

Chemical speciation of sulfur in the Yatsu tideland sediments

Masaki KATAOKA*¹ and Motoyuki MATSUO²

¹Graduate School of Science, The University of Tokyo,
3-8-1 Komaba, Meguro-ku, Tokyo 153-8902, Japan

²Graduate School of Arts and Sciences, The University of Tokyo,
3-8-1 Komaba, Meguro-ku, Tokyo 153-8902, Japan

Introduction

In estuary and tideland, sedimentation rate is quite high, because salting-out of organic substances and suspended solids is occurred and inclination is gentle. Therefore, the sediment of such areas has a very complicated system. Under anaerobic environments in the sediments, the sulfate ion from seawater is reduced, and then various sulfides have been formed in the sediments. We have already studied the chemical state of heavy metals in the sediment of estuary and tideland, and revealed that several heavy metals such as iron, manganese and zinc exist in a form of sulfide [1] [2]. In order to obtain further information on the sulfides in the sediments, the vertical distribution of sulfides was investigated by means of the chemical state analysis of sulfur by XAFS in this study.

Experimental

We collected sediments vertically in Yatsu tideland which is located at the east part of Tokyo and the tideland is assumed to be a non-polluted area. The collected sediments were cut at every 3-5 cm length immediately, and then porewater was extracted by pressure filtration (5 atm, N₂). Approximately 100mg of each sample was mounted in a prolene film. The X-ray absorption measurement was made with synchrotron radiation by using XANES facilities on the beam line 9A. The radiation was monochromatized by Si (111) double crystals. The spectra were collected in fluorescence mode using Lytle-type detector at room temperature in the helium atmosphere.

Results and Discussion

Figure 1 shows the normalized sulfur XANES spectra of the Yatsu tideland sediments from different depth and standard materials of sulfur. The XANES spectrum of sulfur in the sediment shows two sharp peaks which have the different energies. According to the comparison with standard materials, the position of peak top of these two peaks in the sediments agreed with that of sulfur compounds. The spectra of sulfate had only one peak of high-energy side; on the contrary, the spectrum of sulfide had both peaks. Therefore, this fact means that the relative amount of the sulfide in the sediment can be estimated by observing the peak ratio. We already studied the sediments in Arakawa River which is located at east part of Tokyo, and the distribution of the sulfide in the sediments was estimated by this method [3]. The vertical distribution of the peak ratio obtained by this operation is shown in Fig.2. It was estimated that the

distribution of the sulfide was abounding over the middle-deep layer. This distribution was found to be similar to that of iron sulfide, which was most common in the sediments as heavy metal sulfide, except for surface layer. The surface layer accumulation is seemed to be MnS and unstable sulfides which are temporally supplied with surface water.

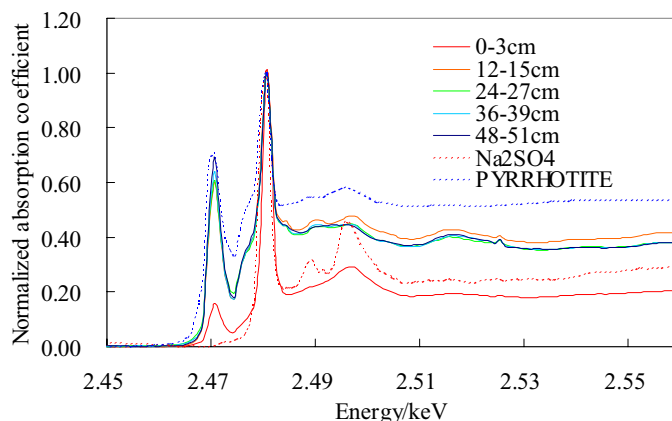


Fig. 1. Normalized sulfur XANES spectra of the Yatsu tideland sediments and standard materials

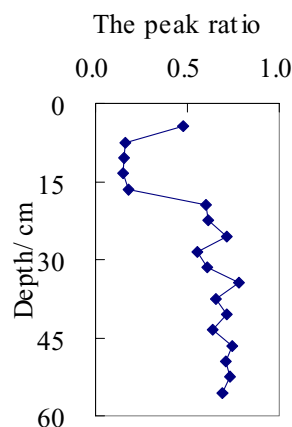


Fig. 2. The vertical distribution of the peak ratio of the two sharp peaks in sulfur XANES spectra of the Yatsu tideland sediments

References

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- *kataokai@dolphin.c.u-tokyo.ac.jp