the bulk sediment $\delta^{15}N$ records. These observations point to the potential of these targeted measurements to complement the bulk N isotope records: where the two agree, the story is straightforward for both (Fig. 1b). Where they don't agree, the specific measurements can reveal changes in the surface ecosystem, alteration of the bulk record, or both. The emerging picture is that bulk organic records are more representative of the export flux than was thought a few years ago. Given the relative ease of measuring bulk sediment $\delta^{15}N$, this is good news.

Taking inventory

A primary motivation behind sedimentary nitrogen isotope research is to understand the coupling between the marine N inventory and climate. A lot of progress has been made, most notably in developing the notion of enhanced water column denitrification and N_2 fixation during warm periods (Fig. 1). However, newly identified issues complicate the translation of sedimentary nitrogen isotope records into quantitative constraints on the marine N inventory. At the forefront of these is the anaerobic oxidation of ammonium by nitrite to yield N_2 (anammox). New measurements from culture experiments show that the anammox isotope effect is distinct from that of canonical (i.e., heterotrophic) denitrification. Problems aside, perhaps the most useful single quantity to track through time would be the isotopic composition of mean ocean nitrate. Although the availability of such a record remains elusive, efforts toward a global synthesis should prove a step in the right direction.

The second NICOPP workshop will include a broader range of nitrogen cycling processes and will be held in Halifax, Canada in 2011. In the meantime, a catalog of published bulk sediment $\delta^{15}N$ records has been developed: http://www.pages-igbp.org/cgi-bin/WebObjects/metadb.woa/wa/map?group=nitrogen. All investigators with relevant data are encouraged to contact eric.galbraith@mcgill.ca for inclusion in the global database, which will ultimately be available as a data product in multiple formats.

