

Water column (community) respiration rates from changes in DO in incubations from samples collected on R/V Knorr cruise KN207-03 in the North Atlantic (transect from Ponta Delgada, Azores to Reykjavik, Iceland) in 2012 (NA-VICE project)

Website: <https://www.bco-dmo.org/dataset/556400>

Version: 20 April 2015

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Project

» [Lipid lubrication of oceanic carbon and sulfur biogeochemistry via a host-virus chemical arms race](#) (NA-VICE)

Program

» [Ocean Carbon and Biogeochemistry](#) (OCB)

Contributors	Affiliation	Role
Van Mooy, Benjamin A.S.	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Collins, James	Woods Hole Oceanographic Institution (WHOI)	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Water column (community) respiration rates from changes in DO in incubations.

Methods & Sampling

Refer to Collins et al., *Global Biogeochem. Cycles* (2015), in review. Excerpted from methods section:

Estimates of aerobic respiration by the water column microbial community (WCR) were calculated by linear regression of measurements of dissolved oxygen concentration in a series of 300 mL shipboard bottle incubations. Determination of dissolved oxygen was made at 3- to 9-hour intervals in at least five replicates using optode spot minisensors (PreSens PSt3; Precision Sensing GmbH, Regensburg, Germany) that were glued to the inside surfaces of the bottles using food-quality silicone cement (M Warkentin et al., 2007). The use of these optode spots eliminated the need for drawing of aliquots from the sample bottles. Incubations were conducted in the dark at in situ temperature as described in Edwards et al. (2011). We validated the rates from these incubations using a series of Winkler titrations; methods are described in the Auxiliary Material to Collins et al. (2015). We used the standard error of the slope parameter from these regressions as the uncertainty in our estimates of WCR.

References:

Collins, J. R., B. R. Edwards, K. Thametrakoln, J. E. Ossolinski, G. R. DiTullio, K. D. Bidle, S. C. Doney, and B. A. S.

Van Mooy (2015), The multiple fates of sinking particles in the North Atlantic Ocean, *Global Biogeochem. Cycles*, in review.

Edwards, B. R., C. M. Reddy, R. Camilli, C. A. Carmichael, K. Longnecker, and B. A. S. Van Mooy (2011), Rapid microbial respiration of oil from the Deepwater Horizon spill in offshore surface waters of the Gulf of Mexico, *Environmental Research Letters*, 6(3), doi:[10.1088/1748-9326/6/3/035301](https://doi.org/10.1088/1748-9326/6/3/035301).

Warkentin, M., H. M. Freese, U. Karsten, and R. Schumann (2007), New and fast method to quantify respiration rates of bacterial and plankton communities in freshwater ecosystems by using optical oxygen sensor spots, *Appl. Environ. Microbiol.*, 73(21), 6722-6729, doi:[10.1128/Aem.00405-07](https://doi.org/10.1128/Aem.00405-07).

Data Processing Description

BCO-DMO processing notes:

- Modified parameter names to conform with BCO-DMO naming conventions.
- Modified format of date/time to fit ISO8601 format.
- Replaced blanks (missing data) and 'NaN' with 'nd' to indicate 'no data'.

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Data Files

File
KN207-03_resp.csv (Comma Separated Values (.csv), 1.92 KB) MD5:06e747f06d7c4bb6ba1bf66364b3d66e
Primary data file for dataset ID 556400

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Parameters

Parameter	Description	Units
station_ctd	CTD station number.	dimensionless
depth	Sample depth.	meters
incub_temp	Incubation temperature.	degrees Celsius (C)
lat_CTD	Latitude of CTD station.	decimal degrees
lon_CTD	Longitude of CTD station.	decimal degrees
delta_O2	Delta O2.	millimoles O2 per cubic meter per day (mmol O2 m-3 d-1)
delta_O2_stdev	Standard deviation of delta O2.	millimoles O2 per cubic meter per day (mmol O2 m-3 d-1)
mean_R2	Mean r-squared value of regressions DO on time.	dimensionless
ISO_DateTime_UTC	Date and time, UTC, (from CTD timestamp) formatted to ISO 8601 standard. T represents the start of the time string and Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.xxZ

