Enabling Collection of Rare Earth Elements by Bacteria

A research group led by Professor Yoshio Takahashi at the Department of Earth and Planetary System Science, Graduate School of Science, Hiroshima University, found the phenomenon of rare earth element (REE) enrichment on bacterial cell surfaces, compared with the surrounding area without bacteria, in an aqueous solution. They also found that particularly rare and precious REEs are selectively enriched. They clarified the enrichment mechanism by the EXAFS method using synchrotron radiation.

REEs are metal resources indispensable in the high-technology industry, and ensuring a stable supply of REEs has become a serious problem in Japan. REEs are a collective term for a total of 17 elements; the 15 lanthanoid elements from lanthanum to lutetium, plus scandium and yttrium; REEs are collected from minerals containing these elements. The establishment of the technologies for the collection and separation of REEs is especially important because specific REEs need to be separated and refined from minerals in the high-technology industry.

The research group found the enrichment of REEs on bacterial cell surfaces. Analyzing the enrichment mechanism by the EXAFS method, they clarified that the enrichment is caused by bonding between REEs and the phosphate sites in the bacterial cell walls.

The enrichment of REEs on bacterial cell surfaces demonstrates that the methods using bacteria are effective for the development of rare earth resources, and for the collection and separation of REEs during the recycling process.
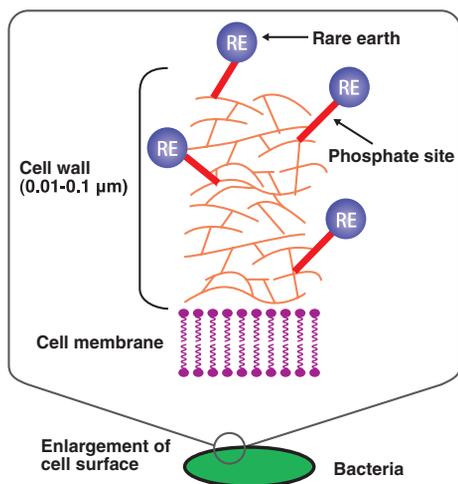
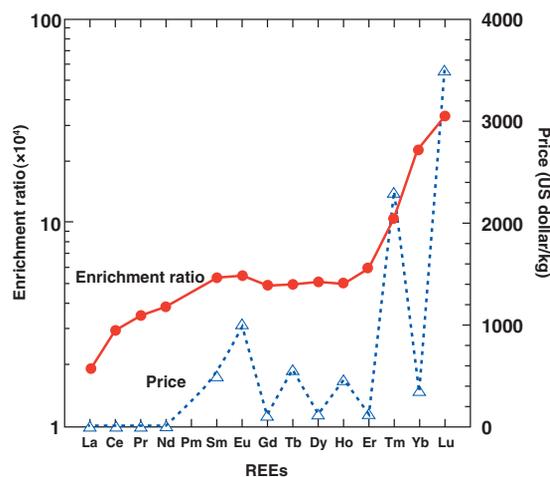**Fig. 1 Schematic of enrichment of REEs on bacterial cell surface**

Fig. 2 Enrichment ratio and price of REEs
Enrichment ratio: the ratio of concentration of a REE in bacteria to that in diluted aqueous solution. The prices of the REEs are cited from Mineral Yearbook 2004.