THEMATIC TOPICS IN 2022

Volume 18, Number 1 (February)

HALOGENS: FROM PLANETARY SURFACES TO INTERIORS

GUEST EDITORS: **Patricia L. Clay** (University of Manchester, UK) and **Hirochika Sumino** (University of Tokyo, Japan)

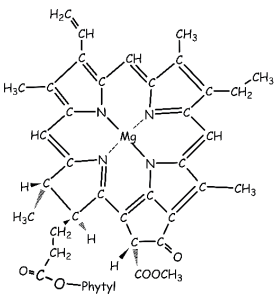
The halogen-group elements (F, Cl, Br, and I) are common in the terrestrial inventory, though often present in trace amounts in many Earth and planetary materials. The halogens play a key role in a variety of geologic environments and processes, from mineralization to their influence on the composition of Earth's atmosphere when released as oceanic, volcanogenic, and anthropogenic emissions. Halogens act as "fingerprints" of fluid-mediated processes on Earth and other planetary bodies. These "bioessential" elements are also critically important to human health. In this issue of *Elements*, we explore the role that the halogens play in shaping diverse planetary systems, from the surface of planets to their interiors. We also review the techniques that are suitable for the analysis of halogen elements and of isotopes of Cl and Br in terrestrial and extraterrestrial materials.

- **Halogens: Salts of the Earth** Patricia L. Clay (University of Manchester, UK) and Hirochika Sumino (University of Tokyo, Japan)
- **A Halogen Record of Fluid Activity in the Solar System** Jessica J. Barnes (University of Arizona, USA) and Michael E. Zolensky (NASA Johnson Space Center, USA)
- **Sediments, Serpentinites, and Subduction: Halogen Recycling from the Surface to the Deep Earth** Mark A. Kendrick (University of Queensland, Australia) and Jaime D. Barnes (University of Texas at Austin, USA)
- **Halogen Behavior at Depth: Insights from Experimental and Observational Constraints** Bastian Joachim-Mrosko (University of Innsbruck, Austria), Tatsuhiko Kawamoto (Shizuoka University, Japan), and Hélène Bureau (IMPMC, CNRS, Sorbonne Université, MNHN, France)
- **Natural Halogen Emissions: Sources, Flux, and Environmental Impact** Anita Cadoux (Université Paris-Saclay France), Susann Tegtmeier (University of Saskatchewan, Canada), and Alessandro Aiuppa (Università di Palermo, Italy)
- **Developments in Halogen Abundance and Isotope Measurements** Ray Burgess (University of Manchester, UK), Mitsuru Ebihara (Waseda University, Japan) and Hans G. M. Eggenkamp (Eberhard-Karls-Universität Tübingen, Germany)

Volume 18, Number 2 (April)

ORGANIC BIOMARKERS

GUEST EDITORS: **Sebastian Naeher** (GNS Science, New Zealand), **Xingqian Cui** (Shanghai Jiao Tong University, China) and **Roger Summons** (Massachusetts Institute of Technology, USA)



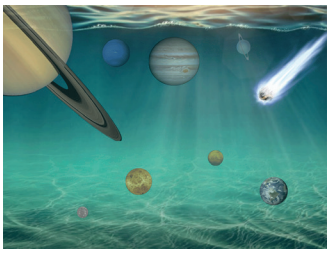
Biomarkers are molecular fossils that are preserved in a wide range of environmental archives (e.g., soils, sediments, sedimentary rocks, and petroleum systems). This issue introduces biomarkers and their compound-specific stable isotope compositions to study fundamental biogeochemical processes and their application as proxies for environmental and climate reconstructions. Molecular biosignatures can be used to study the evolution of life, transitions in ocean plankton over time, the microbiota of extreme environments such as hydrothermal systems and the deep-crustal biosphere, and to search for signs of life beyond Earth. Important new discoveries are typically the result of the development and deployment of improved instrumental techniques, multidisciplinary research approaches, and the combination of organic biogeochemistry with the new tools of molecular biology.

