INTER-ELEMENT CORRELATIONS AMONG MARE BASALTS AND PRISTINE LUNAR GLASSES. J.W. Delano*, S.S. Hughes+, and R.A. Schmitt+. *Dept. of Geological Sciences; State University of New York; Albany, NY 12222. +Depts. of Chemistry and Geology and the Radiation Center; Oregon State University; Corvallis, OR 97331.

INTRODUCTION

Chemical constraints on the nature of the lunar mantle are improving due to the continued success at finding and characterizing previously unknown varieties of mare magmas [e.g. 1,2]. At present, basaltic samples from 50 eruptive units on the Moon have been identified and chemically analyzed by various investigators. This data-base consists of 25 suites of crystalline mare basalts and 25 groups of pristine (pyroclastic) glasses [3]. Although the latter category of mare eruptives is less well-characterized for trace elements than the former, efforts are being made to rectify this. With this large, and steadily growing, source of information about the Moon's mantle, chemical systematics are emerging that provide new insights about the Moon's mantle.

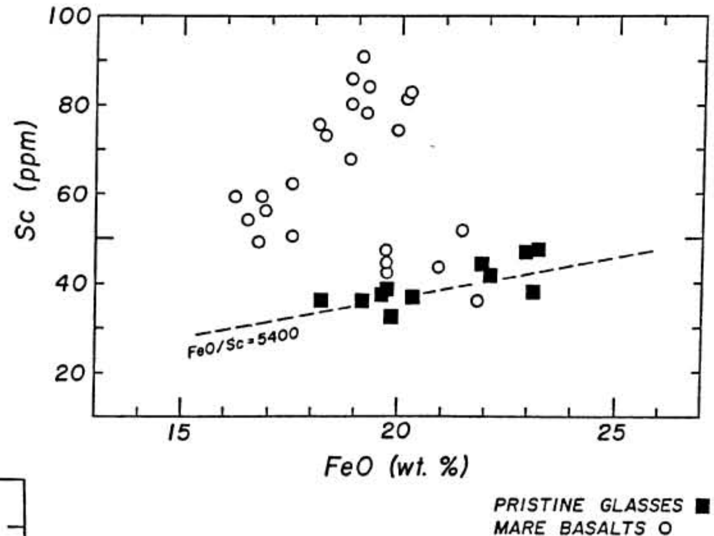
INTER-ELEMENT CORRELATIONS

Laul and Schmitt [4] were the first to suggest that a significant correlation existed between Sc and FeO among lunar samples. Indeed, a lunar FeO/Sc ratio (by weight) of 5400 has subsequently become firmly entrenched in the literature [5]. Note, however, in Figure 1 that current information from mare eruptives shows that actual circumstances are more complex and more interesting than those implied by a single value. The crystalline mare basalts plot in two separate fields. Although the early indications [6] were that this dichotomy was governed by the Ti abundance of the basalt, that inference is now found to be wrong. The high Sc, low FeO suite of samples consists of Apollo 14 low-Ti groups 1-5 basalts [1], Luna 16, Apollo 16 mare basalts from Mare Nectaris, Apollo 12 feldspathic basalts, Apollo 14 VHK basalt [2], Apollo 11 high-Ti basalts [7], Apollo 17 VLT basalt [8], and Apollo 17 high-Ti basalts. In contrast, samples lying on-or-near the ratio FeO/Sc = 5400 include low-Ti mare basalts from Apollo 12, Apollo 15, and Luna 24. Significantly, low-Ti and high-Ti pristine glasses have FeO/Sc ratios of about 5400. Due to the difficulty of strongly fractionating FeO and Sc during partial melting in the presence of residual olivine and low-Ca pyroxene, it is our view that the two groups of basaltic samples evident in Figure 1 reflect two chemially distinct reservoirs in the lunar mantle. Perhaps most significantly, the intersection of the two trends at FeO = 14% and Sc = 25 ppm is close to values suggested by some investigators for the initial composition of the lunar magma ocean, from which the mantle was derived. Since these relations among mare magmas are not significantly affected by moderate degrees of fractional crystallization during emplacement of the lava, this parameter may prove to be useful for all mare samples.

Figure 2 shows that the pristine glasses overlap and extend the correlation between Ni and Co evident from the crystalline mare basalts. Since Ni and Co are compatible trace elements whose abundances can be substantially lowered by modest amounts of olivine fractionation during a magma's emplacement, the higher abundances of these elements in the pristine glasses implies that they are better candidates for primary magmas than the crystalline mare basalts [e.g. 9]. This inference is also supported by the correlation between Mg and Ni previously discussed in [3].

REFERENCES: [1] Dickinson, Taylor, Keil, Schmitt, Hughes, and Smith (1985) Proc. Lunar Planet Sci. Conf. 15th, p. C365-C374. [2] Shervais, Taylor, Laul, Shih, and Nyquist (1985) Proc. Lunar Planet Sci. Conf. 16th, p. D3-D18. [3] Delano (1986) Proc. Lunar Planet Sci. Conf. 16th, p. D201-D213. [4] Laul and Schmitt (1973) Proc. Lunar Sci. Conf. 4th, p. 1349-1367. [5] Taylor (1975) Lunar Science: A Post-Apollo View. Pergamon Press. [6] Ma, Murali, and Schmitt (1976) Proc. Lunar Sci. Conf. 7th, p. 1673-1695. [7] Beaty, Hill, Albee, Ma, and Schmitt (1979) Proc. Lunar Planet. Sci. Conf. 10th, p. 41-75. [8] Wentworth, Taylor, Warner, Keil, Ma, and Schmitt (1979) Proc. Lunar Planet. Sci. Conf. 10th, p. 207-223. [9] Longhi (1987) Proc. Lunar Planet. Sci. Conf. 17th, p. E349-E360.

Figure 1



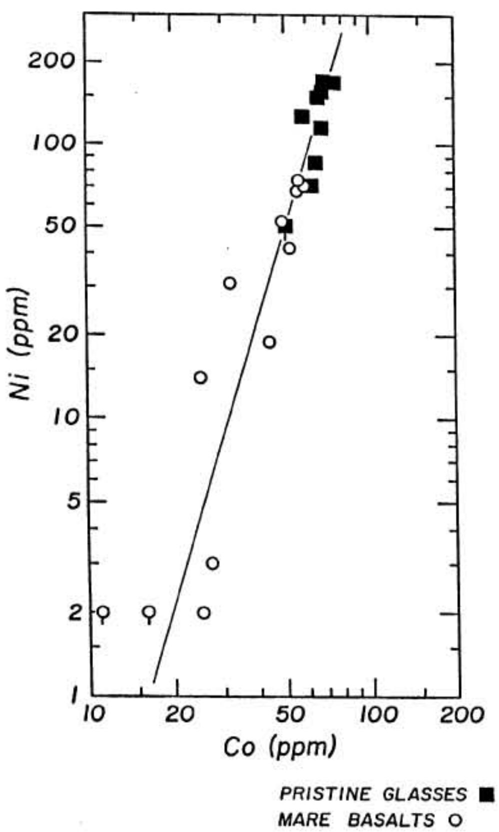


Figure 2