

琵琶湖湖底近傍におけるマンガン・ヒ素の水-鉱物相互作用 —過去40年間の湖内分布の変化に対する考察—

Solid-water interaction of Mn and As near the bottom of Lake Biwa. -Implications for the spatio-temporal change of these elements for past 40 years-

*板井 啓明¹、名取 幸花¹

*TAKA AKI ITAI¹, SACHIKA NATORI¹

1. 東京大学大学院理学系研究科 地球惑星科学専攻

1. Department of Earth and Planetary Science, The University of Tokyo

Enrichment of Mn and As in the surface of sediment caused by diagenetic process has been reported from various lakes in the world. Lake Biwa is a typical example, in which clear enrichments of Mn (up to 5.7 wt%) and As (up to 900 mg/kg) within thin surface enriched layer (< 2 cm) of sediment were observed. This enrichment is caused by the accumulation of manganese oxide and arsenate both of which show lower mobility than these reducing chemical forms. However, decreasing trend of interannual minimum dissolved oxygen level reported from the lake-bottom can change redox behavior of these elements near the sediment-water interface (Itai et al. 2012, Sohrin et al. 2016, Fukushima et al. 2019). Through the geochemical survey after 2009, some specific scientific questions have been arisen.

(i) The degree of surface enrichment of Mn and As from 7 stations in northern lake were markedly increased in 2009 relative to 1977 (Itai et al., 2012). However, the source of them and process of this change are unclear.

(ii) The temporal increase of As in sediment is particularly significant in southern basin of northern lake (so called “first-basin”). The As accumulated on the surface of sediment is likely by scavenging from water column rather than upward diffusion from buried sediment. Nevertheless, difference between northern and southern basin (so called “second-basin”) is unclear.

(iii) Past study suggest that Mn and As level in sediment can be a unique indicator of palaeo water depth (Takamatsu, 1985). This is plausibly caused by higher enrichment of Mn and As toward deeper part of the lake. We confirmed this trend via measurement of 22 core sediments from northern lake. We hypothesize that this distribution is attributed to the geochemical focusing (Schaller et al., 1997), although scientific evidences are still not enough. Besides, there should be some specific mechanism to keep Mn and As enrichment after buried into deep sediment.

In order to answer these questions, we need comprehensive geochemical survey between water column and sediment with focusing speciation of these metals. In the presentation, we would like to present our dataset of lake water (3 stations, 10 m depth interval, 1 year), sediment core (30-40 cm depth, 22 stations), porewater (30 - 40 cm depth, 7 stations), filtered materials of 1, 3, 5, 7, 9 m from lake bottom (7 stations) characterized by X-ray absorption spectroscopy, micro beam chemical analysis, water chemistry analysis, porous diffusion model, and aqueous speciation calculation. Coupling with available monitoring data after 1950s, we make some constraints for the above questions.

キーワード：マンガン、ヒ素、形態分析、酸化還元、経時変化、湖底堆積物

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