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Deployments

KN207-03

Website	https://www.bco-dmo.org/deployment/58868
Platform	R/V Knorr
Start Date	2012-06-15
End Date	2012-07-14
Description	Description from the WHOI Cruise Synopsis: The 30 day "NA-VICE" (North Atlantic Virus Infection of Coccolithophores Expedition) cruise in June-July 2012 aboard the R/V Knorr followed a transect from Ponta Delgada, Azores to Reykjavik, Iceland. The goal for this cruise was to transect the region of the NEA spring bloom and to extensively sample the bloom when it is encountered. The cruise track was modeled after a recent study in this area that documented intense coccolithophore (and other haptophyte) blooms across Rockall Hatton Plateau to the Iceland Basin (55-63°N latitude) and coincided with elevated POC and TEP. The science plan calls for sampling of 12 water depths at 20 station locations. In addition, three stations were occupied for several days to allow opportunities for extended experiments and sinking particulate carbon collection and flux determination. Given that the timing of the bloom is difficult to predict exactly, the precise cruise track was determined by remote sensing data (satellite and autonomous glider from Rutgers) analyzed by the PIs a few days before and during the cruise. The cruise was supported by NSF award OCE-1061883. Additional cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Lipid lubrication of oceanic carbon and sulfur biogeochemistry via a host-virus chemical arms race (NA-VICE)

Coverage: North Atlantic; Azores to Iceland

This project is also called "**NA-VICE**" (North Atlantic Virus Infection of Coccolithophores Expedition).

Project description from NSF award abstract:

Despite the critical importance of viruses in shaping marine microbial ecosystems, very little is known about the molecular mechanisms mediating phytoplankton-virus interactions. As a consequence, we currently lack biomarkers to quantify active viral infection in the oceans, significantly hindering our understanding of its ecological and biogeochemical impacts.

The coccolithophore *Emiliania huxleyi* (Prymnesiophyceae, Haptophyte) is a cosmopolitan unicellular photoautotroph whose calcite skeletons account for about a third of the total marine CaCO₃ production. *E. huxleyi* forms massive annual spring blooms in the North Atlantic that are infected and terminated by lytic, giant double-stranded DNA containing coccolithoviruses. Findings that lytic viral infection of *E. huxleyi* recruits the hosts programmed cell death (PCD) machinery demonstrate that viruses employ a sophisticated, co-evolutionary "arms race" in mediating host-virus interactions. The investigators recently demonstrated that viral glycosphingolipids (vGSLs), derived from unexpected cluster of sphingolipid biosynthetic genes, a pathway never before described in a viral genome, play a crucial functional role in facilitating infection of *E. huxleyi*. The observations of vGSLs in the North Atlantic and Norwegian fjords further suggest that they may be novel, diagnostic biomarkers for viral infection of coccolithophore populations. At the same time, the discovery of vGSLs and a distinct, protective 802 lipid argues that a host-virus, co-evolutionary chemical arms race plays a pivotal role in regulating viral infection and in lubricating upper ocean biogeochemical fluxes of carbon and sulfur.

The focus of this collaborative research project is to elucidate the molecular, ecological, and biogeochemical links between vGSLs (and other polar lipids) and the global cycles of carbon and sulfur.

The team of investigators proposes a multi-pronged approach combining a suite of lab-based, mechanistic

studies using several haptophyte-virus model systems along with observational studies and manipulative field-based experiments the Northeast Atlantic. Using these diagnostic markers, they will document active viral infection of natural coccolithophore populations and couple it with a suite of oceanographic measurements in order to quantify how viral infection (via vGSLs) influences cell fate, the dissolved organic carbon (DOC) pool, vertical export of particular organic (POC) and inorganic carbon (PIC; as calcium carbonate, CaCO₃) (along with associated alkenone lipid biomarkers and genetic signatures of viruses and their hosts) and the upper ocean sulfur cycle (via the cycling of dimethylsulfide [DMS] and other biogenic sulfur compounds). Furthermore, given they are unique to viruses, the investigators propose that vGSLs can be used to trace the flow of virally-derived carbon and provide quantitative insights into a “viral shunt” that diverts fixed carbon from higher trophic levels and the deep sea.

The overarching hypothesis for this study is that vGSLs are cornerstone molecules in the upper ocean, which facilitate viral infection on massive scales and thereby mechanistically "lubricate" the biogeochemical fluxes of C and S in the ocean.

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: <http://us-ocb.org/>

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO₂ and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1059884

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