

Alkenones and nutrients from water column samples collected at the Chatham Rise, east of New Zealand, on R/V Tangaroa cruises TAN0804, TAN0902, and TAN0909 from 2008-2009

Website: <https://www.bco-dmo.org/dataset/1008819>

Data Type: Cruise Results

Version: 1

Version Date: 2026-10-02

Project

» [Collaborative Research: Controls on Alkenone Temperature Estimates in Subtropical and Subpolar Waters](#)
(NZ alkenones)

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Abstract

Non-thermal factors such as nutrient availability and light can influence the alkenone unsaturation index, UK-37, and introduce uncertainty into sea-surface temperature (SST) reconstructions based on this proxy. We investigated the effects of nutrient concentrations on alkenone unsaturation and UK-37-derived temperatures in natural populations of alkenone-producing haptophytes across the Chatham Rise, east of New Zealand. Water-column samples were collected during three seasons from subtropical and subpolar sites representing contrasting low- and high-nutrient regimes.

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Coverage

Location: Chatham Rise, east of New Zealand

Spatial Extent: N:-41.78 E:178.5 S:-46.67 W:178.5

Temporal Extent: 2008-04-29 - 2009-10-30

Methods & Sampling

Cruises and sample Collection:

Study locations were selected based on the positions of New Zealand's National Institute for Water and Atmospheric Research (NIWA) long-term biophysical moorings, deployed along 178°30'E in two major surface-water masses. The Subtropical Mooring (STM) was situated in subtropical waters at 41°47'S with an annual SST range of 14 to 18 degrees Celsius (°C), whereas the Subantarctic Mooring (SAM), located at 46°40'S, lay within subantarctic waters where annual SSTs range from 10 to 14 °C. A third site was located on the crest of the Chatham Rise (CR), positioned just north of the Subtropical Front (STF).

Water-column particle samples for this study were collected aboard the NIWA vessel *Tangaroa* during three cruises: TAN0804 in April 2008 (autumn), TAN0902 in February 2009 (summer), and TAN0909 in October 2009 (spring). Additional casts were conducted on the crest of the Chatham Rise during the autumn (43.43°S, 178.5°E) and spring (43.40°S, 178.5°E).

Methods & Sampling:

A Seabird 911plus CTD rosette was used to collect 60 to 100 liters (L) of seawater throughout the surface mixed layer and thermocline by closing multiple Niskin bottles at targeted depths. Water samples for alkenone analysis were filtered onto 142-millimeter (mm) GF/F filters and stored frozen until processing.

Frozen, filtered samples were extracted using an Accelerated Solvent Extractor (Dionex ASE 200) with a 4:1 dichloromethane:methanol solvent mixture, following procedures modified from Sikes et al. (1997) and (Sikes et al., 2009). Alkenone recovery using this approach is estimated at ~95% (Shin et al., 2002).

Extracts were saponified in 5% KOH in methanol, and the neutral fraction containing the alkenones was isolated by partitioning into a hexane-chloroform mixture. Saponification removes fatty acids that elute in the sterol region, which simplifies compound identification and eliminates the co-elution of the C37 tri-unsaturated fatty acid methyl ester, thereby improving quantification (Sikes and Volkman, 1993; Sikes et al., 1997). The purified neutral fraction was analyzed by capillary gas chromatography (GC) on a Shimadzu GC-17 equipped with an autosampler, cooled on-column injector, and flame-ionization detector.

BCO-DMO Curation Notes

This section documents curation actions performed prior to publication review with the submitter, and additional information relevant to understanding and reusing this dataset. It distinguishes changes made to the submitted (meta)data from unresolved issues and/or enhancements that improve future reuse and interoperability.

