Greetings all,

I think it is safe to say that the highlight of SASQUA’s 2012 activities was the eventual occurrence of the ‘biennial’ congress at Gobabeb, Namibia. Being trapped (happily) together at the Gobabeb Research and Training Centre created a fantastic unified dynamic, with researchers and students from a range of disciplines interacting in a way that happens all too rarely at most conferences. This was, of course, facilitated by Mary Seely and the excellent staff and cast of GRTC, and I only hope that we re-create such an amicable and creative atmosphere at the next congress.

Fortunately, for all of us, Christine Sievers has written a brilliant report on the congress for this newsletter, “‘Grains not behaving well’ and some other issues”, thereby sparing me from going on at great length here. I’m sure reading it will bring back some memories for those who attended, and hopefully motivate the whole SASQUA community to make it to twentieth SASQUA congress in Maun in 2014!

Best wishes,

Brian Chase

Institut des Sciences de l’Evolution, Montpellier;
Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
OBITUARY
IN MEMORIAM

PROFESSOR PHILLIP VALENTINE TOBIAS

By Professor Francis Thackeray

It is with great sadness that we heard that Professor Phillip Vallentine Tobias had died today. Professor Tobias was an outstanding palaeo-anthropologist, a scientist who made major contributions to the study of human evolution. It was Professor Tobias who in meticulous detail described the skull of a new species which he called Australopithecus boisei, discovered by Dr Mary Leakey at Olduvai Gorge in Tanzania in 1959. It was he who in 1964 described Homo habilis, a new hominid species, first recorded in East Africa, and described by Tobias together with Dr Louis Leakey and Dr John Napier. Professor Tobias undertook detailed studies of endocasts of the brain of Homo habilis, recognising that this species had the capacity for speech 1.8 million years ago. It was he who directed excavations at Sterkfontein for more than 40 years. Together with Alun Hughes he described a partial skull as a South African representative of Homo habilis. Later, with Professor Ron Clarke, he published on the discovery of the “Little Foot” skeleton, which represents a species of Australopithecus different from the taxon represented by Mrs Ples (Australopithecus africanus) which had been discovered by Dr Robert Broom of the Transvaal Museum.

Like Robert Broom, Professor Tobias was elected a Fellow of the Royal Society of London. He was given numerous other awards. He was nominated three times for the Nobel Prize. In, 1999, President Nelson Mandela conferred upon him the Order of the Southern Cross. In 1992, President F.W. de Klerk conferred upon him the Order of Meritorious Service (Gold Class) of South Africa. In 1998, President Jacques Chirac made him a Commander in the National Order of Merit of France. As a Professor in Anatomy, he educated and stimulated more than 10,000 students at the University of the Witwatersrand. He considered them “his children”.

He served on the Editorial Boards of numerous scientific journals, including the Journal of Human Evolution, the American Journal of Physical Anthropology, and the Journal of Human Biology. He was the author of many books, including The Brain in Human Evolution, one volume on Australopithecus boisei and two volumes on Homo habilis. He wrote extensively on so-called Piltdown Man, initially called Eoanthropus, and which was announced in London 100 years ago as a new species, but which was shown to be a hoax or joke.

Professor Tobias was recognised not only as an excellent scientist but also as a person who stood up for human rights, and who staunchly objected to apartheid. Professor Tobias will be remembered for his kindness and respect for all, whether he was addressing Presidents or the general public.

Science is usually undertaken dispassionately, but it has been said that “Scientists have feelings too”. This certainly applied to Phillip Tobias who recently shed a tear of excitement on seeing the remarkable skeletons of Australopithecus sediba, discovered by Professor Lee Berger.

We express our sincere condolences to the family, friends and colleagues of Professor Tobias. We have lost a great and special representative of our species, Homo sapiens.

Professor Francis Thackeray
Director of the Institute for Human Evolution
University of the Witwatersrand

June 7, 2012
THE XIX BIENNIAL CONGRESS
GOBABEB, NAMIBIA
13 – 16 September 2012

Celebrating 50 Years of Namib Desert Research at Gobabeb

Student prizes

Best student oral presentation: Loïc Truc, for the paper: The application of pdf-based botanical-climatological transfer functions to southern African fossil pollen sequences: a quantitative reconstruction of palaeoclimatic variables over the last 20 kyr at Wonderkrater, South Africa.

Best student poster presentation: James McPherson, Biome organisation at the Fynbos-Succulent Karoo ecotone on the Kamiesberg granites.

‘GRAINS NOT BEHAVING WELL’ AND SOME OTHER ISSUES

By Christine Sievers

Celebrating 50 years of Namib Desert Research at Gobabeb, the South African Association of Geomorphologists (SAAG) and the South African Society for Quaternary Research (SASQUA) biennial meetings were held at the Gobabeb Research and Training Centre, 120 km inland of Walvis Bay, from 13 to 16 September 2012. The centre is situated on the Kuiseb River at the point where the dune sands to the south and the gravel plains to the north meet (Fig. 1). Here one also finds the westerly extent of the rainfall zone and the easterly extent of the thick fog that rises and flows inland from Namibia’s Atlantic coast. This extraordinary nexus has produced astonishing flora and fauna that have been the focus of research for half a century under the leadership of the legendary Dr Mary Seely.

In the Namib dunefield there are least 295 animal species, of which 156 (53 per cent) are endemic, and 16 plants species, eight of them endemic (Fig. 2). These figures equal those of the Galapagos Islands and are reason enough to hope for success in an application to have the Namib Sand Sea declared a World Heritage Site. More than 100 post-graduate dissertations and over a thousand other publications have been generated by research in the area. Apart from descriptions of the endemics, and the adaptations and interactions in this unique ecosystem, the collection of data over the last 50 years is immensely valuable in showing the great climatic and related variability that has occurred here over the decades. For example, the recorded foraging distance travelled by the sand-swimming Golden Mole (Fig. 3) has varied from 230 m to an astonishing 1 390 m.

Since Namibia’s independence in 1990, the centre has added education as a major component and has made substantial contributions to solving pressing human issues such as the management of scarce water resources. As one delegate to the SASQUA conference put it, people have been ‘living on the edge’ in the Namib for many millennia. Relevant research and the dissemination of information, particularly to those in positions of power, has contributed greatly to a better understanding of the issues involved and sustainability in this arid environment.

The conference – much to think about

The 30 papers and 19 posters presented at the SASQUA conference covered a broad spectrum of topics, techniques and geographical spread. Taken out of context, the implications of some quotes are intriguing: ‘oolites at Poachers Point’ and ‘grains not behaving well’ had to do with a discussion on megafans and dating respectively, and ‘I wouldn’t pay much attention to wobble’ referred to changes in vegetation and MSA (Middle Stone Age) stone-artefact technology at
Klein Kliphuis Rock Shelter. Changed conditions and human responses to these were also illustrated by the distribution of more than 600 radiocarbon dates from archaeological sites in the Namib Desert. The patterns differed in the winter rainfall area in the south and the summer rainfall area in the north, and responses to negative trends were marked and more rapid than responses to improving conditions. The effect of changing conditions is often considered, but, as another delegate pointed out, a case can also be made for the impact of climatic variability on human behaviour and adaptations.

Naturally, weather patterns and climate were under the spotlight at a conference titled Understanding Quaternary Change: Southern Hemisphere Perspectives. Phrases bandied about varied from ‘A hazy shade of winter’, dealing with the influence of climatic changes on foraging behaviour in the MSA, to ‘How wet is wet?’, which had reference to research on the Boteti, an endoreic river (a river with no outflow). Detailed and decades’ worth of scouring early travellers’ descriptions of weather, converting the information into a grading system and plotting the results across a grid map of the African continent illustrated 200 years of rainfall variability and the extent of heavy droughts in the early 1800s.

**Environmental proxies**

A range of other environmental proxies were presented, such as a) fossilised wood from Koobi Fora in Tanzania, charcoal from the MSA layers at Sibudu Cave, and fresh tree ring records from baobabs up to 1 000 years old, with annual rings that can be peeled off with a spatula; b) pollen, particularly from hyrax middens, but also from peat lands, coastal and high-altitude wetlands and hyena scats (‘in the poo or out?’); c) diatoms; d) molluscs; and e) phytoliths, silica bodies that remain after plants are burned or decay. Specific shapes and combinations of shapes can be used to identify plant taxa, but often only to family level. Certain taxa are considered characteristic of particular conditions, thus the presence of *Aristida* (grass) phytoliths is taken to indicate arid environments.

