VOLUME 33 | NUMBER 1 | JULY 2016

Quaternary AUSTRALASIA

VIII Southern Connection Congress

Janet Wilmshurst, FRSNZ

SHAPE update

AQUA BIANNUAL MEETING:
Quaternary perspectives from the City of Sails
AUCKLAND, NEW ZEALAND 5-9 DECEMBER 2016

OLD GOVERNMENT HOUSE, UNIVERSITY OF AUCKLAND

AQUA 2016 includes:

- Four exciting days of conference sessions
- Mid-conference field trip to Auckland Volcanic Field sites and Waitakere Ranges
- Conference dinner at Villa Maria Estate inside the Ihumatao volcanic maar
- Post-conference field trips, 10-15 December 2016

Two post conference field trip options are currently being planned, and will be run according to level of interest.

For further information, please contact Andrew Lorrey (andrew.lorrey@niwa.co.nz).

TRIP 1:
Kauri and the Quaternary (a loop around the sub-tropical Northland/Far North region starting and ending in Auckland; three nights in Bay of Islands, two nights at Kai Iwi Lakes). The trip will focus on ancient kauri, changes in ecology as seen in pollen records over interglacial-glacial scales, and coastal barrier evolution from OIS5-present.

TRIP 2:
Quaternary volcanism and environmental change (excursion south from Auckland through the Waikato, the central North Island and ending in Wellington; three nights in Taupo, two nights in Palmerston North). There will be a focus on Quaternary volcanism, tectonism, sedimentation, and climate. Stops will include the Taupo and Rotorua volcanic centres, glaciation in the Tongariro National Park, Napier/Hawkes Bay and the Kapiti-Horowhenua/ Wanganui Basin sequences.

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The visual and wind-blown magnificence of Parque Nacional Torres del Paine. This park extends over 242,000 ha and lies in the transition area between the Magallanes sub-polar forests and Patagonian Steppe. Much of the geology consists of Cretaceous-aged marine sedimentary rock that has been intruded by a Miocene-age granitic laccolith. Rapid uplift and successive glaciations have dramatically sculptured the Cordillera del Paine which forms the centre-piece of the park. (Photo credit: Brent Alloway)

Model Diprotodontid constructed by the local 'Mens Shed' for the Lancefield Megafauna Festival. (photo credit: Sanja van Huet)

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Caption competition

Bill Bull at Charwell, Marlborough, New Zealand, circa late 1980's. Deciphering the loess story with the aid of hand drilled augers, often to a depth of 6 m, was a significant contribution to our understanding of how Quaternary tectonic uplift, loess deposition and river incision have all shaped this part of the landscape. Please help your editors with an appropriate caption for the photo. Bonus prize for correctly identifying the two torso-less bodies in the background. Send your suggestions to editor@aqua.org.au. The winning entry will appear in the next issue of Quaternary Australasia.

WINNER

The winner of the December 2015 caption competition is Len Martin with "we don't need to measure THAT in microns...".

EDITORIAL

Dear Fellow Quaternarists,

This year will see a full transition of the *Quaternary Australasia* editorship to Carol Smith and Sanja van Huet, with Pia Atahan retiring mid-year. Carol and Sanja represent the twelfth and thirteenth editors in the line that began when Jeannette Hope and Bruce Thom began editing QA's predecessor: the *Australian Quaternary Newsletter*. A strong focus of QA over its lifetime has been on publishing meeting reports and updates related to formal group projects, making QA a valuable asset for the Quaternary community. This strong focus is evident in the current issue of QA, with groups working within the framework of INQUA and PAGES represented.

Kathryn Fitzsimmons describes the INQUA Loess Focus Group meeting, the *International Symposium on Aeolian Deposits in Earth History*, held near Beijing in China. Joelle Gergis and others update us on the *4th Aus2k Workshop* (Auckland, NZ), where progress made by the PAGES *Aus2k* working group was reviewed. Peter Gell reports on progress in the PAGES *Aquatic Transitions* working group.

In this issue of QA, we travel to Tierra del Fuego. Firstly to Punto Arenas (in Chile) where the *VIII Southern Connection Congress* was held. Brent Alloway describes the important work of this meeting to bring together scientists working across the Southern Hemisphere. Following this, Jess Reeves takes us across the border to Ushuaia in Argentina, where she will embark on a three week long journey to Antarctica with 77 other female scientists later this year. Jess outlines this ambitious mission, which aims to build leadership capabilities in women. We look forward to hearing about the trip after she returns!

QA editor, Sanja van Huet reports on the *Lancefield Megafauna Festival*. She includes a fascinating account of the history of fossil discovery in the region and of one town's remarkable embrace of its fossil record. The 'Fossil Road Show' session sounds unmissable.

Also in this issue John Magee reflects on the book 'Climate Change in Deserts: Past, Present and Future' by Martin Williams, and Carol Smith reviews "A Continent on the Move" edited by Ian Graham.

We also pay tribute to the achievements of great Quaternarists. Regents' Professor Herbert Wright sadly passed away recently, and Esmée Webb provides us with a summary of his career highlights. And finally, with the wonderful awarding of a Fellowship of the Royal Society of New Zealand to Janet Wilmshurst; Jaime Wood and Carol Smith summarises her career to date.

We also introduce a new section "Notes from the Field" where we report on current fieldwork projects in the field. We welcome reports (and photos) on your fieldwork, both in Australasia and overseas. We start in this issue with reports on drilling projects from both sides of the Tasman: The LOCH project from Lake Ohau in the South Island; the Whanganui Drilling Project from the North Island and the Lake George drilling project, NSW.

The next AQUA conference, *Quaternary in the city of sails*, is being held in Auckland from the 5th to 9th of December, 2016. We look forward to seeing you there!

Yours Quaternarily,

Pia Atahan, Carol Smith and Sanja van Huet
Editors

PRESIDENT'S PEN

Summer is a busy time for field Quaternarists as it is the main opportunity to undertake field work. Australasian Quaternarists work in a vast range of different climates from the tropics to Antarctica, undertaking a wide range of different types of field work. We would love to hear your field work stories.

Over the last year (or so) there has been several large field work projects involving drilling of Quaternary sediments to understand changes in the local environment, human influence, climate change and natural hazards. Back in February 2014 drilling was undertaken on the offshore volcano, Rangitoto, to understand the eruption risk to Auckland. Then in August, drilling was undertaken at Siberia Station into the Wanganui basin sediments, central North Island of New Zealand. In December 2015 there was drilling of the dry (but green) Lake George, close to Canberra, Australia. Then in February/March 2016, there was the Lake Ohau drilling project (LOCH) in the South Island of New Zealand. All of these major projects will, I'm sure, produce many thousands of analyses and provide some interesting results that we can look forward to hearing about in the future at AQUA conferences or AQUA themed sessions.

As well as field work in Antarctica, AQUA secretary Duanne White found time to attend the annual Science meets Parliament meeting in Canberra, in March 2016. There are also two new, similar, events – Science meets Policy and Science meets Business. If you have been to either of these and have some feedback for the Quaternary community we would love to hear from you.

It is great to see regular emails on AQUAlist and posts on facebook. And it is nice to see that lots of science communication is going on with regular links to blogs, videos of talks and radio interviews. Facebook is also a good way to advertise your latest journal article, and any upcoming events or jobs. We now have 230 followers on our facebook page... a few more than we have members. So please remember to renew your membership if you haven't already done so and encourage your Quaternary colleagues to join.

AQUA is now gearing up for the upcoming biennial AQUA conference in City of Sails – Auckland, New Zealand in December 2016. The conference will be held at the University of Auckland from the 5-9th of December with some very interesting mid-and post-conference field trips in the North Island of New Zealand. We hope that you will be able to attend and present your latest science. It is a great chance to catch up with colleagues (and friends) and meet new ones, and it is also a friendly forum for students to present their work.

It has been an interesting 2 years keeping the AQUA "ship" afloat, both professionally and personally (with a new baby to wrangle). I will remain on the AQUA committee as the past president, but I am delighted to hand over to our new President Scott Mooney (UNSW), who will keep the AQUA "fire" burning for the next 2 years. We welcome the new members of the committee.

Finally, congratulations to Stephanie Kermode (previously our shadow secretary on the AQUA committee) and her partner Florian for the birth of their baby boy Oliver.

Helen Bostock *AQUA President*

MEET A MEMBER OF THE AQUA EXECUTIVE COMMITTEE

SANJA VAN HUET: EDITOR, QUATERNARY AUSTRALASIA

Sanja splits her time between two jobs; as the exploration manager for a junior mining company in Victoria and as a lecturer at Deakin University. With a MSc and PhD, both from Monash University, Sanja's main interests are in Quaternary palaeoenvironments, taphonomy and sedimentology. Her current research areas revolve around the coasts of the Nepean Peninsula and King Island and further inland, the swamp at Lancefield in Victoria; one of the first discovered Australian Quaternary fossil sites. She has also developed an interest in extant and extinct emus and their response to isolation through sea level and vegetation changes during the Quaternary.

Sanja has an adult daughter and a needy rescue greyhound. She spends most of her free time practicing her surfing, watching live music, walking on the beach and nailing together her beach shack – which she hopes to, one day, retire to.

NEWS

AQUA BIENNIAL CONFERENCE: "QUATERNARY IN THE CITY OF SAILS" AUCKLAND NZ 5-9 DECEMBER 2016

The next AQUA biennial conference will be held at the Old Government House in Auckland, from the 5-9 December 2016. The conference will include conference sessions on the 5-6 and 8-9 December, a mid-conference field trip and a conference dinner at Villa Maria Estate in the Ihumatao maar! More details in this issue and further information will be published on the AQUA website and Facebook page as it becomes available.

INTAV

INQUA support has been given for the International Focus Group on Tephra and Volcanism (INTAV) and EXTRAS project. Contact David Lowe for details about how you can participate: (dlowe@waikato.ac.nz) or check out the website: http://www.arch.ox.ac.uk/intav/INQUA-INTAV.html

SHAPE

Southern Hemisphere Assessment of Palaeo-environments SHAPE fully supported by INQUA as an international focus group! See report in this issue and keep up to date by joining the Shape email list. To get involved please contact Drew Lorrey: (Andrew.Lorrey@niwa.co.nz) or Steven Phipps: (s.phipps@unsw.edu.au).

AQUA T-SHIRTS

A limited number of AQUA T-shirts are still available to buy. If you would like to get your hands on one, please contact President Scott Mooney (s.mooney@unsw.edu.au).

T-shirt design Emily Field

AQUA members modelling the AQUA t-shirt at INQUA, 2015 (Photo credit: Len Martin)

THE QA EDITORIAL TEAM IS CHANGING

Quaternary Australasia editor, Pia Atahan, is retiring. She has been involved in QA since taking over from Jasmyn Lynch in 2013. She leaves QA in the capable hands of Carol Smith and Sanja Van Huet who joined the editing team last year. Please continue to send QA contributions to editor@aqua.org.au.

Pia Atahan the retiring editor

A TRIBUTE TO HERBERT E. WRIGHT JR (1917 – 2015)

Regents' Professor of Geology, Ecology and Botany, University of Minnesota (UMN), Minneapolis

Esmée Webb

Perth, Western Australia

When Herb Wright died on 12 November 2015 Quaternary Studies lost one of its founding fathers; whose passing merits recognition by AQUA because he conducted palynological fieldwork not just in 'expectable' places such as Alaska, Yukon, Labrador, Greenland, Iceland, Sweden, Ireland, Catalonia, Altai Mountains, Outer Mongolia, Greece, Lebanon, Iran, Egypt and New Mexico, but also in Swaziland, Patagonia, Peru, Tasmania and New Zealand. His research students apparently 'complained' that he had already been to all the places whose Quaternary record they wanted to study!

Born in Massachusetts on 13 September 1917, Herb studied geology at Harvard: BA (1939), MA (1941) and PhD (1943); also serving as a bomber pilot during WWII. Understandably, that experience left him 'unflappable' in the field, no matter what went wrong. He joined the Geology Department at UMN in 1947 and never left; although he earlier taught at Brown and conducted research for the Oriental Institute in Chicago and the US Geological Survey. He founded and directed (1963-1990) the Limnological Research Centre at UMN. He unravelled Minnesota's glacial history based on over 50 pollen diagrams that documented climatic change, fire history and human activity since 20 ka; meticulous research that has stood the test of time and underpins regional predictions of future climato-environmental change.

Herb held Guggenheim and Wenner-Gren Fellowships in the 1950s and later received prestigious awards from the National Academy of Science, International Palaeolimnological Association, American Quaternary Association (AMQUA), both the Archaeological and the Quaternary Geology and Geomorphology Divisions of the Geological Society of America, Archaeological Institute of America and Society for American Archaeology. Few palynologists receive archaeological awards, Herb was given three; proof of his eclecticism. He was Honorary President of XVI INQUA and given doctorates by Trinity College, Dublin, and Lund University, Sweden.

Herb published over 180 scientific papers that usually synthesised multi-disciplinary data, even archaeology. The last publication I know of is Wright *et al.* (2004). Herb also edited 14 books, including *Pleistocene extinctions, Quaternary Soils* and *Quaternary of the United States*. His research projects always included diverse Quaternary collaborators and topics. He co-founded COHMAP (the Co-operative Holocene Mapping Project) that documented climatic and environmental change since 18 ka.

I first met Herb when I attended the AMQUA biennial meeting at UMN in 1994 and last saw him at another AMQUA meeting in 2010 (Figure 1); still interested in other people's research at 93. Respected by all who met or worked with him, Herb was a gentle man, an unpretentious scholar, dedicated to his own and his students' work. Many of his students now occupy prestigious positions. Herb taught his students to record field data scrupulously and share their ideas; principles that should be more widely instilled. He will be missed.

Herb Wright in Wyoming in 2010, listening attentively to the leader of an AMQUA fieldtrip. (Photo credit: Esmée Webb)

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JANET WILMSHURST – FELLOW ROYAL SOCIETY OF NEW ZEALAND

Jamie Wood[1] and Carol Smith[2]

[1]*Landcare Research, Lincoln, Canterbury, New Zealand*

[2]*Lincoln University, Lincoln, Canterbury, New Zealand*

Janet Wilmshurst is an internationally eminent palaeoecologist whose impressive research centres on reconstructing past ecologies of New Zealand and the Pacific. She has dramatically expanded our knowledge of pre-human ecosystems and the impacts of natural and human-induced environmental change. Based at Landcare Research in Canterbury she is the Director of the Long-Term Ecology Laboratory (LTEL) where she works with Jamie Wood, Matt McGlone, post graduate students Tess Cole and Alex Boast and research technicians Nic Bolstridge and Karen Boot. Current visiting researchers include Francisca Diaz from Chile. Janet is responsible for several significant research programmes and in 2013 she was appointed to a 0.2 FTE Associate Professorship at Auckland University (Harvie, 2015).

