationally," said Rawling. "He has held leadership roles at Universities in France and the US and has won a number of international awards from Sweden, Japan, France, Norway, the US and the Netherlands."

Lambeck, an Emeritus Professor at the Australian National University, guided the development of a comprehensive geodetic monitoring system called the AuScope network. The network consists of about 100 GPS stations, radio telescopes, and laser tracking systems, and enables location tracking with centimetre accuracy across Australia.

"Lambeck is considered to be one of the fathers of this initiative and was instrumental in bringing groups such as Geoscience Australia, the University of Tasmania, Australian National University and the various state government departments together to design and build this program," said Rawling. "The value of this infrastructure to Australia was confirmed this year when the federal government invested A\$225 million in the National Positioning Infrastructure, which is built on this collaboration that Lambeck helped to establish."

NOT A SIMPLE SPHERE

Seen from a distance and by average measurement, Earth is a sphere. But in reality our planet is quite lumpy, and its form changes over time. Lambeck's work has been vital in monitoring Earth's contours, and seeing how they influence human activities.

"Geodesy as a field of expertise includes understanding the state of the crust, the movement of tectonic plates and also the study of the Earth's gravity field," said Rawling. This can help scientists understand where stress may be building up in Earth's crust due to deformation – which can help identify regions at higher risk of earthquakes and natural hazards. It also factors in how melting and freezing of water changes the appearance and physical behaviours of Earth. "Geodesy is very important for navigation, as the data sets that form the basis of maps and navigational systems require highly accurate understanding of the shape of the earth," said Rawling.

AGU CELEBRATE 100 GRANT PROJECT SUPPORT

To help mark its Centennial, AGU is awarding Celebrate 100 grants up to \$10,000 to cover the expenses of grassroots engagement activities that showcase the benefits of Earth and space science.

The grants, which are available to members and non-members around the globe, will support projects demonstrating innovation, collaboration, impact and sustainability in promoting the value of Earth and space science, primarily to the public.

While grant applications will be judged against a set of criteria (see below), the activities they support may be varied. Examples of potential events or activities might include launching a crowd-sourced data rescue project <https://eos.org/articles/award-highlights-need-to-preserve-historic-geoscience-data>, establishing a mentoring program for graduate students, hosting an outreach program at a local middle school, or buying a stall at a local farmer's market for a season to have an 'Ask the Scientist' stand.

Grants are available at two levels:

1. **Small project support of \$1,000 or less;** (Awarded strictly for reimbursement of costs incurred related to the engagement activity)
2. **Large project support up to \$10,000.** (Awarded through a combination of advance and post-project support)

Applications will be accepted and judged on a rolling basis beginning in late 2018 and continuing throughout the Centennial celebration in 2019. Small project applicants will be notified within 20 days of their award status; large-project applicants will be notified within 45 days

Full details at <https://centennial.agu.org/centennial-project-support/>

A TRIBUTE TO PROFESSOR JOHN M. A. CHAPPELL (1940 – 2018)

Kurt Lambeck

Emeritus Professor of Geophysics, Research School of Earth Sciences, Australian National University, Canberra, Australia.

John Chappell was one of Australia's outstanding scientists who had the ability to provide new insights and understanding of nearly every area of science that he explored. With his near-encyclopaedic and wide ranging knowledge he was able to contribute constructively and entertainingly to any scientific discussion from which one invariably departed with some new bit of information.

I first met John in 1977, a few years after he had written his classic 1974 paper on glacio-hydro isostasy in *Quaternary Research* (Chappell, 1974). I had been prepared to be sceptical for what could someone from a geography department contribute to a subject that required a quite high level of mathematical skills. But I was quickly dissuaded from this, primarily from his willingness to acquire these skills and demonstrate great physical insight into the nature of the Earth's response to loading by changing ice sheets and ocean volumes. He did not get it quite right but his subsequent field results from northern Australia demonstrated for the first time the important role played by the latter load in producing a spatial variability in the sea-level response during the post-glacial phase (for example, in his paper in *Marine Geology*: Chappell et al., 1982).

In subsequent years, we saw increasingly more of John in the Research School of Earth Sciences as he recognized the power of isotope analysis for establishing an absolute chronology for land-form processes, and it was only natural that he moved across to the Research School of Earth Sciences (RSES) when ANU scaled down its archaeology and pre-history section. This was of

great benefit to RSES as it opened up new fields for us and legitimized his access to the laboratory facilities. In this, like in administrative matters, he was able to demonstrate considerable incompetence without actually causing damage. For the former he got his results and in return he provided insight and wisdom. For the latter, he managed to avoid much of the mundane part of academic life. My successor as Director of RSES came to me once, shaking his head over his inability to understand John. But when I tried to assure him that there was no cause for despair, that John was the last true scholar left in the School, he must have thought that I too was beyond redemption.

John and I interacted most closely over the review paper that appeared in *Science* in 2001 (Lambeck and Chappell, 2001). I had written a first draft and when I showed it to him he was, at first, not overly happy with what I had done to his PNG Late Quaternary reef data from the Huon Peninsula (a least squares analysis of the reef age-elevations relationships for the sea level signal and the uplift rates for the different sections) (Figures 1 and 2) but then he quickly agreed. This led to one of his two most-cited papers with over 1,700 citations (his other was his 1986 Nature Paper with N. Shackleton, with over 1,900 citations (Chappell and Shackleton, 1986) and for me the pleasure of working through his field notes and discovering more than just observations.

As I said, John was one of Australia's outstanding scientists who has had immeasurable impact on subsequent Quaternary science and on the evolution of the Australian landscape, climate and biosphere;



Figure 1. John Chappell logging cores from the Huon Peninsula, PNG, where he related the pace and direction of global sea level change in the late Quaternary. (Text: Simon Haberle @thatpollenguy. Photo credit: Brad Pillans).

Figure 2. John Chappell sampling the Huon terraces, Papua New Guinea. (Photo credit: Kurt Lambeck).



both through his own work and through the influence he has had on many students. He was recognized for this with his election to the Australian Academy of Science in 1992.

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A TRIBUTE TO EMERITUS PROFESSOR JOHN CHAPPELL FAA (24 APRIL 1940 – 3 OCTOBER 2018)

Martin Williams

Adjunct Professor in Earth Sciences and Emeritus Professor, University of Adelaide, Adelaide, South Australia, Australia.

John Chappell graduated in geology from the University of Auckland with a BSc (1962) and an MSc (1965) before completing a PhD (1973) at the Australian National University. His doctoral research into the uplifted flights of coral terraces on the Huon Peninsula at the eastern tip of Papua New Guinea enabled him to reconstruct a remarkably detailed history of sea level fluctuations during the past quarter million years and attracted attention from scientists across the world.

Subsumed within this work were important insights into the nature and timing of tectonic uplift in this region and initial theoretical studies of the erosional processes responsible for creating the small valleys that dissected the reef platforms. Another major outcome was to provide a rigorous test for the astronomical theory of ice ages proposed over half a century earlier by the great Serbian mathematician Milutin Milankovitch.

John had previously conducted some arduous field investigations in PNG locating the quarry sites of prehistoric stone axes – work which led to an enduring interest in the links between prehistoric humans and their ever-changing environments, including sea level and coastal fluctuations.

John's PhD supervisors were Keith Crook and Joe Jennings, both of whom stimulated his already strong interests in sedimentology, stratigraphy and geomorphology. As a Quaternary geologist and geomorphologist, John was very soon in a league of his own, bringing to bear his expertise in Quaternary dating techniques, including radiocarbon dating, uranium-series dating, luminescence dating and cosmogenic exposure dating. This latter technique in particular he embraced with enthusiasm and applied to good effect in determining denudation rates across Australia as well as rates of soil development.

John lectured in physical geography at ANU while conducting his doctoral research in PNG. He later became Professor and sometime Head of the Department of Biogeography and Geomorphology (later renamed Division of Archaeology and Natural History) in the Research School of Pacific Studies at ANU (late 1980's-1997), before moving to the Research School of Earth Sciences as Professor of Quaternary geology and geomorphology in 1998. He retired as Emeritus Professor in the Research School of Earth Sciences in 2005, and

moved to Dunedin in the South Island, New Zealand. He was elected a Fellow of the Australian Academy of Science in 1992 and remained an active member until shortly before his death.

John's intellectual qualities were matched by his great human qualities. He was a stimulating teacher and cared deeply for the many students he supervised. Working in the field with John was enormous fun (Figure 1). He combined great rigour with humour and an endless flow of esoteric information on matters ranging from prehistoric rock art in SW France (he was himself a gifted artist) to the journals of Alfred Russel Wallace to the migratory habits of Florida alligators. He read voraciously and travelled widely, eager to discover new insights into other cultures and landscapes. He was a generous and lively host, enjoyed playing cricket and loved ocean sailing. He was a great family man. He is succeeded by his wife Helen, daughters Samantha, Anna, Gwenhyfar (Zoe) and Bridget, son Louis, and four grandchildren.

Figure 1. John in the South Island. (Photo credit: Helen Chappell).



OBITUARY FOR PATRICK QUILTY (1939 – 2018)

Nick Gales

Director, Australian Antarctic Division, Department of the Environment and Energy, Kingston, Tasmania.

