

8-3-1999

Collaborative Research: Nitrate Flux Associated with Vertically Migrating Phytoplankton in the Central North Pacific

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Recommended Citation

Pilskaln, Cynthia H., "Collaborative Research: Nitrate Flux Associated with Vertically Migrating Phytoplankton in the Central North Pacific" (1999). *University of Maine Office of Research and Sponsored Programs: Grant Reports*. 396.
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Final Report for Period: 02/1995 - 01/1999**Submitted on:** 08/03/1999**Principal Investigator:** Pilskaln, Cynthia H.**Award ID:** 9423471**Organization:** University of Maine

Collaborative Research: Nitrate Flux Associated with Vertically Migrating Phytoplankton in the Central North Pacific Gyre

Participant Individuals

Senior Personnel

Name: Pilskaln, Cynthia**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Pilskaln had overall responsibility for all in-situ ROV-based and VPR-based water column imaging operations on the 2 cruises, the subsequent image processing of all collected video data, the organic compound analyses of collected algal mat samples, and microscopic documentation of collected samples. Pilskaln supervised 1 graduate student and 1 technician who assisted in the completion of the above activities.

Post-doc

Graduate Student

Name: Darkangelo, Christina**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Darkangelo was funded by the project and participated on both cruises, successfully completing and defending an Oceanography Master's thesis in May 1998 resulting from the project and entitled: 'Marine Aggregate Abundance in the Central North Pacific'.

Undergraduate Student

Partner Organizations

Woods Hole Oceanographic Institution

W.H.O.I (specifically Dave Caron's lab) provided the use of a Video Plankton Recorder (VPR) for the 1996 project cruise to document marine aggregates and algal mats in the Central North Pacific. Assistance was also provided by D. Caron's technician and by S. Gallagher at W.H.O.I. in the initial copying of the video tapes for subsequent analysis at the P.I.'s lab at the University of Maine.

Other Collaborators

The College of Engineering at the University of Michigan Ann Arbor provided a remotely operated vehicle (ROV) which was successfully tested for potential use in the current project (and in anticipated future projects) to collect images and samples of marine aggregates and algal mats using a variety of instrumentation (owned by the P.I.) mounted to the vehicle.

Activities and Findings

Research Activities:

Water column surveys (0-150 m) of marine aggregates and Rhizosolenia algal mats were successfully completed using an ROV-mounted imaging system and a VPR during cruises in 1995 and 1996, at 15 stations across the central North Pacific from Hawaii to CA. Mat samples collected at SCUBA-diver depths on the cruises were analyzed for various organic compounds and detailed microscopic analyses and photo documentation of the mats was completed. Complete hydrographic and nutrient data sets from 0- 150 m were also collected at all cruise stations. This project supported a University of Maine oceanography graduate student for 36 months.

Research Findings:

Rhizosolenia algal mats were documented in abundance down to the below the depth of the nitricline, supporting previous work suggesting that the mats migrated between the surface ocean and the deep nitricline, transporting nitrogen. Previously reported estimates of nitrogen transport via these abundant algal mats in the central North Pacific were revised using the new mat abundance data obtained on the cruises. This has resulted in calculated N transport rates to the mixed layer via these mats that are several times greater than original estimates. Typical marine snow aggregate abundances and estimated POC transport via sinking aggregates were found to be substantially higher than previously assumed for the oligotrophic central North Pacific, and comparable to regions far more productive.

Research Training:

Graduate student and technician funded by the project learned to quantitatively analyze water column video from 2 different imaging systems using a computer-based image analysis system; the graduate student obtained sea-going experience and participated in many cruise activities which included learning standard oceanographic methods of sampling and data collection as well as participating in specialized research activities such as blue-water diving and ROV operations. These are all important skills which the student obtained from the project.

Education and Outreach:

P.I. has given several short interviews regarding the project's objectives, accomplishments, and large-scale oceanographic significance of the project, to the University of Maine's Public relations Dept. for distribution to marine science bulletin boards, university newsletters, local newspapers, and the API.

Journal Publications

Villareal, T.A., C.H. Pilskaln, M.A. Brzezinski, F. Lipschultz, M. Dennett and G.B. Gardner., "Upward transport of oceanic nitrate by migrating diatom mats", *Nature*, p. 423, vol. 397, (1999).) Published
 Ship, R.F. M.A. Brzezinski, C.H. Pilskaln and T.A. Villareal., "Rhizosolenia mats: an overlooked source of silica production in the open sea", *Limnology and Oceanography*, p. 1282, vol. 44, (1998).) Published
 Pilskaln, C.H., C. Darkangelo, T.A. Villareal, G.B. Gardner and M. Dennett., "Use of ROV imaging and Video Plankton Recorder instrumentation to measure marine snow and Rhizosolenia algal mat abundance in the central North Pacific", *EOS*, p. 54, vol. 79, #1, (1998).) Published
 Darkangelo, C., C.H. Pilskaln, T.A. Villareal and G.B. Gardner, "Marine aggregate and suspended particle abundance in the oligotrophic central North Pacific", *EOS*, p. 136, vol. 76, #3, (1996).) Published

Books or Other One-time Publications

Web/Internet Sites

URL(s):

Description:

Other Specific Products

Product Type: Graduate thesis

Product Description:

Project supported the completion of an oceanography Master's degree thesis (unpublished) by C. Darkangelo entitled: 'Marine Aggregate Abundance in the Central North Pacific', completed May 1998.

Sharing Information:

The results of this thesis are being included in a paper in prep. by the P.I. for submission to Deep-Sea Research entitled 'Marine snow abundance and estimated POC export via snow in the upper water column (0-150 m) of the oligotrophic central North Pacific, Hawaii to California'.

Contributions

Contributions within Discipline:

The Video Plankton Recorder has never been used prior to this project to produce quantitative data sets on the size and distribution of marine

aggregates and algal mats in the ocean. Our successful use of the system and subsequent analysis of the data using an image processing program, extends the usefulness of the VPR for in-situ, quantitative water column imaging and thus shows the value of VPR technology in understanding the temporal and spatial importance of large, rare phytoplankton to oceanic biogeochemistry.

Contributions to Other Disciplines:

Contributions to Education and Human Resources:

Contributions to Science and Technology Infrastructure:

Beyond Science and Engineering:

Categories for which nothing is reported:

Any Book

Contributions: To Any Other Disciplines

Contributions: To Any Education or Human Resource

Contributions: To Any Science or Technology Infrastructure

Contributions: Beyond Science or Engineering