Micro-XRF analysis of yttrium and other elements in siliceous sediments and cherts

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Abundances of trace elements in sedimentary rocks have been used as a signature, with which we can estimate the paleoenvironment at the earth's surface at the time of their deposition. In particular, relative abundances of rare earth elements (REE), noted as REE pattern, in siliceous sediments have been used to indicate whether the depositinal environment is in the pelagic area or marginal sea. In order to understand fully the REE signature in the siliceous sedimentary rocks, chemical processes of the REE incorporation into the rocks are important.

We have studied siliceous sedeiments before concretion and cherts which are considered to be solidified from siliceous sediments by the sequential extraction technique. It was found that REE patterns are different among different fractions obtained during the sequential extraction. On the other hand, REE patterns are similar among different fractions in the sequential extraction, though the content of Mn varied among the fractions. These results suggest that the REE is enriched in a certain phase in the sediments, whereas REE is more uniformly distributed in the cherts. In order to confirm the hypothesis that REE is localized in specific phases in sediments but uniformly distributed in sedimentar rocks, REE distribution in the siliceous sediments and cherts were examined by micro-XRF in the beamline 37XU at SPring-8.

The distribution of Fe, Rb, Sr, and Y were studied for siliceous sediments (DSDP 7-66-5) and cherts (Southern Chichibu terrene). A disk of siliceous sediments was made by epoxy type resin. A thin section of cherts was made on a quartz plate where the abundances of the target elements were negligible. These samples were exposed to the incident X-ray at 22 keV. The beam size was 50 μm × 50 μm and the scanned area was 2 mm × 2 mm. Fluorescence X-rays of K lines for Fe, Rb, Sr, and Y were recorded separately by SCAs tuned for each K line.

The distribution of Y in the sediment (Fig. 1a) and the chert (Fig. 1b) were shown as 3-D plots. The Z axis shows the XRF counts (I_f) normalized by I_0, the intensity of the incident X-ray. In the sediment, it is obvious that several spots containing large amount of Y were observed, but the Y concentration in the other area is relatively low. On the other hand, it seems that there is not such a distinctive contrast in the chert sample, showing that there is not particular host phase that contains REE. The relative percentage of data points having the I_f/I_0 values larger than the average value by 2σ is 2.4% for the siliceous sediment, but smaller for the chert (1.8%), supporting the more uniform distribution in the chert. These results are consistent with the hypothesis we made from sequential extraction studies.

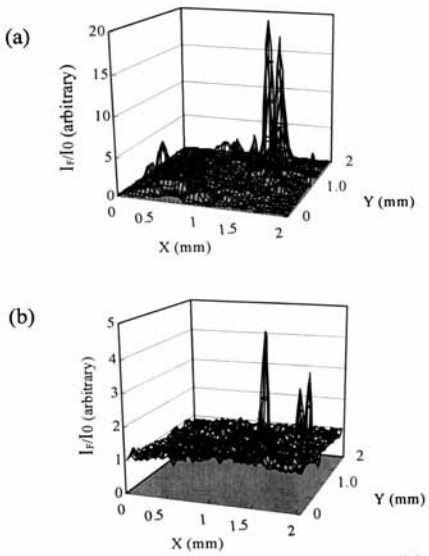

Fig. 1. Distribution of Y in the siliceous sediment (a) and the chert (b) by micro-XRF (beam size: 50 μm).

Sn distribution in liver of the mouse exposed to tributhyltin chloride by SR-XRF imaging

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Organotin coumpounds are environmental hazardous and its contamination into marine sediments is of recent concern. It exhibits hepatotoixicity in experimental animals[1, 2] but detailed distribution of tin in liver is still unknown. In the present study, we attempted to reveal Sn imaging in liver of the mouse exposed to tributhyltin chloride by SR-XRF with micro-beam.

We tried to use the XRF measurements utilizing 75.5 keV X-rays at B-branch of BL37XU[3] for liver sections (10-20 μm) but the samples were too thin for the energy of X-rays. Next, utilizing 37.5 keV X-rays, the Sn imaging of liver was obtained (Fig. 1). Sn was high in the damaged area of the liver of the mouse administered to tributyltin chloride. To carry out further analysis with smaller beam for cell-differences in the tin distribution, improvements of the stability of I0 during experiments are required.

References

1) Ueno, S., *et al., Arch Toxicol.* **77**, 173-181, 2003.

2) Ueno, S., *et al., Toxicol. Sci.* **75**, 201-207, 2003.

3) Terada, Y., *et al., AIP Conference Procwwdings* (in press).

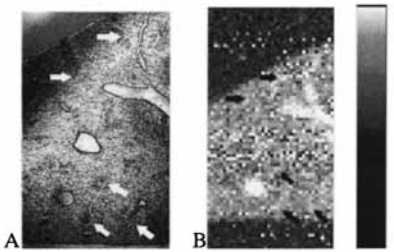

Fig. 1. Sn distrinution in liver of the mouse exposed to tributhyltin chloride. A, photograph of the cryosection (20 μm); B, XRF imaging of Sn of the liver specimen obtained at 24 hr after oral injection of tributhyltin chloride (180 μmol/kg); arrows, damaged area. Measurements condition was as follows ; energy of X-rays, 37.5 kev; beam size, 200 μm^2; step size, 100 μm; counting time, 10 sec per point. The Sn concentration of the specimen was 3.6 μg/g of wet tissue.