MINERALOGY AND PETROLOGY OF NWA 7203: A NEW QUENCHED ANGRITE SIMILAR TO NWA 1296 AND NWA 1670.

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Introduction: "Quenched" angrite is a rapidly cooled magma preserving the original state of primary igneous crystallization at 4563-4564 Ma, and play a significant role as chronological anchors [e.g., 1,2]. Quenched angrites show mineralogical variations among different samples, especially in terms of cooling rates and the abundance of Mg-rich olivine xenocrysts [e.g., 3], and the finding of new samples is crucial to better understand their origin and formation. Here we report mineralogy and petrology of a new quenched angrite NWA 7203 to compare with other samples particularly with NWA 1296 and NWA 1670 [4,5].

Results: NWA 7203 is heterogeneous in appearance due to a large variation in grain size, having nearly equal abundance of very fine-grained (<10 μm) and medium-grained (~1 mm) areas. Both areas show a variolitic texture with distinct grain sizes mainly composed of Ca-rich olivine and anorthitic plagioclase associated with interstitial Al-Ti-rich clinopyroxene. Minor phases include ulvöspinel and troilite. Both olivine and Al-Ti-rich clinopyroxene are extensively zoned up to mg# <0.01. The most magnesian olivine is Fo_{57} and contains ~1 wt% CaO. No Mg-rich olivine xenocrysts are present. Kirschsteinite olivine (~20 wt% CaO) coexists with fayalitic olivine, and they show a complex intergrowth texture. The most magnesian Al-Ti-rich pyroxene has mg#=0.50. Al_2O_3, TiO_2 and Cr_2O_3 in pyroxene are 6-10 wt%, 2-4 wt%, and 0.5-0 wt%, respectively. Plagioclase is essentially Na-free ($An_{>99.5}$) with high Fe content (FeO: >0.5 wt%).

Discussion and Conclusion: The variolitic texture of NWA 7203 suggests rapid cooling of magma similar to other quenched angrites. However, the variation of grain sizes is never seen in other samples and probably due to the change of cooling rate from relatively slow at first (similar cooling rates to those of Asuka-881371, Sahara 99555 and D'Orbigny) to fast (similar to NWA 1296 and NWA 1670) at a late stage. The mineral compositions of NWA7203 are close to those of both NWA 1296 and NWA 1670 [4,5] and different from those of other quenched angrites that are more Mg-rich [1,6]. Because Sahara 99555 and D'Orbigny represent a possible primary magma of quenched angrite [3], we consider that the NWA 7203 magma was produced after olivine fractionation from this primary melt without addition of Mg-rich olivine xenocrysts. Thus, all quenched angrites are closely related and controlled by fractional crystallization with/without addition and resorption of Mg-rich olivine xenocrysts [3]. It is noted that NWA 7203 contains thin shock melt veins (100 μm wide) similar to NWA 1670, suggesting moderate shock unlike other angrites.

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