FE-NI METAL IN LL3.0-6 CHONDRITES: PRIMORDIAL AND SECONDARY FEATURES. M. Kimura1 and M. K. Weisberg2,3, 1Faculty of Science, Ibaraki University, Mito 310-8512, Japan, 2Dept. Physical Sciences, Kingsborough College, City University of New York, Brooklyn, NY 11235, 3Dept. Earth and Planetary Sciences, American Museum of Natural History, NY, NY 10024, U.S.A.

Introduction: The composition of Fe-Ni metal in ordinary chondrites is a useful indicator of chemical group and petrologic type [e.g., 1]. Here we report the results of our systematic study of Fe-Ni metal in two LL3.0, six LL3.1-3.9, and three LL4-6 chondrites. We suggest that the characteristic features of Fe-Ni metal are highly sensitive not only to thermal metamorphism, but also to host chondrule chemistry.

Fe-Ni metal in Semarkona: Fe-Ni metal in Semarkona (LL3.0) chondrules generally shows plessitic intergrowths [2], and its composition varies widely. We obtained the average bulk chemical composition of metal in each chondrule by defocused electron beam microanalysis. The Cr and P contents of the metal are positively related to the mg ratio (Mg/Mg+Fe) of the host chondrule bulk composition. This observation suggests that these minor elements were incorporated into the metal during chondrule formation, supporting the results of previous studies (e.g., [3]). On the other hand, the bulk metal composition shows a positive correlation between Ni (4.0-9.1%) and Co (0.21-0.46%), and the Ni content is not correlated with the mg ratio of the host chondrule. We suggest that the variation in Ni and Co contents in chondrule metal reflects its primordial composition prior to chondrule formation. Some chondrule metal contains low-Ni (1.3-2.2% in bulk composition) and low-Co (0.10-0.12%), reflecting reduction processes.

Although Ni and Co-rich metal is rarely reported in LL3 chondrites [e.g.,1, 2], we found that metal composition depends on its occurrence. Fe-Ni metals on chondrule surfaces and as isolated grains in the matrix are highly enriched in Ni (51.8-68.5%) and Co (0.7-3.4%), and are generally surrounded by troilite and magnetite. This indicates that Ni and Co-rich metal formed by sulfidation and/or oxidation, similar to some metal in CR and other chondrites [4].

Fe-Ni metal in LL3.0-6: Fe-Ni metal in Y74660 (LL3.0) chondrules does not show plessitic intergrowths, but metal in the matrix is enriched in Ni (51.9-64.1%) and Co (0.29-1.84%). On the other hand, in LL3.1 to 6 chondrites, kamacite has higher Co content than taenite, in spite of its occurrence, as previously reported [e.g., 1, 5, 6]. This reflects metamorphic modification. We conclude that only the Fe-Ni metal in LL3.0 chondrites, especially Semarkona, preserves the primordial features it acquired during or before chondrule formation. Therefore, metal composition is one of the most sensitive indicators for distinguishing type 3.0 chondrites from higher petrologic subtypes.