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**PERTHITIC MICROCLINES FROM THE STRZEGOM - SOBÓTKA
GRANITIC MASSIF IN ELECTRON MICROSCOPY AND
CATHODOLUMINESCENCE**

INTRODUCTION

The study is a report of cathodoluminescence investigations of potassic feldspars from biotite-hornblende granite and pegmatites of the Strzegom-Sobótka granitic massif. The granite crystallised at pressure of 1-2 kbars and temperature not lower than 850°C from water-poor magma (Pin et al. 1989). It forms the western part of the Strzegom-Sobótka massif and, in contrary to the eastern part, abounds in druse pegmatites. Vein pegmatites are present throughout the whole massif. Detailed studies of the pegmatites (Janeczek 1985) allowed to define the temperature range of 300-200°C for the main hydrothermal crystallization phase. The crucial factor constraining mineralogical characteristics of the pegmatite minerals seems to have been the composition of the hydrothermal fluids.

ANALYTHICAL METHODS

18 samples of microcline phenocrysts (from Paszowice, Borów, Rogoźnica and Wieśnica), 6 samples of microclines from vein pegmatites (from Strzeblów and Jaroszowskie Wzgórza) and 5 from druse pegmatites (from Strzegom and Borów) were selected for the studies. The criterion of the selection was the absence of any, discernible by XRD, phases other than feldspars. Further observations were carried out on thin sections and included observations under polarised microscope Nikon E600 POL and in cathodoluminescence using Citl CCL 8200 “cold” cathode (both at the Institute of Geological Sciences, Wrocław University). 8 slides, coated with graphite, were analysed using the electron microscope LEO 1430, equipped with a cathodoluminescence detector vis-view CL and SIM luminescence spectrometer (at Polish Geological Institute in Warsaw). CL petrography was carried out at 400-800 mA, 10-14 kV, and recorded with Nikon Coolpix 950, at exposure time 1-8 s. The CL spectra were obtained in the range of 200-900nm with acceleration potential 25kV.

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EXPERIMENTAL AND RESULTS

All the investigated samples are microcline micro and macroperthites of highly ordered structure as proved by XRD studies (author's unpublished data). Apart from perthites of clearly exsolution nature they contain infiltration veinlets and blebs of albitic phase. Hydrothermal alteration products of various nature are present in different amounts, developing along cracks and phase boundaries or distributed completely at random. Phenocrysts often display zonation with the zone borders marked by strings of tiny inclusions.

Typically the investigated feldspars display either blue or bluish-violet CL or appear nonluminescent. Luminescence becomes weaker or disappear altogether in areas particularly rich in alteration products. The CL mime the magmatic zonation, which is not always clearly discernible under optical microscope. Inner and outer parts of the zonation bands vary in the intensity and hue of blue colour with the outer parts usually dimmer and more violet. This pattern repeats throughout the crystal.

Except for the absence of zonation, the alkali feldspars from vein pegmatites exhibit similar features. The analysed alkali feldspars from druse pegmatites display wider variety of CL features. In some samples from Paszowice and Strzegom, parts of the crystals show irregular patches of brown hydrothermal alteration products, usually developed along small cracks. Strikingly, these areas exhibit bright blue CL (whereas usually luminescence vanish in hydrothermally altered regions). The outermost part of the two druse microclines from Strzegom appear nonluminescent and so do cleavandites grown on the microclines. The nonluminescent outermost part is separated from the rest of the crystals with a thin zone very rich in tiny inclusions. Immediately below the inclusion rich zone the crystal is perthite free and show typical blue CL.

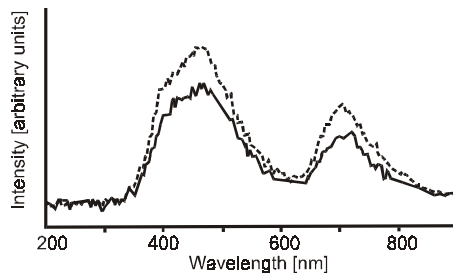


Fig. 1: CL spectra (LEO 1430) of a microcline phenocrysts from Wieńnica; dotted line – inner part of the zonation band, solid line – outer part of the zonation band.

