Trace element signatures of trapped KREEP in Olivine-rich clasts within lunar meteorite NWA773

Conference or Workshop Item

TRACE ELEMENT SIGNATURES OF TRAPPED KREEP IN OLIVINE-RICH CLASTS WITHIN LUNAR METEORITE NWA773. J. C. Bridges, T. E. Jeffries and M. M. Grady, Dept. of Mineralogy, Natural History Museum, Cromwell Road, London SW7 5BD, UK. (j.bridges@nhm.ac.uk).

NWA773 (sample BM2001, M23) is a lunar regolith breccia [1] the major component of which is an unusual olivine-rich cumulate in clasts ≤2 cm across. We use laser-ICPMS trace element determinations on minerals in the clasts to describe their crystallisation history and melt compositions. They have a feldspathic-peridotite modal mineralogy: 66 vol% ol (Fo_{70-71}); 25.9% augite ($En_{50}Wo_{38}$) and pigeonite ($En_{61}Wo_{13}$); 8.2% plag (An_{88-91}) and minor constituents (from point counting of our 2 sections, although the clasts were called olivine gabbronorite in [1]). The bulk composition is 41.2 wt% SiO_2, 0.4 wt% TiO_2, 5.7 wt% Al_2O_3, 26.3 wt% MgO, 19.8 wt% FeO, 5.8 wt% CaO, 100Mg# = 70.3 (average of multiple EPMA point analyses). This composition suggests affinities with the Mg-suite of clasts identified within highland material [2] and in particular Apollo 16 sample 67667 [3].

The olivine, pyroxene and plagioclase have low siderophile and Rb (<0.4 x CI) abundances (FIG. 1). Augite has the highest total REE abundances (La 5 x CI, Lu 18 x CI) and olivine the lowest (La 0.1 x CI, Lu 4.5 x CI). The bulk clasts have LREE 40 x CI, HREE 20 x CI [1]. Melt trace element abundances were calculated using partition coefficients from [4,5] and are shown as open symbols in FIG. 1. The calculated melt compositions from the pigeonite and plagioclase (200-400 x CI LREE, 90-200 x CI HREE, negative Eu anomalies) are close to KREEP compositions and trace element abundances suggested for the parental melts of lunar Mg-suite plutonic rocks [4]. However augite in the clasts crystallised from more enriched melt. Taking the original melt's composition as KREEP, and assuming Rayleigh fractionation, implies that augite crystallised from the last 6-10% of trapped melt. Olivine, pigeonite and plagioclase were derived from a primitive KREEP basaltic melt in a peridotitic cumulate pile, augite (together with some minor phases) crystallised from the final fractions of trapped melt.

References: [1] Fagan T. J. et al. (2001) *Meteorit. Planet. Sci, 36,* A55. [2] Snyder G. A. et al. (1995) *JGR*, 100, 9365-9388. [3] Warren P. H. and Wasson J. T. (1979) *Proc. LPSC* 10, 583-610. [4] Papike J. J. et al. (1996) *GCA*, 60, 3967-3978. [5] http://EarthRef.org/

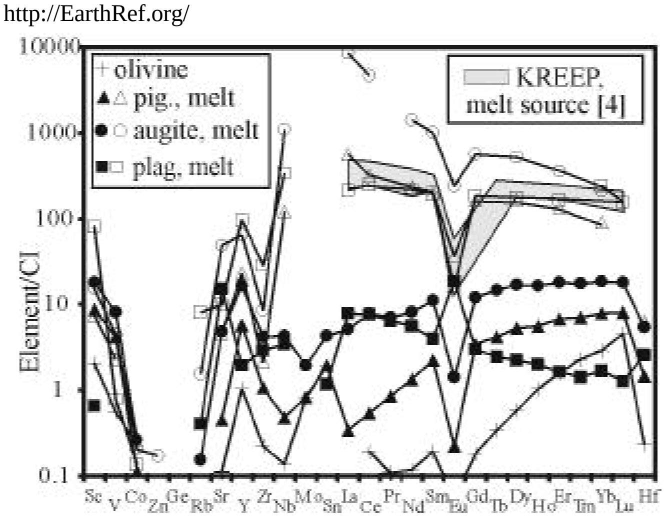

Fig. 1. Trace elements in minerals from NWA773 cumulate clasts.