STUDY OF DIAMOND IN CARBONACEOUS VEINS OF UREILITES BY MICRO RAMAN SPECTROSCOPY

K. Nagashima[1], K. Morishita[1], M. Nara[2] and J. Matsuda[1]. [1]Earth and Space Science, Graduate School of Science, Osaka University, Toyonaka, Osaka, Japan. E-mail: nagashima@ess.sci.osaka-u.ac.jp. [2]College of Liberal Arts and Sciences, Tokyo Medical and Dental University, Ichikawa, Chiba, Japan.

Introduction: Ureilite mainly consists of silicate minerals of which grain boundaries are filled with carbonaceous vein. Graphite, diamond, Fe-Ni compound metal and troilite are present in the vein, and the oxygen isotope composition indicates that ureilite is very primitive [1]. It is often discussed how the carbonaceous veins were intruded in ureilite and how the diamond was formed in the vein. In this study, we carried out a micro Raman spectroscopic study to examine the formation process of diamond in ureilite. We also obtained Raman spectra of graphite to discuss the primordiality of ureilite from the comparison of the ureilite data with those in carbonaceous chondrites.

Samples and Experiments: The samples are Yamato 791538 (Y-791538), Shişr 007, and Northwest Africa 3140 (NWA 3140). We compared our data of Y-791538 with those obtained by the previous author [2]. There is no Raman data for Shişr 007 and NWA 3140 and we selected these samples for our study. For each meteorite, we prepared 4 samples: bulk, HCl/HF resistant residue, oxidation (by H_2O_2) resistant residue and polished thin section [3]. The purpose of the preparation of these samples is to make it easy to get Raman spectra of diamond in carbonaceous veins. In the Raman spectroscopy measurement, the excitation was made by the 532 nm Nd:YAG laser. The laser power was 0.5~1.5 mW at the sample surface. The exposure time is 10 seconds, and we accumulated it 10~15 times. The spectrum was fitted with Lorentzian.

Results: It was difficult to get diamond's spectra from the bulk samples. It is simply because carbonaceous veins are about ~3 wt.% of bulk ureilite. Spectra of diamonds obtained from the chemical residues are different from each other in peak positions and FWHM (Full Width at Half Maximum). The dissolving features of these samples are also different during the chemical leaching process. From the polished thin section, we obtained very sharp diamond's spectra for Y-791538 and Shişr 007 and their peak positions are at about 1330 cm^{-1}. It is known that FWHMs of diamond peaks are different for the diamonds of different origins (shock-produced, CVD etc.). However, FWHMs are variable in each ureilite and we could not get definitive information about an origin of the diamonds. We also measured Raman spectra of graphite in ureilite in the similar manner. The Raman parameters (such as FWHM, band position etc.) of ureilite graphite were compared with those of carbonaceous chondrites [4]. Although ureilite is supposed to be a primitive achondrite and may be related with CV chondrite in oxygen isotopes [1], our obtained Raman parameters show that thermal metamorphism is much more severe and the graphitization further evolves in ureilite compared to carbonaceous chondrite.

References: [1] Clayton R. N. and Mayeda Y. K. 1988. *Geochimica et Cosmochimica Acta* 52:1313-1318. [2] Miyamoto M. et al. 1993, *Mineralogical Journal* 16:246-257. [3] Kagi H. et al. 1991. *Proc. NIPR Symposium of Antarctic Meteorites* 4: 371-383. [4] Busemann H. et al. 2007. *Meteoritics & Planetary Science* 4: 1387-1416.