A NOTE FROM THE PRESIDENT

Time has flown since the 21st SASQUA Congress in Johannesburg last April. SASQUA members engaged in revision of the Constitution to reflect our changing environmental conditions. The electronic council election process also enabled our members around the world to participate even if they were unable to attend the 21st BGM. SASQUA membership stands at less than 100 so it must be a priority to encourage collaborations and grow our membership. During 2017 we welcomed new members Dr Irene Esteban (based at Wits), Dr Naomi Porat (Israel) and Dr Amanda Rau (now in New Zealand).

South Africa is an attractive destination for Quaternarists which is reflected by the fact that some 20% of our members are based overseas, yet produce outstanding contributions towards documenting the chronology and environmental change dynamics of this region.

Although SASQUA members were saddened by the passing of Rodney Maud, Karl Butzer and John Catt, their considerable contributions towards our understanding of the geomorphological development of the subcontinent will keep them in our memories for many years to come.

Following the very successful AFQUA meeting during early 2015 in Cape Town, the next meeting of African Quaternarists is being held during mid-July this year in Nairobi at the national Museum of Kenya. I hope that many SASQUA members will attend and foster relations with like-minded scientists whose interests lie in Africa.

It's already time to plan the next congress and Hayley Cawthra is heading the committee that will organise the 22nd SASQUA Congress in Mossel Bay at the end of January 2019. We will be joined by members of the INQUA-funded International Focus Group SHAPE (Southern Hemisphere Assessment of Palaeo-Environments) which will add international flavour to the event. The Mossel Bay area and southern Cape coast has been the source of much outstanding new research over the years so this setting will be very attractive to many Quaternarists.

Please don't lose sight of the fact that SASQUA is your organisation and relies on your continued support and new ideas to grow. I look forward to meeting you all at the forthcoming gatherings.

Dr Greg Botha

KwaZulu-Natal and Eastern Cape Regional Offices, Council for Geoscience

Newsletter editor: Hayley Cawthra

Marine Geoscience Unit, Council for Geoscience; African Centre for Coastal Palaeoscience, Nelson Mandela Metropolitan University
SASQUA Committee, SA-INQUA and INQUA News

SASQUA COMMITTEE (2017 – 2019)

President
Dr Greg Botha (Council for Geoscience)

Vice President
Dr Lynne Quick (University of Cape Town)

Past President
Prof Marion Bamford (University of the Witwatersrand)

Secretary
Dr Abi Stone (University of Manchester)

Treasurer
Mrs Rebekah Singh (Council for Geoscience)

Early Career Representative
Mr Abraham Dabengwa (University of Cape Town)

Newsletter editor
Dr Hayley Cawthra (Council for Geoscience, Nelson Mandela University)

SA-INQUA COMMITTEE

Prof Marion Bamford (University of the Witwatersrand): Chair
Prof Mike Meadows (University of Cape Town)
Dr Lynne Quick (University of Cape Town)
Dr Hayley Cawthra (Council for Geoscience, Nelson Mandela University)
Dr Margaret Avery (Iziko Museums of South Africa)
Dr Greg Botha (Council for Geoscience)
Dr Brian Chase (Centre National de la Recherche Scientifique (CNRS))
Dr Jemma Finch (University of KwaZulu-Natal)
Ms Lynn Ngwenya (NRF) (until February 2017) replaced by Ms Busiswa Molefe

CONTACT WITH INTERNATIONAL UNIONS

- Margaret Avery (Iziko) is the Immediate Past President of the International Union of Quaternary Research (INQUA)
- Margaret Avery (Iziko) is a member of the South African National Board for the International Council for Science (ICSU)
- Mike Meadows (UCT) is the Secretary-General of the International Geographical Union (IGU)
- Brian Chase (CNRS) is the Secretary-General of the International Union for Quaternary Research (INQUA)
- Brian Chase (CNRS) is engaged in the INQUA funded international focus group “Southern Hemisphere Assessment of PalaeoEnvironments” (SHAPE)
The 21st biennial conference of SASQUA was hosted by the University of the Witwatersrand from 3-7 April but was held off campus at Parktown Girls High School which was a peaceful venue with easy access and plenty of parking. Jennifer Fitchett and Marion Bamford were the organisers with assistance from Jasper Knight, Bronwyn Quinn, Tandi Scott-Turner, Greg Botha and Pat Dlamini. There were about 40 delegates from southern Africa. The organisers are very grateful to PAST and the CoE Palaeosciences for funds to help run the conference.

The conference started with a Plenary Talk by Prof Anson Mackay from University College London on “Reconstructing hydrological variability using $\delta^{18}$O diatom records from lake sediments in southern Siberia and East Africa”.

Professor Anson Mackay works within the Environmental Change Research Centre and the Palaeoclimate Research Group, both within the Department of Geography at University College London. Prof Mackay obtained his BSc Hons in Botany from the University of Edinburgh in 1984, and his PhD from the University of Manchester in 1989. In 1992, he was appointed as a Postdoctoral Researcher at University College London, in 2000 appointed as a Lecturer in environmental change, and in 2013 Professor in Environmental Change. Prof Mackay is a member of, amongst others, the Royal Geographical Society, the Quaternary Research Association and the International Diatom Society. He has published over 100 peer reviewed papers, and has been principal investigator on almost 30 projects. For over 20 years he has worked on assessing human and climatic impacts on some of the world’s most important freshwater ecosystems, including the Okavango Delta. Key to this work is the use of biological organisms and stable isotopes to reconstruct past environments. Recently, Prof Mackay has been involved in state of the art research isolating diatoms from sedimentary sequences and testing the oxygen isotope ratios of those diatoms.

As usual there was a wide variety of talks encompassing environmental proxies, archaeology, climatology, geosciences and hominids, and also some fascinating posters for delegates to enjoy during the breaks. Walking Tall (PAST’s live theatre group) entertained us with one of their energetic shows on evolution, hominids, environmental responsibility and sustainability which was followed by a welcome party. The conference concluded with a panel discussion on the LGM and closed with the BGM and election of some of the next Council members before the formal dinner at Moyo’s restaurant.

A conference field trip to the cradle of Humankind was enjoyed by about 30 delegates. We started with a tour of the Maropeng exhibitions, lunch at the Waffle House and then a most informative guided tour of the Sterkfontein caves and new excavations by Dr Dominic Stratford.

Abstracts for the conference and a few full length papers have been published in the journal Palaeontologia africana.

http://wiredspace.wits.ac.za/handle/10539/23008
OBITUARY

IN MEMORIAM

Rodney Richard Morgan Maud 1935 - 2017

South African consulting geologist and Honorary Professor, founder of Drennan Maud & Partners

Dr Rodney Maud FGS died on 12 May 2017, after a year of declining health. His passion for geology was kindled around the hills of Hillary, south of Durban, collecting rock samples and hoarding them in his mother’s cupboards. Having matriculated from Durban High School (DHS), he went on to read for a Bachelor of Science degree in Geology and Chemistry at the then University of Natal, Durban, (UND) graduating in 1954.

He took up a post as geologist and soil scientist at the South African Sugar Association (SASA) 1955 - 66, but was able continue his tertiary studies, obtaining his BSc (Hons) degree in 1957 and his PhD in 1962. Maud was awarded the Selby Research Fellowship by the Australian Academy of Science and spent 1964 - 65 at CSIRO, Adelaide, as a research scientist.

Consulting geologist

In 1967 he joined Kantey, Templer and Web as a consulting Engineering Geologist but then in 1969 moved to D L Web and Associates as Senior Associate. This association lasted until early 1975 when he and his then colleague Dr John Drennan decided to go for it alone. Drennan Maud and Partners began operations on 1 April 1975. He retired in 2001 but continued as a consultant right up to his passing, ever happy to assist or share his immense experience and knowledge.

Academia

Rodney remained in close contact with UND/UKZN. In 1968 he was invited back as an Honorary Lecturer in Engineering Geology and as an external examiner. This continued until 1978 when he was made Honorary Senior Lecturer. In acknowledgment of his 20 years’ selfless contribution, UND made him Honorary Professor in 1988, a position he held with great pride until retiring in 2010. Between 1996 and 2006 he was also Honorary Research Associate at the Natal Museum, Pietermaritzburg.
During a busy life he found time to author no less than 32 publications and a further 39 in collaboration with colleagues Professors Tim Partridge and Fred Bell and others, predominantly in engineering geology, quaternary geology, geomorphology and hydrogeology.

During his time at SASA he mapped, farm by farm, some 500,000 hectares of the entire South African Sugar Industry as it was then. Between 1967 until his death he was directly or indirectly engaged in an estimated 8000 engineering geological appointments, working on many of KZN’s flagship projects of the day.

He carried out numerous hydrological studies and was appointed project co-ordinator of the KwaZulu-Natal Hydrological Characterisation and Mapping Project for DWAF in 1993 (completed 1995).

Awards

In 1989 Rodney was awarded the Jubilee Medal of the Geological Society of South Africa (together with Prof Tim Partridge). He joined SAIEG as a Member in 1984 and was made a Fellow in 1993. In 2003, SAIEG awarded him the Gold Medal for his significant contribution, lifelong service and loyalty to Engineering Geology in South Africa, having also served as a Council member for many years (at his own cost), President (1989 - 90) and IAEG’s Vice-President for Africa (1999 - 2002). He also served as President and Honorary Treasurer of the South African Society for Quaternary Research.

Rodney will be long remembered and sorely missed as a larger-than-life character, with a wicked sense of humour and for his prolific achievements and contributions, science and engineering in South Africa over some 60 years.