CURATION ACTIONS PERFORMED ON DATA

- Imported original file "NZ alkenone data 2026 4BCO-DMO.xlsx" (sheet 1) into the BCO-DMO data processing system.
- Treated "NaN" and "NaNN" as missing data values (missing data are empty/blank in the final CSV file).
- Renamed columns to comply with BCO-DMO naming conventions.
- Added column "longitude", setting value "178°30'E" for all rows.
- Converted latitude from degrees-decimal_minutes format to decimal degrees South.
- Converted longitude from degrees-decimal_minutes format to decimal degrees East.
- Rounded latitude and longitude to 2 decimal digits (maximum precision).
- Converted Date column to format %Y-%m-%d.
- Saved the final file as "1008819_v1_nz_alkenones.csv".

CURATION ACTIONS PERFORMED ON METADATA

- BCO-DMO's standard metadata entry and text formatting steps were performed. See: <https://www.bco-dmo.org/how-to/standard-curation-edits>

ISSUES POTENTIALLY IMPACTING REUSE

- N/A

Data Files

File
1008819_v1_nz_alkenones.csv (Comma Separated Values (.csv), 5.36 KB) MD5:8eb0c43b24524f5f1bf11442a91cf460
Primary data file for dataset ID 1008819, version 1

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Related Publications

Popp, B. N., Prah, F. G., Wallsgrove, R. J., & Tanimoto, J. (2006). Seasonal patterns of alkenone production in the subtropical oligotrophic North Pacific. *Paleoceanography*, 21(1). Portico.

<https://doi.org/10.1029/2005PA001165>

Methods

Shin, K.-H., Tanaka, N., Harada, N., & Marty, J.-C. (2002). Production and turnover rates of C37 alkenones in the eastern Bering Sea: implication for the mechanism of a long duration of *Emiliania huxleyi* bloom. *Progress in Oceanography*, 55(1-2), 113-129. [https://doi.org/10.1016/s0079-6611\(02\)00073-3](https://doi.org/10.1016/s0079-6611(02)00073-3)

Methods

Sikes, E. L., & Volkman, J. K. (1993). Calibration of alkenone unsaturation ratios (UK'37) for paleotemperature estimation in cold polar waters. *Geochimica et Cosmochimica Acta*, 57(8), 1883-1889.

[https://doi.org/10.1016/0016-7037\(93\)90120-L](https://doi.org/10.1016/0016-7037(93)90120-L)

Methods

Sikes, E. L., Uhle, M. E., Nodder, S. D., & Howard, M. E. (2009). Sources of organic matter in a coastal marine environment: Evidence from n-alkanes and their $\delta^{13}\text{C}$ distributions in the Hauraki Gulf, New Zealand. *Marine Chemistry*, 113(3-4), 149-163. <https://doi.org/10.1016/j.marchem.2008.12.003>

Methods

Sikes, E. L., Volkman, J. K., Robertson, L. G., & Pichon, J.-J. (1997). Alkenones and alkenes in surface waters and sediments of the Southern Ocean: Implications for paleotemperature estimation in polar regions.

Geochimica et Cosmochimica Acta, 61(7), 1495-1505. [https://doi.org/10.1016/s0016-7037\(97\)00017-3](https://doi.org/10.1016/s0016-7037(97)00017-3)

Methods

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Parameters

Parameter	Description	Units
Site	Site. STM = Subtropical Mooring and SAM = Subantarctic Mooring.	unitless
latitude	site latitude	decimal degrees
longitude	site longitude	decimal degrees
depth	depth	meters
Cruise	voyage/cruise ID number on R/V Tangaroa during: TAN0804, TAN0902, or TAN0909.	unitless

