Iron valence variation in plagioclase from eucrite meteorites: Additional information and implications

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$Fe^{3+}/\Sigma Fe$ of plagioclase in extraterrestrial samples is important to determine the redox states of their parent bodies [1]. In our continuing study estimating Fe valences of eucritic plagioclase by synchrotron Fe-XANES, we have analyzed five cumulate eucrites (*Moama, Sioux County*, Y980433, Moore County, and EET 87520; new samples in italics) and eight noncumulate eucrites (*Pasamonte, NWA 1000, Stannern*, Y-75011, Padvarninkai, ALH 76005, Piplia Kalan, and Petersburg) to explore systematic correlations between petrologic eucrite types and $Fe^{3+}/\Sigma Fe$ of plagioclase [e.g., 2].

Moama and Sioux County are coarse-grained gabbroic cumulate eucrites composed of mm-sized pyroxene and plagioclase. The values of $Fe^{3+}/\Sigma Fe$ of plagioclase are 0.43-0.55 and are similar to values of other cumulate eucrites such as Y 980433 (0.48-0.58) [2]. On the other hand, plagioclase in basaltic clasts from noncumulate eucrites have clearly lower $Fe^{3+}/\Sigma Fe$ (Stannern: 0.04-0.24, Pasamonte: 0.08-0.24, NWA 1000: 0.20), similar to data from previous study [2].

The eight noncumulate eucrites represent a wide petrogenetic variety, including “main-group”, “Stannern trend”, and “Nuevo Laredo trend” individuals, and a wide variety of thermal metamorphic grades [e.g., 3,4]. In spite of these diversities, all of the $Fe^{3+}/\Sigma Fe$ values of these samples were low and they did not display any obvious petrogenetic correlations, suggesting formation under reducing fO_2. This is reasonable considering that most of these noncumulate eucrites probably represent surficial lava flows which were subjected to variable degrees of later metamorphism [e.g., 3,4]. However, higher fO_2 for cumulate eucrites requires some explanation. Because cumulate eucrites likely were formed at depth in the crust, they may have been formed in an area that was somewhat more oxidizing due to the presence of volatiles derived from degassing of the original accreted materials, including volatile-rich CM chondrites [2].

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