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东南极格罗夫山陨石(GRV 052382): 一块强烈冲击变质的橄辉无球粒陨石

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摘要:

GRV 052382陨石是在南极格罗夫山地区发现的强烈冲击变质的橄辉无球粒陨石。它主要由橄榄石(75%)、易变辉石(5%)、富碳填隙物(20%)和少量金属组成。橄榄石呈半自形等粒细晶结构, 颗粒大小约10~20 μm , 细晶颗粒间有少量辉石质的熔融填隙物。根据富碳填隙物分布和颗粒间的裂隙, 可以区分出原粗粒橄榄石结构的轮廓, 原颗粒大小约0.5~1.5mm。这些原粗粒橄榄石具有还原边结构, 即边缘的橄榄石细晶富MgO, 而核部橄榄石细晶富FeO。因强烈的还原作用, 这些原粗粒橄榄石的核部成分变化大($\text{Fa}_{12.2-21.8}$), 因此, 原橄榄石核部成分Fa应为21.8%或略高。易变辉石呈浑圆粒状, 大小约0.4~0.9mm, 在颗粒之间其成分基本相当($\text{En}_{76.4-82.6}\text{Wo}_{4.6-9.8}\text{Fs}_{10.9-13.8}$), 但在颗粒内部因冲击作用, 产生波浪状韵律成分变化。富碳质填隙物充填在原粗粒橄榄石颗粒之间, 主要由碳质和富MgO的硅酸盐组成。碳质多型主要为石墨, 呈不规则蠕虫状或网脉状, 大小约0.2~0.4mm, 其中包含有少量金刚石颗粒(约1~3 μm)。因此, 这些特征表明GRV 052382具有橄辉无球粒陨石结构, 为单矿岩质橄辉无球粒陨石。根据橄榄石成分, GRV 052382陨石被进一步划分为富FeO亚型(I型)。此外, 强烈冲击变质特征, 即: (1) 橄榄石冲击细晶结构; (2) 橄榄石细晶颗粒具有圆化特征, 其间存在熔融填隙物; (3) 易变辉石晶体具有波浪状韵律成分变化; (4) 易变辉石中存在大量不规则气孔; (5) 金属Fe沿裂隙或气孔充填; (6) 石墨发生金刚石相变等, 表明GRV 052382陨石的冲击变质程度为S6。因此, GRV 052382陨石可能是经受最强烈冲击变质的橄辉无球粒陨石, 这不仅为橄辉无球粒陨石的冲击历史提供直接证据, 而且有可能获得其母体早期经历的冲击作用信息。

英文摘要:

Grove Mountains (GRV) 052382 is a new highly shocked ureillite found in Grove Mountains, East Antarctica. It is composed mainly of olivine (75%), pigeonite (5%), carbonaceous interstitial (20%) and a little of metal. Olivine is subidiomorphic equigranular texture with the size of 10~20 μm , and there is pyroxene melt among them. Based on the distribution of carbonaceous interstitial and grain boundary, the original outlines of olivine grains can be distinguished, and the size of original olivine grains ranges from 0.5 to 1.5mm. The original grains of olivine have reduction zones, which the fine olivine grains in the rim are rich in MgO, while ones in the core are rich in FeO. Due to strong reduction, the core of the original olivine grains varies greatly in composition ($\text{Fa}_{12.2-21.8}$), so the original olivine should be more than 21.8% in Fa. Pigeonite is round-shaped with size of 0.4~0.9mm, and is almost identical in composition between intergrains ($\text{En}_{76.4-82.6}\text{Wo}_{4.6-9.8}\text{Fs}_{10.9-13.8}$). But it has wave-varied composition caused by strong shock effect in a single grain. The carbonaceous interstitial between the original olivine grain and pigeonite, is composed mainly of carbon and MgO-rich silicate. The main polymorph of carbon is graphite which occurs as amoiboid-shape and/or net, the size is about 0.2~0.4mm. And the other minor polymorph is diamond which embedded in graphite as small grains (1~3 μm). Thus, these petrological characteristics suggest that GRV 052382 has a typical ureilitic texture and is a monomict ureillite. On the basis of the composition of olivine, GRV 052382 is futurally classed into the FeO subtype (type I). Furthermore, the heavily shocked effects, including (1) shocked fine-grained granulitic texture of olivine; (2) the round outline of fine olivine grains and melt interstitial among the fine grains; (3) the wavy variation of composition in pigeonite; (4) a great deal of irregular shaped vesicles in pigeonite; (5) some kamacite filling in fracture and vesicles, (6) transformation of diamond from graphite, indicate that GRV 052382 has the heavily shock stage of S6. Therefore, GRV 052382 is likely a heavily shocked ureillite, which will probably provide some direct evidence of shock history of ureillites and further to get insight on the history of shock events experienced by the ureillite parent body by the later detail study.

关键词: [南极陨石](#) [橄辉无球粒陨石](#) [冲击变质作用](#) [格罗夫山](#)

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