Cathodoluminescence microcharacterizatio of forsterite from Kaba CV3 chondrite: Implication for mineralogy and petrology of IDPs. Sz. Bérczi (1), A. Gucsik (2), T. Okumura (3), K. Ninagawa (4), H. Nishido (3), Á. Kereszturi (5), Sz. Nagy (6), H. Hargitai (1), [1]Eötvös University, Institute of Physics, Dept. Materials Physics, Cosmic Materials Space R. Group, H-1117 Budapest, Hungary, (E-mail: bercziszani@ludens.elte.hu); [2]Max Planck Institute for Chemistry, Dept. of Geochemistry, Becherweg 27, D-55128, Mainz, Germany; [3]Research Institute of Natural Sciences, Okayama University of Science, 1-1 Ridai-cho, Okayama, 700-0005, Japan; [4]Department of Applied Physics, Okayama University of Science, 1-1 Ridai-cho, Okayama, 700-0005, Japan; [5]Collegium Budapest, Institute for Advanced Study, H-1014 Budapest, Szentháromság tér 2. Hungary; [6]Eötvös University, Dept. Petrology and Geochemistry, H-1117 Budapest, Pázmány Péter sétány 1/c, Hungary

Introduction: Previous petrologic studies [1,2] suggest that Kaba (kept in Reform College of Debrecen, Hungary) is the most primitive unshocked CV fall. It is therefore of great interest to us because it will: (1) give us a better understanding of the effects of parent body processing on the mineralogy of CVs and allow comparison of these effects with other meteorite groups, (2) help in determining mineralogy of Interplanetary Dust Particles.

It is believed that IDP's were derived from comets and asteroids. However, to date the formation mechanism of the IDPs is poorly understood. Studies of IDPs provide understandings about grain dynamics in the early Solar System and presolar interstellar and circumstellar environments, grain condensation, chemical and physical evolution, and grain density distribution in the proto-planetary disk. We here discuss cathodoluminescence properties of several grains of the primitive Kaba carbonaceous chondrite to argue that cathodoluminescence spectroscopical and microscopical observations have the potential information to reveal important details of the mineralogy and petrology of the interstellar medium that might not be readily obtained by other standard methods.

Early classification alternately changed from the original Wiik type III (1956) [3], to Wood type II, (1967) [4], to Van Schmus-Wood C2, (1967) [5], to Van Schmus and Hayes type C(V)3 (1974) [6], and finally to CV3 oxidized and Bali-type (Krot et al., 1998) [7]. Its characteristics is also the presence of two endtype olivines: forsterite (Mg_2SiO_4) and fayalite ($Fe^{2+}{}_2SiO_4$), too.

Experimental Procedure: SEM-CL spectral analyses were performed using a Scanning Electron Microscope (SEM), JEOL 5410LV, equipped with a CL detector, Oxford Mono CL2, which comprises an integral 1200 grooves/mm grating monochromator attached to reflecting light guide with a retractable paraboloidal mirror. The operating conditions for measuring BSE (backscattered electron) images, CL images, and CL spectra were accelerating voltage: 15 kV, and 2.0 nA at room and liquid nitrogen temperature. CL spectra were recorded in the wavelength range of 300-800 nm, with 1 nm resolution by the photon counting method using a photomultiplier detector, Hamamatsu Photonics R2228. Powdered samples were used during the above-mentioned measurements. Approximately 40x40 μm areas were selected to the CL measurements, which were carried out at room temperature (Figs. 1a-d).

In this work we investigated a small amount of fine fragment sample from the cut of Kaba happened in 2007 in Debrecen, on the anniversary 150th years of the fall of Kaba in 1857.

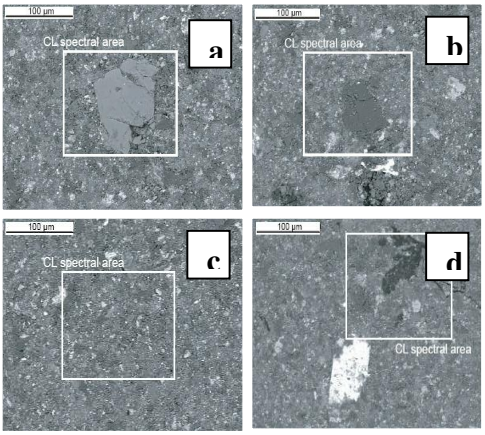

Figure 1. *BSE images of Area 1 (a), Area 2 (b), Area 3 (c), and Area 4 (d) showing CL analyzing area (white frame).*

Results: In the CL images of fayalite shows CL-dark characters (Fig. 2a) and forsterite exhibits CL-bright area in the otherwise CL-dark environment (Fig. 2b). CL spectra of four areas of our Kaba fine grained sample are characterized by a dominant broad band, which is centered at around 630 nm (Fig. 3). An additional shoulder peak at around 720 nm can be found mainly at Area 2. Compared to other areas, the highest peak intensity can be seen at Area 1. The preliminary EDS data show relatively high Mg, Si, and O concentrations in all of the samples.