By Michel Benet

Photographs courtesy of Michel Benet.
A contributor to the Quaternary of Southern Africa

Karl W. Butzer passed away in Austin, Texas, on May 4, 2016. Karl was known by many members of SASQUA through collaboration or through his writings on various aspects of geomorphology and Quaternary environments of South Africa and other parts of the continent.

Karl’s work in Africa began in Egypt in the 1950s, 1960s, and again in the early part of the century. His work in East Africa (Ethiopia and Kenya) in the 1960s and 1970s produced several publications on geomorphological aspects related to hominin sites. In the 1970s and early 1980s, he spent several field seasons in South Africa and Namibia working on the reconstruction of Pliocene and Pleistocene paleoenvironments. The highlights of his work included the pans of the Northern Cape and Free State, the Gaap Escarpment, the west and south coasts, and at famous prehistoric sites such as Swartkrans, Taung, Florisbad, Klasies River Mouth, Nelson Bay Cave, and Elandsfontein, among others.

He published over 30 articles and chapters on his southern African research alone. It was in one his South African research articles that the word geoarchaeology (spelled geo-archaeology) was first coined. (1) During his years of work in Africa, he supervised several master’s and PhD dissertations, and coauthored with several well-known South African and foreign researchers in the fields of geomorphology, geology, Quaternary science, and archaeology.


By Professor Carlos Cordova

Oklahoma State University, USA & Kazan Federal University, Russia
OBITUARY

IN MEMORIAM

John Catt 1939 – 2017

Colleagues at UCL Geography were saddened to learn of the death on 7 December 2017 of Professor John Catt BSc PhD DSc. John graduated in Geology and completed his PhD at Hull University before working from 1963 to 1999 at Rothamsted Experimental Station (now Rothamsted Research) in Harpenden, Hertfordshire. There he carried out research on soil genesis, palaeosols and Quaternary stratigraphy, soil erosion, and contamination of rivers and lakes by agricultural pesticides and plant nutrients.

After retiring, he became Honorary Professor in UCL Geography, continuing his research and writing, and sharing his comprehensive knowledge of regional geology and geomorphology with students and colleagues.

As well as scientific papers, his most recent books were the widely praised Hertfordshire Geology and Landscape, published in 2010 by the Hertfordshire Natural History Society, and The History of the Quaternary Research Association, to mark the 50th anniversary of the QRA in 2014.

John was active in conveying his knowledge to the lay public as Chair of the Hertfordshire Geology Society and through field excursions. His many activities were marked by the Geological Society's Distinguished Service Award in 2015, recognising his 'significant contribution to the geological community'.

By the UCL Geography Department
RESEARCH NEWS, UPDATES & RECENT PUBLICATIONS

Margaret Avery
Iziko Museums of South Africa

EAQUA conference
In July 2017 I participated in the bi-annual conference of the Eastern African Quaternary Association (EAQUA) in Mukono, Uganda. In fact, I was invited, as a special guest, to make opening remarks on EAQUA and closing remarks on the way forward for EAQUA. It was great to be back in East Africa, which is very close to my heart, and to meet up with friends once more. Quaternary research in East Africa is advancing well on a range of fronts, as could be seen from the coverage at the conference. The overall title was ‘Decades of Quaternary Research in Eastern Africa: implications for sustainable future’, divided into sessions on ‘Palaeoclimate and palaeoenvironment’, and ‘Archaeology, history and palaeontology’. I can send a pdf of the programme to anyone who is interested and, hopefully, the proceedings will be published in Quaternary International of which outgoing EAQUA President Asfawossen Asrat is an Associate Editor. We also visited the source of the River Nile near Jinja on Lake Victoria, which was most interesting as well as beautiful. I believe it is the only major river that has its source in a lake, and it is a big tourist attraction. Many thanks go to Julius Lejju and his team for their good organisation and hospitality.

This conference was also notable for being the last time I saw my friend Mike Akaegbobi from Ibadan, Nigeria. He was his usual larger-than-life self as we waved goodbye but less than 1 month later I received the shocking news that he had died very suddenly. The West African Quaternary Association (WAQUA), which he was instrumental in founding, will miss him sorely.

INQUA Executive Committee meeting
I have just returned from a trip to Beijing where I attended this year’s meeting of the International Union for Quaternary Research (INQUA) Executive Committee. One of the most important jobs of the Exec is to enact the mandate of INQUA to support Quaternary science and scientists. This includes making decisions on grant applications and, as we approach the next Congress, ensuring this will be a success. See the website https://www.inqua.org/ for more information, and to find out how you can become more involved and benefit from what INQUA has to offer.

Mike Akaegbobi with, right, Asfawossen Asrat during the trip to the Nile during the EAQUA conference.

Also keep an eye on the INQUA website for the upcoming (April or May) issue of Quaternary Perspectives. This is INQUA’s newsletter, which reports on the activities of Members and other items of interest to Quaternary scientists. It will also include more on our Executive meeting.

Executive Committee meetings are held in different Member countries to allow the Executive to meet local scientists, and vice versa. On this occasion we heard talks by leaders of the various commissions in the Chinese Quaternary Association (CHIQUA). It is amazing how many Quaternary scientists there are in China but, then, there are a great many Chinese! Our hosts, led by Zhengtang Guo, one of four INQUA Vice Presidents, were extremely organised and most attentive. They made sure we didn’t get lost and were
well fed. They also organised for us to meet colleagues and visit the Forbidden City, the Great Wall and the Chinese Opera. Pictures below courtesy of Yu Fu of the Institute for Geology and Geophysics, Chinese Academy of Sciences.

Inside the Forbidden City, a palace of Chinese Emperors until their overthrow early last century.

On the Great Wall, built to protect Beijing from invasion hundreds of years ago.
In June 2017 I joined the Koobi Fora Field School at Ileret in northern Kenya (east side of Lake Turkana) for part of the annual field season. It turned out to be a week of “challenges” but I was able to collect over 80 samples of fossil wood from several sites (Fig 1). The landrover broke down on the trip up north so we had to overnight in a small village at the Catholic Mission while waiting for a replacement vehicle. The next day’s drive was very long and we only arrived at the new camp site late at night so had to pitch tents in the dark. In daylight the next day we were able to move to less thorny and more shady spots before starting on field work. That night the rain started – note we do our field work in the dry season - so this was unseasonal rain. It rained and rained and by midnight our campsite was flooded so we all had to move personal tents (80 of them), the kitchen tent, storage and research tents to dry ground, with the water rising all the time. In the dull morning drizzle we could survey our wet and bedraggled camp (Fig 2) and had to spend the rest of the day transporting everything to another site away from the river. Once back to field work we had to contend with the very sandy and muddy river beds ..... getting stuck several times and wasting valuable research time (Fig 3). Fortunately the rest of the field season was without mishap.

Soon afterwards I went to Olduvai Gorge in Tanzania for another project and in contrast this was a very dry and dusty field season. They were building a new lab in the camp and trucks came and went with loads of gravel, stone and cement. We had a small team in the field this year and carried on with the geo-trenching and sampling as usual (Fig 4 – sampling at site HWKW in the junction area of the Olduvai Gorge). Several papers are in progress.

In August I joined the Palaeo Primate Project – Gorongosa team again in Gorongosa National Park, central Mozambique for the annual field season. After running a workshop for British and Mozambican post grads we went by helicopter to the northern border of the park to survey the limestone caves in the Khodzo area. There are lots of living bat populations but not much in the way of palaeontology. Nonetheless it is a very beautiful area (Figs 5, 6 and 7).


Fitchett, J.M., Grab, S.W., Bamford, M.K., Mackay, A.W., 2017. Late Quaternary research in southern Africa: progress, challenges and future trajectories. Transactions of the Royal Society of South Africa 72, 280-293.


Koobi Fora fossil wood site.
Koobi Fora flood.

Koobi Fora vehicle stuck.
Olduvai UFO site.

Gorongosa gorge from air.
Gorongosa cave & water.

Gorongosa Tongai and Marion.
Having put my role as Secretary-General of the 35th International Geological Congress behind me, I have resumed my Cenozoic geology interests at Council for Geoscience. My project entitled “Cenozoic Rationalisation” aims to address the variable representation of Cenozoic cover depicted on the 71, 1:250,000 geological series maps covering South Africa. There are few map legends where the Quaternary deposits can be correlated with those on the surrounding maps. The sack term “Alluvium” is widely abused and sheetwash colluvium, raised terrace deposits and channel sediments are commonly lumped, thereby losing much of their value. There is usually a disconnect between the lithostratigraphic characterisation of the pre-Cenozoic geological units and the unconsolidated cover that is characterised using lithology. I have done long traverses on navigable routes across sheets on the Karoo margin to create an inventory of useful exposures and validate the Quaternary cover depicted. In the process I have come across some very interesting landforms and new deposits worthy for further attention.

In support of the CGS regional mapping in the area north of Prieska, I conducted traverses across the Prieska and Postmasburg sheets between the Orange River and Witsand. A 20m succession of palaeo-lacustrine deposits that somehow escaped being included on the geological map caught my eye. I’m working with Naomi Porat (GSI) to try and date the succession of dolomitic palustrine sediments with interbedded aeolian sand lenses. The thinly bedded deposits are unfortunately devoid of any pollen.
Bleached aeolian sand covered by a younger red aeolian sand layer, buried by typical calcified palustrine sediments.

Calcified reedbed structures.
Infilled and cemented desiccation cracks in silty clay.

