Raman Spectroscopy of Shocked Olivine in the Hungarian L-Chondrite, Mócs

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Introduction.
The Mócs meteorite is L5-type chondrite, which fell in 1882, Kolozs county. The meteorite major modal composition are: olivine, pyroxene, plagioclase feldspars, and opaque minerals. The meteorite is highly fractured, and shock induced veins are also discernible. The fractures are filled by iron rich material. The sample contains shock-metamorphic effects (especially in olivine), such as weakly-moderately olivine shock mosaicism, and planar fractures (PF's) as well as planar deformation features (PDF's) (Fig. 1). Relatively low interference color in plagioclase and reduce one in pyroxene are also observable in this sample. We have investigated a PDF's enriched olivine grains using Raman spectroscopy, and searching for evidence for the shock-metamorphic effects in the lattice vibrational changes.

Samples and Experimental Procedure
The mineral assemblages and textures were characterized by a Renishaw-1000 Raman spectrometer, the laser wave lenght was 785 nm, with focused energy of 8 mW. The maximal focus was driven to 1μm diameter spot. The thin section was mounted in epoxy material, and the sample thickness is 30 μm.

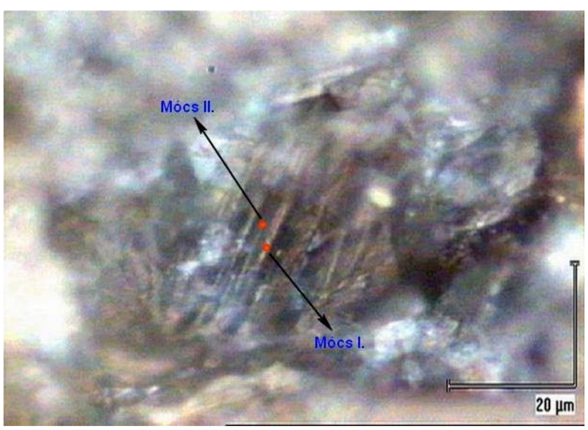

Fig. 1 Reflected light micrograph of PDF's in olivine from Mócs meteorite sample. (Two red solid circles correspond to the Raman analyting points).

Results and Discussion
The Mócs I. spectrum was placed on the PDF's lamellae, but the Mócs II. spectrum was in between PDF's. The characteristic Raman peaks of Mócs I are: 630(strong-s), 706(medium-m), 722(very weak-vw), 751(weak-w), 852(very strong-vs), 883(very strong-vs), 987(strong-s). The Mócs II. spectrum contains the following peaks: 421(s), 577(m), 642(w), 822(vs), 854(vs), 920(m), and 958(m) cm^{-1} We used to reference material from the Trudy's mine olivine to a comparison with the vibrational changes between three spectra (Fig. 2). The spectrum was derived from CALTECH Raman database.
The most characteristic changes in the Mócs I. spektrum are. The olivine doublet peak position is shifted to higher wavenumbers, due to partly disordered olivine structure. The doublet peak's shift was also observed in olivine (crystalline forsterite) experimentally shocked between 0-50 GPa [1]. The second important change in the Mócs I. spectrum is in the middle wavenumber region. The olivine structure vibrations are forbidden in this region. The 751 cm^{-1} peak is assigned to the presence of Si-O-Si bridges characteristic of wadsleyite [1,2] indicating the highly deformed olivine structure [2]. The 722 cm^{-1} peak belongs to the wadsleyite Si_2O_7 symmetric stretching vibrational mode [3,4]. However, the 918 cm^{-1} peak is not identical to the wadsleyit SiO_3 symmetric stretching vibrational mode, because of the doublet peak position.

Conclusion
Consequently, the PDF's lamellae contain modified spinel structure such as wadsleyite crystallite, in a highly deformed olivine grains, indicating an evidence for the localised high-pressure regime of shock-metamorphism in Mócs (L5) meteorite. Furthermore, this study demonstrates the micro-Raman spectroscopy can aid to understand more about the study of shock-induced microstructures in minerals from various meteorites,

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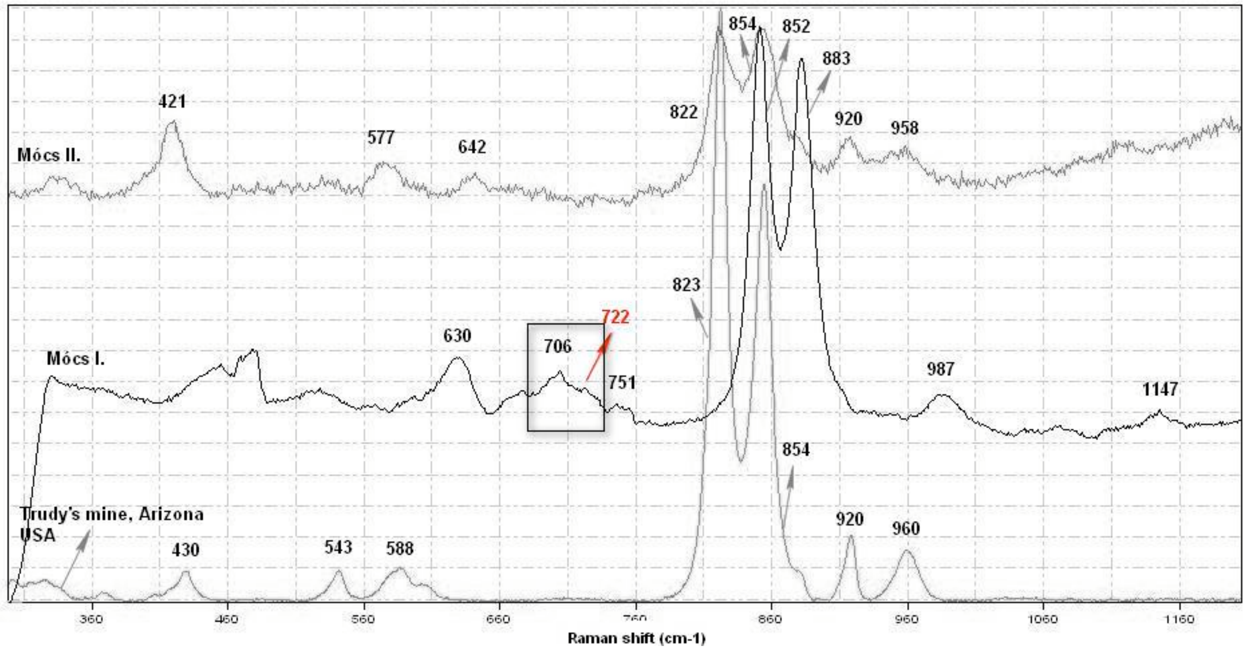

Fig. 2 Raman spectra of shocked olivine from Mócs

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