

Spatial distributions of REE, heavy metals and oxygen isotope of phosphate in the Yasu river, Shiga, Japan

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Introduction

Yasu river is the largest river that flows through the Lake Biwa. The Lake Biwa is the largest freshwater lake in Japan. The land use pattern within the Yasu river system has been gradually changing since 1960s. This study reports the spatial distribution of rare earth elements (REE), heavy metals and oxygen isotope of phosphate ($\delta^{18}\text{O}_p$) in the Yasu river to give insights on the surface geological processes in the river.

Methodology

Surface river water samples were collected from 66 sites in the Yasu river on October 2012 with acid-cleaned polyethylene bottles. Nitric acid was added to the filtered sample to make 2% solution and elements were directly analysed using Agilent 7500cx inductive couple plasma mass spectrometer. Dissolved inorganic phosphate from selected sites were extracted and converted to silver phosphate. Oxygen isotope analysis of these silver phosphate samples were performed using a thermal conversion elemental analyzer coupled to a continuous flow isotope ratio mass spectrometer via a helium stream.

Results and Discussion

There were no direct correlations among land use pattern, nutrients and elemental concentration. The concentrations of REE and heavy metals were generally constant throughout the Yasu river system. However, the concentrations of some elements, such as Na, Ca, Y and Sn, were high in urban areas but not always on the same site. The elemental concentrations of water from the mouth of Lake Biwa were similar to the average concentrations all over the Yasu river system. On the other hand, river waters showed a marked variation in their $\delta^{18}\text{O}_p$ among sites within the river. Significant differences were also detected in the $\delta^{18}\text{O}_p$ among a variety of potential P sources, showing this technique is applicable to trace P sources in the river ecosystems.

Keywords: rare earth elements, Yasu river, Land use, oxygen isotopes of phosphate, metals, geological cycling