Radiocarbon (C14) calendar ages measured on pelagic foraminifera species collected from sediment cores from the Cocos Ridge (Eastern Equatorial Pacific) acquired during cruise SR2113 between November - December 2021.

Website: https://www.bco-dmo.org/dataset/925313
Data Type: Other Field Results
Version: 1
Version Date: 2024-06-20

Project
» Collaborative Research: New approaches to study calcium carbonate dissolution on the sea floor and its impact on paleo-proxy interpretations (CDISP 2021)

Contributors	Affiliation	Role
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Abstract
These data include radiocarbon (C14) calendar ages measured on pelagic foraminifera species collected from sediment cores from the Cocos Ridge in the Eastern Equatorial Pacific. This cruise was aboard the R/V Sally Ride between 2021-11-20 and 2021-12-20. Instruments used were a multicorer and accelerator mass spectrometry . These data contributed to our understanding of the carbonate chemistry system in this region, particularly regarding carbonate dissolution in deep-sea sediments. Patrick Rafter (UC Irvine) measured C14 calendar ages.

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Coverage

Spatial Extent: **N**:6.78487 **E**:-86.59988 **S**:5.35008 **W**:-88.26095
Temporal Extent: 2021-12-01 - 2021-12-14

Methods & Sampling

The sediment cores are taken from the Cocos Ridge in the Eastern Equatorial Pacific using a multicorer at 4 different locations. This cruise was aboard the R/V Sally Ride between 2021-11-20 and 2021-12-20.

Data Processing Description

Radiocarbon values were measured by accelerator mass spectrometry (AMS) at the University of California, Irvine Keck Carbon Cycle Accelerator Mass Spectrometry (KCCAMS) laboratory. The sediment was dried and washed over a 63 µm sieve with DI water, where pelagic forams were selected from the >250 µm fraction at different sediment horizons. Forams were leached with 10% HCl to remove any post-depositional carbonate and hydrolyzed under vacuum using H3PO4. The CO2 released from this hydrolysis was then graphitized and the 14C/C of this CO2 was counted on the AMS. The average percent error of calendar ages using this method was 1.5% for 23 foram measurements.

BCO-DMO Processing Description

* Scientific names in the data were checked using World Register of Marine Species (WoRMS) Taxon Match. Scientific names were corrected after working with the data contributor. All scientific names in the data are valid and accepted names as of 2024-04-18
* Added sample acquisition description (approved by submitter).

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Data Files

File
925313_v1_c14.csv (Comma Separated Values (.csv), 1.45 KB) MD5:0d789da10dbb14f29cc5378ecf9349cf Primary data file for dataset ID 925313, version 1

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Related Publications

Submitted to GCA: Cetiner J. E. P., Berelson W. M., Rollins N. E., Liu X., Pavia, F. J., Waldeck, A. R., Dong S., Fleger, K., Barnhart H. A., Quinan, M., Wani, R., Rafter, P. A., Jacobson, A. D., Byrne R. H. and Adkins J. F. Carbonate dissolution fluxes in deep-sea sediments as determined from in situ porewater profiles in a transect across the saturation horizon
Results

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Parameters

Parameter	Description	Units
Station	Station ID number	unitless
Date	Date of porewater sampler/multi-corer deployment in ISO format (yyyy-mm-dd)	unitless
Latitude	Station latitude, south is negative	decimal degrees
Longitude	Station longitude, west is negative	decimal degrees
Water_Column_Depth	Water column depth	meters (m)
Sediment_Depth	Sediment depth relative to sediment-water interface	centimeters (cm)
Foram_sp	Foraminifera species	unitless
AphiaID	ID in the World Register of Marine Species that pairs to the scientificName	unitless
C14_age	Carbon 14 calendar age	year (yr)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Accelerator Mass Spectrometer
Dataset-specific Description	Accelerator mass spectrometer was used to measure 14C/C
Generic Instrument Description	An AMS measures "long-lived radionuclides that occur naturally in our environment. AMS uses a particle accelerator in conjunction with ion sources, large magnets, and detectors to separate out interferences and count single atoms in the presence of 1x1015 (a thousand million million) stable atoms, measuring the mass-to-charge ratio of the products of sample molecule disassociation, atom ionization and ion acceleration." AMS permits ultra low-level measurement of compound concentrations and isotope ratios that traditional alpha-spectrometry cannot provide. More from Purdue University: http://www.physics.purdue.edu/primelab/introduction/ams.html