Editors Note: The following tribute to Patrick Quilty is modified from a general announcement in August. A further tribute can be found at <https://www.scar.org/general-scar-news/pat-quilty>

It is with great sadness that I pass on the sad news that Professor Pat Quilty AM passed away on the 26 August 2018. Pat has been a great friend to Australian Antarctic Division (AAD) and its staff over many years. Right up to the time of his death he was still writing papers, often popping into the Division gathering information. Pat began his career with AAD in 1980, leading the Division's science program for more than 18 years, firstly as Deputy Director (Research) (1980-83), then Assistant Director (Science) (1983-1993) and finally in 1994 as Chief Scientist until his retirement in 1999.

During this time he made numerous trips 'South' with the Australian Antarctic Program including three summers in the Vestfold Hills and participated in three marine science voyages. He was active in international Antarctic leadership and served as vice-president of the peak international Antarctic science body, the Scientific Committee on Antarctic Research (SCAR) from 1994-1998. He also served as Chair of the XXth SCAR meeting in Hobart in 1988, as well as symposia on the Vestfold Hills and Macquarie Island.

At a national level, he was President of the Association of Australasian Palaeontologists, and was Federal Secretary of the Geological Society of Australia. He also served on both state and federal councils of ANZAAS. Pat convened the 17th Australian Geological Convention in Hobart in 2004, and the Mawson Symposium for the Royal Society of Tasmania in 2011.

Upon leaving the Australian Antarctic Division, Pat undertook teaching and research at the University of Tasmania for eight years. In later years, he was Honorary Research Professor at the University of Tasmania, School of Earth Sciences.

Pat's significant contribution to science was recognised throughout his career:

- Awarded Phillip Law Medal 2016
- Member of the Order of Australia (AM) 1997
- Distinguished Alumnus, UTAS 1997
- Royal Society of Tasmania Medal 1996
- United States Antarctic Services Medal 1974

Quilty Bay in the Larsemann Hills west of the Stinear Peninsula near Davis Station was named by the Australian Antarctic Names Committee in recognition of his contributions. The United States Antarctic Research Program named Quilty Nunataks, a group of nunataks extending over eight miles in West Antarctica, in recognition of his contribution as a field party geologist with their program.

In interviews Pat stated that one of his career highlights was his discovery of fossil whale and dolphin bones at Marine Plain, in the Vestfold Hills near Australia's Davis Station. It is the only site in Antarctica where fossil vertebrates have been found since the continent was glaciated 34 million years ago. This discovery earned Pat international recognition. To recognise Marine Plain's exceptional scientific interest and relevance to the palaeoecological and palaeoclimatic record of Antarctica, the Antarctic Treaty Committee designated the site an Antarctic Special Protected Area (ASPA).

Pat was a friend to many and will be greatly missed.

PALAEOCLIMATE PERSPECTIVES FROM THE SILK ROAD: A FIELD CAMPAIGN IN SOUTHERN TAJIKISTAN

Kathryn E. Fitzsimmons^a, Aditi K. Dave^a, Alexandra Engström Johansson^a, Laurent Marquer^a, Charlotte Prud'homme^a, Giancarlo Scardia^b, Nosir Safaraliev^c

a Research Group for Terrestrial Palaeoclimates, Max Planck Institute for Chemistry, Mainz, Germany.

b Instituto de Geociências e Ciências Exatas, Universidade Estadual Paulista (UNESP), Rio Claro, Brazil.

c Department of Geology, Tajik National University, Dushanbe, Tajikistan.

The impact of an increasingly unpredictable future climate on our landscapes – the land on which we grow our food, our water supplies, our ecosystems – is even less well understood than our models for future climate themselves. One thing we as scientists can agree on is that conditions in marginal regions, such as the edges of deserts, will become increasingly unstable and unable to support human populations (IPCC, 2018). Since deserts occupy some 50% of the world's land masses and host 40% of the world's people, this increasing instability will become a major concern for the future (Huang et al., 2016). Our research group at the Max Planck Institute for Chemistry focusses on improving our understanding of climate dynamics along the desert margins of Central Asia – the core of the Silk Road – by generating high resolution quantitative, long-term palaeoclimate records underpinned by robust age models, and supported by an improved understanding of terrestrial geomorphic processes linking sediment characteristics with climatic influence.

Our work focusses largely on wind-blown dust, or loess. Long sequences of primary loess and buried soils blanket the semi-arid mountain piedmonts of Central Asia and reflect responses to past climatic change over at least the last million years (Ding et al., 2002). Central Asia

and its extensive loess deposits are notably sensitive to the interplay between the powerful climatic drivers; the north Atlantic westerlies, the polar front and the Asian monsoon (Fitzsimmons et al., 2018; Machalett et al., 2008). Ongoing uplift of the Asian high mountains (the Himalaya, Pamirs and Tien Shan, among others) has affected the climate of the central Asian basins to the north through time, driving aridification and continentality (Caves et al., 2016). Evidence of these changing conditions and interacting influences is preserved in the loess sediments (Figure 1).

This year we undertook an ambitious campaign to continuously sample the >100 m thick package of alternating loess-paleosols at Karamaidan, nestled in the foothills of the Pamir mountains in southern Tajikistan (Figure 1). This six-week expedition – a cooperation with the Tajik National University in the capital Dushanbe – involved 17 scientists from 10 nationalities, one professional mountaineer, numerous local support staff – and started after the Ramadan feast of Id, conveniently in the hottest, dustiest time of year (generally temperatures exceeded 40°C!). Luckily summer is also the time of the ripest apricots, melons and peaches, of which we devoured enormous volumes!

The Karamaidan loess profile was created by a series of landslides triggered by several shallow, magnitude >5.7 earthquakes in the area in 1930 and 1943. The entire profile is exposed as vertical cliffs forming a north-south arc approximately 500 m wide (Figure 2). Given the >100 m thickness of the sequence, this means that sampling could only be undertaken by abseil (hence the need for a professional mountaineer! Safety first! Figures 3, 4). The complete profile is best exposed at the northern end, with the upper parts best preserved at the southern end; these can be visibly correlated across the entire cliff. We therefore decided upon four partially overlapping subsections for sampling, which would target the local zones of highest accumulation rates and therefore improve the temporal resolution of our record.

Figure 1. (Left) Climatic context of continental Central Asia, showing the three main sites we are working on. Karamaidan is the westernmost site, located in the piedmont of the Pamir mountains in Tajikistan. (Right) The >100 m thick package of sediments at Karamaidan preserves stacked cycles of primary loess and buried soils on interglacial-glacial timescales. (Photo credit: Kathryn Fitzsimmons).

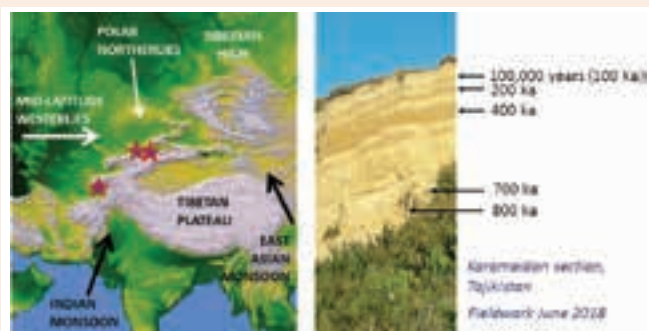




Figure 2. A happy crew at the end of five weeks of fieldwork at Karamaidan; the main sequence can be seen in the background. (Photo credit: Maike Nowatzki.)

Figure 3. Geochronology PhD student Aditi Dave getting dusty at 64 m on the ropes. (Photo credit: Kathryn Fitzsimmons).



Figure 4. Palaeoecologist Laurent Marquer and geochemistry PhD student Alexandra Engström Johansson discussing where to sample. The fields and forest lie some 100 m below. (Photo credit: Kathryn Fitzsimmons).

Figure 5. Some tourism at the golden arch of Ismail Somoni, the Emir credited with unifying the Tajiks just over one thousand years ago. (Photo credit: Maike Nowatzki).



Tajikistan is a nation rather fond of bureaucracy, as we found, and therefore we had a week or so in the pleasant little capital city, Dushanbe, to undertake some tourism (Figure 5). At least, some of the team did! Those of us on the organisational side of things were busy obtaining permits, stocking up on camp food and equipment (which involves bargaining even for the smallest quantity of salt or gas bottles!), and partaking of Tajik hospitality with the various university rectors, directors, secretaries and students whom it is necessary to know in order to work in this country. Hospitality is a serious business in Tajikistan, and a matter of particular national pride in which its inhabitants excel (I lost count of the number of pots of “tea” involved...).

Eventually, however, a convoy of Lada Nivas and one truck (overloaded with melons and climbing rope) made its way up the Rasht valley eastwards of Dushanbe. The usual road was closed due to recent landslides – somewhat of a hazard in this tectonically active, loess-dominated region – and the alternative route was, to put it mildly, a bit rough. At several points we needed to get out of the vehicles and offload some of the cargo in order to get up a particularly tricky slope or across a gully; not that this worried us too much, since mulberries were in season and we were able to snack from the trees while we waited. Nevertheless I think we were all relieved to make it to our campsite at the bottom of the cliff, in the orchard of a local family. Animated discussions then ensued as to who would get the shadiest spot; those who got the shade were later rewarded by pears and walnuts randomly dropping onto their tents of a night time.

