**DETERMINATION OF GD AND SM ISOTOPIC COMPOSITION IN ROCK SAMPLES USING TIMS: APPLICATIONS FOR COSMIC RAY PRODUCED SECONDARY NEUTRON CAPTURE**

I. Jabeen, A. Ali and G. Srinivasan. Department of Geology, U of Toronto, 22 Russell St., Toronto, ON M5S 3B1, Canada. Email:srini@geology.utoronto.ca

**Introduction:** Meteorites are exposed to cosmic rays (CR) in multiple stages and depths; as part of their parent bodies as well as on their way to the Earth. This exposure can leave behind tracers, imprinted as variations in CR produced stable and radiogenic isotopes. One example of an ordinary chondrite with a multiple and complex exposure age of 100 Ma is Devgaon [1]. The lunar meteorites are also determined to have exposure ages of ~ 100 Ma from stable CR produced noble gases [2]. Cosmogenic radionuclides can give information about recent events but cannot tell the time versus depth information for the exposure spanning ~100 Ma. This gap can be filled by determining the stable isotope composition of Gd and Sm as some of their isotopes have large neutron cross sections to capture thermal neutrons. Such studies have lead to the observation that depletion in $^{149}$Sm, $^{155}$Gd and $^{157}$Gd corresponds to enrichment in $^{150}$Sm, $^{156}$Gd and $^{158}$Gd isotopes respectively [3]. TIMS analyses can precisely decipher these shifts in the isotope abundances as a result of such neutron capture events. We have developed high quality techniques for the separation of Gd and Sm following the approach of [4, 5].

**Ion Chromatography:** To develop our analytical methods we used BCR-2 and synthetic mixture of REEs +Ba [in proportion similar to ordinary chondrite (S-OC)] using mono-element ICPMS standards. We separated the REE+Be fraction from BCR-2 using standard techniques developed in our lab. For elution of Gd and Sm, a 2mm i.d. quartz capillary column, packed with AG50WX4 resin (200-400 mesh) was preconditioned with 5ml of 0.2M, 2-methylactic acid (MLA). The sample was dried and dissolved in 0.75M HCl for loading. The elution was done with 10ml of 0.2M MLA at pH 4.6 under gravity assisted pressure applied onto the column with elution rate of 1 drop/min. We collected 230 individual drops and analyzed on ICP for determining the elution scheme. Following the calibration, Gd standard and Gd separated from BCR-2 were analyzed using TIMS for Gd isotopic composition using a static multi-collector approach.

**TIMS Analyses:** Our preliminary analyses of Gd isotopes were performed using $^{158}$Gd beam of 2V on $10^{11}$ resistor. We used $^{156}$Gd/$^{160}$Gd ratio of 0.9361 for exponential fractionation correction. The initial results of Gd std have a high internal precision of <10 ppm for $^{155}$Gd/$^{160}$Gd, $^{157}$Gd/$^{160}$Gd and $^{158}$Gd/$^{160}$Gd after correcting Dy isobaric interferences. The measurements of extremely low abundance $^{152}$Gd and $^{154}$Gd are complicated by the presence of Sm isobaric interference. The Gd data for both std and BCR-2 agree with previously reported data [6]. The number of analyses is too small to determine external precision at this stage. The Sm analyses are in progress. We plan to report the Gd and Sm data of primitive meteorite and standards in the meeting.

**References:** [1] Murty S. V. S. et al. 2004. *Meteoritics & Planetary Science* 39: 387-399 [2] Lorenzetti S. et al. 2005. *Meteoritics & Planetary Science* 40: 315 [3] Hidaka H. et al. 2000. *Earth & Planetary Science Letters* 180 : 29-37 [4] Hidaka H. and Ebihara M. 1995. *Analytical Chemistry* 67: 1437-1441 [5] Eugster O. et al. 1997. *Geochimica et Cosmochimica Acta* 61: 2749-2757 [6] Welten K. C. et al. 2009. *40th LPS* #2449.