But what was Janet's path to Lincoln and paleoecological research? Janet grew up in Britain and graduated from Plymouth University in 1988 with a BSc (Hons) in Environmental Science; receiving the award for the best undergraduate thesis in that degree. An opportunity to study for a PhD at Canterbury University followed and led to working at Landcare Research in the mid 1990's with Matt McGlone. In her current role as Director of the LTEL at Landcare Research's Lincoln offices, Janet and the team work at reconstructing past ecologies by combining ancient DNA techniques with analysis of diverse fossils such as pollen, charcoal, bird bone, dung-fungi and testate amoebae. When relevant, they also utilise the historical record; for example in research for assigning dates to human settlement in the Pacific (Wilmshurst et al, 2011). The fields of research Janet has explored are diverse and include forest disturbance caused by volcanic eruptions (Wilmshurst &McGlone1996); climate change in southern New Zealand and the sub Antarctic islands (Alloway et al., 2007; McGlone et al., 2010; Newnham et al. 2013; Turney et al, 2006); past pollinator-plant associations and fire history (Perry et al., 2014a). Determining the diet of moa and other extinct and extant birds in unmodified ecosystems from analysis of fossilized dung (Figure 1) (Wood et al., 2012) and the reconstruction of previous vegetation communities on strongly modified landscapes (Lyver et al., 2015) has also been a strong focus since joining Landcare Research over 20 years ago. She has collaborated widely with other international researchers, as reflected by her involvement in many overseas funded research projects as a named investigator.

A distinct aspect of Janet's work is that she innovates constantly, pioneering and applying new techniques to new and long-standing problems, such as the use of rat-gnawed seeds preserved in sediment to resolve the long standing question around the timing of human settlement of Aotearoa. This particular line of evidence concurred with other scientific and cultural evidence (the seed cases

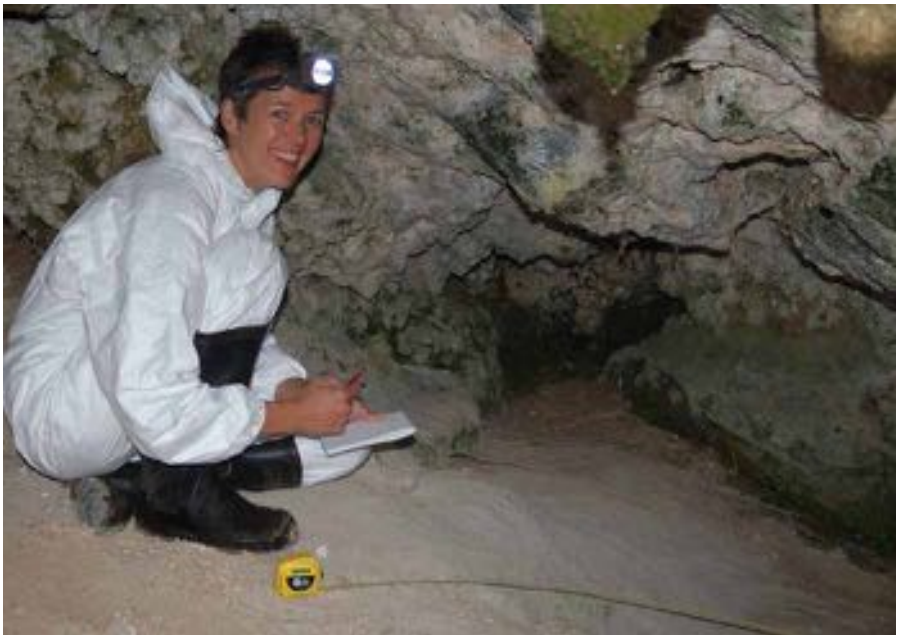

Figure 1: Surveying a new cave at Mt Nicholas Station near Queenstown. This study demonstrated the first coprolite evidence for the diet of the extinct forest dwelling Moa (*Anomalopteryx didiformis*) in New Zealand (Wood et al., 2012). (Photo credit: Jamie Wood)

were constrained by dated tephra layers): humans arrived in 1280AD, plus or minus 30 years (Wilmshurst and Higham, 2004; Wilmshurst et al., 2008). Indeed, applying this research further to encompass human arrival and settlement in the Eastern Pacific, Janet and her team concluded that human settlement was much more rapid than previously thought (Wilmshurst et al, 2011). Using these techniques, Janet has also been involved with research dating the extinction of moa: using radiocarbon dating of moa bones plus rat gnaws and excreta, the team dated effective extinction to about 1430AD and total extinction to about 1480 (Perry et al., 2014b).

Paleoecology is not just about deciphering past ecologies – it is also equally applicable to the management of the contemporary landscape as well as issues such as pest eradication and ecosystem restoration. In 2015, Janet led research that investigated the invasion of the tree daisy *Olearia lyallii* on the sub Antarctic Auckland Islands. There were several unanswered questions. Was the tree daisy native to the islands or introduced? If so, was it a threat to the islands unique ecosystem? Could it have been introduced by Polynesians to the Auckland Islands (360kms south of Stewart Island)? Certainly, Polynesian settlers were briefly on Stewart Island during the 13th or 14th centuries– but did they venture further south? Using a combination of paleoecology and historical records, Janet and her colleagues demonstrated that the tree daisy was introduced around 1807-10; the most likely importers being sealers. A survey of tree daisy coverage across the Auckland Islands showed that it had been competitive against the marine communities it had replaced in these highly disturbed sites which were nutrient enriched from nesting sea birds, seals and sea

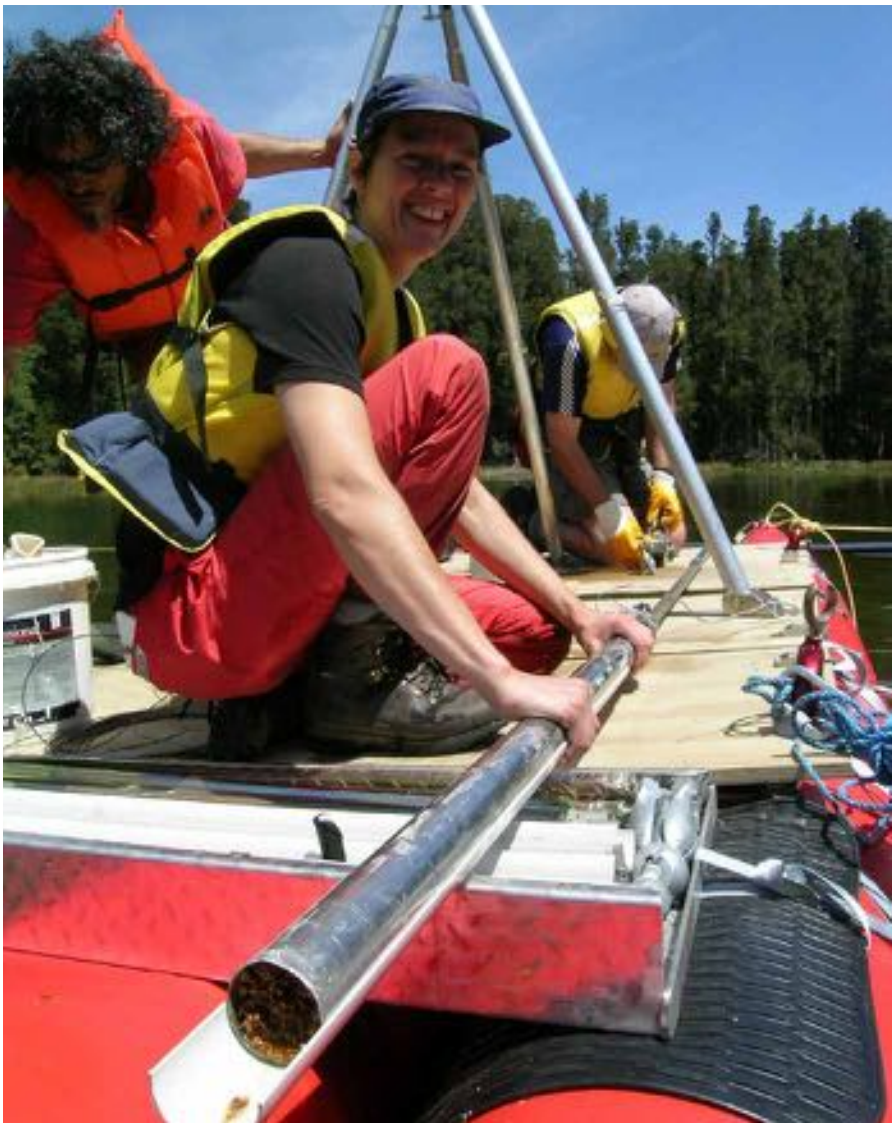

Figure 2: Coring a lake on New Zealand's North Island (Photo credit: Janet Wilmshurst).

spray. However, its spread had been slow across the rest of the island over 200+ years. The current land management implication of this research is that on-going monitoring, with no control, is an appropriate action since *O. lyallii* appears to pose minimal risk to the ecological integrity of the Auckland Islands (Wilmshurst et al, 2015).

Knowing the past vegetational composition and successional dynamics of off shore islands can help to provide baseline ecological data which can be used to inform ecosystem restoration or "rewilding" of degraded islands. Soil samples from swamps on the Poor Knights Islands, 24km off the NE coast of the North Island of New Zealand were cored to extract soil samples. These soil cores represented a 2000 year span of vegetation change than began >1200 years before human settlement and spanned 550 years of settlement and 180 years of forest succession since human occupation ceased. Analysis of the pollen and DNA in the soil cores revealed that the pre-human island forests were dominated by palm trees and podocarps. In contrast, the current forests are largely composed of native but novel angiosperm species, dissimilar to the pre-human ecosystem.
These pre-human vegetation records

help to inform future restoration of degraded offshore islands in several ways: by providing an inventory of past species if restoration planting is required; indicating the rate and likely direction of ecosystem successional change; and helping to determine if natural rates of succession are preferable to costly replanting programs (Wilmshurst et al., 2014).

Janet's research excellence is shown by her seven Marsden Fund grants since 1999, four as Principal Investigator and 3 as Associate Investigator. She has an impressive record of c. 75 refereed publications and an H-index of 27 (Google). In 2013 she gained the New Zealand Ecological Society's premier award for Ecological Excellence. In 2011, as a recognised leader in her field, she became a nominated member of the international scientific steering committee of PAGES (past climates and environments) of the International Geosphere-Biosphere Programme. She also played a key role in the New Zealand Ecological Society as councillor, Vice-President and President. The practical application of her research is highlighted by her work with the New Zealand Department of Conservation and a number of iwi, providing critical guidance for restoration through understanding past ecosystems and the impact of settlement. Janet is a tireless populariser of research, writing popular articles, webpages, a lab Twitter account, press releases and appearing on TV and radio documentaries. She has supervised/mentored over 18 postgraduate students and 6 post-doctoral fellows, many of whom have gone to successful research careers of their own. She is an inspirational Quaternary scientist (Figure 2).

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Lake Ohau Scientific Drilling: A 17,000 year-long annually resolved paleoclimate record from Southern New Zealand

Gavin Dunbar[1], Marcus Vandergoes[2], Richard Levy[2] and the LOCH project members

[1]*Antarctic Research Centre, Victoria University of Wellington, Wellington, New Zealand.* [2]*GNS Science, Lower Hutt, New Zealand*

Our knowledge of the potential impact of climate change is in part limited by the short duration of instrumental records. Highly resolved climate records that span millennia are essential to place current climate change into a longer-term perspective. Records of this type from the southern hemisphere are particularly scarce. New Zealand lies in the southern hemisphere mid-latitudes and its climate and weather patterns are influenced by teleconnections to Antarctica (via the Southern Annular Mode (SAM) and the tropics (ENSO)). Lake Ohau (44°17'S, 169°55'E; Fig. 1), in the lee of the New Zealand Southern Alps, potentially contains a detailed record of climate change since the end of the last glaciation. Cosmogenic dating of moraines around Lake Ohau basin suggests it was occupied by a glacier until ~17,900 years ago. However, within ~500 years the glacier had retreated out of the basin leaving behind a lake dominated by seasonally variable lithogenic sedimentation. Seismic records confirm a significant thickness of mud has accumulated on the lake bed since then. Analysis of short (6m-long) sediment cores that cover the past 1,300 years show that layers in the mud capture inter-annual changes in rainfall and large flood events. Over the past six years a team of researchers led by GNS Science, Victoria University of Wellington (VUW) and The University of Otago have been working towards coring this thick sediment sequence. The LOCH (Lake Ohau Climate History) drilling project was completed in February-March this year at two sites at the south eastern end of the lake.

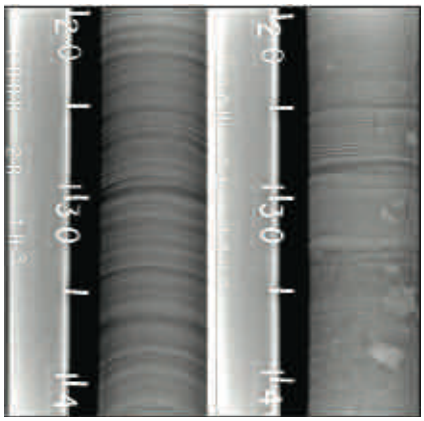
Top to Bottom

Figure 1: Location of LOCH project core sites. (Photo credit: LOCH Project)

Figure 2: LOCH project drill rig and barge (on right) and the support vessel 'Beryl Brewin' with tender on left. (Photo credit: Chris Moy)

Figure 3: X-radiographs from Site 2 core sections 2A-1H3 (left) from ~4 mblf and 2B-13H2 (right) from ~39 mblf. X-ray equipment loaned by Radiographic Supplies Ltd. (Photo credit: LOCH Project)

The lake is 105 m deep at Site 1 and 3.5kHz seismic profiles suggested ~80m of postglacial sediment had accumulated there. The shallower (68m water depth) Site 2 overlies ~40 m of postglacial sediment. Coring was carried out using a Hydraulic Piston Corer (HPC) built by QDTech in Salt Lake City. This drilling/coring system is a shorter and simplified version of that used by the Ocean Drilling Program. It was deployed from a purpose-built modular barge designed in collaboration with Webster's Drilling and Exploration Ltd and the VUW Science Drilling Office (Figure. 2). HPC coring proceeded in 3 m runs from ~1 m below lake floor to refusal. At the shallower of our two sites we were able to offset-core the complete 42 m thick sequence whilst at the more exposed deeper site we were able to offset core the upper 60 m,



whilst the drill hole continued down to Last Glacial Maximum (LGM)-age gravels 80 m below lake floor.

