

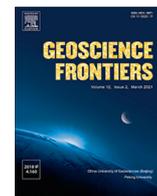
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Geoscience Frontiers

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Editorial

## Environmental geochemistry: Introduction



Assessing the physical, geographic, chemical, and geological aspects are important to understand environmental impacts as well as health concerns in view of building a more sustainable planet with circular economies that would last for the foreseeable future. In the recent years, the significance of incorporating ecosystem, anthropogenic activities, and climate has fortified from being an academic concern (e.g., [WEF, 2011](#)) into a broadly societal concern as the forecasted realities of environmental deterioration and global climate change come to pass, creating urgent public and environmental health issues. The degree and difficulty of these issues, especially within the broader narrative of a ballooning world population and unsustainable consumption patterns, need a harmonized, multidisciplinary, and global effort to increase public attentiveness, and also develop a reasonable response. Researchers, authorities, global managers, policy creators, international governments, stakeholders, and concerned citizens have become aware of the urgent need to address the profound and enduring challenges. In this context, nano-geoscience opens a new avenue to understand a wide range of environmental concerns. Markedly, the most important claims of nano-mineralogy are geared toward the ecologically benign effects of air quality, water, and soil ([Silva et al., 2021](#)).

In this special issue of *Geoscience Frontiers*, we assemble a set of contributions on the theme of environmental geochemistry integrating soil-water-vegetation-human health aspects. We offer a view into the different sides of this environmental discipline and the development of scientific suggestions for a more sustainable global world. The articles in this special issue provide a forum for green nanomaterial scientists and engineers, physicists, and geochemists to highlight some of the most critical themes in the geosciences.

The introductory article by [Silva et al. \(2022\)](#) discusses the importance of Caribbean air quality, and offers a broad overview of conservational values, and health influences, developing from long-term practices of air pollution. Ultra-fine and nano-particle contamination pose ecological problem that is affecting air characteristics, climate, and human health. Carbonaceous particles are a main portion of atmospheric aerosol ([Belkacem et al., 2022](#); [Blanco-Donado et al., 2022](#)), which can be further catalogued into black carbon, and organic carbon. Previous studies described primary and secondary black carbon and brown carbon (entitled BrC, the light-absorbing organic C) as the major atmospheric absorbing carbonaceous constituents ([Zhu et al., 2021](#)). Several carbon forms are produced directly from burning coal, oil, vehicu-

lar fuels and biomass burning ([Schneider et al., 2022](#); [Silva et al., 2022](#)). Brown carbon as secondary product occurs in atmospheric geochemical courses ([Zhu et al., 2021](#)). In this special issue, two articles demonstrate the importance of black carbon: the first by [Blanco-Donado et al. \(2022\)](#) who assess the effect of fires and burning of biomass and tires in the most industrialized Caribbean region; the second article by [Belkacem et al. \(2022\)](#) who review road traffic nanoparticles characteristics, signaling how to increase sustainable environment and mobility.

For several decades, large multinational companies have been installed in the Colombian Caribbean region. In addition, in the last ten years, a major population increase in this area has also been of environmental concern. However, studies on air quality in the Caribbean are still rare, representing only case studies, and are few in scope regionally. In this context, some authors ([Bolaño-Truyol et al., 2022](#); [Duarte et al., 2022](#)) in this special issue were able to expand the information on air quality in the Caribbean. Thus, future studies may be carried out in this area, for adequate improvements in air quality, and aiming at a better respiratory health for the region's population.

Soil contamination via atmospheric precipitation have been increasing in recent years, even with the current crisis generated by COVID. Because it is crucial to develop a study that highlights the possibility of using mining waste ([Ramos et al., 2022](#); [Vieira et al., 2022](#)), we need to seriously make global mining more sustainable, or to improve global food, reduce global change, and the sustainable circular economy ([Li et al., 2022](#)).

In the direction to successfully evaluate the morphology (at micro and nano scale characteristics of the Earth surface media and their effects on resources and environment), composition, mixing state of individual airborne particles, leachability, geo-availability, and pollutant risk linked with numerous compounds of the atmosphere, soil and water, several modern analytical procedures are essential to meticulously characterize illustrative material. [Silva et al. \(2022\)](#) combine Positive Matrix Factorization (PMF) and geophysicochemical techniques to describe air quality in a highly industrialized Caribbean region, and evaluate their suitability for various applications. Several authors of this special issue incorporate experimental work with toxicological tests, light absorption, advanced electron microscopies, X-ray diffraction (XRD), X-ray Fluorescence (XRF), petrographic, and QEMSCAN (Quantitative Evaluation of Materials by Scanning Electron Microscopy) studies to observe the behavior of naturally occurring, inci-

dental, and engineered nanomaterials and their influences on the planet.

Toxicological researchers have validated positive relations between elevated particulate matter concentrations and amplified the occurrence of several diseases and hospital admissions (Martinello et al., 2022a,b; Zhang et al., 2022). These selected works related ambient intensities as a proxy for community contacts, which ignores the variation in personal contact related to individual activities. Traffic-related atmosphere contamination is a principal source of ultra-fine and nano-particles in metropolitan zones (Lima et al., 2021), and the response of surface urban heat islands to urbanization differs widely in space and time (Li et al., 2022). Also, traffic-related nano-particles include an extremely heterogeneous combination comprehending diverse particle-bound components, including black carbon (Blanco-Donado et al., 2022; Moreno-Ríos et al., 2022), elemental compounds (Lima et al., 2021), and polycyclic aromatic hydrocarbons.

The Guest Editors appreciate the opportunity to assemble this special issue, and hope that readers will benefit from the breadth and scope of research addressing the various aspects of environmental geochemistry. We greatly appreciate the time and effort invested by the authors to draft and submit manuscripts, as well as the reviewers who volunteered their time and expertise to perfect the articles presented in this volume. Lastly, we would like to thank Prof. Dr. M. Santosh for his encouragement, support, and guidance in preparing this issue. Despite the COVID-19 pandemic with all its challenges, we are pleased to that we could complete this project in time and assemble important contributions from high-level researchers.

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Available online 15 May 2021



Environment International.

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