

### CATHODOLUMINESCENCE SPECTRA OF REFRACTORY FORSTERITE FROM CARBO-NACEOUS CHONDRITES.

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**Introduction:** Refractory forsterite (RF) is characterized by low FeO and high CaO and Al<sub>2</sub>O<sub>3</sub> content. It occurs in unequilibrated chondrites and can be identified by its cathodoluminescence (CL) [e.g. 4]. The origin of RF is matter of debate. Either RF condensed from a gas of solar composition or RF crystallized from chondrule melts.

**Analytical Techniques:** A LEO 1530 SEM equipped with an ASK CL-detector (200...900 nm) at the Max-Planck Institute for Chemistry (Mainz) was used to record CL-spectra. Major and minor element analyses were performed using a Jeol 8900RL electron microprobe (Cologne).

**Results:** Five distinct maxima were identified in the CL spectra of 16 studied RFs (Figure). The blue CL is caused by a double peak with two distinct maxima located at 392 and 428 nm, respectively [see also 2], and may be related to mechanical defects [3], yellow emission (634 nm) is related to Mn<sup>2+</sup> [2,3], and the 716 nm peak is due to Cr<sup>3+</sup> [3]. In contrast to [2,3], we did not see clear correlation between major and minor element abundances and the relative intensities of the different peaks in the CL-spectra. Al, however, was unequivocally found to increase the overall CL-intensity [see also 4].

**References:** [1] Pack, A., Palme, H. (2001) *MAPS*, 36, A156. [2] Vasconcellos, M.A.Z. and Steele, I.M. (1996) *LPSC XXXVII*, 1359-1360. [3] Benstock, E. J. et al. (1997) *Am. Min.*, 82, 310-315. [4] Jones, R.H. et al. (2002) *LPSC XXXIII*, abstract #1604.

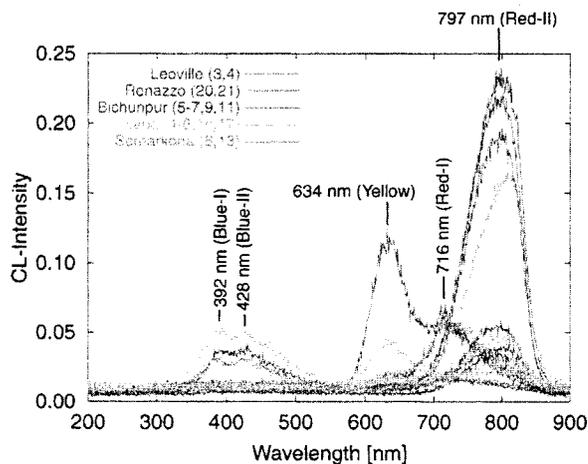


Fig. 1

### <sup>53</sup>Mn-<sup>53</sup>Cr SYSTEMATICS IN ALLENDE REFRACTORY INCLUSIONS. D. A. Papanastassiou<sup>1,2</sup>, O. Bogdanovski<sup>2</sup>, and G. J. Wasserburg<sup>2</sup>, <sup>1</sup>ESS Div., Jet Propulsion Laboratory, 183-335, Pasadena, CA 91109, <sup>2</sup>Lunatic Asylum, GPS Div., 170-25, Caltech, Pasadena, CA 91125.

We have reported Cr isotope determinations on the Lunatic I and <sup>53</sup>Mn-<sup>53</sup>Cr systematics on Allende refractory inclusions [1]. Achievement of the requisite precision has used multiple mass spectrometric analyses of individual samples and a significant time investment per sample. This has also been documented in detail by [2]. We have developed additional mass spectrometric techniques using the TRITON (Thermo Finnigan MAT) at the new geochemistry laboratories at JPL. Based on analyses of terrestrial Cr standards, the external precision corresponds to reproducibility within a total range of ±16 ppm for both <sup>53</sup>Cr/<sup>52</sup>Cr and <sup>54</sup>Cr/<sup>52</sup>Cr. These techniques will be applied to the Allende CAI we previously investigated, using existing, remaining aliquots, and also to new refractory inclusions. The results will be reported at the conference.

In Fig. 1, we present the existing Mn-Cr data, obtained using the Lunatic I. There are significant differences in <sup>53</sup>Cr/<sup>52</sup>Cr for coexisting minerals within an inclusion (spinel and pyroxene), which are correlated with <sup>55</sup>Mn/<sup>52</sup>Cr, determined using ICP-MS. In all cases, the spinels show low <sup>53</sup>Cr/<sup>52</sup>Cr values and low Mn/Cr and therefore, define the initial (<sup>53</sup>Cr/<sup>52</sup>Cr)<sub>0</sub> of -1.5 eu, except for the Big Al inclusion, which also yields a lower inferred initial (<sup>53</sup>Mn/<sup>55</sup>Mn)<sub>0</sub>. The measured inclusions show a range in (<sup>53</sup>Mn/<sup>55</sup>Mn)<sub>0</sub> from 1.25×10<sup>-4</sup> to 1.01×10<sup>-5</sup>. This range corresponds to a time difference of 14 Ma. There are differences in <sup>54</sup>Cr/<sup>52</sup>Cr within coexisting phases in each inclusion. These are correlated with Mn and Fe abundances, and are, therefore, considered to be indicative of late-stage alteration (with the addition of Fe, Mn) and not indicative of initial, intrinsic isotopic heterogeneities in <sup>54</sup>Cr/<sup>52</sup>Cr within an inclusion. The long time differences of ~10 Ma implied by <sup>53</sup>Mn-<sup>53</sup>Cr on CAI are not consistent with (<sup>26</sup>Al/<sup>27</sup>Al)<sub>0</sub> ~5×10<sup>-5</sup> for Egg-3 and Egg-6 [3; and G. Huss, unpubl. data]. We conclude that the Mn-Cr data on spinel define the initial (<sup>53</sup>Cr/<sup>52</sup>Cr)<sub>0</sub> in CAI but that the pyroxene data reflect substantial alteration and addition of Mn. While the presence of live <sup>53</sup>Mn at the time of formation of these CAI appears reasonable, the Mn-Cr system appears less robust and the determination of (<sup>53</sup>Mn/<sup>55</sup>Mn)<sub>0</sub> and of the implied chronology in CAI is highly uncertain.

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**References:** [1] Bogdanovski O. et al. (2002) *LPS XXXIII*, 1802. [2] Lugmair G. W. and Shukolyukov A. (1998) *GCA*, 62, 2863-2886. [3] Armstrong J.T. et al. 1984, *LPS XVII*, 15-16.

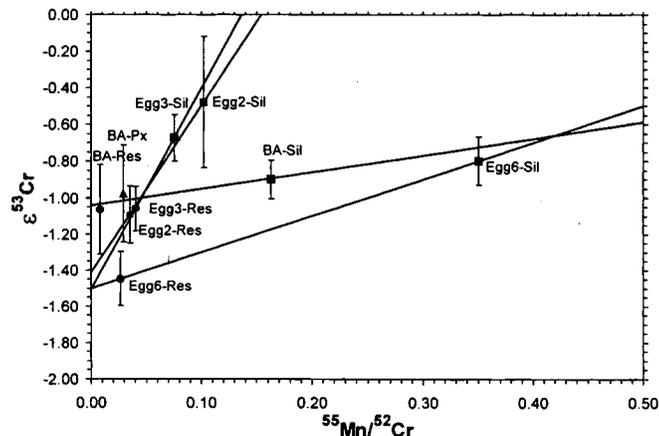


Fig. 1