Our initial assessment of core x-radiographs and pollen biostratigraphy is that the entire late glacial and Holocene sequence has been recovered at both sites

and comprises mm-scale laminated sediments, with drop stones occurring in the oldest part of the record immediately above LGM angular gravels (Figure. 3). The cores will be analysed at high (mm-scale) resolution by computer-aided tomography (i.e. CT scan), x-ray fluorescence, density, compressional-wave velocity, visual light reflectance and sediment magnetic properties. Lower resolution sampling will be undertaken for grain size, palynomorphs, charcoal, diatoms, organic biomarkers (e.g. GDGTs) and organic matter isotopes in addition to visual core description. Layer counts on annual sedimentary couplets combined with radiometric dating will be used to develop a robust chronology.

New information gleaned from this unique record will contribute to a multi-proxy investigation of past temperature, precipitation, and environmental change on annual to millennial timescales. These observations will be integrated with numerical climate and hydrological model simulations to help investigate the causes of climate variability in the southern hemisphere mid-latitudes. The primary focus of this research is to investigate the changing influence of SAM and ENSO in this region and produce a detailed storm history record for the past 17,000 years. Sedimentological analysis of the cores will also be used to identify mass flow deposits (e.g. turbidites) in the record that may signify large-scale catchment disturbance associated with earthquakes in the region.

Drilling high resolution Pliocene continental shelf and slope deposits, Whanganui Basin, New Zealand

Tim Naish[1], Georgia Grant[1], Gavin Dunbar[1], Claudio Tapia[2], and the Whanganui drilling project members

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The warm climate of the Pliocene represents the most recent period of our geological past that can provide insights into how Earth will respond to projected future warming. In particular, how do polar ice sheets respond to global average temperatures 3-4°C warmer than present? What are the consequences for global sea levels? The mid-Pliocene (3-3.6 Ma) is also a time when the relative influence of orbital obliquity and precession on global insolation patterns changed markedly. This provides an opportunity to test how the different

Opposite page

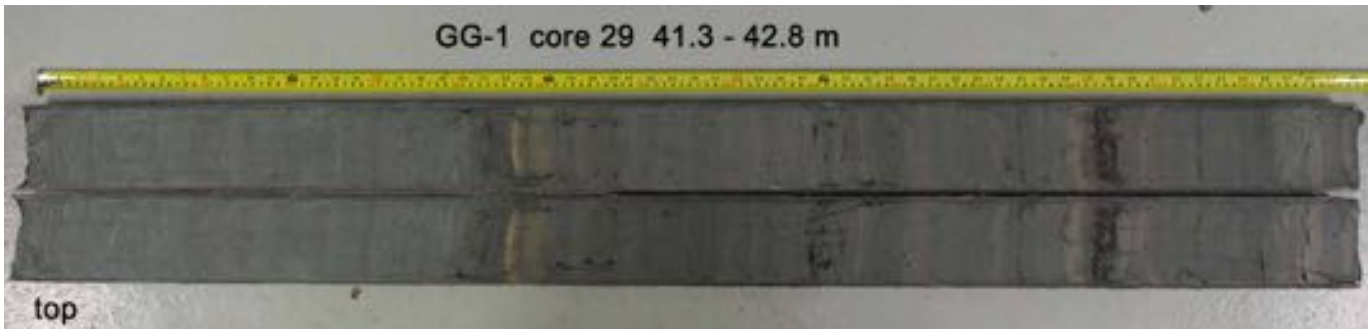
Figure 1: PQ/HQ coring in the Whanganui Basin by Webster's Drilling and Exploration Ltd in conjunction with the Victoria University of Wellington Scientific Drilling Office. (Photo credit: Antarctic Research Centre, VUW).

Left

Figure 2: Drilling progressed through late winter, 2015: Siberia sheep station, Whanganui. (Photo credit: Antarctic Research Centre, VUW).

Below

Figure 3: Part of the 350m long drill core (Photo credit: Antarctic Research Centre, VUW).



orbital components that were driving insolation contributed to ice sheet growth and decay. Two ~350 m-long scientific drill cores were collected from sites on the aptly named Siberia (39°41.6'S; 175°31.5'E), and Tiriraukawa 39°45.8'S; 175°40.2'E) sheep stations in Whanganui Basin in late winter 2015 (Figures 1 and 2).

Cores were collected using industry standard PQ/HQ coring by Webster's Drilling and Exploration Ltd and the Victoria University of Wellington Scientific Drilling Office. These cores targeted coeval continental shelf and slope sediments deposited between 3.6 to 3.0 Ma that capture changes in lithology and faunal composition associated with relative sea level change. Importantly, these deposits were in deep enough water that accumulation is continuous throughout the glacial-interglacial cycles, but shallow enough to reflect changes in seabed shear stress generated by waves – and thus water depth.

Both sites were downhole logged for density, natural gamma radiation and resistivity. Subsequently core magnetic susceptibility and density were measured on a Geotek Multi-sensor core logger provided by the Alfred-Wegener-Institute. Georgia Grant has conducted detailed measurements of foraminiferal abundance, particle size and oxygen isotopic analyses of foraminifera to constrain paleobathymetry and ice volume changes as part of her PhD thesis. Dr Claudio Tapia Orellana is compiling the paleomagnetism and magnetic reversal stratigraphy and Professors Brent Alloway and Diane Seward are assisting with tephrochronology and stratigraphy. The initial age model suggests sedimentation rates of 1-2 m/ky, but further analysis is needed of the complex paleomagnetic signal recorded in Whangnui sediments before finalising the chronology. The foraminifera and textural analysis shows marked changes in composition, consistent with relative sea level changes and these will be compared against forthcoming $d^{18}O$ measurements on benthic foraminifera. These data will be combined and utilized using a sediment 'backstripping' approach to remove the local effects of tectonism and loading to yield new estimates of Pliocene sea level change.

A new core from Lake George

Éva Papp and the Lake George team

Australian National University, Research School of Earth Sciences

On the 27 November 2015, our ARC-funded Lake George Project* arrived at a milestone: the first core appeared from the direction of the high-tech sonic drill rig perched above a surveying mark on the bed of mysterious Lake George, or, to use its traditional name, Weereewa. A team of drillers, surpassed in number by a team of scientists, excitedly started to package the fresh core to keep it from sunlight in anticipation of OSL dating, some months away.

We, a team of researchers and students from the Australian National University, felt lucky that the drilling was finally happening after almost a year of preparation, planning, permit writing and negotiations on multiple fronts. The drillers felt lucky mostly because they arrived from interstate just in time, and managed to move into position without getting bogged. About the same time, another 4WD vehicle rolled in with various antennas, attachments and signage. Not leaving much room for guess-work – our downhole geophysical logging contractor had arrived.

The rest of the day and the next were full of new experiences for all of us, as the drilling progressed deeper, into 50 m of the Bungendore Formation lacustrine clays and silts, then into the sandier fluvio-lacustrine sediments of the Ondyong Formation. Drilling stopped late afternoon next day, at 77m depth, with 86% overall core recovery.

The site was carefully chosen: on a geophysical line that Dan Clark (Geoscience Australia) had surveyed using seismic methods and Éva Papp (ANU) using the direct-current electrical method. These surveys had shown the existence of a bedrock ledge or wave-cut platform, extending about 100 metres out from the lake shore, and beyond that a more-or-less horizontal sequence of Quaternary sediment, about 140 metres deep, consistent with existing understanding derived from earlier results of BMR and ANU researchers including Gurdip Singh, Bob Abell and others. The electrical survey has indicated the presence of fresh water near the Lake George Fault, and also shown that the subsurface is progressively becoming extremely conductive towards the lake's centre.

One of our PhD students, Michael Short, has been studying the groundwater, surface water and rainwater composition of the area, in order to understand the movement of groundwater and dissolved salts. Michael has undertaken an extensive sampling program over two years, collecting water samples, including around Bungendore, a small town at the south-eastern corner of the lake. Using archived cores extracted by Geoscience Australia's precursor (the Bureau of Mineral Resources), Michael travelled to Canada to measure the stable isotope signatures of chloride and bromide to understand the importance of chemical diffusion of salt in the Lake George sediments and groundwater. Our new core will provide an excellent comparison for a similar study in the near future.

The new core is currently being sampled and analysed by several ANU researchers including Mike Macphail and Janelle Stevenson (pollen), Brad Opdyke (chemical composition and sedimentology), Brad Pillans (paleomagnetism), Éva Papp (pore space), Iain McCulloch (OSL dating) and Bear McPhail (pore water composition). Tony Dosseto (University of Wollongong) will be doing U-series measurements on the core.

The 77 meters of new core, combined with information gained from previous coring at Lake George, will provide a record of environmental change that extends back 2.5 million years. Judging from the dark laminations we recovered deep in the core, it is clear that Lake George has spent long periods of time full to the brim!

*LP140100911 – From ancient to modern environments in south eastern Australia: evidence from the unique natural archives of Lake George. ARC Linkage Project.

Figure 1: The Lake George drilling team (Photo credit: Éva Papp).

VIII Southern Connection Congress Punta Arenas, Chile (18 -23 January 2016)

Brent Alloway

School of Geography, Environment and Earth Sciences, Victoria University of Wellington, NZ

At 18.45 UTC on June 4th, 2011, an explosive eruption (VEI ≤ 5) of rhyolitic magma began at Puyehue-Cordón Caulle volcanic complex (PCCVC), southern Chile and close to the frontier with Argentina. The eruption commenced with the development of a sustained eruption column that ascended to >15 km above the newly formed vent (Figure 1). Ash from this column circum-navigated the Southern Hemisphere in less than 14 days and successively and severely disrupted aviation in Argentina, Uruguay, Falkland Islands/Islas Malvinas, South Africa, Australia, New Zealand and FINALLY – in Chile itself. What an appropriate reminder of just how inter-connected we are in the Southern Hemisphere. Indeed, there are many other notable examples of *'Southern Connection'* that effectively link and influence our widely dispersed and variably-sized southern landmasses and oceans – such as the Southern Westerly Wind (SWW) Belt, the Antarctic Circumpolar Current (ACC) and the extraordinary array of floral/faunal similarities and ancient Gondwana affinities that can be recognized throughout the Southern Hemisphere.

Southern Connection was originally conceived to link scientists interested in the natural sciences across the Southern Hemisphere, with emphasis on temperate ecosystems. Indeed, *Southern Connection* aims to highlight research on shared yet divergent biotas and cultures, and their histories in different lands and oceans, in order to devise strategies for sustaining species and ecosystems as well as discuss and highlight research approaches of common interest. An important objective of *Southern Connection* is also to engage in comparative studies with equatorial and northern hemispheric regions. To date *Southern Connection*

Figure 1: The June 4th 2011 eruption of Puyehue-Cordón Caulle, Chile. Ash from this column circum-navigated the Southern Hemisphere in less than 14 days and successively and severely disrupted aviation in Argentina, Uruguay, Falkland Islands/Islas Malvinas, South Africa, Australia, New Zealand and FINALLY – in Chile itself. What better reminder is there – of just how inter-connected we are in the Southern Hemisphere. (Photo credit: B.V. Alloway)

Top - Figure 2: Memorial to Hernando De Magallanes in the central plaza of Punta Arenas (Plaza Muñoz Gamero). Legend has it – that if you rub or kiss the foot of the bronze statue portraying the indigenous gentleman (Patagonian) then you are destined to have good luck and one day, return to Punta Arenas. However, judging by how many times the foot is actually kissed by tourists during the course of the day *(see close-up of 'kiss-polished' foot)* – I'd be fairly certain that the only thing you end up getting if you went ahead and kissed that foot – would be a cold or maybe something a little worse. (Photo credit: B.V. Alloway)

Figure 3: Estancia San Gregorio located 124 km north-east from Punta Arenas and en-route to Pali Aike is a now an abandoned farm and relict of the sheep farming boom of the early 20th Century. This farm dates back to 1876 and at its peak encompassed an area extending over 91,000 hectares and supported 130,000 sheep. (Photo credit: B.V. Alloway)

congresses have included topics such as biogeography, phylogenetics, ecology, conservation, ecophysiology, invasions, ethnography, plant reproductive biology, macroecology, phylogeography, palaeobotany and palaeontology and Earth and ocean processes. For someone like myself whose wide-ranging research interests straddle different disciplinary areas and perpetually operate at the overlapping fringes – what an amazing opportunity to gain knowledge and insight into other but distantly allied disciplinary realms. Over the years *Southern Connection* has organized seven very successful congresses hosted by five different countries in the Southern Hemisphere – the last Congress was held in 2013 at Otago University, Dunedin, New Zealand. This eighth Congress was held at the University of Magallanes in Punta Arenas, Chile in the very far south (53°S) of South America.

Punta Arenas is the capital city of Chile's southernmost region, Magallanes and Antártica Chilena, and is the largest city south of the 46th parallel south. It's a place steeped in history – from its first human settlement by the descendants of the Selk'nam, Aonikenk, Yámana, and Kawésqar (Figure 2) to European visitation by Magallanes in 1520, the establishment of a Chilean settlement in 1843, the first emergence in 1893 of the *Sociedad Explotadora de Tierra del Fuego* which controlled the largest sheep station in the world (10,000 km^2) (Figure 3) and later in 1916, was the operational centre for the dramatic rescue of Shackleton. Now Punta Arenas is one of two South American southern gateways to the Antarctic Peninsula and the tourist entry point for Terra del Fuego and the breathtakingly beautiful Torres del Paine. What a venue.

