COMPOSITIONAL VARIATIONS IN SILICATE PHASES WITHIN THE CV AND CK CARBONACEOUS CHONDRITES. J. Davidson, D. S. Lauretta, and D. L. Schrader. Lunar and Planetary Laboratory (LPL), University of Arizona, Tucson, AZ 85721, USA (davidson@lpl.arizona.edu).

Introduction: The CV3 and CK3-6 carbonaceous chondrites are hypothesised to originate from a single, heterogeneous parent asteroid [1]. They show similarities in terms of bulk oxygen isotopic compositions [1], mineralogy, and petrology [2,3]. Abundances of opaque minerals (e.g., metal, sulphide, chromite, and magnetite) vary among the CV and CK chondrites and their subgroups [1-3]. By systematically studying the abundances, sizes, and compositions of the opaque and silicate (e.g., olivine, pyroxene) phases across the two groups we aim to determine whether they share a common genesis [4,5]. We previously reported compositions of opaque phases within chondrules and matrix of the CV3 and CK3 chondrites [4,5]. Here we present compositional data for the silicate phases (specifically chondrule olivine) of the same samples to further determine the genesis of these two chondrite groups.

Analytical Procedure: Silicate minerals (primarily chondrule olivine) within thin sections of RBT 04133, MET 01017, Dhofar 1612, NWA 4676, A-881595, and a polished slab of NWA 4476 were studied using EMPA, and elemental X-ray mapping techniques (Si, Mg, Ca, Fe, Na, Al, P, Ni, P, Mn/Ti, and Cr; 15kV, 40nA). Analyses of Na, Si, Mg, Al, P, K, Ca, Mn, Ti, Fe, Cr, Ni, and Zn within silicate minerals were performed on the Cameca SX-50 EMP at LPL using a 1 µm beam, 15 kV, and 20 nA.

Results: *Classification.* The analysed samples are classified as [2-8]: RBT 04133, MET 01017, Dhofar 1612 = CV3 reduced ($CV3_{Red}$); NWA 4676 = CV3 oxidised Allende-type ($CV3_{OxA}$); NWA 4476 = CV3 oxidised Bali-type ($CV3_{OxB}$); A-881595 = CK3 oxidised Karoonda-type [8].

Table 1. Number of chondrules studied (#), mean Fa, Fe/Mn, and Fe/Mg compositions of type-I and type-II chondrule olivine for each subgroup studied. Standard deviations from the mean are shown in parentheses.

	#	Fa	Fe/Mn	Fe/Mg
Type I				
$CV3_{Red}$	17	3.9 (3.4)	37 (25)	0.042 (0.041)
$CV3_{OxA}$	2	5.1 (3.6)	41 (20)	0.055 (0.042)
$CV3_{OxB}$	5	2.3 (2.9)	36 (14)	0.024 (0.032)
CK3	5	0.7 (0.2)	6 (2)	0.007 (0.002)
Type II				
$CV3_{Red}$	10	25.1 (18.1)	82 (27)	0.427 (0.392)
$CV3_{OxA}$	1	24.8 (6.2)	82 (23)	0.337 (0.121)
CK3	1	22.8 (5.2)	75 (12)	0.301 (0.089)

Petrography. Olivine within type-I and type-II chondrules were located in all samples except NWA 4476 ($CV3_{OxB}$) which lacked type-II chondrules. FeO-poor relict grains were present in type-II chondrules of all samples.

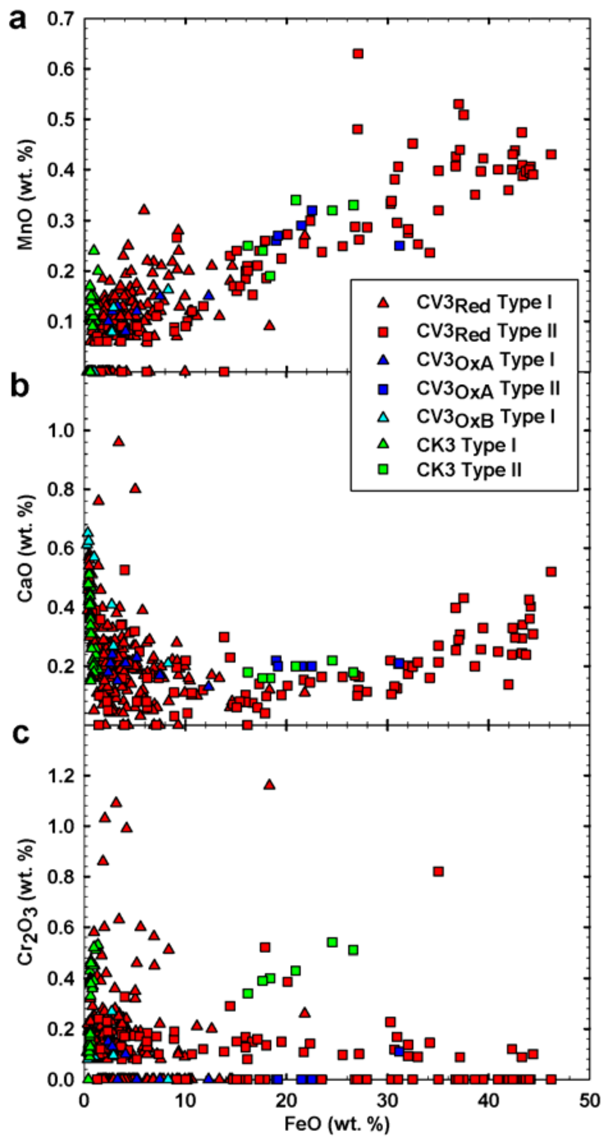

Figure 1. a) MnO (wt. %) versus FeO (wt. %) for individual analyses of type-I and type-II chondrule olivine in CV3 and CK3 chondrites. CV3 chondrites are coloured according to subgroup. b) CaO (wt. %) and c) Cr_2O_3 (wt. %) versus FeO (wt. %) for all chondrules as in (a).

