Investigating Early Differentiation of Igneous Asteriods : A New Variety of Eucrite?

Bermingham, Katherine[1] Christy, Andrew G.[2] Norman, Marc D.[2]
[1]Münster University, Institut für Mineralogie Corrensstrasse 24 Münster 48149 Deutschland [2]Australian National University, Research School of Earth Sciences Bldg 61 Mills Road Canberra 0200 Australia

Eucrites are among the oldest basaltic lavas in the Solar System. They are thought to originate from a differentiated asteroid, probably 4Vesta. We characterized the mineralogy and geochemistry of twelve monomict Antarctic eucrites (BTN00300, EET90020, EET90029, GRA98098, MAC02522, MAC041169, MET01081, PCA82502, PCA91078, QUE94484, QUE97014, and QUE99658) in order to improve our understanding of eucrite petrogenesis and igneous processes contributing to early planetary differentiation.

Textures and mineral compositions were determined using optical and electron microscopy. Major element compositions of whole rock powders were measured using XRF and energy-dispersive SEM analysis of Li-borate fused glasses. Whole rock trace element compositions were measured on the Li-borate glasses using laser-ablation ICPMS.

All samples are monomict and unbrecciated, with the exception of sample PCA82502 which is monomict and brecciated. Major mineral phases are calcic plagioclase and clinopyroxene. Minor and accessory phases include silica polymorphs, chromite, ilmenite, baddeleyite, and phosphates. There is a range of grain size and degree of equilibration among the samples, indicated by rounding of plagioclase grains and pyroxene exsolution lamellae. The petrography and major element compositions indicate that our samples have melt compositions and are not cumulates.

Two compositional groups have been identified based on trace element data. Group 1 (BTN00300, EET90029, GRA98098, MAC02522, MAC041169, QUE94484, QUE97014, and QUE99658) has flat to slightly LREE-enriched patterns with negative europium anomalies. These samples appear to be Main Group eucrites except for QUE94484 which has enriched levels of incompatible elements similar to Stannern Trend eucrites. The Group 2 samples (EET90020, MET01081, PCA82502, and PCA91078) have LREE depleted patterns with positive europium anomalies. Other incompatible trace elements are lower in abundance in Group 2 samples compared to Group 1 samples. Plagiophile elements are particularly distinctive with Group 1 samples trending toward low, subchondritic Sr/Nd rations with increasing depth of the negative Eu anomaly whereas Group 2 samples trend towards markedly superchondritic Sr/Nd ratios with a positive Eu anomaly. In contrast to trace element data there is no difference in the major element indicators of fractionation (e.g. Al2O3 or MgO/FeO) between the two groups.

The combination of petrographic and geochemical characteristics of Group 2 eucrites appears not to have been widely discussed. We tentatively suggest they represent a new variety of non-cumulate basaltic eucrite. As such they may provide new insights into the early evolution of the eucrite parent body. Preliminary modeling suggests that the general trace element characteristics of Group 2 eucrites can be reproduced by melting of a plagioclase-enriched source region.

→

Abs. No. **354**
Meeting: **DMG 2008**
submitted by: **Bermingham, Katherine**
email: **katherine.bermingham@uni-muenster.de**
date: **0000-00-00**
Req. presentation: **Vortrag**
Req. session: **S02**