

ORTHOPYROXENES AS RECORDERS OF DIOGENITE PETROGENESIS: MAJOR AND MINOR ELEMENT SYSTEMATICS. J.J. Papike, M.N. Spilde, G.W. Fowler, and C.K. Shearer; Institute of Meteoritics, Dept. of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM 87131-1126

**INTRODUCTION.** As a part of our research to better understand magmatic processes in the Eucrite Parent Body we have initiated an ambitious program of study of major, minor and trace elements in orthopyroxene from diogenites. This paper reports preliminary results for major and minor elements in orthopyroxenes for a suite of 13 diogenites: Aioun El Atrouss, ALH 84001, ALH A 77256, EET 87530, Ellemeet, Garland, Ibbenburen, Johnstown, Manegoan, Peckelsheim, Roda, Shalka, and Tatahouine. A companion paper by Shearer et al. [1] (this volume) reports new trace element data for ALH 84001, ALH A 77256, Ibbenburen, and Tatahouine. We have presently collected over 800 high quality pyroxene microprobe analyses for Si, Al, Ca, Na, Mn, Fe, Mg, Cr, and Ti. The chemical systematics observed for these orthopyroxenes reflect original magmatic mineral/melt partitioning plus later trapped liquid/mineral equilibration, subsolidus exsolution, and mineral/mineral metamorphic reactions. We have therefore avoided, at this point, any attempt to use statistical analysis to group (e.g. factor or cluster analysis [2, 3]) these orthopyroxenes chemically.

**DISCUSSION.** Fe/Mg systematics can be seriously affected by subsolidus equilibration with trapped liquid. The more disparate the Fe/Mg of the trapped liquid and OPX and the greater the amount of trapped liquid, the greater the shift in OPX Fe/Mg will be. This trapped liquid shift effect has been discussed with regard to terrestrial layered intrusions by Barnes [4] and Cawthorn et al. [5]. Figure 1 presents the  $Fe/(Fe+Mg) = X_{Fe}$  data for the 13 diogenites studied, ordered (upper left to lower right) in terms of increasing  $X_{Fe}$ . One assemblage in Rhoda is the most Mg-rich. Ellemeet has two populations  $X_{Fe}$  (0.20) and (0.27). The highest  $X_{Fe}$  values are found in Peckelsheim and Garland. The olivine diogenites (Sack et al [6]) require further comment. If the thirteen diogenites represent cumulates from magmatic systems, the olivine diogenites would be expected to display low  $X_{Fe}$  values. In fact one population of ALH 84001 has a value of (0.20). The second, more Fe-rich population ( $X_{Fe}=0.24$ ) in ALH 84001 most likely reflects reaction between trapped melt and OPX. ALH A 77256 is even more annealed and it appears that its magmatic  $X_{Fe}$  has been erased. Thus in order to read the magmatic record recorded by OPX chemistry we will have to use elements with slower diffusion rates (e.g. REE [1]).

Figure 2 shows some interesting systematics in terms of Al vs Cr. A main trend occurs on the diagram with Peckelsheim, one assemblage of Garland (which is polymict), and Ellemeet plotting on the low Cr, Al end and Manegoan, Johnstown, and Aioun El Atrouss plotting near the high Cr, Al end. The olivine diogenite ALH A 77256 falls off the trend at lower Cr values. Most OPX groups show rather smooth trends on this diagram with a positive slope; however, the slopes are different. The slopes of regression lines through the Al vs. Cr points range from 0.1 for ALH A 77256 to a high of .945 for Tatahouine. Note Tatahouine (tight group), ALH 84001, Ibbenburen, and ALH A 77256 which are highlighted on this diagram for comparisons to our companion study [1]. A range of Cr, Al concentrations can be found in single grains. Three mechanisms that could cause a decrease in Cr, Al abundances towards the rim of an OPX grain are: (1) co-crystallization of OPX and spinel, (2) a magmatic trend if Cr<sup>3+</sup> and Al behave compatibly in OPX/melt partitioning, and (3) reequilibration with trapped melt that has lower concentrations of Al and Cr relative to OPX.

Based on this study and our companion study, [1] it appears that: (1) olivine diogenites are cumulates, not restites [6], and (2) the diogenite suite appears to have crystallized from a series of chemically similar but distinct basaltic magmas.

