Niskin bottle metadata and environmental measurements associated with bacterial DNA samples collected from January to February 2022 during RVIB Nathaniel B. Palmer cruise NBP 22-02 in the Amundsen Sea Embayment

Website: https://www.bco-dmo.org/dataset/1004881
Data Type: Cruise Results
Version: 1
Version Date: 2026-08-13

Project
» NSFGEO-NERC: Collaborative Research: Accelerating Thwaites Ecosystem Impacts for the Southern Ocean (ARTEMIS) (ARTEMIS)

Contributors	Affiliation	Role
Yager, Patricia Lynn	University of Georgia (UGA)	Principal Investigator
Sherrell, Robert M.	Rutgers University	Co-Principal Investigator
Stammerjohn, Sharon E.	University of Colorado at Boulder	Co-Principal Investigator
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Abstract
This dataset provides water column environmental data for a study that explored the relationships between glacial meltwater-modified ocean circulation, iron supply, and pelagic bacterial community structure in the Amundsen Sea polynya (ASP), Antarctica. Onboard the RVIB Nathaniel B. Palmer, cruise NBP 22-02, January–March 2022, we examined particle-associated (3-micrometer (µm) polycarbonate pre-filter) and free-living (0.2 µm Durapore filter) bacterial 16S rRNA in seawater from 21 stations (at depths from 2 to 1271 meters (m)) in the context of a suite of ocean observations along the "iron conveyor belt." This key circulation pathway follows Circumpolar Deep Water cascading from the Antarctic Circumpolar Current, along the bottom of the fore-deepened continental shelf toward the deep ice shelf cavity, where it melts the base of the ice shelf, then buoyantly upwells via meltwater entrainment, and delivers iron-rich waters to the surface waters of the polynya. A coastal current also transports this and other meltwater-rich outflows from east to west, and may play an important role in fueling ecosystem production. We were able to sample key water masses: Antarctic Surface Water (AASW), Winter Water (WW), Circumpolar Deep Water (CDW), and modified/mixed variants. Measured environmental parameters in this dataset are CTD variables (temperature, salinity, pressure, dissolved oxygen, beam transmissivity, fluorescence), macronutrients (nitrate, nitrite, ammonium, phosphate), lab chlorophyll a, micronutrient dissolved iron, $\delta^{18}O$, and calculated meltwater fractions. Results from this dataset, combined with 16S rRNA amplicon data, revealed distinct bacterial communities, characterized by location within the ASP, suggesting community succession along the route.

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Coverage

Location: Amundsen Sea, coastal western Antarctic
Spatial Extent: **N**:-72 **E**:-110.086 **S**:-74.393 **W**:-119.399
Temporal Extent: 2022-01-15 - 2022-02-25

Methods & Sampling

Water samples were collected aboard R/V Nathaniel B. Palmer during NBP 22-02 (January to March 2022) in the Amundsen Sea, Antarctica. Water sampling was conducted with a profiling rosette of 24 12-liter (L) Niskin bottles equipped with an SBE 911CTD (conductivity-temperature-depth recorder; Sea-Bird Scientific, Bellevue, WA, USA) with additional chlorophyll a (Chl-a) fluorescence (ECO FLRTD-1482; WETLabs, Philomath, OR, USA) and dual dissolved oxygen sensors (SBE43 Sea-Bird Scientific, Bellevue, WA, USA). At each of 21 stations (January 15 - February 25, 2022), seawater samples were collected by Niskin bottle from 3 to 6 depths (2 to 1271 meters (m)), including Antarctic Surface Water (AASW) within the surface mixed layer, intermediate Winter Water (WW), and near-bottom Circumpolar Deep Water (CDW; Randall-Goodwin et al., 2015).

Nutrient samples for nitrate, nitrite, ammonia, and phosphate were collected at the same stations and depths from the profiling rosette/CTD used to collect DNA samples, filtered (0.45-micrometer (µm)), frozen (-80 degrees Celsius), and analyzed at the Oceanographic Data Facility (ODF) Chemistry Laboratory at Scripps Institution of Oceanography, University of California San Diego (Becker et al., 2019). Water column Chl a samples were filtered onto 45-millimeter (mm) GFF filters, dried, and flash frozen (-80 degrees Celsius), and transported back to Georgia where the concentration was measured using acetone extraction and a spectrofluorometer (Knap et al., 1994). Meltwater fraction was determined using oxygen isotope ratios of seawater samples collected and measured (British Antarctic Survey; Meredith et al., 2008) in combination with temperature, salinity, and dissolved oxygen (Randall-Goodwin et al., 2015). Dissolved iron (dFe) samples were also collected at similar stations and depths (using a Trace-Metal Clean CTD that was deployed immediately after the conventional CTD) and analyzed by the Sherrell lab at Rutgers University using standard protocols (Sherrell et al., 2015; Chinni et al., 2026).