Silicate Composition. The mean Fa content, Fe/Mn ratios and Fe/Mg ratios of type-I chondrule olivine from the CK3 are all much lower than those of the CV3 subgroups (Table 1) whilst the parameters for type-II chondrule olivine are similar.

In terms of FeO vs. MnO (Fig. 1a), FeO vs. CaO (Fig. 1b), and Mn vs. Fe (Fig. 2a,b) the CK3 type-I chondrule olivine has a more restricted compositional range than those of the CV3 subgroups. Type-II chondrule olivine appears to behave similarly in the CV3s and CK3 for all parameters except FeO vs. Cr_2O_3. Cr_2O_3 increases in the CK3 type-II chondrule olivine with increasing FeO (Fig. 1c); there is no noticeable increase in the CV3s. There appears to be no distinct difference between the CK3 and CV3 subgroups in respect to molar Fe/Mn vs. molar Fe/Mg (Fig. 2c) of either chondrule type.

Discussion: Chondrule olivine compositions in type 3 chondrites reflect the conditions of the pre-accretionary stage of parent asteroid formation. Therefore, investigating their compositions and if/how they vary across the different sub-groups allows us to infer whether the CV3 and CK chondrite groups formed from common materials. Several lines of evidence suggest they do not share a common origin:

1. The lower mean Fa content of type-I chondrule olivine in the CK3, compared to the CV3s, suggests a more reducing environment during CK3 chondrule formation; this is in agreement with the composition of their metal [4].

2. The Fe/Mn ratio of chondrule olivine is dependent on the conditions of chondrule formation, and varies between chondrite groups [e.g., 9]. Significant differences in Fe/Mn ratio of the CV3 vs. CK3 type-I chondrules are seen here.

3. Differences between FeO and Cr_2O_3 (Fig. 1c) in the CV3s and the CK3 can be attributed to their opaque assemblages; Cr-bearing spinel are found exclusively in the type-II chondrules of the CV3s but are entirely absent from the CK3 which may explain why the CK3 type-II chondrule olivine contains more Cr_2O_3 [4,5].

4. A change in the trend of FeO vs. minor elements between type-I and type-II chondrule olivine has been suggested at ~2 wt. % FeO for the ordinary chondrites [10] and at ~10 wt. % FeO for the CR chondrites [11]. This implies that the location of this trend change, or "break", varies between chondrite groups. Whilst there appears to be no obvious break in the CV3 data presented here one appears to be present at ~2 wt. % FeO in the CK3 analysed (Fig. 1).

We will extend our study to a further seven recently acquired CV3 and CK3/4 samples to ensure that those analysed to date are representative of each group.

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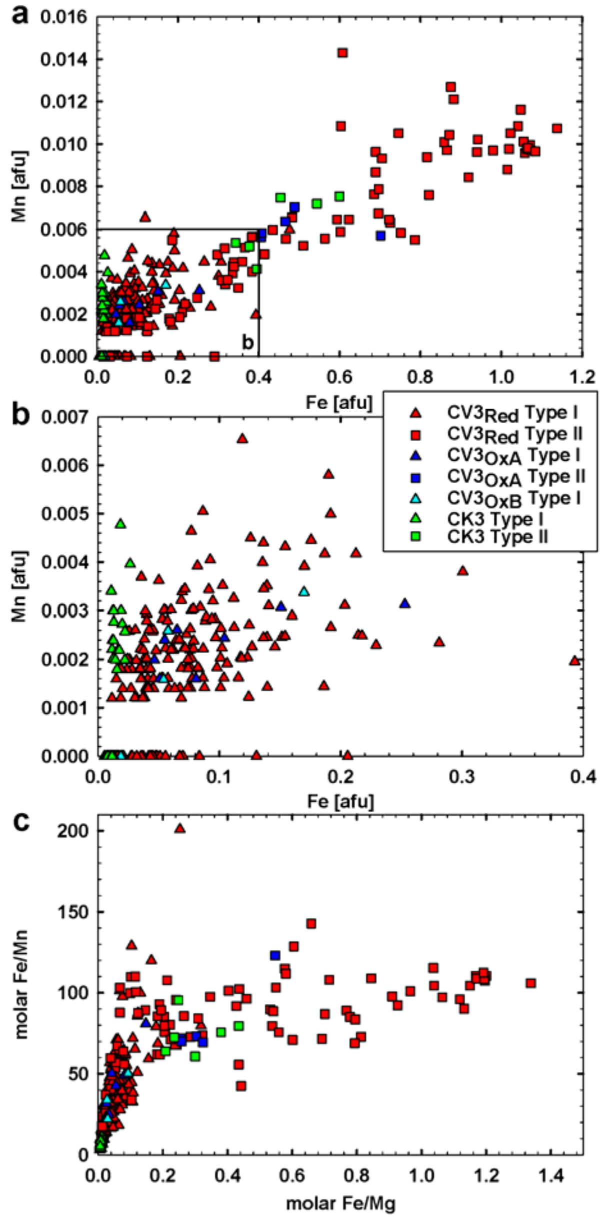

Figure 2. a) Mn (afu) versus Fe (afu) for individual analyses of type-I and type-II chondrule olivine in CV3 and CK3 chondrites. CV3 chondrites are coloured according to subgroup. b) Zoomed area of (a) showing type-I chondrules only. c) Molar Fe/Mn versus molar Fe/Mn for all chondrule olivine, as in (a).

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