# XXIV. Grove Mountains 99027

Lherzolite Shergottite

9.97 grams

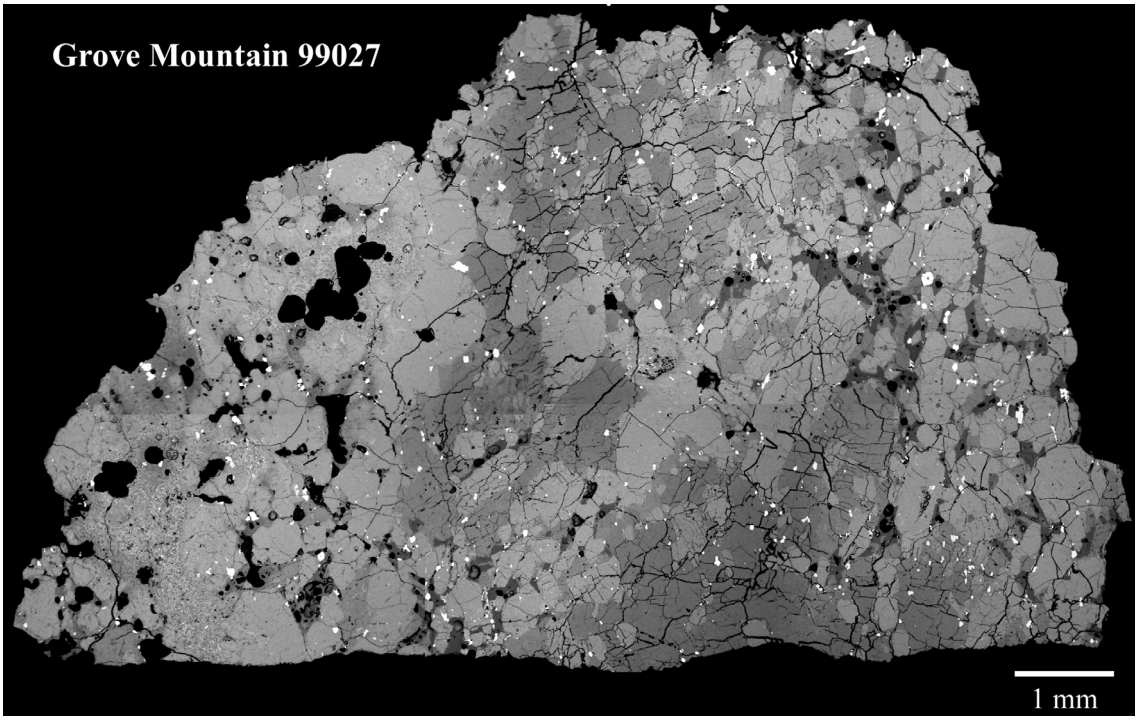


*Figure 1: Back-scatter-electron image of thin section of GRV99027 (kindly provided by Yunbin Guan and Lauri Leshin) (see also figure 2 in Hsu et al. 2004). Dark gray is pigeonite, light gray is olivine. Melt pocket is on left.*

## Introduction

Lin *et al.* (2002a, b), Wang et al. (2002) and Hsu et al. (2004) reported a new Martian meteorite from Grove Mountains, Antarctica, collected by the 16th Chinese Antarctic Research Expedition in 1999. It is shaped like a rounded cone and is partially covered with fusion crust.

## Petrography

GRV99027 consists of mostly olivine and pyroxene and has both poikilitic and interstitial lithologies. Like the other lherzolitic shergottites, GRV99027 also has partially devitrified "melt pockets" of impact glass (figure 1). A small amount of maskelynite, troilite, chromite and phosphate (merrillite) can be found in the intersticies between the olivine and pyroxene. The texture and mineral composition appears similar to that of ALH77005 (Russell *et al.* 2002, Hsu et al. 2004).

The modal composition is 55.1% pyroxene, 39.4% olivine, 4.4% plagioclase and 1.1% chromite. Hsu et al. (2004) determined that there is about 0.3% merrillite.

Olivine and pyroxene exhibit undulose extinction, plagioclase has been partially shocked to maskelynite and several grains of olivine show granulation.

The shock stage is S4, weathering grade W1 (Russell *et al*. 2002).

## Mineral Chemistry

***Olivine:*** Small, rounded olivine is poikilitically enclosed in large oikocrysts of pigeonite. The composition of olivine is $Fo_{70-76}$. Olivine in the poikilitic region is slightly more magnesian than in non-poikilitic regions.

***Pyroxene***: Pigeonite oikocrysts are rather homogeneous and sometimes exhibit augite exsolution (?) around the rims (Hsu et al. 2004). The composition of pigeonite is $En_{74}Fs_{22}Wo_4$. Augite ($En_{53}Fs_{15}Wo_{32}$) is found separately in non-poikilitic regions. Orthopyroxene $En_{78}Wo_2$ has FeO/MnO ratio = 34 ± 5. Pyroxene was analyzed by Hsu et al. (2004).

***Plagioclase***: Plagioclase ($An_{44-57}$) has been partially converted to glass by shock.

***Opaque Oxides***: Euhedral chromite is mainly enclosed in pyroxene.

***Phosphates:*** Merrillite grains up to 150 microns are found interstitial to olivine, pyroxene and plagioclase (Guan et al. 2003). They are found to cntain small apatite grains and some veins of plagioclase glass. Seven grains of merrillite were analyzed for REE by Hsu et al. (2004).

## Whole-rock Composition

Hsu et al. (2003, 2004) determined the REE content of the melt glass and individual minerals. From this and the mode they were able to model the REE pattern for the rock (figure 2). Since the REE are found mainly in the merrillite, this model is critically dependent on the merrillite content (0.1 to 0.5%).

The REE content of the melt glass is elevated above the value calculated for the bulk rock, probably due to selective melting of some phosphates.

## Terrestrial Weathering (?)

Hsu et al. (2004) report that olivines and pyroxenes in GRV99027 commonly display light REE enrichment and have a negative Ce anomaly that they interpret as due to "terrestrial weathering".

## Other Isotopes

The deuterium/hydrogen ratio (D/H) of phosphates in GRV99027 has been found to be high and variable (Guan et al. 2003). It is felt that this high D/H ratio is enough to verify the Martian origin of this sample.

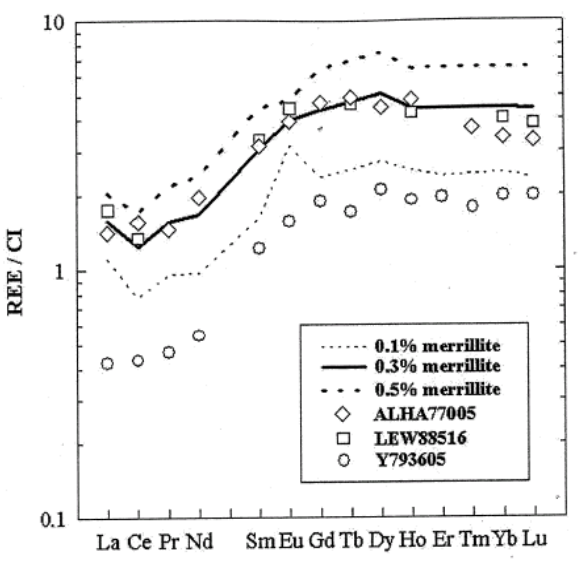


*Figure 2: Rare-earth-element content calculated for GRV99027 (from Hsu et al. 2004).*