

Thesis Abstract

Thesis title : Thermoluminescence of feldspars. Tunnel afterglow and thermoluminescence emission in the infrared spectral range - Effect on the feldspars dating

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Abstract:

Too many feldspars cannot be dated by thermoluminescence, as they display an anomalous fading of their natural thermoluminescence. To understand the presence of this anomalous fading, tunnel afterglow was investigated in some forty feldspars from various origins.

Feldspars were observed to display at lower temperature a tunnel afterglow with quite specific features: its emission is entirely in the near infrared (IR) around 710 nm, it is remarkably intense due to an effect of thermal quenching. At high temperature, in the TL proper, the known emissions between 200 and 600 nm, so-called 'blue' spectral range, could be observed. But we could observe as well in TL a very strong IR component, with the same emission spectrum as in the tunnel emission. This IR emission is attributed to Fe³⁺.

Systematic investigations were made for an evaluation of respective stabilities of 'blue' and 'IR'

TL emissions during storage. The 'IR' TL was observed to be much more stable, and not to fade during the storage, while the 'blue' did.

The two emission bands are bleached by the same wavelengths. Activation energies are similar for the 'blue' and 'IR' emissions. The two bands are strongly coupled. We related the tunnel afterglow with the microscopic structure of feldspars. Disordered feldspars, such as the sanidines display an intense tunnel afterglow. 'Ordered' feldspars, such as the microclines display a weak tunnel afterglow.

Natural TL emission may be observed in the infrared band, even when the 'blue' has faded. The variation of the intensity of the TL with the dose is similar for the two emission bands. If sanidines cannot be dated using the faded 'blue' emissions, measurements made with the 'IR' emission on several samples give a calculated natural dose of the same order as the dose estimated.

The main conclusions are the followings:

- The anomalous fading in feldspars may be attributed to the tunnel effect.
- Microclines are hardly affected by tunnel effect.
- For the sanidines, the tunnel effect prevents all dating using the 'blue' emission. But they might be dated using the 'IR' TL emission. It is of interest, especially, for volcanism dating.