Geophysical Research Abstracts
Vol. 16, EGU2014-15778, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Evaluating the primary and/or diagenetic origin of rare earth element abundances in Ediacaran to early Cambrian phosphate deposits, Yangtze Platform (South China) by LA-ICPMS

Dorothee Hippler (1), Andreas Klügel (2), Nicole Biedermann (3), Qingjun Guo (4), and Gerhard Franz (3)

(1) Graz University of Technology, Institute of Applied Geosciences, Graz, Austria (dorothee.hippler@tugraz.at), (2) University of Bremen, Insitute of Geosciences, Bremen, Germany (akluegel@uni-bremen.de), (3) Technical University Berlin, Institute for Applied Geosciences, Berlin, Germany (gerhard.franz@tu-berlin.de), (4) Center for Environmental Remediation, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Science, Beijing, China (guoqj@igsnrr.ac.cn)

The Precambrian-Cambrian time interval represents one of the greatest phosphogenic episodes in Earth's history with giant and well-preserved phosphate deposits occurring on the Yangtze Platform in South China. We investigated concentrations of rare earth elements (REE) and yttrium of shallow and deep-water sedimentary phosphate deposits of the Ediacaran Doushantou Formation and the early Cambrian Zhongyicun Formation by using LA-ICP mass spectrometry. The aim is to examine the temporal and spatial variability of seawater chemistry in conjunction with the conditions of phosphate formation and the evaluation of the extent of diagenetic modification. The mineralogical and textural composition of the samples was pre-screened using SEM and XRD, and polished thick sections were prepared for subsequent high-resolution LA-ICPMS analyses.

Overall concentrations in REE range between 18 and 657 ppm, with elevated concentrations (> 200 ppm) in apatite from the deep-water phosphate deposits. REE+Y patterns of shallow-water phosphate deposits exhibit the evolution from flat shale-like to gently inclined seawater-derived patterns, with the early Cambrian phosphate deposits revealing distinct negative Ce- and positive Y-anomalies indicative for oxygenated surface waters. REE+Y patterns of phosphate deposits of the deep-water facies are flat to highly enriched in MREE, which is manifested in variably pronounced concave-down patterns. In detail, these patterns display different Ce-anomalies, as well as small positive Eu-anomalies.

We propose that REE+Y patterns of Ediacaran and early Cambrian sedimentary phosphate deposits can inherit both primary and secondary signatures reflecting either seawater composition or diagenetic modification and fluid flow. The combination of imaging techniques and in-situ LA-ICPMS thereby enables a more sophisticated examination of the potential sources and processes than whole rock determinations. Placing the results in stratigraphic order and assuming the Ce-anomaly to be a proxy for seawater composition and oxygenation, analog to what is known for carbonates, our results point to evolving depositional niches with surface waters enriched in oxygen.