Collage of invertebrate feeding trace fossils.
My mapping and traverses in the Kalahari and northern Karoo regions has revealed the need to differentiate the Gordonia Formation (Kalahari dunes) from dunefields generated off the Vaal and Orange River valley left bank terraces. The Kalahari linear dunes must be distinguished from the widespread sand ramps/climbing dunes and pan lunettes on the geological maps. SASQUA members based at Sheffield and Oxford in the UK have done sterling research on the geochronology of the Kalahari dunefields.

The Council for Geoscience has begun a 10-year geological mapping programme that aims to release 500 new 1:50,000 geological maps. My initial contribution is the publication of the 20, 1:50,000 sheets covering the Maputaland coastal plain, the type area of the Maputaland Group that characterises the Neogene evolution of coastal KZN, stretching into Mozambique.

**Hayley Cawthra**  
Council for Geoscience Marine Geoscience Unit; Nelson Mandela University African Centre for Coastal Palaeoscience

I continue to work on the South Coast shelf and coastal plain from the Breede River to Plettenberg Bay where we focus on (1) reconstructing the Pleistocene Palaeoscape (with a large group of colleagues under the guidance of Curtis Marean and Richard Cowling), (2) investigating proxies for past sea level from coastal and submerged aeolianite and cemented beach deposits (published in Feb 2018) and (3) palaeoclimatic and environmental proxies from sediment cores with partners on the German – South African ‘RAIN’ project, PI Matthias Zabel (Hahn et al.,

Hluhluwe 1:50,000 geological map covering the central part of lake St Lucia, part of a 20 map series covering the Maputaland coastal plain.
I spent three months in Germany to complete the last phase of this work on a fellowship awarded from the Hanse-Wissenschaft Kolleg, from November 2017 – January 2018. I work with Charles Helm, who maps out ichnofossil trackways, to establish geological context in coastal Pleistocene deposits. Charles has documented numerous new sites and we have published a series of articles: the first listed here (Helm et al., 2017). In Pondoland, on the Wild Coast, our team of Erich Fisher, Irene Esteban, Justin Pargeter and I are co-PIs on the P5 project and are conducting research in rock shelters and on the landscape between Waterfall Bluff and the Mtentu River. At the CGS I lead the South African Nearshore Mapping Programme which aims to map the entire continental shelf using five geophysical instruments and produce seamless onshore-offshore geological maps. We have commenced in the Western Cape, in close proximity to our office (see image below). From the perspective of ocean governance, I continue work on the South African extended shelf claim which is lodged with the United Nations and serve as the technical advisor on the South African team for the International Seabed Authority, where we are drafting legal code to include deep-ocean minerals in the United Nations Convention of the Law of the Sea (UNCLOS).

Current involvement in projects
- The South African Nearshore Mapping Programme (SANMAP)
- South African Coast Palaeoclimate, Palaeoenvironment, Palaeoecology, Palaeoanthropology (SACP4)
- Developing and Testing an Integrated Palaeoscape Model for the early Middle and Late Pleistocene of the South Coast of South Africa
- Pondoland Palaeoclimate, Palaeoenvironment, Palaeoecology, Palaeoanthropology (P5)
- Regional Archives for Integrated iNvestigations (RAIN)

Conferences and workshops attended in 2017
- I convened a marine geoscience workshop at the CGS in March 2017.

Commissions/committee membership
- ICSU/SANC-INQUA committee member
- SASQUA committee member
- National Marine and Coastal Ecosystem Classification and Mapping committee member: 2017 onward
- Steering committee member for the Second International Indian Ocean Expedition (IIOE-2): 2016 onward
- Steering committee member of the South African Extended Continental Shelf Claim Project 2012 onward
- Chair of the South African Committee for Stratigraphy (SACS) Post-Karoo Task Group: 2014 – present
- South African delegation to the International Seabed Authority (in partnership with DIRCO and DMR)

Publications
http://hdl.handle.net/10539/23462

https://doi.org/10.2312/cr_m123


Hahn, A., Schefuß, E., Andö, S., Cawthra, H.C., Frenzel, P., Kugel, M., Meschner, S., Mollenhauer, G., Zabel,


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**Conference abstracts**


Mfikili, A., Bornman, T., Cawthra, H.C.. Evidence of Late Holocene tsunami deposits in selected estuaries along the South African coast. Sea Level Change from Minutes to Millennia, St. Lucia, 18-23 September 2017.


Cawthra, H.C., Jacobs, Z., Compton, J.S., Fisher, E.C., Karkanas, P., Marean, C.W. Palaeoshoreline depositional history from MIS 6 (Termination II) to MIS 3 on the southern margin of South Africa. SASQUA, Johannesburg, 3-7 April 2017.


Brian M. Chase
Director of Research, Centre National de la Recherche Scientifique (CNRS)
Secretary General, International Union for Quaternary Research (INQUA)

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European Research Project HYRAX website: http://www.hyrax.univ-montp2.fr/


Abstract
A fundamental and long-standing question of southern African palaeoclimatology is the way tropical and temperate climate system dynamics have influenced rainfall regimes across the subcontinent since the Last Glacial Maximum. In this paper, we analyse a selection of recently published palaeoclimatic reconstructions along a southwest-northeast transect across South Africa. These records span the last 22,000 years, and encompass the transition between the region’s winter and summer rainfall zones. In synthesis, these records confirm broad elements of the dominant paradigm, which proposes an inverse coeval relationship between temperate and tropical systems, with increased precipitation in the winter (summer) rainfall zone during glacial (interglacial) periods. Revealed, however, is a substantially more complex dynamic,
with millennial-scale climate change events being strongly – even predominantly – influenced by the interaction and combination of temperate and tropical systems. This synoptic forcing can create same sign anomalies across the South African rainfall zones, contrary to expectations based on the classic model of phase opposition. These findings suggest a new paradigm for the interpretation of southern African palaeoenvironmental records that moves beyond simple binary or additive influences of these systems.

**Figure from Chase et al., 2017, QSR:** Comparison of proxy records considered to primarily reflect trends in temperate (f; Fischer et al., 2007) and tropical systems (a; Chevalier and Chase, 2015) as they influence records from the south-central summer rainfall zone (c; Chevalier and Chase, 2015) and the southern Cape. To study millennial-scale variability, panes (b) and (e) show measures of correlation (using 2500-4500-year windows at 500-year intervals) between the south-central summer rainfall zone and southern Cape records and temperate (f) and tropical records (a). For this analysis, all records were detrended to remove orbital-scale deglacial trends (cubic polynomials) and highlight similarities in millennial-scale variability between the regions. Results indicate that the weakened system has the strongest control over millennial-scale climate variability in the region, and that this dynamic has evolved, inverting across the last glacial-interglacial transition.

Abstract
Pollen, spores, and microscopic charcoal from a sediment core of Lake Ngami, in the Middle Kalahari, reflect paleovegetation and paleoclimatic conditions over the last 16,600 cal years BP. The location of Lake Ngami implies that the region may have received moisture sourced from the Indian and/or Atlantic oceans, which may have influenced local rainfall or long distance water transport via the Okavango system. We interpret results of statistical analyses of the pollen data as showing a complex dynamic system wherein variability in tropical convective systems at different latitudes and local forcing mechanisms influence local hydrological changes. Our reconstructions show three primary phases in the regional precipitation regime: 1) an early period of high but fluctuating summer rainfall under relatively cool conditions from ~16,600-12,500 cal BP, with reduced tree to herb and shrub ratio; 2) an episode of significantly reduced rainfall centered around c. 11,400 cal BP, characterized by an increase in xeric Asteraceae pollen, but persistent aquatic elements, suggesting less rainfall but cooler conditions and lower evaporation that maintained water in the basin; and 3) a longer phase of high, but fluctuating rainfall from ~9000 cal BP to present with more woody savanna vegetation (Acacia and Combretaceae). We propose a model to relate these changes to increased Indian Ocean-sourced moisture in the late Pleistocene due to a southerly position of the African rain belt, a northerly contraction of tropical systems that immediately followed the Younger Dryas, and a subsequent local insolation forcing modulated by changes in the SE Atlantic basin.


Abstract
Reproducible climate reconstructions of the Common Era (1 CE to present) are key to placing industrial-era warming into the context of natural climatic variability. Here we present a community-sourced database of temperature-sensitive proxy records from the PAGES2k initiative. The database gathers 692 records from 648 locations, including all continental regions and major ocean basins. The records are from trees, ice, sediment, corals, speleothems, documentary evidence, and other archives. They range in length from 50 to 2000 years, with a median of 547 years, while temporal resolution ranges from biweekly to centennial. Nearly half of the proxy time series are significantly correlated with HadCRUT4.2 surface temperature over the period 1850-2014. Global temperature composites show a remarkable degree of coherence between high- and low-resolution archives, with broadly similar patterns across archive types, terrestrial versus marine locations, and screening criteria. The database is suited to investigations of global and regional temperature variability over the Common Era, and is shared in the Linked Paleo Data (LiPD) format, including serializations in Matlab, R and Python.