**References** [1] Shearer C.K., Papike J.J. and Layne G.D. (1993) this volume. [2] Harriott T.A. and Hewins R.H. (1984) *Meteoritics*, **19**, 15-23. [3] Berkley J.L. and Boynton N.J. (1992) *Meteoritics*, **27**, 387-394. [4] Barnes S.J. (1986) *Contrib. Mineral. Petrol.*, **93**, 524-531. [5] Cawthorn R.G., Sander B.K. and Jones I.M. (1992) *Contrib. Mineral. Petrol.*, **111**, 194-202. [6] Sack R.O., Azeredo W.J. and Lipschutz M.E. (1991) *G.C.A.*, **55**, 1111-1120.

**Acknowledgement** This research was funded by NASA Grant NAG 9-497 (J.J. Papike, P.I.).

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Figure 1.

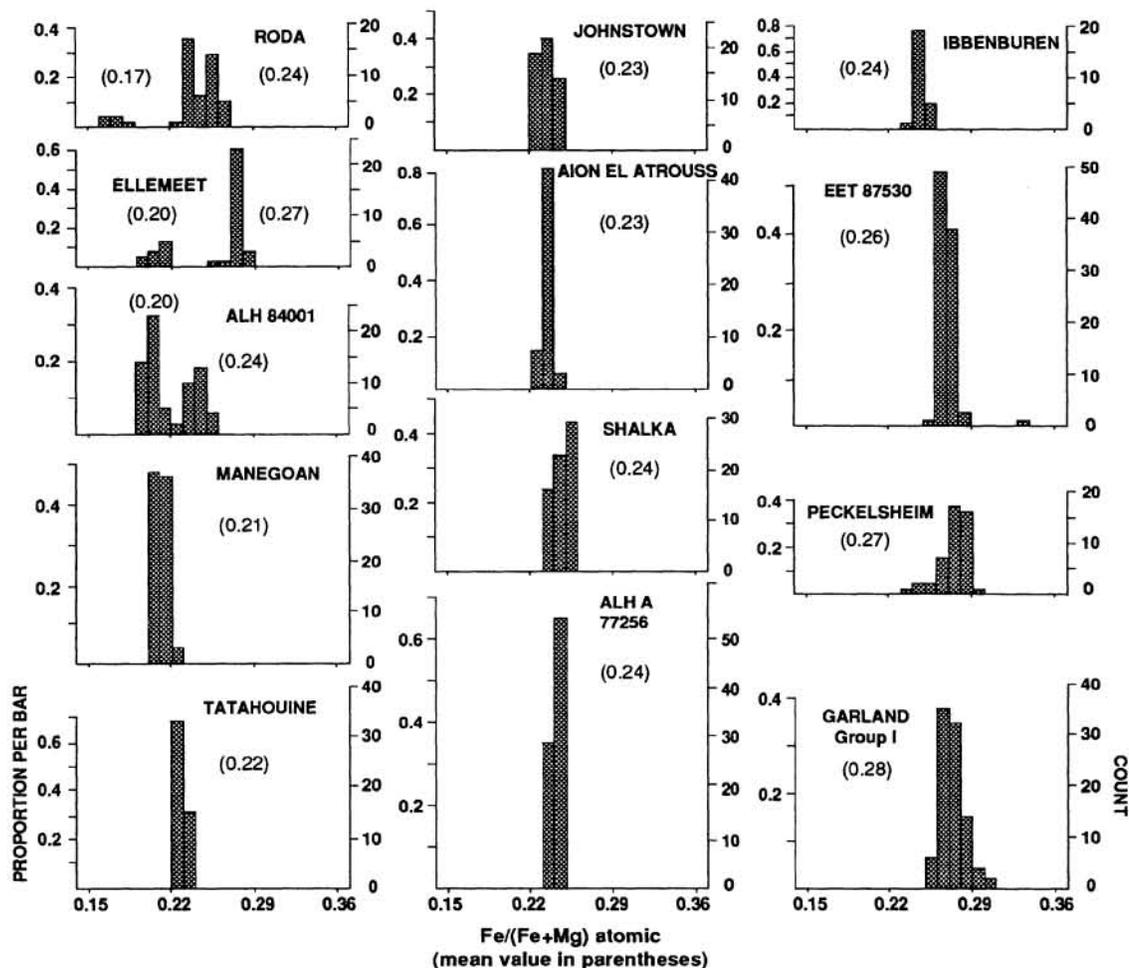


Figure 2.

