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An improved analytical method for Re-Os isotope analysis and its application to GSJ geochemical reference materials, JCu-1 and JZn-1

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The Re-Os isotope system is an effective tool in geological studies, especially in radiometric dating. Since both Re and Os are highly siderophile and chalcophile elements, they tend to be concentrated in various sulfide minerals. Therefore, the Re-Os geochronology has been employed for direct age determination of sulfide mineralization [1, 2]. However, conventional analytical methods for the Re-Os dating are complex and consume much time and cost.

Here we present an improved analytical method for Re-Os in sulfides combined with acid digestion using HClO₄ [3] and sparging introduction of Os [4]. In our method, 0.4 g of powdered sulfide was digested by 1 mL of HClO₄ in addition to 4 mL of inverse aqua regia in Carius tube, and then the Re and Os isotope ratios were measured by MC-ICP-MS. We applied this method to the GSJ geochemical reference materials JCu-1 (copper ore from Kamaishi mine, northeastern Japan) and JZn-1 (zinc ore from Kamioka mine, central Japan). The Re-Os concentrations of JCu-1 and JZn-1 were 255-280 ppt and 4622-4828 ppt for Re, and 39.7-41.7 ppt and 21.7-30.0 ppt for Os, respectively. Furthermore, the analytical results (Re-Os concentrations, ¹⁸⁷Os/¹⁸⁸Os, and ¹⁸⁷Re/¹⁸⁸Os) of separated chalcopyrite from Kamaishi mine showed good agreements with those by the conventional method digesting 0.5 g of sample by 10 mL of inverse aqua regia and measured with N-TIMS.

The new method, using less total volume of acids for sample digestion, enables MC-ICP-MS analysis of sulfides with relatively lower Re and Os concentrations. In addition, for Os isotopes, a sparging method using MC-ICP-MS [4] can be utilized as a simplified analytical procedure. This simplified and improved method may be useful for dating a wider range of sulfide deposits efficiently.

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