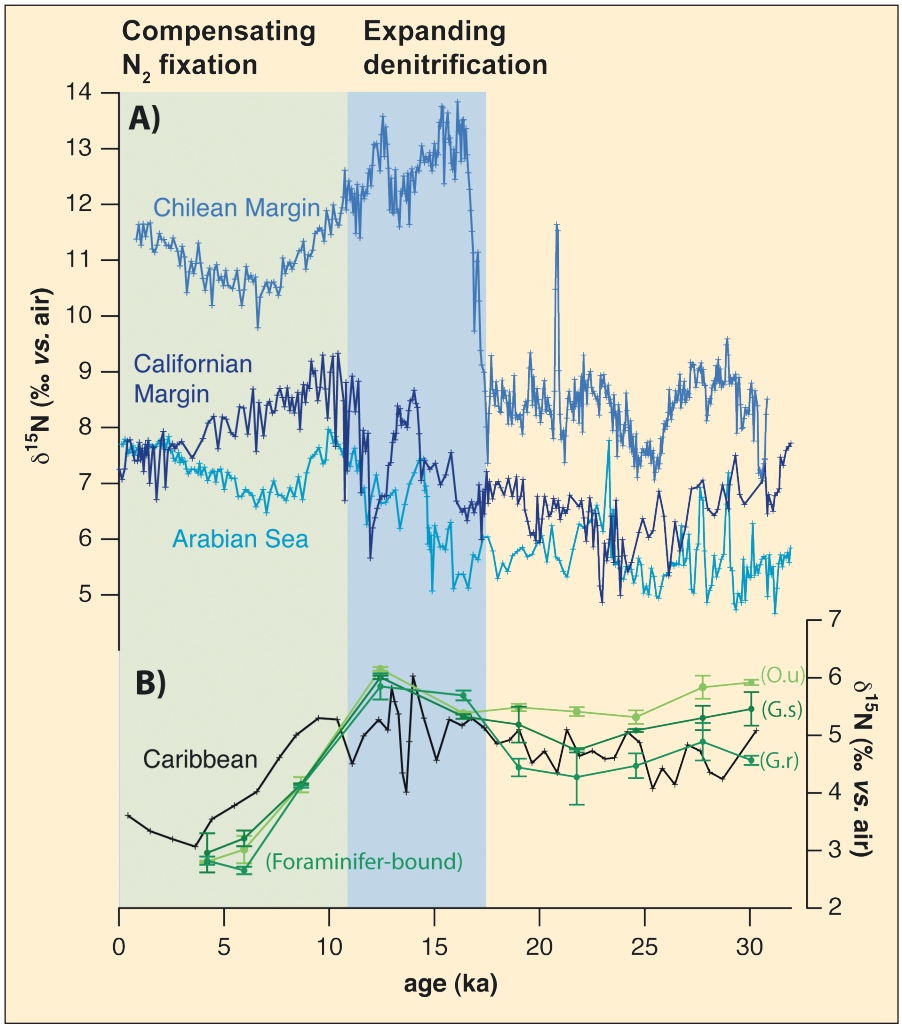

*Figure 1: Sedimentary records of bulk and microfossil-bound $\delta^{15}N$ since the last glacial maximum (after Ren et al., 2009). **A**) Bulk sediment $\delta^{15}N$ records from each of the three major oceanic denitrification zones (Chilean Margin, Californian Margin, Arabian Sea) increased between 12-18 ka, although with local nuances. **B**) Bulk sediment record (black) from the Caribbean Cariaco Basin and three foraminifera-bound $\delta^{15}N$ records (O.u = Orbulina universa, G.s = Globigerinoides sacculifer, G.r = G. ruber) from the open Caribbean. N_2-fixation is very active in both Caribbean regions today. The bulk and microfossil-bound records of the Caribbean reveal an opposite sense of change to that of the oxygen-minimum zones in panel A, consistent with the notion that deglacial warming drove an increase of denitrification that was then compensated by a delayed increase of N_2 fixation.*

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The first Africa 2k regional workshop

Ghent, Belgium, 11-14 May 2010

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The first workshop of the PAGES Africa 2k Working Group was a small, focused workshop, hosted by Dirk Verschuren in Gent and attended by all Working Group members (see http://www.pages.unibe.ch/science/2k/africa2k/people.html). May 12 was dedicated to presentations and May 13 was for discussions. The workshop was opened by Louise Newman (PAGES IPO) who presented the PAGES Regional 2k Network, as well as issues relating to the geographical boundaries of each focal region, critical time intervals, deadlines on expected outcomes and the development of metadatasets. The first formal presentation, by Sharon Nicholson, dealt with the spatial patterns of African climate anomalies associated with important drivers of tropical climate variability. The ensuing presentations dealt with sets of paleodata currently available from various regions of sub-Saharan Africa. These included precipitation patterns from documentary and gauge station data (Sharon Nicholson); 19th century documentary evidence of precipitation variability in South Africa (David Nash); a regional synthesis of records spanning the West African monsoon domain (Tim Shanahan); anthropogenic versus climatic impacts on paleoenviron-

