

Using uranium isotopes to understand ancient marine systems: Advances and challenges

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The development of reliable geochemical tracers of the redox state of the oceans through time is critical in studying environmental changes that influenced the deposition of siliciclastic sediments. With modern multi-collector mass spectrometry and measurement methods, it is now possible to measure isotopic variations of redox-sensitive elements previously thought not to undergo significant natural mass-dependent fractionation. Most such efforts have focused on iron and molybdenum. It has recently been shown that substantial variations in the $^{238}\text{U}/^{235}\text{U}$ ratio exist in nature [1, 2]. This discovery points the way to the development of a new paleoenvironmental proxy.

Compared to other isotope systems, uranium is particularly promising because this element is abundant in siliciclastic sediments and in precipitates of calcium carbonate. Recent work has revealed significant variations in the natural isotope composition of uranium isotopes in these systems, driven by isotope fractionation. Much of this fractionation is driven by redox transformations of uranium in solution, suggesting that the uranium isotope composition of seawater may vary with redox conditions. Thus, uranium isotopes in siliciclastic sediments can provide greater insights into redox conditions and circulation patterns during the time of deposition. In addition, uranium isotopes in carbonates could be used as a paleoenvironmental proxy in shallow water environments (and complement redox indicators tied to deeper, basinal black shales) to understand the redox conditions that influenced the deposition in marginal seas or the deep ocean. In this talk, I will discuss recent advances and results, and current challenges, to using $^{238}\text{U}/^{235}\text{U}$ ratios to analyze the paleoenvironmental conditions in ancient marine systems.

[1] Weyer, Anbar, Gerdes, Gordon, Algeo & Boyle (2008) *Geochimica et Cosmochimica Acta* **72**, 345-359. [2] Stirling, Andersen, Potter & Halliday (2007) *Earth and Planetary Science Letters* **264**, 208-225.

An investigation on Au mineralization in Khuni mining area, Anarak, Iran

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The Khuni mining area, in central Iran, consists of Upper Proterozoic metamorphic rocks and Eocene volcanic rocks. In this area there are several mineral deposit occurrences, some of which have been studied before [1, 2, 3]. The Kazemi occurrence in the western part of Kuh-e Khuni, the Cheshmeh Khuni occurrence in the eastern part of Kuh-e Khuni and mineralized zones in the northern part of Kuh-e Khuni are considered to be the most important mineral deposit occurrences in this area. Based on ore microscopic studies, and geological and geochemical investigations, mineral deposit occurrences in the study area can be classified into two major groups. The Kazemi occurrence is composed of base metal sulfides formed under low temperature conditions, whereas the Cheshmeh Khuni occurrence and the mineralized zones in the northern part of Kuh-e Khuni are composed of oxides with low concentration of base metals but contain significant values of Au.

[1] Yakovenko *et al.* (1981) Technoexport Report No. 13, Moscow, 293 p. [2] Adib (1972) PhD Dissertation, Heidelberg, 194 p. [3] Nezampour & Rassa (2005) Proceedings of the Eighth Biennial SGA Meeting Beijing, China, 18-21 August 2009.