BCO-DMO Processing Description

- Imported original file "ARTEMIS_DNA_METADATA_FINAL.csv" into the BCO-DMO processing system.
- Flagged "na" as a missing data value (note: missing data are empty/blank in the final CSV file).
- Renamed columns to comply with BCO-DMO naming conventions.
- Converted Date column from string format %m/%d/%y to date type with output format %Y-%m-%d.
- Renamed column "In_situ_Fluorescense_mg_m3" to "In_situ_Fluorescence_mg_m3" and "Amonium_umol_L" to "Ammonium_umol_L" to correct spelling.
- Saved the final data file as "1004881_v1_artemis_dna_metadata.csv".

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Data Files

File	
1004881_v1_artemis_dna_metadata.csv	(Comma Separated Values (.csv), 69.00 KB) MD5:59cd3ad1e7e93cb7b5254ed72a19a403
Primary data file for dataset ID 1004881, version 1	

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Related Publications

Bartlett, S. (2024). Bacterial community structure in the Amundsen Sea Polynya, Antarctica [Master's thesis, University of Georgia]. UGA Open Scholar. https://openscholar.uga.edu/record/26641
Results

Becker, S., Aoyama, M., Woodward, E. M. S., Bakker, K., Coverly, S., Mahaffey, C., & Tanhua, T. (2019/2020).

GO-SHIP Repeat Hydrography Nutrient Manual: The Precise and Accurate Determination of Dissolved Inorganic Nutrients in Seawater, Using Continuous Flow Analysis Methods. Frontiers in Marine Science, 7. https://doi.org/10.3389/fmars.2020.581790
Methods

Chinni, V., Steffen, J. M., Stammerjohn, S. E., St-Laurent, P., Herbert, L. C., Yager, P. L., Conway, T. M., Fitzsimmons, J. N., & Sherrell, R. M. (2026). Iron supply to the Amundsen Sea, Antarctica is dominated by circumpolar deepwater and continental subglacial sources. Communications Earth & Environment, 7(1). https://doi.org/10.1038/s43247-026-03264-x
Methods

JGOFS (1996). Protocols for the Joint Global Ocean Flux Study (JGOFS) core measurements. In: Knap, A. (Ed.), Report no. 19 of the Joint Global Ocean Flux Study. Scientific committee on oceanic research, international council of scientific unions. Intergovernmental Oceanographic Commission, Bergen, Norway, p. 170.
Methods

Meredith, M. P., Brandon, M. A., Wallace, M. I., Clarke, A., Leng, M. J., Renfrew, I. A., van Lipzig, N. P. M., & King, J. C. (2008). Variability in the freshwater balance of northern Marguerite Bay, Antarctic Peninsula: Results from δ18O. Deep Sea Research Part II: Topical Studies in Oceanography, 55(3-4), 309–322. https://doi.org/10.1016/j.dsr2.2007.11.005
Methods

Randall-Goodwin, E., Meredith, M. P., Jenkins, A., Yager, P. L., Sherrell, R. M., Abrahamsen, E. P., Guerrero, R., Yuan, X., Mortlock, R. A., Gavahan, K., Alderkamp, A.-C., Ducklow, H., Robertson, R., & Stammerjohn, S. E. (2015). Freshwater distributions and water mass structure in the Amundsen Sea Polynya region, Antarctica. Elementa: Science of the Anthropocene, 3. https://doi.org/10.12952/journal.elementa.000065
Methods

Sherrell, R. M., Lagerström, M. E., Forsch, K. O., Stammerjohn, S. E., & Yager, P. L. (2015). Dynamics of dissolved iron and other bioactive trace metals (Mn, Ni, Cu, Zn) in the Amundsen Sea Polynya, Antarctica. Elementa: Science of the Anthropocene, 3, 000071. doi:10.12952/journal.elementa.000071
Methods

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Parameters

Parameter	Description	Units
Sample_ID	Name of DNA sample	unitless
ARTEMIS_ID	Unique Niskin bottle identifier	unitless
Station	Station number	unitless
Event	Event number	unitless
CTD	Conventional CTD Cast number	unitless
NISKIN	Niskin Bottle number (1-24)	unitless
Date	Date sampled (GMT)	unitless
VolumeFiltered_L	Volume of water filtered for DNA Sample	liters

