SYNCHROTRON XRF Fe AND Ni MAPPING AND Ni XANES OF UOC CHONDRULES: IMPLICATIONS FOR ^{60}Fe-^{60}Ni ANALYSES. M. Telus[1], G. R. Huss[1], R. C. Ogliore[1], K. Nagashima[1]. [1]HIGP, Univ. of Hawai‘i at Mānoa, Honolulu, HI, USA. telus@higp.hawaii.edu.

The ^{60}Fe-^{60}Ni ($t_{1/2}$ = 2.6 Myr) system has been used for early solar system chronology [1] and constraining the stellar source of short-lived radionuclides [2]; however, discrepancies in the initial ^{60}Fe/^{56}Fe inferred from *in situ* and bulk analyses of chondrules from unequilibrated ordinary chondrites (UOCs) remain [1-4]. These discrepancies suggest isotopic disturbance of the Fe-Ni system in UOC chondrules. In order to evaluate this, we collected high-resolution X-ray fluorescence (XRF) maps of UOC chondrules to better understand the mobility of Fe and Ni at the low metamorphic temperatures of these chondrites.

Synchrotron XRF Analyses: We used the Australian Synchrotron's X-ray Fluorescence Microscopy beamline [5] to map Ca to Zn (spectral resolution = 0.4 keV at FWHM) in portions of 80 chondrules from thin sections of 8 UOCs (type 3.0-3.2). Nickel maps with higher spectral resolution (~0.2 keV at FWHM) were recently collected for 14 chondrules at the Advanced Photon Source (APS) GSECars (Sector 13) [6], where we also collected Ni XANES (x-ray absorption near-edge spectra) from some chondrules to determine the local oxidation state of Ni in various phases.

Results: Synchrotron XRF maps show clear enrichments of Fe and/or Ni in fractures of chondrules from all UOCs analyzed for this study regardless of petrologic type and regardless of whether "fall" or "find". Analyses from the Australian Synchrotron indicated that 30% of Semarkona chondrules have Fe and Ni enrichment along fractures, while 80-100% of chondrules analyzed from the other UOCs show these enrichments [7]. Higher-energy-resolution Ni maps of Semarkona chondrules recently collected at the APS indicate that actually ~60% of Semarkona chondrules have Fe and/or Ni in fractures. This larger fraction is due to the lower minimum detection limit at APS. A few chondrules from Semarkona show clear variations in Ni within pyroxene in the APS maps. These variations seem to be associated with secondary alteration of neighboring FeNi metal or sulfides. Nickel XANES data show that Ni in olivine is dominantly NiO. This is also true for pyroxene, except in Semarkona where it is a mixture between NiO and sulfide/metal.

Discussion: Our results provide further evidence for significant mobilization of Fe and Ni in UOC chondrules. Mobilization was assisted by aqueous alteration on the parent body and/or by terrestrial weathering. Discrepancies between *in situ* and bulk ^{60}Fe-^{60}Ni analyses [1-4] and the weak correlation between excess ^{60}Ni and the Fe/Ni ratios from *in situ* analyses [2-3] could result from 1) exchange of Fe and Ni between chondrules and surrounding matrix, or 2) closed system redistribution of Fe and Ni with Ni from the silicates concentrating into metal or sulfide blebs inside the chondrules.

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