EVOLUTION OF MELT COMPOSITIONS IN SEMARKONA TYPE II CHONDRULES. R. H. Hewins¹, ², B. Zanda ³, C. Bendersky ¹ & H. Leroux ³. ¹MNHN & CNRS UMR 7202, 61 rue Buffon, 75005 Paris, France. E-mail: hewins@rci.rutgers.edu. ²Earth & Planet. Sci., Rutgers University, Piscataway, NJ08854. ³LSPES, UMR CNRS 8008, Université des Sciences et Technologies de Lille, 59655 Villeneuve d'Ascq, France.

Introduction: With chondrule condensation to melts in mind [1,2], we extended a study of melt inclusions in Semarkona chondrules [3] to track chondrule melt changes.

Observations: Melt inclusions are common in Types IIA, IIAB and intermediate IIA(B) chondrules in Semarkona. We used SEM, EMP and STEM to analyze bulk chondrules, primary glass inclusions, melt channels, and mesostasis, to search for evidence of fractional crystallization or open systems. Most inclusions we studied are glass, sometimes with sulfide blebs, shrinkage cavities and strain effects in the surrounding olivine. The melt inclusions are generally richer in Si, Al, Ca, Na and K than the initial liquid, but poorer than the mesostasis, consistent with the entrapment of liquid during the growth of the olivine.

Calculations: We have used PETROLOG [4] to model the fractional crystallization of liquids of bulk chondrule compositions. For IIAB chondrules, melt inclusion compositions are quite well explained by crystallization of olivine, and mesostasis compositions by crystallization of olivine + pyroxenes. For IIA and IIA(B) chondrules, crystallization of olivine does not reach the low Fe and high Si contents of the inclusions. This could be explained by Fe-Mg exchange between olivine and inclusion after olivine crystallization [4] and the replacement of Fe by Mg atoms may be sufficient to boost the wt.% of other constituents like SiO₂. However, some addition of SiO from the gas [2] may also be required. The Ca/Al ratio of the bulk chondrules is CI, as it is for most of the early-trapped inclusions (<11% Al₂O₃). This is surprising because crystallization of olivine must lower the Ca/Al ratio below the initial value. Late trapped inclusions and melt channels (11-12% Al₂O₃) are somewhat depleted and mesostasis (12-16% Al₂O₃) strongly depleted in Ca and enriched in Na. Late crystallization of augite lowers Ca and raises Na in the melt, but is inadequate to explain the abrupt change of Ca/Na ratio at 11-12% Al₂O₃. A replacement reaction is more plausible, especially considering the presence of pentlandite or magnetite in some melt inclusions. Thus melt composition trends in Semarkona Type II chondrules can be largely explained by fractional crystallization, but there is evidence of some open system behavior.