

A report on the workshop 'Modern Dune Survey Techniques' held at Gobabeb Training and Research Centre in September 2012

Workshop organiser:

Dr Kevin White, University of Reading. Email k.h.white@reading.ac.uk

Other workshop leaders:

Professor Charlie Bristow, University of London. Email c.bristow@ucl.ac.uk

Professor Mark Bateman, University of Sheffield. Email m.d.bateman@sheffield.ac.uk

SAAG Conference Organiser:

Dr Frank Eckardt, University of Cape Town. Email Frank.Eckardt@uct.ac.za

Introduction: A recent one-day meeting on sand seas and dunefields, held at the RGS-IBG on 18th October 2010, highlighted the importance of long-term monitoring of dunes for improving our understanding of sand transport and bedform depositional processes. Apart from direct applications to do with infrastructure design and engineering, this understanding is also required to allow us to interpret palaeoenvironmental aeolian records, which provide dated information on arid climate phases, palaeowind directions, and other indicators required for elucidating global patterns of environmental change. Modern methods of dune survey, incorporating topographic survey to monitor changes in surface morphology, coupled with GPR to resolve dune sedimentology and appropriately sampled optical dating, sufficiently detailed to characterise periods of accretion and periods of hiatus, offer new insights into dune-forming processes (Bristow *et al.*, 2005, 2007). An understanding of these processes is of use not only in deserts but also in coastal areas, where control of dune sands is often a major management issue. Blown sand and mobile dunes can give rise to significant hazards to human activity (Sherman and Nordstrom, 1994).

The workshop: With funding from the Royal Geographical Society (with Institute of British Geographers), and with student scholarships provided by the International Association of Geomorphologists (IAG), a training workshop in modern dune survey techniques was held at the Biennial Congress of the South African Association of Geomorphologists, held at Gobabeb Training and Research Centre in September 2012. The workshop comprised three activities. The first was the use of Leica Differential GPS equipment to undertake a survey of a dune profile, covering topics such as use of real-time satellite correction signals *versus* base-station/rover survey methods, vertical and horizontal accuracies, and data processing issues. The second activity was collecting a GPR survey of the dune transects using a Pulse EKKO 100 with a 1000 V transmitter and 100 MHz antennae (Bristow *et al.*, 2005; 2007). The third component of the workshop was the use of a SUERC portable OSL reader. Optically stimulated luminescence (OSL) is the only dating technique that can be used to directly date dune sand (e.g. Bateman *et al.*, 2011). It relies on sunlight exposure of quartz grains resetting radiation charge built up within the quartz grains. Once buried, naturally occurring background radiation builds up this charge again and, if quartz grains are measured without sunlight exposure, this built up charge can be used to establish a burial age in the range 10-100,000+ years. However, full OSL dating is resource and time intensive both in the field and in the required follow-up laboratory work. A long held ideal would be able to determine the age of dunes in the field. New field-based OSL technology developed by Sanderson and Murphy (2010) and tested in complex sedimentary environments (Bishop *et al.*, 2005; Muñoz-Salinas *et al.*, 2011) has two main advantages

over traditional OSL dating. Firstly, because it can be used to guide field sampling for full OSL ages. Secondly, because it is rapid (only a few minutes per sample), a large number of readings can be taken relatively quickly, enabling the establishment of relative chronologies either vertically within a stratigraphy or spatially across a dune field.

Gobabeb Training and Research Centre (Figure 1) is located at 23°34'S, 15°03'E in the Namib-Naukluft Park, in the Namib Desert. It was founded in 1962 as the Namib Desert Research Station by Dr. Charles Koch (1904-1970) in association with the Transvaal Museum. In 1963, the Station changed to Desert Ecological Research Unit (DERU). In 1990, after Namibia's independence, DERU expanded and the Desert Research Foundation of Namibia (DRFN) was established. It has a wide range of facilities, including well-appointed science labs, an outstanding library and information centre, and excellent accommodation, conference and leisure facilities. The joint meeting of SAAG and SASQUA was held to celebrate 50 years of Namib Desert research at Gobabeb, an indicator of the importance of this centre to the dryland research community.

The IAG kindly funded three bursaries to support the attendance of young African geomorphologists at the conference and workshop. The three recipients selected by IAG were Nandipha Mabuza (Swaziland), Christel Hansen (Namibia) and Johanna Niipele (Namibia).



Figure 1: Gobabeb Training and Research Centre (G. Wiggs)

The workshop took place over two days. The first session began indoors (Figure 2) with a presentation by Kevin White (University of Reading) on Differential GPS surveying techniques. Mark Bateman (University of Sheffield) then introduced optical dating methods. Charlie Bristow (University of London) wrapped up the presentations with an introduction to ground penetrating radar (GPR). Conference participants were then guided across the Kuiseb River to Station Dune where Bristow and White set up the DGPS and GPR equipment which was used for the demonstration (Figure 3) and where Bateman demonstrated how to sample dune sands for Optically Stimulated Luminescence dating. The IAG sponsored students formed a small team of three to run the GPR taking the console and one antenna apiece, they collected data along a transect up the west flank of Station Dune (Figure 4). Meanwhile White supervised the collection of DGPS data (Figure 5)

along the same line of section so that a topographic correction could be applied to the GPR data. The results were processed and presented at the end of the conference (Figure 6).