Abstract
The hydrogen isotope composition of plant leaf wax (δD wax) has been found to record the isotope composition of precipitation (δD p). Hence, δD wax is increasingly used for palaeohydrological reconstruction. δD wax is, however, also affected by secondary factors, such as vegetation type, evapotranspiration and environmental conditions, complicating its direct application as a quantitative palaeohydrological proxy. Here, we present δD wax data from soils along vegetation gradients and climatic transects in southern Africa to investigate the impact of different environmental factors on δD wax. We found that δD wax correlated significantly with annual δD p (obtained from the interpolated Online Isotopes in Precipitation Calculator data set) throughout the eastern and central South Africa, where the majority of the mean annual precipitation falls during the summer. We found evidence for the effect of evapotranspiration, while vegetation change was of minor importance. In contrast, we found that δD wax did not record annual δD p in western and southwestern South Africa, where most of the mean annual precipitation occurs during winter. Wide microclimatic variability in this topographical variable
region, including distinct vegetation communities and wide vegetation diversity over small spatial scales as well as a potential influence of summer rain, likely compromised a clear relationship between $\delta D_{\text{wax}}$ and $\delta D_p$. Our findings have implications for palaeoenvironmental investigations using plant wax $\delta D$ in southern Africa. In the summer rain dominated eastern and central region, $\delta D_{\text{wax}}$ should serve well as a qualitative palaeohydrological recorder. By contrast, the processes influencing $\delta D_{\text{wax}}$ in the winter rain dominated western and southwestern South Africa remain unclear and constrain its use as palaeohydrological proxy in this region.


Abstract

In this paper we compare a compilation of multiproxy records spanning the eastern African margin with general circulation model simulations of seasonal precipitation fields for the mid-Holocene and the Last Glacial Maximum (LGM) carried out as part of the third phase of the Paleoclimate Modelling Intercomparison Project (PMIP3). Results show a good agreement during the mid-Holocene (the ‘6K experiment’), with palaeodata and model outputs correlating well and indicating that changes in insolation drove a stronger northern African monsoon during the terminal “African Humid Period” north of ~0-5°S and a weaker southeast African monsoon. For the LGM (the ‘21K experiment’), however, significant discrepancies exist both between model simulations, and between existing palaeodata and simulated conditions, both in terms of direction and amplitude of change. None of the PMIP3 simulations reflect the pattern inferred from the palaeodata, which is a continental decrease of precipitation except in a narrow coastal band roughly between the Equator and 20°S. Two major discrepancies have been identified to explain this: 1) the limited sensitivity of the southern monsoon domain to the colder temperatures of the Indian Ocean (-2°C), and 2) the absence of changes in the dynamic of the Indian Ocean Walker circulation over the entire basin, despite the exposure of the Sahul and Sunda shelves that weakened convection over the Indo-Pacific Warm Pool during the LGM. These results indicate that some major features of the atmospheric and oceanic teleconnections between the different monsoon regions require further consideration as models evolve.

John Compton
Geological Sciences/UCT

Research Highlights

Rebecca von Koslowski completed her MSc in Applied Marine Science and worked on changes in neodymium isotopes on the western margin of South Africa. The title of her thesis is “Glacial-interglacial variations of the water masses in the southeast Atlantic Ocean derived from foraminiferal neodymium isotope ratio”. This work is being furthered by Eugene Bergh as part of his PhD.

Abstract

Variations in the global climate over time have long been associated with changes in the meridional overturning circulation of the oceans. It is now commonly believed that, during the Last Glacial Maximum (LGM), the transport of North Atlantic Deep Water (NADW) to the southeast Atlantic Ocean was reduced. A popular method to trace these ambient changes is the stable isotope systematics of neodymium (given as $\varepsilon$Nd). In this study $\varepsilon$Nd data were measured on mixed planktic and bulk foraminifera from two gravity cores, GeoB8336-6 and GeoB8342-6, retrieved from the Cape Basin at water depths of 3524 and 3521 meters from the western continental slope of South Africa. The samples were prepared following the protocol presented by the Cambridge group [Tachikawa et al., 2014]. Planktic and bulk foraminifera samples taken from the same core depth interval had the same $\varepsilon$Nd ratios within error, which suggests that bulk foraminifera may provide a quick way to reconstruct ambient bottom water values. However, more research is needed to further support these findings. While the Holocene samples’ $\varepsilon$Nd ratios ($\varepsilon$Nd(N36/6a) -10.7±0.3 and $\varepsilon$Nd(N42/6a) -10.2±0.4) lie within the range of modern Eastern NADW ($\varepsilon$Nd(modern ENADW) -10.9±1.2), glacial samples yield significantly more radiogenic $\varepsilon$Nd ratios ($\varepsilon$Nd(N42/6b) -7.7/ $\varepsilon$Nd(N36/6b) -8.1). This indicates the greater influence of southern-sourced water masses and thus provides further evidence for a
reduction of NADW during the last glacial. MIS3 samples show ratios that lie in between those observed in the LGM and Holocene, and it is hypothesized that ocean circulation during MIS3 was comparable to that during the transition from the LGM to the Holocene (Termination I).

Wilhelm van Zyl has submitted his MSc entitled: Geology, Geomorphology and Sedimentology of the Atlantic Seaboard

Abstract
The Atlantic Seaboard is an 18 km stretch of coastline located on the Cape Peninsula, South Africa, roughly between Mouille Point in the north and Hout Bay in the south. It contains a mix of urban and natural environments including the up-market neighbourhoods of Sea Point, Bantry Bay, Clifton Beach and Camps Bay and the Table Mountain National Park. The predominantly rocky coastline has a northeast–southwest orientation with interspersed sandy pocket beaches. A narrow, low-lying coastal plain (marine terrace) in the north merges with coastal cliffs further south. The geomorphology and sedimentology of the coast are closely linked to the underlying geology, influencing the shape of coastal embayments and promontories, as well as the composition and distribution of sediment. Hydrographic, geophysical and sedimentological techniques were used to collect high-resolution bathymetry, seafloor geology and sediment distribution data to better understand modern coastal processes. The results indicate a low-relief seafloor consisting of Malmesbury Group rocks in the north. To the south the seafloor consists of high-relief Cape Granite reefs interspersed with fine to medium grain sand and bioclastic (shelly) gravel. Sediment transport is generally northward by longshore drift. In the south, the high-relief granite reef and headlands form sediment traps resulting in several large pocket beaches and offshore sediment deposits. In the north, the low-relief Malmesbury bedrock is largely free of sediment, except within narrow erosional gullies. Most sediment rapidly passes through to the north resulting in a sediment-starved rocky seafloor. The three principal sources of beach sand are aeolian fine sand transported by the Karbonkelberg headlands bypass dune entering the sea at Sandy Bay, biogenic carbonate production along the coast, and weathering of Table Mountain Group sandstone and granite bedrock. A fourth source is sediment entering the system via longshore drift from the south of Duiker Point. Presently the water depth around the Duiker Point headland is mostly too deep for sediment to be transported easily though longshore drift, but during past sea level low stands this would have played an important part in supplying sediment to the coast. Changes in sea-level play an important part in shaping the geomorphology of the coastline. Beach deposits, both sandy and boulder beaches have been left at various elevations along the coast, both offshore and on-land. Although today the Sea Point area is protected by sea walls and man-made structures, a higher sea-level was responsible for shaping the narrow coastal plain. Increasing rates global sea-level change becoming an important issue all over the world and the Atlantic Seaboard coast is not immune
to the effects of sea-level rise. The frequency and magnitude of storm events that breach the sea defences and cause damage to private and public property will increase. Erosion of beaches and sea cliffs are problems that will become more and more prominent in the future.

Phytoliths, pollen, work, and more work
Carlos Cordova has not done fieldwork in southern Africa in the past two years because he is processing samples and writing papers. He is currently collaborating on projects and/or papers with Louis Scott, Kelly Kirsten, Michael Meadows, Graham Avery,
Alex Mackay, Christopher Ames, and Ben Collins. His book, Geoarchaeology: The Human-Environmental History is finally finished and will appear in 2018.

Publications

Abstract
Pollen, spores, and microscopic charcoal from a sediment core of Lake Ngami, in the Middle Kalahari, reflect paleovegetation and paleoclimatic conditions over the last 16,600 cal years BP. The location of Lake Ngami implies that the region may have received moisture sourced from the Indian and/or Atlantic oceans, which may have influenced local rainfall or long distance water transport via the Okavango system. We interpret results of statistical analyses of the pollen data as showing a complex dynamic system wherein variability in tropical convective systems at different latitudes and local forcing mechanisms influence local hydrological changes. Our reconstructions show an early period of high but fluctuating summer rainfall under relatively cool conditions from ~16,600-12,500 cal BP, with reduced tree to herb and shrub ratio; an episode of significantly reduced rainfall centered around c. 11,400 cal BP, characterized by an increase in xeric Asteraceae pollen, but persistent aquatic elements, suggesting less rainfall but cooler conditions and lower evaporation that maintained water in the basin; and a longer phase of high, but fluctuating rainfall from ~9000 cal BP to present with more woody savanna vegetation (Vachellia and Combretaceae). We propose a model to relate these changes to increased Indian Ocean-sourced moisture in the late Pleistocene due to a southerly position of the African rain belt, a northerly contraction of tropical systems that immediately followed the Younger Dryas and a subsequent local insolation forcing modulated by changes in the SE Atlantic basin.