- **Biomarkers: Molecular Tools to Study Life, Environment, and Climate** Sebastian Naeher (GNS Science, New Zealand), Xingqian Cui (Shanghai Jiao Tong University, China), and Roger E. Summons (Massachusetts Institute of Technology, USA)
- **Contributions of Genomics to Lipid Biomarker Research: From Paleoclimatology to Evolution** Laura Villanueva (NIOZ – Royal Netherlands Institute for Sea Research and Utrecht University, The Netherlands) and Marco J.L. Coolen (Curtin University, Australia)
- **Biomarkers in Earth's Ancient Sedimentary Record** Christian Hallmann (Helmholtz-Centre Potsdam – GFZ German Research Centre for Geosciences, Germany), Katherine L. French (United States Geological Survey, USA), and Jochen J. Brocks (Australian National University, Australia)
- **Biomarkers in Extreme Environments on Earth and the Search for Extraterrestrial Life in Our Solar System** Florence Schubotz (University of Bremen, Germany), Mark A. Sephton (Imperial College London, UK), and Sylvie Derenne (Sorbonne University and CNRS, France)
- **Advancing Analytical Frontiers in Molecular Biomarker Research Through Spatial and Mass Resolution** Amy M. McKenna (Florida State University, USA), Paul D. Zander (University of Bern, Switzerland), and Lars Wörmer (University of Bremen, Germany)
- **Future Outlook for Applications of Biomarkers and Isotopes in Organic Geochemistry** John K. Volkman (CSIRO, Australia)

Volume 18, Number 3 (June)

WATER IN PLANETARY BODIES

GUEST EDITORS: **Yves Marrocchi** (Centre de Recherches Pétrographiques et Géochimiques, France) and **Pierre Beck** (Grenoble Alpes University, France)



Despite a simple molecule, water has played a key role in shaping the Solar System from the formation of early solids to the processes of planetary and moon formation. Through its astrophysical cycle, water has driven the evolution of protoplanetary disks, which, in turn, has affected the water budget of terrestrial planets and, therefore, their geological activities and habitability. Understanding water's role in diverse natural processes requires expertise in astrophysics, geophysics, and geochemistry. This issue of *Elements* will introduce the different environments and processes where water is of fundamental importance, as well as its past and present distribution within the Solar System and how this peculiar molecule affects astrophysical and geological processes.

- **The Quest for Water** Yves Marrocchi (CRPG-CNRS, France) and Pierre Beck (Grenoble Alpes University, France)
- **We Drink Good 4.5 Billion-Year-Old Water** Cecilia Ceccarelli (Grenoble Alpes University, France) and Fujun Du (Purple Moutain Observatory, China)
- **Ocean Worlds in Our Solar System** Julie C. Castillo-Rogez (California Institute of Technology, USA) and Klara Kalousova (Charles University, Czech Republic)
- **Water in Differentiated Planets, Moon, and Asteroids** Anne H. Peslier (NASA Johnson Space Center, USA) and Maria Cristina de Sanctis (INAF, Italy)
- **Water in Chondrites and Aqueous Activity on their Parent Asteroids** Lionel G. Vacher (Washington University, USA) and Wataru Fujiya (Ibaraki University, Japan)
- **Water Delivery During Terrestrial Planet Formation** André Izidoro (Rice University, USA) and Laurette Piani (CRPG-CNRS, France)

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Volume 18, Number 4 (August)

CASCADIA SUBDUCTION ZONE

GUEST EDITORS: **Adam Kent** (Oregon State University, USA) and **Josef Dufek** (University of Oregon, USA)

The canonical Cascadia Subduction Zone runs along the west coast of North America from Canada to northern California. The issue will emphasize the region as a historically important location for the development of ideas in subduction zone science, a place for understanding the compound hazards of a subduction zone in a populous region, and as a location where science is now moving beyond the traditional disciplinary confines to embrace multidisciplinary and transdisciplinary approaches. The Cascadia Subduction Zone is a natural laboratory for exploring ideas related to evolving subduction zone geometry and seismicity, melt transport, and the controls on eruptions. This issue will describe our current understanding of the combined tectonic and magmatic systems in this important subduction system.

- **The Cascade Arc: An Introduction** Adam Kent (Oregon State University, USA) and Josef Dufek (University of Oregon, USA)
- **Tectonics of the Cascadia Subduction Zone** Haiying Gao (University of Massachusetts, Amherst, USA) and Maureen Long (Yale University, USA)
- **Quaternary Volcanism and Magmatism in the Cascade Arc and Associated Regions** Adam Kent (Oregon State University, USA) and Christy Till (Arizona State University, USA)
- **The Nature of Active Magma Reservoirs and Storage Underneath Cascade Volcanoes** Josef Dufek (University of Oregon, USA), Kathy Cashman (University of Bristol, UK), Paul Bedrosian (United States Geological Survey, USA), and Emilie Hooft (University of Oregon, USA)
- **The Role of Subduction Zone Processes in the Cultural History of the Cascade Region** Nicole Moore (Pomona College, USA), Lynn Robertson (Bureau of Land Management, USA) and Adam Kent (Oregon State University, USA)
- **Volcanic and Earthquake Hazards of Cascadia** Elizabeth Westphal (USGS Cascade Volcano Observatory, USA) and Chris Goldfinger (Oregon State University, USA)

