

## Vertical distribution of iron species in sediments from Qinghai Lake, China

Akihito KUNO\*, Motoyuki MATSUO

The Univ. of Tokyo, Komaba, Meguro-ku, Tokyo 153-8902, Japan

### Introduction

Qinghai Lake is the largest salt lake in China. Although a number of investigations have been carried out on marine and coastal sediments, there have been few studies on iron speciation of lacustrine sediments, especially sediments collected from salt lakes. In marine and coastal sediments, sulfate ion from seawater is reduced to hydrogen sulfide, which reacts with iron compounds to form iron sulfides. Therefore, the speciation of iron compounds in the sediments collected from salt lakes, which also contain sulfate ion, receives much attention from geochemical point of view. In addition, Qinghai Lake sediments are intensively studied to reconstruct the past climate by carbonate content, fossil pigments, etc., since vertical sediment cores record the climatic change. Among such reconstruction studies, the iron speciation using XANES spectroscopy has the advantage of non-destructiveness and sensitivity to environmental change. From these standpoints, the iron speciation in the Qinghai Lake sediment was carried out using XANES spectroscopy in this study.

### Experimental

Qinghai Lake, an intermontane plateau lake, lies on the northeastern edge of the Tibetan Plateau, near N37°,

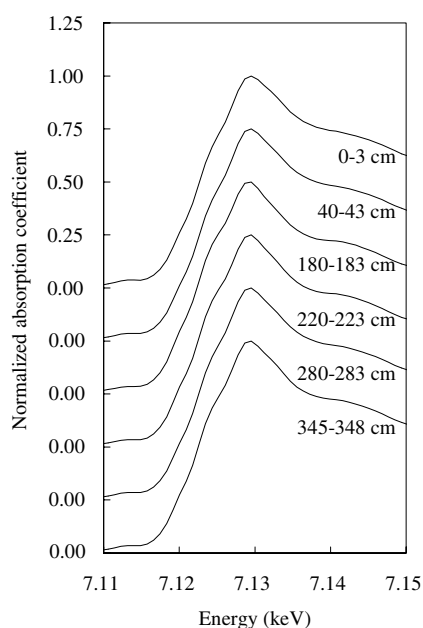


Fig. 1: Fe XANES spectra of the sediments collected from Qinghai Lake.

E100°, with an area of 4200 km<sup>2</sup>. It has a surface elevation of 3194 m, an average depth of more than 20 m, pH value 9.21, density 1.01, and salinity 14.15 g/L. A vertical sediment core of approximately 350 cm in length was collected from southeastern part of Qinghai Lake. It is considered to record the environmental change during the past nine thousand years based on the estimated sedimentation rate (40 cm/ka). The collected sediment was cut at every 2-3 cm length, freeze-dried, and ground into powder. Approximately 200 mg of each sample was mounted in a sample holder. In order to avoid air oxidation, the sediments were purged with nitrogen gas in oxygen-impenetrable plastic bags. The Fe K-absorption spectra of the sediments were measured in fluorescence mode using a Si(111) double-crystal monochromator and a Lytle-type detector at BL-9A. The sediments were also analyzed by <sup>57</sup>Fe Mössbauer spectroscopy.

### Results and discussion

Figure 1 shows a composite of six XANES spectra out of eighteen spectra of the sediments collected from different depths, in which slight shifts of the spectra were observed. Comparison with the speciation results by Mössbauer spectroscopy revealed that the shifts to a lower energy side were mainly due to the existence of pyrite (FeS<sub>2</sub>). This is often the case with sediments under saline waters [1,2]. Also, framboidal pyrite particles were found in Qinghai Lake sediments by scanning electron microscope. The vertical distribution of pyrite showed a positive correlation with the organic matter content measured by the loss on ignition (LOI), which increases under warm climate. This observation is reasonable because one of the factors controlling sulfate reduction is temperature that strongly affects the activity of sulfate reducing bacteria. A high content of organic matter produces reducing environment, which also favors the activity of sulfate reducing bacteria. The distribution of pyrite and sedimentation rate suggested a relatively warmer climate around 500, 2500, 4500, and 7000 years B.P., which was consistent with other reconstruction studies [3].

### References

- [1] A. Kuno et al., *J. Synchrotron Radiat.* 6, 667 (1999).
- [2] A. Kuno, *Bunseki Kagaku* 51, 287 (2002).
- [3] A. Kuno et al., *Hyperfine Interact.* in press (2002).

\* kuno@dolphin.c.u-tokyo.ac.jp