CATHODOLUMINESCENCE MICROCHARACTERIZATION OF ILLITE FROM FÜZÉRRADVÁNY, NE HUNGARY

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The purpose of this study is to contribute to the structural characterization of illite by the application of the cathodoluminescence technique.

The operating conditions for all SEM-CL investigation as well as SEM and backscattered electron (BSE) microscopy were accelerating voltage: 15 kV, and 1.0 nA at room temperature (MARSHALL, 1988; IKENAGA *et al.*, 2000). 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.

The SEM images, especially secondary electron images, (SEI) of illite from Füzérradvány show individual grains with highly altered or damaged rim structures. The core of these grains does not contain any cracks or other mineral phases. The pore spaces are relatively low. In general, mostly hexagonal grains are separated by fractures, which occur in variable widths between 1 and 10 μm (Fig. 1A). CL image of illite shows relatively bright, crystallographically controlled bands and zones in the otherwise CL-dark background. The CL-bright patchy areas and spots in the CL images may be related to the quartz impurity. The presence of minor amounts of quartz was indicated by XRD analyses of the illitic raw material. The presence of quartz may also be expected from the extensive silification of the area as revealed by the geological exploration (CSONGRÁDI *et al*., 1996). The CL-dark background of these images is due to lack of the recombination centers or electron traps producing the non-luminescent nature of the CL emission in the illite samples. The low intensity might also be caused by quenchers such as Fe, however this particular illite practically does not contain iron (Fig. 1B).

CL spectrum of illite from Füzérradvány shows a broad band centered at 589 nm (2.1 eV), which contains a shoulder peak with a peak maximum at 456 nm (2.71 eV). A relatively weak narrow emission peak is centered at 428 nm (2.89 eV). The characteristic blue CL in the clay minerals is known as an intense emission band around 400 nm (double peak with two maxima at 375 and 410 nm) (3.3-3.0 eV) on kaolinite. Electron Paramagnetic Resonance (EPR) measurements indicate that this blue emission can be related to the radiation-induced defect centers (RID), which occur as electron holes trapped on apical oxygens (Si-O centre) or located at the Al-O-Al group (Al substituting Si in the tetrahedron) (Fig. 2.) (GÖTZE *et al*., 2002).

References

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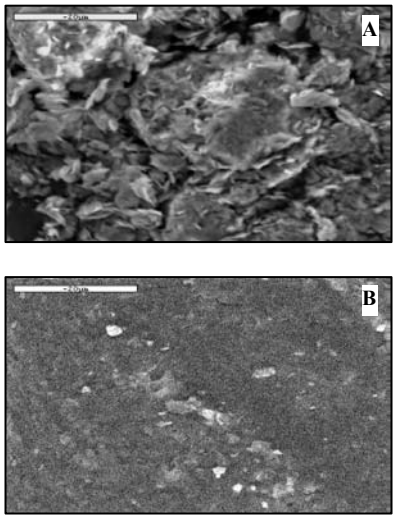

Fig. 1: SE (A) and CL (B) images of illite.

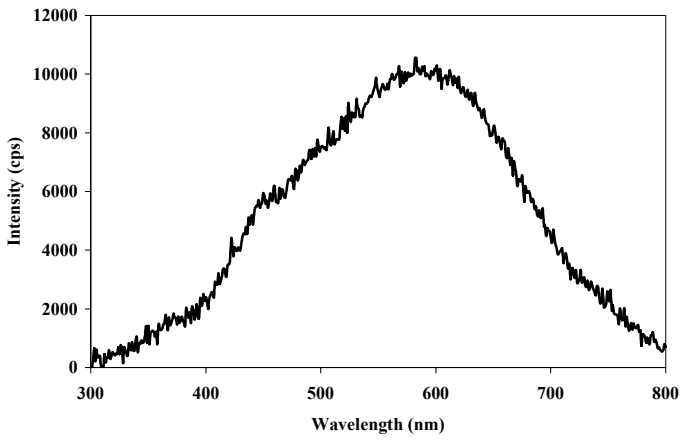

Fig. 2: CL spectrum of illite.