The next morning we were faced with the not insubstantial task of actually getting to the top and bottom of the cliff. Loess soils are particularly nutritious and their indigenous vegetation dense (some might even say impenetrable) and populated with stinging plants, wasps, and snakes... Our first task, therefore, was to clear paths through this jungle while avoiding such hazards. After this came the momentous occasion of fixing the ropes for the abseils, followed by the popular job of cleaning back the profiles to ensure no contamination of our samples by recently redeposited dust and mud.

Finally, after spending some days to log the stratigraphic sequences in detail and measure magnetic susceptibility *in situ*, sampling began in earnest. The aim was to collect continuous columns of samples down the partially overlapping sections. Bulk samples collected at 10 cm resolution will be analysed for lipid and bacterial biomarkers, grain size and palaeomagnetism, pollen and phytolith assemblages, and stable isotope analyses of earthworm calcite granules (Prud'homme et al., 2016; 2018). These proxies will give us quantitative information

about past climate parameters, and will be placed within a chronological framework using luminescence, electron spin resonance, radiocarbon and palaeomagnetic dating, collected at 50 cm frequency.

Following our 6 week campaign we returned with over 700 kg of samples packed into custom-made wooden chests (the price for which was, naturally, negotiated at the bazaar), along with optimism about generating some fantastic science. Watch this space for some exciting new discoveries about Eurasian climate dynamics!

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INTERNATIONAL TEPHRA CONFERENCE “CROSSING NEW FRONTIERS: TEPHRA HUNT IN TRANSYLVANIA”, 24 JUNE – 1 JULY, 2018, MOIECIU DE SUS, ROMANIA

David J. Lowe

School of Science (Earth Sciences), University of Waikato, Hamilton, New Zealand.

The International Focus Group on Tephrochronology and Volcanism (INTAV) held an international tephra conference, “Crossing New Frontiers: Tephra Hunt in Transylvania”, at the spectacular mountain resort ‘Cheile Gradistei’ Fundata near Moieciu de Sus (Fig. 1), about 30 km southwest of the regional city of Braşov, in the southern Carpathian Mountains of Transylvania, Romania, from 24 June to 1 July, 2018. INTAV (which has operated previously under various names including COT, SCOTAV, and ICCT) is a global tephra research group active within the Stratigraphy and Chronology Commission (SACCOM) of INQUA since its initiation in 1961 (Kobayshi, 1965; Westgate and Gold, 1974; Lowe et al., 2011). It organises specialist tephra meetings every four years or so on average, although the most recent meeting (before this one in Romania) was held in 2010 in Kirishima, Japan (Holt and Lowe, 2010). The Romanian tephra meeting was convened by Daniel Veres (Romania) and Ulrich Hambach (Germany), together with support from the INTAV executive committee of Britta Jensen (Canada), Peter Abbott (UK/Switzerland), Takehiko Suzuki (Japan), Siwan Davies (UK), and David Lowe (New Zealand).



Figure 1. View of spectacular landscape encompassing the conference venue, ‘Cheile Gradistei’ Fundata, which is near the village of Moieciu de Sus in the southern Carpathian Mountains in Transylvania.

(Photo credit: all photos by David Lowe unless stated)

Figure 2. Participants eagerly awaiting a keynote talk.



By all measures, the conference must be judged a tremendous success, helping to advance most of the objectives of INTAV's underpinning EXTRAS project (*EXTending tephRAS as a global geoscientific research tool stratigraphically, spatially, analytically, and temporally*), and allowing insight into much of the really excellent research being undertaken in Romania and nearby countries.

As well, the special venue and the way the conference programme was constructed provided great opportunities for discussion, networking, and interactions between the wide range of participating researchers. Not least, the conference was a success because of the warmth, friendliness, and helpfulness of the hosts at the venue and during the field trips: no stone was left unturned by Daniel Veres and Ulrich Hambach, and their friendly student and postdoctoral helpers, to ensure that all participants felt welcome and well looked after for their entire stay in Romania.

The conference also featured, notably, strong contributions in volcanology as well as many papers representing the explosion of research on cryptotephra in a range of environmental settings, and on new methods for detecting and analysing them including the use of X-ray fluorescence core scanners (such as ITRAX) and computed tomography (CT) imaging, new methods for analysis including trace element mapping of small glass shards using multiple line scans with LA-ICP-MS, new dating applications, and a number of novel applications of tephra deposits that are best described as 'beyond isochrons' in the words of Dugmore and Newton (2012).

The meeting involved 92 participants (Fig. 2) – a record number for an INTAV meeting – from 20 countries (76 participated in the Kirishima meeting in 2010). The greatest numbers were from the UK (24), Germany (14), Romania (7) and the USA (5) with up to four representatives from each of Denmark, Russia, Norway, Sweden, Canada, Italy, Switzerland, Turkey, Japan, China, Poland, Serbia, Hungary, Singapore, Iceland, and New Zealand. The total included 22 students, with 17 of these undertaking PhDs. On the basis of these participatory figures, and ignoring many other factors such as travel distances, it is indeed interesting to reflect that (crypto) tephra studies are so very strong in the UK especially.

Figure 3. Participants in front of columnar basalt in the Perșani volcanic field (active from 1.2-0.6 Ma) in the southern Carpathians during the mid-conference field trip. (Photo credit: Pierre Oesterle).



The interest in general in such studies is shown by the remarkable increase of published papers on cryptotephra in the past decade (Lane et al., 2017).

Participants were treated to 94 stimulating papers, including 41 oral papers in seven sessions and 53 poster papers presented in three sessions. All the poster papers remained on display for the entire conference so they could be viewed at times other than during the dedicated sessions. Seven outstanding invited keynote presentations were made, one in each oral session, by Sabine Wulf (UK), Michael Sigl (Switzerland), David Karátson (Hungary), Caroline Bouvet de la Maisonneuve (Singapore), Maarten Blaauw (UK), John Westgate (Canada), and Vera Ponomareva (Russia). A special evening lecture was given by Ioan ('Nino') Seghedi (Romania) entitled "Geological and volcanological outline of the Carpathian-Pannonian region with emphasis on the Romanian territory", which summarised the complex regional geological setting and very active tectonism as well as local volcanism in the southern Carpathians. The presentation helped to set the scene for the one-day mid-conference field excursion in the region (and the later post-conference excursion). The mid-conference trip was led by Ioan Seghedi, Daniel Veres, and Ulrich Hambach (Seghedi et al., 2018) and included a visit to the basaltic Perşani volcanic field (Figs. 3 and 4) and a very popular viewing of Dracula's castle in Bran at the end of the day (Fig. 5).

The conference abstract volume is available at the conference website (Hambach and Ulrich, 2018). Many papers arising from the conference are to be assembled into a special tephrochronology volume of *Quaternary International* (in preparation).

The conference was supported financially and in kind by a number of sponsors (all listed in the programme and abstracts volume and on the conference website) and an INQUA grant (1710P) of €4600 obtained by INTAV through SACCOM (supported by commission president, Mauro Coltorti). The INQUA grant was used to help 18



From top:

Figure 4. A New Zealand connection: small group photographed in the Perşani volcanic field who have worked, or are working, in New Zealand. From left: Leonie Peti (University of Auckland), Maria Gehrels (York University), Ola (Aleksandra) Zawalna-Geer (University of Exeter), David Lowe (University of Waikato), and Jenni Hopkins (Victoria University of Wellington).

Figure 5. Bran (Dracula) Castle, Transylvania, visited during the mid-conference excursion. Not far from the conference venue, the castle in Bran was completed in 1388 AD.

Figure 6. Ten of the 18 happy ECR and student recipients of INQUA travel grants.





Figure 7. Maarten Blaauw (right) leading the age-modelling workshop for around 25 participants.



Figure 8. The winners and runners-up for best student oral and poster papers. From left, Jayde Hirniak, Jennifer Saxby, Hannah Buckland, and Ali Monteath.

Figure 9. Esther Ruth Gudmundsdottir (Iceland) receiving the INTAV Honorary Life Member certificate on behalf of Gudrun Larsen (Iceland) from INTAV president Takehiko Suzuki.



early career researchers (ECRs) and students to travel to the meeting (Fig. 6). Most were from within Europe (14) but four travelled from beyond Europe including several from as far away as New Zealand.

Another feature of the conference was an excellent Bayesian-based age modelling workshop (Fig. 7) led by Maarten Blaauw (UK) following his insightful keynote paper, “More dates and use Bayes – recommendations for robust age-depth models”. Maarten’s presentation is available on the conference website. Steve Kuehn (USA) reported on progress on the development of the INTAV global database project and provided new updated protocol sheets for evaluation by tephra community in the next few months.

Four students were awarded certificates and cash prizes (sponsored by the University of Waikato, New Zealand) for first and second places in poster and oral presentations (Fig. 8). As noted by the judges, the standards of

presentation were uniformly high throughout the conference and so their job was a difficult one.

