High precision Ag isotope analytical method with MC-ICP-MS (Nu Plasma II)

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Silver isotopic composition has received special attention because of its ability to trace processes in the very early solar system. The Ag isotopic measurements were previously performed by thermal ionization mass spectrometry (TIMS) with the limited precision of ~1-2 per mil. Silver has two isotopes, ^{107}Ag and ^{109}Ag, thus internal correction for the mass fractionation induced by thermal ionization is not possible. The level of the precision obtained with TIMS is not sufficient to examine small differences of silver isotope compositions on terrestrial samples. However, multi-collector inductively-coupled-plasma mass spectrometry (MC-ICP-MS) leads the improvement of analytical precision for Ag isotope analyses to resolve the very small differences in Ag isotope compositions. It has already led to the discovery of Ag isotopic variation in native Ag metal samples from ore deposits which have varied by up to 0.6 %, due to mass dependent stable isotope fractionations during natural chemical processing (Hauri et al., 2000). This indicates that Ag isotopes may be a useful geochemical tracer, i.e., ore deposits and hydrothermal geochemistry studies.

The improved Ag isotope analytical method using MC-ICP-MS (Nu Plasma II) at Akita University is presented, which permits isotopic analyses of small quantities of Ag (10 ng). This technique is suitable for terrestrial materials. The average ^{107}Ag/^{109}Ag = 1.08041 ±0.00004 (2 S.D., standard deviation of the population) was obtained for the NIST SRM 978a Ag reference material in wet plasma mode. This value is identical within uncertainty to the ratio reported by previous studies (Fig. 1).

Keywords: Ag isotope, MC-ICP-MS

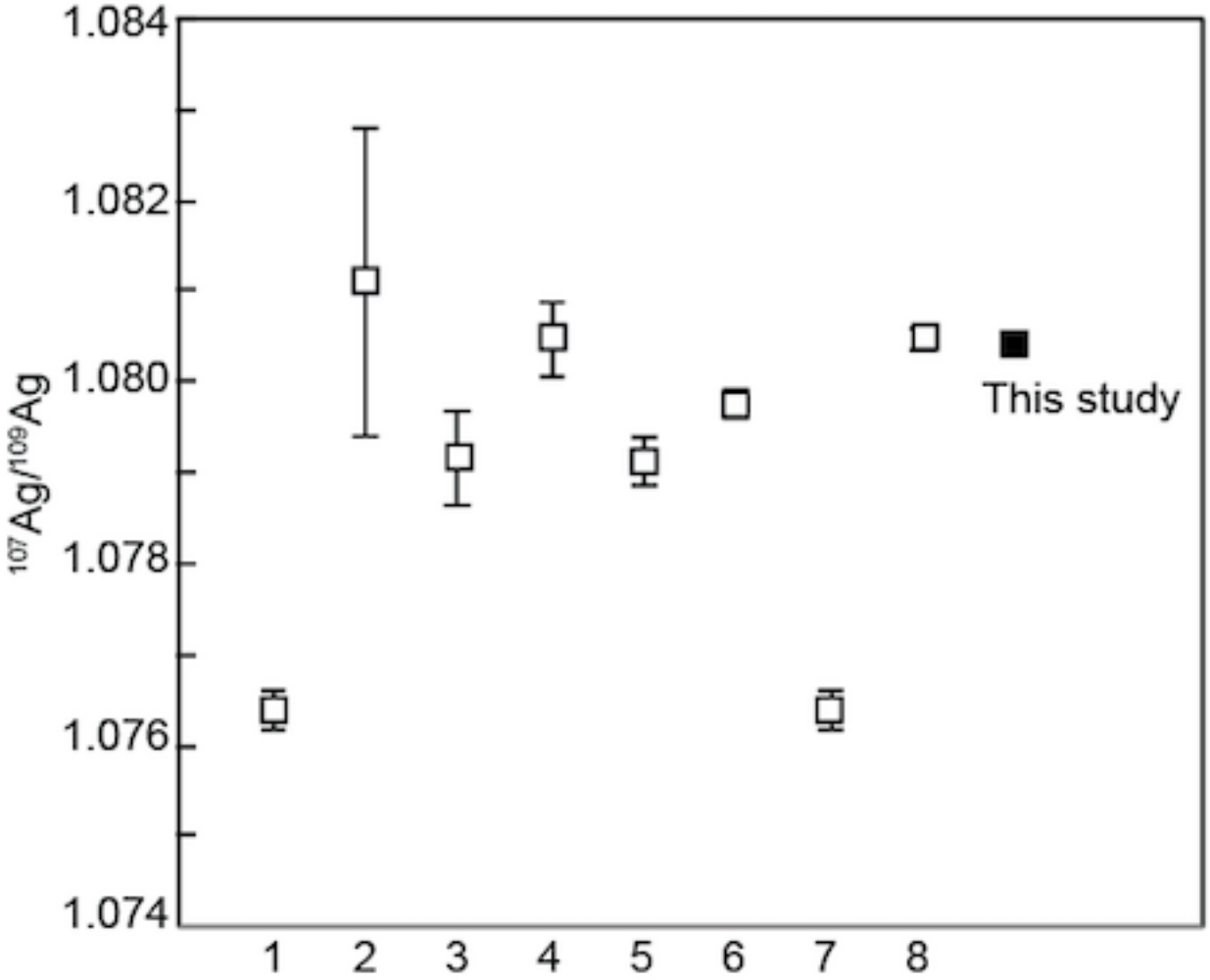

Figure 1. Accuracy and precision of Ag isotope ratio for NIST SRM978a solution in this study and previous studies.
1: NIST 978a certified value by Powell et al. (1982), 2: Chen & Wasserburg (1983), 3: Carlson & Hauri (2001), 4: Woodland et al. (2005), 5: Schönbächler et al. (2007), 6: Schönbächler et al. (2007), 7: Yang et al. (2009), 8: Matthes et al. (2005)

