



# SCAR Fellowship Report



## Response of Southern Indian Ocean coccolithophores to climate change: evidence from laboratory culture experiments



**Name of Fellow: Shramik Maruti Patil**

Position: DST-Inspire Faculty

Affiliation: National Centre for Antarctic and Ocean Research

Country: India

Email: shramikpatil@gmail.com

**Home Institution: National Centre for Antarctic and Ocean Research**

Home Contact: Dr. Rahul Mohan

Home Contact Email: rahulmohan@ncaor.gov.in

Home Country: India

**Host Institution: Station Biologique de Roscoff-CNRS- Sorbonne University**

Host Contact: Dr. Ian Probert

Host Contact Email: probert@sb-roscoff.fr

Host Country: France

**Dates of Activity: 4<sup>th</sup> May-3<sup>rd</sup> August, 2018**

## Introduction (~ 100 words)

*What motivated the application and project? Brief explanation of the background and rationale for the proposal.*

The applicant was working on calcareous nannoplankton from the Southern Ocean water, sediment, sediment trap samples since past 10 years. In past few decades, research on calcareous nannoplankton has diversified as they play a significant role in the global carbon cycle and which is also applied as important proxy indicators in the immediate past sediments. It is presumed that, in coming decades, increase in sea surface temperature will shift the biogeographic boundaries of coccolithophores whereas; increase in carbon dioxide will make oceans acidic. Such changes will affect the ecology and functioning of coccolithophore community, which may play a role in modulating the climate. The purpose of this proposal was to carry out laboratory-controlled experiments on coccolithophores, learn the state of art and develop a coccolithophore culture laboratory at India.

## Project Objectives (~ 100 words)

*What were the aims of the project at the outset?*

- (1) To investigate morphological and physiological responses of Southern Indian Ocean coccolithophores to carbonate chemistry changes via targeted ex-situ culture experiments.
- (2) To use this information to calibrate coccolith morphology proxies specific to Antarctic/sub-Antarctic zones.
- (3) To obtain hands-on training in order to develop a state-of-art coccolithophore culture laboratory in the applicant's home institute.
- (4) To isolate and characterize new coccolithophore cultures from Indian Ocean waters.

## Methods, Execution and Results (~200 words)

*What was the nature of the research and activities undertaken? Did everything go as you and your host had hoped? What results were generated and how do they reflect expectations?*

I have conducted laboratory-controlled experiments on 26 *Gephyrocapsa oceanica* strains collected from Indian Ocean, Southern Ocean and rest of the world oceans. These cultures were obtained from Roscoff Culture Collection (RCC). The incubation experiments were carried out at 5 different temperatures (10°C, 15°C, 20°C, 25°C and 30°C) in duplicates. Coccolithophore cultures were initiated as low as 200cells/ml in 75ml airtight sterile culture flasks and monitored till abundance reaches to 100,000cell/ml. During the experiment, samples were obtained for Scanning Electron Microscopic studies and to calculate coccolith mass (using SYRACO Software). The preliminary results show diverse response of *G. oceanica* strains to different temperatures. We presume the morphometric and mass calculation studies will provide important information, which can be related to studies in sediment to develop a new *G. oceanica* size based paleotemperature proxy.

During this visit, I have obtained expertise on Flow Cytometer instrument. I have also learned basic algal isolation techniques, preparation of media, sterilization and maintenance of cultures. I have also supported RCC by isolating over 100 strains from tropical and Southern Ocean waters.

## **Project Outcomes (~ 200 words)**

*What do you feel were the significant outcomes in terms of the research but also in terms of personal development?*

With the electron microscopy, measurement and mass calculation analysis gets accomplished; this project will result in at least one peer reviewed publication. This publication will contribute to better understanding on the response of coccolithophores to changing climatic variability and potential use of coccolithophore size based proxies in paleoclimate reconstruction.