FilterDiameter_mm	Diameter of filter used	millimeters
FilterType	Type of filter used	unitless
FilterPoreSize_um	Pore size of filter	micrometers
Community	Designation of sample as 'free-living', 'particle-associated', or both, according to filter and pre-filter pore size.	unitless
DepthThreshold	Designation of water column region samples	unitless
Watermass	Designation of water mass based on Temperature and Salinity	unitless
Location	Designation of sample based on general location in the region	unitless
Latitude	Latitude	degrees
Longitude	Longitude	degrees
Pressure_db	Water pressure of sample	decibars
Depth_m	Water depth of sample	meters
InsituTemp_C	In situ temperature	degrees C
PracticalSalinity	Practical Salinity	(psu) or unitless
PotentialTemp_C	Potential Temperature	degrees C
AbsoluteSalinity_g_kg	Absolute Salinity	gram per kilogram seawater
Potential_Density_Anomaly_kg_m3	Potential Density Anomaly	kilograms per cubic meter seawater
Dissolved_Oxygen_ml_L	Dissolved Oxygen	milliliters per liter seawater
Beam_Transmissivity_pcnt	Beam Transmissivity	percent (%)

In_situ_Fluorescence_mg_m3	In situ fluorescence	milligrams per cubic meter seawater
Nitrate_umol_L	Nitrate concentration	micromole per liter seawater
Phosphate_umol_L	Phosphate concentration	micromole per liter seawater
Nitrite_umol_L	Nitrite concentration	micromole per liter seawater
Ammonium_umol_L	Ammonium concentration	micromole per liter seawater
Lab_Chlorophyll_a_ug_L	Chlorophyll a concentration measured in the lab	microgram per liter seawater
Dissolved_Iron_nmol_kg	Dissolved iron concentration	nanomole per kilogram seawater
delO18_ppt	Oxygen 18 to Oxygen 16 ratio relative to a standard	parts per thousand
Fraction_CDW_pcnt	Calculated fraction of circumpolar deep water	percent
Fraction_Sea_Ice_Melt_pcnt	Calculated fraction of sea ice melt	percent
Fraction_Meteoric_pcnt	Calculated fraction of meteoric water	percent
meltwater_fraction_TS_pcnt	meltwater fraction calculated using Temperature and Salinity	percent
Meltwater_Fraction_O2S_pcnt	meltwater fraction calculated using dissolved oxygen and Salinity	percent
Meltwater_Fraction_O2T_pcnt	meltwater fraction calculated using dissolved oxygen and temperature	percent

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Instruments

Dataset-specific Instrument Name	Seal Analytical continuous-flow AutoAnalyzer 3 (AA3)
Generic Instrument Name	Bran+Luebbe / SEAL Analytical AutoAnalyzer 3 (AA3) continuous-flow analyzer
Dataset-specific Description	Nutrient analyses are performed at Scripps on a Seal Analytical continuous-flow AutoAnalyzer 3 (AA3).
Generic Instrument Description	The AutoAnalyzer 3 (AA3) is a segmented continuous-flow analyzer (continuous flow analyzer, CFA) used for automated colorimetric analysis of dissolved nutrients and other analytes in environmental, seawater, freshwater, wastewater, soil, and agricultural samples. The AA3 was originally manufactured by Bran+Luebbe and, following acquisition of the product line in 2006, has continued to be manufactured and supported by SEAL Analytical. The AA3 is the third-generation instrument in the Technicon AutoAnalyzer family and is widely used for determination of nitrate, nitrite, ammonium, phosphate, silicate, and other dissolved nutrients. See the description from the manufacturer.

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Water sampling was conducted with a profiling rosette of 24 12-L Niskin bottles.
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	SBE 43 oxygen (O2) sensors
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	The sensor suite for each comprised dual SBE temperature (T), conductivity (C), and SBE 43 oxygen (O2) sensors, a WET Labs ECO-AFL/FL fluorometer, and a C-Star transmissometer. Post-cruise corrections were applied to the dual T/C/O2 sensors based on Seabird pre- and post-cruise calibrations and discrete-depth O2 titrations performed during NBP2202.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. More information from the manufacturer: https://www.seabird.com/products/sbe-43-dissolved-oxygen-sensor

