# Micro-Raman spectroscopy of the shocked olivine in the Martian meteorite ALH 77005

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**Introduction:**

Olivine is one of the most refractory and abundant igneous rock-forming minerals, which has been proven useful as an indicator of shock metamorphism in the study of meteorites [1] [2]. The systematic studies of micro-Raman properties of experimentally shocked olivine crystal assemblages have been performed by [3] and [4]. [3] have found no significant characteristic relation between Raman shifts as a function of increasing shock pressure in olivine. However, [4] described a new metastable phase formed at ambient pressure as the metastable intermediate during back-transformation from wadsleyite.

**Sample and methods:**

Two thin sections (ALH 77005-A and ALH 77005-B) were supplied from National Institute of Polar Research (NIPR, Tokyo, Japan), which belong to the meteorite collections. They were prepared as polished thin sections.
The ALH 77005 Martian meteorite is a lherzolitic type shergottites. Olivine (Fo72) occurs as an anhedral to subhedral grains up to 2 mm in lenght. The ALH 77005 consists of melt pockets, which are mostly crystallized as the spinifex texture. Olivine in the bulk of ALH 77005 has brownish color because of approximately 4.5 wt% of the total iron (Fig. 1).
Raman spectra were recorded with a Renishaw Rm-2000 Raman spectrometer attached to a Leica DM/LM microscope. The 785 nm line of the diode laser served as excitation source, the laser power on the sample was 8 mW. The microscope has focused the excitation beam into a 1 μm diameter spot. Raman spectra were recorded in the 200-1100 $cm^{-1}$ region using a CCD camera, the accumulations lasted during 60 sec.

**Results and discussion:**

We have investigated the olivine grains based on the increasing distance from the melt pocket to the outermost position of the sample. Close to the melt pocket (sp1), the Raman spectrum shows not significant changes (Fig. 2). In the intermediate region (sp2) a new peak appears at 755 $cm^{-1}$, and observed a slightly broadening features (Fig. 2).

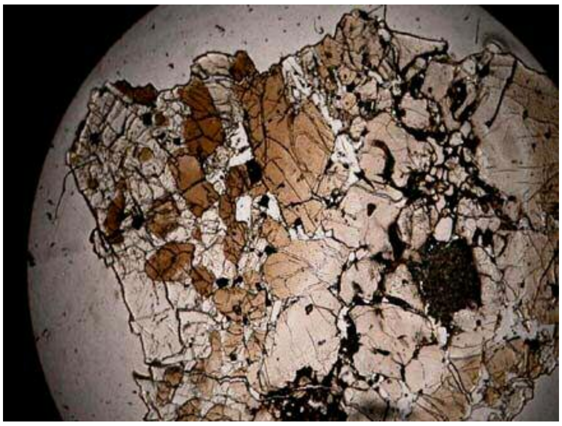

**Fig. 1** Brown olivine grains in the ALH 77005.

In the third spectrum (sp3) the 416 $cm^{-1}$ peak disappears (Fig. 2). The disappearance of the olivine-related peak at 600 $cm^{-1}$ may indicate the presence of a new phase such as ξ-$(Mg, Fe)_2 SiO_4$ [4]. In this spectrum a medium peak at 535 $cm^{-1}$ is presented, which may be related to the ξ-$(Mg, Fe)_2 SiO_4$ phase. This peak is not related neither to α and β nor γ-olivine phases. In this spectrum there is an appearing peak at 918 $cm^{-1}$, which is related to the wadsleyite. In the fourt spectrum (sp4) which is lie the fartest point from the melt pocket, the 600 $cm^{-1}$ olivine peak is absolutely disappearing.

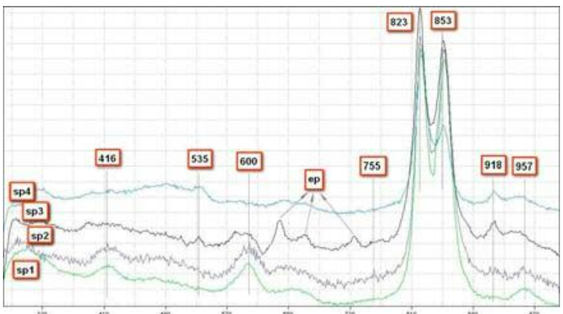


**Fig. 2** Raman-spectra of different distance of olivine grains from the melt pocket.

**Conclusion:**

These Raman-spectra indicate a belt-like arrangement of the structural changes of olivine grains from the melt pocket away to the far regions of the sample.

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