The characteristic biochemical pathways, C$_3$, C$_4$ and CAM (Crassulacean acid metabolism) refer to the fixation of carbon during photosynthesis by different plant groups and are indicators of environmental conditions. Generally interpretations are made on the basis of the predominance of C$_3$ or C$_4$ plants (for example, C$_3$ grasses occur high in the uKhahlamba-Drakensberg and variation in C$_3$ and C$_4$ grasses/plants in archaeological contexts there is used to document environmental change). Evidence provided at SASQUA 2012 indicated that the CAM values overlap with those of both C$_3$ and C$_4$ – the delegate stressed that ‘we cannot ignore CAM’.

Another interesting plant-based environmental proxy that was explored was the analysis of leaf wax lipids. Long n-alkane chain-length distributions can be used to distinguish broadly between biomes and the quote, ‘if it gets drier I need to seal myself up more’, describes the adaptations made by plants with respect to wax on and within their cuticle or surface covering. The question, ‘has anyone ever tried making an experimental soup of alkanes?’, presumably referred to the many issues surrounding the proxy and its potential, rather than a pre-occupation with diet. With respect to leaf wax lipids within hyrax middens, the following seemingly bizarre, but quite informative statement was made: ‘We don’t think hyraxes were urinating waxes’.

As for other animals, the distribution of bones at a brown hyena den in the lower Uniab River had interesting taphonomic implications. Species represented in the hyena diet were seal, whale, oryx, ostrich, springbok, jackal and hyena pups (drowned when the site was flooded). Seal bones were brought from the seashore 4,5 km away and the hyena were also foraging 11 km to 12 km up and down the beach. A study of larger animals, specifically extinct mega-herbivore fauna, was made through analysis of the phytoliths in their dental calculus. This has potential for suggesting their diets and past environments.
Chronology is a major factor for consideration when comparing proxy records. Age calculations using carbon dating, U-series dating of speleothems and various studies on Optically Stimulated Luminescence (OSL) received attention. We heard about the age of silcrete formation and of dunes as far apart as the Kalahari and the sterile post-Still Bay layer at Blombos Cave in the southern Cape. Apart from lack of chronological precision, different scales of proxy evidence make comparisons difficult. However, ‘there are not good or bad data sets per se … each analysed appropriately has a contribution to make in respective temporal and spatial domains’.

Palaeosols, long-term ecosystem dynamics and anthropogenic processes, dune generations and interdigitated aeolian and water-lain interdune deposits, marine geophysics and geological modelling were all discussed. A superbly composed presentation on the sedimentary dynamics and depositional controls of the Hout Bay area near Cape Town illustrated how development of the headland from Hout Bay to Sandy Bay has reduced open areas by 96 per cent since 1930. Because this is the source of sand for beaches such as Clifton, there will, in time, be a serious lack of sand on Cape Town’s famous Atlantic seaboard.

While most delegates could not resist a trip to view the ancient and fascinating Welwitschia plants (Fig. 5), a few die-hard archaeologists went to explore Mirabib Shelter (Fig. 6) and were richly rewarded with the discovery of a wealth of stone artefacts (some crystal-quartz worked pieces elicited groans of delight), a copper bead, pottery including a lug and some faded rock art. The site is famous for an early date for sheep and there was appropriate appreciation of the thickness of the preserved dung layer. The Kuiseb River and surrounds is still home to pastoralists and energetic goats belonging to the local Topnaar people passed by the Gobabeb camp periodically. Mournful donkeys could be heard occasionally, as well as jackals. The barking geckos, with barks reminiscent of bird calls, were heard at night. At times the delegates were also quite vocal, but the campground with comfortable tents and stretchers was distant enough from the communal area for others to sleep well, even though a single powerful solo, duets and sometimes trios of snores carried clearly across the still desert night.

Dunes, sunsets, Welwitchias and more

Certainly, there is no lack of sand in the Gobabeb area and, sensibly, the conference sessions were broken by two free afternoons enabling delegates to explore the fascinating and varied landscape around the research centre. No visit to Gobabeb is complete without a dawn witnessed from Station Dune (Fig. 4). The few who tried this climb after the first morning were greeted by thick mist and returned soaked but elated, in spite of not seeing the sun rise. The energetic climbed High Dune (an understatement) at sunset and were rewarded with unparalleled sunset vistas. Another afternoon excursion was to see the sunset at Homeb, with a view of the deep green Kuiseb canyon and a glimpse of the conditions in Henno Martin’s Sheltering Desert.

Our group ranged in age from eight months to over 80 years and everyone appeared to be making the most of the opportunities provided. Satisfied bellies contributed much to the enjoyment and the excellent fare, particularly the homemade rusks and biscuits, were fully appreciated. But the real meat of the conference was the variety of disciplines brought together by delegates from across the world, providing insights on various aspects of the past, contributing to a richer, fuller picture of ancient and less ancient times, and stimulating further research and connections through serious discussions late into the night.

Acknowledgements

The conference booklet included three obituaries, and here too acknowledgement is made of the role of SASQUA stalwarts who have passed away since the last SASQUA conference: Hilary Deacon, Tim Partridge and John Vogel all made huge contributions to Quaternary Studies and their legacy lives on. With regard to SASQUA 2012, I
thank Prof Lyn Wadley for sponsoring my participation and extend thanks to everyone for the interesting presentations, posters and discussions, to the organisers of the SASQUA conference, to the staff at Gobabeb and to those delegates who commented on what I say they have said.

Fig. 1: The Kuiseb River separates the dunes to the south and the gravel plains to the north

Fig. 2: An endemic grass of the Namib dunefield, Stipagrosis sabulicola, on a foggy morning

Fig. 3: The route of the sand-swimming endemic Golden mole (courtesy M Bamford)

Fig. 4: The vegetation-fringed Kuiseb River, and the rising sun penetrating the thick early morning fog. Gobabeb Research and Training Centre is to the lower left, out of the picture.

Fig. 5: Fascinating Welwitschia plants (courtesy M Bamford)
Fig 6: View from Mirabib shelter, with distinguished delegates discussing the dung layer

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Christine Sievers is a freelance archaeobotanist based in Durban. Her PhD, submitted, is on sedges as bedding in the Middle Stone Age at Sibudu Cave, KwaZulu-Natal.

QUATERNARY CLIMATE AND VEGETATION OF SOUTHERN AFRICA, EAST-WEST-NORTH-SOUTH

Funding was obtained in 2012 from the South African NRF and Germany to hold the “Quaternary climate and vegetation of southern Africa, East-West-North-South” workshop. This workshop was organized by Prof Marion Bamford and Dr Frank Neumann and held at the BPI in February 2013. The objectives were:

1. A review of the status of palaeoclimate research,
2. The identification and discussion of key questions and
3. A roadmap for a research strategy involving multidisciplinary joint venture projects.

The participants discussed results from the last decades and explore integrated joint research of isotopes, pollen, phytoliths, diatoms, sedimentological and geomorphological data, biomarkers and other proxies from archives as diverse as marine and lacustrine cores, peat, and hyrax, hyaena and cow dung deposits. The new projects will focus on the summer rainfall region on southern Africa.

RESEARCH NEWS, UPDATES & RECENT PUBLICATIONS

Marco Andreoli  
Necsa - NLM  
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Introduction

Quaternary research continues at the Vaalputs Radioactive Waste Disposal Facility in Namaqualand-Western Bushmanland, where the Necsa-led team focuses on issues of
Cenozoic/Quaternary geology, ranging from neotectonics to pedogenesis and palaeoclimate. The gates of Vaalputs, where the logistic facilities are of the highest standard, always welcome academics and post-graduate students with a healthy appetite for exciting research in an unique geological and geographic environment. The current research is inserted in the Inkaba yeAfrica German – South African collaborative initiative (www.inkaba.org/the-science/associate-projects.html).