Dataset-specific Instrument Name	Seabird 911+
Generic Instrument Name	Sea-Bird SBE 9plus CTD
Dataset-specific Description	Hydrographic variables were measured with the use of a CTD/rosette system. The conventional (CNV) package included a Seabird 911+ system on a 24-bottle SBE32 rosette.
Generic Instrument Description	High precision and accuracy CTD comprising an SBE 9plus underwater unit (SBE 3plus temperature, SBE 4C conductivity, and Paroscientific Digiquartz pressure sensors, and an SBE 5T submersible pump). Can be used for either real-time data acquisition or for autonomous operations at a sampling speed of up to 24 Hz. The instrument package also includes a TC duct, to reduce salinity spiking caused by ship heave for improved resolution of water column features, and to ensure that temperature and conductivity measurements are made on the same parcel of water. Supplied with both an aluminium and titanium main housing, allowing for use up to 6800 and 10,500 metre depths respectively. Also capable of measuring from eight auxiliary sensors.

Dataset-specific Instrument Name	dual SBE temperature (T) sensors
Generic Instrument Name	Sea-Bird SBE-3 Temperature Sensor
Dataset-specific Description	Hydrographic variables were measured with the use of a CTD/rosette system. The conventional (CNV) package included a Seabird 911+ system on a 24-bottle SBE32 rosette. The sensor suite for each comprised dual SBE temperature (T), conductivity (C), and SBE 43 oxygen (O2) sensors, a WET Labs ECO-AFL/FL fluorometer, and a C-Star transmissometer. Post-cruise corrections were applied to the dual T/C/O2 sensors based on Seabird pre- and post-cruise calibrations and discrete-depth O2 titrations performed during NBP2202.
Generic Instrument Description	The SBE-3 is a slow response, frequency output temperature sensor manufactured by Sea-Bird Electronics, Inc. (Bellevue, Washington, USA). It has an initial accuracy of +/- 0.001 degrees Celsius with a stability of +/- 0.002 degrees Celsius per year and measures seawater temperature in the range of -5.0 to +35 degrees Celsius. More information from Sea-Bird Electronics: https://www.seabird.com/products/sbe-3-oceanographic-temperature-sensor

Dataset-specific Instrument Name	dual SBE conductivity (C) sensors
Generic Instrument Name	Sea-Bird SBE-4 Conductivity Sensor
Dataset-specific Description	Hydrographic variables were measured with the use of a CTD/rosette system. The conventional (CNV) package included a Seabird 911+ system on a 24-bottle SBE32 rosette. The sensor suite for each comprised dual SBE temperature (T), conductivity (C), and SBE 43 oxygen (O2) sensors, a WET Labs ECO-AFL/FL fluorometer, and a C-Star transmissometer. Post-cruise corrections were applied to the dual T/C/O2 sensors based on Seabird pre- and post-cruise calibrations and discrete-depth O2 titrations performed during NBP2202.
Generic Instrument Description	The Sea-Bird SBE-4 conductivity sensor is a modular, self-contained instrument that measures conductivity from 0 to 7 Siemens/meter. The sensors (Version 2; S/N 2000 and higher) have electrically isolated power circuits and optically coupled outputs to eliminate any possibility of noise and corrosion caused by ground loops. The sensing element is a cylindrical, flow-through, borosilicate glass cell with three internal platinum electrodes. Because the outer electrodes are connected together, electric fields are confined inside the cell, making the measured resistance (and instrument calibration) independent of calibration bath size or proximity to protective cages or other objects.

Dataset-specific Instrument Name	SBE32 rosette
Generic Instrument Name	Seabird SBE 32 Carousel Water Sampler
Dataset-specific Description	Hydrographic variables were measured with the use of a CTD/rosette system. The conventional (CNV) package included a Seabird 911+ system on a 24-bottle SBE32 rosette.
Generic Instrument Description	The SBE 32 is a Carousel Water Sampler. With an accessory Deck Unit, the Carousel provides water sampling and real-time CTD data acquisition with any Sea-Bird profiling CTD (requires electro-mechanical cable and slip-ring equipped winch). With an accessory underwater unit, the Carousel can operate autonomously with a Sea-Bird Scientific profiling CTD and can be programmed to close bottles at selected depths, allowing deployment using non-electrical wire or line. The Carousel is available in two models: • Full-size SBE 32 for a 12 or 24-position system (36-position custom). • Compact SBE 32C for a 12-position sampler with bottles up to 8 liters, for use with limited vertical clearance.