The Southern Connection Congress was attended by 295 delegates from 25 countries. The Australasian contingent totaled 46 with 24 coming from Australia and 22 from New Zealand. The programme included 10 plenary lectures, 16 symposia and several sessions of contributed posters. The standard of oral and poster presentations was

Figure 4: Pali Aike cinder cone and lava flows with a herd of Guanaco's (a camelid native to South America) in the foreground. Pali Aike volcanic field is 150 km north-east of Punta Arenas and consists of Pleistocene to Holocene maar craters, cinder cones and extensive lava fields. There has been no historic eruptive activity. An archaeological site within which a cave formed along the inner wall of a cone was found to contain evidence of human occupation dating back >10,000 ^{14}C years B.P. (Photo credit: B.V. Alloway)

high – as to be expected. A couple of standout presentations were: Philip Hulme's (Landcare Research, Lincoln) paper on "*Biogeographic lessons for weed risk assessment*" – a topic of great relevance especially in a steadily warming world, as well as Ricardo Rozzi's (University of North Texas/Universidad de Magallanes) presentation which focused on "*Ecological science and biocultural ethics*". OK – I'll come completely clean – as an earth scientist I concede that I hadn't given too much thought about this topic before – but this presentation was, in its way, absolutely mesmerizing and offered so many startling new (for me at least) concepts and ideas that I really hadn't contemplated or comprehended before. There were many other equally interesting and inspiring presentations – some directly relevant to my research and others that were not. Nevertheless – the intimacy of this small congress with its eclectic, but overall 'connected', array of symposia was all about intellectual extension and broadening of one's horizons beyond our disciplinary noses. Precisely from that point of view – I am completely adamant that this Southern Connection Congress easily fulfilled its objectives and consequently, was a great success.

The congress field-trips to Pali Aike volcanic field (native Tehuelche name meaning "*Desolate Place*") (Figure 4) and Torres del Paine (Paine means "*blue*" in Tehuelche – pronounced *PIE-nay)* (front cover photo) were special AND thoroughly organized right down to the gourmet lunches. The additional bonus of course was that the weather gods in this harsh and sometimes very unpredictable southern environment treated us most favorably so that we had, for the most part, spectacular views of what we all travelled so far to see (relief over relief).

As for the final night – the Congress dinner – that was great event as well – held on a small farm on the outskirts of Punta Arenas. Congress attendees were greeted at the door with traditional pisco-sour, meat stretched out on delicately placed spits surrounding a fire pit (Figure 5), bottles of Carmenere adorning the tables, in attendance were a multitude of new friends – including a rather frisky Ilama outside, a Patagonian sheep shearing demonstration (as a kiwi I wasn't too sure about that ! – yep – the jokes were about to reign on us poor kiwis' from our trans-Tasman cousins – we had to brace ourselves) AND Chris Moy's 40th birthday! (Figure 6) – what else could you possibly ask for?! – except perhaps getting the bus driver to drop off a bunch of very happy Australasian revelers at the Casino on the way back into town at the end of the formal dinner.

At this point of the narrative, you should now be feeling the love and getting that sense of just how well-organized and special this Congress was.

On that basis, I would like to extend a personal note of gratitude to the organizing committee – Juan Armesto, Ricardo Rozzi, Juan Carlos Aravena and Mary Kalin-Arroyo, as well as to the organizing institutions (Institute of Ecology and Biodiversity (IEB), University of Chile, Santiago; Universidad de Magallanes and Instituto Antartico Chileno (INACH) located in Punta Arenas) for a thoroughly well-organised and informative congress. I'm very sure my Australasian colleagues who attended this Congress share my point of view and heart-felt sentiments. If this excellent Chilean experience in Punta Arenas is anything to go by – then I'm certainly looking forward to the next meeting in Campos do Jordão (State of São Paulo) in Brazil in 2019. Pode vir!

Figure 5: The conference dinner – a traditional Patagonian Asado (bar-be-qued mutton on a spit) certainly not a culinary occasion for the faint-hearted, vegans and/or vegetarians. (Photo credit: B.V. Alloway)

Figure 6: Chris Moy's 40th Birthday coinciding with the Congress dinner. Personally – I can just vaguely remember turning 40! Maybe in the future this photo might serve to remind Chris. (Photo credit: B.V. Alloway)

International Symposium on Aeolian Deposits in Earth History, INQUA Loess Focus Group meeting, Beijing, China, 12-15 October 2015

Kathryn E. Fitzsimmons

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The loess-paleosol sequences of Eurasia contain the longest, most complete and most widespread records of Quaternary terrestrial palaeoenvironments. Consequently it is no surprise that scientific research into loess records has a long and distinguished history in Eurasia (e.g. Markovic et al., in press), and one which transcended the political barriers of the second half of the twentieth century. The international Loess Commission was established in 1961 and straddled both sides of the Iron Curtain. Loess fever was abetted by the efforts of Professor Tungsheng Liu who drew the attention of the Quaternary scientific community to the exceptional Chinese loess archives (Liu and Chang, 1964) – and incidentally, also catalyzed connections with Australian Quaternary research (Bowler, 2007).

Loess can therefore be viewed as a fantastic catalyst for international scientific collaboration. The loess community across the world remains an active one – albeit nowadays with much more sophisticated tools for analysis. The INQUA Loess Commission has more recently morphed into the Loess Focus Group, and continues the tradition of active international exchange, most notably through its annual meetings held in various dusty places around the world.

So it was that on a sparkling autumn morning in October 2015, approximately 200 aeolian scientists from across the world gathered under the shadow of the Great Wall on the University campus of the Chinese Academy of Sciences, at Yanqi Lake, an hour or so north of Beijing. The programme promised two keynote and 42 additional presentations, as well as 38 posters, held over two days, and was followed by two days of exciting field trips to loess profiles near Beijing and to the famous archaeological site of Zhoukoudian.

Monday the 12th began with two keynote talks held by Professors Nat Rutter (University of Alberta, Canada) and Andrei Velichko (Russian Academy of Sciences), spanning long timescale palaeoclimate records of the Americas and loess formation on the Russian Plain respectively. This was followed by an exciting array of presentations on aeolian themes. These ranged from proposed stratigraphic frameworks linking eastern European and Chinese loess (Slobodan Marković, University of Novi Sad, Serbia), to loess as a recorder of East Asian monsoonal change over Quaternary timescales (Shiling Yang, Chinese Academy of Science). There were models for palaeodust generation and deposition (Yaping Shao, University of Cologne, Germany) and advances in methodological tools for aeolian provenance and palaeoclimate reconstruction (Youbin Sun, Chinese Academy of Science; Natalia Gerasimenko (National University of Kiev, Ukraine; et al.). The topics and case study areas spanned not only the entire loess belt of the northern hemisphere temperate latitudes – eastern Europe, Russian Plain, Central Asia to China – but also included a provocative talk on the aeolian nature of the Tertiary sediment deposits near Port Campbell in Victoria, Australia (thanks to Xiuming Liu, Fujian Normal University, China!).

In the evening we were treated to a banquet dinner, on a scale only Chinese can pull off with style. Figure 1 sees a selection of participants who survived the rice wine and folk songs from around the world (at least, I think the photo was taken afterward...). After sitting quietly through several rounds of lusty Chinese folk songs and cheerful Russian tunes I was induced into warbling "Kookaburra sits in the old gum tree" as quickly as I could!

Tuesday continued the diverse programme of talks, as well as a fantastic poster session which kick-started a number of animated discussions. Highlights included Zorica Svirčev's (University of Novi Sad, Serbia) hypothesis that cyanobacteria in loess is responsible for mass hallucinations across the steppe belt; the impressive dataset of Zhiwei Xu (Nanjing University, China) from the Mu Us dunefield linking dune activity with palaeoclimate; and a proposed link between Tethys Sea regression and Saharan aridification during the Miocene (Zhongshi Zhang, Bjerknes Centre for Climate Research, Norway).

The following two days comprised an ambitious programme combining science with tourism. On the Wednesday, we were treated to a visit

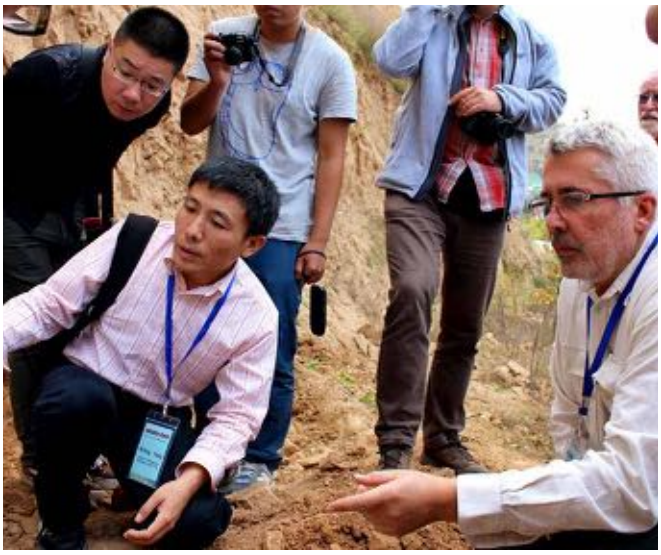

Figure 1: Survivors of the ISADEH banquet. (Photo credit: C. Lan)

Figure 2: Thick loess deposits at Fanshan have been terraced for agriculture – during our walk up the sequence we hunted for apples. (Photo credit: S. Marković)

Figure 3: Professor Shiling Yang (Chinese Academy of Sciences) draws our attention to the impressive So (Holocene) soil at Fanshan. Photo credit: S. Marković)

to loess deposits at Fanshan, barely two hours west of Beijing (Xiong et al., 2001). Despite keeping half an eye on Chinese loess research, I hadn't realized how substantial the loess deposits outside of the Chinese Loess Plateau could be (Figures 2 and 3)! According to stratigraphic correlations, the Fanshan deposits – which we visited at two sites – are proposed to span 1.1 Ma.

In the late afternoon we were ushered to the Great Wall. Despite the late hour – the sun was only just still lingering over the russet leaves of the surrounding hills – the guards opened the gates for us specially (Figure 4). Having the Great Wall all to yourself as the autumn sun sets is a pretty special experience.

Our final day saw us visit one of the Holy Grails of human evolution, the Peking Man site at Zhoukoudian (Rukang et al., 1985; Shen et al., 2009). I admit that my appreciation for all things palaeoanthropological has amplified since moving to Germany, but seriously, you don't need to work with archaeologists to be impressed by this site. In typical Chinese style, Zhoukoudian is introduced by a spectacular museum summarizing the finds of the many caves at "Dragon Bone Hill" – including casts of the Homo Erectus remains, casts and evidence for occupation by Homo Sapiens, zooarchaeological inventories, and a smaller exhibit on the ongoing search for the original fossil collections which went missing during the Second World War. There wasn't really time to visit all 20+ caves which dot the Hill itself, but we were treated to the highlights. These included caves preserving multiple anatomically modern human occupation events and fossil hyena dens, as well as the Peking Man sequence proper. The latter, while now almost entirely excavated, is truly impressive, and is entered

Figure 4: Savouring day's end and having the Great Wall all to ourselves. (Photo credit: C. Lan)

by two stairways leading down to the bottom of the cave deposits which were 40+ m thick. One cave wall is constructively signposted with tags at various depths informing the visitor as to the species of human occupying the site, as well as the age and stratigraphic level. It was hard to top this visit, but a stop at the Temple of Heaven complex in Beijing afterward certainly came close.

All in all, this was a great meeting, spanning all aspects of aeolian research as it relates to palaeoenvironmental reconstruction. I'm very much looking forward to the next conference, to be held in Wisconsin, USA in September 2016! Check http://inqua-loess.org/ for updates.

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4TH AUS2K WORKSHOP REPORT
Australasian palaeoclimate of the last 2000 years: Inter-comparison of climate field reconstruction methodologies, modeling, and data synthesis approaches

Joelle Gergis[1], Steven J. Phipps[2], Andrew M. Lorrey[3], Nerilie J. Abram[4], Benjamin J. Henley[1], Krystyna M. Saunders[5], and Aus2k Workshop Participants*

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The aim of the 4th Aus2k workshop (27–29 October 2015, held in Auckland) was to review progress made by the PAGES Aus2k working group, and to identify research from the Australasian research community that will contribute to Phase 2 of the PAGES 2k Network. Nineteen palaeoclimatologists from New Zealand and Australia attended the workshop at the National Institute of Water and Atmospheric Research (NIWA) in Auckland. There was an increased representation of lake sediment and speleothem specialists at the meeting, adding to the recent consolidation of non-annually resolved data from Australasia. From the outset, the highly multidisciplinary group generated very insightful and collegial discussions, setting the tone for a highly productive workshop.

Day one of the workshop showcased recent research developments in data synthesis, climate modelling and new record development. Helen McGregor discussed the recent low-resolution sea surface temperature synthesis generated by the PAGES Ocean2k group (McGregor et al., 2015). A composite of 57 records reveals a long-term cooling trend during the pre-industrial Common Era, with climate modelling identifying volcanic eruptions as the most likely driver. Nerilie Abram presented a PAGES2k Consortium paper currently in revision, examining the onset of Industrial-era warming across the oceans and continents. Warming begins later in the Southern Hemisphere than in the Northern Hemisphere, potentially due to delayed warming in the tropics. Mandy Freund presented a new Australian precipitation field reconstruction spanning the last millennium. This was identified as one of the region's contributions that will go towards the planned global PAGES 2k special issue of *Climate of the Past*.

Hamish McGowan presented a promising 2100-year temperature reconstruction using a speleothem from the Snowy Mountain region of New South Wales, showing that there is good coherence with major hemispheric and global climatic events. Chris Moy linked high-accumulation lake records from southern South America and the NZ sub-Antarctic Auckland Islands to changes in the Southern Hemisphere westerly winds, demonstrating strong millennial-scale variability throughout the Holocene. Ben Henley presented results of an Interdecadal Pacific Oscillation reconstruction spanning the period from 1600 CE to present using a new Tripole Mode Index (Henley et al., 2015), and considered its possible links to global temperature variations.

Of significance for bridging the gap between proxy data and climate model simulations, Steven Phipps presented preliminary Australasian climate field reconstructions generated by assimilating Southern Hemisphere records into a new 25-member ensemble of CSIRO Mk3L model simulations. Duncan Ackerley presented plans to run a suite of simulations of the last millennium using the Australian Centre for Water and Climate Research's (CAWCR) ACCESS model. He also invited suggestions for new experiments, highlighting growing interest in palaeoclimatology from the broader climate science community in Australia.

The morning session of day two focused on an update on the new Australasian database of low-resolution records, synoptic typing data synthesis techniques being used by the Aus2k group (Lorrey et al., 2013; Browning and Goodwin, 2015). A lively discussion led by Ian Goodwin considered the development of guidelines for future record collection in our sector of the Southern Hemisphere, framed around understanding regional

and hemispheric climate dynamics. Within this session, Bronwyn Dixon described the new Australasian 'low-resolution' database, which includes 536 low-resolution records from Australia and Indonesia. The highest quality records in the database were identified and their age models were recalibrated using BACON. Preliminary results using a Monte Carlo EOF method previously applied to east African data (Anchukaitis and Tierney, 2012) were also presented. Stuart Browning gave an extremely thought-provoking presentation on a new 1000-year climate reanalysis called 'PalaeoR'. This product was generated using a novel data assimilation technique and has been made freely available to the research community (http://climatefutures.mq.edu.au/research/themes/marine/paleor/). The follow-on presentation by Drew Lorrey showcased the NIWA Past Interpretation of Climate Tool (PICT; http://pict.niwa.co.nz), which applies modern analogues to understand past circulation changes using collections of proxy data. Initially developed for New Zealand, the tool is now being expanded to include other regions and a wider range of climatic variables.