Dataset-specific Instrument Name	Ocean Instruments MC 800 Multicolor
Generic Instrument Name	Multi Corer
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in Oceanologica Acta, 7, pp. 399-408.

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Deployments

SR2113

Website	https://www.bco-dmo.org/deployment/925232
Platform	R/V Sally Ride
Start Date	2021-11-20
End Date	2021-12-20

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Project Information

Collaborative Research: New approaches to study calcium carbonate dissolution on the sea floor and its impact on paleo-proxy interpretations (CDISP 2021)

Coverage: Cocos Ridge, Eastern Equatorial Pacific

NSF Award Abstract:
The uptake of anthropogenic CO2 by the ocean will eventually be mitigated by the dissolution of CaCO3 on the sea floor. Dissolution is an important component of the carbon cycle in models used for climate projections though the relative importance of where it occurs (water column versus sediments) and the rates and processes involved are not fully understood. This ambitious field and laboratory study is designed to advance our knowledge of the important factors that control carbonate dissolution/ preservation in deep ocean sediments. Using a novel tracer approach and multiple in situ sampling strategies, the project will investigate sea floor dissolution rates, their kinetic controlling factors, the depth in sediments at which dissolution occurs, the role that oxidation of particulate organic carbon plays, and the ramifications of solid phase alteration for the use of geochemically-based paleoceanographic proxies. The project will foster further development of benthic lander technology and yield key information relating sea floor conditions to carbonate dissolution rate, thereby helping to constrain the rate at which the ocean can neutralize the impacts of ocean acidification. Graduate and undergraduate students will be trained and the research team will use film and animation to bring this work to a broader audience through a collaboration with the Los Angeles Natural History Museum.

The research team has developed a new approach to quantify calcium carbonate dissolution rates based on 13-C labeled carbonate substrates, a technique which is significantly more sensitive than traditional approaches based on alkalinity and/or calcium measurements. This has opened a range of new opportunities and insights into the governing mechanisms and rates of calcium carbonate dissolution, a challenging and long-standing geochemical problem. Carbonate dissolution rates on the sea floor will be directly assessed by benthic chamber flux measurements of alkalinity and calcium as well as pore water models of TCO2 and alkalinity and their isotopic composition. The potential impacts of organic carbon remineralization will be measured through oxygen and nutrient flux determinations, pore water gradients and modeling. Labeled 13C-enriched calcite will

serve as a tracer of near surface dissolution processes when added to benthic chambers and of down-core dissolution processes using 13C-labeled rods inserted into the sediment column. These in situ experiments of labeled carbonate dissolution will be the first of their kind. To complement these measurements, the team will continue development of a rhizon-based pore water sampler that works on a multi-corer at all ocean depths. Field experiments will be conducted at sea at 4-6 sites in a transect through water column supersaturation to undersaturation between Panama and the Galapagos. Dissolution rate measurements, coupled with analyses of cation/Ca ratios in CaCO3 foraminiferal shells will help calibrate the impact of dissolution on paleo-proxy interpretations. Further, analyses of sediment calcite and aragonite fractions will help explain net dissolution and sediment response with time. The results from this study should help to better parameterize sediment variables in ocean-climate models (GCMs), which has important implications for predicting the consequences of ocean acidification and the modeling of paleoceanographic records. The methodologies and new techniques will surely be adopted by other researchers, therefore impacting the larger geochemical community.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1834475

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