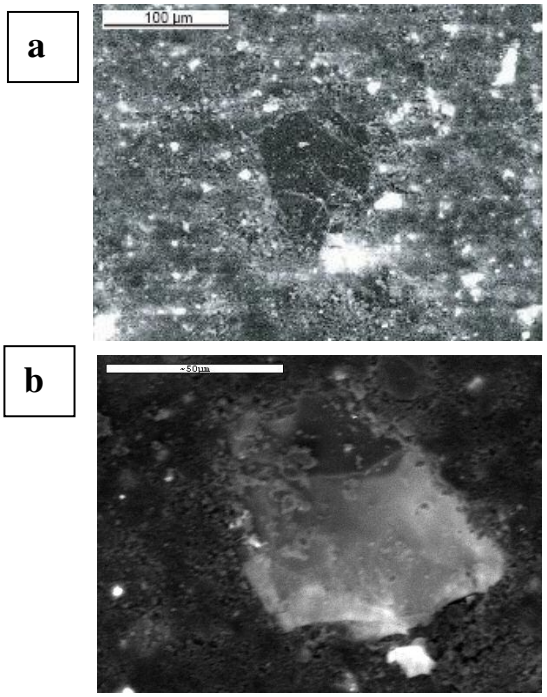

Figure 2. *CL images of Area 1 exhibiting CL-dark patterns (fayalite-a), and Area 2 CL-bright character (forsterite-b).*

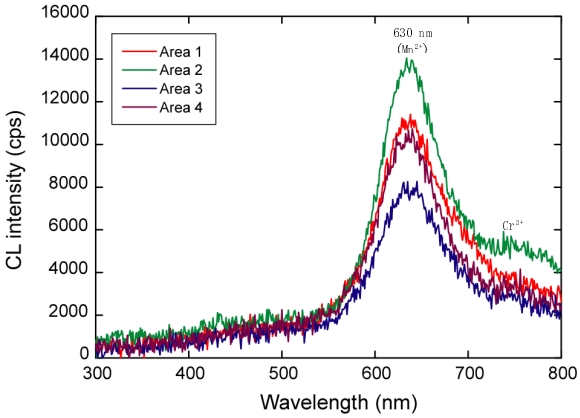

Figure 3. *CL spectra of four area containing a dominant broad band cenetered at around 630 nm.*

Discussion: Gucsik et al. [8] suggested that cathodoluminescence would be a means of quickly surveying Stardust particles to get a first order indication of their mineralogy and petrology. In their CL study, they used Semarkona chondrules for the implications for studies of IDPs.*Cathodoluminescence properties of Kaba forsterite and fayalite.* Our CL spectral and imaging features are in a good agreement with previous studies. The peak at 630 nm is assigned as Mn2+-activator element-related band, and the shoulder peak at 720 nm might be related to Cr3+ [9,10]. These activator elements can cause relatively high CL intensity parts (CL-bright areas) in the CL images of forsterite. On the other hand, there is a relatively high Fe-content as a major quencher element of fayalite, which can produce CL-dark parts of the sample. *Petrology and Mineralogy of IDPs.* The elemental composition of interplanetary dust particles (asteroidal and cometary) is one of three major types: chondritic, 60 %, iron-sulfur-nickel, 30 %, and mafic silicates, which are iron-magnesium-rich silicates, (i.e., olivine and pyroxene), 10 %. In general (according to the Stratospheric Dust Collections), cometary dust is different from asteroidal dust. Asteroidal dust resembles carbonaceous chondritic meteorites, and cometary dust resembles interstellar grains, which can include elements silicates, polycyclic aromatic hydrocarbons, and water ice [11,12]. Kaba forsterite shows a well-crystalline background and clear CL properties, which indicate that this mineral might be a potentially useful or reference material for studies of thermal history of the parent body and IDPs emphasizing their petrology, as well as chemistry. **Conclusions:** Studies of IDPs provide insight about grain dynamics in the early Solar System and presolar interstellar and circumstellar environments. Processes like grain condensation, chemical and physical evolution, and grain density distribution in the proto-planetary disk can be investigated through studies of IDPs. Thus, this cathodoluminescence study can aid to understand more about the formation mechanisms of these cosmic particles. Furthermore, it would be a powerful technique for the further analysis of Sardust mission particles, too.

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