Radiocarbon dates on calcite and organic material (gorgonin) in bamboo coral skeletons Keratoisis (Bamboo Coral Boron Isotopes project)

Website: https://www.bco-dmo.org/dataset/542953
Version: 17 December 2014
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Project
» Calibration and application of the boron isotope seawater-pH indicator in deep-water corals (Bamboo Coral Boron Isotopes)

Contributors	Affiliation	Role
Hoenisch, Baerbel	Lamont-Doherty Earth Observatory (LDEO)	Principal Investigator
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Dataset Description

Radiocarbon dates on calcite and organic material (gorgonin) in bamboo coral skeletons

Related References:
Farmer, J.R., Hönisch, B., Robinson, L.F. and Hill, T.M. (2015) Effects of seawater-pH and biomineralization on the boron isotopic composition of deep-sea bamboo corals. In revision, *Geochim. Cosmochim. Acta*.

Sherwood, O.A., Edinger, E.N., Guilderson, T.P., Ghaleb, B., Risk, M.J. and Scott, D.B. (2008). Late Holocene radiocarbon variability in Northwest Atlantic slope waters. *Earth Planet. Sci. Lett.* 275, 146-153, doi:10.1016/j.epsl.2008.08.019.

Methods & Sampling

Sampling and Analytical Methodology:
All radiocarbon dates were obtained at the National Ocean Sciences Accelerator Mass Spectrometry facility (NOSAMS). Prior to sample submission, 3 to 5 mg of powdered calcite was cleaned of organic material following the oxidative procedure given in Farmer et al. (2015). Clean calcite powders were submitted to NOSAMS and leached with 200 µL of 0.1N HCl under sonication immediately prior to hydrolysis to remove any adsorbed modern CO_2. Approximately 10-20% of the sample mass was removed by the HCl leach. Gorgonin samples were prepared following Sherwood et al. (2008): decalcified nodes were separated with tweezers and a scalpel into individual gorgonin units, comprising 3 to >10 gorgonin layers where distinguishable. Approximately 2 to 3 mg of gorgonin was subsampled from larger units, soaked in 5% HCl for 48 hours to remove any residual carbonate, rinsed in deionized water and dried prior to submission to NOSAMS.

Full methodology, equations, and discussion of instrumental precision are available from the NOSAMS website:

http://www.whoi.edu/nosams/

Data Processing Description

Data Processing:
Fraction Modern (Fm) = ((^{14}C /$^{12}C_{sample}$ - ^{14}C /$^{12}C_{blank}$)/(^{14}C /$^{12}C_{reference}$ - ^{14}C /$^{12}C_{blank}$))* ((1-25/1000)/(1+$\delta^{13}C$/1000))^2;

The reference is 95% of the radiocarbon concentration of NBS Oxalic Acid I (in 1950 AD) normalized to $\delta^{13}C_{VPDB}$=-19‰.

Conventional ^{14}C age (in ^{14}C years before 1950) = -8033*ln(Fm)

$\delta^{13}C$ (‰) = ((($^{13}C/^{12}C_{sample}$)/($^{13}C/^{12}C_{standard}$))-1)*1000; The standard is Vienna Pee Dee Belemnite (VPDB)

BCO-DMO Processing Notes
- Generated from original file: "DATASET-14C.xlsx" contributed by Jesse Farmer
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- Lat/Lon sampling locations added from locations dataset to allow plotting in MapServer
- "nd" (no data) added to blank cells

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Data Files

File
BC_14C.csv (Comma Separated Values (.csv), 4.65 KB) MD5:72db3cd6cd871272fa4537a4acea769f Primary data file for dataset ID 542953

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Parameters

Parameter	Description	Units
Coral	Speciman Identifier	text
Lat	Sample Latitude Location (South is negative)	decimal degrees
Lon	Sample Longitude Location (West is negative)	decimal degrees
Sample	Sample	text
Type	Sample Type	text
Depth	Length scale for sample either relative to the outside of the coral (distal surface)	mm
Depth_Error	Depth Error	mm
Accession_Number	Accession Number	text
Fraction_Modern	Fraction Modern (Fm) = ((14C /12Csample - 14C /12Cblank)/(14C /12Creference - 14C /12Cblank))* ((1-25/1000)/(1+δ13C/1000))^2	‰
Fm_Err	Fraction Modern Error	‰
Conventional_14C_Age	Conventional 14C age (in 14C years before 1950) = -8033*ln(Fm	14C years
Age_Err_14C	Conventional 14C age error	14C years
Delta13C	13C (‰) = (((13C/12Csample)/(13C/12Cstandard))-1)*1000; The standard is Vienna Pee Dee Belemnite (VPDB)	‰

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Instruments

Dataset-specific Instrument Name	AMS - National Ocean Sciences Accelerator Mass Spectrometry facility
Generic Instrument Name	Accelerator Mass Spectrometer
Dataset-specific Description	All radiocarbon dates were obtained at the National Ocean Sciences Accelerator Mass Spectrometry facility (NOSAMS). Full methodology, equations, and discussion of instrumental precision are available from the NOSAMS website: http://www.whoi.edu/nosams/
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

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Deployments

BambooCoral_Hoenisch

Website	https://www.bco-dmo.org/deployment/542792
Platform	shoreside BAMBOO CORAL
Start Date	1879-01-01
End Date	2009-12-31
Description	Locations for studied bamboo corals

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Project Information

Calibration and application of the boron isotope seawater-pH indicator in deep-water corals (Bamboo Coral Boron Isotopes)

Coverage: Global sample locations

Description from NSF award abstract:
Anthropogenic CO2 enters the ocean in the high latitudes, from where it spreads into the deep ocean interior. Because carbonate ion saturation at greater water depth is generally reduced in the deep ocean, deep-sea corals may be particularly vulnerable to ocean acidification. Efforts are needed to determine the effects of changing seawater chemistry on these ecosystems, and in particular reconstructions of past pH-variations experienced by these corals may help to implement long-term management plans for deep-sea coral reefs. This project will provide new insight into the effect of changing seawater carbonate chemistry and anthropogenic ocean acidification on deep-sea coral reefs. The researchers will calibrate the boron isotope and B/Ca paleo-pH proxies in several species of modern and cultured deep-sea corals. The resulting proxy calibrations will be used to interpret the boron isotope composition of live collected and fossil deep-sea corals with regard to past ocean pH changes. Live collected corals from the North Atlantic and Southern Ocean will provide ultra-high resolution temporal records of anthropogenic CO2 invasion at intermediate depths. Radiometrically dated corals from the same locations will be used to document pH changes in the deep ocean over the last deglaciation. Comparison of paleo-pH with already established changes in coral species composition will allow interpretation of coral sensitivity to ocean acidification. The project will also improve paleo-pH reconstructions by cross- calibrating the principal techniques of boron isotope analysis.

Related Reference:
Hoenisch_ocean_acidification_2010

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1041133

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