

堆積物組成への化学風化の影響を粒度および原岩組成の影響から分離する：揚子江堆積物を例として  
Separating silicate weathering effect from grain size and source rock effects on sediment composition of Yangtze River

多田 隆治<sup>1\*</sup>; 久保木 結<sup>1</sup>; Zheng Hongbo<sup>3</sup>; 入野 智久<sup>2</sup>; 齋藤 京太<sup>1</sup>; Luo Chao<sup>4</sup>; He Mengying<sup>3</sup>; 王 可<sup>2</sup>; 綱澤 有哉<sup>1</sup>; 高橋 嘉夫<sup>1</sup>

TADA, Ryuji<sup>1\*</sup>; KUBOKI, Yui<sup>1</sup>; ZHENG, Hongbo<sup>3</sup>; IRINO, Tomohisa<sup>2</sup>; SAITO, Keita<sup>1</sup>; LUO, Chao<sup>4</sup>; HE, Mengying<sup>3</sup>; WANG, Ke<sup>2</sup>; TSUNAZAWA, Yuya<sup>1</sup>; TAKAHASHI, Yoshio<sup>1</sup>

<sup>1</sup> 東京大学大学院理学系研究科, <sup>2</sup> 北海道大学大学院地球環境学研究院, <sup>3</sup> 南京師範大学地理学院, <sup>4</sup> 南京大学地球科学与工程学院

<sup>1</sup>Graduate School of Science, the University of Tokyo, <sup>2</sup>Faculty of Environmental Earth Science, Hokkaido University, <sup>3</sup>School of Geographic Science, Nanjing Normal University, <sup>4</sup>School of Earth Sciences and Engineering, Nanjing University

Silicate chemical weathering plays a critical role on the long-term carbon cycle and stabilizing atmospheric pCO<sub>2</sub> by so-called Walker feedback (a negative feedback) through neutralizing carbonic acid by dissolving Ca and Mg silicate minerals and re-precipitated as carbonates and chert (SiO<sub>2</sub>). Consequently, it is important to quantitatively evaluate past intensity of silicate weathering. There are several proxies proposed for silicate weathering intensity based on chemical and/or mineral composition of bulk sediments. However, it becomes increasingly apparent that chemical and mineral composition of bulk sediments is significantly influenced by the difference in grain size as well as the difference in source rocks. However, none of previously proposed proxies takes into account of both the grain size effect and source rock effect simultaneously.

We selected Yangtze River because it is one of the largest river in the world with over 250 gauge stations, the large variation in bed rock geology among branches, and large ranges in topographic relief and climate. Thus we expect large ranges in chemical weathering intensity and source rock types.

In this study, we used 21 river bed sediment samples and 42 suspended particulate matter (SPM) samples collected from major branches and throughout the main stream of the Yangtze River. We conducted grain size separation of bulk river bed sediment samples into 3 fractions (<4μm, 4-16μm, 16-63μm). As to SPM samples, we did not conduct grain size separation because their median diameters range from 3.5 to 10.6 μm and more than 98% of SPM is less than 100μm. We analyzed major element composition and mineral composition of these samples by XRF and/or ICP-AES and XRD, respectively. We compare chemical and mineral compositions of the 3 size fractions of the same samples to evaluate the grain size effect on chemistry and mineralogy. We found sediments and SPM are basically composed of 3 components; one is Si, Na, Ti, Mn (quartz)-rich component representing coarser grains, another is Al, K, and Fe (clay minerals)-rich component representing finer grains, and the other is Ca and Mg (carbonate)-rich component representing dolostone and limestone fragments. Sediments from the uppermost reaches and their branches where chemical weathering is minimal, K/Al and Fe/Al of the 3 different size fractions tend to show similar values suggesting Al, Fe, and K are contained in the same component with the same composition that are diluted by the coarser fraction that are dominantly composed of quartz. However, K/Al of fine fraction relative to K/Al of coarse fraction decreases downstream with the increase in temperature and precipitation, suggesting the ration (K/Al)<sub>f</sub>/(K/Al)<sub>c</sub> ratio may reflect the intensity of chemical weathering.

We will discuss the possibility of (K/Al)<sub>f</sub>/(K/Al)<sub>c</sub> ratio as a quantitative indicator of silicate weathering.

キーワード: 化学風化, 堆積物, 化学組成, 粒度効果, 原岩効果, 揚子江

Keywords: chemical weathering, sediments, chemical composition, grain size effect, source rock effect, Yangtze River