**Seismology, crustal deformation, neotectonics**

Prof. Ray Durrheim, assisted by Ph D candidate Ms H Malephane is measuring the seismicity of Bushmanland with a dedicated network of three seismometers located at Vaalputs, Aggeneys and in the farm Koffiemeul. The data obtained are combined with the recordings by the stations of the South African Council for Geoscience to generate focal mechanism solutions and improve on the existing seismic hazard assessment for the area. The issue of crustal stress, essential to determine the reactivation potential of the Namaqualand faults, is also addressed by Mr Andrew Logue in his part-time M Sc (UCT) study of borehole breakouts on well logs supplied by the Petroleum Agency. This M Sc is being co-supervised by Profs. Oliver Heidbach (GFZ – Potsdam) and Zvi Ben-Avraham (Univ. Tel Aviv). Preliminary data were presented by Andrew and Hlompho at a Workshop held in November 2012 at the Helmholtz Center Potsdam.

The palaeostress of Namaqualand were the focus of a recently published study by Prof. Giulio Viola (Geological Survey of Norway, and Univ. Trondheim) and Dr Alex Kounov (Univ. Basel) (see below).

**Soils, palaeosoils of Bushmanland**

These are currently being studied by a multidisciplinary team of Soil Scientists, including Dr. F. Netterberg and Prof. R. Shlemon (USA) and students at leading South African Universities. Among the pedogenic features of interest are penetrative ‘tongues’ of patchily indurated sandy soil (see photo). Current projects include: Brittle shear fractures - studied by Mr J Nel (B Sc. Hons project; Prof. K Saalmann, Wits U.); barite veins - studied by Mr O. Majodina (M. Sc. Thesis; Dr C. Clarke, Univ. Stellenbosch); Brittle cracks - studied by R. Vermeulen (B Sc Hons. project; Prof. Louis VanRooy, Univ. Pretoria).

![Photo of an intriguing, partly consolidated “soil tongue” penetrating the surficial duricrust and the underlying weathered, calcritized greywacke of the Vaalputs Formation (wall height: 3 m; scratches and auger marks by the author).](image)

**Climate vs. Palaeoclimate**

This theme is being pursued by H. Freysen (B. Sc. Hons. project; Mrs. M. Evans, Wits U.). Mr. Freysen will process 25 years of detail climate data collected by the Vaalputs weather station.

**Escarpmont retreat, and uplift rates**

These are topical issues specifically addressed with the use of cosmogenic isotopes and apatite fission track ages across the West Coast/Vaalputs
escarpment (see publication below). Logistical assistance and collaborative assistance were also provided to Mr. M. Wildman, Ph. D. candidate; supervisor: Prof. R Brown, Univ. Glasgow). Topic of Mr Wildman’s research is “Reassessing the structural and geomorphic evolution of a ‘classic’ Atlantic type passive margin: an integrated study of the Namaqualand sector of the S. African continental margin”.

Recent publications


Margret Avery

Travel

I went to the 3rd Western African Quaternary Association (WAQUA) meeting in Accra, Ghana, last October. The theme was ‘Implications of paleoclimatic and sea level changes on coastal evolution. Are humans adapting?’ The West African countries are particularly bothered by coastal erosion and how to combat it so this was a major topic, as it had been in Cotonou two years before. On the mid-conference fieldtrip we went out to the coast where we saw what the Ghanaians have been doing to reclaim land by building up barriers. We also visited the campus of the University of Accra, which is one of the oldest in Africa and has a magnificent site on top of a hill. WAQUA is now firmly established, with its statutes accepted and a new committee elected at the AGM. More West African countries are joining, both Francophone and Anglophone. At the first meeting language was a bit of a problem and the French speakers were in a minority. Now everyone is trying to speak the other language and taking everything in good humour; breaking down this barrier is no mean feat but they are succeeding. If anyone is interested in doing some collaborative work in West Africa or just going to the next conference I encourage them to get in touch with Sowah Laryea sowah_laryea@yahoo.com. He is the Secretary and can give you more information. PAST made my trip possible, for which I am very grateful.

Marion Bamford

BPI Palaeontology, University of the Witwatersrand

As part of their ongoing research project Marion Bamford (Wits University) and Rosa Maria Albert (ICREA and University of Barcelona) visited Lake Eyasi in northern Tanzania to collect modern reference plant material in April. They also had time to visit a family of Hadza people who are well known for their hunter-gather lifestyle. The men of this particular group (about 60 men, women and children) hunt baboons daily, accompanied by dogs and they use bows and arrows. The women collect honey, fruits, seeds and tubers. In July we went back to Tanzania for the usual field season at Olduvai Gorge to excavate trenches in Bed I and carry on with our modern plant sampling. A special issue has been published in the Journal of Human evolution that showcases the research of our team: OLAPP (Olduvai Landscape and Palaeoanthropology Project).
The SASQUA conference at Gobabeb in Namibia was a wonderful experience with a stunning setting, close group of interested people and wonderful hospitality. One of the highlights for me was to see the Welwitschia mirabilis growing in its natural surroundings, as well the rocks exposed along the Kuiseb river that were explained to us by John Ward.

**Publications**


Berna, F., Goldberg, P., Horwitz, L.K., Brink, J., Holt, S., Bamford, M., Chazan, M. 2012. Microstratigraphic evidence for in situ fire in the Acheulean strata of Wonderwerk Cave, Northern Cape Province, South Africa. PNAS Plus 9 (20), E1215 - E1220 Doi/10/1073/pnas.1117620109

Hayley Cawthra
Council for Geoscience Marine Geoscience Unit and University of Cape Town Department of Geological Science

East coast research

During the 2011-2012 period, my work on the area offshore of Durban culminated in the publication of 3 papers and a Council for Geoscience Bulletin. This work was based on 4 geophysical surveys and 41 dives in order to document the seafloor and sub-seafloor deposits that form Blood Reef (the offshore extension of the Bluff Ridge).

South coast research

My ongoing PhD project (registered in 2011 at UCT under the supervision of Prof John Compton) is a geophysical and geological study in the southern Cape, centred on Mossel Bay. This work was initiated through the multi-disciplinary SACP4 (South African Coast Palaeoclimate, Palaeoenvironment, Palaeoecology and Palaeoanthropology) programme led by palaeoanthropologist Prof Curtis Marean of Arizona State University. My work offshore aims to study the response of coastal systems to fluctuating Quaternary sea levels, unravel the structural evolution of the inner- to mid shelf and link this drowned palaeoenvironment to the coastal plain. To understand the nature of this environment and how it may have influenced early modern human occupation, we have mapped an area of 250 km$^2$ using multibeam bathymetry, side-scan sonar and sub-bottom profiling (boomer and pinger seismics). This work is funded by the National Geographic Society and the Council for Geoscience.
Above: Marine Geoscience Unit survey vessel, Willem Kupido and Hayley Cawthra deploying the multibeam echosounder, Michael MacHutchon with the side-scan sonar, seismic equipment. All photos from Mossel Bay.

Other Marine Geoscience Unit projects

The Council for Geoscience Marine Geoscience Unit currently has four major ongoing projects. Besides the Mossel Bay study (described above) we are working on a coastal vulnerability research project towards a GeoHazards Atlas which involves remote sensing and field techniques. In addition, an ongoing programme to monitor onshore and offshore sediment dynamics in the Western Cape was is being undertaken by Michael MacHutchon (Mac) and other colleagues. Mac was awarded an MSc in 2012 for his thesis entitled 'The Marine Geology of Hout Bay'. This work was supervised by Prof John Compton at the University of Cape Town. An offshore minerals mapping and modelling study is being led by Hayley Cawthra.

Conference attendance

I attended the 34th International Geological Congress (IGC) in Brisbane in August 2012 and presented one paper and two posters. The Council for Geoscience sent 16 delegates as South Africa will be hosting the 35th IGC in Cape Town in 2016.

