

THE TYPE, OCCURRENCE AND ORIGIN OF SYMPLECTITES IN LUNAR METEORITES.

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Introduction: The symplectites, which mainly composed of three phases (Fe-augite, fayalite and silica) or two phases (fayalite and silica), are commonly observed in lunar meteorites and lunar rocks returned by Apollo projects[1]. Generally, the majority of symplectites were believed to be decomposed of pyroxferroite. However, there has been a controversy about the origin of symplectites, e.g. the crystallization from primary melt at low pressure, a residue from the last stage of crystallization, and decomposition of ferro-pyroxene during shock-induced heating. The type and occurrence of symplectites in four Antarctic lunar meteorites have been surveyed, their petrology is analyzed and also their origin is discussed here.

The type and occurrence of symplectites: Of four lunar meteorites (Miller Range (MIL) 05035, MIL 090036, MIL 090070 and Elephont Moraine (EET) 96008), except for Miller Range (MIL) 05035 which is an unbrecciated mare basalt, the three others are basalt-bearing anorthositic regolith breccias. The symplectites have been surveyed under SEM. Many patches of symplectite areas in MIL 05035, and 11 nodules of symplectites in EET 96008 are found. But no symplectites is found in the other two meteorites except for some single silica grains. In MIL 05035, there are two types of symplectites: ferroproxene+ fayalite+silica and fayalite+silica. Both types with different textures have different occurrences. The former is fine-grained and related closely to shock-induced darken pyroxene area, while the latter is coarse-grained and distributes in undarken region and the silica in it is shocked with plane deformation fractures. The symplectites in EET 96008 also have two same types as those in MIL 05035. The type of ferroproxene + fayalite + silica has round shapes and also related closely to shock-induced darken area. However the type of fayalite + silica varies in texture with silica shape from worm-like to needle-like.

Mineral chemistry: *Pyroxene:* In MIL 05035, the composition of host pyroxene varies from the core (Fs41.9Wo26.3En31.8) to the rim (Fs57.5 Wo33.4En9.10), while the symplectitic pyroxene is Fs 52.9 Wo 39.1En8.00. The composition of the symplectitic pyroxene in EET 96008 is Fs42.7-45.7Wo37.2-44.1En10.6-19.4. *Olivine:* In MIL 05035, the olivine in the former type has the composition of Fa88.9-93.5 and that in the latter type is Fa95.5-96.6. The olivine in symplectites in EET 96008 is Fa84.2-93.4. *Silica:* The silicas in two types of symplectite in MIL 05035 enrich in K, Al, Fe, Ti, the former type silica has much higher FeO (2.71wt%) than the latter type one (0.28wt%).

Discussion: Both types of symplectites of three phases and two phases are found in unbrecciated basalt and basalt-bearing anorthositic breccia. Based on the above observations, the three-phase type of symplectite should form from decomposition of ferro-pyroxene during the shock event. While the formation of the two-phase type of symplectite may be related to the crystallization of magmatic melt.

References: [1] Liu Y. et al. 2009. *Meteoritics & Planetary Science* 44: 261-284.