Abstract
This study tests the association between opal phytoliths in dental calculus on modern, historic, and prehistoric specimens of *Loxodonta africana* (African savanna elephant) with their local and regional vegetation. The modern samples were obtained from dental remains from deceased animals at the Addo Elephant National Park (Eastern Cape Province) and the Pilanesberg National Park & Game Reserve (Northwest Province) in the Republic of South Africa. The historic and prehistoric specimens, presumed to be free-roaming elephants, were sampled from museum collections in the Eastern Cape and Western Cape Provinces. In addition to comparing phytolith assemblages in dental calculus with those of the main vegetation associations, this study assesses the phytolith assemblage differences between free-roaming and park elephants. The results show that: (1) the phytolith assemblages in dental calculus of park elephants show little variation among individual specimens and close resemblance to phytolith assemblages of soils inside their areas of confinement; (2) the free-roaming specimens have a much higher diversity of phytolith morphotypes than those in parks and reserves, exhibiting sometimes typical signatures of more than one biome; (3) free-roaming Cape elephants from fynbos areas have significant amounts of Restionaceae phytoliths, which suggests that grazing on restios in grass-poor fynbos types was important; (4) short saddles, typical of Chloridoideae grasses, are always the most abundant short-cell morphotypes in dental samples, even in areas where other grass subfamilies dominate, and (5) with some limitations, the study of phytoliths in herbivore dental calculus has a high, largely unexplored, potential in paleoecology and conservation ecology.
Elephant molar and tools used for sampling tartar. The jaw with other bones were found buried under a dune near Stillbay, Western Cape.

Richard Cowling
Nelson Mandela Metropolitan University Centre for Coastal Palaeoscience

Highlights
The major highlight for 2017 was the Palaeoscape III Workshop, held in Mossel Bay from 27-29 June and hosted by Curtis Maren and his associates. The aim of the workshop – a third in a series the NSF-funded SACP4 project – was to present research outcomes relevant to our understanding of the resource base of the extinct ecosystems Palaeo-Agulhas Plain. Details on this project are provided in the last year’s report.

The workshop attracted 28 participants from many countries. The participation by South African researchers has grown steadily since the first workshop in 2012 and now comprises the majority, including four postgrads. Two managers for the DSTs African Origins Programme also attended the full event. The workshop imprinted on us again the novelty and power of our resource-based approach to understanding the behavior of early modern humans, as well as the evolution of the coastal biota – the coastal adaptation of the Cape Floristic Region. Consequently, we decided to submit the papers emanating from our research for a special issue of Quaternary Science Reviews entitled: The Palaeo-Agulhas Plain: A lost world and extinct ecosystem. The editors are Naomi Cleghorn (University of Texas at Arlington), Hayley Cawthra (Council for Geosciences) and Alastair Potts (Nelson Mandela University). If all papers are accepted, the issue will comprise 23 contributions, 13 of which are being led by South Africans.
Participants at the Palaeoscape III Workshop, Mossel Bay (27-29 June 2017).

Publications


Irene Esteban
Evolutionary Studies Institute, University of the Witwatersrand
African Centre for Coastal Palaeoscience, Nelson Mandela University

Highlights
My postdoctoral research addresses the question of whether human collection of fuel and food is driven by the surrounding habitat or by other preferences beyond that of environment. For this, I use a palaeobotanic discipline, phytoliths - amorphous silica particles formed in plant cells- to better understand plant foraging strategies in relation to habitat settings (inland vs coastal) and its coupled response to climate changes during the South African Late Pleistocene. My postdoctoral project continues my PhD work conducted on the southern coast of South Africa (Esteban 2016 PhD dissertation; Esteban et al. 2017a Quat Int 434 B, 160-179; 2017b Rev Palaeobot Palynol 245, 69–84) by enlarging and expanding the study areas to include other geo-climatic regions of southern South Africa, both in inland and coastal regions. Four Middle Stone Age archaeological sites located are the focus of my studies, and these are Die Kelders Cave 1,
Boomplaas Cave, Knysna Eastern Heads Cave 1 and Klasies River main site. The excavations/interventions at these sites are led by Curtis W. Marean, Justin Pargeter and Simen Oestmo, Naomi Cleghorn and Sarah Wurz, respectively.

Comparative studies of phytoliths (reference collections) from modern plants and soils are necessary for accurate interpretation of fossil (archaeological) phytolith assemblages. I have recently received a PAST (Palaeontological Scientific Trust) Research Grant to build a phytolith reference collection of modern analogues (modern plants and surface soils from extant habitats) from the surrounding areas of the four archaeological sites mentioned above. These regions are: Walker Bay – Cape Agulhas, Cango Valley, Knysna and Tsitsikamma regions. This material will be used as proxy for correctly identifying and interpreting the archaeological phytolith record. As a research associated, my previous and current research is part of, and has been also supported by the African Centre for Coastal Palaeoscience - ACCP (Nelson Mandela University). My postdoctoral host, Prof. Marion Bamford also kindly supports my research when needed.

I continue to work as a phytolith specialist with the South African Coastal Palaeoclimate, Palaeoenvironment, Palaeoecology, and Palaeoanthropology (SACP4) team, led by Prof. Curtis W. Marean and the Palaeoscape Project (the flagship of the ACCP), of which my research is an integral part.

I am co-PI, along with Hayley Cawthra and Justin Pargeter, of the Pondoland Project (P5) led by Erich C. Fisher. We have recently submitted a research grant proposal to the National Science Foundation of USA, in order to seek funding to test questions about fisher-hunter-gatherer behavioural variability in a persistence coastal context across a glacial/interglacial cycle in the Pondoland region, Eastern Cape Province. Our project synergizes researchers from numerous international universities and disciplines to answer questions about the evolution of human behavioural variability in persistent coastal environments.

Out of Africa, I also work as a phytolith specialist in two project focused on the Mediterranean region of Spain, where I am originally from. The Mediterranean region has the world's longest history of coupled natural and human landscapes, and thus palaeoenvironmental reconstructions are key to understand this relation.

I am a team member of the project led by Prof. Valentín Villaverde of the University of Valencia that focuses on chronological, palaeoenvironmental, economic and cultural aspects along the Middle and Upper Palaeolithic in the Valencian and Murcia regions of Spain. Here, I collaborate with the MedLand project, led by Prof. Michael Barton from ASU. This project focuses in the western Mediterranean region of the Canal de Navarrés (Valencia). It seeks to simulate the feedbacks in which human decisions are affected by land-cover and terrain, vegetation is affected by land-use and landscape change, and the land surface and underlying soils/sediments are affected by land-cover and land-use.
Facing the Fynbos biome.

Trapped in a Coastal Forest.
Current involvement in projects
South African Coastal Palaeoclimate, Palaeoenvironment, Palaeoecology, and Palaeoanthropology project (SACP4), PI: Curtis W. Marean, Arizona State Univ.

Pondoland Palaeoclimate, Palaeoenvironment, Palaeoecology, Palaeoanthropology project (P5), PI: Erich C. Fisher, Arizona State Univ.

Elandsfontein Archaeological Project, PI(s): J. Tyler Faith (Univ of Utah) and David Braun (George Washington Univ).

Middle and Upper Palaeolithic from Valencia and Murcia (Spain): chronological, palaeoenvironmental, economic and cultural aspects, PI: Valentín Villaverde, Univ of Valencia

The Mediterranean Landscape Dynamics project (MedLand), PI: Michael Barton, Arizona State Univ.

Mwulu’s Cave revisited: new archaeological results and some thoughts around the Pietersburg, PI: Paloma de la Peña, Univ of Witwatersrand.

Publications


Conference abstracts
Esteban, I., The study of plant remains through microscope analysis; the case of phytoliths. Life Science Imaging Facility Research Day, Medical School, University of the Witwatersrand, November 2017.


Technical reports
Esteban, I., Albert, R.M., 2017. Phytolith analyses of pre-urban and urban sites at Brussels (Belgium).
Palaeoenvironmental research on the east coast of South Africa

Sediment coring at Lake St Lucia

Publications


Abstract

Few long-term environmental records are available for southern Africa where shifts in atmospheric circulation and changes in sea surface temperatures interact to influence regional climate dynamics. We present downcore grain size and inorganic geochemistry data covering the last ~23,000 years from a peatland on the east coast of South Africa and examine links between shifts in regional wind activity and palaeoclimatic variability. Our record documents substantial variations in aeolian flux associated with changes in regional climate and wind patterns that reflect larger scale atmospheric circulation patterns. Substantially higher fluxes observed during the Last Glacial Maximum (LGM) are linked to widespread aridification and an expansion in local source areas brought about by a clear shift to dry and cool conditions. Variations in grain size distribution reveal that the aeolian record from Mfabeni comprises two dominant end-members; locally-derived coarse-grained material and a more fine-grained dust component. Marked changes in composition and modal grain size suggest that hydrological shifts in the region during the LGM were accompanied by an increase in storm frequency and wind strength that we link to a northward displacement in the westerly wind belt and a strengthening in wind intensity. Coupling between a rapid increase in sea surface temperature (SST) and an approximate three-fold decrease in aeolian activity after 15 kcal yr BP suggests that changes in SST and its effect on the position and intensity of the westerlies in the Southern Ocean was the dominant climatic driver in the region during deglaciation. Substantially lower aeolian activities through the early Holocene indicate a warming in regional climate and the establishment of more humid conditions under the influence of enhanced tropical easterly flow. Our record also documents more subtle changes in climate over the mid to late Holocene and provides support for an arid phase in southern African climate 6–4 kcal yr BP, as well as an increase in climate variability associated with a strengthening in El Niño–Southern Oscillation (ENSO) activity ~2 kcal yr BP. The study contributes to current knowledge of atmospheric circulation patterns in the Southern Hemisphere and provides new insight into links between aeolian activity, regional wind patterns and climatic variability over glacial-interglacial timescales for a region where existing palaeoclimate records are scarce.