Recent publications


Abstract

We explored the recent cementation of modern beachrock on the seaward margin of the Durban Bluff, central KwaZulu-Natal. The low latitude and subtropical climatic setting is a unique context compared to the more commonly documented contemporary beachrock formation in the tropics. Geological field mapping was carried out and here we present results based on sedimentary facies of a clastic shoreline and carbonate diagenesis of interstitial cements using transmitted light microscopy. The beachrock was cemented by micrite and aragonite, and iron oxide infilled voids.
The presence of human artefacts within the deposit showed evidence for cementation within the last century. The elevation (at Mean Low Water) and correlation to rates of sea level change for the east coast of South Africa showed that the beachrock is less than 72 years in age. In contrast to older local Pleistocene deposits, beachrocks have cemented along this stretch of coast during successive sea level highstands with similar climatic regimes – the last Interglacial, the Holocene High and the present. Here we report the most southerly documentation of modern beachrock in KwaZulu-Natal, which, to our knowledge, represents the youngest deposit reported in southern Africa.


Abstract

The narrow transform margin of southeast Africa and its associated sedimentological and hydrodynamic setting differs to other documented continental margins. The Durban Bluff continental shelf is extremely narrow and steep (8 km wide with a gradient ranging from 2 to 8°) characterised by a wave- and oceanic current-dominated regime. Seismic Sequence Boundary 2, developed during the Last Interglacial regression, spans the entire shelf separating the Holocene sediment wedge (Seismic Unit H) from underlying Pleistocene deposits. A wave ravinement surface marks the Holocene transgression, comprising a pavement lag of well sorted gravels and bioclastics overlain by inshore reef-derived carbonate rich sediments and offshore by quartzose mid-shelf sands. The shelf sands represent the transgressive Holocene to modern sediment wedge forming a seaward thinning unit stacked against the Pleistocene Blood Reef aeolianite/beachrock substrate. The sediment wedge is dynamic and constantly redistributed by currents associated with the Durban Eddy inshore of the Agulhas Current and bottom surge associated with high swells and marine storm events. These have been instrumental in shaping large-scale shoreface attached and detached sand ridges. The presence of mud lenses in the vicinity of Blood Reef represents deposition from turbid flood waters with preservation facilitated by the morphology of the Durban Bluff and Blood Reef. Palynological results, reflecting the local subtropical vegetation and recently introduced neophytes, together with radiocarbon dates, provide a very recent age for this sediment supporting a terrestrial origin and deposition from a single large flood event.


Abstract

The narrow, oceanic current-swept shelf of the Durban Bluff is characterised by Pleistocene aeolianites deposited unconformably onto a Cretaceous sequence. Subsequent beachrocks were deposited on and erosional features cut into the aeolianites, tracking a series of palaeocoastlines that extend from the supratidal zone to the outer continental shelf and record sea level fluctuations from the Last Interglacial to the present. High-resolution boomer seismics reveal a detailed sequence stratigraphy for the late Cretaceous drift sequence (Early Santonian to Late Maastrichtian) followed by a likely Miocene/Pliocene sequence preserved on the shelf edge, the first record of these deposits from the Durban continental shelf. Seven seismic units are recognised (Units A to G), bounded by regional sequence boundaries, maximum flooding surfaces and wave ravinement surfaces. Mapping of the Bluff Ridge and adjoining Blood Reef by geophysical surveys and scuba diving enabled subdivision of the Quaternary deposits into three aeolianite units and 13 beachrock units. Calcareous nannoplankton preserved in the
aeolianite units indicate a late Pleistocene to Holocene age (Zone NN21, maximally 290 ka) for the deposits and the presence of reworked Miocene forms provides further support for the existence of Neogene on the shelf edge. A new Infared Stimulated Luminescence age of 60 ka obtained from offshore aeolianite indicates dune-building during the Marine Isotope Stage 4 glacial period.

Brian Chase
Centre National de Recherche Scientifique (CNRS) Institut des Sciences de l’Evolution de Montpellier; Department of Archaeology, History, Cultural Studies and Religion, University of Bergen

My work over the last year has primarily involved collecting mass quantities of dassie piss, and chipping little holes in it. All in the name of Science, of course; and in this case ‘science’ is spelled HYRAX. All this primary data collection has meant less time writing, but two important papers have come out on hyrax related topics: 1) on hyrax middens as an archive, and 2) on the potential of aDNA studies in herbivore middens.

In addition to these papers, I assisted in two other published studies, one reconstructing droughts in the western Sahel from AD 460 to 1090 based on hydrological changes in the Saloum Estuary; and a second reconstructing rainfall variability over the last 1400 years at Verlorenvlei.

While all very interesting, I can promise some truly astonishing data for 2013: 55,000 year records from the winter rainfall zone, records spanning the Holocene at resolutions higher than the Greenland ice cores, sub-decadal records for the last 2 kyr... Quel Bonheur.


Abstract
Like many of the world’s subtropical regions, southern Africa is highly sensitive to changes in the earth’s climate system, but a dearth of reliable palaeoenvironmental records means that relatively little is known about how regional environments have been affected over centennial to multi-millennial timescales. To a large extent this sensitivity is a function of the position of these regions at the interface between temperate and tropical circulation systems. The resulting seasonality and irregularity of rainfall have limited the development of suitable archives, such as lakes and wetlands, for the preservation of palaeoenvironmental proxies.

This paper reviews and evaluates the value of rock hyrax middens as novel palaeoenvironmental archives in southern Africa. Considered are (1) the contemporary taxonomy, distribution and ecology of hyraxes, (2) the mechanisms of hyrax midden development, their physical and chemical structure, rates of accumulation and age; and (3) the palaeoenvironmental proxies preserved within hyrax middens, including fossil pollen, stable isotopes and biomarkers. The interpretive constraints and opportunities offered by these various midden characteristics are assessed with a view to demonstrating the potential of these deposits, widespread as they are through arid and semi-arid southern Africa, in providing a more detailed and chronologically resolved view of late Quaternary palaeoenvironments across the subcontinent.


Abstract
The study of arid palaeoenvironments is often frustrated by the poor or non-existent preservation of plant and animal material, yet these environments are of considerable environmental importance. The analysis of pollen and macrofossils isolated from herbivore middens has been an invaluable source of information regarding past environments and the nature of ecological fluctuations within arid zones. The application of ancient DNA (aDNA) techniques to hot, arid zone middens remains unexplored. This paper attempts to retrieve and characterise aDNA from four Southern Hemisphere fossil middens; three located in hot, arid regions of Australia and one sample from South Africa’s Western Cape Province. The middens are dated to between 30,490 (380) and 710 (70) cal yr BP. The Brockman Ridge midden in this study is potentially the oldest sample from which aDNA has been successfully extracted in Australia. The application of high-throughput sequencing approaches to profile the biotic remains preserved in midden material has not been attempted to date and this study clearly demonstrates the potential of such a methodology. In addition to the taxa previously detected via macrofossil and palynological analyses, aDNA analysis identified unreported plant and animal taxa, some of which are locally extinct or endemic. The survival and preservation of DNA in hot, arid environments is a complex and poorly understood process that is both sporadic and rare, but the survival of DNA through desiccation may be important. Herbivore middens now present an important source of material for DNA metabarcoding studies of hot, arid palaeoenvironments and can potentially be used to analyse middens in these environments throughout Australia, Africa, the Americas and the Middle East.

Abstract

There is a critical need to document the long-term variability of the West African Monsoon (WAM) in the Sahel region. We present here a multi-decadal proxy record of the past hydrology from AD 460 to 1090 in the Saloum Delta, Senegal. The Saloum Delta is a hypersaline estuary where the salinity and the water isotopic composition are highly sensitive to rainfall variations. The past hydrology was studied using the oxygen isotopic ratio of *Anadara senilis* fossil shells, since mollusk shell isotopic composition (δ¹⁸O) in this environment is primarily determined by the precipitation-evaporation budget. Successive samples of shells were taken along the stratigraphy of the massive Dioron Boumak fossil shell middens for new insights into the past WAM multi-decadal to centennial variability. The averaged δ¹⁸O value of fossil shells was more negative by 1.4‰ compared to modern shells isotopic signature. This result indicates substantially fresher mean conditions in the Saloum Delta, that was likely not hypersaline as it is today. The precipitation-evaporation budget was thus more positive in response to a more intense and/or longer monsoon season during the studied period. Our record suggests that strong multidecadal droughts as observed in the Sahel in the late 20th century did likely not occur in Senegal during this ~600-yr time period.


