CRUSTAL PARTIAL MELTING ON VESTA: EVIDENCE FROM STANNERN TREND AND RESIDUAL EUCRITES.

A. Yamaguchi[1], J. A. Barrat[2,3], R. C. Greenwood[4], M. Ebihara[5], and I. A. Franchi[4]. [1]National Institute of Polar Research, Tachikawa, Tachikawa, Tokyo 190-8518, Japan. E-mail: yamaguch@nipr.ac.jp, [2]Université Européenne de Bretagne. [3]UBO-IUEM, CNRS UMR 6538, place Nicolas Copernic, 29280 Plouzané Cedex, France. [4]PSSRI, The Open University, Milton Keynes MK7 6AA. UK. [5]Department of Chemistry, Tokyo Metropolitan University, Hachioji, Tokyo 192-0397, Japan.

Basaltic eucrites can be classified into three chemical groups: Main-Nuevo Laredo (MG-NV), Stannern (ST) trend and residual eucrites, which were added recently [1]. These three groups have similar major element compositions, but have distinctive incompatible element abundances. Although the petrogenesis of MG-NV eucrites can be explained by fractional crystallization in a magma ocean (e.g., [2,3]), ST and residual eucrites seem to have experienced more complex petrogenetic histories. The metamorphic and geochemical evidence furnished by these two groups provides important information about the formation processes of primary asteroidal crust.

ST trend eucrites are very similar to MG eucrites in term of major element compositions, but are significantly richer in incompatible elements and display distinctive negative Eu, Sr, and Be anomalies. These eucrites are among some of the least metamorphosed examples known (type 1-4) [4]. Residual eucrites (e.g., DaG 945, EET90020) [1,5,6] are similar to MG eucrites in terms of major elements, but their REE patterns show varying degrees of LREE depletion due to the extraction of partial melts. Pyroxene mineralogy indicates that these residual eucrites are generally highly metamorphosed rocks (type 4-7). There is no correlation between the metamorphic conditions recorded by their pyroxenes and the degree of melting (extent of light REE depletion). This could be due to short and high temperature reheating events overprinted on the global metamorphism that caused homogenization, exsolution and inversion of pigeonite [7].

Contamination of MG eucrites by melts derived by partial fusion of the eucritic crust can successfully explain the chemical composition of ST eucrites [8]. In contrast, the REE composition of residual eucrites can best be explained by extraction of small amounts of partial melt (< a few %) from MG eucrites [1]. This crustal partial melting model explains both the petrogenesis and thermal history of ST and residual eucrites. The magma ocean model, plus secondary re-processing of the primary crust can explain both the range of metamorphic types, as well as the chemical groups, displayed by basaltic eucrites.

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