

More on Os isotope anomalies in chondrites: Possible carriers

TETSUYA YOKOYAMA¹, VINAI K. RAI²,
CONEL M. O'D. ALEXANDER³ AND
RICHARD J. WALKER¹

¹Dept. of Geology, Univ. of Maryland, USA
(yokoyama@geol.umd.edu)

²Dept. of Chemistry and Biochemistry, UC San Diego, USA

³DTM, Carnegie Institution of Washington, USA

Recent, highly-precise isotopic analyses of various bulk meteorites and acid residues have revealed that some primitive chondrites contain isotopically anomalous presolar grains which record diverse stellar nucleosynthesis. Another essential but still unsolved issue is whether or not the chondrite precursors, including presolar grains, were homogeneously distributed in the early solar nebula at the time of planetesimal formation. We have previously demonstrated that bulk samples of carbonaceous, enstatite and ordinary chondrites have uniform ¹⁸⁶Os/¹⁸⁹Os, ¹⁸⁸Os/¹⁸⁹Os and ¹⁹⁰Os/¹⁸⁹Os ratios when decomposed by an alkaline fusion total digestion method, although acid residues of some carbonaceous chondrites were enriched in Os isotopes produced by s-process nucleosynthesis [1]. These results suggest that chondrite precursors were thoroughly mixed in the early solar nebula, and we speculated that the main carrier of the anomalous s-process-enriched Os was presolar SiC grains. Reisberg *et al.* [2], similarly carried out sequential acid leaching of the bulk Murchison meteorite, and found that an s-process-enriched Os-rich component was accessible with mild leaches (e.g. hot HCl treatment). They proposed that the main carrier of the s-process Os may not be presolar SiC grains but rather more easily digestible presolar phases such as graphite or metal alloy.

To investigate this issue further, we have carried out a hot HCl leaching experiment for the Murchison acid residue prepared by a relatively mild CsF/HF technique. The bulk sample of this residue was strongly enriched in s-process Os ($\epsilon^{186}\text{Os}^i = +11.0$). The hot HCl leaching recovered ~10% of the Os in the residue, which was also enriched in s-process isotopes ($\epsilon^{186}\text{Os}^i = +8.0$) but not as high as the bulk residue. This indicates that the HCl insoluble phase in the residue is more enriched in s-process Os, corroborating the existence of acid resistant SiC grains as an s-process Os carrier. The leachate is known to have a ⁵⁴Cr anomaly, an isotope that can be produced by r-process nucleosynthesis [3]. Therefore, the leachate may contain an HCl digestible, r-process Os carrier, the existence of which may be masked by the HCl digestible s-process Os carrier. The likely hosts of the s- and r-process Os remain unclear. We will conduct further leaching tests (e.g. HNO₃, HClO₄) on the Murchison residue as well as other chondrite acid residues to better identify the carrier of isotopically anomalous Os in the chondrites.

References

- [1] Yokoyama *et al.* (2007) *EPSL* submitted.
- [2] Reisberg *et al.* (2007) *LPSC XXXVIII*, 1177
- [3] Alexander (2002) *LPSC XXXIII*, 1872

REE geochemical study on the formation environment of the Hishikari epithermal gold deposit, Japan

K. YONEZU¹, A. YASUMATSU², Y. OKAUE², A. IMAI¹,
K. WATANABE¹ AND T. YOKOYAMA²

¹Department of Earth Resources Engineering, Kyushu University, 744 Motoooka, Nishi-ku, Fukuoka, 819-0395 Japan (yone@mine.kyushu-u.ac.jp)

²Department of chemistry, Kyushu University, 4-2-1 Ropponmatsu, Chuo-ku, Fukuoka, 810-8560 Japan (yokotscc@mbx.nc.kyushu-u.ac.jp)

In order to investigate the formation environment, especially redox environment, during the mineralization at the Hishikari epithermal gold deposit, Kagoshima prefecture, Japan, the concentration of rare earth elements (REE) and Y in the Hosen No.1 auriferous quartz vein were determined by ICP-MS after acid dissolution and selective separation.

The Hosen No.1 vein shows well symmetric banded structure and it was classified into four main bands (band I - IV). This vein was consisted of quartz, adularia and smectite associated with electrum and metal sulphides (e.g. pyrite, sphalerite and galena). Adularia could be commonly observed in each band, especially it is abundant in the earliest precipitation stage of each band. Electrum and other metal sulphides occurred with adularia and/or smectite. The quartz vein samples were collected from each band at -20 and +62.5 meter levels. The samples collected in the band II were analyzed separately by specific minerals due to the existence of electrum and sulphide-rich band called "ginguro" band.

The total concentration of REE including Y was varied from 9.72 to 0.45 and from 5.11 to 0.66 ppm at -20 and +62.5 meter levels, respectively. The highest concentration at each level was obtained in the samples obtained from the band II containing "ginguro". The chondolite normalized REE patterns of all the samples at both -20 and +62.5 meter levels showed a strong positive Ce anomaly. These results suggest that the Hosen No.1 quartz vein was precipitated and formed by mixing with oxidizing fluid (groundwater or meteoric water) and hydrothermal fluids after loss of H₂S and CO₂ gasses, and increase in pH due to boiling.