A number of awards were presented at the conference dinner, which also featured traditional Romanian dancing and music. Two INTAV Honorary Life Memberships were awarded to Gudrun Larsen (Iceland) (the award was received on Gudrun's behalf by her colleague Esther Ruth Gudmundsdottir; Fig. 9) and to (a surprised) David Lowe (New Zealand). Their achievements in tephrochronology were described in brief by Andrew Dugmore (UK) and Peter Abbott, respectively. Only 14 such awards have been made internationally since they were instigated formally about 20 years ago by INTAV. John Westgate (Canada) was awarded, to universal acclaim, a special framed certificate to mark the 50th anniversary of the publication of his pathfinding paper (with the late D.G.W. Smith) in 1969 on the use of the electron probe to characterise glass shards in tephra to enable them to be correlated over long distances (Figs. 10 and 11) (Smith and Westgate, 1969). The venue hosts also baked a commemorative chocolate layer-cake to mark the occasion (Fig. 10).

On the last day of the conference, a business meeting was held by the executive of INTAV at which the future of INTAV as a global tephra community was discussed, including possible roles in INQUA and IAVCEI or as a stand-alone organisation (see Lowe et al., 2018, pp.3-4). The forthcoming INQUA congress in Dublin (2019) was also noted, in which four sessions relating to tephrochronology are currently open for abstracts.

The conference was followed by a compelling three-day post-conference field trip involving 32 participants. It was led by David Karátson, Daniel Veres, and Ulrich Hambach (Karátson et al., 2018) along with student/ECR helpers. The excursion, which ended in Bucharest, included a visit to a huge and impressive underground salt mine at Slănic; proximal rhyolitic and dacitic tephra deposits, domes, and craters; the mountainous impacts of dynamic and complex tectonism; beautiful monasteries, churches, walls and castles and other buildings from Romania's rich history; loess encompassing distal tephra and paleosols on the Wallachian plains (Figs. 12 and 13); landsliding landscapes; and spectacular mud volcanoes (Fig. 14).



Above from top:

Figure 10. Certificate and special chocolate (layer) cake prepared to commemorate the 50th anniversary of the publication of John Westgate's pioneering paper (with D.G.W. Smith) in 1969. From left, Takehiko Suzuki, Cora and John Westgate, Britta Jensen, Peter Abbott, and David Lowe.

Figure 11. The special commemorative certificate presented to John Westgate (to learn more about John's extensive and pathfinding contributions to tephrochronology, see Froese et al., 2008). The SEM images of glass shards (provided by Britta Jensen) represent the North American tephra that John analysed in undertaking his seminal research.

Opposite from top:

Figure 12. Loess section supporting Mollisols on the Wallachian plains in southeast Romania alongside the Buzău River. At the base is a thick distal tephra (~0.5 m), the Y5 tephra (Fig. 11) associated with the Campanian Ignimbrite eruption c. 39-40 ka in the Campi Flegrei field, Italy.

Figure 13. The darker-tinted Y5 tephra, about 0.6 m thick, seen here alongside Dan Veres.

Figure 14. Top of a mud volcano in a natural reserve at Berca belching mainly methane derived from deposits ~3 km below. In the background are hills that have been subject to very fast rates of mass movement (landsliding).



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AN OVERVIEW OF THE FINAL SHEMAX MEETING, NORTH STRADBROKE ISLAND, QUEENSLAND, 28-30 JUNE, 2018

Daniel Ellerton

School of Earth and Environmental Science, University of Queensland, St Lucia Campus, Queensland.

The 28-30 of June saw the final meeting of the Last Glacial Maximum in the Southern Hemisphere (SHeMax) workshop with 30 participants descending on the beautiful North Stradbroke Island. (Figure 1). SHeMax is an INQUA funded project group with the specific aim to investigate the timing and nature of the Last Glacial Maximum in the Southern Hemisphere. Now in the final year of the project, SHeMax has followed on from the outputs of the SHAPE and INTIMATE projects, focusing on understanding climatic variability across the Southern Hemisphere by synthesising the available records and model outputs.

The aim of the workshop was to summarise the current state of knowledge by synthesising recent proxy data recorded in terrestrial records across a myriad of palaeoclimate settings between the period of 35-15 kyr BP. With this summary in place, a series of key regional syntheses were developed to determine what progress has been made over the past year and what gaps still exist in the state of knowledge. Several key papers were identified, as well as a SHeMax session at the 2019 INQUA congress meeting in Dublin.

SHeMax 2018 was held at the Moreton Bay Research Station operated by the University of Queensland on North Stradbroke Island, (Figure 2).

This proved to be an excellent choice of venue as Stradbroke Island has produced several key records investigating palaeoclimate variability in south eastern Queensland (Moss et al., 2013; Petherick et al., 2013; Petherick et al., 2008). Attendees from all over were attracted to the workshop including Australia, New Zealand, China and South Africa. Such a mix of participants, both in nationality and research interests, ensured that discussions were varied and covered several aspects of palaeoclimate research in the Southern Hemisphere. Several of the participants this year were undergraduate, post-graduate or early career researchers which is promising for the future of palaeoclimate research! The workshop was organised and run by three of the SHeMax committee members, Jamie Shulmeister, Lynda Petherick and Jasper Knight. Jasper was unable to attend this year but Jennifer Fitchett, University of the Witwatersrand, was able to represent the South African contingent in his stead.



Above:

Figure 1. Beautiful Stradbroke Island

Opposite from top:

Figure 2. Morton Bay Research Station at Sunrise

Figure 3. Tortoise Lagoon, North Stradbroke Island

(Photo credit: All photos Lynda Petherick)



On the first day of the workshop, the morning and afternoon sessions were dedicated to LGM records from Australia and South Africa. This was followed by the evening session which discussed new approaches and techniques which can be used to investigate the LGM across the Southern Hemisphere. The morning of the second day started off with regional summaries across South Africa, New Zealand and Australia. The talks were then followed by a series of workshops that focused on the timing and persistence of the LGM, the climatology of the Southern Hemisphere LGM and a summary of progress made and an outline of new targets to come. Some key points from the talks on the first day include:

DAY 1 SESSION 1: AUSTRALIAN RECORDS OF THE LGM

- An 80,000 year record from Welsby Lagoon that shows a progressive change from a lacustrine to palustrine system after ca. 40 ka (Haidee Cadd)
- Evidence of large scale mass movements along the New England Tablelands triggered by saturated conditions during the early to mid-Last Glacial Cycle indicative of high amounts of snowfall (Adrian Slee)
- A new function to describe the relationship of channel bank full discharge (Q_{bf}) to channel width and applying it to dated palaeochannels in the Murray-Darling Basin (MDB). In the southern MDB, temperature (e.g. seasonal snow melt, enhanced orographic rainfall and CO₂ /vegetation feedbacks) appears to be driving increased Q_{bf} while the northern MDB needs an additional mechanism, potentially increased tropical rainfall (Paul Hesse)
- A new understanding of local and regional variability during the LGM from crater lake pollen records in north eastern and south eastern Australia that can assist in the identification or refinement of climate forcing's across eastern Australia (Peter Kershaw)
- A new quantitative pollen database used to reconstruct Australia's palaeoclimate between 36-18 ka using pollen collected across the continent along with an update and standardisation of most age models used. The general trends suggest two phases of the LGM in the Southern Hemisphere but more data will be required from areas that are poorly represented (Annika Herbert)

DAY 1 SESSION 2: AUSTRALIAN AND SOUTH AFRICAN RECORDS OF THE LGM

- New developments in proxy record interpretation using continuous palaeoclimate reconstructions to determine water availability in South Africa during the LGM. Proxy records include isotopes, pollen, diatoms and fossil rodents which are used to reconstruct precipitation seasonality in southern Africa (Jennifer Fitchett)

- A new fossil pollen record recovered from a stalagmite from Mammoth Cave, Western Australia. The record suggests a transition from *Eucalyptus* forest to treeless, shrub dominated communities at ~28 ka. Treeless communities were maintained until 18 ka when *Eucalyptus* recolonised as temperature and CO₂ began to increase. Two distinct palaeoenvironments were distinguished during the extended LGM suggesting an early cold/moist LGM and a cold/dry late LGM (Kale Sniderman)
- The stratigraphical interpretation of Maynes Junction, Tasmania that shows alternating layers of aeolian and colluvial deposition interspersed with palaeosol development. The upper Aeolian layer (19.6 ka) suggests a windy and dry period during the late LGM. The underlying palaeosol suggests the period preceding this was relatively wet indicating an abrupt transition around 19.6 ka. Two more aeolian layers dated to 31.6 ka and 90.2 ka suggest dry windy periods spanning 32-23 ka and MIS 5c across southern Tasmania (Peter McIntosh)
- A continuous, multi-proxy record of local vegetation from northeast Tasmania was presented. Evidence suggests dry and cold LGM marked by an increase in spineless Asteraceae and a transition from peats to inorganic clays (Amirah Farrel)
- Two new speleothem records from the Flinders Ranges along the transition between tropical and mid-latitude rainfall systems. The Mairs Cave record spans 23-15 ka and suggests relatively wet conditions that peaked between 19-16 ka, followed by an abrupt shift to drier conditions following 16 ka (Pauline Treble)
- A new interpretation of two established sites within Tasmania, Hazards Lagoon and Lake Selina, to understand the nature of the southern westerly winds during the LGM (Michael-Shawn Fletcher)

