

EVALUATING SILICA EXCESS IN DOMINION RANGE 08006 CHONDRULE PLAGIOCLASE: COMPARISONS TO YAMATO 81020 AND ACFER 094 CHONDRULE PLAGIOCLASE

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Introduction: The presence of the excess silica, or the []Si₄O₈ component, has been documented among plagioclase within lunar basalts [e.g. 1]. []Si₄O₈ mole fractions of ~5-10% have been found experimentally to incorporate into plagioclase at 1 atm. and anhydrous conditions, and at temperatures of 1200-1500°C along the anorthite-SiO₂ join [2]. Based on electron microprobe analyses (EPMA), [3] documented that chondrule anorthite from near-CR3 chondrites Queen Alexandra Range (QUE) 99177, Meteorite Hills (MET) 00426, as well as that from Acfer 094 (ung. 3.00) has an appreciable excess silica component. Further EPMA data from 3.05-3.1 CO and CV chondrule plagioclase also exhibit varying degrees of excess silica [4]. As excess silica in plagioclase is an anhydrous and high-temperature feature, its presence in chondrules may be used as an indicator that such plagioclase has not been disturbed by aqueous/thermal metamorphism, validating the reliability of their use for Al-Mg isotope systematics, and verifying the trustworthiness of their O-isotope ratios. Here we present chondrule plagioclase EPMA data from Dominion Range (DOM) 08006, a chondrite with CO-like and Acfer 094-like affinities with several characteristics implying a petrologic type 3.00-3.01 classification [e.g. 5-6].

Samples and Methods: Plagioclase was examined from 33 chondrules (22 type I, 1 Al-rich, 10 type II) within the DOM 08006, 50 thin section, using the Cameca SX51 electron microprobe at UW-Madison. A 15 kV accelerating voltage was employed, using a fully focused 10 nA beam. Peaks were counted for 10 seconds and backgrounds were calculated using mean atomic number (MAN) correction. A suite of plagioclase standards (An₁-An₁₀₀) were measured to calibrate Si, Al, Ca, and Na concentrations of unknowns; rutile, chromite, hematite, tephroite, forsterite, and microcline standards calibrated respective Ti, Cr, Fe, Mn, Mg, and K concentrations. Na was counted first on its respective spectrometer, and no migration was found at the analyzed conditions on an albite standard. When measured as unknowns, plagioclase standards produced 99-101 wt.% totals, formula totals of 12.99-13.01 (assuming 8 oxygens), with compositions closely matching reference values. Plagioclase endmember compositions were calculated according to the methods of [1], where []Si₄O₈ are reported as mole fractions.

Results: On a per-chondrule basis, averaged plagioclase EPMA totals range from 99.3-101.1 wt.%, and formula totals range from 12.957 to 13.017; calculated excess silica abundances range from -1.3 mol.% up to 4.5 mol.%. Taking into account the ranges of excess silica measured per chondrule, 11 of 33 chondrules have plagioclase with a resolvable excess silica component: 10 being type I chondrules and one being a type II chondrule (Fig. 1). We note MgO contents of plagioclase are higher in type I chondrules (~0.6-1.2 wt.%), than type II chondrules (~0.1-0.6 wt.%).

Discussion: A significant proportion of plagioclase within DOM 08006 chondrules (especially type I) have retained a high-temperature primary excess silica component. This result, along with the abundances of MgO in type I chondrule plagioclase, is similar to plagioclase characteristics from Acfer 094 (data associated with [7]), and Yamato 81020 (CO3.05) [4]. The nature of excess silica in DOM 08006 chondrule plagioclase is yet another characteristic that supports the low petrologic type of this chondrite.

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References: [1] Beatty D.W. & Albee A.L. (1980) *Am. Miner.* 65: 63-74. [2] Longhi J. & Hays J.F. (1979) *Am. J. Sci.* 279: 876-890. [3] Tenner T.J. et al. (2014) *45th LPSC* #1187. [4] Chaumard N. et al. (2017); this meeting. [5] Davidson J. et al. (2014) *45th LPSC* #1384. [6] Nittler L.R. et al. (2013) *44th LPSC* #2367. [7] Ushikubo et al. (2012) *GCA* 90, 242-264.

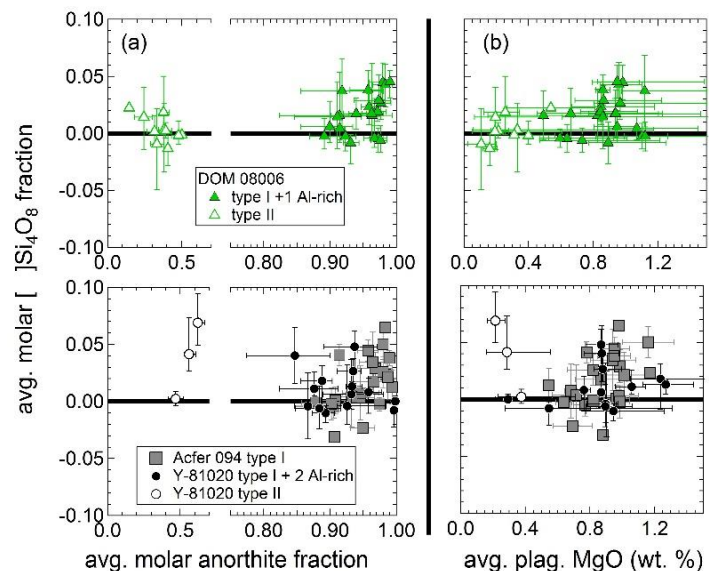


Fig. 1. (a) anorthite vs. excess silica and (b) MgO vs. excess silica in DOM 08006 (top panels), Acfer 094 & Y-81020 (bottom panels) chondrule plagioclase. Each datum = 1 chondrule.