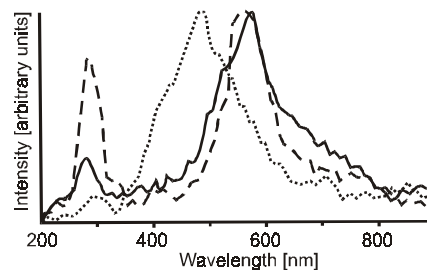


Fig. 2: CL spectra (LEO 1430) of microclines from druse pegmatites; dotted line – sample from Borów, solid and dashed lines – inner and outer parts of the crystal from Strzegom

Perthites may luminesce similarly to the host microclines, sometimes brighter or in yellow-green (in one phenocrysts from Wieśnica and two samples from the vein pegmatite in Jaroszkowskie Wzgórza) and rusty red colours (sample of druse pegmatite from Borów). Red and yellow-green CL was not observed in the exsolution albites but concentrate in the hydrothermally coarsened parts of the perthites or in irregular albitic blebs. Plagioclase inclusions, if luminescent at all, appear yellow-green. No regional variation pattern of the CL features was observed.

The emission spectra obtained from the investigated samples allow tentative correlation of CL colours with particular luminescent centres in the microclines. Review of the luminescence properties of feldspars and the earlier literature on the subject were presented by Götze et al. (2000). All spectra obtained from microcline phenocrysts are dominated by the emission around 450-460 nm with a minor peak at about 705-710 nm (Fig. 1). The first one is commonly ascribed to Al-O-Al centres and the broadness of the band as well as asymmetry of its left shoulder suggest more than one structural type of the centre. The red/IR peak comes from Fe³⁺ present in the T site. It contributes to the colour visible with a naked eye when its higher energy shoulder shifts into the visible region due to ordering of the feldspar structure (Finch and Klein 1999). Differences between inner and outer zones of the zonation bands in the microcline phenocrysts results from weaker intensity of the blue emission. The spectra of druse microclines show a different pattern (Fig. 2). The samples of druse microclines from Borów exhibit the dominant emission around 480 nm, which may be related to the same Al-O-Al centre noticed in the phenocrysts, but shifted toward lower energies, or to Si-O...M²⁺, where M²⁺ stands for divalent metal in a T site (Götze et al. 2000). This emission is absent from the spectra of the druse microclines from Strzegom or masked by strong emission at 560 nm. Such bands, less common in potassic than in other feldspars, are believed to come from Mn²⁺ substituting K and Ba (Götze et al. 2000). Red/IR peaks, analogue to the bands in the phenocrysts spectra, are present in both pegmatitic samples either as minute peak around 710 nm (Borów sample) or may be inferred from asymmetry of the right shoulder of the 560 nm emission (Strzegom samples). The UV emission around 280-290 nm is relatively poorly understood and was ascribed to various causes: centers evolved onto interphase boundaries (Garcia-Guinea et al., 1999), substitutions of Pb²⁺ or Tl⁺ for K or Ba (Tarashchan et al. 1975; Gorobets et al. 1989 after Götze et al. 2000). The emission is more pronounced in the outer part of the crystal from Strzegom what suggests rather substitution centres, which intensity may vary with changing amount of impurity ions incorporated during the crystal growth.

Crystallisation conditions and hydrothermal alterations seem to be the main factors governing the CL properties of the microcline phenocrysts and feldspars from the vein pegmatites. In case of the druse microclines these factors depended strongly on chemical character of the pegmatitic fluids which varied in individual druses. Postcrystallisation alteration took place in several stages and led sometimes to rebuilding of the CL centres.

Further investigations, especially EPR studies and microprobe analyses, will be carried out to verify the correlation of the CL emissions with particular luminescence centres. CL properties of albitic phases from the rocks of the Strzegom-Sobótka massif will be a matter of a separate work. All the investigations were performed as a part of the PhD research.

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