DAY 1 SESSION 3: NEW APPROACHES FOR LOOKING AT THE LGM

- Quantifying past summer temperatures using a transfer function model based on chironomid head capsules from lake sediments. Two records were presented, Welsby Lagoon and Tiancai Lake (Southwestern China) with the latter suggesting rapid post-glacial temperature recovery caused by changes to adiabatic lapse rates (Jie Chang)
- The application of branched glycerol dialkyl glycerol tetraethers (brGDGT) derived from lake sediments to develop past temperature reconstructions. A brGDGT temperature record from Fraser Island, eastern Australia suggests a temperature depression during the LGM, similar to that recorded by a chironomid-based transfer function (~2-4°C) (Jie Chang)

- The application of isotopic tools to groundwater held within regional aquifers to investigate recharge intensity, recharge source and past climatic conditions. Groundwater systems within the Perth Basin (Western Australia) were investigated to produce a ~40 ka low resolution record of recharge signals for Western Australia. Stable isotope data suggests that ground water is recharged from large (>150 mm) rainfall events. Shifts in the isotopic signal of $\delta^{18}\text{O}$ were observed over the past 40 ka and were compared with regional rainfall and speleothem records (Stacey Priestly)
- The application of cosmogenic ^{14}C , ^{10}Be , and ^{26}Al to explore sediment dynamics between source and sink areas in the Murray Darling and Lake Eyre basins. Downstream changes in the ratios of these radionuclides were used to quantify sediment mixing and storage times. The ^{10}Be , and ^{26}Al ratios suggest a significant burial signal while ^{14}C suggests a more complex burial/exposure history. These geochemical proxies can help identify palaeo-climate driven sediment sources at the outlet of the MDB (Reka Fülöp)

DAY 2

In addition to the talks presented by the attendees, Jamie Shulmeister, Lynda Petherick and Jennifer Fitchett provided regional summaries for Australia, New Zealand, South America and South Africa. On the first day, Jamie presented a breakdown of the progress made in eastern Australia as well as some work on glaciation within New Zealand. His summary of recent work investigating the LGM in eastern Australia suggests two distinct phases of the LGM with an arbitrary division centred around 26 ka. The early period is characterised by cool to cold conditions that were relatively moist, with increased flow in the south eastern rivers. This was followed by, on average, drier conditions during the latter part of the LGM. Temperature reconstructions suggest increased seasonality with a maximum of 8-10°C cooling in winter and ~6°C in summer. Towards the termination of the LGM, conditions were less arid along the Great Dividing Range evidenced by the persistence of rainforest within south east Queensland, northern New South Wales and eastern Tasmania. To the west arid conditions prevailed except along river corridors, with rivers flowing from the range having higher capacities than modern.

In New Zealand, recent work suggests that the latitude of maximum glacial extent changed over the last glacial cycle. This can be explained by a shift in the surface westerlies which migrated 2-3° north to 43°S during the early phase of the LGM. During the later phase of the LGM it appears that the westerlies moved southward to about 46°S. These observations are in-line with the

Australian pattern; with the period 35-26 ka characterised by cool but moist conditions, followed by colder and drier conditions during the “global” LGM from 26-19 ka.

The remainder of the second day focused on discussion, including gaps in the state of the knowledge that still exist, chronological control and a more thorough understanding of how we interpret proxy data. An interesting discussion arose from this about spineless Asteraceae (*Tubuliflorides pleistocenicus*) and Poaceae and what they actually mean in pollen records. For example, the traditional view that the now extinct spineless Asteraceae reflects very cold and arid conditions could potentially be reinterpreted to represent cold but moist conditions. There was also talk about applying previous work conducted by Jennifer Fitchett in South Africa to Australia. Jennifer’s work involved developing seasonality records using the ratio of Asteraceae and Poaceae and several attendees were excited about applying this to Australia. Another interesting discussion followed this about the relationship between CO_2 and vegetation and how that could be influencing our interpretations of pollen records.

The theme of reinterpreting our records continued for the rest of the day with the discussion focussing heavily on chronological control of old and new records, as well as the development of a chronostratigraphic framework for Australia, similar to what has been developed in New Zealand. The idea behind this is to develop a framework to be able to identify synchronous periods of climate change across Australia during the extended LGM. However, from this discussion a new problem arose; how can we reconcile records when we only have a limited number that cover the entire LGM, use a variety of different proxies between records and use different dating techniques and calibrations? To solve this, several members volunteered their time and effort to work towards a new paper that aims to make Australian records more comparable by remodelling and recalculating ages and considering the age uncertainties on each record. It is fantastic to see how eager the community is to improve our understanding of the LGM and the outcomes of this work is highly anticipated.

The day closed with discussions about the INQUA Congress in Dublin next year and what key outputs from the project will be coming. SHeMax will have a session at INQUA and we invite any contribution related to the timing and nature of environmental and climatic variability during the termination of the Last Glacial Cycle (35-15 ka) across the Southern Hemisphere. There is also a special edition in the works and again encourage anyone to submit to this. More information on this will be coming soon.

Following the dating paper mentioned above, attendees decided that at least three more key papers should be produced. The proposed papers are:

- An investigation of the role that seasonality plays on hydroclimate variability
- A paper on the climate event stratigraphy for Australia, to identify periods of synchronous change
- An anthropology/archaeology focused paper looking at human history during the LGM. This work would also have the potential of an indigenous collaboration

After a long day of talks and workshopping, the second day concluded with a trip to the local pub for some much-needed refreshment. A lot of great science was presented over the course of the workshop, but it is apparent that there is still much work to do. Despite this, the eagerness of the attendees to accomplish the new goals set and the new collaborations that were set up really shows how fantastic the SHeMax and AQUA communities are. With INQUA next year and some key papers on the way, 2019 will be an exciting year!

DAY 3

On the last day of the workshop the attendees embarked on a field trip around Stradbroke Island to visit some of the key palaeoecological sites on the island. The day started off with a trip to Blue Lake and Tortoise Lagoon (Figure 3).

At Blue Lake, which is an example of a “window” lake, we discussed the local hydrology of the sand island and how the lakes water level has remained remarkably constant over the past 7,000 years (Barr et al., 2013). The group then visited Tortoise Lagoon, the key site of committee member Lynda Petherick’s PhD thesis. Here we discussed the palaeoclimatic variability of the site over the past ~40,000 years and how that compares to recent work from other key sites on the Island. This was followed by a stop at Brown Lake, an example of a perched lake system on North Stradbroke Island. Again we discussed the hydrology of the Island and how these amazing lake systems form. For our final stop, we visited a small sand quarry that provides a unique insight into the stratigraphy of the Island, as it was one of the only exposures present. Here we discussed the chronology, formation and evolution of the sand islands of south east Queensland as well as the spectacular soil development that they are known for. With that SHeMax 2018 was done. We boarded the barge once again and returned to the mainland for our journeys home.

Overall the workshop was a fantastic success. As a current PhD student it was amazing to be able to have discussions with the big hitters in the community from South Africa, New Zealand and Australia, as well as a mix of senior and early career researchers. It was equally great to share a drink and get to know everyone a little better. There are now new, clear and achievable outcomes for the project and we are well prepared for AQUA at the end of this year, followed by INQUA next year. The future of palaeoclimate research in the Southern Hemisphere is going to be an exciting one! For further details about the SHeMax project or the INQUA session next year please contact Lynda Petherick (lynda.petherick@vuw.ac.nz).

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5TH SOUTHERN DESERTS CONFERENCE, KARRATHA, WESTERN AUSTRALIA, 7 – 10 AUGUST 2018

Martin Williams

Adjunct Professor in Earth Sciences and Emeritus Professor, University of Adelaide, Adelaide, South Australia, Australia.

Dr Mike Smith, renowned for his work on the prehistory of arid Australia, had the honour of launching the first Southern Deserts Conference (SDC) in Canberra, Australia in 2003. It was a dramatic occasion, with Canberra ringed by bushfires, and charred gum leaves blowing into the conference venue at the National Museum. The aim was to foster comparative studies of the Quaternary evolution of desert landscapes and peoples from a Southern Hemisphere perspective, embracing South America, Africa and Oceania. The 2nd SDC was held in Arica (Chile) in 2005; the 3rd SDC in the Kalahari (Southern Africa) in 2008; the 4th SDC near Mendoza in northern Patagonia (Argentina) in November 2014; and the 5th (and latest) SDC in Karratha, Western Australia in August 2018.

The conference venue was in the spectacular Red Ochre Arts Precinct and was preceded by an enlightening and very moving World Heritage Summit in which we learned of the long, hard road to attaining World Heritage status. Renowned West Australian author Tim Winton spoke eloquently by video link in his role as patron of the Murujuga, Dampier World Heritage proposal.