Abstract
The diverse lagoons and coastal lakes along the east coast of South Africa occupy incised valleys that were flooded during the rise and subsequent stabilisation of relative sea-level during the Holocene. Sedimentary deposits contained within these waterbodies provide an opportunity to investigate complex hydrological and sedimentological processes, and examine sea-level controls governing system geomorphic evolution. In this paper, we combine diatom and sulfur isotope analyses from two sediment cores extracted from the northern sub-basins of Lake St Lucia, a large shallow estuarine lake that is today largely isolated from direct ocean influence behind a Holocene-Pleistocene barrier complex. Analyses allow the reconstruction of hydrological changes associated with the geomorphic development of the system over the mid-to late Holocene. The sedimentary sequences indicate that St Lucia was a shallow, partially enclosed estuary/embayment dominated by strong tidal flows prior to ∼6200 cal. BP. Infilling was initiated when sea-level rise slowed and stabilised around present day levels, resulting in the accumulation of fine-grained sediment behind an emergent proto-barrier. Diatom assemblages, dominated by marine benthic and epiphytic species, reveal a system structured by marine water influx and characterised by marsh and tidal flat habitats until ∼4550 cal. BP. A shift in the biological community at ∼4550 cal. BP is linked to the development of a back-barrier water body that supported a brackish community. Marine planktonics and enrichments in δ34S suggest recurrent, large-scale barrier inundation events during this time, coincident with a mid-Holocene sea-level highstand. Periodic marine incursions associated with episodes of enhanced storminess and overwash remained prevalent until ∼1200 cal. BP, when further barrier construction ultimately isolated the northern basins from the ocean. This study provides the first reconstruction of the palaeohydrological environment at Lake St Lucia and highlights the long-term geomorphic controls that have shaped the recent evolution and natural dynamics of the system. Unlike most coastal lake systems, this system is particularly effective as an archive of geomorphological change. Systems driven by back-barrier modifications, such as Lake St Lucia, highlight how geomorphological changes driven by sediment-supply, climate and sea level can be distributed unevenly over several isolated back-barrier basins.

Michael E Meadows
Department of Environmental & Geographical Science, University of Cape Town and Department of Geographic Sciences, East China Normal University, Shanghai

News
Appointed as Distinguished Honorary Professor in the Department of Geographic Science, East China Normal University, Shanghai and Honorary Professor at both the Institute of Geography and Natural Resources Research of the Chinese Academy of Sciences and of Beijing Normal University.

Presented keynote address at first national conference of Physical Geography, in Nanjing, China, in November 2018.

Awarded NRF-NSFC three year research grant on ‘The Critical Zone: coastal wetlands in South Africa (Knysna Lagoon) and China (Chongming Island, Yangtze River Estuary, Shanghai).

Stood down as HOD after 16 years! Department ranked 49th in ‘Geography’ in latest QS World University Rankings

Publications


David J. Nash
School of Environment & Technology, University of Brighton, UK and School of Geography, Archaeology & Environmental Studies, University of the Witwatersrand, South Africa
The last year has seen a continuation of my research into climates of the past 2000 years, including work specific to Africa (Nash 2017) and as part of the PAGES 2k Network (PAGES 2k Consortium, 2017). I have also continued to work on aspects of geomorphology relevant to southern African researchers, including experimental work on the properties of silcrete in South Africa and Botswana (Schmidt et al., 2017) and calcrete in the Grand Canyon (Hill et al., 2017).

2017 publications on historical climatology


Abstract
Precipitation levels in southern Africa exhibit a marked east-west gradient, and are characterised by strong seasonality and high interannual variability. Much of the mainland south of 15°S exhibits a semi-arid to dry subhumid climate. More than 66% of rainfall in the extreme southwest of the subcontinent occurs between April and September. Rainfall in this region – termed the "winter rainfall zone" (WRZ) – is most commonly associated with the passage of mid-latitude frontal systems embedded in the austral westerlies. In contrast, more than 66% of mean annual precipitation over much of the remainder of the subcontinent falls between October and March. Climates in this "summer rainfall zone" (SRZ) are dictated by the seasonal interplay between subtropical high-pressure systems and the migration of easterly flows associated with the Intertropical Convergence Zone. Fluctuations in both SRZ and WRZ rainfall are linked to variability of sea surface temperatures in the oceans surrounding southern Africa, and are modulated by the interplay of large scale modes of climate variability, including the El Niño-Southern Oscillation (ENSO), Southern Indian Ocean Dipole and Southern Annular Mode.

Ideas about the nature of long-term rainfall variability in southern Africa have shifted over time. During the early- to mid-19th century, the prevailing narrative was that the climate was progressively desiccating. By the late-19th to early-20th century, when gauged precipitation data became more readily available, debate shifted towards the identification of cyclical rainfall variation. The integration of gauge data, evidence from historical documents, and information from natural proxies such as tree-rings during the late-20th and early 21st centuries has allowed the nature of precipitation variability since ~1800 to be more fully explored.

Drought episodes affecting large areas of the SRZ occurred during the first decade of the 19th century, in the early and late 1820s, late 1850s-mid 1860s, mid-late 1870s, early-mid 1880s and mid-late 1890s. Of these, the drought during the early 1860s was the most severe of the 19th century, with the droughts of the 1820s and 1890s the most protracted. Many of these droughts correspond with more extreme ENSO warm phases. Widespread wetter conditions are less easy to identify. The year 1816 appears to have been relatively wet across the Kalahari and other areas of south central Africa. Other wetter episodes were centred on the late 1830s-early 1840s, 1855, 1870 and 1890. In the WRZ, drier conditions occurred during the first decade of the 19th century, for much of the mid-late 1830s through to the mid-1840s, during the late 1850s and early 1860s, and in the early-mid 1880s and mid-late 1890s. As for the SRZ, markedly wetter years are less easily identified, although the periods around 1815, the early 1830s, the mid 1840s, mid-late 1870s and early 1890s saw enhanced rainfall. Reconstructed rainfall anomalies for the SRZ suggest that, on average, the region was significantly wetter during the 19th century than the 20th, and that there appears to have been a drying trend during the 20th century that has continued into the early 21st. In the WRZ, average annual rainfall levels appear to have been relatively consistent between the 19th and 20th centuries, although rainfall variability increased during the 20th century compared to the 19th.


Abstract
Reproducible climate reconstructions of the Common Era (1 CE to present) are key to placing industrial-era warming into the context of natural climatic variability. Here we present a community-sourced database of temperature-sensitive proxy records from the PAGES2k initiative. The database gathers 692 records from 648 locations, including all continental regions and major ocean basins. The records are from trees, ice, sediment, corals, speleothems,
documentary evidence, and other archives. They range in length from 50 to 2000 years, with a median of 547 years, while temporal resolution ranges from biweekly to centennial. Nearly half of the proxy time series are significantly correlated with HadCRUT4.2 surface temperature over the period 1850–2014. Global temperature composites show a remarkable degree of coherence between high- and low-resolution archives, with broadly similar patterns across archive types, terrestrial versus marine locations, and screening criteria. The database is suited to investigations of global and regional temperature variability over the Common Era, and is shared in the Linked Paleo Data (LiPD) format, including serializations in Matlab, R and Python.

2017 publications on geomorphology


Abstract
Analyses of stratigraphic sequences within the paleocanyons of the Hualapai Plateau, Arizona, are important because these deposits offer the only evidence for the Paleogene-Neogene geological history of the Grand Canyon area. In this paper, we focus on the origins and paleoenvironmental significance of the West Water Formation, located within the Milkweed and West Water paleocanyons on the Hualapai Plateau. We propose that the supposed “limestone unit” of the West Water Formation at and near its type section is not a limestone; rather, it is a 21 m-thick valley calcrete, overprinted by a ~1-2 m-thick pedogenic calcrete, and subsequently dolomitized in its upper-to-middle sections, with a superimposed 4 m-thick red paleosol. We also propose that this unit is not coeval in age or origin with the Long Point limestone on the Coconino Plateau, and that the presence of a complex calcrite-dolocrete-paleosol alters previous interpretations associated with this unit. Evidence for a calcrite-paleosol origin, beyond the West Water Formation’s lack of fossils, includes: its predominantly micritic calcite-palygorskite composition; its textures characteristic of valley and pedogenic calcrete deposits (as exhibited by thin section, SEM, and TEM analyses); and its association with a relatively thick overlying red paleosol that also contains abundant palygorskite. Stable carbon and oxygen isotope values from carbonate cements are also within the range expected of a near-surface calcrete. Carbonate minerals within the calcrete-dolocrete were precipitated at or near the water table in a valley setting due to evaporation and/or CO2 degassing in a semi-arid to arid environment of deposition. High 87Sr/86Sr values within the calcrete were inherited from groundwater infiltrating through Music Mountain Formation arkosic sediments, which were derived from a Precambrian source terrane to the south and southwest. No absolute ages exist for the Music Mountain Formation and West Water Formation in the Milkweed and West Water paleocanyons; these sediments could range in age from the Late Cretaceous to the latest Eocene-earliest Oligocene, and may record the Eocene-Oligocene Transition in the Grand Canyon area.