Date	sample collection date	unitless
measured_T	temperature	degrees Celsius
UK37	alkenone unsaturation index	unitless
Diff_UK37T	The difference between measured T and reconstructed T in degrees C	degrees Celsius
Prod	how fast are they growing	nanogram per liter per day (ng-L/day)
Error_Prod	This is a propagation of error calculation. See Popp et al 2006 (below) for detailed methods. The equation is detailed there. Popp, B. N., F. G. Prahl, R. J. Wallsgrave, and J. Tanimoto (2006), Seasonal patterns of alkenone production in the subtropical oligotrophic North Pacific, Paleoceanography, 21, doi: 10.1029/2005PA001165 .	nanogram per liter per day (ng-L/day)
K37_2_3	(SUM) K37:2+K37:3 (sum of the two compounds, K37:2 and K37:3)	nanogram per liter (ng/L)
Avg_PARz	light level	micromoles per square meter per second (umol.m-2.s-1)
Redfield_Ratio	ratio of N to P	unitless
NO3_avg	average concentration of NO3 from multiple sample replicates; the number of replicates varies and was not recorded.	micromoles per liter (umol/L)
PO4_Avg	average concentration of PO4 from multiple sample replicates; the number of replicates varies and was not recorded.	micromoles per liter (umol/L)

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Instruments

Dataset-specific Instrument Name	Dionex ASE 200
Generic Instrument Name	Accelerated 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	Shimadzu GC-17
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Shimadzu GC-17 equipped with an autosampler, cooled on-column injector, and flame-ionization detector
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	Niskin bottles
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Seabird 911plus
Generic Instrument Name	Sea-Bird SBE 911plus CTD
Generic Instrument Description	[tethered, real-time] The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

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Deployments

TAN0909

Website	https://www.bco-dmo.org/deployment/1008835
Platform	R/V Tangaroa
Start Date	2009-10-25
End Date	2009-11-01

TAN0902

Website	https://www.bco-dmo.org/deployment/1008834
Platform	R/V Tangaroa
Start Date	2009-01-27
End Date	2009-02-05

TAN0804

Website	https://www.bco-dmo.org/deployment/1008833
Platform	R/V Tangaroa
Start Date	2008-04-27
End Date	2008-05-04

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Project Information

Collaborative Research: Controls on Alkenone Temperature Estimates in Subtropical and Subpolar Waters (NZ alkenones)

Coverage: Southwest Pacific Subtropical and Sub-Antarctic waters

NSF Award Abstract:

The subtropical front (STF) is the northern boundary of the Southern Ocean, separating oligotrophic, warm subtropical surface waters north of the STF from cooler, nutrient-rich, subpolar waters to the south. East of New Zealand, the STF is bathymetrically anchored to the Chatham Rise, a 1000 km long submerged continental plateau. The National Institute of Water and Atmospheric Research (NIWA), New Zealand, maintains two sediment trap arrays only 200 km apart on the Chatham Rise. The traps, although closely spaced, sit just out of the axis of the STF and thus allow comparison of subtropical and subpolar waters under similar environmental conditions such as weather and light levels over the annual cycle without the complication of frontal migrations.

In this project, researchers at Rutgers University and the University of Hawaii will examine at these sites the processes involved in the formation of the proxies on which paleo-sea surface temperatures (SST) records are based and resolve the issue of differential seasonality between the organisms which are arguably two of the most important paleotemperature estimators now in use (e.g. U37 K ' accuracy, foraminiferal $\delta^{18}\text{O}$ values). The principle hypotheses to be tested are:

1. Episodic delivery of alkenones and foraminifera exported from the surface mixed layer are the underlying cause of differences between alkenone and foraminiferal temperature reconstructions.
2. Nutrient depletion in subtropical waters during summer months and subsurface production during prolonged winter darkness in subpolar waters are important environmental influences controlling the accuracy of U 37 K ' SST reconstructions.

Efforts in this work primarily and actively address the broader impact criteria of enhancing infrastructure for research. Collaborations among United States, New Zealand, and European scientists represent a significant investment in outreach with international colleagues by the US PI's. The combined results will enhance the research of all members by disseminating shared data widely and serve to stimulate future partnerships. Additionally, training of students who will take central roles in this research addresses advancing training and learning. Better quantification of SST records will benefit paleoclimatic reconstructions and thus have societal

benefits.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0726048

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