SHEDDING LIGHT ON THE EUROPEAN ALPS

GUEST EDITORS: Anders McCarthy (University of Bristol, UK and University of Tasmania, Australia) and Othmar Müntener (University of Lausanne, Switzerland)

The European Alps are one of the most studied orogens worldwide. Research over last 30 years is forcing us to rethink our understanding of Alpine evolution: new concepts have emerged that question long-established paradigms. We will provide a petrological, geochemical, and tectonic overview of the Alpine Orogeny, from rifting and spreading to subduction and collision and, finally, to postcollisional uplift and erosion. In this issue, we shed light on the current debates regarding the origins of (ultra-)high pressure metamorphism, the origins of syn-magmatic magmatic events, and the evolution of rifting and ocean spreading. We also examine the consequences of the new interpretations on the dynamics of subduction and collision.

• **Subduction Dynamics in the Alps** Philippe Agard (Sorbonne University, France) and Mark Handy (Free University of Berlin, Germany)
• **Climate, Uplift and Erosion Shaping the European Alps** Pierre Valla (Grenoble Alpes University, France), Pietro Serneri (University of Milano–Bicocca, Italy), and Matthew Fox (University College London, UK)
• **The Heterogeneous Tethyan Oceanic Lithosphere of the Alpine Ophiolites** Elisabetta Rampone (DISTAV, University of Genoa, Italy) and Alessio Sanfilippo (University of Padua and CNR, Italy)
• **Amagmatic Convergence Controlled by Rift Inheritance** Anders McCarthy (University of Bristol, UK and University of Tasmania, Australia), Julie Tugend (Sorbonne University, France), and Geoffrey Mohn (University of Cergy-Pontoise, France)
• **Under Pressure: High-Pressure Metamorphism in the Alps** Lucie Tajčmanová (Heidelberg University, Germany), Paola Manzotti (Stockholm University, Sweden), and Matteo Alvaro (University of Pavia, Italy)
• **Superhydrous Arc Magmas in the Alpine Context** Othmar Müntener (University of Lausanne, Switzerland), Peter Ulmer (ETH Zurich, Switzerland), and Jon Blundy (University of Oxford, UK)

EXPLORING EARTH AND PLANETARY MATERIALS WITH NEUTRONS

GUEST EDITORS: David R. Cole (Ohio State University, USA) and Nancy L. Ross (Virginia Tech, USA)

For over half a century, the structural details and the dynamics of atomic arrangements in materials have been determined using neutron-based scattering and absorption measurements. Neutron scattering experiments have contributed valuable information on geological materials and how they interact with fluids. In situ studies of transformations and fundamental properties can emulate diverse environments from Earth’s surface to its deep interior. Potential growth of the “neutron community” is being realized with the development of new and improved neutron sources. This issue of Elements will familiarize the reader with the basic concepts of neutron scattering, the methods that are available to Earth scientists, provide a summary of facilities around the world, and give key applications of the technique.

• **Neutron Scattering: A Beginners’ Guide for Earth Scientists** Nancy L. Ross (Virginia Tech, USA) and David R. Cole (Ohio State University, USA)
• **Where is the Hydrogen?** G. Diego Gatta (University of Milan, Italy), Klaudia Hradil (Vienna University of Technology, Austria), and Martin Meven (RWTH Aachen University, Germany)
• **Phase Transitions and Magnetism in Minerals** Bryan C. Chakoumakos (Oak Ridge National Laboratory, USA) and John B. Parise (Stony Brook University, New York, USA)
• **Probing the Structure of Melts, Glasses, and Amorphous Materials** Chris J. Benmore (Argonne National Laboratory, USA) and Martin C. Wilding (Sheffield Hallam University, UK)
• **Nanoscale Structure and Dynamics in Geochemical Systems** Andrew G. Stack (Oak Ridge National Laboratory, USA), Hsuan-Wen Wang (Oak Ridge National Laboratory, USA), and David R. Cole (Ohio State University, USA)
• **Imaging with Neutrons** Gilberto Artioli (University of Padua, Italy) and Daniel S. Hussey (National Institute of Standards and Technology, USA)