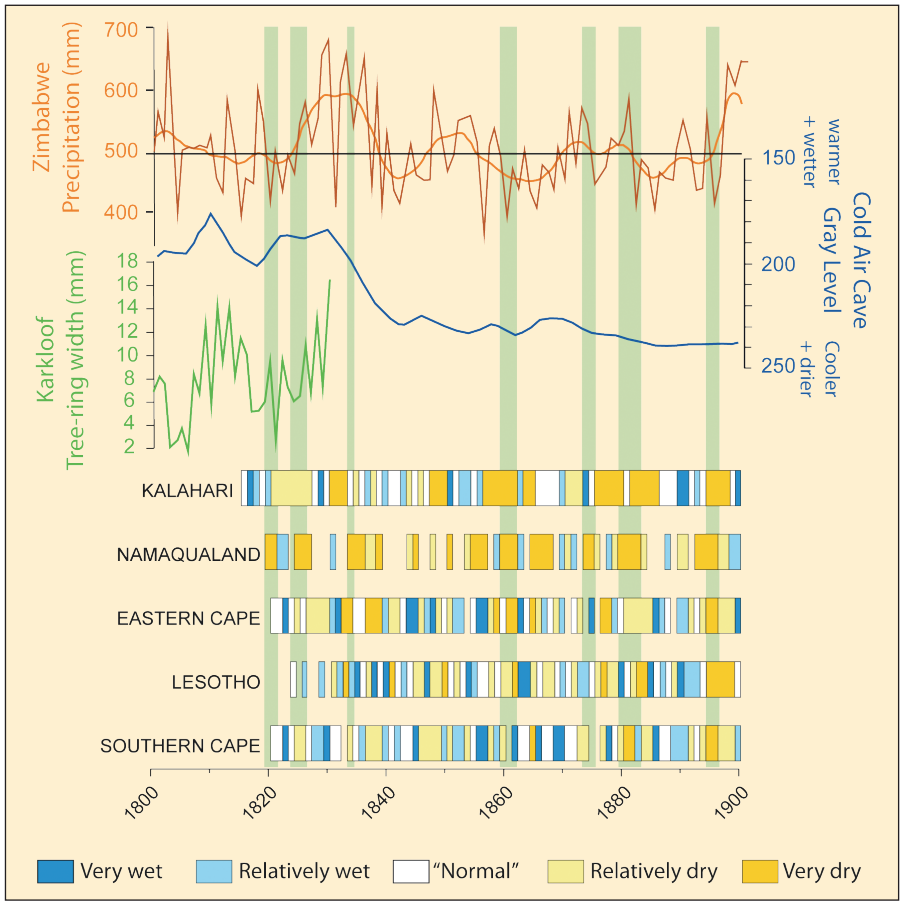

*Figure 1: Nineteenth-century climate chronologies for southern Africa, including tree-ring based rainfall reconstructions for Zimbabwe (**orange**; bold line is a 10-a running mean; Therrell et al. 2006) and Karkloof (South Africa) (**green**; Hall, 1976), the speleothem record of regional hydrology from Cold Air Cave (South Africa) (**blue**; Holmgren et al., 1999) and document-derived rainfall reconstructions from the southern Kalahari Desert (Nash and Endfield, 2002a, 2008), Namaqualand (Kelso and Vogel, 2007), the Eastern and Southern Cape (Vogel, 1989) and Lesotho (Nash and Grab, 2010). Gaps in the documentary records are unclassified years. Widespread drought (**green shading**) occurred in 1820–21, 1825–27, 1834, 1860–62, 1874–75, 1880–83 and 1894–1896 (Kelso and Vogel, 2007), with an additional dry period from the early- to mid-1840s affecting the Kalahari and Zimbabwe only (Nash and Endfield, 2002b; Therrell et al., 2006).*

ments in western Central Africa (Ilham Bentaleb); climate of the past 2 ka and impacts in Ethiopia (Mohammed Umer); decadal-scale rainfall variability in Ethiopia recorded in annually laminated Holocene-age stalagmites (Asfawossen Asrat); climate variability in central and eastern equatorial Africa over the past two millennia (Dirk Verschuren); and high-resolution palaeoenvironmental records from southern Africa (Brian Chase). This was a truly interactive workshop, with much discussion during the presentations themselves keeping both speakers and audience on their toes. Broader discussion after each block of talks focused on internal and external mechanisms of climate variability and emphasized the role of oceans, land-surface changes, and atmospheric circulation. It was stressed that the geographically complex climate of Africa requires thorough consideration of regional climate regimes and the exact timing of climate shifts. For this a reference map showing homogeneous modern climate regions will be established (by Sharon Nicholson) on which existing sites of paleodata for the last 2 ka will be plotted. This will reveal spatial gaps as well as show how patterns of regional variation at different times in the past compare to present-day regional patterns. During discussions it was also pointed out that the geographical boundary of Africa 2k should include Yemen and the Arabian Peninsula, and also the Sahara. Finally the group discussed a spreadsheet format for the compilation of available datasets holding all existing site and metadata information. Later, this will be filtered and reduced to include only those data that fit strict criteria for their dating reliability and time resolution. Brian Chase will lead this task. The data will be further structured into two partial datasets; those dealing with the last 2 ka at decadal- to century-scale resolution, and those that cover the last 200 years at annual resolution.

The next meetings of the Africa 2k Working Group will be conducted during the 3rd East African Quaternary Association meeting in Zanzibar, Tanzania, 8-13 Feb 2011, and the 18th INQUA Congress in Bern, Switzerland, 20-27 July 2011.

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For full references please consult:
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PAGES regional workshop in Japan

Nagoya, Japan, 5-6 June 2010

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Due to its unique language, culture and geographical isolation, it is frequently mentioned that Japanese do not often play major roles in international societies, including political and scientific areas. In fact, the average Japanese scores of international English communication tests (e.g., Test of English for International Communication) are almost worst in the world. In addition, young Japanese scientists rarely move to foreign countries because they worry about job opportunities upon returning to Japan. Yet, Japanese people have created many industrial and academic products, some of which are very unique and have been analogized with the isolated and specialized evolution of life on the Galapagos Islands. Likewise, in Japanese paleoscience, there are also some unique research products that are rarely shared with the international paleoscience community. This PAGES Regional Workshop, held at the Noyori memorial conference hall, Nagoya University (prior to the PAGES Scientific Steering Committee (SSC) meeting), was designed to introduce the variety of Japanese paleosci-