Record of abundance and δ2H of dinosterol in down core lake sediments from T Lake, Palau collected in September 2013

Website: https://www.bco-dmo.org/dataset/771344
Data Type: Other Field Results
Version: 1
Version Date: 2019-06-19

Project
» Do Parallel Patterns Arise from Parallel Processes? (PaPaPro)

Program
» Dimensions of Biodiversity (Dimensions of Biodiversity)

Contributors	Affiliation	Role
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Abstract
Record of abundance and δ2H of dinosterol in down core lake sediments from T Lake, Palau collected in September 2013 using a 5cm-diameter Colinvaux-Vohnout Livingstone-type rod-operated piston corer.

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Coverage

Spatial Extent: **Lat**:7.3045 **Lon**:134.4385
Temporal Extent: 2013-09 - 2013-09

Dataset Description

These data are published in Table 2 of Sachs et al., 2018 (doi: 10.1029/2018PA003469)

Methods & Sampling

Methods are as per "Southward Shift of the Pacific ITCZ During the Holocene" in Paleoceanography and Paleoclimatology, volume 33, pages 1383-1395 (Sachs et al. 2018).

Sediment core PTLN-PC1 was collected September 2013 in sequential 1m sections using a 5cm-diameter Colinvaux-Vohnout Livingstone-type rod-operated piston corer (Geocore, Columbus, Ohio). Each section was sealed in the field and refrigerated at 4 °C until core splitting and subsampling.

Sample ages were linearly interpolated from calibrated 14C dates (see dataset "T Lake PC1 Chronology") using the Clam 2.2 (Blaauw, 2010) software package.

Sediment subsamples were transferred to combusted glass vials, frozen, then freeze dried. Lipids were extracted with 10% methanol in dichloromethane on an accelerated solvent extractor (ASE 200; Dionex) at 100°C and 1500 psi with three 5-min static cycles. Lipid extracts were saponified using 2:1 1N KOH in methanol:water at 70°C overnight. Saponified extracts were acidified to pH ~1 with HCl, neutral lipids extracted from the water/methanol phase with hexane, and the hexane extracts washed with water. Lipid extracts were acetylated at 70°C for 30 min in a mixture of 20 µl acetic anhydride of known isotopic composition and 20 µl pyridine. Sterol acetates were then isolated via preparative high-performance liquid chromatography as per the methods in Nelson and Sachs (2013, 2014). Extracts were taken up in 25 µl of 2:1 dichloromethane:methanol and the complete volume injected onto an Agilent 1100 high-performance liquid chromatography system equipped with a Zorbax Eclipse XDB C18 column; after an initial elution of polar compounds in 5:95 methanol:acetonitrile, sterol acetates were eluted with an isocratic mobile phase of 5:10:85 methanol:ethyl acetate:acetonitrile. Aliquots (5%) of each sample were injected on an Agilent 6890N GC with flame ionization detector and PTV inlet, equipped with an Agilent VF-17 ms column (60 m × 0.32 mm × 0.25 µm), in splitless mode at 300°C using helium carrier gas at 1.5 ml/min. The initial oven temperature was 110°C, followed by a ramp to 320°C at 5°C/min, and was then held for 20 min. Detector response was determined via an α-cholestane internal standard. Dinosterol fluxes were calculated from the product of dinosterol concentration per gram dry weight of sediment, the linear sediment accumulation rate, and the dry bulk density of sediment. Uncertainty in dinosterol fluxes is conservatively assumed to be 25%.

Hydrogen isotopes of dinosterol were measured via a modification of the procedures outlined in Nelson and Sachs (2013). Gas chromatography was conducted using a Thermo Trace GC Ultra equipped with a GC-TC interface. Samples were injected into the 330°C inlet in splitless mode, with a 1.1 ml/min helium carrier flow through a VF-17 ms column (60 m × 0.25 mm × 0.25 µm). The oven temperature was held at 120°C for the 2-min splitless time, increased to 260 °C at 20 °C/min, increased to 325°C at 1°C/min, and held for 10 min. The pyrolysis interface was operated at 1400°C, and the sample hydrogen admitted to a Thermo Delta V Plus isotope ratio mass spectrometer via open split.

Isotope measurements are given as δ^2>H values relative to Vienna Standard Mean Ocean Water and calibrated via external isotope standards (Arndt Schimmelmann, Indiana University). Secondary corrections were determined based on time-in-sequence, retention time, and peak area, as necessary, on a sequence-by-sequence basis. Each sample analyzed at least three times. δ^2H values were corrected for added acetate hydrogen (−124.4‰ ± 8.1) via mass balance. Uncertainty is given as the standard deviation of these replicate analyses and uncertainty in the value of the known acetate, propagated through the mass balance calculation.

