

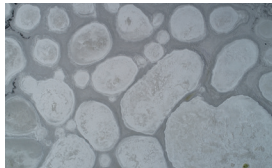
2023 THEMATIC PREVIEW

Volume 19, Number 1 (February)

ALKALINE LAKES

GUEST EDITORS: **Benjamin M. Tutolo** (University of Calgary, Canada) and **Nicholas J. Tosca** (University of Cambridge, UK)

Alkaline lakes are incredibly dynamic, unique, and fascinating biogeochemical environments. This thematic issue will leverage the authors' multidisciplinary insights to portray alkaline lakes' biogeochemical, mineralogical, and geological importance for both science and society. The articles will individually explore the unique conditions leading to the formation of alkaline lakes, the distinctively productive microbial ecosystems that inhabit them, their distinguishing chemistry and mineralogy, their role as societally important economic resources, and their potential to have originated life on Earth as well as Mars. This approachable overview of the geochemical, biological, and societal aspects of alkaline lakes will establish their vital importance to the broad readership of *Elements* and stimulate continued explorations of these mesmerizing geological systems.



- **Dry, Salty, and Habitable: The Science of Alkaline Lakes** Benjamin M. Tutolo (University of Calgary, Canada) and Nicholas J. Tosca (University of Cambridge, UK)
- **How to Make an Alkaline Lake: Fifty Years of Chemical Divides** Nicholas J. Tosca (University of Cambridge, UK) and Benjamin M. Tutolo (University of Calgary, Canada)
- **Making Salt from Water: The Unique Mineralogy of Alkaline Lakes** Maija J. Raudsepp (University of Alberta, Canada), Siobhan A. Wilson (University of Alberta, Canada), and Bree Morgan (Sydney University, Australia)
- **The Vigor, Vanity, and Application of Microbial Element Cycles in Alkaline Soda Lakes** Marianne Haines (University of Calgary, Canada), Varada Khot (University of Calgary, Canada), and Marc Strous (University of Calgary, Canada)
- **High Carbonate Alkalinity Lakes on Mars and their Potential Role in an Origin of Life Beyond Earth** Joel A. Hurowitz (Stony Brook University, USA), David C. Catling (University of Washington, USA), and Woodward W. Fischer (Caltech, USA)

Volume 19, Number 2 (April)

INTO THE RIFT: THE GEOLOGY OF HUMAN ORIGINS IN EAST AFRICA

GUEST EDITORS: **Anatoly N. Zaitsev** (St. Petersburg State University, Russia), **Charles Musiba** (University of Colorado, USA), and **Lindsay McHenry** (University of Wisconsin-Milwaukee, USA)

Spanning from the horn of Africa down to Lake Malawi, the East Africa Rift preserves a plethora of paleoanthropological sites (e.g., Olduvai Gorge, Turkana, Awash) that document our evolutionary journey spanning the last seven million years of Earth's history. A common feature of these sites is that they are associated with volcanic-sedimentary basins intimately related to the development of the rift. Radiometric and paleomagnetic geochronology helps establish age relations between different hominin species. Geochemical studies of primary tuffs help correlate between sites and identify specific volcanic sources. Authigenic minerals formed in rift lakes can help reconstruct past climates and environments. Recent excavations at Laetoli show that this valuable site is slowly disappearing owing to diagenetic processes, and preservation of the footprints is essential and urgently needed.



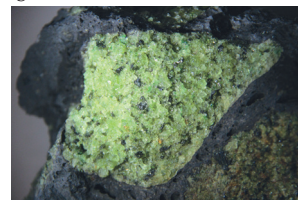
- **The Dawn of Humanity: What Can Paleoanthropologists and Geoscientists Learn From One Another?** Charles Musiba (University of Colorado, USA), Purity W. Kiura (National Museums of Kenya, Kenya), and Mulugeta Alene Araya (Addis Ababa University, Ethiopia)
- **Tectonic and Paleoclimatic Setting for Hominin Evolution in East Africa** Lydia Olaka (Technical University of Kenya, Kenya) and Cynthia J. Ebinger (Tulane University, USA)
- **Using Radiometric Dating, Magnetostratigraphy, and Tephrostratigraphy to Calibrate Rates of Hominin Evolution in the East African Rift** Alan L. Deino (Berkeley Geochronology Center, USA), Luis Gibert (University of Barcelona, Spain), and Céline M. Vidal (University of Cambridge, UK)
- **Paleolakes of Eastern Africa: Zeolites, Clay Minerals, and Climate** Lindsay J. McHenry (University of Wisconsin-Milwaukee, USA), Verena Foerster (University of Cologne, Germany), and Daniel Gebregiorgis (Georgia State University, USA)
- **Laetoli: The Oldest Known Hominin Footprints in Volcanic Ash** Anatoly N. Zaitsev (St. Petersburg State University, Russia), Anton R. Chakhmouradian (University of Manitoba, Canada), and Charles Musiba (University of Colorado, USA)

Volume 19, Number 3 (June)

OLIVINE

GUEST EDITORS: **Emily First** (Macalester College, USA), **Philipp Ruprecht** (University of Nevada-Reno, USA), and **Benoît Welsch** (Macalester College, USA)

To study the Earth and other planetary bodies, one has to understand the mineral olivine; when and where it forms, how it crystallizes and deforms, and how it responds to changing environmental conditions in the Earth's interior, on the surface, and in space. This issue will take a look at olivine research from the atomic scale to the Solar System and beyond. Olivine plays a critical role for plate tectonics, magma transport from mantle sources to the surface, how the Solar System differentiated and evolved, and also for the efforts addressing climate change through carbon capture and storage. This issue will highlight olivine research that crosses many disciplines, from seismology and geodynamics, petrology and volcanology to low-temperature geochemistry and remote sensing.