The afternoon session of day two focused on an update of progress developing lake sediment records from Lake Ohau in New Zealand by Marcus Vandergoes. The Southern Annular Mode has a strong influence on rainfall in the lake catchment, giving the potential to develop a record of changes in Southern Hemisphere circulation spanning the past 17,000 years. Krystyna Saunders presented an update on the application of high-resolution hyper-spectral scanning techniques to Rebecca Lagoon in Tasmania. She has generated the first high-resolution, quantitative reconstruction of Tasmanian rainfall

Figure 1: Members of the Aus2k group visiting the Cascades Kauri Park, Auckland, New Zealand. (Photo credit: Drew Lorrey)

to be based on lake records, with the reconstruction identifying the start of the 19th century as being one of the driest periods of the last 2,000 years. There was also an interactive group poster session that highlighted progress on the climatic interpretation of Western Australian speleothem records from Pauline Treble; a new borehole temperature reconstruction for eastern Australia by Suman Asadusjjaman, only the third attempted for the Australian continent; an array of sedimentary charcoal records from the Pacific Island region spanning the western Solomon Islands to western Polynesia by Matthew Prebble; and a new high-resolution Southern Hemisphere westerly wind reconstruction using sub-Antarctic lake sediments being developed by Krystyna Saunders.

Day three was primarily focused on extensive discussion of the development of regional 'best practice' standards for proxy metadata reporting to be compatible with the LiPD framework (McKay and Emile-Geay, 2015). The group watched a pre-recorded presentation on LiPD given by Julien Emile-Geay, then discussed examples in the literature for existing geochronology protocols and ideas for new record collection. Drew Lorrey agreed to coordinate the further development of a metadata template that will form the basis of a journal article on this critical topic, with the intention that it will assist the next generation of palaeoscientists in reporting and collecting material from our region. The group also discussed a group contribution in assessing different data-model assimilation methods being employed in the Aus2k region and how they can inform future palaeoclimate record collection, with Ian Goodwin volunteering to lead this project.

The workshop wrapped up by identifying two contributions on regional hydroclimate synthesis papers, led by Early Career Researchers Mandy Freund and Bronwyn Dixon, for the planned PAGES 2k network-wide special issue of *Climate of the Past*. The group also generated a proposed table of contents for a regional special issue of the same journal to showcase the diversity of new research being developed by the Aus2k community. The proposed submission timeframe is expected to span around September 2016 to March 2017. Please contact a member of the steering committee if you are interested in contributing your research as part of the group's legacy to the 2k network.

*Aus2k Workshop Participants:

Duncan Ackerley, Monash University; Suman Asadusjjaman, University of Canberra; Stuart Browning, Macquarie University; Bronwyn Dixon, University of Melbourne; Mandy Freund, University of Melbourne; Ian Goodwin, Macquarie University; Hamish McGowan, University of Queensland; Helen McGregor, University of Wollongong; Chris Moy, University of Otago; Matthew Prebble, Australia National University; Pauline Treble, Australian Nuclear Science and Technology Organisation (ANSTO); and Marcus Vandergoes, GNS Science.

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C-Peat October 2015, Lamont-Doherty Earth Observatory, New York

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October 2015 saw a group of peaty people congregating at the Lamont-Doherty Earth Observatory (LDEO) in Palisades, New York, a campus of Columbia University. Sponsored by PAGES and INQUA the meeting was initiated by Zicheng Yu and Dan Charman, the C-PEAT (Carbon in Peat on EArth though Time) group aims to improve our understanding of carbon stores, fluxes and long term dynamics of peat forming and carbon-storing environments. The first public outing for the project was a group discussion between the many peat-based researchers at the Nagoya INQUA congress in August 2015. This face-to-face meeting helped steer the planned meeting later in the year and formed the basis for the four focus groups within C-PEAT; tropical peatlands, initiation and lateral expansion, buried peats and deep-time peats. Both ecology and geoscience were equally represented.

For Len, a window seat on the flight from LA to New York was a good crash course in North American Geography, starting with the sprawling suburbs of LA then over the mountains and across the desert before spending hours flying over patchwork farmland in the Midwest. After landing at JFK then heading straight through the hustle and bustle New York City, crossing the Hudson River to the quiet green woods of the Palisades in New Jersey was a total change of scenery. Geoff drove across from Indiana getting an expert commentary on Laurentide ice landscapes from a colleague. We had all been organised to stay at the same hotel near the conference venue and the group of about 60 (Figure 1) slowly filtered in during the evening ahead of an early start on Sunday with breakfast at LDEO. The campus started life as the weekend estate of Thomas Lamont before being donated to the University of Columbia in 1949 and has become a world-famous geoscience-specific postgraduate and research campus. Amongst scattered newer buildings, our venue was Lamont's original manor house, so quite a flash venue (Figure 2).

The first day was devoted to short talks; so that we could understand everyone's background once we split into workshops and discussion groups for the remainder of the week. Zicheng Yu (Lehigh) and Nigel Roulet (McGill) gave overviews, stating that peatlands are the major mechanism for decreasing CO_2 atmospheric concentration and emphasising the very wide range of environments in which peats form and are preserved. Tim Moore (McGill) suggested that nutrients such as P were probably the main constraint on carbon accumulation rates (he introduced the term "nekromass"). Rene Dommain (Smithsonian) introduced us to the fantastic world of lowland tropical peat with an analysis of rapid tree fall rates (4 trees/ha/10 yr) as the cause of the massive amounts of wood preserved. How much peat is there and can it be mapped and modelled?

Figure 1: Participants at the C-PEAT workshop. Lamont-Doherty Earth Laboratory, University of Columbia. (Photo credit: L. Martin).

Figure 2: Thomas Lamont's original manor house, part of The University of Columbia since 1949 (Photo credit: L. Martin).

Steve Frolking (New Hampshire) and Thomas Kleinen (Max Planck, Hamburg) modelled peat growth and global extent of peatlands for us. The boreal peatlands are the best mapped and modelled. However carbon density mapping is still developing and the acrotelm (upper seasonally drying layer) carbon flux processes are not well understood.

After these reviews more specific topics were presented in three areas-Peats through Earth's History, Peats from Around the World and Future Trajectories. Stephen Greb (Kentucky GS) outlined all the great coal-forming epochs since life took over the land in the Devonian – the US coals were tropical while the Australian black coals were cold permafrost, reflecting the division today. Dave Large (Nottingham) showed that 2m of coal is about 100,000 years of time and represent periods with low dust accession and C rates of 60g/m^2/yr in the tropics and 20 g/m^2/yr in temperate areas. Viktor Brovkin (Max Planck, Hamburg) suggested that the fact that CO_2 seems to mirror ice sheets may reflect the burial of peat as ice expands. Re-exposure of these peats lead to the abrupt rises in CO_2 at the start of interglacials. It is possible that the lockup of CO_2 in peat eventually lowers CO_2 concentration and tips the earth towards ice cap growth.

The regional reviews covered tropical mountains, coastal fens and estuarine wetlands. New data on Amazonian peatlands from Ian Lawson (St Andrews) revealed previously suspected but unproven large peatland carbon stores. Australia (in the form of the Blue Mountains) even had a mention. In the Future Trajectories attention turned to the potential emissions of carbon as CO_2, CH_4 and DOC with global warming and human disruption and peatland exploitation for crops such as oil palm and forestry. Thawing of the present day discontinuous permafrost will lose a total of 56.1 Pg of carbon (mainly as CO_2, thankfully). Elaine Matthews (NASA) has been building a wetland GIS of the 5.3 x 106 of flooded wetlands to estimate CH_4 fluxes. Tim Daley (Plymouth, UK) broke the welcome news that methanotrophic bacteria eat methane and that 10-15% of the carbon in much peat is bacterial. Thus restoring peatlands does not lead to greatly heightened methane releases as has been feared.

After the brief talks, we formed four focus groups where we examined the major knowledge gaps in peat accumulation limits, past and current carbon stock and future trajectories for peat. This open style of workshop meant that time flew past and before long we reconvened to summarise the main points each group had come up with and worked out a few inroads that could be achieved under the collaborative umbrella of C-PEAT. This included a new working group on mapping future threats to peatlands – and opportunities for conservation.

The third day involved another new conference experience: being randomly allocated into a discussion groups to cover a wide range of topics, from ranking the fundamental controls on peat forming environments through to discussing modern analogues of buried peat and deep-time peat. An interesting outcome, from an Australian perspective at least, came from discussing the fundamental controls on peat-forming environments with such a diverse group of researchers. This highlighted the role of topography in controlling the initiation and continuation of peat forming environments, something that has long been overlooked due to the high-latitude Northern Hemisphere dominance in the literature.

At Quaternary conferences we have found ourselves to be in a minority as peat-based people amongst a large group of paleo people, but C-PEAT was the opposite and really broadened our appreciation for contemporary issues in the field and potential future challenges. New ideas spanned many diverse topics: ranging from evidence for step-wise peat accumulation in tropical peat forests moderated by lightning strikes to large scale swamp-heating experiments modelling climate change. We also heard from researchers working in incredibly diverse peat-forming environments from all over the world, and Len especially enjoyed surprising the group that yes, Australia does indeed have peat swamps, reinforced by Geoff distributing a pre-print of his paper on carbon in Snowy Mountain peatlands.

Overall, the experience of attending C-PEAT and getting out of our normal palaeo comfort zone was really useful and served as a platform for raising many of the ideas that we have discussed at AQUA and related events. Moving forward from the 2015 meetings at INQUA and LDEO, the four working groups are continuing to develop ideas with subsequent meetings at AGU and other conferences and I'm sure there will be more news of interest to the peat and palaeo communities to come from this project.

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Southern Hemisphere Assessment of PalaeoEnvironments (SHAPE): An International Focus Group supported by PALCOM

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Since the INQUA congress in Japan there has been continued progress for SHAPE, including the submission of a formal proposal to advance the SHAPE project (2013-2015) to International Focus Group (IFG) status within PALCOM (Palaeoclimate Commission). The IFG application the SHAPE steering committee submitted was successful, and it attained full requested financial support for the current INQUA inter-congress period (2016-2019). The INQUA executive also noted in their award letter that they were impressed with the high-quality and breadth of the science contained in the SHAPE-IFG application. In addition, the depth of participation for SHAPE has grown to over 200 researchers. Part of the role of the SHAPE-IFG is to support the efforts of aligned projects in PALCOM, of which there are currently three under the SHAPE-IFG. They are: Southern Westerlies' Evolution in Environments of the Past, PalaeoLakes of the Arid Southern Hemisphere, and the Last Glacial Maximum in the Southern Hemisphere. More projects are expected to be added to the SHAPE-IFG in the coming years.

The SHAPE session at INQUA in Nagoya was one of the most well-attended and highly subscribed, and it included more than 45 presentations of research (Figure 1). An equal number of paper titles have come out of that session to form a backbone for several SHAPE special issues that are being hosted by Journal of Quaternary Science, Quaternary International, and Climate of the Past. Each of these special issues has begun receiving articles and some have already been published online. We encourage members of the community who would like to contribute to SHAPE to have a look at the remit for each special issue and consider submitting research to one (or more) of the three issues, and the submission deadlines will be re-posted on a SHAPE website that is to be launched in July 2016.

Three workshops will be held between 2016-2019, and they will be aligned to regional research initiatives that will help to achieve the major aims of the SHAPE IFG. The first SHAPE-IFG workshop will be held in Santiago, Chile and it will be hosted by Maisa Rojas at Universidad de Chile. The focus of the workshop will be on Southern Hemisphere climate systems. A major component of that workshop will be to enhance engagement between palaeoscientists and climatologists, climate theoreticians and climate modellers. SHAPE funding from PALCOM will also be applied to assist early career researchers attend meetings and workshops, and it will contribute toward the development of a Southern Hemisphere palaeoscience mentoring network (e.g. for authorship of publications, training on tools and climate model use).

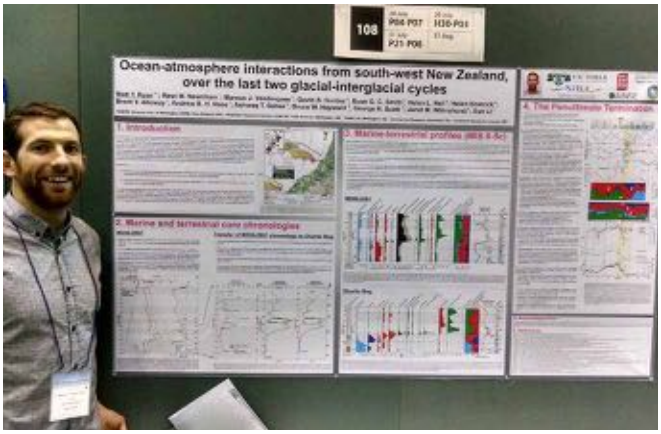

Figure 1: Matt Ryan, long-standing PhD Candidate at Victoria University Wellington, presents his research at Nagoya. Matt is an active participant in SHAPE and AQUA. He has recently led papers dealing with the alignment of terrestrial and marine proxy records and outlining the last 210ka of climate history for Westland, New Zealand.
(Photo credit: Matt Ryan)

In addition, SHAPE will have a presence at several planned meetings across the Southern Hemisphere that are upcoming, including at the Australasian Quaternary Association Biennial Meeting in December 2016 and the Southern African Society for Quaternary Research biennial meeting in 2017. For the 2019 INQUA Congress in Dublin, the SHAPE team intends to propose a session to highlight the products of associated IFG work that has been coordinated across all sub regions of the Southern Hemisphere. This effort is also expected to foster the discussion of future directions for new research, led by early career researchers, and it is hoped that a series of successor projects will build off of SHAPE that can be embedded within PALCOM.

Aquatic Transitions – A PAGES Working Group

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Aquatic Transitions is an official working group of PAGES, which has transitioned from the IGBP and is now under the auspices of ICSU's Future Earth. The aim of the working group is to integrate regional records of change in aquatic systems to provide a global synthesis of the sensitivity of sites to critical stages of human impact, detailing the nature of changes that can provide insights for management of these aquatic ecosystems. The two principal objectives are:

[1] To document the history of human impact on aquatic systems through the identification of the first point of human impact, and the inception and peak of the impact of the industrialised phase.

