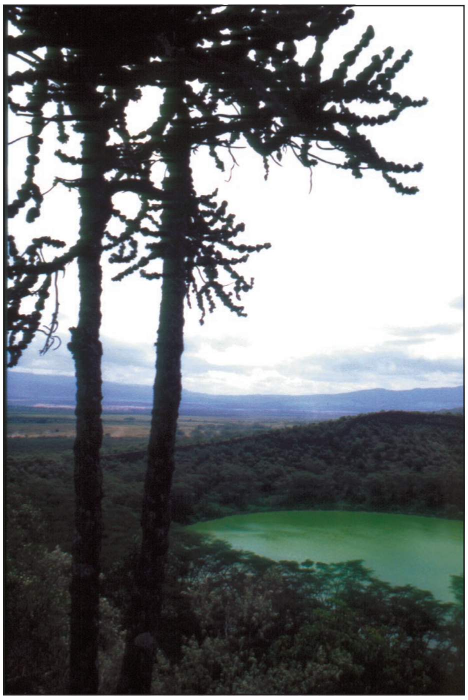

Lake Sonachi, Eastern Rift Valley, Kenya (Photo: Dirk Verschuren).

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ting, description, logging, and reconnaissance dating and compositional analyses). From there, the cores would be available for future detailed analytical projects. The acquisition and construction costs of the system are about 0.7 million USD. Minimum costs for test-drilling operations and basic core processing are about 0.3 million USD for 300–400 m of core (paleoclimate or neotectonic issues only). For the 2500 m of core that would be necessary to address all of the scientific issues, the drilling-processing costs would be about 0.5 million. Total cost of the acquisition and testing project would therefore range between 1.0 and 1.2+ million USD.

We have been working for almost four years to develop a functional lake-drilling system. We believe that the proposed drilling system would provide an opportunity to address many of the priorities of ICDP and PAGES, including those of previously reviewed ICDP lake-drilling projects. Much depends on the fate of this latest proposal in the review process at ICDP and NSF over the next few months (January–April, 1999). Stay tuned.

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PEP III African Crater Lakes Workshop

Gent, Belgium, October 10–11 1998

Unraveling the climatic history of Africa and the Near East during the past 2000 years remains one of the major challenges in paleoclimate research, and sediment records from crater lakes are among the most valuable sources of information on this history. However, apart from the unique biology and distinct hydrogeological settings of the tropical and subtropical crater lakes dotting the southern half of the PEP III transect, their study also involves issues of access, organization, and scientific infrastructure that are quite different from the situation in Europe and add to the challenge of obtaining high-quality climate-proxy records from them (see PAGES Newsletter 97–2). The 1996 PEP III strategy meeting in Bierville (see PAGES Report 97–2) stressed the urgent need to redress the current geographic imbalance of paleoclimatic information within the PEP III transect, and recommended prioritization of a research initiative focusing specifically on high-resolution, PAGES Time Stream 1 paleoclimate reconstruction using sediment records from crater lakes and other small lakes in Africa and the Near East.

The African Crater Lakes workshop in Gent brought together a group of leading paleolimnologists currently active in Africa and the Near East, PAGES representatives, and specialists in data acquisition and management who could take on the function of a thematic working group to promote, guide and coordinate future lake-based, late Holocene paleoclimate research following PAGES guidelines with respect to time resolution, chronological control, climate-proxy calibration, and data management.

