

1 **Manuscript 3056**
2 **Appendix**
3 **Analytical Methods**
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5 Two thin section of this pair meteorite were studied (GRA 06129,23 and GRA 06128,55) along with
6 a sample mass of approximately 6 grams. Samples were initially inspected using backscattered electron
7 imaging (BSE), from which false colored maps were created. These maps aided in the identification of
8 major phases, namely plagioclases, olivine, orthopyroxene and clinopyroxene, as well as less abundant
9 phases such as phosphates (apatite and merrillite), spinel, pentlandite, troilite and Fe,Ni metal.
10 Following phase identification, quantitative point analyses were conducted on the phases of interest,
11 using an accelerating voltage of 15 kV, a beam current of 20 nA and a $\sim 1\ \mu\text{m}$ spot size. Phosphate
12 analyses were conducted using a defocused, $10\ \mu\text{m}$ spot in order to minimize beam volatilization.
13 Analyses were standardized using Taylor brand mineral and metal standards; ferric Fe was calculated
14 using the equation of Droop (1987). Stoichiometric constraints used to determine the quality of the
15 datasets, and detection limits were calculated at the 3δ level.

16 Major and trace element contents of GRA06129-128/129 were determined in duplicate.
17 Approximately 1 g of GRA was powdered in a clean agate pestle and mortar. Two ~ 0.25 g aliquots
18 were fused using a LiBO_3 flux and analyzed using ICP-AES using the method described by Shafer et
19 al. (2004). Two ~ 50 mg aliquots were dissolved using HF/HNO_3 digestions and analyzed for trace
20 elements following the procedure described by Neal (2001). The reference material BIR-1 was analyzed
21 with both the major element and trace element analyses.

22 Oxygen isotope measurements were made on bulk material that was pre-cleaned with dilute
23 HCl . 1-2 mg samples were fluorinated using BrF_5 as an oxidant, following the procedure described in
24 Sharp (1990; 1995). O_2 gas generated from laser fluorination was cleaned by passage over a heated
25 NaCl trap to remove any excess F_2 gas produced by breakdown of the BrF_5 . The O_2 was adsorbed on
26 two successive cold traps filled with 14X mol sieve to remove any traces of NF_3 . Gore Mountain garnet
27 and San Carlos olivine were used as standards, both plotting on the terrestrial fractionation line.

28 Initial sample processing was conducted in a clean laboratory at Lawrence Livermore National
29 Laboratory. Several interior fragments weighing a total of ~ 185 mg were lightly crushed and leached
30 for ~ 1 hour in 1N HCl at room temperature. The sample was then rinsed in ultrapure water and dried on
31 a hotplate. All subsequent processing for the ^{26}Al - ^{26}Mg isotopic analyses was conducted under clean
32 laboratory conditions in the Isotope Cosmochemistry and Geochronology Laboratory (ICGL) in the
33 School of Earth and Space Exploration at Arizona State University. A ~ 30 mg fraction from the whole
34 rock sample was digested using a 3:1 mixture of $\text{HF}:\text{HNO}_3$, followed by concentrated nitric acid and

was finally brought into solution in 1N nitric acid. A ~5% aliquot was reserved for Al/Mg ratio measurements and ~3-4 mg equivalent aliquot was subjected to column chromatography for separating Mg for high precision Mg isotope ratio measurements. Mg isotope ratio analyses were conducted with a Thermo Neptune multicollector inductively coupled plasma mass spectrometer (MC-ICPMS) in the ICGL. Magnesium isotope ratios are expressed as per mil (‰) deviations from the mean Mg isotopic composition measured in the bracketing standards, where $\delta^x\text{Mg} = ([^x\text{Mg}/^{24}\text{Mg}]_{\text{sample}}/[^x\text{Mg}/^{24}\text{Mg}]_{\text{standard}} - 1) \times 10^3$, and x is either 25 or 26. Mass-independent excesses in ^{26}Mg from the decay of ^{26}Al ($\Delta^{26}\text{Mg}$) were calculated by normalizing all measured $^{26}\text{Mg}/^{24}\text{Mg}$ ratios to a $^{25}\text{Mg}/^{24}\text{Mg}$ ratio of 0.12663 using the exponential law and comparing the normalized $^{26}\text{Mg}/^{24}\text{Mg}$ ratio in the sample to the mean of the normalized $^{26}\text{Mg}/^{24}\text{Mg}$ ratios of the bracketing standards.

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