Analysis of Mg, Sr, and Ba in deep sea corals using SIMS and ICP-MS

R.I. GABITOV*, A.C. GAGNON, J.F. ADKINS AND J.M. EILER

Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA, 91125, USA
(*correspondence: gabitr@gps.caltech.edu)

Chemical compositons of corals are widely used to reconstruct the temperature and composition of the ocean. However, many corals are heterogeneous in minor and trace elements even when they grew at constant temperature and seawater composition. The goals of our work are to characterize and explain Mg, Sr, and Ba distributions across known skeletal features of corals, and to establish how these distributions vary with temperature.

The Mg/Ca and Sr/Ca ratios in *Desmophyllum dianthus* (a deep sea scleractinian coral from the South Pacific, T=3.6±0.6°C) were analyzed by ims-7f ion probe and ICP-MS. Ratios of Ba/Ca were measured only by 7f. Sets of ion probe measurements that traverse the coral septum reveal that Mg/Ca in the central band (COC) is elevated by factors of 2 or 3 compared to the rest of the septum (fabric) (Figure 1). Sr/Ca ratios decrease with incresing Mg/Ca, with the slope of -0.8 (R^2=0.3, $P<10^{-4}$) for septum fabric. Sr/Ca is independent of Mg/Ca and less variable in COCs. Ba/Ca ratios increase with increasing Sr/Ca, with the slope of $9.6 \cdot 10^{-3}$ (R^2=0.6, $P=2.05 \cdot 10^{-4}$) in COCs, but not for the rest of the septum.

We expect to also present planned analyses of Sr/Ca, Mg/Ca, and Ba/Ca ratios in *Desmophyllum dianthuses* corals grown at different temperatures, which may permit us to establish calibrations of the temperature dependencies of trace-element compositions of COCs and/or other septa materials.

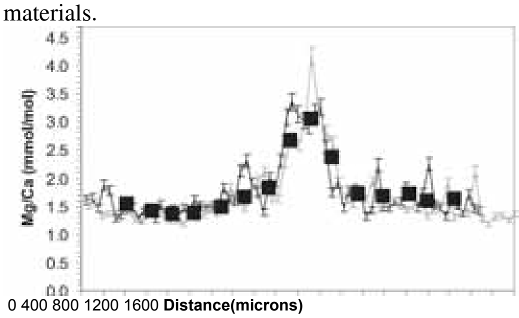

Figure 1: Comparison of Cameca 7F-Geo Me/Ca (two lines) and isotope dilution data (squares) from micromilling and analysis on the ICP-MS (ThermoFinnigan Element).

What we are learning about the Moon from lunar meteorites

AMY M. GAFFNEY*AND LARS E. BORG

Lawrence Livermore National Laboratory, CMELS, IGPP, Livermore, CA 94550
(*correspondence: gaffney1@llnl.gov)

Lunar samples collected over 30 years ago during the Apollo and Luna missions are the basis for the long-standing magma ocean model for the petrogenetic evolution of the Moon. However, these samples were collected from a relatively small geographic region of the lunar surface, and do not fully represent the petrologic and geochemical diversity of lunar materials. Lunar meteorites provide a complementary record of lunar geochemistry and chronology that contributes to a more comprehensive picture of the differentiation and evolution of the moon.

Our recent work on several basaltic lunar meteorites has identified: a) an expanded compositional range of mantle sources that formed during initial differentiation of the moon in the magma ocean, and b) the youngest known lunar magmatism. Mare basalt Northwest Africa (NWA) 4898, with a crystallization age of 3600 ± 59 Ma and a preliminary initial ε_{Nd} of + 15.8, is derived from the most depleted mantle source yet identified on the Moon [1]. Another lunar meteorite, NWA 032, shows KREEP-like incompatible element enrichments, but its initial ε_{Nd} of + 9.71 ± 0.74 and initial $^{87}Sr/^{86}Sr$ of 0.700054 ± 17 indicate derivation from an incompatible element depleted mantle source for which calculated Rb/Sr and Sm/Nd ratios lie outside of the domain defined by the Apollo samples and other lunar meteorites [2]. This indicates the presence of yet another previously unidentified lunar mantle source, as well as an alternative mechanism for generating the incompatible element enrichments in some basalts that are typically ascribed to a KREEP source component. NWA 032, along with NWA 773, a KREEP-rich basalt, are two of the youngest lunar basalts yet dated, with ages of 2974 ± 15 Ma [2] and 2993 ± 33 Ma [2, 3], respectively. These and other examples indicate that the Apollo and Luna sample collections do not provide a complete picture of the compositional range of lunar materials or the chronology of lunar magmatism, and underscore the importance of continued investigations of the growing collection of lunar meteorites.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

[1] Gaffney *et al.* (2008) *LPSC* **39**, 1877. [2] Borg *et al.* (2007) *MAPS* **42**, 5232. [3] Borg *et al.* (2004) *Nature* **432**, 209.