Environmental and
Biogeochemical Processes

Editorial

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The inauguration of *Environmental and Biogeochemical Processes* coincides with a pivotal moment in Earth system science, as the international community grapples with interconnected crises of climate change, biodiversity loss, and biogeochemical cycle disruptions. With human activities intensifying global change, there is unprecedented urgency to understand the cycling of elements and compounds through terrestrial, aquatic, atmospheric, and biological systems. The current consensus is that environmental and biogeochemical processes are the core link connecting 'microbial activity' and 'macro Earth system', scientists should aim to achieve the ultimate goal of dual carbon plans, biodiversity conservation, and effectiveness of global environmental governance, with a particular focus on the following three aspects:

Firstly, the exploration of environmental biogeochemical processes must be rooted in mechanistic research to uncover the underlying principles. Cutting-edge studies in environmental biogeochemistry currently prioritize investigating how elemental cycles (especially carbon and nitrogen) interact with climate change and pollutants. Over the years of research, interdisciplinary studies have deepened, such as the integration of molecular biology, artificial intelligence (AI), and geochemical methods, gradually forming a research paradigm of 'elemental speciation-bioavailability-environmental feedback'. With the help of these advanced tools, scientific investigations have systematically scaled up from micro-interface processes to global-scale cycling and assessments.

Secondly, the relationship between environmental biogeochemical processes and human health is a key issue that we hope to understand and address. Human activities such as the burning of fossil fuels, fertilizer abuse, and large-scale land use are severely disrupting global biogeochemical cycles. This disturbance leads to global environmental issues such as accelerated climate change, ocean acidification, ozone layer depletion, biodiversity loss, freshwater scarcity, and the emergence of new pollutants. Biogeochemical processes regulate water conservation, nutrient supply, and pollutant filtration, profoundly affecting environmental quality, agricultural and ecosystem sustainability, and human health.

Finally, the research on environmental biogeochemistry is rapidly advancing from mechanistic studies to engineering applications and effective remediation and management strategies. To achieve efficient remediation and management, researchers are focusing more on sustainable green and low-carbon technologies, with greater consideration given to the compatibility between technology and environmental systems. Through an in-depth study of natural systems, reconstructing efficient and viable environmental and biogeochemical systems is the key direction that technology and management should prioritize. Incorporating AI into environmental research will greatly facilitate technique, decision, and industrial optimization.

Therefore, *Environmental and Biogeochemical Processes* seeks to bridge the gap between laboratory-scale discoveries and field-scale applications, including pollution remediation and ecosystem restoration. We welcome multidisciplinary submissions elucidating: (1) breakthrough discoveries in elemental cycling; (2) pioneering methodological developments; and (3) policy-relevant syntheses that bridge fundamental biogeochemical research with practical environmental solutions. It aims to provide an innovative, efficient, and professional platform for scientists in the area of *Environmental and Biogeochemical Processes* worldwide, accelerating the translation of scientific knowledge into sustainable management strategies for soil, sediment, freshwater, and the atmosphere.

Join us in mapping solutions that heal our planet - where smart environmental stewardship meets nature's recovery, creating thriving ecosystems for future generations.

Declarations

Competing interests

The authors declare that they have no conflict of interest.

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