Abstract

The austral westerlies strongly influence precipitation and ocean circulation in the southern temperate zone, with important consequences for cultures and ecosystems. Global climate models anticipate poleward retreat of the austral westerlies with future warming, but the available paleoclimate records that might test these models have been limited to South America and New Zealand, are not fully consistent with each other.

and may be complicated by influences from other climatic factors. Here we present the first high resolution diatom and sedimentological records from the winter rainfall region of South Africa, representing precipitation in the equatorward margin of the westerly wind belt during the last 1400 yr. Inferred rainfall was relatively high ~1400–1200 cal yr BP, decreased until ~950 cal yr BP, and rose notably through the Little Ice Age with pulses centred on ~600, 530, 330, 200, 90, and 20 cal yr BP. Synchronous fluctuations in Antarctic ice core chemistry strongly suggest that these variations were linked to changes in the westerlies. Equatorward drift of the westerlies during the wet periods may have influenced Atlantic meridional overturning circulation by restricting marine flow around the tip of Africa. Apparent inconsistencies among some aspects of records from South America, New Zealand and South Africa warn against the simplistic application of single records to the Southern Hemisphere as a whole. Nonetheless, these findings in general do support model projections of increasing aridity in the austral winter rainfall zones with future warming.

Carlos Cordova
Oklahoma State University

My phytolith research in Southern Africa includes several projects in collaboration with colleagues from South Africa, the United Kingdom, France, and the United States. Most of my effort to this day has been put on building a modern phytolith database, which encompasses information recovered from modern surface samples along transects crossing climatic and biome boundaries. Thus far, the total amount of samples collected is 245 (Figure 1). The breakdown of the 245 samples by biomes is listed on Table 1. Of these, 165 have already been processed and counted. The existing data is being used for several purposes including building a vegetation reconstruction model, a project in collaboration with Marine Pasturel (Centre Européen de Recherche et d’Enseignement des Géosciences de l’Environnement, Aix-en-Provence, France), and a series of statistical tests carried out at Oklahoma State University.

Some biomes are still misrepresented in the sampling (Table 1), but they are being covered with samples contributed to the database, including 5 samples from Maputaland collected by Greg Botha (Council of Geosciences), and 61 samples from western South Africa and Namibia collected Brian Chase (University of Bergen, Norway, and ISEM, France). These contributions will make a total 301 samples (Fig. 1).

In addition to the modern phytolith database, the paleo reconstruction projects I am currently working on include a series of sections in the Western and Eastern Cape, a core from Lake Ngami, Botswana, and calibration of modern phytoliths for their use in interpreting assemblages from hyrax middens. Work on dental calculus phytoliths is in the process of writing for publication.

Recent publication


Abstract

The main objective of this research is to identify graminoid phytolith morphotypes with potential as proxies for reconstructing past winter rainfall in South Africa. The main argument of this study is that phytolith proxies for winter-rainfall maxima should be found among native graminoids abundant in the Cape Region, where most of the precipitation occurs in the cooler part of the year. Vegetation surveys indicate that C₃ Poaceae (cool-season grasses) and Restionaceae (restios) are abundant graminoids in the winter rainfall zone (WRZ). Therefore, the frequencies of diagnostic graminoid morphotypes of each of these two groups are correlated independently with both percent and amount of winter rainfall (defined here as the sum of April-September precipitation). The phytolith assemblages used for this study were collected from soils along two transects
across the winter (WRZ), all-year (ARZ), and summer (SRZ) rainfall zones of South Africa.

The study shows that the highest frequencies of the diagnostic C$_3$ grass silica short-cell (GSSC) morphotypes increase with winter rainfall. Although considerable numbers of C$_3$-GSSC morphotypes occur in samples at elevation above 1500m in the SRZ, their frequencies are lower than in the samples of the WRZ and ARZ. Correlation is noteworthy only when all the C$_3$-GSSC morphotypes are grouped. Individual C$_3$-GSSC morphotypes and groups of GSSC morphotypes linked to particular C$_3$ grass subfamilies (Pooideae, Ehrhartoideae and Danthonioideae) correlate poorly with winter rainfall incidence. The results of this study also suggest that Restionaceae phytoliths are good indicators of winter rainfall, but because Restionaceae occur mainly in oligotrophic soils in association with fynbos vegetation, the use of their phytoliths in paleorainfall reconstruction should be taken with care. Despite certain limitations this research shows that the use of C$_3$-GSSC and Restionaceae phytolith has a strong potential for reconstructing the extent of winter rainfall during the colder stages of the Pleistocene. However, to achieve this objective a study a larger number of reference material and tighter geographical sampling is needed.

<table>
<thead>
<tr>
<th>Biome/ecosystem</th>
<th>Number of samples</th>
<th>Number of vegetation types sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savanna</td>
<td>67</td>
<td>24</td>
</tr>
<tr>
<td>Grassland</td>
<td>56</td>
<td>19</td>
</tr>
<tr>
<td>Nama Karoo</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Succulent Karoo</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Fynbos</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>Temperate-Subtropical Forest</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Indian Ocean Coastal Belt</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Subtropical Thicket</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Desert</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

| Okavango Delta*     | 6                 | 4                                  |
| Totals              | 245               | 109                                |

1. Grass-dominated ecosystem  
2. Grasses constitute a significant part of the ecosystem  
* Not a biome

Table 1. Surface samples by biome and ecosystem

Figure 1. Coverage of modern phytolith-vegetation surface sampling

Department of Environmental and Geographical Science (EGS), University of Cape Town

The Physical Geography researchers in EGS at the University of Cape Town has been the South African partner in a bilateral agreement with German colleagues from the Friedrich-Schiller University Jena (FSU) which began in 2010 and was jointly funded by the NRF and BMBF. In March 2012, the department hosted the German contingent as well as other interested parties to determine the state of the collaboration and to develop future undertakings. As a result of these discussions it was decided to pursue a major new grant application, news of which is still awaited.

The past year has seen two masters students from FSU complete their degree based on geochemical analyses on sediment cores taken from the Wilderness region, near Knysna. Both students
have presented at various conferences and have generated a journal article which is currently under review. On the South African side, one doctoral student, Kelly Kirsten and one masters student, Nadia du Plessis are undertaking the biological analyses which should yield results within the coming months. Lynne Quick submitted her PhD thesis in February.

**Peter Holmes**  
**Department of Geography, University of the Free State**

Late 2011 and 2012 respectively saw two field trips to the Wilderness lakes - Knysna area as part of ongoing collaborative research into the late Quaternary geomorphic evolution of the area by Prof Mark Bateman (Sheffield) Dr Andy Carr (Leicester) Prof Peter Holmes (UFS) and Ms Hayley Cawthra (Council for Geoscience). During the first trip, the bathymetry of Swartvlei and Eilandvlei was plotted, and bedforms which may comprise aeolianite remnants below the current floor of the lakes were recorded. Grab samples of sediment from the lake floors were taken and are currently undergoing analysis. Lignites from the Knysna area were also sampled. During the 2012 trip, lignite samples from Veldmanspad, and coversands at Harkerville were sampled. The results of this work should be published in late 2013 or early 2014.

Although not limited to the Quaternary, a new publication edited by Peter Holmes and Mike Meadows (see below) which covers much of the recent work on southern African Quaternary palaeoenvironments from a geomorphic perspective appeared in late 2012.

**Publications**


Coversands at Harkerville. This is currently the largest known exposure of sand in the Knysna area.

Ian Russell, Hayley Cawthra, Mark Bateman, Willem Kupido and a somewhat pensive Andy Carr about to brave the waters of Swartvlei.

