ORTHOPYROXENE AS A RECORDER OF LUNAR Mg-SUITE NORITE PETROGENESIS: PRELIMINARY ION MICROPROBE STUDIES OF APOLLO 17 FRAGMENTS; J.J. Papike, G.W. Fowler, and C.K. Shearer; Institute of Meteoritics, Department of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM 87131-1126, U.S.A.

INTRODUCTION. Recent abstracts by S.R. Taylor et al. [1, 2] emphasized that we still have a poor understanding of the lunar Mg-Suite which could make up as much as 20% of the lunar crust. These authors suggest, based on published ages, that the Mg-Suite is 100-200 m.y. younger than the ferroan anorthosites. They point out that the Mg-Suite has two distinct and contradictory components. The suite is Mg-rich with Mg # >90 (implying primitive) but also contains high concentrations of incompatible elements typical of highly evolved rocks. These authors suggest that the primitive component accreted late onto the surface of the moon and mixed with a KREEP component which provided the high incompatible element concentrations.

APPROACH. We became intrigued with this problem and decided to take a "tree before forest" approach rather than the inverse. We were aided greatly by the recent compilation of petrologic information on possibly pristine nonmare rocks by Warren [3]. We used this compilation to select a suite of 24 noritic fragments with a high confidence class indicating a high likelihood of pristine character. The first three fragments we selected to work on are (77035,69), (77215,203), and (78235,39). Sample 78235 was chipped from a glass-coated O.5 meter boulder near the base of Sculptured Hills. An early and complete description of this rock was provided by McCallum and Mathez [4]. Cumulus phases are plagioclase ~50% and orthopyroxene ~50%. We chose noritic lithologies for this study because we believe orthopyroxenes are effective recorders of their parental melt compositions. Diffusion rates for REE are poorly determined but appear to be low and augite exsolution (usually on (100)) is not the serious problem that exists in "inverted pigeonites" where complex exsolution textures greatly compromise the trace element distributions. The approach we use here is very similar to that which we used in our study of diogenites [5].

RESULTS. The grains studied showed limited zoning from core to rim based on electron microprobe traverses. Table 1 presents averages of SIMS data for the three fragments (4 points on 77035, 4 points on 77215, 5 points on 78235). The concentrations are delightfully high (compared to OPX in most diogenites) but nevertheless Eu was usually below detection. The Fe-Mg systematics for the three fragments are illustrated in Figure 1 with Fe increasing in the sequence 78235→77035→77215 which is the same sequence in which the heavy REE increase. Also, 77215 which contains the highest Fe and heavy REE is most depleted in LREE. We attempted to do a preliminary estimate of the parental melt REE patterns. These results are preliminary and approximate because we still have to determine the most appropriate partition coefficients to use. For the calculation we used those of McKay et al. [6]. Nevertheless, the relative positions of the melt REE patterns should be correct. All three fragments could have come from the same or similar magmatic reservoirs that were likely KREEP enriched either during melting (KREEP in the source region) or by assimilation. The calculated melts show a decrease in Mg#, $(Ce/Yb)_N$, and Sr in the sequence 78235→77035→77215. This sequence probably reflects the co-crystallization of orthopyroxene and plagioclase. Significant crystallization of plagioclase was likely the cause of the depleted LREE in the calculated melts relative to what one might expect if a significant KREEP component was present.

REFERENCES. [1] Taylor, S.R. et al. (1993) *LPS XXIV*, 1413-1414. [2] Taylor, S.R. et al. (1993) *Meteoritics*, **28**, 448. [3] Warren, P.H. (1993) *American Mineralogist*, **78**, 360-376. [4] McCallum, I.S. and Mathez, E.A. (1975) *Proc. Lunar Sci. Conf. 6th*, 395-414. [5] Papike, J.J. et al. (1993) *EOS*, **74**, 380-381. [6] McKay, G. (1991) *LPS XXII*, 883-884.

