Isotopes in Lunar and Martian Lavas

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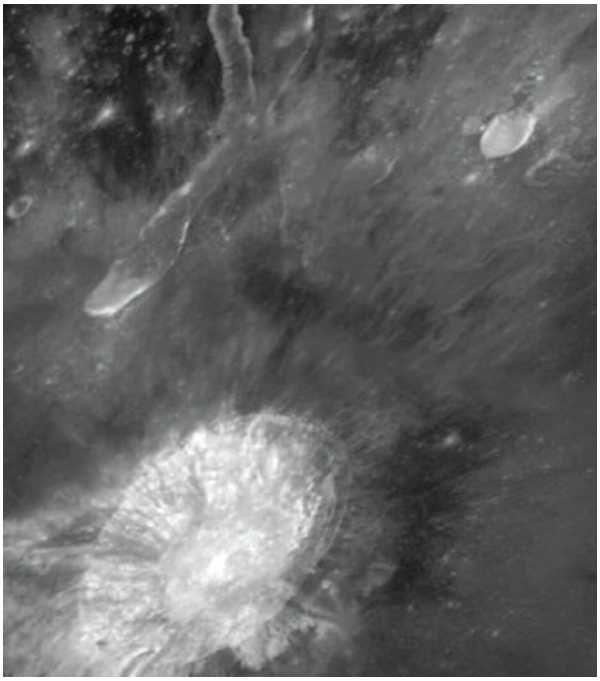
Lunar mare basalts provide insights on the compositionally stratified interior of the Moon. Petrologic investigations suggest these lavas are derived from a number of deep layers originally solidified from an early magma ocean. The so-called SNC meteorites – coined from the names of the three primary specimens: Shergotty-Nakhla-Chassigny – which are thought be from Mars, also preserve evidence for early fractionation of distinct deep layers within Mars that appear to be linked to solidification of a magma ocean. Hence, rocks from the Moon and Mars provide a special opportunity to examine the early differentiation of terrestrial planets, relative to the Earth, where geodynamical processes have erased much of the compositional evidence of early differentiation.

A natural extension of the previous and ongoing work by Brandon's group on SNC, lunar meteorites, and Apollo Moon samples, as well as the other numerous studies of these meteorites, is a systematic geochemical and petrological investigation of a newly discovered shergottite from the Roberts Massif in Antarctica (RBT 04261/04262). We have formed the Houston Area Cosmochemistry Consortium (HACC) – a consortium of cosmo-geochemists and petrologists from the area – to examine the Rb-Sr, Sm-Nd, Lu-Hf, and Re-Os isotope, trace element concentrations, and mineralogy of this meteorite as well as continued work on the recently discovered lunar meteorite LaPaz Icefield 02205. In this study, Alan Brandon (Johnson Space Center [JSC]), Thomas Lapen (University of Houston [UH]), Cin-Ty Lee (Rice University), and Anne Peslier (UH) comprise HACC and will perform isotope and mineralogic analyses using an electron microprobe and three mass spectrometers located within the host institutions. The Lu-Hf isotope analyses will be conducted at the new UH multi-collector induced plasma mass spectrometer (MC-ICP-MS) facility. The ^{87}Rb-^{86}Sr, ^{147}Sm-^{143}Nd, ^{146}Sm-^{142}Nd, ^{187}Re-^{187}Os, and trace element analyses will be performed using the ThermoFinnigan Triton thermal ionization mass spectrometer at JSC and the ThermoFinnigan Element 2 at Rice University. The mineralogic characterization will be conducted using electron microprobe facilities at JSC.

This study will augment our knowledge of how the Moon and Mars formed and evolved during their earliest histories and provide clues to the early history of our own planet. We believe this cross collaboration between cosmo-scientists and geoscientists at UH, JSC, and Rice University will foster greater cooperation between researchers and educators in the Houston area, cooperation that will be sustained beyond this one study. This endeavor will also result in educational opportunities for undergraduate and graduate students at Rice University and UH who join the team in our research, and will form the basis for strong links within the Earth and planetary sciences between local universities and JSC. Therefore, science and education in Houston will be greatly enhanced through scientific collaboration between users of the new MC-ICP-MS at UH, the JSC Triton and electron microprobe, and the Element 2 at Rice University.



Aristarchus Plateau on the Moon.