We have also utilized a call for proposal from Indo-French Centre for the Promotion of Advanced Research (CEFIPRA) to submit a proposal to study "Response of Southern Ocean coccolithophores to ocean warming and acidification" worth of Euro 200,000. This proposal includes studies on Indian Ocean coccolithophores; carry out deck incubation experiments and for metagenomics analysis. This will be a strategic beginning of joint collaboration between Station Biologique and NCAOR. The cultures grown will be kept at NCAOR and Station Biologique for use of researchers around the world.

## **Publications, Presentations and Products**

*Are there papers or articles submitted or in preparation as a result of the Project? Have you made presentations as a result of the Fellowship? Are there significant products as a result that will have use beyond the Fellowship for yourself or others?*

I am currently analyzing samples using electron microscopy. The total numbers of samples obtained during experiment were over 250. I still have to carry out measurement of coccoliths, coccospheres and statistical analysis. Once analysis is completed, a manuscript will be communicated in a peer-reviewed journal.

The data generated during SCAR fellowship will be presented in the upcoming International Nannoplankton Association meeting at Brazil.

## **Capacity Building, Education and Outreach Activities (~ 200 words)**

*As a result of the Fellowship did you engage in educational and/or outreach activities before/during/after your visit? Did you meet with students to explain your work? Did you give a public lecture? Was there any publicity about your visit - either in your host country or your home country?*

In the Station Biologique, I discussed and interacted with many PhD and Postdoc researchers working on algae and different disciplines. We discussed our research work and also talk about possible collaborations. In my home country news of SCAR award was announced through Facebook, Twitter as well as institute webpage. Ministry of Earth Sciences and Department Of Science and Technology also tweeted about the SCAR awards of 2017. In the Host institute I discussed about the SCAR programs and fellowships with senior researchers. I will be also delivering lectures and encouraging students to apply for SCAR fellowship programs in my home country.

## **Future Plans and Follow ups (~ 100 words)**

*Do you plan to continue contact with the host institute and others you met as a result of the project? What will be the nature of the future work?*

If the Joint oceanographic cruise proposal gets sanctioned by Indian authorities, Dr. Ian Probert and Dr. Luc Beaufort will be visiting NCAOR to discuss about future collaborations and programs. Dr. Probert will interact with scientists and help to establish coccolithophore culture laboratory at NCAOR. The proposal for CEFIPRA is under review, if selected, I will be carrying out studies at NCAOR as well as at Station Biologique on coccolithophore cultures.

Station Biologique has very friendly environment to work. I will be applying to other fellowships/postdoc to work with Dr. Ian Probert for few months to few years.

## **Personal Impact**

*How do you feel the Fellowship has and will continue to impact your research and career objectives? What was the main impact for you personally?*

The SCAR fellowship has provided an opportunity to enhance my skills, learn state of art techniques and bring new scientific expertise to my home institute. The SCAR Fellowship will be a beginning of bigger and productive collaboration between Station Biologique and NCAOR in future. This would have helped me to learn algal isolation techniques, do's and don'ts and how to maintain cultures, which is quite new to me.

I could learn many things from Dr. Probert and other researchers working at Station Biologique. Dr. Ian has encouraged me to apply for postdocs to work with him and to carry out experiments on coccolithophores.

## **Financial Statement**

*Please provide a brief breakdown how the funds were used. Example: The SCAR Fellowship was used to help cover travel to the host institute, buy supplies for the experiments and cover a month of rent at the host location.*

The SCAR Fellowship was used to cover my travel expense (Flight and Train) from Goa, India to Roscoff, France, accommodation at Roscoff and Institute hotel, allowance for shipping samples to Goa, travelling, accommodation and sample transport from Bordeaux to Roscoff, analytical costs and living expense. I had utilized all the amount (\$11000) awarded to me by SCAR for above-mentioned things.

## **Acknowledgements and References:**

I am grateful to Dr. Ian Probert, and Station Biologique for hosting me during my fellowship. I thank Scientific Committee on Antarctic Research for providing Prince Albert II Monaco fellowship. I would like to thank Director, NCAOR, Ministry of Earth Sciences, Dr. Rahul Mohan (NCAOR), Department of Science and Technology and DST-INSPIRE for providing permission to utilize this fellowship.