[2] To examine the nature of these transitions to identify the ecosystem dynamics that have resisted human pressures, as well as the changes leading up to the point where the system succumbed, and the degree to which new, stabilising forces have entrenched the system in a new regime. Essentially, to assess whether paleolimnological records can demonstrate stable state shifts in the past.

The group first met at the British Geological Survey in April 2015 and held a follow up workshop at the International Paleolimnological Congress in Lanzhou last August. We ran a special poster session at the Fall session of AGU in San Francisco and will be running a session at Intecol Wetlands in Changshu, China this coming September.

Our next working group workshop was at the University of Maine from 26-28 April 2016. See the website (http://www.pages-igbp.org/calendar/all-events/127-pages/1554-aquatic-transitions-2nd-meeting) for details. For those interested in other PAGES activities visit the PAGES website. The next PAGES Young and Open Science Meetings have been announced for 7-9 and 9-13 May 2017 respectively, both in Zaragoza, Spain.

Figure 1: Mike Reid and Peter Gell with the PAGES Aquatic Transitions working group at the University of Maine USA, 28 April 2016.

Heading South to Find a Better Way Forward

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What do you get when you put 78 women on a boat to Antarctica? I don't know – but I am going to find out. To the rarefied audience that comprises the readers of *Quaternary Australasia*, I feel at best a fraud when I talk about my impending trip Down South. After all, many of you have been before for legitimate reasons – true expeditions of scientific endeavour, breaking new ground (or ice) and making important contributions to our understanding of ice dynamics, (palaeo)climate variability and biotic response in seriously remote regions. Me – I'm just going for a jolly. Or am I?

I will explain – as best I can. I put my hand up – and was subsequently selected to take part in 20 day leadership program, specifically designed for female scientists, on an expedition from Ushuaia, Tierra del Fuego, to the Antarctic Peninsula. Pretty cool huh! (Apologies for bad pun). I am one of 78 women from around the world undergoing this voyage, which is the brainchild of leadership consultant and savvy Melbourne business-woman, Fabian Dattner. Fabian's vision is: "to elevate each participant's leadership capabilities, to refine their skills to design and execute strategy, and devise plans for future collaborations as women leaders working towards a sustainable future."

The basic premise underpinning the expedition is found in the challenges we face as a global population in view of a changed climate and globalised world. The *status quo* may have got us this far, but may not be sufficient to address the future that awaits us.

Women's leadership style can be different – and that difference celebrated. Perhaps more inclusive, perhaps more lateral. Many of us (including me) find it extremely difficult to lead from the front, but would rather shepherd others together. There needs to be a range of leadership styles and techniques to move forward. This program is designed to explore how female leadership across the sciences contributes to solving complex scientific challenges such as climate change and to investigate what makes women particularly well suited to leading and communicating research (Homeward Bound, 2016).

Female scientists are on the rise in numbers, and looking to find a stronger voice. And whilst the number of female science graduates, across the disciplines, is equivalent to men, the number of females in level D and E or in executive positions certainly is not. Women are greatly under-represented in leadership positions – particularly in academia. Many of us share the challenges of putting our career on the back-burner to give support to children and/or partners. But women, particularly in science, have an important contribution to make to our community, as well as our disciplines.

Why Antarctica? Polar science provides an evidence-base for global climate change action (Homeward Bound, 2016). It is essentially a back-drop to accentuate the impact of climate change – and thus the relevance for us to be undertaking this work collectively and now. It also worked as a pretty good carrot to get us all to sign up.

The program itself comprises a combination of leadership and strategy training, and science, headed up by Fabian Dattner of Dattner Grant, Harvard business psychologist Dr Susan David, UK strategy guru Kit Jackson and Dr Jess Melbourne-Thomas, marine ecologist from the Antarctic Climate and Ecosystems Cooperative Research Centre. As well as the team on board, there is a virtual "faculty" of experts in the fields of advocacy and ecology, including Dr Jane Goodall and Dr Sylvia Earle, adding their knowledge and support to this endeavour. "By giving women the leadership and strategic skills, coupled with a sound understanding of the science behind the state of our planet, this could be the start of a global collaboration of women able to influence policy and decisions towards a sustainable future" – Fabian Dattner.

But it is not all just about what happens on board. Each of us are participating in group projects leading up to the voyage. Topics include education outreach, engagement of organisations making a positive social and environmental impact and the one that I am involved in, developing and leading transdisciplinary science programs to address global change priorities. There is also a longitudinal social science project being undertaken on the participants by Dr Meredith Nash of the University of Tasmania, to record the impact and efficacy of this unique program. Even more terrifying is a 1-hour documentary being made of the program by Greer Simpkin and David Jowsey.

What am I hoping to get out of this? I suppose more confidence in taking on leadership roles and the skills and techniques to enable this. Importantly, I am really interested to meet the other 77 women. Most of the Victorian women have already met up and they are quite a diverse bunch, with regards age, experience and expertise. All of them do share a very 'can do' attitude and are ready to take on this challenge. I do not normally spend time with large groups of women, so this will be an interesting aspect for me – and hopefully a positive one.

This voyage, heading off in December, is likely to be the first of many. Fabian envisages up to 1000 women participating over the next 10 years. We will be the willing guinea pigs and I will happily report on our adventures upon our safe return. Depending on the internet connection, I might even Skype into the AQUA Auckland meeting and say kia ora. In the meantime, you can follow the pre-journey musings at: https://www.facebook.com/homewardboundprojects.

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The Lancefield Megafauna Festival

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The EXTINCT Festival is a community-based Arts and Cultural event that celebrates the discovery of megafauna in Lancefield. In October 2015 the small town of Lancefield, north of Melbourne, celebrated the inaugural event in its own unique way.

SIGNIFICANCE AND BRIEF HISTORY OF THE LANCEFIELD SWAMP SITE

The Lancefield megafauna site has a history of fossil finds that spans well over 150 years. The site is acknowledged as one of the most important Late Quaternary sites in Australia. It is considered significant because it was the third megafauna locality to be discovered in Australia and provided the first record for the extinct giant dromornithid *Genyornis* on the Australian continent. It is estimated to contain the bones of over 10,000 individual animals, buried in swamp mud. There are three known separate bone localities in the swamp area, each with its own unique sedimentary and taphonomic signature; the Classic Site, located in 1974, the South Site, located in 1983 and the Mayne Site, first discovered in 1843 and subsequently relocated in 1991 (van Huet, 1993).

In 1843 James Mayne was digging a well in the swamp when he discovered the 'fossil bones of a number of animals embedded in a layer of dark alluvium, about a foot in thickness' (Orchiston et al., 1977). The bones were taken to the Museum in Melbourne (then known as the Mechanics Institute) and identified as from a 'large kangaroo', a 'huge rodent' and other bones that resembled a 'mastodon' (Orchiston et al., 1977). A brief field visit by Museum staff in 1844 recovered the long bones of a cursorial bird, which were later identified as *Genyornis* sp. (Orchiston et al., 1977). However, any extensive excavation had to be abandoned due to over-abundant water flow (van Huet, 1993, 1999).

In 1973 geologist Robin Glennie sunk several auger holes in the swamp, in an area he suspected may have bone. Glennie was hoping to relocate the original fossil site. He was successful in his search for fossil bone, but, as it turned out, had also discovered a different locality from the original discovery. Consequently, a team of archaeologists from Sydney University, the Institute of Aboriginal Studies in Canberra and palaeontologists from Museum Victoria and Monash University extensively excavated Glennie's new site – now referred to as the Classic Site. The findings led to the, now, seminal investigation and subsequent 1978 paper by Gillespie, Horton et al. Over 3,000 bones were found from more than 27 species, as well as a hand axe. This last, in conjunction with a radiocarbon date of 25,200 +800 to 26,600 +650 ybp led to speculation for the co-existence of humans and megafauna (Gillespie et al., 1978, van Huet, 1993).

In 1983 a second site was located during construction of a dam and subsequently excavated by Wade Miller from Brigham University in Utah, USA, in collaboration with Museum Victoria. It was coined the 'South Site' (although this name is still providing significant 'head scratching' as it is actually east of the Classic Site). Many of the specimens Miller collected are still in the Brigham Young University collection. In 1991, during a reconnaissance auguring program, a third and fluvially separate site was discovered, which later proved to be the original site located by Mayne in 1843. This site became known as the Mayne Site (van Huet, 1993).

Since then, the area has become a proving ground for Honours and Masters research students from Victoria and New South Wales. Of the variety of work done, there has been mixed consensus regarding the depositional environment, the association between the human/megafaunal coexistence and the age of the deposition. Conclusions from work done on the taphonomic and fluvial aspects of the site vary from in situ deposition to fluvial and overland flow (van Huet, 1999, Peel, 2001, Ngo, 2004, McKenzie, 2016). What is established is that the area has produced a significant amount of bone material from a range of extinct megafauna. At each of the three known sites, bone was found buried in a different matrix. Each site thus has a distinct depositional signature. The original radiocarbon age has now been pushed back to approximately 50,000 ybp. Electron Spin Resonance dating returned values of 50,100±9700, 46,300±8900, 56,000±10,000; leading to an overall accepted age of around 50,000 ybp (Grun et al., 1998).

Left to Right, Top to Bottom
Figure 1: A *Thylacoleo* in your front yard (Photo credit: Sanja van Huet).

Figure 2: Local art work (Photo credit: Sanja van Huet).

Figure 3: Carved and painted cypress tree (Photo credit: Sanja van Huet).

Figure 4: Fossil Roadshow (Photo credit: Sanja van Huet).

Below:
Figure 5: Auguring in the swamp (Photo credit: Sanja van Huet).

THE EXTINCT FESTIVAL

Of course, apart from all this, it is the megafauna that the EXTINCT Festival is all about. Many of the shops on Lancefield's main street sported giant wooden megafauna 'cutouts' constructed by the local men's shed. Local schools produced plaster fossil casts and art work which was on display in cafes and the local community centre.

Local and regional artists were invited to participate and contribute to the event. My personal favourite were the megafauna 'characters' carved out of two old cypress trees near the football oval.

Museum Victoria's Department of Vertebrate Palaeontology prepared and presented to the Lancefield Park Management Committee a 'Frankenroo'; a compilation of random *Macropus titan* fossil bones, put together into a representative skeleton. 'Frankenroo' is now on display in the local community centre. A 'Panel of Experts' information session was held which included talks by local amateur Syd Green, archaeologist Joe Dortch from University of Western Australia and the author, taphonomist Sanja van Huet from Deakin University. Joe and Sanja have both worked extensively at the Lancefield site. The session was attended by over 150 interested local residents. The topic? Why the bones were there. Syd gave a rundown on his involvement with the excavations, starting with Glennie's work in 1973, up until recent work by Honours student Cameron McKenzie from Deakin University in 2015. Sanja went over her findings from the 1991 excavations and her subsequent Museum work on bones and sediments from the site. Joe described the findings from his 2004 field work.

The activities concluded on the Saturday with a 'Fossil Road Show' (like the Antiques Road Show but with fossils) and Cameron McKenzie supervised a 'fun public auguring session' ... which got serious when they hit bone. Not everything brought to the road show was a fossil ... and one or two specimens even stumped our 'experts'! The event is in the planning stages for November 2016 and is expected to be bigger and better than last year.

There is a genuine and more driven motive for this event. Locals and scientists who have worked at Lancefield are concerned that the site will be degraded through drying exacerbated by recently constructed drainage (it is no longer a swamp and the bones become highly friable when they are dry). As well as this, the site is readily accessible and not protected from the public. If the amazing history of the area is destroyed and disappears through mismanagement, ignorance or apathy then the whole story will never be revealed. Alternatives are being discussed to decide what can be done to preserve this significant site.

Any Quaternary Australasia readers who would like more information, have suggestions, or would like to contribute in any way to the EXTINCT Festival please contact Adam Bostanci of the Lancefield Megafauna Festival Organising Committee at adam.bostanci@googlemail.com

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Climate Change in Deserts: Past, Present and Future

Martin Williams

Cambridge University Press, New York, 2014. ISBN 9781107016910, 629 pp.
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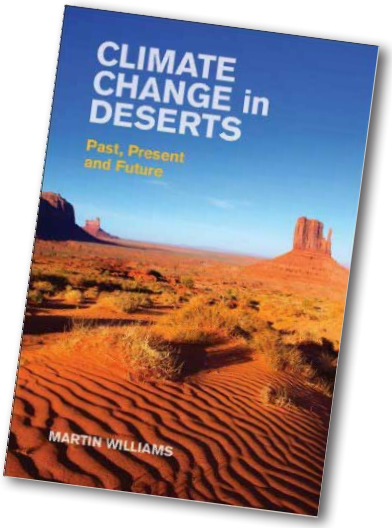
Reviewed by John Magee

Geoscience Australia, Canberra, Australia



This is a large and ambitious book that manages to be a comprehensive introduction to drylands of the world, including their origins, palaeoclimates, palaeoenvironments, present climatic settings and prospects of how they might react to future climate changes. It is large in every sense, weighing in at 1.5 kg, with 530 pages of text spread over 26 chapters and an 88-page bibliography. The chapter structure looks first at present day deserts – their classification and distribution, then moves on to their origins due to plate tectonics and the interaction of continental movements and the resultant impacts on the complexities of the ocean-atmosphere system. This is followed by an outline of the adaptation of living things to deserts then a history of desert research. Williams then reviews the basics of dating methodologies and isotope and trace element geochemistry, which are fundamental for understanding much of the research work summarised in subsequent chapters. The middle portion of the book then contains 10 chapters that review different landform or landscape characteristics fundamental to all or most desert regions. These include dunes, dust, rivers, lakes, glaciations, speleothems and tufas, soils (including paleosols and duricrusts), plant and animal fossils and human occupation. Then follow five chapters that provide descriptions of individual desert regions – Africa and Arabia, Asia (mostly India and China), North America, South America and lastly Australia. The final four chapters move onto modern desert environments, reviewing extreme drought and flood events, desertification and how these might change in a world of human-modified climate. The book finishes with a look at how desert lands might be used sustainably in the future. I'm not sure that I would have chosen this structure for such a book, but I would not be so churlish as to try and suggest a better model. What is clear is that Williams' structure has served him well and he has adroitly avoided a major potential pitfall whereby the review of landforms across all regions followed by regional reviews might have resulted in repetition. There is some overlap but the emphasis is often different in the two approaches and with good use of cross-referencing the overall result is very comprehensive and very rarely repetitive.

