OXYGEN ISOTOPIC COMPOSITION OF MARE-BASALTS: MAGMA OCEAN DIFFERENTIATION AND SOURCE HETEROGENEITY. L.J. Hallis[1,2], R.C. Greenwood[3], M. Anand[1,2], S.S. Russell[1], M. F. Miller[3,4] and I. A. Franchi[3]. l.hallis@nhm.ac.uk. [1]Department of Mineralogy, The Natural History Museum, Cromwell Rd, London, SW7 5BD, UK. [2]Dept. of Earth and Environmental Sciences, The Open University, Milton Keynes MK7 6AA, UK. [3]PSSRI, The Open University, Milton Keynes MK7 6AA, UK. [4]British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Rd, Cambridge, CB3 0ET, UK

Introduction: Previous investigations of lunar basalts have demonstrated the heterogeneous nature of mare basalt source regions [1-3]. Mare basalts are generally classified on the basis of their whole-rock TiO_2, Al_2O_3 and K_2O concentrations, abundances and ratios of key trace elements (e.g., Rb, Sr, Sc, Hf and REEs) can also be used for classification [1,2]. These studies have highlighted the dichotomy between low and high-Ti basalts, with various models proposed to explain the geochemical characteristics and suggest potential source regions [4,5]. Oxygen isotope studies using laser-assisted fluorination indicate that low-Ti mare basalts have heavier $\delta^{18}O$ values than high-Ti basalts [6,7]. These differences have been interpreted as reflecting source region heterogeneity, established during differentiation of the lunar magma ocean [7]. Here we discuss new high-precision oxygen isotope measurements of a chemically diverse suite of basalt samples from the Apollo 11, 12, 14, 15 and 17 sites. The overall aim of this study is to further investigate mare-basalt genesis, and hence the evolution of the lunar magma ocean.

Methods: Oxygen isotope analyses were performed by infrared laser-assisted fluorination following the procedures outlined by [8]. Each analysis used an aliquot of ~ 2 mg of powder taken from a well-homogenized powdered sample of a ~ 250 mg rock chip. All samples were fused in vacuum prior to reaction.

Results & Conclusions: Preliminary data are consistent with previous results [6,7], indicating that the high-Ti basalts have slightly lighter $\delta^{18}O$ values (average 5.58 ± 0.08 (1σ), n=9) compared to low-Ti samples (average 5.70 ± 0.12 (1σ), n=6). In contrast Apollo 15 KREEP basalt 15386 and high-Al Apollo 14 basalt 14053 yielded higher $\delta^{18}O$ values (5.947 ‰ ± 0.030 (1σ) and 5.814 ‰ ± 0.047 (1σ)). Comparisons of other geochemical parameters with the oxygen isotopic composition of mare basalts are underway to ascertain various processes involved in petrogenesis. In the first instance, however, the differences between $\delta^{18}O$ values for specific mare-basalt types can most easily be reconciled with the heterogeneous nature of the lunar mantle, yet the exact process(es) giving rise to such distinct oxygen isotopic compositions for each sub-group remains to be fully investigated.

References: **[1]** Neal & Taylor, 1992. *Geochim. Cosmochim. Acta* 56: 2177-2211. **[2]** Neal et al., 1994a,b. *Meteoritics* 29: 334-361. **[3]** Schnare et al., 2008. *Geochim. Cosmochim. Acta* 72: 2556-2572. **[4]** Ryder et al., 1991. *Geophysical Research Letters* 18: 2065-2068. **[5]** Spera, 1992. *Geochim. Cosmochim. Acta* 56: 2253-2265. **[6]** Wiechert et al., 2001. *Science* 294: 345-348. **[7]** Spicuzza et al., 2007. *Earth and Planetary Science Letters* 253: 254-265. **[8]** Miller et al., 1999. *Rapid Commun. Mass Spectrom.* 13: 1211-1217.