Abstract
Heat treatment was one of the first transformative technologies in the southern African Middle Stone Age (MSA), with many studies in the Cape coastal zone of South Africa identifying it as an essential step in the preparation of silcrete prior to its use in stone tool manufacture. To date, however, no studies have investigated whether heat treatment is necessary for all silcrete types, and how geographically widespread heat treatment was in the subcontinent. The aim of this study is to investigate experimentally whether heat treatment continued further north into the Kalahari Desert of Botswana and northernmost South Africa, the closest area with major silcrete outcrops to the Cape. For this we analyse the thermal transformations of silcrete from both regions, proposing a comprehensive model of the chemical, crystallographic and ‘water’-related processes taking place upon heat treatment. For the first time, we also explore the mobility of minor and trace elements during heat treatment and introduce a previously undescribed mechanism – steam leaching – causing
depletion of a limited number of elements. The results of this comparative study reveal the Cape and Kalahari silcrete to respond fundamentally differently to heat treatment. While the former can be significantly improved by heat, the latter is deteriorated in terms of knapping quality. These findings have important implications for our understanding of the role of fire as a technical solution in MSA stone tool knapping, and for the extension of its use in southern Africa. Silcrete heat treatment – at least in the form we understand it today – may have been a strictly regional phenomenon, confined to a narrow zone along the west and south coast of the Cape. On the basis of our findings, silcrete heat treatment should not be added as a new trait on the list of behaviours that characterise the MSA of the southern African subcontinent.

Lynne Quick  
Department of Environmental and Geographical Science, University of Cape Town

My final stint as a postdoc at UCT has been focussed on generating a Holocene pollen sequence from a sediment core extracted from Verlorenvlei (west coast). I also spent a large part of 2017 working towards the publication of pollen and microcharcoal data generated from the 30.5 m sediment core extract from Eilandvlei (Wilderness). This record represents the highest resolution record of Holocene vegetation change from the region (further details below). All of these activities are embedded in the RAIN project (https://www.marum.de/en/Research/R-A-i-N.html).

Conferences/workshops attended in 2017
SASQUA 21st Biennial Conference in Johannesburg, April 2017

Commissions/committee membership
ICSU/SANC-INQUA committee
Vice-President of SASQUA

Publications

Louis Scott
Department of Plant Sciences, University of the Free State, Bloemfontein, South Africa

Palynology activities
The palynology group at the University of the Free State welcomed Petrus Chakane (see photograph) as laboratory worker who processed fossil pollen samples from many sites. With him here, the laboratory should be able to provide a pollen processing service in future if the work load allows it. The samples he processed so far included marine deposits for Frank Neumann who is currently stationed here while working on the RAiN2 project for the University of KwaZulu-Natal under Jemma Finch. Juan Ochando Tomás, Ph.D student from the University of Murcia, Spain, visited the pollen laboratory and assisted in a number of palynology projects, viz., Taung deposits in collaboration with Philip J. Hopley from the UK, Holocene stream deposits from Uniondale, hyena coprolites (see photograph) from Gibson Bay provided by James Brink, and deposits from the Kalkkop impact crater site near Aberdeen in the Karoo that were provided by the late Dave Roberts. Andri van Aardt did pollen analysis of samples from Florisbad, Free State, that were provided by Michael Tofollo (Tofollo et al 2017), while Juan Ochando helped to manage old pollen counts from the site that were previously produced by E.M. by van Zinderen Bakker (1989). Louis Scott attended the PAGES Open Science meeting in Spain in May, 2017. Andri van Aardt attended the GPWG2 Workshop, “Paleofire knowledge for current and future ecosystem management” in Montreal in October, 2017.
Petrus Chakane at the UFS pollen laboratory.

Publications

Abstract
Pollen, spores, and microscopic charcoal from a sediment core from Lake Ngami, in the Middle Kalahari, reflect paleovegetation and paleoclimatic conditions over the last 16,600 cal years BP. The location of Lake Ngami allows for the receipt of moisture sourced from the Indian and/or Atlantic oceans, which may have influenced local rainfall or long distance water transport via the Okavango system. We interpret results of statistical analyses of the pollen data as showing a complex, dynamic system wherein variability in tropical convective systems and local forcing mechanisms influence hydrological changes. Our reconstructions show three primary phases in the regional precipitation regime: 1) an early period of high but fluctuating summer rainfall under relatively cool conditions from ~16,600e12,500 cal BP, with reduced tree to herb and shrub ratio; 2) an episode of significantly reduced rainfall centered around c. 11,400 cal BP, characterized by an increase in xeric Asteraceae pollen, but persistent aquatic elements, suggesting less rainfall but cool conditions and lower evaporation that maintained water in the basin; and 3) a longer phase of high, but fluctuating rainfall from ~9000 cal BP to present with more woody savanna vegetation (Vachellia (Acacia) and
We propose a model to relate these changes to increased Indian Ocean-sourced moisture in the late Pleistocene due to a southerly position of the African rain belt, a northerly contraction of tropical systems that immediately followed the Younger Dryas, and a subsequent dominance of local insolation forcing, modulated by changes in the SE Atlantic basin.


Abstract
In view of a scarcity of terrestrial Quaternary pollen records relating to climate change in desert areas, we present new terrestrial sequences from hyrax middens in Namibia. While the few previously available pollen records are mainly Holocene, we present climate time series for Marine Isotope Stages 2 and 3 (MIS 2 and MIS 3). The data are from two sites in central Namibia that are surrounded by desert plains and close to the Namibian escarpment, viz., the D$aures Massif (Brandberg) and 200 km further south, the Mirabib Shelter located in a small inselberg. In the studied material, grass-rich pollen assemblages were more common at Mirabib where the vegetation is desert grassland, than at Brandberg with its mountain vegetation. Hyrax radiocarbon ages range from 21 ka to >50 ka, with inconsistencies in ages near the limit of effective radiocarbon dating. However, correlation of overlapping sequences supports the chronology we present. Despite chronological gaps in the available deposits, pollen assemblages from different middens indicate marked climate cycles, starting with moderately cool dry conditions with grassy karroid vegetation at Mirabib c. 50 ka. After a gap in the record, warmer conditions with savanna woodland are indicated at both Mirabib and Brandberg around 40 ka. Eventually, cool conditions supporting shrubby grassland with wild olives developed at Brandberg during MIS 2, c. 21 ka. Comparison with marine pollen data confirms earlier findings that terrestrial pollen assemblages differ markedly from South Atlantic Ocean marine pollen assemblages of the same age presumably due to mixing of pollen from wide source areas at the marine localities versus the more locally restricted terrestrial pollen sources trapped in hyrax dung. The results therefore add information for the interpretation of local vegetation shifts on land during the interval between 50 ka and 21 ka in Namibia.

Hyena coprolite from Gibson Bay provided by James Brink of the National Museum in Bloemfontein.
Rebekah Singh  
Council for Geoscience (KwaZulu-Natal Unit)  

Remote sensing analysis of regolith susceptibility to erosion on the Eastern Cape Wild Coast

Earlier investigations of this research project were focused in the Xolobeni pilot study region where a remote sensing-based, land degradation/erosion mapping methodology was established. Recently the research has expanded the regional erosion inventory mapping to cover the 258km extent of the Wild Coast coast stretching from the Mtamvuna River in the north to the Kei River in the south. Multi-spectral Sentinel data and a series of historical multi-temporal aerial photography and Google EarthTM imagery facilitated erosion mapping and inventorization. Current investigations have also identified complex erosional histories and growth patterns associated with some of the larger wind erosion features. All wind erosion features occur within a 2km inland buffer from the Indian Ocean coastline where these features are preferentially associated with rubified aeolian sands of the older coastal dunes. Blowouts generally have a long axis aligned with the prevailing NE – SW wind directions. Bare patches and/or segments of tracks/footpaths which trend parallel to these prevailing winds are highly susceptible to wind erosion. Anthropogenic activities (including traditional subsistence farming and communal mining) have accelerated soil erosion rates and led to localised desertification along the Wild Coast.

Land degradation due to wind and water erosion occurring on elevated aeolian sand regolith at Mbolompo Point, Wild Coast, Eastern Cape province.

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I’m very grateful to Lynne Quick’s guidance helping me to step into the secretary role for SASQUA and am enjoying working with the committee. Please keep sending information you would like circulated to members and if you think your subscription fees are due, please get in touch with Pat Dlamini pdlamini@geoscience.org.za to make your payment.

I continue to serve as editor the Quaternary Newsletter of the UK Quaternary Research Association (QRA). Please contact me with any reports you have written if you are already a QRA member and please have a look here at details on this website you might like to join the QRA https://www.qra.org.uk
Research highlights

Dating dunes on the double
With Mark Bateman (University of Sheffield), and large number of samples with published OSL ages from my research and Sallie Burrough (University of Oxford) and Matt Telfer (Plymouth University), I have been pushing the portable luminescence reader to the limits to try to calibrate it as a tool for rapid age assessment for sand sediments across southern Africa. This research was presented at the 15th International Conference on Luminescence and Electron Spin Resonance Dating, hosted by Makaiko Chitambo and colleagues in Cape Town from the 11-15th September, 2017. See the abstract in publications section for the paper in press in Quaternary Geochronology (accepted manuscript online).

Soggy, salty sand dunes
In 2017 and into 2018 I continued to investigate moisture within sand dunes, measuring nitrate concentrations and isotopic compositions to understand more about ‘Nitrate beneath the surface in drylands’, with Andi Smith from the NERC Isotopes Geosciences Laboratory in Keyworth, UK (grant IP-1542-0515). This subsurface zone makes up the unsaturated zone (USZ) of the Stampriet Artesian Basin, which is an important transnational aquifer resource for southeast Namibia, western Botswana and northern South Africa. This work will be presented in April at the EGU, 2018, in Vienna and the write-up is currently intended for the Journal of Arid Environments. In addition to the nitrate work, three field seasons (2011, 2014, 2016) investigating chloride in the USZ is being written up for the Holocene ‘Reconstructing past rainfall in southern African drylands: Assessing the suitability of the Kalahari dunes to provide unsaturated zone hydrostratigraphies’. The outlook for the suitability of the approach is frustratingly poor, nonetheless the path to discovering that has proved extremely interesting, and provided insights into the nature of the USZ in this region of Namibia.

