PETROGRAPHIC STUDY OF THERMAL AND SHOCK METAMORPHISM OF THE HUNGARIAN L-CHONDRITES: MEZŐMADARAS (L3,7), KNYAHINYA (L5), AND MÓCS (L6) I. Gyollai[1] (gyildi@gmail.com), J. Fürj[1], Sz. Bérczi[1], A. Gucsik[2],, Sz. Nagy[1], [1]Eötvös University, Faculty of Science, Institute of Physics, Dept. Material Physics, H-1117 Budapest, Pázmány P. s. 1/a, Hungary, [2]Max Planck Institute for Chemistry, Dept. of Geochemistry, Joh.-J. Becherweg 27, D-55128, Mainz, Germany.

Introduction

We investigated two processes in a series of the Hungarian L-chondrites: shock and thermal metamorphism. Thermal metamorphism transforms the textures in the relatively small chondritic planetary body. Shock metamorphism is caused by hypervelocity impact processes transforming texture and mineral structure mainly in the outermost layers of the chondritic planetary body [1,2]. The purpose of this optical microscopic study is to indentify the degree of thermal metamorphism and stages of shock metamorphism in the selected Hungarian meteorites, which have not been described well, up to date.

Samples and Experimental Procedure

The mineral assemblages and textures were characterized with a Nikon Eclipse LV100POL optical microscope using plane-and cross polarized light modes (at Eötvös Lorand University of Budapest, Hungary). Knyahinya and Mócs sample were prepared with 35 µm in thickness.

Results and Discussion

Thermal metamorphism

In (L3,7) Mezőmadaras sample, there are a lot of microchondrules, and the boundary of condrules are in a sharp contrast, but in Knyahinya (L5) sample the margin of chondrules is blurry. Mócs sample contain relatively small number of chondrules (**Table 1**), which show the recrystallized texture **(Table 2)**. The grains were grown in the coarse of thermal metamorphism. The matrix of the Mezőmadaras (L3) sample was kryptocrystalline. In a comparison with larger crystals appeared in matrix of the Knyahinya sample the Mócs specimen (L6) shows microgranular matrix. Compared the spherical shape of chondrules in Mezőmadaras to those of Knyahinya sample, the Knyahinya chondrules were greater in size, but they were more deformed in shape containing more chondrule-fragments **(Table 2).** According to Miyamoto et al. [3] this optical description predicts that the thermal alteration occurred between 500-800 K in the chondritic parent body.

Table 1: Types of chondrule in the Hungarian L-chondrites

Samples	Texture of chondrules					
	Glas-sy	Exc. radial	por-phyr ic	bar-red	Gra-nular	Poi cili tic
Mezőma daras*	9	8	20	5	11	10
Knyahi-nya	7	4	21	6	6	5
Mócs**	0	7	1	1	7	1

New chondrumtype :
*: symplectitic chondrule **(Fig 1)** (3 chondrules)
**: beltic chondrules: accreted from little chondrules

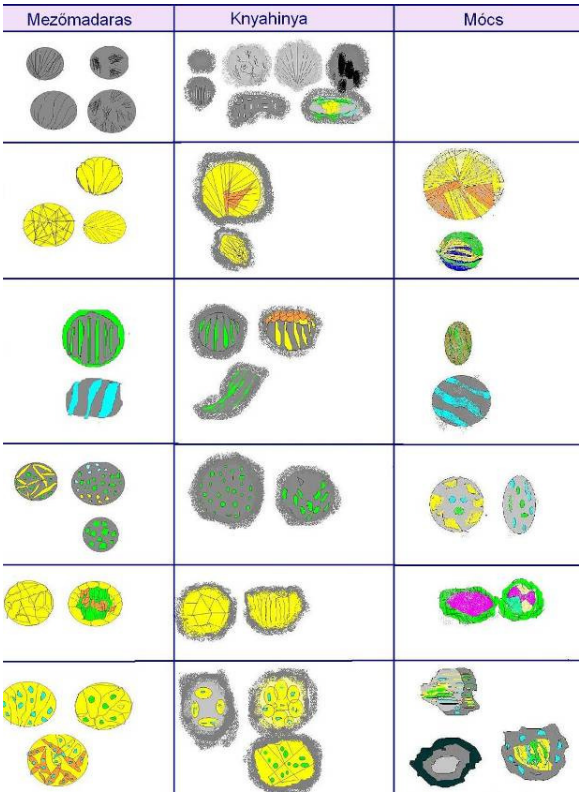

Table 2: Alteration of chondrules by thermal metamorphism
Rows: texture of chondrules: (1) glassy, (2) excentroradial, (3) barred, (4) porphyric, (5) granular, (6) poicilitic (last row by Mócs: beltic chondrules)

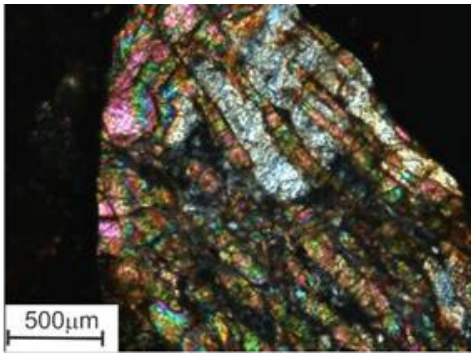

Fig. 1. Simplectic chondrule in Mezőmadaras chondrite: olivine worm growth with pyroxene.

