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HIGH PRESSURE MINERAL ASSEMBLAGES IN THE LHERZOLITIC SHERGOTTITE GROVE MOUNTAINS (GRV) 020090

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YT Lin[1*], Lu Feng[1], Sen Hu[1]
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[1]Institute of Geology and Geophysics, CAS
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Introduction: Shergottites commonly experienced heavy shock metamorphism that could be significantly different from that took place in the parent bodies of ordinary chondrites [1]. As a subgroup, most lherzolitic shergottites share similar petrography, geochemistry, radiometric ages and ejection ages, probably ejected from the same or similar igneous units on Mars. The main difference among them is various degree of post-shock thermal metamorphism [2]. GRV 020090 was recently found in Antarctica. It was classified as an lherzolitic shergottite [3], but highly enriched in REEs and other incompatible elements [4]. Hence, GRV 020090 supplies us with another probe of shock metamorphism on Mars.

Results: GRV 020090 contains poikilitic and interstitial lithologies. Olivine and pyroxenes show mosaic extinction, and are highly fractured. Plagioclase is characteristic of smooth surface and complete extinction under the crossed Nicol, indicative of transformation to glass. However, in high-contrast BSE images, assemblages of plagioclase grains with various brightness can be noted. Towards ferromagnesiam silicates, plagioclase becomes more Ab-, Or-rich, and K-feldspar was usually found at the rims of plagioclase.

Shock-induced melt veinlets (up to 100 micrometers wide) were found in the poikilitic lithology. They are usually zoned, from assemblages of tiny granular or needle grains of low-Ca pyroxene at the cores to pyroxene glass layers in contact with the host rock, which were confirmed by Raman. Chromite grains close to the veinlets show dark-bright lamellae with three directions of orientation. Presence of $FeCr_2O_4$-structured chromite was confirmed by Raman, similar to those reported in ordinary chondrites [5]. EPMA reveals no significant chemical variation in both of them. Olivine inside or in contact with the veinlets was transformed to assemblages of ring-woodite and glass, and then surrounded by an another layer of olivine glass. Coexisting with ringwoodite, low-Ca pyroxene was transformed to lamellae of akimotoite with interstitial glass. Merrillite in the veinlet was partially melted and mixed with chromite. The relict grains were transformed into the high-pressure polymorph.

Discussion and Summary: The complete extinction of maskelynite in the host rock and clear glass of olivine and pyroxene in the shock-induced melt veinlets indicate that GRV 020090 was quenched from the shock-induced melt and experienced little post-shock thermal metamor-phism. The coexistence of ringwoodite, majorite, akimotoite, and tuite suggests a P-T condition of 18-20GPa, ~1800^{o}C. The pyroxene glass may be vitrified perovskite, indicative of a pressure >22 GPa. Plagioclase in the host rock of GRV 020090 was shocked to diaplectic glass, but not melted.

References: [1] Beck P., et al. 2005. Nature 435: 1071-1074. [2] Lin Y., et al. 2005. Meteoritics & Planetary Science 40: 1599-1619. [3] Miao B., et al. 2004. Acta Geologica Sinica 78: 1034-1041. [4] Lin Y., et al. 2008. Meteoritics & Planetary Science 43: A86. [5] Chen M., et al. 2003. Geochimica et Cosmochimica Acta 67: 3937-3942.

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