Karin Holmgren
Bert Bolin Centre for Climate Research and Department of Physical Geography and Quaternary Geology, Stockholm University

Holocene climate variability in southern Africa

I am leading an on-going Swedish-funded project that aims to improve the knowledge of patterns and drivers behind climate variability in southern Africa through increasing the accuracy and precision in the interpretation of regional climate proxy signals and through confronting the climate proxy observations with climate models. Although climate proxy data is increasingly available from southern Africa, there are still gaps in the spatial coverage, problems with chronological controls and limited consensus regarding how to interpret available proxy data in terms of climate parameters and potential drivers. The ambiguity concerns e.g. issues of synchrony/asynchrony between the hemispheres; between tropics, subtropics and polar regions; between east and west and between land and sea. These ambiguities must be addressed for precise understanding of the relative importance of different climate driving processes and internal feedback effects at a regional scale. In this project we combine climate proxy data analyses with climate modelling experiments. We focus on two time scales: i) The Holocene time scale to resolve issues surrounding millennial scale climate driving forces; and ii) the Last Millennium because of this time scales direct relevance for today’s political and financial decisions. For both these time scales we will:

• through improved high-resolution analysis and isotope modelling experiments, test the accuracy in the interpretation of the South Africa Cold Air Cave speleothem record for which alternative interpretations have been proposed by various research groups;
• improve the geographical coverage through the investigation of a new potential paleoarchive in Mozambique;
• contrast local to regional proxy data from southern and eastern Africa with results from climate models, thereby testing hypotheses for reasons behind past regional climatic changes.

The scientific questions that we aim to dwell upon by the present research are:

• How can forcing factors, such as orbital parameters, sea and land surface temperatures, global ice volume, monsoon strength, solar activity and greenhouse gases explain the observed pattern of Holocene climate and environment in southern and eastern Africa?
• Are past latitudinal shifts of Intertropical Convergence Zone (ITCZ) and mid-latitude low pressure belts contemporaneous and synchronous or do we rather see patterns of contraction/expansion of the Hadley cells?
• How has climate evolved in Africa during periods when the so called Medieval Warm Period (MWP) and the Little Ice Age (LIA) were prominent features in other regions?
• What is the potential role of El Niño-Southern Oscillation (ENSO) and the Indian Ocean dipole (IOD) for Holocene millennial-scale variability?

Results from this project, and often in collaborations with other projects, have been presented in papers and at conferences as outlined below. Forth-coming results are in press for being published 2013.

**Publications**


**Abstracts in congress volumes**

Zhang, Q., Holmgren K et al., 2012: How well do reanalyses represent the southern African precipitation? EGU General Assembly 2012: HS7.2/AS1.20/CL5.16/NH1.3/NP3.6


**Antonieta Jerardino**  
Department of Prehistory, Ancient History and Archaeology, University of Barcelona

**Recent Publications**


**Abstract**  
Sustainability is closely linked with biodiversity, and the later relies on the understanding of ecosystem functioning and the biogeography of species involved. Archaeology in South Africa has contributed considerably in documenting Late Quaternary extinctions and mayor shifts in geographic distribution patterns of terrestrial and marine taxa. The study of coastal shell middens have also provided observations that can be translated into deeper historical baselines for the use in the fishing industry than the ones afforded with the study of existing marine reserves alone. From an archaeological perspective, the mid-
Holocene Climatic Altithermal and Medieval Warm Period are beginning to present some insightful opportunities for making comparisons with current warming trends despite dissimilar orbital parameters.


**Abstract**

Very large shell middens, known as ‘megamiddens’, appear along the West Coast of South Africa c. 3000–2000 BP during one of three known Neoglacial periods. Rising population levels between 3500 and 2500 BP are followed by a reformulation of the foraging ecology of both marine and terrestrial prey. Tortoise collection became emphasised over that of mammals from 3000 BP (when megamiddens started to accumulate) until c. 2600 BP. After 2600, shellfish collection became even more intensified and focused on one species and hunting of high-ranking prey, such as eland, became largely substituted by chasing or snaring small bovids. Environmental changes assisted but did not determined this cultural and economic process.

Mike Meadows

Department of Environmental and Geographical Science, University of Cape Town

**Research highlights and achievements 2011 – 2012**

There have been a number of key developments during the last twelve months, although the publication, with Peter Holmes as co-editor, of the book on Southern African Geomorphology was certainly a highlight. Other than that, attending SASQUA (and SAAG) at Gobabeb and seeing so many students and close collaborators present their work was a major source of satisfaction. On-going initiatives with colleagues in France (Chase), Jena (Mausbacher et al.) and Bremen (currently in development) suggest good things for the future.

**Papers in peer-reviewed journals**

Stager JC, Mayewski PA, Barr C, White J, Chase BM, Neumann FH, Meadows, ME, King, CD and Dixon DA 2012: Precipitation variability in the winter rainfall zone of South Africa during the last 1400 yr linked to the austral westerlies. Climates of the Past 8: 877-887.

**Abstract**

The austral westerlies strongly influence precipitation and ocean circulation in the southern temperate zone, with important consequences for cultures and ecosystems. Global climate models anticipate poleward retreat of the austral westerlies with future warming, but the available paleoclimate records that might test these models have been limited to South America and New Zealand, are not fully consistent with each other and may be complicated by influences from other climatic factors. Here we present the first high-resolution diatom and sedimentological records from the winter rainfall region of South Africa, representing precipitation in the equatorward margin of the westerly wind belt during the last 1400 yr. Inferred rainfall was relatively high ∼1400–1200 cal yr BP, decreased until ∼950 cal yr BP, and rose notably through the Little Ice Age with pulses centred on ∼600, 530, 470, 330, 200, 90, and 20 cal yr BP. Synchronous fluctuations in Antarctic ice core chemistry strongly suggest that these variations were linked to changes in the westerlies. Equatorward drift of the westerlies during the wet periods may have influenced Atlantic meridional overturning circulation by restricting marine flow around the tip of Africa. Apparent inconsistencies among some aspects of records from South America, New Zealand and South Africa warn against the simplistic application of single records to the Southern Hemisphere as a whole. Nonetheless, these findings in general do support model projections of increasing aridity in the austral winter rainfall zones with future warming.

Abstract
The call to adopt a longer-time perspective in order to better understand contemporary and near-future global environments is not new. Nevertheless, there is a growing recognition that evidence from the geologically recent past, in particular the late Quaternary, is essential if we are to understand the profound changes that have taken place in the human relationship with the living world. This progress report reviews how the understanding of environmental dynamics over extended time periods is now incorporated into science dealing with predictions of future climate change by the IPCC consortium, how possible analogues for a warmer future are still vigorously explored and how information on past environments may better inform an understanding of contemporary ecosystem processes and influence the future management of biodiversity in protected areas.


Abstract
Enrolments in doctoral degrees in South Africa mirror international trends and there is a strong national policy emphasis on these higher qualifications to fulfil needs, not only of the academy, but also of the economy and broader society. There are significant constraints, however, including the historical legacy of apartheid that has left the South African education system deeply inequitable. There are encouraging signs emerging from a national initiative to further increase doctoral output and also the fact that the PhD, more especially as a professional qualification, is regarded as a key element in nurturing the future development of the nation.


Abstract
Like many of the world's subtropical regions, southern Africa is highly sensitive to changes in the earth's climate system, but a dearth of reliable palaeoenvironmental records means that relatively little is known about how regional environments have been affected over centennial to multi-millennial timescales. To a large extent this sensitivity is a function of the position of these regions at the interface between temperate and tropical circulation systems. The resulting seasonality and irregularity of rainfall have limited the development of suitable archives, such as lakes and wetlands, for the preservation of palaeoenvironmental proxies.

This paper reviews and evaluates the value of rock hyrax middens as novel palaeoenvironmental archives in southern Africa. Considered are (1) the contemporary taxonomy, distribution and ecology of hyraxes, (2) the mechanisms of hyrax midden development, their physical and chemical structure, rates of accumulation and age; and (3) the palaeoenvironmental proxies preserved within hyrax middens, including fossil pollen, stable isotopes and biomarkers. The interpretive constraints and opportunities offered by these various midden characteristics are assessed with a view to demonstrating the potential of these deposits, widespread as they are through arid and semi-arid southern Africa, in providing a more detailed and chronologically resolved view of late Quaternary palaeoenvironments across the subcontinent.


Abstract
An extensive land reform programme is underway, which faces many challenges unique to the socio-
political context of post-apartheid South Africa. The aim of this paper is to review the extent to which agrarian land reform policy, more particularly in respect to its land distribution element, incorporates environmental sustainability principles into resultant practice and whether or not this may lead to exacerbation of land degradation problems in the country. The paper briefly outlines the key land reform role-players, the policy and implementation process of land reform, and considers these in relation to the problem of land degradation. Ongoing problems of implementation with the land redistribution programme are discussed in relation to a number of significant challenges. The paper illustrates the lack of integration of environmental planning in the land reform process generally and points to the potentially deleterious impact of land reform on land degradation.