Data Processing Description

BCO-DMO Processing: modified parameter names (changed "2H_dino" to "dino_2H" because column names cannot start with numbers)

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Data Files

File	
T_Lake_1200yr_Reconstruction.csv	(Comma Separated Values (.csv), 1.73 KB) MD5:0eeb9e95432f097907c4ad7ae0a91f9b
Primary data file for dataset ID 771344	

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Related Publications

Blaauw, M. (2010). Methods and code for “classical” age-modelling of radiocarbon sequences. Quaternary Geochronology, 5(5), 512–518. doi:10.1016/j.quageo.2010.01.002

Methods

Nelson, D. B., & Sachs, J. P. (2013). Concurrent purification of sterols, triterpenols and alkenones from sediments for hydrogen isotope analysis using high performance liquid chromatography. Organic Geochemistry, 64, 19–28. doi:10.1016/j.orggeochem.2013.09.005
Methods

Nelson, D. B., & Sachs, J. P. (2014). The influence of salinity on D/H fractionation in dinosterol and brassicasterol from globally distributed saline and hypersaline lakes. Geochimica et Cosmochimica Acta, 133, 325–339. doi:10.1016/j.gca.2014.03.007
Methods

Sachs, J. P., Blois, J. L., McGee, T., Wolhowe, M., Haberle, S., Clark, G., & Atahan, P. (2018). Southward Shift of the Pacific ITCZ During the Holocene. Paleoceanography and Paleoclimatology. doi:10.1029/2018pa003469 https://doi.org/10.1029/2018PA003469
Results

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Parameters

Parameter	Description	Units
depth_cm	composite depth, top of 1cm sampling interval	centimeters (cm)
age_ybp	linear interpolation of PTLN_PC1_chron via CLAM 2.2	years before present (yr bp)
conc_dino	dry bulk sediment density	grams per cubic centimeter (g cm-3)
dbd	dinosterol per gram dry sediment	micrograms (ug)
flux_dino	dinosterol per square centimeter per year	micrograms per square centimeter per year (ug cm-2 yr-1)
dino_2H	delta 2H (d2h) of dinosterol vs. SMOW	per mil (‰)
dino_2H_1sig	1 standard deviation of replicate analyses of 2H_dino	per mil (‰)

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Instruments

Dataset-specific Instrument Name	ASE 200 Accelerated Solvent Extractor (Dionex)
Generic Instrument Name	Accelerated Solvent Extractor
Dataset-specific Description	ASE 200 Accelerated Solvent Extractor (Dionex). High pressure/temperature solvent extractor.
Generic Instrument Description	Accelerated solvent extraction (ASE) is a method for extracting various chemicals from a complex solid or semisolid sample matrix. The process uses high temperature and pressure, which results in the extraction taking less time and requiring less solvent, and possibly also giving better analyte recovery, than traditional methods that use less extreme conditions.

Dataset-specific Instrument Name	6890N GC (Agilent)
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	6890N GC (Agilent). Gas chromatograph equipped with flame ionization detector and PTV (programmable temperature volatilization) inlet.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	Trace GC Ultra (Thermo)
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Trace GC Ultra (Thermo). Gas chromatograph equipped with pyrolysis interface (GC-TC II) and split/splitless inlet.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	1100 HPLC system (Agilent)
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	1100 HPLC system (Agilent). High performance liquid chromatograph, equipped with fraction collector for preparative separations.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	Delta V Plus IRMS (Thermo)
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Delta V Plus IRMS (Thermo). Isotope ratio mass spectrometer with continuous flow inlet, interfaced to open split in GC-TC interface.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Colinvaux-Vohnout Livingstone-type rod-operated piston corer
Generic Instrument Name	Piston Corer
Dataset-specific Description	Colinvaux-Vohnout Livingstone-type rod-operated piston corer (Geocore, Columbus, Ohio). Hand-operated sediment coring device.
Generic Instrument Description	The piston corer is a type of bottom sediment sampling device. A long, heavy tube is plunged into the seafloor to extract samples of mud sediment. A piston corer uses a "free fall" of the coring rig to achieve a greater initial force on impact than gravity coring. A sliding piston inside the core barrel reduces inside wall friction with the sediment and helps to evacuate displaced water from the top of the corer. A piston corer is capable of extracting core samples up to 90 feet in length.

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Deployments

Palau_lakes

Website	https://www.bco-dmo.org/deployment/542180
Platform	Small boats - CRRF
Start Date	2010-08-21
End Date	2016-06-14
Description	Palau marine lakes

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Project Information

Do Parallel Patterns Arise from Parallel Processes? (PaPaPro)

Website: http://marinelakes.ucmerced.edu/

Coverage: Western Pacific; Palau; Indonesia (West Papua)

This project will survey the taxonomic, genetic, and functional diversity of the organisms found in marine lakes, and investigate the processes that cause gains and losses in this biodiversity. Marine lakes formed as melting ice sheets raised sea level after the last glacial maximum and flooded hundreds of inland valleys around the world. Inoculated with marine life from the surrounding sea and then isolated to varying degrees for the next 6,000 to 15,000 years, these marine lakes provide multiple, independent examples of how environments and interactions between species can drive extinction and speciation. Researchers will survey the microbes, algae, invertebrates, and fishes present in 40 marine lakes in Palau and Papua, and study how diversity has changed over time by retrieving the remains of organisms preserved in sediments on the lake bottoms. The project will test whether the number of species, the diversity of functional roles played by organisms, and the genetic diversity within species increase and decrease in parallel; whether certain species can greatly curtail diversity by changing the environment; whether the size of a lake determines its biodiversity; and whether the processes that control diversity in marine organisms are similar to those that operate on land.

Because biodiversity underlies the ecosystem services on which society depends, society has a great interest in understanding the processes that generate and retain biodiversity in nature. This project will also help conserve areas of economic importance. Marine lakes in the study region are important for tourism, and researchers will work closely with governmental and non-governmental conservation and education groups and with diving and tourism businesses to raise awareness of the value and threats to marine lakes in Indonesia and Palau.

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)
Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010 was year one of the program. [MORE from NSF]

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a

broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1241255
NSF Division of Ocean Sciences (NSF OCE)	OCE-1241247

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