Dataset-specific Instrument Name	WET Labs ECO-AFL/FL fluorometer
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Dataset-specific Description	The sensor suite for each comprised dual SBE temperature (T), conductivity (C), and SBE 43 oxygen (O2) sensors, a WET Labs ECO-AFL/FL fluorometer, and a C-Star transmissometer. Post-cruise corrections were applied to the dual T/C/O2 sensors based on Seabird pre- and post-cruise calibrations and discrete-depth O2 titrations performed during NBP2202.
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

Dataset-specific Instrument Name	C-Star transmissometer
Generic Instrument Name	WET Labs {Sea-Bird WETLabs} C-Star transmissometer
Dataset-specific Description	The sensor suite for each comprised dual SBE temperature (T), conductivity (C), and SBE 43 oxygen (O2) sensors, a WET Labs ECO-AFL/FL fluorometer, and a C-Star transmissometer. Post-cruise corrections were applied to the dual T/C/O2 sensors based on Seabird pre- and post-cruise calibrations and discrete-depth O2 titrations performed during NBP2202.
Generic Instrument Description	The C-Star transmissometer has a novel monolithic housing with a highly integrated opto-electronic design to provide a low cost, compact solution for underwater measurements of beam transmittance. The C-Star is capable of free space measurements or flow-through sampling when used with a pump and optical flow tubes. The sensor can be used in profiling, moored, or underway applications. Available with a 6000 m depth rating. More information on Sea-Bird website: https://www.seabird.com/c-star-transmissometer/product?id=60762467717

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Deployments

NBP2202

Website	https://www.bco-dmo.org/deployment/1004907
Platform	RVIB Nathaniel B. Palmer
Report	https://service.rvdata.us/data/cruise/NBP2202/doc/NBP2202DATA.pdf
Start Date	2022-01-06
End Date	2022-03-08
Description	See more information at R2R: https://www.rvdata.us/search/cruise/NBP2202

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Project Information

NSFGEO-NERC: Collaborative Research: Accelerating Thwaites Ecosystem Impacts for the Southern Ocean (ARTEMIS) (ARTEMIS)

Website: https://www.marsci.uga.edu/artemis/home

Coverage: Amundsen Sea, Coastal West Antarctic

NSF Award Abstract:
Part I: Non-technical summary:
The Amundsen Sea is adjacent to the West Antarctic Ice Sheet (WAIS) and hosts the most productive coastal ecosystem in all of Antarctica, with vibrant green waters visible from space and an atmospheric carbon dioxide uptake rate ten times higher than the Southern Ocean average. The region is also an area highly impacted by climate change and glacier ice loss. Upwelling of warm deep water is causing melt under the ice sheet, which is contributing to sea level rise and added nutrient inputs to the region.

This is a project that is jointly funded by the National Science Foundation's Directorate of Geosciences (NSF/GEO) and the National Environment Research Council (NERC) of the United Kingdom (UK) via the NSF/GEO-NERC Lead Agency Agreement. This Agreement allows a single joint US/UK proposal to be submitted

and peer-reviewed by the Agency whose investigator has the largest proportion of the budget. Upon successful joint determination of an award, each Agency funds the proportion of the budget and the investigators associated with its own country.

In this collaboration, the US team will undertake biogeochemical sampling alongside a UK-funded physical oceanographic program to evaluate the contribution of micronutrients such as iron from glacial meltwater to ecosystem productivity and carbon cycling. Measurements will be incorporated into computer simulations to examine ecosystem responses to further glacial melting. Results will help predict future impacts on the region and determine whether the climate sensitivity of the Amundsen Sea ecosystem represents the front line of processes generalizable to the greater Antarctic. This study is aligned with the large International Thwaites Glacier Collaboration (ITGC) and will make data available to the full scientific community. The program will provide training for undergraduate, graduate, post-doctoral, and early-career scientists in both science and communication. The team will also develop out-of-school science experiences for middle and high schoolers related to climate change and Antarctica.

