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Revisiting the Ceara Rise, equatorial Atlantic Ocean: isotope stratigraphy of ODP Leg 154

Roy Wilkens (1), Anna Joy Drury (2), Thomas Westerhold (2), Mitchell Lyle (3), Thomas Gorgas (4), and Jun Tian (5)

(1) University of Hawaii, SOEST, Institute of Geophysics, Kailua, United States (rwilkens@hawaii.edu), (2) MARUM - Center for Marine Environmental Sciences, University of Bremen, Germany (ajdrury@marum.de), (3) College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, USA (mlyle@coas.oregonstate.edu), (4) Zentrum für Wissenschaftliches Bohren, Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany (tgorgas@gfz-potsdam.de), (5) State Key Laboratory of Marine Geology, Tongji University, China (tianjun@mail.tongji.edu.cn)

Isotope stratigraphy has become the method of choice for investigating both past ocean temperatures and global ice volume. Lisiecki and Raymo (2005) published a stacked record of 57 globally distributed benthic δ18O records versus age (LR04 stack). In this study LR04 is compared to high resolution records collected at all of the sites drilled during Ocean Drilling Program (ODP) Leg 154 on the Ceara Rise, in the western equatorial Atlantic Ocean. Newly developed software - the Code for Ocean Drilling Data (CODD) - is used to check data splices of the Ceara sites and better align out-of-splice data with in-splice data. CODD allows to depth and age scaled core images recovered from core table photos enormously facilitating data analysis. The entire splices of ODP Sites 925, 926, 927, 928 and 929 were reviewed. Most changes were minor although several large enough to affect age models based on orbital tuning.

We revised the astronomically tuned age model for the Ceara Rise by tuning darker, more clay rich layers to Northern Hemisphere insolation minima. Then we assembled a regional composite benthic stable isotope record from published data. This new Ceara Rise stack provides a new regional reference section for the equatorial Atlantic covering the last 5 million years with an independent age model compared to the non-linear ice volume models of the LR04 stack. Comparison shows that the benthic δ18O composite is consistent with the LR04 stack from 0 - 4 Ma despite a short interval between 1.80 and 1.90 Ma, where LR04 exhibits 2 maxima but where Ceara Rise contains only 1. The interval between 4.0 and 4.5 Ma in the Ceara Rise compilation is decidedly different from LR04, reflecting both the low amplitude of the signal over this interval and the limited amount of data available for the LR04 stack. Our results also point out that precession cycles have been misinterpreted as obliquity in the LR04 stack as suggested by the Ceara Rise composite at 4.2 Ma.