Volume 18, Number 5 (October)

CEMENT AND CONCRETE: FROM THE ROMANS TO MARS

GUEST EDITORS: **Luca Valentini** (University of Padua, Italy), **Maarten Broekmans** (Geological Survey of Norway, Norway), **Jan Elsen** (KU Leuven, Belgium), and **Ruben Snellings** (VITO, Belgium)

Portland cement represents an essential commodity in a developing and fast urbanizing world. However, the downside of its popularity is a massive ecological footprint, in terms of global warming potential and consumption of mineral and water resources. Therefore, the development of sustainable alternatives to ordinary Portland cement constitutes a fundamental technological and societal challenge. In this context, mineralogy and geochemistry play an important role in assessing primary and secondary resources for a new generation of cement and concrete that has a reduced ecological footprint, drawing from the knowledge of both ancient and modern binders. Mineralogical and geochemical tools are also essential for establishing a link between the basic physical and chemical processes that occur during production, hardening, service life, and degradation of concrete.

- **Cement and Concrete – Past, Present, and Future** Herbert Pöllman (Martin Luther University Halle-Wittenberg, Germany), Ruben Snellings (VITO, Belgium), and Luca Valentini (University of Padua, Italy)
- **Historic Cementitious Materials, Including Roman concrete: Mineralogical Sources and Crystalline Binders** Jan Elsen (KU Leuven, Belgium), Marie D. Jackson (University of Utah, USA), and Encarnación Ruiz-Agudo (University of Granada, Spain)
- **The Rise of Portland Cements** Karen L. Scrivener (EPFL, Switzerland) and Ruben Snellings (VITO, Belgium)
- **Alternative Non-Portland Binders** Theodore Hanein (University of Sheffield, UK), Angeles G. De la Torre (University of Malaga, Spain), Zuhua Zhang (Hunan University, China), and John L. Provis (University of Sheffield, UK)
- **Seeing the Light: Polarization-Fluorescence Microscopy of Concrete and Natural Rocks** Maarten A.T.M. Broekmans (Geological Survey of Norway, Norway), Isabel Fernandes (University of Lisbon, Portugal), and Giulio Viola (University of Bologna, Italy)
- **Sustainable Sourcing of Raw Materials for Construction: From the Earth to the Moon and Beyond** Luca Valentini (University of Padua, Italy), Kathryn R. Moore (University of Exeter, UK), and Mark Bediako (BRRI-CSIR, Ghana)

Volume 18, Number 6 (December)

EXPLORING JUPITER'S MOON IO

GUEST EDITORS: **Anne Pommier** (Carnegie Institution for Science, USA) and **Alfred McEwen** (University of Arizona, USA)

Credit: NASA/JPL

Jupiter's moon Io is the best place to understand a fundamental planetary process that shaped terrestrial planets, icy ocean worlds, and extrasolar planets: tidal heating. Io is the most tidally heated world in our Solar System and may contain a magma ocean. Io's spectacular volcanic plumes sustain the atmosphere and feed the giant magnetosphere of the Jovian system. The lavas covering its surface reflect heat-pipe tectonics, which is analogous to the volcanically hyperactive youth of all rocky planets. Io is the ideal planet-scale laboratory to study the intertwined processes of tidal forcing, extreme volcanism, and atmosphere–magnetosphere interactions. This issue of *Elements* will review our knowledge of Io, emphasizing on its composition, interior dynamics, and surface processes. We will also share perspectives for future missions.

- **Io: A Unique World in Our Solar System** Anne Pommier (Carnegie Institution for Science, USA) and Alfred McEwen (University of Arizona, USA)
- **Tidal Heating in Io** Isamu Matsuyama (University of Arizona, USA), Teresa Steinke (Delft University of Technology, The Netherlands), and Francis Nimmo (University of California Santa Cruz, USA).
- **Io's Volcanic Activity and Atmosphere** Ashley G. Davies (Jet Propulsion Laboratory, USA) and Audrey Vorburger (University of Bern, Switzerland)
- **The Internal Structure of Io** Doris Breuer (DLR Institute of Planetary Research, Germany), Christopher Hamilton (University of Arizona, USA), and Krishan Khurana (UCLA, USA)
- **The Tectonics of Io: An Analogue for Early Terrestrial Planets** Laszlo P. Keszthelyi (USGS, USA), Jani Radebaugh (Brigham Young University, USA), and Windy Jaeger (USGS, USA)
- **Perspective: The Future Exploration of Io** James T. Keane (Jet Propulsion Laboratory, USA), Katherine de Kleer (Caltech, USA), John Spencer (Southwest Research Institute, USA).