Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11085

Developing A Proof-of-Concept Environmental Geochemistry Database in Canada

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The FAIR data principles – findability, accessibility, interoperability, reusability – provide guidance to enhance data utilization beyond its initial purpose. To meet new scientific challenges in an era of big data and machine learning, large quantities of data are only beneficial if they are easily accessible, well-documented, and reliable. The broader international geochemistry research community efforts regarding data stewardship inspired an initiative to consider these concepts in the environmental geochemistry sub-discipline of acid rock drainage and metal leaching (ARD/ML) associated with mining deposits.

Proposed mining projects are a substantial source of environmental geochemistry data for mine waste (i.e., mine rock and tailings), as it is crucial for mining operators to evaluate ARD/ML potential to support the development of waste management and mitigation plans. In Canada mining proponents complete geochemical characterization studies during the regulatory process, with PDF files stored on public online impact assessment registries constituting a large industry-driven dataset that cannot be utilized effectively. Digital reports from 78 metal mining projects across Canada provide a data source for the development of a proof-of-concept database. A semi-automated approach using Python was developed to extract, standardize, verify, and aggregate tabulated geochemical data into a digital solution. This can be queried to download data meeting search criteria related to analytical method, project geography, geology, commodity, and proposed mine plan, among others. Targeted data includes tests such as major and trace elements, acid base accounting, leach tests, and quantitative mineralogy.

This proof-of-concept initiative provides valuable insights regarding data stewardship for the environmental geochemistry community. The aggregation of these industry-driven datasets would support advanced analytical approaches to addressing research questions regarding the geo-environmental characteristics of mine waste and improved decision making on its management. To facilitate the reuse and interoperability of these datasets, minimum information requirements and (meta)data standards could be considered to address inconsistencies arising from the variability of evolving analytical methods and their application within the ARD/ML discipline. Thus, a consensus on data stewardship for this sub-discipline would support the reusability of these valuable datasets by both industry and researchers.