Books and chapters in books


Ina Plug

Recent publications

Diversity and applications: some bone tools from the past to the present in southern Africa. Pp. 87-96, in “Bones for tools – tools for bones. The interplay between objects and objectives.” Edited by Krish Seetah and Brad Gravina. McDonald Institute Monographs. Oxbow books.
The article discusses formal and informal bone tools, bone tools that mimic stone tools, bone tools used in fishing and divining bones. The period covered by the tools range from the Early Later Stone Age to the present day.

I have also completed a book with the title: “What bone is that?” It consists mainly of drawings of post cranial remains of four species of primates, most of the southern African carnivores, two wild pig and two zebra species, most of the southern African antelopes and hares and some of the largest rodents. Most of the drawings are life size and. I estimate that it will run to well over 500 pages A4 size. It will be published by Rosslyn Publishers.

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

**Research highlights and achievements 2011 – 2012**

My greatest achievement and most exciting research highlight is without a doubt the submission of my PhD thesis in early February this year. This work has generated three new palaeoenvironmental records for the southern Cape coast. Many thanks are due to Mike Meadows and Brian Chase for their excellent supervision and to Andy Carr for all the help and large quantities of geochemical and plant biomarker data!

**Conferences and workshops**

I attended and presented at the XVIII INQUA Congress in July 2011 in the Bern, Switzerland.

In March 2012, my department (EGS, UCT) hosted a workshop ‘Palaeoecology of southern African wetlands’ where we showcased the current results generated from the bilateral - South African/German - research project between Friedrich Schiller University of Jena and the University of Cape Town.

I attended and presented at both the Society of South African Geographers (SSAG) Conference in June 2012 (also hosted by EGS) and the SASQUA conference in September 2012 (at Gobabeb, Namibia).

I attended and presented at a workshop entitled ‘Workshop on African climate – vegetation interactions’ hosted by MARUM (Center for Marine Environmental Sciences) and the University of Bremen, Germany in November 2012.

This year I shall be attending the 4th PAGES Open Science Meeting in Goa, India in February.

**Publications 2011 – 2012**


**Abstract**

Our ability to identify the timing and extent of past major climate fluctuations is central to understanding changes in the global climate system. Of the events that have occurred in recent geological time, the Younger Dryas (YD, 13–11.5 ka), an abrupt return to near-glacial conditions during the last glacial-interglacial transition (ca. 18–11.5 ka), is one of the most widely reported. While this event is apparent throughout the Northern Hemisphere (Peteet, 1995), evidence for its occurrence in the Southern Hemisphere remains equivocal due to a lack of well-dated terrestrial records. Here we report high-resolution stable carbon and nitrogen isotope records obtained from a rock hyrax midden, revealing the first unequivocal terrestrial manifestation of the YD from the southern African subtropics. These results provide key evidence for the relative influence of the YD, and suggest that a subtropical-temperate transition zone existed along the oceanic Subtropical Front (~41°S) across the Southern Hemisphere, with the Northern Hemisphere exerting a strong influence on all but
the higher latitudes of the Southern Hemisphere after the Heinrich Stadial 1 (15 ka).


**Abstract**

In arid and semi-arid areas such as southern Africa, rock hyrax (Procavia capensis) middens represent an exceptionally valuable source of late Quaternary palaeoenvironmental information. Pollen and stable isotope data derived from two rock hyrax middens extracted from De Rif in the Cederberg Mountains of the southwestern Cape, casts new light on climatic changes that occurred across the Last Glacial–Interglacial Transition (LGIT) and the Holocene (19.5–0.7 cal kBP) and how the region’s vegetation responded to these changes. Significant changes in vegetation community composition would be expected in response to environmental changes characteristic of the contrast between ‘glacial’ and ‘interglacial’ climates. However, the pollen assemblages in general indicate that mountain fynbos remained dominant throughout the record and that most of the pollen taxa exhibited only muted frequency variations. This finding could be considered to be inconsistent with indications of marked climatic variations recorded in the stable isotope records for the same midden. An analysis of the geological setting and the bioclimatic affinities of the taxa suggest that the explanation for this inconsistency may lie in the dominating influence of sandstone substrates and the relative resilience of mountain fynbos vegetation to climate change.


**Abstract**

Like many of the world’s subtropical regions, southern Africa is highly sensitive to changes in the earth’s climate system, but a dearth of reliable palaeoenvironmental records means that relatively little is known about how regional environments have been affected over centennial to multi-millennial timescales. To a large extent this sensitivity is a function of the position of these regions at the interface between temperate and tropical circulation systems. The resulting seasonality and irregularity of rainfall have limited the development of suitable archives, such as lakes and wetlands, for the preservation of palaeoenvironmental proxies.

This paper reviews and evaluates the value of rock hyrax middens as novel palaeoenvironmental archives in southern Africa. Considered are (1) the contemporary taxonomy, distribution and ecology of hyraxes, (2) the mechanisms of hyrax midden development, their physical and chemical structure, rates of accumulation and age; and (3) the palaeoenvironmental proxies preserved within hyrax middens, including fossil pollen, stable isotopes and biomarkers. The interpretive constraints and opportunities offered by these various midden characteristics are assessed with a view to demonstrating the potential of these deposits, widespread as they are through arid and semi-arid southern Africa, in providing a more detailed and chronologically resolved view of late Quaternary palaeoenvironments across the subcontinent.

**Dave Roberts**

Council for Geoscience

**Publications**

A) Mesozoic basement conglomerate overlain by transgressive/regressive MIS 11 succession at KBR. Transgressive lag formed of sparse rounded boulders overlies basement at about +10 m with an erosive contact (1). B) Cross-bedded MIS 11 shoreface strata (1) at site DB2 overlain with erosive contact (2) by MIS 5e low angle laminated foreshore sandstone (3). The well cemented MIS 11 shoreface strata formed a sea-stack in the intertidal zone during MIS 5e times.

Work on later Pleistocene eustatic sea levels came to fruition with publication in 'Earth and Planetary Science Letters'- along with my co-authors- of the results of a study of the fantastic outcrops of Marine Isotope Stage (MIS) 11 and 5e near Mossel Bay along our southern coast. This is the only locality worldwide where beachrocks representing these two interglacials occur juxtaposed-(see figure). We were able with unprecedented accuracy to determine that global sea levels rose to +13 m during MIS 11 (~400, 000 years ago)- probably the warmest period over the last ~2.7 million years. MIS 11 is thought to be an analogue for future climate evolution because of the similarity in ‘wobbles’ in Earth’s orbit around the Sun. Given that this 13 m high sea level was driven by natural (orbital) climate forcing without any impetus from human activities, our results predict a possible future sea level rise well in excess of 13 m. We also know that the rate of sea level recovery from its Last Glacial Maximum lows was catastrophically high (up to 4 m /100 years) from~15-14, 000 years ago-a rate that could well be exceeded in the future according to our findings.

Conferences

SASQUA

The venue for SASQUA was inspirational, a confluence of towering Namib sand dunes, stony desert and riparian forest. The following two presentations were given:

I and my co-authors gave a presentation on the fascinating topic of silcretes on the South African coastal plain. Cosmogenic \(^{21}\)Neon exposure dating has shown that some silcretes are as young as later Pleistocene whereas the oldest examples near Garies on the west coast which are above the Great Escarpment, could well be pre-Gondwanan in age. The long held concept that silcretes represent fragments of a formerly continuous seaward inclined palaeosurface no longer appears tenable. They formed in moist settings such as along rivers, low relief, poorly drained marine terraces and at the foot of hills; as such they represent effective climate indicators. New silcrete occurrences have been found along the west and
southern coasts, which were used as a raw material by MSA people. Recent research which included myself (Brown et al., 2009, *Science*), has shown that silcrete was highly sought after and systematically heat treated by fire, greatly improving its knapping qualities and demonstrating advanced cognitive behaviour as long as 70,000 years ago.

Ponani Mthembi, Dave Roberts and Chris Harris. Palaeoclimate and ecosystems of the Pleistocene in South Africa as archived in the Kalkkop Crater Lake deposit.