In harmony with the grandeur of the Pilbara landscape, the theme of the Karratha conference was equally grandiose: “Adapting to arid landscapes: Developing new narratives of environmental change and human-environmental relationships within the great deserts of the Southern Hemisphere.” Whether we achieved that goal is moot, but we had a good try, and much fun in the attempt. Brilliant plenary talks by Rebecca Bliege Bird on the role of fire in maintaining ecological communities in desert Australia; by Tim Cohen on late Quaternary ‘aridification’ in the ‘dead heart’ of Australia; and by Dave Tomas on whether the Kalahari Desert interior was ever indeed empty during prehistoric times provided food for thought and later discussion during the excellent lunches and dinners provided at the venue. With perhaps a couple of exceptions, every talk was relevant, well prepared and capably delivered, with prizes going to two of the student members for their outstanding presentations (Figure 1).

The one day mid-conference trip to see the rock art on the Burrup Peninsula, led by young Aboriginal rangers, culminated in a memorable dinner at the Dampier Yacht Club, with wonderful vistas of the setting sun. I was not able to join the post-conference field trips, but my South American friends tell me that the landscape and sites visited were among the most memorable they had seen, especially the great waterholes in the gorges, veritable oases in the desert.

Our warmest thanks go to the intrepid, patient and ever-smiling organising committee: Lucia Clayton, Wendy Reynen, Sam Harper, Paul Hesse, Jo McDonald, Peter Veth, Ramiro Barberena and Al Paterson. A great conference, informative, stimulating and enjoyable. The 6th SDC is scheduled for 2020 in Namibia, to be organised by SDC stalwarts Jill and John Kinahan.



Figure 1. Dave Thomas (Oxford) asking another tricky question at the 5th Southern Deserts Conference, Karratha, WA, August 2018. (Photo credit: Martin Williams).

NILE VALLEY WORKSHOP, PARIS, 31 MAY – 2 JUNE 2018

Martin Williams

Adjunct Professor in Earth Sciences and Emeritus Professor, University of Adelaide, Adelaide, South Australia, Australia.

The Quaternary Period was a time of rapid climatic changes; as reflected in the waxing and waning of continental ice sheets and associated fluctuations in global sea level. It was also the time when ancestral humans first made stone tools in the Afar Rift of Ethiopia some 2.5 Ma ago, with *Homo sapiens* emerging much later, and eventually moving out of Africa to occupy every continent except Antarctica. The ‘Out of Africa’ saga has aroused the interest of archaeologists, geneticists, and earth scientists from across the globe. The Nile Valley has always played a pivotal role in the wider story, prompting us to ask when and how it might have acted as a conduit for migration from tropical Africa into Eurasia.

Within this context, three prehistoric archaeologists (Drs Alice Leplongeon and David Pleurdeau from Paris and Dr Mae Goder-Goldberger from Israel) organised an invited workshop in the National Museum of Natural History in Paris during late May-early June 2018 with the title: “Not just a corridor – Human occupation of the Nile Valley and neighbouring regions between 75,000 and 15,000 years ago”

The rationale for the workshop was as follows. The end of the Pleistocene (ca. 75-15 ka) is a key period for Nile Valley prehistory. The global shift to more arid conditions regionally led to expansion of the Sahara, lowering of sea level and desiccation of some major East African lakes. These changes had important consequences for the Nile, including its role as an ecological refuge area, and on human populations living in its vicinity. During this period, genetic studies suggest that several dispersals of modern humans ‘out-of’ and ‘back-into’ Africa took place. Although the Nile Valley constitutes one of the possible routes for these dispersals, archaeological evidence for contacts between the Nile Valley and its neighbouring regions remains scarce and debated. The three-day workshop was designed to bring together leading authorities in all fields (archaeology, geology, palaeo-environments, zoo-archaeology, genetics, and palaeoanthropology) relating to the prehistory of NE Africa and neighbouring regions (Figure 1). This it did with considerable success and panache, aided by lively lunches and invigorating dinners. We discussed a range of topics, including human responses to changes in their environment, human occupation of the Nile Valley and adjacent deserts in Sinai, the Levant and North Africa, as

Figure 1. Group photo of participants at the Paris Nile workshop, Martin Williams on the far right talking to the group. (Photo credit Martin Williams).



well as the role of NE Africa in modern human dispersals. The outcome of the workshop will be published soon in a refereed volume to be published by CNRS (Figure 2).

One of the highlights for me was the one day visit to the Musée de l'Homme, during which we examined the original stone tool collections from across this vast region (Figure 3), and paid our respects to the Neanderthal skeletons from the SW of France. They reminded me eerily of the second row forwards in the French rugby team, also mostly from the SW of France!

Below:

Figure 2. Final day at the Paris Nile workshop. Martin Williams summing up. (Photo credit Martin Williams).

Bottom:

Figure 3. Drs Maxine Kleindienst (Canada) and Elena Garcia (Italy) examining the original stone artefact collections from the Nile Valley at the Paris Nile workshop in May-June 2018. (Photo credit Martin Williams).



The Nile Basin: Quaternary Geology, Geomorphology and Prehistoric Environments

Martin Williams

Cambridge University Press, December 2018, 420 pages, ISBN: 978-1-107-17919-6, Hardback: c. £89.99 / c. \$140.00

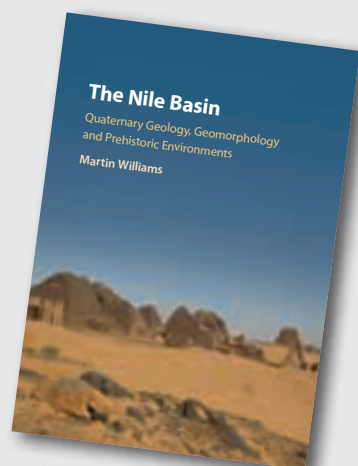
Earth Sciences, University of Adelaide.

The Nile Basin contains a record of human activities spanning the last million years. However, the interactions between prehistoric humans and environmental changes in this area are complex and often poorly understood.

This comprehensive book explains in clear, non-technical terms how prehistoric environments can be reconstructed, with examples drawn from every part of the Nile Basin. Adopting a source-to-sink approach, the book integrates events in the Nile headwaters with the record from marine sediment cores in the Nile Delta and offshore. It provides a detailed record of past environmental changes throughout the Nile Basin and concludes with a review of the causes and consequences of plant and animal domestication in this region and of the various prehistoric migrations out of Africa into Eurasia and beyond. A comprehensive overview, this book is ideal for researchers in geomorphology, climatology and archaeology.

A thorough understanding of events in the Nile headwaters will allow the reader to interpret with greater clarity the work of marine geologists working on Nile deep-sea sediments and enable archaeologists to integrate their work more effectively into a broader Nile Basin context.

Martin Williams is Adjunct Professor in Earth Sciences at the University of Adelaide, Australia. He has worked with archaeologists in the Sahara, Nile Valley and Ethiopia, and has written over two hundred research papers and a dozen books, including *Climatic Change in Deserts* (Cambridge, 2014), *A Land Between Two Niles* (with Donald Adamson, 1982) and *The Sahara and the Nile* (with Hugues Faure, 1980). He received the Farouk El Baz Award for Desert Research from the Geological Society of America in 2008.



THESIS ABSTRACTS

Direct and indirect effects of long-term climatic change on terrestrial-aquatic ecosystem interaction in Tasmania

Kristen Beck (PhD)

School of Geography, University of Melbourne, Australia.



Figure 1. Photo of field site Paddy's Lake with anchored Nesje platform (November 2014)/ (Photo credit: Kristen Beck).

Climate influences aquatic ecosystems through two important pathways: (1) directly through temperature or changes in the precipitation/evaporation balance and/or (2) indirectly mediated by changes in the terrestrial environment. However, the indirect impacts of climate on aquatic ecosystems are poorly understood. The aim of this thesis is to better understand how aquatic ecosystems respond to past climate change, using two lakes in western Tasmania as case studies. Palaeoecological research on two multiproxy lake sediment records (Paddy's Lake and Lake Vera) were used to reconstruct chronology (radiometric dating, i.e. ^{14}C); fire regimes (charcoal); vegetation dynamics (pollen); nutrient dynamics ($\text{C}\%$, $\text{N}\%$, C/N , $\delta^{13}\text{C}$, and $\delta^{15}\text{N}$); catchment geochemistry (\blacktriangle XRF scanning); and aquatic response (diatoms and cladocerans) to determine the impact of climate change on these aquatic ecosystems. Results from Paddy's Lake reveal long-term changes in the cladoceran community are indirectly driven by climate through changing vegetation productivity and available ^{14}N altering the trophic status of the lake. Following the invasion of sclerophyll vegetation caused by increased fire frequency, the indirect climate influences on the aquatic system break down and the cladocerans appear complacent to changing vegetation productivity. At Lake Vera, diatoms respond indirectly to climate through

changes in the acidity and dystrophic conditions of the lake with catchment peat formation. An increase in climate variability at ca. 5 ka caused declines in lake level resulting in a shift to a direct response in the diatoms to climate. During a period of increased drying at ca. 2.4 to 0.7 ka, increased fire activity adversely impacts the aquatic system causing a non-linear transition in the diatom community. The findings from this thesis show aquatic ecosystems of Tasmania are predominantly indirectly driven by climate through the formation of thick organic peats. Shifts in vegetation composition alter the surrounding soils and catchment dynamics impacting aquatic ecosystems trophic status and pH. Fire is another important driver of aquatic ecosystem response that causes changes in vegetation composition, altering the nutrient profile of soils and increasing erosion and sediment delivery. Aquatic ecosystems respond with increased pH, disturbance taxa and a shallowing of lake mixing depth in the diatom community. These terrestrial-aquatic ecosystem interactions have the potential to be more widespread across Southern Hemisphere biomes and temperate peatlands worldwide that share similar vegetation-soil dynamics.

