Noble-gas isotopes are a well-established technique for providing detailed temperature-time histories of rocks and meteorites. We have established the MSFC Noble Gas Research Laboratory (MNGRL) at Marshall Space Flight Center to serve as a NASA investigator facility in the wake of the closure of the JSC laboratory formerly run by Don Bogard. The MNGRL lab was constructed to be able to measure all the noble gases, particularly Ar-Ar and I-Xe radioactive dating to find the formation age of rocks and meteorites, and Ar/Kr/Ne cosmic-ray exposure ages to understand when the meteorites were launched from their parent planets.

**THE MSFC NOBLE GAS RESEARCH LABORATORY (MNGRL): A NASA INVESTIGATOR FACILITY**

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- Nu Noblesse magnetic sector mass spectrometer with a high-voltage Nier source
- Four discrete dynode counting multipliers and a Faraday cup for simultaneous counting of up to five isotopes
- Mass resolution of 3000 and 30Ar sensitivity of 6.25 × 10^19 cps/mol
- Complete system automation using Mass Spec software
- Integrated system control, data collection, and data reduction
- Standard gas mixtures and calibrated as for standards
- Cross-calibrated with the Washington University noble gas laboratory
- Ultra high vacuum (UHV) noble gas extraction system achieved with oil-free, turbomolecular, and scroll pumps and SAES SORB-AC getters
- Manual and automatic control modes
- Janis closed-cycle cryogenic cold trap for concentration and/or separation of noble gas species
- MNGRL combined extraction line and mass spectrometer blanks (procedural background measurement) are 39Ar = 8.06E-16 mol (±20%); 40Ar = 4.15E-17 mol; 39Ar = 1.15E-17 mol. Air analyses yield a reproducible terrestrial atmospheric ratio of 39Ar/40Ar = 291.90 ± 0.06%. The baseline (off-peak) measurements on our air pipettes typically show 0-1 counts (after blank correction).

**Sample Results**

- Samples of young (3 Ma) volcanics from areas around the country were used to test the system, giving good results.
- Older (1 Ga), K-rich plagioclase samples from the Santa Fe Crater granite body show regional exhumation of the area in the Proterozoic, which is the same age observed in previous analyses of this sample.
- Lunar meteorite Dhofar 961 exhibits an apparent age of ~3.5 Ga, along with diffusive gas loss in the low-temperature steps. Our sensitivity and precise temperature control increases confidence in derived ages, reveals irregularities in gas release, and enables diffusion parameters to be recovered and multi-domain behavior to be investigated (see poster #1389 in this session for more details!)

**Sample K content, age, and mass for analysis in MNGRL**

MNGRL is an Investigator Facility where we work with other NASA-funded collaborators in the community. This means you! Please contact us for more information if you have a project in mind.