My colleague and MSc student, Ponani Mthembi presented a poster on the Kalkkop impact crater lake deposits near Graaf Reinet. The 90 m thick carbonate palaeo-lake deposits are in places laminated on a sub-millimetre scale, offering a climate record with annual or even seasonal resolution. A visit to the site revealed the highly degraded nature of the crater rim, suggesting that a Neogene age is more likely than the published Middle Pleistocene date. Stable isotopes suggest that the climate fluctuated considerably but became generally drier over the ~200,000 year lake history. However pollen like *Podocarpus* points to periodic much wetter intervals than the present arid regime.

**Other research highlights**

The Mio-Pliocene Langebaanweg palaeontological site on the West Coast of South Africa displays an extraordinary seabird diversity compared to the present day. Aluminium phosphate deposits (palaeo-guano) on hilltops in the region represent Pliocene seabird breeding sites. By electronically manipulating sea levels it is possible to track the palaeo-sea levels at which the hills became islands (when they would have attracted seabird breeding colonies). We found that relative sea levels of up to 70 m above present were required to transform all aluminium phosphate bearing hills around Langebaanweg to islands. This research, conducted by myself, Albrecht Manegold (Senckenberg Forschungsinstitut), Tim Cook (Percy FitzPatrick Institute of African Ornithology) and Deano Stynder (UCT) is soon to be submitted to Palaeo 3.

Research on the late Pleistocene fossil vertebrate footprints in coastal aeolianites is proceeding well with several new trackways discovered. These include elephant, several bovids ranging up to eland in size and birds, providing new insights into faunal diversity and by inference, floras from that era and directly bearing on early modern human origins. The research is being conducted in partnership with Charles Helm from Canada.

**Louis Scott**

**University of the Free State**

Louis Scott is arranging a new contract as retired researcher at the University of the Free State. He is still involved in several Quaternary and older fossil pollen projects, listed below with collaborators, which will hopefully receive attention:
Eastern Cape (Uniondale, Louterwater) phytoliths, pollen (A. Carr P. Holmes, M. Bateman, C. Cordova)

Lake Ngami, pollen and phytoliths, Botswana (C. Cordova)

Dry land hyrax dung studies (G.A. Brook, E. Marais, G. Gil Romera, B Chase; V. Valsecchi)

Spring and swamp deposits at Erfkroon, Cornelia, Florisbad, Blydefontein, Baden-Baden (B. Bousman, J. Brink, L. Rossouw, G.A. Brook)

Swamp deposits in KwaZulu-Natal (F. Neumann, G.A. Botha)

Tswaing Crater (S.E. Metcalfe, F. Neumann, A. Metwally)

Wonderkrater spring (L. Backwell, B. Chase, Loic Truc)

Wonderwerk Cave Northern Cape (L. Horwitz, M. Chazan, G.A. Brook, L. Rossouw)

Cape Neogene (D. Stynder; D. Rogers, F. Neumann, Lara Scicio, L. Rossouw, G. Avery, A. Carr)

Hominid Caves (L. Berger, M. Bamford, F. Neumann, R. Clarke)

Hyena scats, fresh and fossil dung (Y. Fernandez-Jalvo, Graciela Gil Romera, Frank Neumann)

Recent publications


Christine Sievers
Department of Archaeology, Wits

Recent publications


Although micromorphological investigations of fire in archaeological deposits are not new, this paper describes the first experimental micromorphological investigation to address an archaeobotanical issue. It explains the design, methods and results of experimental fires, and compares the micromorphologies of the modern fires with those of ancient Sibudu combustion events. Our conclusions support the evidence for carbonised sedge bedding at Sibudu from as early as 73 000 years ago and particularly around 58 000 years ago when there was repeated refurbishment and burning of bedding.

Bruch, A.A., Sievers, C., Wadley, L. 2012. Quantification of climate and vegetation from southern African Middle Stone Age sites: an application using Late Pleistocene plant material from Sibudu, South Africa. Quaternary

The paper describes the quantification of climate and vegetation using the combined seed and charcoal assemblages from Sibudu in a GIS-based coexistence analysis approach. This is the first time the method has been applied to archaeological data in southern Africa. The analysis presents detail not possible through other current methods for investigating past climatic conditions and indicates that the mean temperature of the coldest winter month was the likely mechanism driving vegetation change around Sibudu.

Rebekah Singh
KwaZulu-Natal Unit, Council for Geoscience
Remote sensing analysis of regolith susceptibility to erosion on the Eastern Cape Wild Coast

Although the Eastern Cape Wild Coast is considered to be one of the most pristine regions in South Africa, some areas along this coastal zone has been severely affected by erosion. Rebekah Singh has recently registered a PhD research project at the University of Stellenbosch. The project will involve remote sensing analysis of regolith susceptibility to erosion on the Eastern Cape Wild Coast and aims to use spatial analyses of satellite imagery during the development of a monitoring protocol for the forecasting of erosion prone areas and assessing on and/or off site impacts.

This PhD project forms part of the DST funded Council for Geoscience umbrella project entitled: “Earth Observation and Geological Hazard Assessment: Towards the creation of the Geological Hazard Atlas of South Africa.” Colleagues at the Council for Geoscience, Jeanine Engelbrecht and Greg Botha, will provide academic support to the research project. Dr Jaco Kemp, having related research interests, will supervise this PhD study.

Francis Thackeray
Director of the Institute for Human Evolution,
University of the Witwatersrand

Francis Thackeray has served as Director of the Institute for Human Evolution (IHE) at the University of the Witwatersrand since 2009. In 2013, the IHE will merge with the Bernard Price Institute to form an Evolutionary Studies Institute.

Recent publications


**Julia Lee-Thorp**  
**Research Laboratory for Archaeology, University of Oxford**

Since 2010 I have twice joined Dr Charles Musiba for fieldwork in Laetoli. On the last occasion in 2012 I also joined Dr Henry Bunn and his team to participate in his ongoing excavations at FLKN.

Other trips in 2011 were for conferences rather than fieldwork but luckily they included excursions too. I was privileged to be invited to the First International Symposium on Palaeoanthropology, N’Djamena, Chad, 31 Oct-5 November 2011, which was followed by a fascinating trip into the Djurab Desert to view the site locations of the famous Late Miocene fossils. Shortly after I paid my first visit to India, attending the “Workshop on Palaeoclimates and human dispersal during Marine Isotope Stage” in Chennai, India, 12-17 December 2011, sponsored by the International Centre for Theoretical Physics.

I attended SAFa in Toronto in June 2012, presenting papers in the sessions in honour of Nikolaas van der Merwe, and on the archaeology of Lesotho respectively, and enjoying the opportunity to meet with so many South African archaeologists. This was followed by a paper on a palaeoaridity indicator at JESIUM 2012, in Leipzig, Germany, and then a contribution to the International Workshop “The world seen through the eyes of isotopes”, in honour of Tony Fallick and Antonio Longinelli in Montecarlo di Lucca, Italy. Finally, I paid my first visit to Australia to give an invited plenary at the Australian Association of Archaeologists Conference 2012, in Wollongong.

**Journal Articles**


Books/Chapters in books


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SASQUA MEMBERSHIP 2012

Marco Andreoli
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Graham Avery
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Oliver B Barker
Mark Bateman
Greg Botha
C.K. “Bob” Brain
Liesl Breytenbach
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John A Catt
Hayley Cawthra
Brian Chase
Joseph Chikumbirike
H.B.S. Cooke
Carlos Cordova
C.H. De Beer
Mike de Wit
Jeanette Deacon
Joakim Donner
Lydie Dupont
Yolanda Fernandez-Jalvo
Jemma Finch
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Tamara Franz-Odendaal
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Graciela Gil-Romera
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Werner K Illenberger
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H C Jenner-Clarke
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Julia Lee-Thorp
Sandra J. Lennox
Penny Letley
Jared Lodder
Andrew Logue
Johan C Loock
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Lesley May Murungi
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Arnaud Temme
Francis Thackeray
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Loic Truc
Peter D Tyson
Verushka Valscetti
Nikolaas van der Merwe
A.E. Van Wyk
Thomas P Volman
John C Vogel
Lyn Wadley
C.J. Ward
John D Ward
Stephan Woodborne
M.S. Zavada