Figure 2: Introductory lectures in the first workshop session (G. Wiggs)



Figure 3: Field session of the workshop (G. Wiggs)



Figure 4: IAG sponsored students Nandipha Mabuza, Christel Hansen and Johanna Niipele using the Ground Penetrating Radar to image the internal structure of the dune (G. Wiggs)



Figure 5: Kevin White instructing on the use of Differential GPS for topographic survey of dune profiles (G. Wiggs)

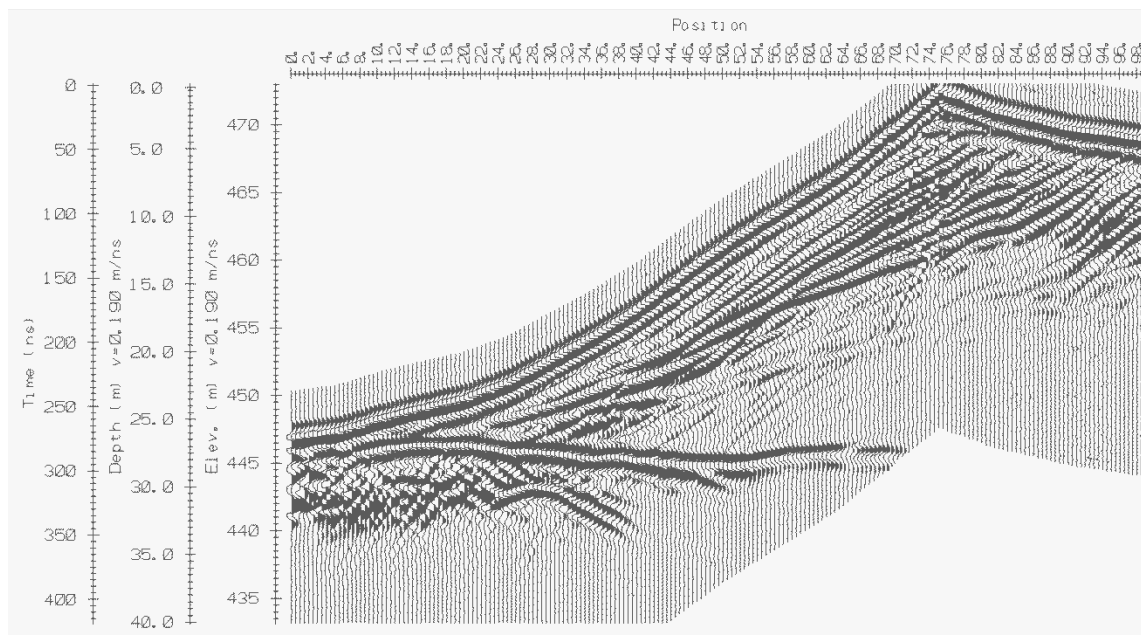


Figure 6: Results of the survey of Station dune, showing the internal sedimentary structure (C. Bristow)

The Gobabeb Research Station was an ideal location for the workshop because it is conveniently located within walking distance of large linear dunes, allowing a large group of conference goers to gain first-hand experience of new dune survey techniques. The workshop was very well received by the sponsored students, and the attendance of a large number of interested and enthusiastic students (and other researchers) from southern Africa at the workshop made it a rewarding experience for all concerned. The success of the workshop has highlighted the demand for similar training opportunities. We have kept in contact with the sponsored students to see how their experiences of the workshop have influenced their future studies. Nandipha Mabuza is now at the University of Witwatersrand undertaking Masters research on GIS and ecology. Christel Hansen has started a PhD on diurnal frost environments in high altitude and latitude environments in Marion Island and Western Dronning Maud Land in Antarctica and the Eastern Cape Drakensberg in South Africa. Johanna Niipele is lecturing at University of Namibia and is looking for a suitable PhD opportunity. A video describing activities at the workshop was produced and posted on Youtube at <http://www.youtube.com/watch?v=yXOFTT60to>

References:

- Bateman, MD, Carr, AS, Dunajko, AC, Holmes, PJ, Roberts, DL, McLaren, SJ, Bryant, RG, Marker, ME, Murray-Wallace, CV. 2011. The evolution of coastal barrier systems: a case study of the Middle-Late Pleistocene Wilderness barriers. *Quaternary Science Reviews*, **30**, 63-81.
- Bishop, P., Sanderson, D., Hansom, J., Chaimanee, N. 2005. Age-dating of tsunami deposits: lessons from the 26 December 2004 tsunami in Thailand. *Geographical Journal*, **171**, 379-384.
- Bristow, C.S., Duller, G.A.T., and Lancaster, N., 2007. Age and dynamics of linear dunes in the Namib desert. *Geology*, **35**, 555-558.
- Bristow, C. S., Lancaster, N. and Duller, G. A. T., 2005. Combining ground penetrating radar surveys and optical dating to determine dune migration in Namibia. *Journal of the Geological Society*, **162**, 315-322.
- Muños-Salinas E, Bishop, P., Sanderson, DCW, Zamorano, J-J. 2011. Interpreting luminescence data from a portable OSL reader: three case studies in fluvial settings. *Earth Surface Processes and Landforms*, **36**, 651-660.

Sanderson, DCW, Murphy, S 2010. Using simple portable OSL measurements and laboratory characterisation to help understand complex and heterogenous sediment sequences for luminescence dating. *Quaternary Geochronology*, **5**, 299-305.

Sherman, D.J. and Nordstrom, K.F. 1994. Hazards of Wind-Blown Sand and Coastal Sand Drifts: A Review. *Journal of Coastal Research , Special Issue*, **12**, 263-275