

SECTOR ZONED LUMINESCENT GYPSUM CRYSTALS FROM GÁNT, HUNGARY

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Gypsum crystals can be found at an abandoned bauxite mine in Gánt, Hungary which show photoluminescence under short and long wave UV light (254 nm and 365 nm, respectively). UV excitation reveals sector zoning in the crystals (IWASE, 1936). Luminescent sector zoning in gypsum crystals is quite common, just in Hungary we found them at four other localities (Dévaványa, Herend, Pilisborosjenő and Törökbálint), and it occurs in many other countries including Belgium, Canada, China, Germany, Poland, Romania and Turkey (IWASE, 1936; LENGYEL, 1943; TAGA *et al.*, 2011). In spite of its common occurrence, the cause of luminescence in gypsum is not fully understood yet. TAGA *et al.*, (2011) proposed organic molecular inclusions to be potential source of luminescence, besides the common fluorescence phenomena caused by trace element substitution. In trace amounts, organic molecular inclusions in the luminescent sectors can also effect unusual luminescence. Optical spectra published by Nurieva (1999; cited by GOROBETS & ROGOJINE, 2002) indicated the presence of organic matter as fluorophore in gypsum, too. In this research we examine the morphology, inclusions and luminescent properties of gypsum crystals from Gánt, Hungary, and we make an attempt to find out the cause of their luminescence.

Euhedral single crystals, crystal groups and swallow-tail twins were common in the locality.

The morphology of the crystals was cleared by determining the position of the crystallographic *c* axis using the optical properties in polarizing microscope. For indexing we used the $\beta = 127.46^\circ$ (BOEYENS & ICHHARAM, 2002) setting. Three crystal forms build up the crystals: the {010} pinacoid, the {011} prism and the {120} prism. The luminescent sectors are formed along the {011} prism. Two types of elongation arose: one by the *c*, another by the *a* axes, causing an apparent alternative position of sector zoning (Fig. 1).

Solid inclusions were characterised in gypsum by different light microscopy techniques and Raman spectrometry. The 10–100 μm inclusions represented pyrite and dolomite. None of the inclusion was connected to the luminescence.

Luminescence was examined macroscopically, microscopically and also by optical spectroscopy. The crystals show light blue fluorescence combined with 15

second long phosphorescence in 254 nm UV excitation. The samples were examined under transmitted light microscope equipped with UV excitation source and filter set.

Experiments were conducted also to observe the changes of luminescent properties as an effect of changing temperature. Gypsum specimens were heated from 250 °C up to 600 °C in 50 °C/10 minutes steps. XRD patterns revealed the presence of bassanite, anhydrite and subordinate gypsum at 300 °C, while anhydrite was the only phase at 600 °C. In a cooling experiment down to –17 °C, phosphorescence lasted longer by 1 second as compared to the room temperature reference counterpart, registered by video camera.

Most of these results indicate organic matter as luminophore in the Gánt gypsum crystals.

This work was completed in the ELTE Institutional Excellence Program (TKP2020-IKA-05) financed by the Hungarian Ministry of Human Capacities.



Fig. 1. Gypsum crystals of different elongation directions from Gánt, Hungary (visible light and 254 nm UV light).

References

- BOEYENS, J. C. A. & ICHHARAM, V. V. H. (2002): *Zeitschrift für Kristallographie*, 217: 9–10.
 GOROBETS, B. S. & ROGOJINE, A. A. (2002): *Luminescent Spectra of Minerals: Reference Book*. RPC VIMS Press, Moscow.
 IWASE, E. (1936): *Bulletin of the Chemical Society of Japan*, 11: 475–479.
 LENGYEL, E. (1943): *Földtani Közlöny*, 73: 285–295.
 TAGA, M., KONO, T. & YAMASHITA, M. (2011): *Journal of Mineralogical and Petrological Sciences*, 106: 169–174.