Shock metamorphism

The shock metamorphism in our sample is a local phenomena, it is not abundant in the whole rock, but in some more detail in the mineral grains. Based on Stöffler [2], we classified the shocked minerals into shock stages, as follows. In Mezőmadaras sample, there are irregular fractrures (S1), and PF-s /planar fractures/ (S3), and mechanical twins in pyroxene. We observed that minerals with mechanical twins exhibit less interference color, compared to the non-shocked minerals, especially pyroxene. It is important to note that, the mechanical twins were difficult to describe, only the direction of the deformation was determined. In Knyahinya chondrite, two phenomena were observed as follows: the weak mosaicism (S4) (**Fig 3**) and mechanical twins in pyroxene (**Fig 2**). The Mócs sample is characterized by strong shock metamorphic effects such as, high density of fractures and abundant shock-veins. Planar Deformation Features (PDFs) were identified in two olivine grains, and an olivine grain shows well-developed PFs (**Figs. 4, 5**). The shock-induced microstructures such as PDFs, PFs and mosaic texture in minerals of these meteorite samples indicate the peak shock pressure was ranged between 15-35 GPa [4].

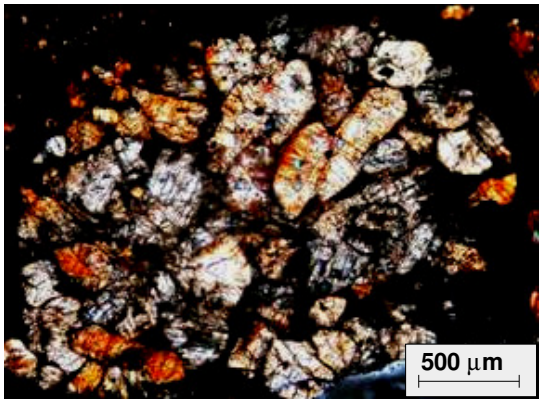

Fig. 2. **:** Mechanical twin in pyroxenes in poicilitic condrule.

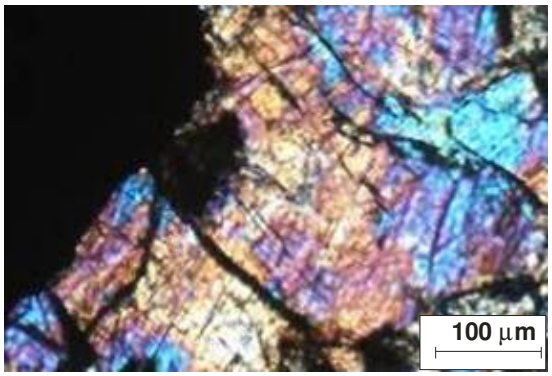

Fig. 3. Weak mosaicism in olivine.

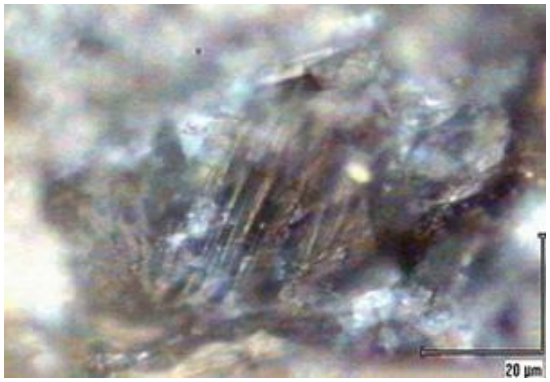

Fig. 4. PDFs in the Mocs olivine.

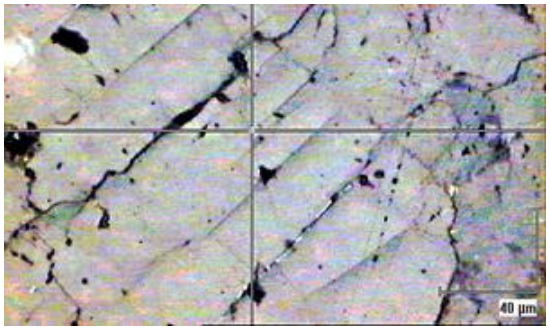

Fig. 5. Planar fractures in olivine (Mocs sample)

Acknowledgments:

We are grateful for Professors I. Kubovics and Z. Ditrói-Puskás for advices by petrography, and for LRG (Eötvös University) for instrumental background.

References:

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