The Ba Isotope Composition of Barites from Ore Deposits

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The mineral barite ($BaSO_4$) occurs in sedimentary, metamorphic, and igneous geological settings as well as in the oceans.

Barite formation in the oceanic water column is associated with degradation of organic matter and barite accumulation rates in marine sediments are often used as tracers for (past) productivity and marine carbon export. Barite is also a common mineral in a wide variety of ore deposits. Its predominat commercial use is as a vital ingrediant of drilling mud mainly in the oil industry.

The trace element and isotope composition of barite has been used to better understand the precipitation environment and to identify source components of ore deposts.

Recently variations in the stable isotope composition of barium (Ba) have been explored as a tracer for water mass mixing and marine carbon export [1, 2]. Ba isotope compositions show systematic variations within the water column of the oceans, which are also distinct from the freshwater signal. In addition, unpublished data also indicate small but systematic variations in igneous rocks. The isotopic differences between these reservoirs are small but systematic and analytically significant.

We will investigate the hypothesise that (1) either the specific Ba isotope signature of source fluids responsible for barite formation can be inherited and that this will allow us to trace the sources of mineral forming fluids or that (2) the process of mineral formation will reset this signature and therefore allow to better constrain formation conditions. In both cases, Ba isotopes might have the potential to provide unique information about the genetic history of ore formation. We will present Ba isotope data of barites from a variety of different ore deposit types (e.g. SEDEX, VHMS, porphyry, orogenic gold, evaporite) and explore the applicability of Ba isotopes as a tracer for ore formation processes.

[1] Hsieh & Henderson (2017), Earth Planet. Sci. Letters, 473, 269-278. [2] Bridgestock et al. (2018), Earth Planet. Sci. Letters, 481, 101-110.