

## Mass-dependent fractionation of Ti stable isotope during intensive weathering of basalts

XIN-YUE HE<sup>1,2</sup>, JIN-LONG MA<sup>1\*</sup>, GANG-JIAN WEI<sup>1</sup>, ZHI-BING WANG<sup>1</sup>, LE ZHANG<sup>1</sup>, TI ZENG<sup>1</sup> AND ZHUO-YING ZHANG<sup>1,2</sup>

<sup>1</sup> State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China (\*correspondence: [jlma@gig.ac.cn](mailto:jlma@gig.ac.cn); [hexinyue@gig.ac.cn](mailto:hexinyue@gig.ac.cn); [gjwei@gig.ac.cn](mailto:gjwei@gig.ac.cn); [wangzhibing@gig.ac.cn](mailto:wangzhibing@gig.ac.cn); [zhangle@gig.ac.cn](mailto:zhangle@gig.ac.cn); [zengti@gig.ac.cn](mailto:zengti@gig.ac.cn); [zhangzhuoying@gig.ac.cn](mailto:zhangzhuoying@gig.ac.cn))

<sup>2</sup> University of Chinese Academy of Sciences, Beijing 100049, China

Recent work has suggested a conservative behavior of titanium stable isotopes during terrestrial chemical weathering thus it could be used for tracing the chemical composition of emerged crust to constrain the onset of plate tectonics. Nevertheless, direct observation of Ti isotope fractionation in terrestrial surface processes is still vacant. To test this hypothesis, we carried out sequential leaching experiment and Ti isotope analyses on the saprolites developed on the Neogene tholeiitic basalt from Hainan Island, South China.

We found distinct Ti isotope variations in the saprolites, with the  $\delta^{49}\text{Ti}$  values ranging from -0.040‰ to +0.094‰, slightly lighter than the unaltered parent rock (+0.054‰). In the leaching experiments, the poorly-crystalline Fe (hydr)-oxides, crystalline Fe (hydr)-oxides, organic matter and residue were sequentially extracted. The crystalline Fe (hydr)-oxides and residue phase count for over 98% Ti of the saprolite. The variations of the  $\delta^{49}\text{Ti}$  of the two phases are remarkable, up to 0.6‰. The sequential leaching results suggest that Ti isotope fractionations during weathering were controlled by dissolution, reservation and formation of titaniferous minerals: (1) the rock forming minerals in the parent basalts like pyroxene and plagioclase which contain heavy  $\delta^{49}\text{Ti}$  dissolved first during weathering process; while (2) the weatherproof Ti-Fe oxides like ilmenite containing light Ti isotope remain and host 80%-90% Ti of the saprolites; (3) the secondary titaniferous Fe (hydr)-oxides which preferentially combine isotopically heavy Ti in their formation and count for the rest Ti. This suggests that Ti isotopic compositions could be altered after intensive chemical weathering both in mineral and profile scale, and the conservative Ti isotope assumption during weathering needs to be cautious.