

### A MAGNESIAN GRANULITE CLAST IN LUNAR METEORITE ALHA81005.

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**Introduction:** Granulites are impact-metamorphosed rocks [1] found throughout the lunar highlands [2]. The composition of many lunar granulites cannot be linked to known highland lithologies [3]. Specifically, magnesian granulites ( $Mg^* > 70$ ) are distinct from pristine highland rocks in major and trace element chemistry [4-6]. An additional distinction exists between the magnesian granulites in some feldspathic lunar meteorites and those collected by the Apollo missions [Treiman A.H., unpublished data]. We combine EMP element X-ray maps with EMP and SIMS mineral compositions to reconstruct the bulk chemical composition of a magnesian granulite in ALHA81005.

**Sample and Methods:** Analyses were performed on a magnesian granulite, Clast 3, in lunar meteorite ALHA81005.48. A compositionally representative field of Clast 3 was selected. Major and minor element X-ray maps, and compositions of major mineral phases in the clast, were acquired with a Cameca SX 100 EMP. The trace element compositions of major mineral phases were obtained by SIMS (Cameca ims 4f) at UNM. Element maps were imported into image-processing software and classified into mineral maps. The proportions of minerals were estimated from the histogram outputs of classifications. Mineral modes were translated into the mass % of each phase, and then combined with mineral compositions to calculate the bulk chemistry of Clast 3 (Table 1).

**Results and Discussion:** Clast 3 is similar to other magnesian granulites in ALHA81005 [7]. It consists of approximately 66% plagioclase ( $An_{97.1}$ ), 17% low-Ca pyroxene, 14% olivine ( $Fo_{81.5}$ ), 2% augite, and traces of chromite, troilite, and whitlockite. The  $Mg^*$  of Clast 3 is 82. From their concentrations in plagioclase, we infer La  $\sim 0.8xCI$  and Eu  $\sim 9.5xCI$  for bulk Clast 3. Clast 3 is similar to Mg-Suite rocks in plagioclase composition and  $Mg^*$ , but is more feldspathic. Estimating Sm from La [6], Clast 3 has Ti/Sm  $\sim 4xCI$ , which is not in the range displayed by Apollo magnesian granulites. The composition of Clast 3 indicates that magnesian granulites in ALHA81005 are not like Apollo magnesian granulites, and are not simple mixtures of highland rocks in the Apollo sample set.

**References:** [1] Warner J.L. et al. 1977. *Proceeding of the 8th Lunar Science Conference* 2051-2066. [2] Wood J.A. et al. 1970. *Proceeding of the Apollo 11 Lunar Science Conference* 965-988. [3] Simonds C.H. et al. 1974. *Proceeding of the 5th Lunar Science Conference* 337-353. [4] Lindstrom M.M. and Lindstrom D.J. 1986. *Journal of Geophysical Research* 91(Suppl.): D263-D276. [5] Korotev R.L. and Jolliff B.L. 2001. Abstract #1455. *32<sup>nd</sup> Lunar & Planetary Science Conference*. [6] Korotev R.L. et al. 2003. *Geochimica et Cosmochimica Acta* 67: 4895-4923. [7] Goodrich C.A. et al. 1984. *Journal of Geophysical Research* 89 (Suppl.): C87-C94.

**Table 1**

SiO <sub>2</sub>	44.77
TiO <sub>2</sub>	0.15
Al <sub>2</sub> O <sub>3</sub>	24.08
Cr <sub>2</sub> O <sub>3</sub>	0.18
FeO	4.59
MnO	0.08
MgO	11.77
CaO	13.95
Na <sub>2</sub> O	0.22
K <sub>2</sub> O	0.01
P <sub>2</sub> O <sub>5</sub>	0.001
S	0.016
Total	99.82
La (x CI)	0.81
Eu (x CI)	9.52