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U-Th Dating of Marine Isotope Stage Seven in Bahaman Slope Sediments

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An accurate chronology of Pleistocene climate change allows comparison of climate records with one another and with possible forcing mechanisms. It is hoped that dating of changes in sea level, temperature and carbon dioxide may help to shed light on the mechanism through which orbital signals are amplified to drive climate.

U-Th dating of Pleistocene change has been applied successfully to tropical corals from sealevel highstands from marine-isotope stage (MIS) 5e and younger. Dating of older highstands has proved more difficult, partly because high precision thorium measurements are required as errors expand rapidly as the (^{230}Th /^{238}U) tends towards unity. However the major problem with dating corals on these older terraces is that they have suffered subaerial diagenesis. U-series diagenesis is indicated by the initial δ^{234}U values of the corals.

Modern seawater has a δ^{234}U of ~150 and it is thought that this value has been roughly constant over the last few hundred thousand years (Henderson et al., 1993, Gallup et al., 1994). In contrast, most older corals have much higher and more scattered δ^{234}U values. Although Gallup et al. (1994) reported two reliable MIS 7.1 ages at 200.1 and 200.8 ka with reliable δ^{234}U values, coral dating in this period generally does not return concordant U-Th dates.

The suitability of Bahaman slope sediments for U-Th dating has recently been demonstrated (Slowey et al., 1996). The advantages include: . Rapid sedimentation rates (up to 200 cm/kyr) give a high-resolution chronology. Sediments have not been exposed to subaerial diagenesis. The aragonite-dominated sediments have high initial uranium values up to 12 p.p.m.. Sediments have unusually low detrital contents and shallow water depths mean that scavenged thorium contents are low

In this study we make use of these advantages to provide a U-Th chronology for MIS 7 at ODP sites 1009 and 1008 (Leg166) from the leeward slope of the Great Bahamas Bank. These cores penetrate MIS 7 and beyond and have a highstand sedimentation rate of ~50 cm/kyr. Eight samples were selected from Site 1009 to span MIS 7 based on a provisional low-resolution δ^{18}O stratigraphy (Figure 1). U-Th dating was performed on the bulk sediment following the techniques of Slowey et al. (1996). Uranium concentrations range from ~5 to 12 p.p.m. ^{232}Th/^{230}Th atom ratios generally lie between 400 and 1200 (with one exception at ~4500) indicating that only a small correction need be made for initial ^{230}Th. Importantly, the δ^{234}U initial values are generally close to modern values with an average of 155 (see Figure 1) suggesting that the U-Th systematics of the sediment have not been perturbed.

One sample yielded an implausibly young (but concordant) age of 171 ka. This age may represent a sample mix up and immediately adjacent samples will be analysed to assess this sample. The other 7 samples yield ages that range from 199-246 ka and, within error, increase with depth. These dates are broadly consistent with orbitally tuned chronologies e.g. Imbrie et al. (1984) and with other studies that have attempted to date MIS 7 radiometrically e.g. Winograd et al. (1997). These first U-Th ages from Site 1009 show considerable promise that the sediments can provide a direct radiometric chronology for this interglacial period in the marine realm. Furthermore, bulk sediment and *G. sacculifer* δ^{18}O curves shown on Figure 1 enable a tentative sub-division of MIS 7 to be made.

Work is currently underway to enhance both the oxygen isotope and age resolution from Core 1009. Age information will be improved through increasing the sampling density and the errors will be reduced by measuring thorium using a newly installed multi-collector-ICP-MS. A second ODP core, 1008, is also being dated to ensure that the data from 1009 are consistent across a wider area. It is hoped that as further data are collected these cores will provide an accurate chronological framework for MIS 7 and will add to the debate regarding the mechanisms driving climate change.