

**IRON ISOTOPE COMPOSITIONS OF SI-BEARING METAL NODULES FROM THE MOUNT
EGERTON AUBRITE**

S. Ray¹, M. Wadhwa^{1,2}, V. K. Rai¹, L. A. J. Garvie^{1,2}, ¹School of Earth and Space Exploration and ²Center for Meteorite Studies, Arizona State University, Tempe, AZ 85287-6004. Soumya.Ray@asu.edu

Introduction: Aubrites are enstatite achondrites that are dominated by nearly Fe-free enstatite, with variable amounts of Fe-free diopside and forsterite, Si-bearing Fe-Ni metal, plagioclase, troilite and a range of accessory minerals [1]. Their mineralogy is indicative of the highly reduced conditions under which they formed [1]. We showed that the Fe isotope compositions of 18 metal nodules from several aubrites belonging to the main aubrite and Shallowater parent bodies, are correlated with their Si contents and structure [2-6]. The majority of aubrite metals, except from Shallowater which is unbrecciated, derive from either regolith or fragmental breccias [1]. Based on our results, we suggested that the Si-poor metal nodules were exogenous, and thus distinct from the Si-bearing nodules [2,4,6]. The Si-bearing metals are proposed to have a “residual” origin (i.e., represent equilibration with silicates) and likely were formed during igneous processes on the parent body. We also observed an anti-correlation between the Si content and $\delta^{56}\text{Fe}$ of Si-bearing metal nodules from several aubrites [6]. As a follow-up to these investigations, here we report the Fe isotope compositions of metal nodules from the Mount Egerton aubrite. Mount Egerton is an unbrecciated, anomalous aubrite with 21 wt. % of Si-bearing metal [1].

Analytical Method: Sample preparation and column chemistry were carried out under clean laboratory conditions in the Isotope Cosmochemistry and Geochronology Laboratory (ICGL) at Arizona State University (ASU). Four metal nodules (ME1 to 4 ranging from 11 to 18 mm in diameter) from the Mount Egerton aubrite were cut in half: one half was mounted in epoxy and then characterized using the CAMECA SX100 electron microprobe in the Michael J. Drake Electron Microprobe Laboratory at University of Arizona using methods similar to [5]. A clean, interior piece (weighing about ~6 mg) of the other half of each nodule was ultrasonicated in ethanol, and then dissolved in concentrated HCl. Iron was purified using standard anion exchange column chemistry techniques [7]. Iron isotopes were measured on a Thermo Neptune multicollector inductively coupled plasma mass spectrometer in medium-resolution mode and instrument mass bias was corrected using both Cu-doping and sample-standard bracketing (using IRMM-014 as the standard). The accuracy and precision of our analyses were assessed using repeated analyses of BCR-2, AGV-1, BHVO-1 terrestrial rock standards as well as a homogenized bulk sample of the Allende CV3 chondrite during each analytical session.

Results and Discussion: The metal nodules ME1 to 4 have similar Si contents, i.e., 2.00 ± 0.04 to 2.07 ± 0.04 wt% (2SD errors are $\pm 5\%$) and Fe isotope compositions ($\delta^{56}\text{Fe}$) of $0.015 \pm 0.043\%$ to $0.026 \pm 0.021\%$ (2SD). These values are similar, within errors, to the composition of Mount Egerton metal (average $\delta^{56}\text{Fe} = 0.002 \pm 0.024\%$, 2SD) [8]. Our $\delta^{56}\text{Fe}$ data are similar to those of the Si-bearing Norton County metal nodules with similar Si content (e.g., NC9, which has Si ~2 wt. % and $\delta^{56}\text{Fe} = (0.03 \pm 0.01\%)$ [6]). This study of the correlated measurements of Fe isotopes and Si content of metal nodules from the Mount Egerton aubrite is consistent with our previous study of metal nodules in the brecciated aubrites, and supports the anti-correlation between Si content and $\delta^{56}\text{Fe}$ in Si-bearing metal nodules [6]. This further suggests that the Si-bearing metal nodules in brecciated and unbrecciated aubrites (from the main group or other anomalous groups) equilibrated with silicates at either different temperatures or redox conditions on their parent bodies.

References: [1] Keil K. (2010) *Chemie der Erde*, 70, 295–317. [2] Ray S. et al. (2017) *MetSoc Meeting, Abstract #6400*. [3] Garvie L. A. J. et al. (2017) *MetSoc Meeting, Abstract #6384*. [4] Ray S. et al. (2018) *49th LPSC, Abstract #2140*. [5] Garvie L. A. J. (2018) *49th LPSC, Abstract #2104*. [6] Ray S. et al. (2019) *50th LPSC, Abstract #1960*. [7] Arnold G. L. et al. (2007) *Analytical Chemistry*, 76, 322-327. [8] Jordan M. K. et al. (2019) *GCA*, 246, 461-477.