The middle chapters reviewing desert characteristics include useful discussions of the background of some problematic terminology and concepts. These include the pluvial debate and the use of the term laterite for ferricrete or iron-rich duricrusts. In palaeoclimate research 'pluvial' has a different meaning to its common English meaning of wet or rainy as it was originally defined as explicitly a wet phase associated with a glacial climate. Laterites, as first defined, were specifically associated with a hot wet or seasonally wet tropical origin, usually assumed to be Tertiary in age (as recognised in the geological timescale at the time). Ferricretes can, however, form under a variety of conditions and have done so at varying times in the geological past. Williams reviews both these terms and their contexts well and makes what I see as a good case against their use because of the baggage of genetic implications that both terms carry. However, Williams then somewhat inexplicably goes on to use both terms in following sections of the book, particularly laterite.

One issue that puzzled me throughout the book was the use of the term hominid for the grouping of humans and their direct ancestors rather than the current correct term hominim. This taxonomic change, which came about because of DNA phylogenetic revision, certainly considerably predates the publication date of the book and presumably the writing stage. Well into the book, in Chapter 17 on prehistoric occupation (Page 302), Williams explains that he is aware of the taxonomic change but regards the terminology as 'a matter of taste' and personally prefers the established term hominid. While such usage is not incorrect, because all hominims are indeed hominids, which is now a wider taxonomic grouping that includes all the great apes, it is clearly not a matter of taste but one of following taxonomic conventions, even if they don't agree with personal preference.

It seems very unfortunate that such an otherwise scholarly work published in 2014 might add to the confusion of students as to the use of correct up-to-date terminology. This aspect of terminology contrasts with complete acceptance of the also recent rather major revisions of the Cenozoic timescale with removal of the term 'Tertiary' and extension of the lower Quaternary boundary to include the former last Stage of the Pliocene. Tertiary as a term only appeared in a historical context in the book.

The book greatly benefits from Williams' extensive background of research across much of the world's deserts, particularly North African, Arabian, Indian, Chinese and Australian deserts and also from some personal familiarity with North and South American deserts. This results in an excellent combination of thorough reviews of the research literature of all these regions, informed by detailed personal familiarity with many of the environments and research issues. This extends to many photographic illustrations of widely separated regions. The only omission in the regional coverage of desert environments is the complete lack of discussion, or even mention, of the Madagascan drylands which sit astride the Tropic of Capricorn and contain an intriguing mixture of endemic plants and animals as well as widespread evidence of human occupation and disturbance – recurring themes throughout the book. Madagascan drylands do appear on the mapped worldwide occurrence of deserts (Fig 1.1) and Williams may lack personal familiarity with them but even a brief outline of the published accounts would have been useful. That, however, is a relatively minor quibble and the coverage of almost all other dryland environments is meticulous, thorough and wide ranging. There is an emphasis on North African, particularly Saharan, environments that reflects the author's long research association with that region. It is difficult to argue against Williams' own justification for that bias in that the North African drylands represent the most extensive continuous desert on Earth, are the location of much fundamental dryland research of wider applicability and are closely associated with the origins of humanity.

The real strength of this book is the breadth of its coverage in terms of both dryland topics and regions. In a number of individual discussions in the book Williams claims that the treatment of the topic will 'not be encyclopaedic' but the overall impression of the book is that it is indeed encyclopaedic, not in alphabetic organisation but in the range and detail of its coverage. As such it forms an ideal textbook or research resource for undergraduate or post-graduate students or for researchers at any level. A multitude of research issues, topics and debates are reviewed in considerable detail including historical background, present status and likely future research directions or resolutions. Polarised debates, such as megafaunal extinction causes, are reviewed in a balanced way with evidence on all sides laid out. Williams' personal preferences in such issues are often evident but do not bias his reviewing of the evidence. Throughout all these discussions, the referencing is extensive, to the point that elongated lists of references can often seem tedious and interrupt the smooth flow of text. But to be a comprehensive resource, extensive referencing is unavoidable. It is this aspect of being a comprehensive and detailed introduction to a multitude of research issues that is in my view the greatest achievement of Williams' book and it is very highly recommended to all students or researchers with an interest in drylands.

The writing style is generally excellent with meaning rarely if ever not abundantly clear. Mostly the proof reading and editorial vetting must have been careful as I detected very few typos or errors. There is a puzzling mix-up of plant photosynthetic pathway associations in a few places where descriptions include mention of conversion of 'C3 grassland to.... C4 woodland or forest' (e.g. pp 370). Also somewhat puzzlingly, climate at one site was reported as '...cold and dry at 21-20 ka, warmer and wetter at 21 – 19 ka, cold and dry at 19 ka...'. But instances such as this are very rare in the book. Most figures in the book are not overly complex, are well designed and convey the required information. The lack of colour in figures and photographs is unfortunate and seems strange in such a high quality and relatively expensive book. The photographs are relatively high-quality black and white reproductions and convey valuable information but would have been so much better in colour, particularly where colour is an important characteristic of many aspects of desert landscapes. Some of the maps and illustrations, where geographic or climatic zones are illustrated by shadings or stipples etc, were barely adequate and would have been much improved by use of colour. Presumably this was a cost issue but does seem to be out of step with 2014 expectations.

In summary, I would say that this book is an outstanding thematic treatment of most aspects of desert environments and research and it should be a readily accessible source book for any students and researchers with an interest in drylands. I recommend it very highly to all Quaternarists, especially those with an interest in deserts.

A Continent on the Move: New Zealand Geoscience Revealed

Second Edition (2015)

Ian J Graham, chief editor

The Geoscience Society of New Zealand, in association with GNS Science

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Reviewed by Carol Smith

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The first edition (2008) of this book was created to celebrate both the 50th anniversary of the founding of the Geological Society of New Zealand, but also to provide a guide to the diverse and eclectic applications of geoscience in 21st Century New Zealand society. It also coincided with the IYPE 2008 – International Year of Planet Earth. The herculean effort to collate the material for this book was duly recognized: garnering several prominent awards in 2009 (Montana Environmental Award and the New Zealand Post Book award – Environment Category). Two reprints later, it could rightly be considered one of the most popular books on New Zealand's geology and landscapes.

However, the very dynamic nature of our landscape upon which this book was predicated (volcanic eruptions, earthquakes, changes in extractive industry practices and advances in geoscience research), prompted the need for a revised edition, rather than another reprint. 2015 was a significant year; 150 years since the founding of the New Zealand Geological Survey, five years since the establishment of the Geoscience Society of New Zealand and also four years since the (literally) ground-changing Canterbury earthquake sequence (CES). A country very much ....*'on the move...*".

On comparing the two editions, the broad structure of the second edition remains the same. Chapter 1 ("This land of ours") is an overview chapter narrating the many ways that geoscience interacts with society, and the broad physiographic/ landscape setting of New Zealand. It has been updated to include the CES and other topical issues: seabed mining and fracking, deep sea drilling, adaptions to climate change, slow-slip earthquake hazard, ocean acidification and mine safety.

The next four chapters focus on the foundations of geoscience – geological mapping, geochronology, basement geology and plate tectonics. With this foundation firmly established, the following seven chapters focus on the applications of geoscience – tectonic evolution, volcanology, geological hazards, oceanography, paleontology, paleoclimate and economic geology. The final chapter provides a reflective overview of the preceding chapters as well as introducing and discussing issues around the cultural landscape, heritage and science ethics.

New Zealand has been well served by a range of books on geosciences over the last few years, each exploring in more detail many of the aspects covered in this book. "A continent on the move" is not a text-book and nor is it intended to be; it is more a collection of essays on aspects of geoscience in New Zealand. Ian Graham the chief editor states that geoscience research in both New Zealand and globally is focused on understanding the Earth's dynamic environment. In the New Zealand context it is to provide information that allows decision makers (such as politician's, planners and developers) to better understand the issues relating to our natural environment. This will, in theory, allow them to make better-informed decisions regarding land use, resource extraction, protection and mitigation against climate change and other geological hazards.

Each chapter is limited to either two or four pages, and with many excellent colour diagrams and photographs, the subject matter is clearly and succinctly described. There is sufficient scientific rigor in the narrative to carry weight with the scientific community (including students of geoscience and allied disciplines), yet at the same time to be understandable to the well-informed layperson.

But what of its application to the Quaternary community? There are few Quaternary scientists in New Zealand who have not been involved in either the writing or the editorial process for this book (indeed, 130 authors were involved in contributing to this edition). More specifically, the very nature of the New Zealand landscape and its position straddling an active plate boundary means that

a significant part is, or has been, shaped by Quaternary processes which have and continue to influence the landscape: dominantly volcanism, glacial-interglacial cycles, earthquakes, tectonic uplift and active geomorphic processes. The geological evolution of New Zealand informs us of the nature of the resources of the land; if we understand how the landscape is formed and how it works then we can make well-informed decisions about how to sustainably manage the landscape. In addition, New Zealand also incorporates an internationally-relevant and readily accessible archive of past climates, recorded in a range of proxies.

Two areas of interest to Quaternary scientists, the Canterbury earthquake sequence (CES) and climate change, have been revised. The CES of 2010-2011 has been a major focus of geoscience research in New Zealand over the past five years. The myriad effects on the landscape – rock fall hazards, liquefaction and the effect on the built environment and subterranean infrastructure are well addressed in the second edition. Chapter 8 (" The land strikes back") has accordingly been extensively updated to encompass all the geological hazards occurring in the New Zealand region and the measures required to attempt to mitigate their effects. The earthquakes and associated events are succinctly summarized here. In addition, other aspects of the effects of the CES are addressed elsewhere in the book. The resilience of the built environment is covered, with detail on liquefaction and resilient foundation construction ("Sound foundations", Chapter 1) and there is an update on rock fall hazards ("Danger in the hills", Chapter 8).

On first reading this book, I must admit I went straight to those sections on the CES and poured over the detail to see how it tallied with my own experiences. Living on the Port Hills 500m from the epicenter of the magnitude 6.3 M_L June 2011 aftershock I can attest to the accuracy of the rock fall information presented. The rock fall hazard assessment process is also clearly explained and presents a balanced perspective on what has been, at times, a somewhat contested issue in the affected suburbs.

To compliment the geoscience updates, there is an expanded and updated chapter on the ramifications of earthquakes on the economic and social infrastructure and on the issues around ensuring societal resilience ("Underwriting the future"). This is a key area, since the true beneficial impacts of science to the community are in both the communication of scientific research and the integration of science into the socio-eco-political decision making processes that shape our societies. This is where better-informed decision makers come in. Increasing scientific literacy and understanding can only help in this regard. These chapters are well written and succinctly cover all aspects of the science behind the CES and the place of this knowledge in shaping future planning and policy making both in Christchurch but also in New Zealand.

Chapter 11 ("Climate swings and roundabouts") is updated with a chapter on the mitigation and adaption to the effects of climate change. This chapter not just talks to reducing emissions, but the allied effects of sea-level rise, changes to weather patterns and extreme weather events. This section of the book demonstrates how New Zealand operates at the cutting edge of climate change science. Here, the chapter covers ocean cores, ice cores and the ANDRILL project, glacial and loess landscapes and speleothems. It also acknowledges the pioneering and seminal research of Charles Fleming in the Whanganui Basin.

This book achieves on two levels. Firstly, it can be a coffee table book for dipping into and browsing through the beautiful illustrations of this dynamic landscape of ours. Secondly, at a deeper level it is an elegantly written scientific text, that a well-informed layperson can understand. This book is an excellent launch pad for students, visitors and scientists new to New Zealand who need to get up to speed with the landscape and the geology. The recommended reading provides a detailed list of both technical information as well as that aimed at general readership. This book would sit equally well in any school or University library, as well as local, regional and central government. It is the sort of book you can dip into and read a self-contained chapter and come away feeling better informed. The narrative strikes a balance between technical terminology (there is a good glossary) and readability.

Indeed, one of the strengths of this book is in the objectivity it brings to topical and recent geoscience issues – such as safe mining and fracking by way of example. In a world where everyone is an expert (thanks to Dr. Wikipedia) people seek clarity on such complex environmental issues; their opinions and perceptions of these are often tuned/filtered by seeking out simplified messages that are easy to understand and which fit with our own thinking and personal biases (confirmation bias, as one example). In fact, we all do this to a certain degree, it's just that as scientists, we are trained to seek to understand and investigate natural phenomena using evidence-based decision making ... and to try to put our personal bias to one side. This book presents a well-informed explanation of the facts on

both sides of the issue and calls for balanced debate of the issues as we know them.

My only criticism (and it is a small one) is in the weight and size: this is a sizeable tome, tipping the scales at 2 kg and slightly larger than A4. It is more of a coffee table book, and that is a comment relating to its physical presence. It is not the book to read on the train or bus, as you commute home (although a kindle version would be!). However, the nature of the book and the subject matter means that a large hardback format is required to showcase the superb colour photos (over 700 of them) and diagrams that illustrate so well the concepts and issues within our landscape. The upside – and it's a big one – is that at NZ$65 this book is incredibly good value; we are indebted to GNS Science and the other sponsors in supporting this book; at this price it is highly affordable and thus accessible to everyone.

I use both the 1st and 2nd editions for teaching in a 100 level earth science course and 200 level geomorphology course. This book is comprehensive in coverage and topical in content. It is a New Zealand specific geoscience text, in a publishing landscape understandably dominated by European and North American texts. A plea to the publishers – a digital version would be well received by teachers and students alike.

My recommendation? This book is an excellent summary of the current state of New Zealand Geoscience and landscapes – equally at home in the office, lab and on the coffee table. Also buy it as a farewell gift for your geoscience/Quaternary – inclined overseas visitors... and waive the excess baggage fees. But at $65 a book, you can afford to.

Development and application of subfossil chironomid based methods for late Quaternary climate reconstructions in eastern Australia

Jie Chang (PhD)

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The lack of tools to quantify past climate has hindered the development of our knowledge of climate change in the late Quaternary in eastern Australia. This thesis developed two methods using subfossil remains of non-biting midge larvae (Chironomid, Diptera: Chironomidae) preserved in lake sediments to reconstruct past changes in the Australian climate system during and since the Last Glacial Maximum (LGM). Firstly a transfer function model for reconstructing past summer temperatures based on the temperature tolerance of modern Australian chironomid taxa was created. Secondly the stable oxygen and hydrogen isotope composition ($\delta^{18}O$, $\delta^{2}H$) of the chitinous head capsules was used to determine temperature changes from chironomids from the same lakes. Both techniques were tested and the complexities of applying these methods as independent temperature proxies in Australia were explored.