Investigating the sediment conveyor in arid Australia with cosmogenic nuclides

Martin Struck (PhD)

School of Earth, Atmospheric and Life Sciences, University of Wollongong, New South Wales, Australia.

Assessing sediment production and transfer on a range of time and spatial scales is indispensable to understand Earth's surface dynamics and landscape evolution processes. Linking and quantifying these processes from erosional source areas through to depositional sinks is crucial to apprehend down-system signal propagation and modification. Cosmogenic nuclide analyses have proven incredibly useful to investigate a variety of geomorphic landforms and processes along such sediment conveyors on 103-106-year timescales but have, to date, largely focused on steep landscapes.

This thesis utilizes cosmogenic ^{10}Be and ^{26}Al abundances, measured in exposed bedrock, hillslope soils, and modern stream sediments, to investigate and link sediment production mechanisms and transfer dynamics in three post-orogenic, low-relief catchments covering >100,000 km² of the Eyre Basin in arid central Australia.

In the studied catchments, ^{10}Be -derived bedrock erosion rates of ~0.2-7 m/Myr decrease with rock type strength in the following order: conglomerate, sandstone, quartzite, and silcrete, with lithology likewise controlling hillslope morphology. Along the slopes, differing nuclide abundances reflect main sediment transport processes, which are dominated by slope-wash and downslope creep. Creep is driven by shrink-swell processes, which also promote upward migration of gravels detached from underlying bedrock. The production and exhumation histories of these mantle gravels were reconstructed by conducting Monte Carlo-based modelling, with the result that subsoil bedrock erodes at <0.1 to ~10 m/Myr. These erosion rates equal 2-6 Myr or more that particles spend in the upper 0.6 m of the bedrock column and additionally at least ~0.2-2 Myr while in transit towards the soil surface. Aeolian dust-derived silty soils, which spark shrink-swell processes, thereby promoting upward gravel migration, date to at least 0.2-1 Myr, in line with intensified aridity. This slow hillslope evolution over 105-106 years, indicates independence from local base level, suggesting top-down evolution, driven by authigenic sediment production rates rather than fluvial incision as in tectonically active settings.

Stream sediments retain the distinct lithological signal determined by headwater erosion, with post-orogenic ranges and silcrete-dominated areas yielding catchment denudation rates of ~6-11 m/Myr and ~0.2 m/Myr, respectively, despite sediment mixing over hundreds of kilometres. Apparent burial signals of <500 kyr, derived from $^{26}\text{Al}/^{10}\text{Be}$ inventories in hillslope soils, are likewise reflected by headwater stream sediments, but increase overall downstream. Minimum cumulative burial is generally ~400-800 kyr and can reach up to ~1.1 Myr. The increasing burial-signal magnitude correlates with more abundant sediment cover downstream, reflecting assimilation from long-exposed storages, such as alluvial fans, desert pavements, alluvial plains, and aeolian dunes. In agreement with findings of previous studies, this suggests that preservation of $^{26}\text{Al}/^{10}\text{Be}$ signals is favoured by high sediment supply rates, high mean runoff, and a thick sedimentary basin pile, whereas signal masking prevails in landscapes of low sediment supply and discontinuous lux, and juxtaposition of sediment storages with long exposure histories.

The reconstruction of moisture availability over the past 8800 years in south-eastern Australia

Xianglin Zheng (PhD)

*School of Biological, Earth & Environmental Sciences,
University of New South Wales, New South Wales, Australia.*

Due to the temperate and relative dry climate of south-eastern Australia, there are relatively few palaeo-environmental records in the region, and moisture-sensitive proxies are particularly rare. Any new and independent palaeo-hydrological reconstruction that offers insight to the climate system in south-eastern Australia is hence a novel contribution. Reconstruction of the palaeo-climatic conditions of south-eastern Australia is likely, however, to be not only of regional importance, but potentially significant to much wider spatial scales, because the region is influenced by several major ocean-atmospheric modes. This includes El Niño–Southern Oscillation (ENSO) and the Inter-decadal Pacific Oscillation (IPO), modes that impact both hemispheres and may be highly sensitive to future climate change.

This thesis represents the first attempt to apply testate amoebae to the quantitative reconstruction of moisture availability in south-eastern Australia over the Holocene. Firstly, this thesis proposed a revised laboratory method, incorporating an organic co-solvent (acetone) and a sodium-based dispersant (sodium pyrophosphate), to address issues with the identification and quantification of testate amoebae in minerogenic sediments. This revised method effectively concentrated testate amoebae and significantly improved the clarity of slides, thereby greatly reducing counting time. These methods made this research feasible, and allow for the use of testate amoebae as a (moisture-sensitive) proxy in south-eastern Australia. The methods are also applicable for the concentration of testate amoeba in other more minerogenic sediments.

This thesis then considered if there was a strong ecological relationship between the community composition of testate amoebae and water-table depth (WTD). A strong, significant relationship between WTD and testate amoebae in south-eastern Australia was supported and this allowed further development of robust and reliable transfer functions. This relationship was tested using several analyses, including canonical correspondent analysis (CCA), stepwise regression, variation partition and a ratio of the first constrained/unconstrained eigenvalue in CCA with only one explanatory variable (λ_1/λ_2).

Transfer functions between testate amoebae community composition and WTD were then developed and thoroughly tested using various statistical perspectives. Transfer functions were built using all species (minus rare species, all-species models) and with only informative taxa (species-pruned models). The performance of these transfer functions was tested using leave-one-out, traditional bootstrap, cluster-bootstrap and leave-one-site-out cross-validation, segment-wise analysis (un-even sampling bias) and spatial auto-correlation analysis. Both the all-species and species-pruned transfer functions had statistically sound performance, with R^2 values of around 0.8 and RMSEP values of ~ 7 cm. The all-species modern analogue technique (MAT), was found to have negligible bias from un-even sampling and spatial autocorrelation, and this was recommended as the best transfer function for future reconstruction of testate amoebae in south-eastern Australia. The species-pruned transfer functions proved to be a useful way to consider the importance of taxa and verify the performance of different types of transfer functions. Lastly, two reconstructions of moisture availability were derived at Snowy Flat, a high altitude Sphagnum-shrub bog. One was a reconstruction calculated using the derived transfer functions between sub(fossil) testate amoebae and WTD, covering the last 2800 cal. yr BP. The other was derived from the principal component analysis (PCA) of geochemical elements measured by ITRAX, and this extended to 8800 cal. yr BP at a much higher temporal resolution than the first. The reconstruction of moisture availability from geochemical elements was supported by a PCA biplot and similar zonation and synchronous changes to the reconstructed WTD from testate amoebae during the period of their overlap. In addition, loss-on-ignition and charcoal were analysed to better characterise past environmental conditions and/or change.

The reconstruction of moisture availability suggested four distinct periods during the Holocene in south-eastern Australia. Before 7800 cal. yr BP (early Holocene), south-eastern Australia saw enhanced moisture availability, followed by a progressive decrease from 7800–3400 cal. yr BP (middle Holocene). From 3400 to 1800 cal. yr BP (late Holocene), the variability of moisture availability increased, and this was particularly apparent after 1800 cal. yr BP (recent past). Periods of enhanced moisture availability were identified from 3200–3000, 2200–2000, 1325–1175, 930–870 and 700 to 30 cal. yr BP. After 1800 cal. yr BP, moisture availability in south-eastern Australia was reminiscent of trends in the Northern Hemisphere, that is, moisture availability followed the trends of the

'Roman Warm Period', the 'Dark Ages Cold Period', the 'Medieval Climatic Anomaly' and 'Little Ice Age'. As an example, south-eastern Australia saw enhanced moisture availability in the Little Ice Age and reduced moisture in the Medieval Climate Anomaly, with the latter interspersed by a period of higher moisture availability at 930-870 cal. yr BP. Wavelet analysis indicated significant 10-64 year cycles in the reconstruction on moisture availability, particularly in the late Holocene. These conform to the periodicity of the IPO. The reconstruction implies a negative IPO mean state over the early and middle Holocene. The reconstruction suggested that the modern IPO became apparent in south-eastern Australia at 3400 cal. yr BP and to have become intensified after 1800 cal. yr BP ka. The reconstruction also implied that a positive IPO (El Niño-like) mean state prevailed in the MCA and a negative IPO (La Niña-like) mean state dominated the LIA.

