CONSTRAINING THE NUMBER OF LUNAR AND MARTIAN METEORITE FALLS.

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Introduction: Extensive searches in Antarctica and in other arid environments for extraterrestrial materials are increasing the number of lunar and Martian meteorites to our collections. However, in many instances, the meteorite is paired with other fragments from the same object that impacted Earth. Identification of these pairs is a critical component of the studies of source objects, impact events, and orbital dynamics of those meteorites. Chemical and petrographic properties are useful criteria for distinguishing individual falls for both lunar and Martian meteorites, however this information alone is not always sufficient for all objects, especially lunar meteorites. Cosmogenic nuclide studies of lunar and Martian meteorites have contributed significantly to our understanding of these objects. The specific goals of these measurements are to constrain or set limits on the following shielding or exposure parameters: (1) the depth of the sample at the time of ejection from the Moon or Mars; (2) the transition time from ejection off the lunar or Martian surface until capture by the earth; (3) and the terrestrial residence time. The ejection age in conjunction with the sample depth on the Moon or Mars can then be used to model impact and ejection mechanisms. We have measured cosmogenic nuclides in 48 (33 individual) lunar and 37 (30) Martian meteorites; a summary of new measurements is presented below.

New Measurements: Although the data are still preliminary, we measured cosmogenic nuclides in 10 new lunar and 7 new Martian meteorites since our last report [1].

Lunar meteorites. Among 11 Dhofar meteorites we studied, we found 7 individual falls. Dhofar 489/908/911/1085 are paired. Our measurements indicate that they were ejected from >1,100 g/cm^2 on the Moon and the transition time from Moon to Earth is 4±1 kyr; the terrestrial age is ~300 kyr. Dhofar 081/280/910 are paired and were ejected from a depth of 200-230 g/cm^2 on the lunar surface. The preliminary ^{10}Be 4π exposure age of Dhofar 1084 is 0.32±0.06 Myr. We identified 6-7 individual falls of NWA meteorites using cosmogenic nuclide. ^{10}Be and ^{26}Al results indicate: (1) NWA 3160 is possibly paired with NWA 773; (2) NWA 2200 and 3136 were ejected from a depth of 50-100 g/cm^2 on the lunar surface; (3) NWA 3163 was ejected from a depth of 300-320 g/cm^2. The ^{10}Be 4π exposure age of NEA 001 is 0.44±0.08 Myr. Conclusive exposure histories will be obtained after ^{36}Cl and ^{41}Ca measurements.

Martian meteorites. New exposure ages of shergottites are consistent with previously identified exposure age clusters. The preliminary ^{10}Be exposure age of NWA 1195, 2046, and 2626 are 1.1±0.2 Myr. The exposure ages of NWA 1068, 1110, 1460, 2646, 3171, and GRV 99027 are in the range of 2.5-3.1 Myr. ^{36}Cl and ^{41}Ca terrestrial age measurements are in progress.

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References: [1] Nishiizumi K. 2004. *Meteoritics & Planetary Science* 39:A77.