TEXTURAL AND COMPOSITIONAL VARIATIONS OF CR-BEARING SPINEL MINERALS IN REDUCED CV3 CHONDRITES.

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Introduction: The CV3 and CK chondrites have been hypothesized to originate from a single parent body [1]. During our ongoing study of the links between opaque phases from CV3/CK chondrites we found less Cr in Fe,Ni metal grains of reduced CV3 ($CV3_{Red}$) chondrites than expected when compared to a more oxidised CK3 [2]. Since the CV3/CK chondrites have approximately bulk solar abundance of Cr [1], Cr must be present in different phases for each group/sub-group. Cr in oxidized CV3s is most abundant in magnetites but these are absent in $CV3_{Red}$ [2]. Instead Cr appears to be present, with variable abundance, in the spinel phases of $CV3_{Red}$. Here we investigate the partitioning of Cr between different phases in unequilibrated $CV3_{Red}$ chondrites.

Analytical: Polished sections of the reduced CV3 chondrites RBT 04133 [3], MET 01017, and Dhofar 1612 were studied via (1) optical microscopy, (2) X-ray mapping, and (3) major/minor elemental analysis of individual mineral phases with the LPL's Cameca SX-50 electron probe microanalyzer (EPMA).

Results: Cr-bearing spinel grains in RBT 04133, MET 01017, and Dhofar 1612 are located exclusively in FeO-rich (type II) chondrules. However, not all FeO-rich chondrules observed are spinel-bearing. Chromium-composition appears to correlate with morphology, with the most euhedral grains being generally the most Cr-rich; RBT 04133 (euhedral; 46.6–52.4 wt.% Cr_2O_3), Dhofar 1612 (rounded, euhedral; 28.6–41.4 wt.% Cr_2O_3), and MET 01017 (subhedral; 18.2–34.9 wt.% Cr_2O_3). Cr-bearing spinels in MET 01017 have Fe-rich rims (increasing from ~22 wt.% Fe_2O_3 in the core to ~33 wt.% at the rim). No zoning was seen in Cr-bearing spinels from RBT 04133 or Dhofar 1612.

Discussion: Chromites from unequilibrated chondrites are reported to be entirely euhedral, with subhedral chromites only present in equilibrated chondrites [4]. The presence of subhedral spinels in MET 01017 may suggest that it has experienced higher degrees of thermal metamorphism than the other CV3s analyzed. This is consistent with a classification of CV3.7 for MET 01017 determined by Raman spectral analysis of its insoluble organic matter [5]. Therefore, we suggest that spinel morphology may also be an indicator of the degree of thermal metamorphism experienced by unequilibrated $CV3_{Red}$ chondrites.

Zoning in the Cr-bearing spinels of MET 01017, the most thermally altered CV3, suggests mobilization of elements with increasing degrees of heating. Cr-bearing spinels appear to become less Cr-rich with increasing parent body thermal alteration. The Cr-composition of FeO-rich olivine grains in carbonaceous chondrites is known to decrease with increasing metamorphic grade [6], forming Cr-rich rims and chromites. This appears to contradict our results. We will determine the Cr-composition of co-existing silicate phases to address this issue.

References: [1] Greenwood R. G. et al. 2010. *GCA* **74:**1684. [2] Davidson J. et al. 2011. *LPSC* #1886. [3] Davidson J. et al. 2009. *MAPS* **44**:A57. [4] Johnson C. A. and Prinz M. 1991. *GCA* **55:**893. [5] Busemann, H. et al. 2007. *MAPS* **42:**1387. [6] Grossman, J. N. and Brearley, A. J. 2005. *MAPS* **40:**87.

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