The enhanced (reduced) moisture availability/negative (positive) IPO over the Holocene was apparently closely related to the reconstruction of low (high) temperature from δD in the high-resolution EPICA (Antarctic) ice core, supporting the 'atmosphere hydrological cycle' rather than a 'ocean dynamical thermostat' mechanism. This relationship appeared to be driven by changes in insolation but once this reached a plateau after 1800 cal. yr BP changes in solar activity became increasingly important.

Late Quaternary Environments for the Uplands of North East Tasmania – A new record from the Nicholas Range

Amirah Farrell (Honours)

School of Earth and Environmental Sciences, University of Queensland, Queensland, Australia.

Late Quaternary environmental records from Tasmania are geographically biased to the western region of the island. A sediment core from Nicholas Swamp provides a multi-proxy palaeoenvironmental record of the past 47,220 cal yr BP, aiming to redress this bias. Most records from eastern Tasmania only cover the Holocene to Last Glacial Maximum (LGM) and this record provides new insight into pre-LGM landscapes for this region. Results of palynological analysis, Loss on Ignition and micro-charcoal analysis reveal clear signals of local mass wasting occurring in the cold LGM period which corresponds to a cool, dry climate. Environmental data supports the hypothesis of McIntosh & Barrows (2011) and Slee et al (2017) that other, large-scale mass wasting on the Nicholas Range is a product of a cool, moist climate during interstadial periods and saturation of dolerite colluvium. The environmental record produced in this study shows climate changes consistent with eastern mainland Australia with a cool and wet Marine Isotope Stage 3 (MIS 3), cooler and drier Early Glacial and LGM, a wet and warm Last Glacial – Interglacial Transition and a warm and dry Holocene with a more variable climate. From the Holocene, the climate of eastern Tasmania has been shown to be 'out of phase' with that of western Tasmania (Mackenzie & Moss, 2017). This study provides evidence of further variance between those regions prior to the LGM. Evidence of both Aboriginal and European impacts in the region are found at Nicholas Swamp, including a signal that implicates humans in the disappearance of the Tasmanian megafauna.

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UPCOMING MEETINGS

DECEMBER 2018

2018 AQUA Biennial Conference

Venue: Acton Peninsula, Canberra, Australia

Date: 10-14 December 2018

www.aqua.org.au/conference/aqua2018

2019

FEBRUARY 2019

PAGES 2k Network PALEOLINK Project workshop 'Joint effort to bring together GCM, RCM and proxy communities'

Venue: Murcia, Spain

Dates: 6-8 February 2019

jjgomexnavarro@um.es

www.um.es/gmar/staff/gomez/workshop/home/index.html

JUNE 2019

Asia Pacific Conference on Human Evolution (APCHE)

Venue: Griffith University, Brisbane Australia

Date: 25-27 June, 2019

apche@griffith.edu.au

www.griffith.edu.au/environmental-futures-research-institute/research-centre-human-evolution/news-events/asia-pacific-conference-human-evolution

JULY 2019

PALSEA: Using ecological and chronological data to improve proxy-based palaeo sea-level reconstructions.

Venue: Dublin Ireland

Dates 21-23 July, 2019

<https://palseagroup.weebly.com>

XX INQUA Congress

Venue: Dublin, Ireland

Date: 25-31 July 2019

www.inqua2019.org

AUGUST 2019

2019 Summer School on Speleothem Science (S4)

Venue: Cluj-Napoca, Romania

Date: 11-17 August, 2019

www.speleothemschool.com/

SEPTEMBER 2019

13th International Conference on Paleoclimatology (ICP13)

Venue: University of New South Wales, Sydney, Australia

Date: 1-6 September 2019

www.icp13.com.au

International Symposium on Loess Deposits as Archives of Environmental Change in the Past. National Academy of Science of the Republic of Armenia

Venue: Yerevan, Armenia

Date: 15-22 September, 2019

loess2019@geology.am

DETAILS TO BE CONFIRMED

OCTOBER 2019

Society of Vertebrate Palaeontology

Venue: Brisbane

Date: 9-12 October 2019

<http://vertpaleo.org/Annual-Meeting/Annual-Meeting-Home.aspx>

ADVANCE NOTICE

2020

Palaeo Down Under 3

Venue: Brisbane



The Australian Research Centre on Human Evolution (ARCHE; <https://www.griffith.edu.au/environmental-futures-research-institute/research-centre-human-evolution>) at Griffith University (Brisbane, Australia) will organize the first Asia Pacific Conference on Human Evolution (APCHE) in June 2019.

This conference aims to bring together experts working on all aspects of biological evolution of humans in the broader Asian and Pacific regions. Participants will include active researchers in palaeoanthropology, biological anthropology, genomics and palaeogenomics, primatology, as well as all disciplines engaged in understanding the environmental and site-specific context of human evolution across Asia and Australasia, including taphonomy, geochronology, palaeoecology, and geoarchaeology.

APCHE will foster international collaborations between researchers actively engaged in scientific analyses and exploration in Asia and the Pacific, and will highlight the exciting developments and discoveries that are rewriting our understanding of how and when humans left Africa and expanded into new lands to the east.

Travel assistance is available for researchers from developing countries.

- WHEN: 25-27 June 2019
- WHERE: Griffith University, Southbank campus, Brisbane.
- FURTHER INFORMATION: Please see our website www.griffith.edu.au/conference-human-evolution or contact apche@griffith.edu.au

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Quaternary AUSTRALASIA

Quaternary Australasia publishes news, commentary, notices of upcoming events, travel, conference and research reports, post-graduate thesis abstracts and peer-reviewed research papers of interest to the Australasian Quaternary research community. Cartoons, sardonic memoirs and images of mystery fossils are also welcome.

The Australasian Quaternary Association (AQUA) is an informal group of people interested in the manifold phenomena of the Quaternary Period. It seeks to encourage research by younger workers in particular; to promote scientific communication between Australia, New Zealand and Oceania; and to inform members of current research and publications. It holds biennial meetings and publishes the journal *Quaternary Australasia* twice a year.

Full annual membership of AQUA with an electronic subscription to QA is AUD50, or AUD35 for students, unemployed or retired people. The AQUA website (www.aqua.org.au) has information about becoming a member; alternatively please contact the Treasurer (address below). Members joining after September gain membership for the following year. Existing members will be sent a reminder in December.

2019 AQUA EXECUTIVES

PRESIDENT

A/Prof Tim Cohen

School of Earth and Environmental Sciences
University of Wollongong,
NSW 2522, Australia
PH: +61 (0)2 4239 2375
tcohen@uow.edu.au

VICE PRESIDENT

Dr. Lynda Petherick

School of Geography,
Environment and Earth
Sciences
Victoria University of
Wellington
Kelburn Campus
Wellington, New Zealand
PH: +64 (0)4 4635844
lynda.petherick@vuw.ac.nz

SECRETARY

Dr Emily Field

School of Geography,
Planning and Environmental
Management
University of Queensland,
QLD 4071, Australia
PH: +61 (0)7 3365 3015
e.field@uq.edu.au

SHADOW SECRETARY

A/Prof Scott Mooney

School of Biological, Earth
and Environmental Sciences
University of New South
Wales, NSW 2052, Australia
PH: +61 (0)2 9385 8063
s.mooney@unsw.edu.au

TREASURER

Georgina Falster

Department of Earth
Sciences
University of Adelaide, SA
5005, Australia
PH: +61 (0) 8 8313 1717
georgina.falster@adelaide.edu.au

COMMUNICATIONS AND IT COORDINATORS

Haidee Cadd

Sprigg Geobiology Centre
Department of Earth
Sciences
The University of Adelaide
SA, 5005, Australia
PH: +61 (0) 4 0459 9285
haidee.cadd@adelaide.edu.au

GENERAL MEMBERS

Dr Andrew Rees

School of Geography,
Environment and Earth
Sciences
Victoria University of
Wellington
Kelburn Campus
Wellington, New Zealand
PH: +64 (0)4 463 8396
andrew.rees@vuw.ac.nz

Dr Jessica Reeves

Faculty of Science and
Technology
Federation University
Australia,
Gippsland Campus,
Churchill
VIC 3842, Australia
PH: +61 (0)3 53279049
j.reeves@federation.edu.au

A/Prof Peter Almond

Department of Soil and
Physical Sciences
Lincoln University
PO Box 85084
Lincoln 7647, Canterbury,
New Zealand
PH: +64 (0)3 423 0768
peter.almond@lincoln.ac.nz

Heather Haines

Australian Rivers Institute,
Griffith University
QLD, Australia
PH: +61 (0)4 2828 0606
h.haines@griffithuni.edu.au

Lillian Luk

School of Biological, Earth
and Environmental Sciences
University of New South
Wales, NSW 2052, Australia
l.luk@unsw.edu.au

QUATERNARY AUSTRALASIA EDITORS

Dr Carol Smith

Department of Soil and
Physical Sciences
Lincoln University
PO Box 85084
Lincoln 7647, Canterbury,
New Zealand
PH: +64 (0)3 423 0791
editor@aqua.org.au

Dr Sanja van Huet

Deakin University
School of Life and
Environmental Science
Victoria 3125, Australia
PH: +61 (0)3 924 68529
editor@aqua.org.au