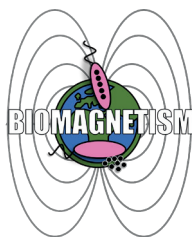


- **Olivine – The Little Green Science Machine** Benoît Welsch (Macalester College, USA), Emily First (Macalester College, USA), and Philipp Ruprecht (University of Nevada-Reno, USA)
- **Hide and Seek: Trace Element Incorporation and Diffusion in Olivine** Michael C. Jollands (Gemological Institute of America, USA), Ralf Dohmen (Ruhr Universität Bochum, Germany), and José Alberto Padrón-Navarta (CSIC Universidad de Granada, Spain)
- **Driving Upper Mantle Flow – Olivine Mechanical Properties and Anisotropy** Sylvie Demouchy (Université Clermont Auvergne, France), Qin Wang (Nanjing University, China), and Andréa Tommasi (Université de Montpellier, France)
- **Olivine Exit Interviews – Piecing Together Magmatic Puzzles** Philipp Ruprecht (University of Nevada-Reno, USA) and Benoît Welsch (Macalester College, USA)
- **Olivine – The Alteration Rock Star** Oliver Plümper (Utrecht University, Netherlands) and Juerg Matter (National Oceanography Centre Southampton, UK)
- **Galaxy of Green – Olivine from Early Solar System to Exoplanets** Emily First (Macalester College, USA), Christopher Kremer (Stony Brook University, USA), Myriam Telus (University of California-Santa Cruz, USA), and David Trang (University of Hawai'i at Mānoa, USA)

Volume 19, Number 4 (August)

BIOMAGNETISM

GUEST EDITORS: **James Byrne** (University of Bristol, UK) and **Matthieu Amor** (École Normale Supérieure de Lyon, France)



In this thematic issue of *Elements*, we look into biomagnetism and the production of magnetic minerals by microorganisms. In popular culture, this may have supernatural connotations; however, in reality, there are many microscopic biological organisms possessing magnetic behaviour owing to their formation of magnetic nanoparticles (MNP) such as magnetite (Fe_3O_4), maghemite ($\gamma\text{-Fe}_2\text{O}_3$), and greigite (Fe_3S_4). We look broadly at the relationship between biogenic MNP formation and biomagnetism: focusing on the mechanisms responsible for these minerals by bacteria; seeking to address whether MNP hold clues to the evolution of life on Earth, and potentially beyond; investigating the contribution of biomagnetism to the biogeochemical cycling of iron; considering the potential application of MNP for industrial remediation; and probing the presence of MNP in multicellular prokaryotes and eukaryotic organisms.

- **Biomagnetism: Insights into Magnetic Minerals Produced by Biological Microorganisms** James M. Byrne (University of Bristol, UK) and Matthieu Amor (École Normale Supérieure de Lyon, France)
- **Magnetofossils: Relicts and Records of Deep Time and Space** Sarah P. Slotznick (Dartmouth College, USA), Ramon Egli (Zentralanstalt für Meteorologie und Geodynamik Austria), and Ioan Lascu (National Museum of Natural History, Smithsonian Institution, USA)
- **Impact of Biogenic Magnetite Formation and Transformation on Biogeochemical Cycles** Andreas Kappler (University of Tübingen, Germany), Aaron Thompson (University of Georgia, USA), and Muammar Mansor (University of Tübingen, Germany)
- **Environmental, Biomedical, and Industrial Applications of Biogenic Magnetite Nanoparticles** Lucía Gandarias (Universidad del País Vasco, Spain), Richard L. Kimber (University of Vienna, Austria), and Georges Ona-Nguema (Sorbonne Université, France)
- **Magnetosomes and Magnetic Orientation in Multicellular Prokaryotes and Eukaryotes** Pedro Leão (University of Texas at Austin, USA) and Christopher Lefevre (Aix-Marseille Université, France)

Volume 19, Number 5 (October)

LARGE IGNEOUS PROVINCES: VERSATILE DRIVERS OF GLOBAL CHANGE

GUEST EDITORS: **Frances M. Deegan** (Uppsala University, Sweden), **Sara Callegaro** (University of Oslo, Norway), **Henrik H. Svensen** (University of Oslo, Norway), and **Joshua H.F.L. Davies** (Université du Québec à Montréal, Canada)



Earth's history is punctuated by volcanic episodes at a scale never witnessed by humans, known as large igneous provinces (LIPs). These extraordinary volcanic and tectonic events are associated with profound changes to planet Earth, including its climate and habitability. One of the major factors controlling the impacts of LIPs is the cocktail of gases emitted to the atmosphere and oceans. In this issue of *Elements*, we explore the versatile impacts of LIPs, from their connections to mass extinctions in aquatic and terrestrial environments to climate warming and global icehouse events. This issue also highlights our current understanding of subterranean architectures of LIPs, processes and consequences of interaction between LIP magma and surrounding crustal rocks, and advances in the timing of intrusive events.