Nitrate concentrations & isotopes for one of the sand dune profiles.
Arabian Archaeology
Following the field season, early in 2017, on the eastern shores of the Red Sea, the team, led by Dr Robyn Inglis (York, UK), has been hard at work interpreting the landscape and geoarchaeological setting of the > 3000 Palaeolithic lithic artefacts found at Wadi Dabsa. I’ve been working on the tufa component of this project, which (1) represents a valuable proxy for understanding formerly wetter conditions at this site and (2) provides datable material to constrain both the timing of these wetter conditions and some broad age control for the Palaeolithic lithic artefacts. This year, this has involved obtaining research funding from NERC Isotopes Geosciences Facility for U-Th dating of the tufa (and also 40Ar/39Ar dating of the basalt lava flows surrounding the Wadi Dabsa Basin) (IP-1739-0517). In addition, Ian Candy (Royal Holloway, University of London) has been measuring stable isotopes from these same tufas for me to give an insight into the vegetation in the region (from carbon stable isotopes) and initial insights into meteoric v. thermal signature of waters from which these tufas formed, and if meteoric the moisture source and levels of evaporative enrichment (from oxygen stable isotopes). I’ll be chewing over these initial data with those at the EGU in Vienna in April who stopped at the poster.

Ramps wrap-up
This is a chance to advertise the excellent southern African research sand ramp research of completed PhD student, Dr Alex Rowell, supervised by Dave Thomas and Richard Bailey at the University of Oxford. During her PhD I had the pleasure to spend lots of research time with Alex talking fieldwork strategy, OSL dating, sand provenance, Namibian palaeoenvironments; share samples of sand from elsewhere in Namibia, and help with one of the papers now published in Earth Surface Processes and Landforms (see below). If you are a sand ramp fan, look for other papers, led by Alex and written with her supervisors Dave Thomas and Richard Bailey.

Publications

**Abstract**

Sand ramps have the potential to provide rich palaeoenvironmental information in dryland regions where proxy records are typically scarce. However, current knowledge of the geomorphic controls and processes of sand ramp formation is limited. This study provides a data-rich examination of the key factors controlling sand ramp formation. The location and morphology of 75 sand ramps in southern Namibia are examined. The sediments and chronologies of 10 sand ramps are studied in detail using 51 OSL dates and 83 grain-size and LOI samples. Heavy mineral assemblages are used to determine the provenance of 10 samples and OSL sensitivity is used to explore geomorphic processes of eight samples.

Sand ramp morphology can be grouped into one of four classes of increasing size and complexity and is closely linked to the available accommodation space. Heavy mineral assemblages indicate local sediment sources and all 75 studied sand ramps are within 4 km of a large ephemeral river channel or within 5.5 km of a dune field. Therefore, accommodation space and sediment supply are identified as the primary controls of sand ramp formation. Sedimentology and OSL sensitivity suggest a complex interplay of aeolian, fluvial and colluvial processes contribute to sand ramp formation with large variability observed between ramps. Three of the ten dated sand ramps have been present in the Namibian landscape for >100 ka. Eight sand ramps show episodic deposition between >75–12 ka and five show evidence of surface reworking over the past 2 ka. Environmental sensitivity is probably linked to the size and availability of the accommodation space. Therefore, individual sand ramps are expected to reflect local environmental conditions, recording when an abundant sediment supply coincided with available accommodation space, while a regional analysis of multiple sand ramps with chronometric data offers the potential to identify larger scale palaeoenvironmental controls of sediment supply.

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**David Thomas**  
University of Oxford

**Landscape archaeology of the Kalahari: How did major hydrological shifts affect Stone Age mobility and landscape use in the late Quaternary?**

This multidisciplinary project is funded by the Leverhulme Trust and has now completed two field seasons, in 2016 and 2017. Led by the University of Oxford, with the universities of Brighton, Oslo and Botswana, and the assistance of the National Museum of Botswana, we are providing the first systematic analysis of the neglected Stone Age archaeology of the Middle Kalahari, and its material source areas, in relation to the region’s hydrological history.

The central research question addresses how Late Quaternary hydrological changes affected human mobility and resource use, and the distribution of lithic archaeology in the interior southern African dryland landscape. The focus of investigations to date has been the extensive MSA lithic sites of Botswana’s Makgadikgadi basin. The project is using palaeoenvironmental and age data, geochemical fingerprinting of artefacts and raw materials, and systematic field excavations and lithic analyses, in an environment where major environmental changes have imprinted the landforms and sediments in which the lithic archaeology occurs. The emerging empirical data set will be used to develop new theories about early human-environment interactions.

The project team includes Prof David Thomas and Dr Sallie Burrough (palaeoenvironments), Prof David Nash (geochemistry) and Drs Sigrid Staurset, Sheila Coulson and Sarah Mothulatshipi (archaeology). The two field seasons, focussed on the western Ntwetwe Pan of Makgadikgadi but extending into feeder fluvial systems, have seen 38 archaeology sites and 44 minor sites and scatters identified, with six of the former subject to excavations that have also involved students from the University of Botswana. The majority of sites are sufficiently undisturbed to allow refitting and the potential to establish prehistoric behaviour at the sites.
Palaeoenvironmental fieldwork has aimed to extend work carried out in Makgadikgadi in the last decade and has focussed on providing answers to specific questions relating to basin history as well as individual archaeological sites. For the latter these include why sites occur where they do on the basin floor, how they have remained largely undisturbed, and how they relate to lake high-stands, dune formation in the system and deflation of pan floor sediments, as well as providing chronometric control on deposits and lithics. Ongoing analyses include geochemical, leaf wax isotope and diatom data from basin sediment cores collected in this and allied projects. Geochemical work is aiming to establish the relationship between silcrete artefacts and their material source areas around the basin system and beyond, with over 300 outcrop and over 50 waste flake samples subject to ongoing analyses including via ICP-MS and ICP-AES.

Preliminary findings from this project will be presented in 2018 by Sallie Burrough, David Thomas, David Nash and Sigrid Staurset at a range of meetings including the EGU, AFQUA, 5th Southern Deserts Conference and the 15th Pan African Archaeological Congress.

See [www.geog.ox.ac.uk/spotlight/kalahari](http://www.geog.ox.ac.uk/spotlight/kalahari)

**Publications**


Dansie A, Wiggs GFS, Thomas DSG 2017 Iron and nutrient content of wind-erodible sediment in the dry river valleys of Namibia. Geomorphology 290, 335-346


One of the Makgadikgadi Pans excavation sites investigated in the Leverhulme-funded Kalahari geoarchaeology project.

University of Botswana students participating in the 2016 excavations.
UPCOMING EVENTS

AFQUA and INQUA
Contributed by Margaret Avery

AfQUA Conference 2018
For those of you who have not yet heard about it, the second AfQUA Conference* will take place in Nairobi during July this year. Please have a look at the website https://afquacongress.wixsite.com/afqua2018 for more information and act quickly to secure your place in this event!

*The first AfQUA Conference was held in Cape Town in 2015 and the aim is that these geographically intermediate conferences should take place in years between the more local conferences (SASQUA, EAQUA, WAQUA) and the four-yearly INQUA Congresses.

INQUA Congress 2019
The INQUA Congress will take place in Dublin next July. See the Congress website http://www.inqua2019.org/ for more information, including sessions and excursions, and not forgetting opportunities to apply for funding to attend. The 5th Southern Deserts Conference may be of interest to your newsletter readers.

SASQUA Conference 2019
A joint SASQUA-SHAPE meeting will take place from 28 January – 1 February 2019. More information will be communicated shortly, but please diarise the dates! The venue is Mossel Bay and the keynote presentation as follows:

Prof Curtis W. Marean (Arizona State University and Nelson Mandela University) The Palaeo-Agulhas Plain – Unravelling its ecology teaches us how to do Palaeoscience

There will be an optional field trip to Pinnacle Point and the interesting Quaternary outcrops in the area.

SOUTHERN DESERTS CONFERENCE 2018
The Southern Deserts Conference is an interdisciplinary meeting that promotes a comparative perspective on the Quaternary evolution of desert landscapes and peoples from the southern Hemisphere (Oceania, Africa and South America). This endeavour is necessarily based on a fluid dialogue between Quaternary science, climate studies, scientific dating, environmental science, archaeology, rock art research and other social sciences. The 5th Southern Deserts Conference 3 (SDS) will be held in Western Australia’s Pilbara, a desert region famous for archaeological heritage of over 50,000 years of human occupation, and more recently a massive mining industry which has generated a plethora of heritage knowledge and recent research impacts.

The theme is Desertscape: Adapting to Arid Landscapes. Developing new narratives of environmental change and human-environmental relationship within the great deserts of the southern hemisphere. While papers are closed we should welcome posters. Each session includes contributions from different disciplinary research perspectives from the natural and social sciences including: Quaternary science, climate studies, scientific dating, environmental science, geomorphology, archaeology, anthropology, rock art research and other disciplines; interdisciplinary contributions are especially welcomed. The conference runs for 4 days from August 7-10 2018, including a half day fieldtrip. Conference delegates are also invited to participate in a one-day heritage summit about the Murujuga/Burrup World Heritage Nomination on August 6.

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