Dekkers Mark, J. (Orcid ID: 0000-0002-4156-3841)

Feinberg Joshua, M. (Orcid ID: 0000-0002-5845-9848)

Florindo Fabio (Orcid ID: 0000-0002-6058-9748)

Introduction to the special collection: Magnetism in the Geosciences – Advances and Perspectives

Mark J. Dekkers, Joshua Feinberg and Fabio Florindo

Abstract. Magnetic property research in the geosciences has seen an enormous development during the most recent decade. The underlying special collection published in two AGU journals: *Journal of Geophysical Research – Solid Earth* and *Geochemistry, Geophysics, Geosystems* is an outcome of the 11th International Conference on Rock Magnetism, held in Utrecht (The Netherlands) in July 2017, and reflects this full breadth. We recognize four groups in which individual contributions are gathered. 1) Recent advances in fundamental rock and mineral magnetic methods, including discussions on how to assess magnetic grain size, which is centrally important to magnetic stability over geologic timescales and high-fidelity paleomagnetic recording. 2) Geomagnetism with an emphasis on late Pleistocene paleosecular variation and relative paleointensity records, relevant to geomagnetic field models. 3) Reassessments of classic paleomagnetic field tests and examples of tectonic and magnetostratigraphic applications. 4) The merit of magnetic property analysis in solving geoscience problems, both in soft and hard rocks.

Research on magnetic properties and records in natural materials and rocks has broadened in an extraordinary way over the last decade. Specialists in rock, paleo-, and geomagnetism now provide critical insights to an incredible range of disciplines, including tectonics, planetary geology, biophysics, archaeology, paleoclimate, exploration geology, and geodynamics. The scientific breadth of our community was on full display at the International Conference on Rock Magnetism held in Utrecht (The Netherlands) from 10-14 July 2017, the 11th conference in the Santa Fe conference series organized by the Institute for Rock Magnetism (University of Minnesota, Minneapolis, MN, USA). These meetings focus on fundamental research in magnetism as it is applied to a wide array of geoscientific disciplines and beyond. Traditionally, rock magnetism has provided the scientific basis for paleomagnetic approaches and protocols, and much research has thus been devoted to understanding the stability of magnetic recordings in rocks as a function of geological time. Sessions at the meeting included: Fundamental Rock Magnetism, Sources and Significance of Crustal Magnetic Anomalies, Environmental Magnetism, Determining Geomagnetic Field Behavior from Terrestrial and Extraterrestrial Materials, Sediment Magnetization – Acquisition and Preservation, Advanced Approaches to Rock Magnetic Characterization and Data Analysis, and two cross-thematic poster sessions. Among many exciting findings, these sessions explored the state-of-the-art in micromagnetic modeling and the elusive nature of the relationship between magnetic grain size and physical grain size. The impact of remanent magnetization on the expression of crustal magnetic anomalies was evaluated, along with methodologies for assessing the veracity of the magnetic signal recorded in rocks for paleoenvironmental assessments. New research on magnetotaxis and magnetoreception, at the interface of biology and geoscience, was presented. How sediments

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1029/2019JB018375

acquire and maintain their magnetization was addressed in great detail, along with how to deal with the increasingly larger data sets in the magnetic geosciences. This broad context is reflected in this special collection "Magnetism in the Geosciences – Advances and Perspectives" published in two AGU journals: *Journal of Geophysical Research – Solid Earth* and *Geochemistry, Geophysics, Geosystems*. The collection reflects the wide range of topics being studied by our community, conveniently categorized into four groups. Recent advances in fundamental rock and mineral magnetic methods form the first group, along with discussions on how to assess magnetic grain size, which is centrally important to magnetic stability over geologic timescales and high-fidelity paleomagnetic recording. The second group focuses on geomagnetism with an emphasis on late Pleistocene paleosecular variation and relative paleointensity records, relevant to geomagnetic field models. The third group includes timely reassessments of classic paleomagnetic field tests and examples of tectonic and magnetostratigraphic applications. The fourth group illustrates the merit of magnetic property analysis in solving geoscience problems, both in soft and hard rocks.

Guest editors include Mark Dekkers, Josh Feinberg, and Fabio Florindo. We are particularly grateful to conference organizers, session conveners and chairs for a wonderful meeting, and to the editors-in-chief of *Journal of Geophysical Research – Solid Earth* and *Geochemistry, Geophysics, Geosystems* for their permission to host this special collection. We gratefully acknowledge support from the University of Minnesota, Utrecht University, the U.S. National Science Foundation, and the Netherlands Academy of Sciences for hosting the meeting and providing travel support to its participants. Most of all, we are grateful for the efforts of all the authors and reviewers who made this special collection a reality, and we hope that you will enjoy reading it.