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Marine Pyrite trace element database and its multiple applications

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Trace element chemistry of certain minerals can be used to provide insights into a range of geological problems related to, but not limited to, mineral exploration, sediment provenance, redox conditions. Pyrite, one of the most ubiquitous sulphides, is an excellent source for extensive trace element data. And the LA-ICPMS technique assists with the rapid generation of high-quality trace element data for a suite of elements (~22). Pyrite trace element geochemistry obtained via *in-situ* LA-ICPMS method can be used for a variety of geoscience research pertaining to marine chemistry (modern and ancient oceans), ore genesis for a multitude of ore deposits, targeted mineral exploration, atmosphere-ocean redox structures and evolution of life on Earth [1] [2] [3] [4] [5].

This talk will focus on the applicability of the marine pyrite database (~10,000 pyrite analyses) in mineral exploration, and ancient marine chemistry and evolution of life. First, we aim to clearly demonstrate the advantage of evaluating and utilising large datasets of pyrite trace element analyses from sediment hosted ore deposits (sed-Cu and Zn-Pb). Powerful mineral exploration tools such as trace element vector and fertility diagrams constructed using this trace element data will be discussed [4]. More importantly, we put special emphasis on datasets, that makes it possible to assess and define barren rock pyrite chemistry for different ore deposits. That's because the information serves as an excellent reference for background chemistry for mineral exploration. Second, we discuss how marine sedimentary pyrite trace element data is being used to infer past marine redox & nutrient trends and evolution of early life [5]. Applications of various geochemical proxies in deep time geology is work in progress and availability of extensive datasets is key. A combination of machine learning and pyrite trace element database coupled with other existing datasets is proving to be a powerful resource in geoscience research.

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[2] Gregory et al. (2015), Econ. Geol. 110(6), 1389-1410

[3] Mukherjee & Large (2016), Precam. Res. 281, 13-26

[4] Mukherjee & Large (2017), Ore Geology Reviews. (81), 1249-1270

[5] Mukherjee & Large (2020) Geology. 48: 1018–1022