Tellurium Stable Isotope Compositions in Tellurium Standard Regents

*Yusuke Fukami[1], Jun-Ichi Kimura[1], Katsuhiko Suzuki[1]

1.Japan Agency for Marine-Earth Science and Technology

Tellurium (Te) is extremely concentrated in submarine ferromanganese crusts (Fe-Mn crusts) by a factor of 10^4 relative to the continental crusts (Hein et al., 2010). Cobalt and platinum is also highly enriched in the Fe-Mn crusts, therefore, are expected to be one of the mineral resource of minor and precious metals in the future. For geochemical interests, Fe-Mn crusts retain information on the changes in the ocean environment during their growth. Recently, the adsorption structure for the Te in the marine ferromanganese oxides has been revealed (Kashiwabara et al., 2014). For better understanding of the genesis of the Fe-Mn crusts, we developed determination method for precise stable isotope ratios of Te for the marine ferromanganese oxides. The stable isotope ratio study of Te is still in an infant stage. For example, a few papers on the Au-Ag-Te minerals (Fornadel et al., 2014) and the meteorites (Fehr et al., 2014) have been published. In addition, they used their own in-house standards as the reference of the Te isotope composition. Hence, no certified standard is available. There is no report regarding the difference in Te isotope compositions in different Te standard reagents supplied from different suppliers or from different batches of the same supplier. In this study, we developed an analytical method of stable isotope ratios of Te using the double spike mass spectrometry, and then measured Te stable isotope compositions in four different Te standard regents.

We used a multiple collector ICP-MS (NEPTUNE, Thermo Scientific) at JAMSTEC equipped with a desolvating nebulizer sample solution introduction system (Aridus II, Cetac). Mass discrimination in the instrument was corrected for by the double spike method using the ^{125}Te-^{128}Te double spike. The repeatability of our in-house standard (Kanto Chemical) was 0.2‰ (2σ, n = 25) for ^{130}Te/^{125}Te ratio using 11 ng of Te in one measurement run. The Te standard solutions supplied from Kanto Chemical (#40856-1B), Alfa Aesar (#44632), and Sigma-Aldrich (#92027) and the Te lump (99.9999%; Alfa Aesar, #10758) were analyzed for comparisons. The result showed that the ^{130}Te/^{125}Te ratio of the Sigma-Aldrich solution was identical with that of the Kanto Chemical solution within the analytical uncertainty. The ^{130}Te/^{125}Te ratio of the Alfa Aesar solution was 1.2‰ higher than that of the Kanto Chemical solution. The isotope composition of the Te lump was identical with that of the Alfa Aesar standard solution within errors. These results indicate that the Te isotope compositions of the source materials differed or isotope fractionation differed in their manufacturing process. The reported values of the Te stable isotope compositions from different laboratories may differ from each other in the range of ~1‰. Therefore, it is required to prepare the certified standard solution and carry out inter-laboratory calibration for wide geochemical application of Te isotopes.

Keywords: Tellurium, Stable Isotope, Fe-Mn Crusts