Part II: Technical summary:
The Amundsen Sea hosts the most productive polynya in all of Antarctica, with atmospheric carbon dioxide uptake rates ten times higher than the Southern Ocean average. The region is vulnerable to climate change, experiencing rapid losses in sea ice, a changing icescape and some of the fastest melting glaciers flowing from the West Antarctic Ice Sheet, a process being studied by the International Thwaites Glacier Collaboration. The biogeochemical composition of the outflow from the glaciers surrounding the Amundsen Sea is largely unstudied. In collaboration with a UK-funded physical oceanographic program, ARTEMIS is using shipboard sampling for trace metals, carbonate system, nutrients, organic matter, and microorganisms, with biogeochemical sensors on autonomous vehicles to gather data needed to understand the impact of the melting ice sheet on both the coastal ecosystem and the regional carbon cycle. These measurements, along with access to the advanced physical oceanographic measurements will allow this team to 1) bridge the gap between biogeochemistry and physics by adding estimates of fluxes and transport of limiting micronutrients; 2) provide biogeochemical context to broaden understanding of the global significance of ocean-ice shelf interactions; 3) determine processes and scales of variability in micronutrient supply that drive the ten-fold increase in carbon dioxide uptake, and 4) identify small-scale processes key to iron and carbon cycling using optimized field sampling. Observations will be integrated into an ocean model to enhance predictive capabilities of regional ocean function.

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.

Project metadata and links to related datasets in project ARTEMIS are available from USDAP-DC site: https://www.usap-dc.org/view/project/p0010249

NERC Award Abstract:
The Amundsen Sea hosts the most productive polynya in coastal Antarctica, with its vibrant green waters visible from space, and an atmospheric CO2 uptake flux density 10x higher than average for the Southern Ocean. The region is vulnerable to climate change, with rapid losses in sea ice, episodic shifts in the coastal icescape, and the fastest melting glaciers in the adjacent West Antarctic Ice Sheet (WAIS). In an ecosystem experiencing such dramatic change, it is critical to resolve the climate-sensitive drivers and feedbacks of the meltwater-associated iron (Fe) delivery, which underpins productivity in this otherwise high-nutrient, low chlorophyll region. Our previous field research (ASPIRE) identified a clear link between the melting WAIS and the delivery of micronutrient Fe to the polynya ecosystem, and its role in rapid CO2 drawdown. Our recent numerical modeling effort (INSPIRE) suggests several pathways for Fe delivery, ways to optimize fieldwork, and guidance for improving mechanistic understanding of Fe supply and cycling. An ongoing physical oceanographic field program (TARSAN, part of the International Thwaites Glacier Collaboration, ITGC) offers an ideal physical framework for our next research effort. We propose here to collaborate with TARSAN-supported UK scientists, providing significant value added to both teams. TARSAN explored the eastern Amundsen Sea by ship in Feb-Mar 2019 and expects to operate in the Thwaites region again in Feb-Mar 2021. They will use a full suite of physical oceanographic techniques, including 2 under-ice-shelf AUVs, gliders, surface vehicles, a microstructure profiler, shipboard CTD, seal tags, noble gases, and underway sensors to characterize the ice-ocean interactions responsible for rapid glacial melting. During 2019, TARSAN and THOR (also ITGC) collected detailed bathymetric, sedimentary, and ice-shelf cavity information (available Sept 2019) that will immediately improve and update the INSPIRE model to present-day boundary conditions. Our combined NSFGEO-NERC project (ARTEMIS) will facilitate collaboration between ASPIRE/INSPIRE team members and TARSAN/ITGC, add biogeochemical measurements to the funded 2021 expedition, and build on existing glider infrastructure and seal tag expertise (adding biogeochemical sensors to autonomous vehicles) at modest additional logistical cost. Numerical runs with ARTEMIS's updated model will inform TARZAN's 2021 field effort. Observations made will

improve our understanding and our model, allowing a more sophisticated assessment of the role of Fe in present and future scenarios. Our team (ARTEMIS) would add shipboard biogeochemical observations (trace metals, carbonate system, nutrients, organic matter, microorganisms) and autonomous vehicle biogeochemical observations (nitrate, Chl a, optical backscatter) to gather knowledge critical to understanding the impact of WAIS melting on both the polynya ecosystem and the regional carbon (C) cycle. ARTEMIS combines the expertise of a US component comprising a carbonate system and microbial ecologist (Yager), a trace metal biogeochemist (Sherrell), a trace metal isotope geochemist (Fitzsimmons), an organic geochemist (Medeiros), an ice-ocean-atmosphere interactions expert (Stammerjohn), and a numerical ocean modeler (St-Laurent), with a UK component comprising 3 physical oceanographers: TARSAN lead PI (Heywood), a biogeochemically savvy autonomous vehicle expert (Queste), and an oceanographer whose vehicles are marine mammals (Boehme). This international team will work together at sea and with shore-based analyses to address a set of interconnected questions arising from the findings of ASPIRE/ INSPIRE.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1941483
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1941292
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1941308
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1941327
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1941304

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