- **Driving Global Change One LIP at a Time** Frances M. Deegan (Uppsala University, Sweden), Sara Callegaro (University of Oslo, Norway), Henrik H.

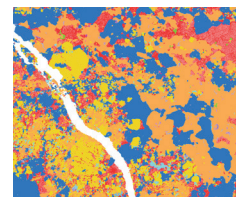
Svensen (University of Oslo, Norway), and Joshua H.F.L. Davies (Université du Québec à Montréal, Canada)

- **How Large Volcanic Eruptions Have Killed Most Life on Earth – Numerous Times** Stephen E. Grasby (Geological Survey of Canada – Calgary, Canada) and David Bond (University of Hull, UK)
- **Impacts of Large-Scale Magmatism on Land Plant Ecosystems** Jennifer Galloway (Geological Survey of Canada – Calgary, Canada) and Sofie Lindström (University of Copenhagen, Denmark)
- **Subvolcanic Architectures, Thermogenic Volatiles, and Climate Warming at LIPs** Henrik H. Svensen (University of Oslo, Norway), Morgan T. Jones (University of Oslo, Norway), and Tamsin Mather (University of Oxford, UK)
- **Franklin Large Igneous Province and Initiation of Snowball Earth** Francis A. Macdonald (University of California – Santa Barbara, USA) and Nicholas L. Swanson-Hysell (University of California – Berkeley, USA)
- **High-Precision Geochronology of LIP Intrusions: Records of Magma–Sediment Interaction** Sean P. Gaynor (Princeton University, USA), Joshua H.F.L. Davies (Université du Québec à Montréal, Canada), and Urs Schaltegger (University of Geneva, Switzerland)

Volume 19, Number 6 (December)

GEOMETALLURGY: RESOURCE OPTIMIZATION FOR A SUSTAINABLE FUTURE

GUEST EDITORS: **Max Frenzel**, **Raimon Tolosana-Delgado**, and **Jens Gutzmer** (all of Helmholtz-Zentrum Dresden-Rossendorf HZDR, Germany)



Geometallurgy is an interdisciplinary research field concerned with the planning, monitoring, and optimization of mineral resource extraction and processing. Geometallurgy requires a quantitative understanding of primary resource characteristics such as mineralogical composition and texture, the distribution and variability of these characteristics across the target ore body, and how these interact with mining and beneficiation processes. This requires accurate analytical data for resource characterization, a detailed understanding of ore body geology, process technology, economics, and the often-complex interactions between them. In this issue of *Elements*, we explore the fundamental concepts relevant to the field. We also review how current geometallurgical research is opening up opportunities for geoscientists to generate better economic and environmental outcomes for the global raw materials industry as part of a sustainable economy.

- **Geometallurgy: Present and Future** Max Frenzel (Helmholtz-Zentrum Dresden-Rossendorf HZDR, Germany), Regina Baumgartner (Teck Resources Ltd., Canada), Raimon Tolosana-Delgado (HZDR, Germany), and Jens Gutzmer (HZDR, Germany)
- **Characterization of Ore Properties for Geometallurgy** Alan R. Butcher (Geological Survey of Finland GTK, Finland), Simon Michaux (GTK, Finland), Quentin Dehaine (GTK, Finland), and Andrew H. Menzies (Bruker Nano Analytics, Germany)
- **All About Particles: Modelling Particle Behavior in Mineral Beneficiation** Lucas Pereira (Helmholtz-Zentrum Dresden-Rossendorf HZDR, Germany), Max Frenzel (HZDR, Germany), Edgar Schach (TU Bergakademie Freiberg, Germany), and Raimon Tolosana-Delgado (HZDR, Germany)
- **Fire and Water: Geometallurgy and Extractive Metallurgy** Deshenthree Chetty (MINTEK, South Africa), Glen T. Nwaila (University of the Witwatersrand, South Africa) and Buhle Xakalasha (MINTEK, South Africa)
- **Opportunities for the Environmental Mitigation of Wastes across the Life-of-Mine Using Geometallurgical Tools** Anita Parbhakar-Fox (University of Queensland, Australia) and Regina Baumgartner (Teck Resources Ltd., Canada)
- **Uncertainty and Value: Geometallurgical Optimisation of the Mining Value Chain** Julian M. Ortiz (Queen's University, Canada), Sebastian Avalos (Queen's University, Canada), Alvaro I. Riquelme (Queen's University, Canada), Oy Leuangthong (SRK Consulting, Canada), and Nasser Madani (Nazarbayev University, Kazakhstan)