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Fig. 1

Mg vs Fe (apfu) for Three A-17 Mg-Suite Norites

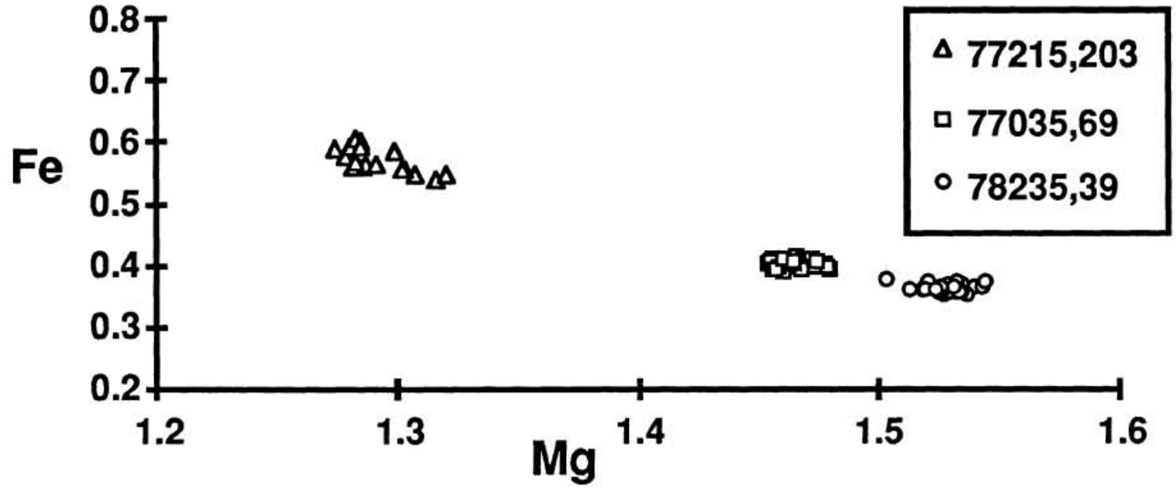
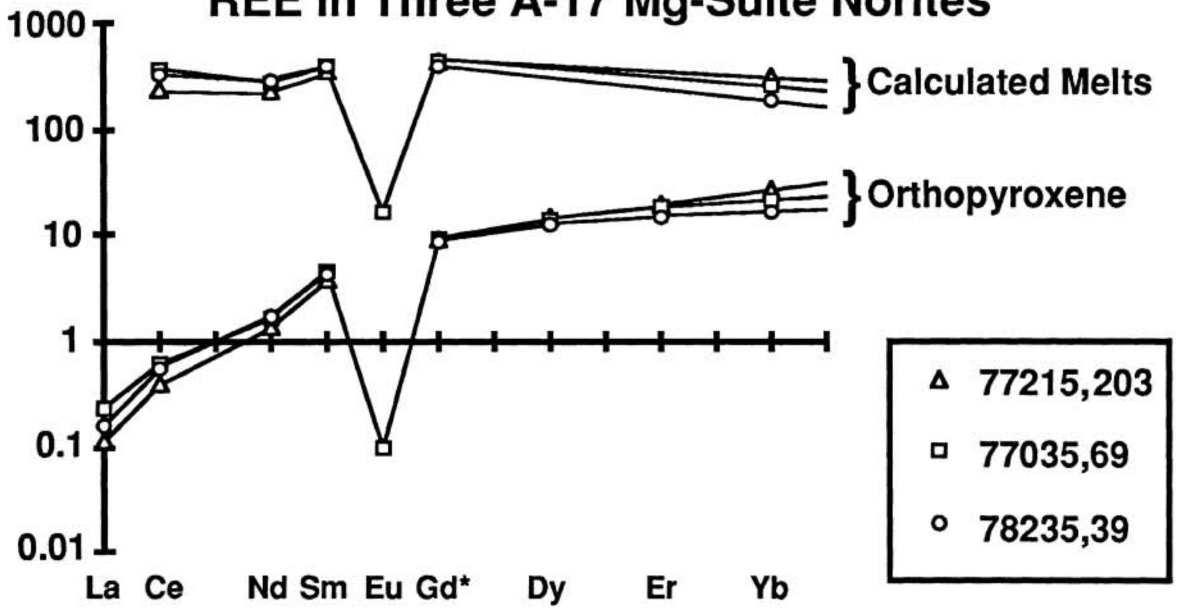


Fig. 2

REE in Three A-17 Mg-Suite Norites



* Gd values are extrapolated

Table 1

Orthopyroxene From Selected A-17 Mg-Suite Norites

AVERAGES In ppm

	Sr	Y	Zr	La	Ce	Nd	Sm	Eu	Dy	Er	Yb
77215,203	0.103	30.2	29.3	0.027	0.245	0.621	0.583	B.D. *	3.58	3.18	4.48
78235,39	0.122	23.3	30.3	0.039	0.336	0.761	0.647	B.D. *	3.07	2.43	2.71
77035,69	0.112	27.7	29.0	0.056	0.372	0.732	0.658	*0.006*	3.49	2.89	3.61

* B.D. = Below Detection.