

SILICAMICS 3

Biogeochemistry and genomics
of silicification and silicifiers

12-15 October 2021

Second Institute of Oceanography, Hangzhou (China)
& on line

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The SILAMICS conferences aim to develop an integrative approach that includes chemistry, biogeochemistry, biochemistry, physiology and genomics to better understand biosilicification and silicifiers in past, contemporary and future oceans.

BACKGROUND

Silicifiers are among the most important organisms on planet Earth. They are able to take advantage of the abundance of silicon (the second-most-abundant element in the Earth's crust) to build silica structures, which can help for protection against predators, for motility, or for facilitating the penetration of light and nutrients. At the same time, silicifiers have a paramount impact on the cycling of silicon, carbon and other nutrients in marine waters.

The SILICAMICS transdisciplinary conference focuses on the marine realm, for which numerous unknowns still remain regarding the global marine silica cycle. Marine diatoms have dominated over siliceous sponges and radiolarians over the last 150 M years. Today diatoms play a key role in the trophic networks of the most productive coastal and open-ocean ecosystems, as well as in the biology-mediated transfer of CO₂ from the surface to the ocean interior (i.e. the biological carbon pump). The physiology and biochemistry of biosilicification have been studied in diatoms and other silicifiers but many gaps remain regarding mechanisms, evolutionary significance, variations in response to environmental change and the impact of these processes on marine biogeochemistry. Moreover, benthic diatoms and their role in coastal ecosystems have been largely overlooked despite significant contributions to coastal primary production. Along the same vein, the roles of other siliceous organisms, such as benthic sponges, rhizaria and silicoflagellates in the silica cycle, are starting to be better constrained at a global scale.

In the last two decades, the genomes of several diatom species have been sequenced. Scientific programs (such as Tara Oceans and the Gordon and Betty Moore Foundation's projects) have provided additional DNA sequence information from diatoms as well as from other silicifying organisms. Genomics data can now be exploited to address fundamental research questions about the role of different silicifiers in coastal and open-ocean ecosystems, and their controls on C, N, P, and Si biogeochemical cycles. The interactions between silicifiers and other organisms are starting to be elucidated at different spatial and temporal scales, and their impact on nutrient cycling and

ecosystem functioning are now being addressed. It is an exciting time to study the biology of ocean silicification processes.

The first SILICAMICS conference, organized by the IUEM (University of Brest, France) held in l'Aber Wrac'h (near Brest, France) in September 2015. It provided an extraordinary opportunity to develop interdisciplinary connections between researchers with expertise and interest in silicification and silicifiers and to learn about the latest advances in the silicon world. This conference concluded with the organization of a special issue in *Frontiers in Marine Science* (Moriceau et al 2019), that includes 13 manuscripts, and with the publication of a review paper in *Nature Geoscience* (Tréguer et al., 2018).

The second SIMICAMICS conference, held at the University of Victoria (British Columbia, Canada) in June 2018, continued developing interdisciplinary connections between experts in Si cycles, and the biology and genomics of silicifiers. Among the major outputs from this conference is the implementation of an international SILICA SCHOOL which brings together students and teachers of 31 institutes from 12 different countries. Launched in November 2020, it provides a transdisciplinary e-learning experience for a Master of Marine Science degree, as a Short Private On-line Course (SPOC). A second output is the publication of a review article in *Biogeosciences* on the Si biogeochemical cycle in the modern ocean (Tréguer et al. 2021) that incorporates a decade of new knowledge about net input/output fluxes, and new estimates of biogenic silica production of plankton and sponges at world ocean scale.

SILICAMICS 3

To further develop an integrative approach that includes chemistry, biogeochemistry, biochemistry, physiology and genomics to better understand biosilicification and silicifiers in past, contemporary and future oceans, the SILICAMICS 3 conference will facilitate once more the exchange of information between scientists from different 'silicon' disciplines and expertise, with the aim of moving forward in our understanding of the impact of silicifiers on Earth.

