

A possibility of REE pattern as an indicator of biomineralization

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The influence of microbial activity on mineral formation has been studied from a chemical, mineralogical and microbiological point of view in present-day aquatic systems (Fortin and Langley, 2005). However, information gained from such environments remains difficult to extend to ancient geological formations because of post-depositional transformations, and as a result, the use of minerals as biosignatures or indicators of past biological activity is still being debated. For example, the origin of banded iron-formations (BIF) has been interpreted as being the direct or indirect product of biological activity (e.g., Konhauser et al., 2002; Fortin and Langley, 2005), or resulting from magmatic and hydrothermal activity. We propose here to use rare-earth element (REE) distribution patterns as indicators of bacterial presence in natural minerals, specifically iron oxides. In our study, it was found that REE distribution patterns between bacteria and water in laboratory experiments exhibit a peak around middle REE and a steep increase at heavy REE part (Takahashi et al., 2005). The similar pattern was also confirmed in biofilms in a modern natural aquifer system and in the Fe precipitates formed under bacterial influence near the biofilms. These results strongly suggest that REE patterns can be indicators of microbial activity during the formation of natural iron oxides. Some REE patterns in the BIFs in the Hamersley Province showed similar patterns to the bacteria-bearing samples, which gave another evidence for the microbial contribution to the deposition of iron-formations.

References

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