Geophysical Research Abstracts
Vol. 14, EGU2012-3131, 2012
EGU General Assembly 2012

New chronology for Red Sea sea-level record reveals phase relationship between changes in polar climate and ice volume

K.M. Grant (1), E.J. Rohling (1), C. Bronk Ramsey (2), M. Bar-Matthews (3), C. Satow (4), M. Medina-Elizalde (1), and A.P. Roberts (5)

(1) School of Ocean and Earth Science, University of Southampton, National Oceanography Centre, European Way, Southampton SO14 3ZH, United Kingdom (kxg@noc.soton.ac.uk), (2) Research Laboratory for Archaeology and the History of Art, Dyson Perrins Building, South Parks Rd, Oxford, OX1 3QY, UK, (3) Geological Survey of Israel, 30 Malchei Israel Street, Jerusalem 95501, Israel, (4) Department of Geography, Queens Building, Royal Holloway University of London, TW20 OEX, UK, (5) Research School of Earth Sciences, The Australian National University, Canberra, ACT 0200, Australia

Understanding process relationships within the climate system requires records of individual climate components with excellent time control. Continuous records of ice volume, a key component in the climate system, now exist from several sea level reconstruction methods. However, none of these have sufficient time control to allow detailed comparison with other climate records, or systematic evaluation of rates of change. Here we present a tightly controlled U-series chronology for the high-resolution Red Sea sea-level record through the last 150,000 years. This chronology is based on strong signal similarity between δ^{18}O records from the Red Sea and the nearby eastern Mediterranean. We constrain the chronology of the latter with U-series dating of Soreq Cave (Israel) speleothems and dated volcanic ash horizons. The resultant sea level chronology is validated using the timing of major sea level transitions in a global compilation of coral data, and for the first time characterises the timing of ice volume variability throughout the last 150,000 years on millennial timescales. We then use a probabilistic assessment of our new sea-level record to show where variations in global ice volume significantly agree (within the 67 and 85% probability range) with variations in Antarctic and/or Greenland climate. Next, by performing a series of lagged correlations and cross-spectral phase analyses, we show that polar climate and ice volume are strongly coupled within a relatively fast (generally 100-200 years) response time. Most significantly, rates of change in polar climate and ice volume appear to be directly in phase, and rates of sea-level rise during six major deglaciations are at least 2 m per century.