The third SILICAMICS conference is organized by the Second Institute of Oceanography, Ministry of Natural Resources (P.R. China). It will take place in October 2021 in Hangzhou (capital city of Zhejiang Province, China) and on-line.

OBJECTIVES

(1) to enhance interactions among researchers from different disciplines, such as chemistry, biochemistry, physiology, biogeochemistry and genomics, for a better understanding of silicification processes and the role of silicifiers in marine ecosystems,

(2) to facilitate a constructive dialogue between top-level senior scientists and early-career researchers through a Gordon-like conference format that will provide valuable and challenging opportunities for mutual learning

(3) to build a niche for preparing future research proposals to obtain national and international research funding.

THEMES

After an introduction on the potential role of silicon for building block for life, this conference comprises invited conferences, oral and poster communications, about 7 themes, which include: Past variations in the global silica cycle; Updating the Si cycle in the modern ocean; Genomic and proteomic tools for silicifiers; Pelagic and benthic silicifiers; Silica cycle in coastal ecosystems; Isotope chemistry providing tools for processes and fluxes; Modelling the Si cycle and silicifiers in the modern and future ocean.

SCIENTIFIC COMMITTEE

- Kim Thamtrakoln (Rutgers University)
- Kate Hendry (University of Bristol)
- Su Mei Liu (Ocean University of China)
- Manuel Maldonado (CSCIC, Blanes)
- Aude Leynaert (CNRS, IUEM-UBO, Brest)
- Brivaela Moriceau (CNRS, IUEM-UBO, Brest)
- Jill Sutton (IUEM, Brest)
- Paul Tréguer (IUEM-UBO, Brest)
- Jianfang Chen (SIO, Hangzhou)
- Fei Chei (SIO, Hangzhou)
- Fabrice Not (CNRS, Sorbonne University)

ORGANISING COMMITTEE

- Jianfang Chen (SIO, Hangzhou)
- Fei Chei (SIO, Hangzhou)
- Lihua Ran (SIO, Hangzhou)

PROGRAMME

TUESDAY 12 OCTOBER 2021

- 17h** Ice-breaker at SIO ; meeting of students and early carrier scientists about their expectations regarding the Silicamics 3 conference

WEDNESDAY 13 OCTOBER

9h00 Official & introductive talks

9h30 *On the potential of Silicon as a building block for life* by Janusz J. Petkowski (MIT)

10h30 Break ; posters

Past variations in the global cycle of Si

11h00 Daniel J. Conley, U. Lund (Sweden), on-line

12h00 1 oral communication

12h30 Lunch ; posters

Si cycle of the modern ocean, modelling and processes

14h00 Paul J. Tréguer (IUEM-UBO, Brest, France)

15h00 3 oral communications on processes (reverse weathering, dissolution of lithogenic silica, ..)

16h30 Break ; posters

17h00 *The silica school* by Jill Sutton; A proposal for a scientific film on silica (*from stardust to the living world*) by Paul Tréguer

19h00 Silicamics dinner

THURSDAY 14 OCTOBER

Pelagic and benthic silicifiers

9h00 Manuel Maldonado (CSI, Blanes, Spain) et Aude Leynaert (CNRS, IUEM-UBO, Brest)

10h00 Break ; posters

10h30 3 oral communications

12h00 Lunch ; posters

Isotope chemistry of silicon providing tools for models, processes and fluxes

14h00 Kate Hendry (U. Bristol, United Kingdom), on-line

15h00 2 oral communications

16h00 Break ; posters

16h30-18h30 Working groups on silica projects at international scale

FRIDAY 15 OCTOBER

The Si cycle in the coastal ocean

8h30 Su Mei Liu (UOC, Qingdao, China)

9h30 Break ; posters

10h00 3 oral communications

Genomic and proteomic tools for silicifiers

11h30 Chris Bowler (Collège de France, Paris, France)

12h30 Lunch ; posters

14h00 3 oral communications

15h30 Break ; posters

16h00 Gaps to be filled and Silica projects, general conclusions and perspectives ; feedbacks from students and early carrier researchers

18h00 End of the conference