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EarthChem Communities: Building Geochemical Data Best Practices with Researcher Engagement

Lucia Profeta, Kerstin Lehnert, Lulin Song, and Juan David Figueroa

Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA

Acquisition and use of geochemical data are pervasive in the Earth, Environmental and Planetary Sciences as they are fundamental to our understanding of past, present, and future processes in natural systems, from the interior of the Earth to its surface environments on land, in the oceans, and in the air, to the entire solar system. Accordingly, the range of research communities that generate and use geochemical data is quite extensive. Data practices and workflows for processing, reporting, sharing, and using data are numerous and distinct for different research communities. Furthermore, the type of data generated is highly diverse with respect to analyzed parameters, analyzed materials, analytical techniques and instrumentation, as well as volume, size, and format. This makes it difficult to define generally applicable best practices and standards for geochemical data that the entire range of geochemical data communities will adopt. While it is technically possible to describe and encode the large variety of geochemical measurements in a consistent, unifying way provided by the Observations and Measurements conceptual model (<https://www.ogc.org/standards/om>), communities need to build consensus around specifics in data formats, metadata, and vocabularies, and most importantly, they need to 'own' the best practices to ensure adoption.

EarthChem is a data facility for geochemistry, funded by the US National Science Foundation since 2006, to develop and operate community-driven services that support the discovery, access, preservation, reusability, and interoperability of geochemical data. EarthChem has a long record of engaging with the global research community to develop and promote data best practices for geochemistry by, for example, initiating and helping to organize the Editors Roundtable (Goldstein et al. 2014, <http://dx.doi.org/10.1594/IEDA/100426>). In recent years, as researchers have become increasingly aware of the benefits and requirements of FAIR data management, EarthChem has supported research communities wanting to establish consistent data formats and rich metadata for better findability and reproducibility of specific data types acquired and used within these communities. EarthChem now works with community advisers to build consensus around data best practices, provide resources for researchers to comply with these best practices, and streamline data submission and data access for these communities. EarthChem provides Community web pages as spaces to explain community-specific best practices, offer downloadable data templates, and link to customized community portals for data submission and access. EarthChem is in the process of defining guidelines and policies that will ensure that the best practices and data templates promoted by an EarthChem Community are indeed community

endorsed. By making sure that the community-specific best practices align with more general data standards such as the elements of the O&M conceptual data model or the use of globally unique identifiers for samples, EarthChem Communities can advance overarching data best practices and standards that will improve reusability of geochemical data and data exchange among distributed databases. Initial EarthChem Communities include Tephra, Clumped Isotopes, and Experimental Petrology. Additional communities such as GeoHealth and Laser Induced Breakdown Spectroscopy are currently in an exploratory stage.