Dr. Soumita Boral

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RESEARCH INTERESTS

I am an isotope geochemist interested in the hydrology of rivers and the biogeochemical cycling of metals and nutrients through the critical zone (living sphere) of earth. My primary focus is investigating:

(1) The impact of climate change and glacial retreat on river water quantity and quality in the Himalayan region.

(2) The role of inorganic and biological processes in modulating the bioavailability and toxicity, reactive transport pathways, and biogeochemical cycling of key transition metals in freshwater and saline environments.

(3) The regional and global impacts of natural and human perturbations of freshwater chemistry and their solutions/treatment.

I use field-based samples and analyze geochemical tracers such as stable and radiogenic isotopes along with case-specific geochemical modeling techniques to solve my research problems.

EDUCATION

July 2015 – Jan 2021 **Ph.D. (Geochemistry)**
Department of Earth Sciences, Indian Institute of Technology Kanpur, India.
Course work CGPA: 10/10.
Thesis Title: "Isotopes and geochemical modelling to trace water sources and chemical dynamics of Himalayan Rivers from source to sink."
Supervisor: Dr. Indra Sekhar Sen

July 2013 - May 2015 **Master of Science** in Geology
Department of Earth Sciences, Indian Institute of Technology, Bhubaneswar, India.
Course work CGPA: 9.5/10.
Thesis Title: "Identification of Gas Hydrates on Multichannel Seismic Data"
Supervisor: Dr. Abhishek Kumar Rai

July 2010 - May 2013 **Bachelor of Science** in Geology
Department of Geological Sciences, Jadavpur University, Kolkata, India.
First Class (79%) in Geology Honours with Distinction in Physics and Mathematics.

PROFESSIONAL EXPERIENCE

Sept. 2021 – March 2022 **Post-doctoral researcher**
Institut de Physique du Globe de Paris, Paris, France
Topic: Exploring Ga/Al ratios and boron isotopes as tracers of biogeochemical processes in contrasting critical zones.
Supervisor: Prof. Louis Derry and Prof. Jérôme Gaillardet

Nov 2020 – June 2021 **Post-doctoral research associate**
Centre for Earth Sciences, IISc Bangalore
Topic: Assessing the biogeochemical cycling of metals using their isotope compositions in freshwater and estuarine settings.
Supervisor: Dr. Sambuddha Misra

May 2016 - Sept. 2016 **Guest Student**, Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution (hosted by Dr. Bernhard Peucker-Ehrenbrink; worked on $^{87}Sr/^{86}Sr$ composition of rivers Ganga and Brahmaputra)

TEACHING INTERESTS

Biogeochemistry; Environmental Geochemistry; Water resources, quality, and treatment; Geochemical modeling techniques.

AWARDS and ACADEMIC ACHIEVEMENTS

2018 Augmenting Writing Skills for Articulating Research (AWSAR) Award from the Department of Science and Technology, Govt. of India. (Awarded to top 100 research articles from all branches of STEM at a national level)

2015 National Eligibility Test for Junior Research Fellow Rank (All India) – 37

2015 Graduate Aptitude Test in Engineering Rank (All India) - 171

2015 Silver medal for the best M.Sc. Thesis, IIT Bhubaneswar

2013 Joint admission test for Masters Rank (All India) - 65

PEER-REVIEWED PUBLICATIONS

(1) **Boral, S.,** Peucker-Ehrenbrink, B., Hemingway, J., Sen, I.S., Galy, V., Fiske G.J. Controls on short-term dissolved $^{87}Sr/^{86}Sr$ variations in large rivers: Evidence from the Ganga–Brahmaputra. *Earth and Planetary Science Letters* 566, 116958. https://doi.org/10.1016/j.epsl.2021.116958. **(Impact Factor: 5.255)**

(2) Shukla, T., Sen, I.S., **Boral, S.,** Sharma, S., 2021. Time-series record during COVID-19 lockdown shows high resilience of dissolved heavy metals in the Ganga River. *Environment Science and Technology Letters* https://doi.org/10.1021/acs.estlett.0c00982. **(Impact Factor: 7.653)**

(3) **Boral, S.**, Sen, I.S., Tripathi, A., Sharma, B., Dhar, S., 2020. Tracking dissolved trace and heavy metals in the Ganga River from source to sink: A baseline to judge future changes. *Geochemistry, Geophysics, Geosystems* 21, e2020GC009203. https://doi.org/10.1029/2020GC009203. **(Impact Factor: 3.598)**

(4) **Boral, S.**, Sen, I.S., 2020. Tracing 'Third Pole' ice meltwater contribution to the Himalayan rivers using oxygen and hydrogen isotopes. *Geochemical Perspectives Letters* 13, 48-53. https://doi.org/10.7185/geochemlet.2013. **(Impact Factor: 5.570)**

(5) **Boral, S.**, Sen, I.S., Ghoshal, D., Peucker-Ehrenbrink, B., Hemingway, J., 2019. Stable water isotope modeling reveals spatio-temporal variability of glacier meltwater contributions to Ganges River

headwaters. *Journal of Hydrology* 577, 123983. https://doi.org/10.1016/j.jhydrol.2019.123983. **(Impact Factor: 5.722)**

(6) Sen, I.S., **Boral, S.**, Ranjan, S., Tandon, S.K., 2018. Small but important –the role of small floodplain tributaries to river nutrient budgets. *American Chemical Society Earth and Space Chemistry* 2, 64 -71. https://doi.org/10.1021/acsearthspacechem.7b00112. **(Impact Factor: 3.475)**

In review

(1) Roy, N., Sen, I.S., **Boral, S.**, Shukla, T.,Velu, V. Rain-induced melting of the Himalayan glaciers will enhance meltwater discharge to the river (*Journal of Hydrology).*

(2) Shukla, T., Roy, N., Sen, I.S., Sundriyal, S., **Boral, S.** Overestimation of meltwater fractions due to temperature bias in electrical conductivity based hydrograph separation models in the Himalayas (*Journal of Hydrology).*

In preparation

(1) Noireaux, J., Riotte, J., Gaillardet, J., **Boral, S.,** Louvat, P., Lemarchand, D., Bouchez, J., Sekhar, M., Kumar, M. S. M., Candaudap, Braun, J. Vegetation cycling and chemical weathering in a tropical catchment: constraints from B isotope geochemistry.

