Trace element molecular geochemistry: A new approach for investigating the past

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Redox sensitive trace elements are regularly used as paleo proxies. The first studies employing trace elements relied only on interpreting changes in their concentrations. Although simplistic, this approach allowed major scientific breakthroughs. The availability of MC-ICP-MS allowed the determination of trace element isotopic signatures. The community considered this the rise of a new geochemical golden age. However, several recent studies highlight some problematic issues when using so called 'non-traditional' isotope techniques.

Most of the community examining trace elements in Earth's materials continue to rely on bulk elemental concentration and, when available, bulk isotopic composition, but neglect molecular geochemical information. Unfortunately, this omission can lead to misinterpretation of environmental archives.

Here, I demonstrate the importance of implementing trace element molecular geochemistry to study geological records. To this end, I present preliminary results from two on-going studies investigating molybdenum and uranium biogeochemistry in unique microbiological-mineral settings.