OCCURRENCE OF SILICEOUS IMPACT MELT IN NETSCHAËVO IIE? A FIB-TEM STUDY.

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Introduction: The IIE iron meteorites are known to contain silicate inclusions, which can be classified into five subgroups, ranging from primitive/unfractionated to differentiated/fractionated [1,2]. From Netschaëvo, chondritic (*i.e.*, primitive/unfractionated) inclusions with preserved chondrules are known [3]. Here, we report the results of a FIB-TEM study on a silicate inclusion in the Netschaëvo IIE host metal and present petrographic features indicating that this inclusion is, in fact, quenched impact melt.

Results: The studied silicate inclusion is characterized by a porphyritic texture comprising olivine and pyroxene grains 20–200 µm in size embedded in partially crystallized silicate melt matrix. The olivine and pyroxene grains show compositionally homogeneous cores (Fa_{14} and $Fs_{15}Wo_{1}$, respectively) overgrown by zoned, heterogeneous rims (Fa_{25}–Fa_{34} and $Fs_{22}Wo_{1}$–$Fs_{35}Wo_{14}$, respectively). As revealed by a TEM foil that was FIB-cut from the silicate inclusion, the silicate melt matrix contains (i) elongated/skeletal crystallites of P-bearing olivine, (ii) dendritic chains of hopper-shaped Cl-apatite crystallites, (iii) phase-separated, Si–Al–Na-rich silicate glass droplets 0.5–1.5 µm in diameter showing secondary, Fe-rich, 20-nm-diameter silicate glass droplets, and (iv) Fe sulfide blebs. Interstitial to the crystalline phases, a Si–Al-rich matrix glass is present, which continuously merges with the large glass Si–Al–Na-rich droplets. Furthermore, the P-bearing olivine crystallites show a common crystal orientation, as well as crystal lattices free of lattice defects.

Discussion: The studied silicate inclusion shows textures indicative of shock melting, rapid cooling, recrystallization, and silicate liquid immiscibility. In particular, crystal morphology (*i.e.*, hopper-shaped olivine and Cl-apatite quench crystals; [4]), mineral composition (*i.e.*, P in olivine; [5]), and phase-separated silicate glass droplets (*e.g.*, [6]) document fast cooling rates that are inconsistent with endogenic models involving slow cooling [1]. In contrast, the observed textures are strikingly similar to quenched impact melt from, *e.g.*, the Barringer impact structure [7]. Therefore, we conclude that Netschaëvo is likely an impact melt breccia, suggesting that impact could have played a major role in the formation of the IIE group.

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