CONFERENCE PROCEEDINGS *(* represents presenting author)*

(1) **Boral, S.***, Peucker-Ehrenbrink, B., Hemingway, J., Sen, I.S., Galy, V. Controls on temporal variations in the dissolved $^{87}Sr/^{86}Sr$ of large rivers: Evidence from the Ganga and Brahmaputra. Goldschmidt Conference 2019, Barcelona, Spain (Oral Presentation).

(2) **Boral, S.***, Sen, I.S., Sinha, R., Peucker-Ehrenbrink, B., Ghosal, D. Relationship between Indian summer monsoon and melting Himalayan glaciers. Goldschmidt Conference 2017, Paris, France (Oral Presentation).

(3) **Boral, S.***, Sen, I.S., Sinha, R., Peucker-Ehrenbrink, B. Hydrological Dependence of River Ganga on Himalayan Cryosphere. Frontiers in Earth and Climate Science Conference 2016 (organized by the World Academy of Sciences ROCASA and Divecha Centre for Climate Change IISC Bangalore), Bangalore, India (Invited poster presentation).

(4) **Boral, S.**, Sen, I.S.*, Sinha, R., Peucker-Ehrenbrink, B., Ghosal, D. Hydrological dependence of Ganges river on Himalayan cryosphere. Goldschmidt Conference 2016, Yokohama, Japan (Poster presentation).

RESEARCH SKILLS

Fieldwork

- Conducted several field campaigns in a variety of terrains, from the Himalayas to the Indo-Gangetic floodplains to collect samples of glacier, river water and sediments, and groundwater samples.

Laboratory and Analytical

- Adept in working in clean-lab environment, dissolved and particulate sample preparation techniques for major and trace element analysis, column chromatographic separation techniques for Sr, Pb, Fe,

and B isotopes.

- Experienced at working with quadruple inductively coupled mass spectrometer (Thermo Fisher Scientific Q-ICP-MS), multi-collector mass spectrometer (Thermo Scientific™ Neptune MC-ICP-MS) for trace elements and isotope analysis. Also skilled in analyzing dissolved nutrients with the Seal Analytical AA3 flow analyzer.

- Measuring stable isotopes of water using LGR-LWIA (cavity ring-down spectroscopy)

Computational

- Modeling skills using computer languages: Matlab, C.

- Geochemical calculations using LoadEst, and PHREEQC.

TEACHING EXPERIENCE

(1) Primary tutor for undergraduate course: Fundamentals in Earth Science, 2017, IIT Kanpur.

(2) Teaching Assistant for postgraduate courses: Geochemistry, Isotope Geochemistry, Aqueous Geochemistry and its applications, Geology and Geochemistry of Petroleum, Instrumentation in Earth Sciences, 2015-2019, IIT Kanpur.

COMMISSION OF TRUST

Since 2019 regular reviewer in many international journals such Journal of Hydrology; Frontiers in Earth Science; Geochemistry, Geophysics, Geosystems; Catena; Chemosphere, Journal of Geochemical Exploration.

MEDIA HIGHLIGHTS:

- Our unique study of tracking the change in the metal chemistry of the Ganga River as a result of the nationwide lockdown due to COVID-19 pandemic (published in Environment Science and Technology Letters) was covered by several media channels such as *India Today*, *Business Standard*, and the *Wire Science*.
- My findings related to the metal chemistry of the Ganga River (published in Geochemistry, Geophysics, Geosystems) was published as science news in the *New Indian Express* on 8th October 2020. Also, as this study was DST funded, it was highly popularized by DST and the Ministry of Jal Shakti.
- The findings from my Geochemical Perspective Letters article was published as science news by the national newspaper *Dainik Jagran* (on 5th June 2020), which is the second-highest circulated newspaper in India.
- My AWSAR article related to the role of small floodplain rivers in controlling the chemistry of the Ganga mainstream (published in American Chemical Society: Earth and Space Chemistry) was made available to Indian public through DST's magazine '*Vigyan Prakash*'.

REFEREES

(1) Dr. Louis Derry (Professor)
Department of Earth and Atmospheric Sciences, Cornell University, USA.
Email id: derry@cornell.edu

(2) Dr. Indra Sekhar Sen (Associate Professor)
Department of Earth Sciences, Indian Institute of Technology Kanpur, India
Email id: isen@iitk.ac.in

(3) Dr. Bernhard Peucker-Ehrenbrink (Senior Scientist)
Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, USA.
Email id: bpeucker@whoi.edu

(4) Dr. Sambuddha Misra (Assistant Professor)
Centre of Earth Sciences, Indian Institute of Science Bangalore, India
Email id: sambuddha@iisc.ac.in

(5) Dr. Jérôme Gaillardet (Professor)
Department of Geochemistry of External Envelopes, Institut de Physique du Globe de Paris, France.
Email id: gaillard@ipgp.fr

DECLARATION

I hereby declare that all statements made herein are true to the best of my knowledge.

Soumita Boral

Date: 12th April 2022 **Soumita Boral**