Chemical compositional relationship between winonaite metal and IAB irons.

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Winonaites are primitive achondrites that are defined as the partial melting residues of asteroids and might share the same parent body with IAB irons [1]. IAB irons have several subgroups according to its Au and Ni abundances [2]. In this study, we have performed in-situ chemical analyses of metal grains in winonaites and found relationships between winonaites and IAB irons, and among IAB iron subgroups.

We have analysed thick sections of winonaites Y-8005,51-4 and A 10077,51-1. Y-8005 metals have nearly chondritic composition. On the other hand, highly siderophile elements, W, Ge and Ga abundances of A 10077 metals are severely depleted (~0.1 in $(X/Ni)_{CI}$).

Y-8005 metal composition is consistent with those of IAB-sLL (subgroup low-Au, low-Ni) and A 10077 metal composition with those of IAB-sLM (subgroup low-Au, medium-Ni) in a Ge/Ni-Au/Ni diagram. When we use IAB-sLL metal as the starting material, metallic partial melting model calculation [3,4] could explain the chemical compositional difference between Y-8005 metal (IAB-sLL) and A 10077 metal (IAB-sLM). In this calculation, A 10077 metal and IAB-sLM are indicated as partial melt liquid, and IAB-MG (main group) is indicated as partial melt residue. However, volatile siderophile element (like Ge and Ga) compositions of A 10077 and IAB-sLM show severe depletion relative to model calculated partial melt liquid. We thus suggest there was evaporative loss of these volatile siderophile elements at the timing of melting or during cooling of parent metallic liquid. The presence of evaporative loss strongly suggests that a shallow metallic melt pool was the origin of IAB-sLM.

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