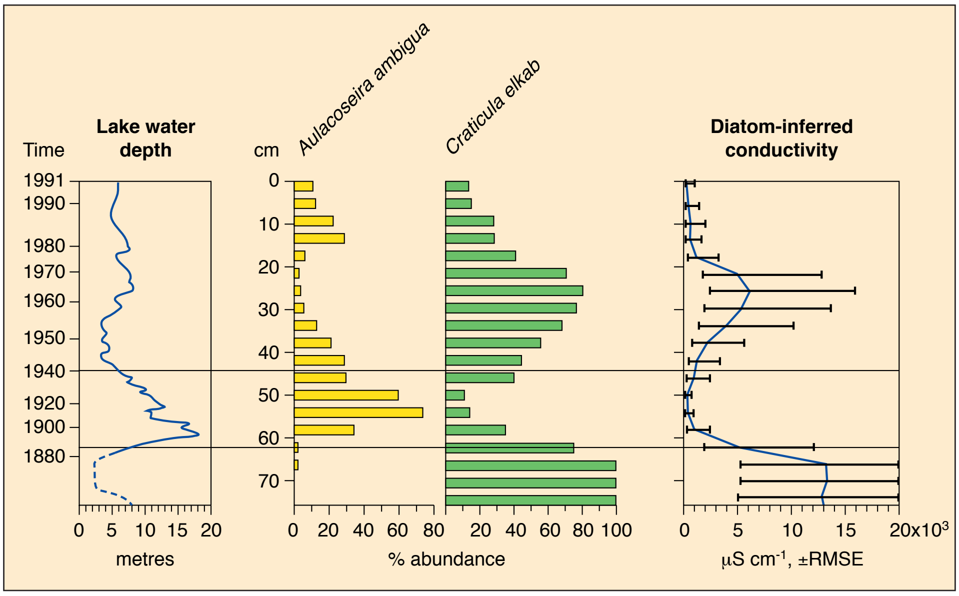
Regional data synthesis

Despite the large number of crater lakes and other small natural water bodies across Africa and the Near East, only a small subset of them are likely to have accumulated a continuous record of past environmental change resolvable at sub-annual to decadal time scales. A major objective of the meeting was to identify and rank specific study sites according to their potential for paleoclimate reconstruction. The main part of the meeting therefore comprised region-by-region summaries of the present status of Time Stream 1 paleoclimate research in Africa and the Near East, and comparative evaluation of sites according to their potential to preserve a continuous sediment record of late-Holocene hydro-climatic variability. The geographical hub of the southern PEP III transect is the East African Rift, within which key areas include central Ethiopia (data summarised by H. Lamb and L. Carvalho), central Kenya (D. Verschuren), and southwest Tanzania (D. Williamson, P. Barker). Other important clusters of crater lakes, so far less well studied paleolimnologically, exist in western Uganda (D. Verschuren), Cameroon, and Madagascar (F. Gasse). Important complementary archives exist in the form of small high-altitude headwater lakes, in some cases pro-glacial, and recent work on Mt. Kenya was described by K. Holmgren (on behalf of W. Karlén) and P. Barker. The intense hydrological deficit in north-eastern Africa means that few lakes of any kind are available for study, making the handful of extant crater lakes in northern Sudan prime study targets (S. Kroepelin). A greater density of crater lakes exists adjacent to the Jordan Rift and in central and eastern Turkey (N. Roberts). Subtropical regions at the southern end of the PEP III transect seem to have few lake sites suitable for high-resolution paleoclimate research (L. Scott), and are likely to be better served via other climate-proxy archives such as speleothem records (K. Holmgren).

Research Questions

The working group identified two principal categories of research questions: (1) fundamental questions about the history and causes of climatic variability, and (2) methodological questions about the reliability of sedimentary proxy records as the source of information on that climatic variability.

(1) The primary goal of Time Stream 1 paleoclimate research on African crater and other small lakes is to document the temporal patterns and spatial coherence of past climatic change with a quality of proxy data and chronological control that permits evaluation of possible causative mechanisms over a hierarchy of time-



Validation of lake sediment records can be provided by historical data. Here, the recorded water level of Lake Oloidien, Naivasha, Kenya (left) over the last century is compared against the results of a ^{210}*Pb-dated short sediment core. Stratigraphic changes in the two principal diatom taxa,* A. ambigua *(fresh, planktonic) and* C. elkab *(halophytic, benthic) and inferred conductivity, match closely to the sequence of historic lake-level fluctuations at this site. (Simplified from Verschuren, D., Tibby, J., Leavitt, P.R. and Roberts, C.N. The environmental history of a climate-sensitive lake in the former 'White Highlands' of central Kenya.* Ambio, *in press).*

scales. For high-frequency variations, such as those induced by ENSO or solar forcing, a prime criterion for a lake-sediment record to be of value is that it possesses the annual chronometer of varves. On the other hand the working group recognized that for documentation of the long-term climate shifts contemporary with the European Little Ice Age, and the frequency, intensity and duration of major drought and flood episodes, a more important criterion is that a lake has been adequately sensitive to hydroclimatic variations without desiccating completely during the more arid phases.

(2) Within- and between-site integration of climate-proxy data required for documentation of temporal and spatial coherence in past climate critically depends on the reliability of both the lake system and the sedimentary climate proxies to record truthfully climate history. The working group stressed the importance of developing strategies for the calibration and validation of reconstructed climate variations, in particular fluctuations in effective moisture (P-E), at individual sites. Crater lakes are not fundamentally different from other aquatic systems in having complex and sometimes lagged hydrological, hydrochemical and biological responses to climatic variations. As much as possible, climate-proxy data from recent lake sediments must be validated against historical limnological and climatic time series. Of particular value for climate-proxy validation are lake districts and systems where suitable conditions exist to elucidate processes of climate-proxy formation and preservation through comparative historical paleolimnology. The prospective generation, integration, and use of multi-proxy data obtained from a network of lake-sediment and speleothem archives also raised important issues of information management (S. Juggins). It was agreed that development of a relational database system will be a primary requirement if systematic and quantitative intra- and inter-site comparison of lake sediment data within the PEP III transect is to be achieved.

Recommendations

A multiple-track approach was proposed for future PEP III Time Stream 1 paleoclimate research:

1) Four lake districts in East Africa already tested for scientific and logistic suitability should be developed as natural laboratories for validation of climate-proxy archives: the Debre Zeit (Bishoftu) crater lakes in Ethiopia, the Lake Naivasha system in Kenya, the cluster of proglacial and high-elevation crater lakes on Mt. Kenya, and the Rungwe crater lakes in Tanzania.

2) From each of these districts, one lake should be selected for the recovery of a high-resolution climate-proxy record spanning the last 2000 years. These sites will form an initial spatial network of high-quality small-lake records that can be compared with records of possible climate-forcing mechanisms, and linked to comparable climate-proxy records obtained from the large African Rift lakes (under the auspices of IDEAL), speleothems (SPEP III), and corals.

3) Exploratory fieldwork for high-quality sediment records should be undertaken in other promising regions along the southern PEP III transect, such as Cameroon, western Uganda, Sudan, Turkey, and Madagascar. Because modern sediment samples collected from these lakes will be essential for establishing a comprehensive training set for numerical calibration of biological and geochemical climate proxies throughout the PEP III transect, community-wide coordination and integration of effort is needed to ensure that a common set of protocols is applied to the collection and processing of samples and environmental data.

4) High priority should be given to the application and testing of a relational database, based on that developed for the PALICLAS Italian crater lakes project (see Juggins, Newsletter 98–2), to compare and integrate data produced in lake-specific investigations and to interface the PEP III results with global data archives (World Data Center-A).

5) Progress in this multi-faceted initiative should be reviewed and presented to the wider scientific community at the INQUA Congress in Durban (August 1999) to promote community-wide scientific coordination and stimulate involvement of African scientists.

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