SPELEOTHEMS

GUEST EDITORS: Joshua M. Feinberg (University of Minnesota, USA) and Kathleen R. Johnson (University of California, Irvine, USA)

Growing slowly drip by drip through the millennia, stalagmites, stalactites, and flowstone—collectively known as speleothems—are some of the most fantastic mineral features in nature. Speleothems are also critical archives of past environments, and their study incorporates expertise from groundwater hydrogeology and geochemistry, atmospheric chemistry, climate science, geobiology, and even geophysics. Research on speleothem trace element and isotopic geochemistry, constituent organic compounds, noncarbonate minerals, and morphology can help illuminate paleoenvironmental conditions and document historical anthropogenic land-use changes. This issue of Elements will introduce the many ways that speleothems are used within the geoscience community to learn about natural Earth processes and our role in modifying them.

• **The Origins of Caves and Speleothems** Joshua M. Feinberg (University of Minnesota, USA) and Kathleen R. Johnson (University of California, Irvine, USA)
• **Uranium-Series Geochronology of Speleothems** Katee Wendt (University of Minnesota, USA), R. Lawrence Edwards (University of Minnesota, USA), and Xiangli Li (Xi’an Jiaotong University, China)
• **Reconstructing Past Hydroclimates from Speleothems** Kathleen R. Johnson (University of California, Irvine, USA)
• **Speleothem Paleothermometry** Nele Meckler (University of Bergen, Germany) and Hubert Vomhof (Max Planck Institute for Chemistry, Germany)
• **Cave Decorating with Microbes: Geomicrobiology of Caves** Daniel S. Jones (New Mexico Institute of Mining and Technology, USA) and Diana E. Northrup (University of New Mexico, USA)
• **Mineral Magnetism of Cave Deposits** Joshua M. Feinberg (University of Minnesota, USA), Plinio Jaqueto (University of São Paulo, Brazil), and Ron Shaar (Hebrew University of Jerusalem, Israel)
Carbonatites are rare, but important, igneous rocks in the Earth’s crust. They are composed dominantly of the Ca, Mg and Fe carbonates, along with many other minor and trace components. The popularity of high-tech devices—smart phones, electric motors for zero-emission vehicles, wind turbines for renewable energy—has led to a renewed focus on these enigmatic carbonatite magmas, because to make these devices requires rare earth elements and the majority of the world’s rare earth crust, the temporal and tectonic controls on their formation, why they are so enriched in rare earth elements, and what are their economically significant minerals.

- **Carbonatites: Are They the Product of Simplicity or Diversity?** Vadim S. Kamenetsky (University of Tasmania, Australia), Anatoly N. Zaitsev (St. Petersburg State University, Russia), Anna G. Doroshkevich (Sobolev Institute of Geology and Mineralogy, Russia), and Holly A.L. Elliott (University of Southampton, UK)
- **Upper Mantle to Crustal Evolution of Carbonatite Magmas** Gregory M. Yaxley (Australian National University), A. Lynnot Jacques (Australian National University), and Bruce A. Kjaergaard (Geological Survey of Canada)
- **Carbonatites and their Role in Diamond Formation in the Deep Earth** Suzette Timmerman (University of Alberta, Canada), Anna V. Spivak (Russian Academy of Sciences), and Adrian P. Jones (University College London, UK)
- **Rare Earth Deposits in Carbonatites** Michael Anenburg (Australian National University), Sam Broom-Fendley (University of Exeter, UK), and Wei Chen (China University of Geosciences)
- **The Distinctive Mineralogy of Carbonatites** Andrew G. Christy (Queensland Museum, Australia), Igor V. Pekov (Lomonosov Moscow State University, Russia), and Sergey V. Krivovichev (St. Petersburg State University, Russia)
- **Carbonatites and Global Tectonics Through Geological Time** Emma R. Humphreys-Williams (Natural History Museum, London, UK) and Sabin Zahirovic (University of Sydney, Australia)