In order to develop the transfer function, forty-five lakes were examined in eastern Australia for eighteen physical and chemical parameters. The physical and chemical analysis of the lakes suggests that sub-humid and semi-arid sites are naturally eutrophic, whereas high altitude and actively managed sites were mostly mesotrophic. Thirty-four lakes were subsequently used in the transfer function. The transfer function first axis was Mean February Temperature which explains 9.5% of the variance and the secondary axis is pH which also explains 9.5% of the variance. Despite these low values the function appears robust. The transfer function had an $r^2_{jack\text{-}knifed}$ of 0.69 and a root mean squared error of prediction (RMSEP) of 2.33°C.

The transfer function method was then applied to subfossil chironomids from a subtropical site on North Stradbroke Island, Australia that spans the LGM and the last deglaciation. This has provided the first quasi-continuous quantitative temperature reconstruction from mainland terrestrial Australia covering these critical periods (between c. ~ 23.2 and 15.5 cal ka BP). The results of this reconstruction show a maximum cooling of c. ~6.5°C had occurred at c. ~18.5 cal ka BP during the LGM. A rapid warming followed and temperatures reached near Holocene values by c. ~17.3 cal ka BP. The warming trend started at c. ~18.1 cal ka BP and is consistent with the start of deglaciation from Antarctic records. The records suggest high latitude influencing of subtropical climate during the LGM.

Stable isotopes ($\delta^{18}O$ and $\delta^{2}H$) from a single genus of chironomid head capsules (*Chironomus* spp.) were also evaluated to reconstruct past temperatures. Results suggest that both $\delta^{18}O$ and $\delta^{2}H$ are potentially valuable tools for reconstructing temperature in humid and low nutrient regions of Australia (e.g. Tasmania and the south-eastern highlands). The correlation between $\delta^{18}O$ of chironomid head capsules and temperature is consistent with observations from Europe and indicates that there is potential for this technique. However, the collection of enough material from suitable sites is challenging and the use of stable isotopes is recommended for late Holocene and modern studies, perhaps focussed on nutrient changes rather than temperature.

The Quaternary geomorphological evolution of the River Murray mouth and lakes region, southern Australia

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This thesis examines the Quaternary geomorphological evolution of the River Murray mouth region of southern Australia in the context of increasing aridity and fluctuations in eustatic sea level and climate. The region is located at the northern margin of the Coorong Coastal Plain, which preserves a long terrestrial record of Quaternary sea-level highstands within the Bridgewater Formation, a sedimentary succession of coastal carbonate aeolianites with associated beach and back-barrier lagoon facies. The stratigraphic record within the study area has been obscured by long term regional subsidence due to its location adjacent to the uplifting Mount Lofty Ranges, erosion by the River Murray and the dune fields of siliceous Molineaux Sands deposited under continental conditions during periods of glacially low sea levels. Unravelling the depositional record within this region assists in understanding localised variations in the sea-level record, the position of the River Murray during eustatic sea-level fluctuations and the dichotomy of sedimentary successions between the terrestrial, arid climates of glacial periods and marginal marine, wetter climates of interglacial periods.

The development of the Pleistocene coastline has been extrapolated from the modern beach-barrier-lagoon analogue, following the principle of uniformitarianism. Pleistocene sedimentary successions were recognised by facies architecture and lithology with depositional and diagenetic environments determined through petrographic analyses. The correlation of the sedimentary successions was based on their morphostratigraphic relationships and geochronological analyses using amino acid racemisation, thermoluminescence, optically stimulated luminescence and radiocarbon methods. The results of these analytical techniques were correlated with the Coorong Coastal Plain sea level highstand record and the oxygen isotope record.

The calcium carbonate content of the Bridgewater Formation aeolianite in the study area is regionally variable and lower than the Coorong Coastal Plain equivalents with consequently higher quartz content. This is attributed to terrestrial sediment input by the River Murray, the quartz-rich character of the offshore shelf environment, continental siliceous dune development during periods of lowered sea level and the reworking of sediments during sea-level transgressions. Extensive recycling of sediments in the region is reflected in a lack of characteristic features on quartz grains from interglacial and glacial sedimentary successions indicative of depositional environment, the ubiquitous presence of reworked quartz and carbonate skeletal grains throughout interglacial sedimentary successions as revealed by AAR analysis of whole-rock samples and individual foraminifer tests.

This research has revealed an extensive record of Pleistocene deposition, most likely correlating with the earliest recognised deposit of the Bridgewater Formation on the Coorong Coastal Plain. The early Pleistocene barriers are composite features deposited when the orbitally driven cycles of eustatic sea level and climate change transitioned from obliquity (41 ka) to eccentricity (100 ka). The middle Pleistocene record within the study area is best represented by MIS 7 (191-243 ka) aeolianites forming Sturt Peninsula. The remaining middle Pleistocene record is minimal reflecting ongoing rates of subsidence and high potential for erosion in the region, hindering the ability to draw conclusions regarding the height of interglacial sea level. The longest Pleistocene sedimentary succession is found at Point McLeay, a topographic high in the study are since at least MIS 11 (374-424 ka). The last interglacial shoreline (MIS 5e, 130-109 ka) is the best-preserved exhibiting regional variability in sedimentary characteristics and preservation as a result of sediment source, environment of deposition, calcrete development and position in the landscape.

The distribution of Bridgewater Formation throughout the Pleistocene and orientation of the coastline has been affected by differential rates of uplift across the Coorong Coastal Plain and dominant longshore drift to the northwest. Both factors have helped to constrain the position of the River Murray to the northern coastal plain where it has been located since its initiation following the demise of Lake Bungunnia. The orientation of the early Pleistocene ranges was also influenced by the granitic basement feature, the Padthaway Ridge. The subsidence in the Murray mouth has resulted in closely-spaced, onlapping or stacked sedimentary successions of middle to late Pleistocene age that have been subjected to erosion and reworking by the River Murray and Southern Ocean during successive sea-level highstands. The preservation of interglacial and glacial sedimentary successions reflects the differential rates of uplift in the region, their proximity to the River Murray and the height of successive sea-level highstands which, on the southern Australia coastline, has returned to within 6 m. Sedimentary successions within the region of subsidence are more susceptible to the migration and erosive force of the River Murray and the Southern Ocean during sea-level transgressions. Erosion by the river delivers sediment to the continental shelf, which is then redistributed within the continental dune fields of siliceous sand during periods of glacially lowered sea level. During sea-level transgressions these dune fields are reworked and the sediment is redelivered to the coastline bringing full circle the sediment recycling characteristic of the region. The low preservation potential of sedimentary successions in the region reaffirms the River Murray mouth identity as a failed delta.

An Investigation into the Sedimentary laminations at West Basin Lake, Victoria: Are they Varves?

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West Basin Lake, in the Western Victorian Volcanic Region, has characteristics conducive to deposition of annually laminated sediments known as varves. The uppermost 50 cm of lake sediment consists of finely laminated, organic-carbonate sediments of a size and frequency that are typically associated with varved lake sediments. Varves hold tremendous potential as palaeoclimate indicators, allowing for the development of precise chronologies and annual scale climate reconstructions. Through detailed micro-facies analysis and counting of the West Basin Lake sediments, the study found that the number of laminations was in good agreement with radiometric depth age modelling, suggesting annual deposition. While it was concluded that although seasonal lamina were unable to be classified by the scope of this study, the laminations are more likely to represent varves than non-annual laminations. This is likely to be due to the meromixis of West Basin Lake, its sheltered nature and sediment-water interface anoxia, in conjunction with the good agreement to radiometric depth-age modelling. This should warrant further investigation.

Quantifying lake hydrological and isotopic responses to climate change: A coupled hydrologic-isotopic mass balance model applied to two Australian maar lakes

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A hydrologic-isotopic mass balance model was developed and applied to Lakes Bullen Merri and Gnotuk in the Newer Volcanic Province, Australia to investigate the influence of basin morphometry upon a lake's hydrological and isotopic response to climate change. Model calibrations were successful from 1965 to 2001, however no calibration simulated an extreme lake level change from 1889 to 2006. This is interpreted to reflect that catchment flow to the lake is not proportional to catchment area, suggesting an additional influence from groundwater, and demonstrating the need for long-term lake monitoring documenting a range of lake conditions. The model broadly captures change in lake $\delta^{18}O$ and δD, based upon a sparse monitoring dataset. Both observed and modeled values indicate opposing trends in $\delta^{18}O$ and δD, which implies lake water re-equilibration to past climate change. Experiments were carried out to explore the influence of lake morphology on both the timing and extent of isotopic responses to changes in hydroclimate. Following a shift in precipitation, lake water isotope ratios underwent transient excursions opposite in sign to the precipitation change, before returning to an equilibrium value. Lakes with shallower basin slopes resulted in more rapid excursions with a lower magnitude. Lakes with longer residence times had longer and more subdued excursions. Applying a 1400 year hypothetical climate with both El Nino Southern Oscillation (ENSO) type cycles and hydroclimate shifts to the Gnotuk basin suggested that on the shallow slopes at lower lake levels, the seasonal isotopic cycle would obscure both ENSO cycles and hydroclimate shifts, while at higher lake levels and steeper basin slopes, the excursions following hydroclimate change may became identifiable. These results demonstrate that lake isotopic studies should target records that capture isotopic composition over several years, or during specific times of the year, so as to minimise the seasonal isotopic cycle.

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UPCOMING MEETINGS

AQUA BIENNIAL MEETING

Date: 5-9 December 2016. Five or six day post conference trips commencing 10 December 2016.

Venue: Auckland

See details elsewhere in Quaternary Australasia.

http://aqua.org.au/?page_id=19

OTHER MEETINGS

JULY 2016

AMQUA 2016 American Quaternary Association 24th Biennial Meeting

Date: 28 June-2 July 2016

Venue: Santa Fe, New Mexico

http://biology.unm.edu/fasmith/2016AMQUA/

Palaeo Down Under 2

Date: 10-15 July 2016

Venue: Adelaide, Australia

http://aap.gsa.org.au/PDU2.html

Challenges and Opportunities for Human Evolution Research in SE Asia and Australasia

Date: 8-9 July 2016

Venue: Griffith University, Brisbane, Australia

https://www.griffith.edu.au/conference/human-evolution-symposium

AUGUST 2016

15th International Peat Congress 2016

Date: 15-19 August 2016

Venue: Kuching, Sarawak, Malaysia

http://www.ipc2016.com/

35th International Geological Congress (IGC)

Date: 27 August – 4 September 2016

Venue: Cape Town, South Africa

http://www.35igc.org/

12th International Conference on Paleoceanography

Date: 29 August – 2 September 2016

Venue: Utrecht, Netherlands

http://icp12.uu.nl/

SEPTEMBER 2016

8th International Geochronology Summer School: dating techniques in environmental research

Date: 4-9 September 2016

Venue: Bergun, Switzerland

http://www.geo.uzh.ch/microsite/geochronology

INQUA Early Career Researcher Conference and Summer School

Date: 5-9 September 2016

Venue: University of Reading, UK

http://www.inquaecr2016.com/index.php

CLIVAR: Early Career Scientists Symposium

Date: 16-18 September 2016

Venue: Qingdao, China

http://www.clivar.org/

CLIVAR Open Science Conference (OSC2016): Charting the course for future climate and ocean research

Date: 18-25 September 2016

Venue: Qingdao, China

http://www.clivar2016.org/

DIG 3rd Workshop on Dinaric Glaciation

Date: 24-28 September 2016

Venue: Starigrad-Palaenica, Croatia

l.jerka.marjanac@gmail.com

Loess Fest-2016

Date: 22-25 September 2016

Venue: Eau Claire, Wisconsin, USA

https://uwec.ticketforce.com/eventperformances.asp?evt=90

4th ICAZ Taphonomy Working Group Meeting

Date: 7-9 September 2016

Venue: Paris, France

https://taphonomyworkinggroup.wordpress.com/

Australian Society for Limnology Conference

Date: 26-30 September 2016

Venue: Federation University Australia Ballarat

http://www.asl.org.au/

OCTOBER 2016

XIV IC/XV IOPC CONFERENCE Palaeobotany and Palynology: towards new frontiers

Date: 23-28 October 2016

Venue: Salvador, Brazil

http://www.ipciopcbrazil.com/

NOVEMBER 2016

Lancefield Megafauna Festival

Date: 26-27 November 2016

Venue: Lancefield Victoria

adam.bostanci@googlemail.com

DECEMBER 2016

AGU Fall Meeting 2016

Date: 12-16 December 2016

Venue: San Francisco, USA

http://fallmeeting.agu.org/2015/

FEBRUARY 2017

17th Australian & New Zealand Geomorphology Group (ANZGG) Conference

Date: 6-10 February 2017

Venue: Greytown, Wellington, New Zealand

http://www.anzgg.org/conferences

AMOS/NZMS Conference 2017 and ANZ Climate Forum

Date: 7-10 February 2017

Venue: ANU, Canberra

http://www.amos.org.au/Main/Upcoming_Events/amos2017.aspx

MARCH 2017

International Symposium on Eolian Dynamics, Paleosols and environmental Change in Drylands

Date: 13-16 March 2017

Venue: La Oliva, Fuerteventura, Spain

yesmine.trigui@tu-dresden.de

APRIL 2017

Southern African Society for Quaternary Research: Biennial Congress

Date: early-mid April 2017

Venue: TBA

https://sasqua.co.za/upcoming-meetings/

MAY 2017

PAGES 5TH OPEN SCIENCE MEETING (OSM)

Date: 9-13 May 2017

Venue: Zaragoza, Spain

14-16 May 2017: Various regional excursions – optional

http://www.pages-igbp.org/news/all-news-items/9-latest-news/1359-save-the-date-pages-osm-ysm-2017/

PAGES 3RD YOUNG SCIENTISTS MEETING (YSM)

Date: 7-9 May 2017

Venue: Morillo de Tou, north of Zaragoza Spain

14-16 May 2017: Various regional excursions – optional

http://www.pages-igbp.org/news/all-news-items/9-latest-news/1359-save-the-date-pages-osm-ysm-2017/

AUGUST 2017

10th International Carbon Dioxide Conference (ICDC10)

Date: 20-25 August 2017

Venue: Interlaken, Switzerland

http://www.oeschger.unibe.ch/events/conferences/icdc10

JULY 2019

XX INQUA Congress

Date: 25-31 July 2019

Venue: Dublin, Ireland

www.inqua2019

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.

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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.

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