

The induced thermoluminescence and thermal history of plagioclase feldspars

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ABSTRACT

Feldspars are a common component in igneous and metamorphic rocks. Most feldspars exhibit luminescence, and this has proved useful in a number of mineralogical applications. In this paper, we concentrate on the thermoluminescence (TL) properties of feldspar, or the luminescence produced when a sample of feldspar is heated. We determined the induced TL properties of four feldspars of various compositions in their natural states, and after heating, and we compared the TL data with structural changes as determined by X-ray diffraction. The major TL peak at 120–240 °C in the TL glow curve, a plot of light intensity against temperature, varies significantly among feldspar-bearing samples. Meteorites and lunar samples with slow cooling histories of ~10 °C/My as determined by independent methods, have induced TL peak temperatures of ~120 °C, while samples with fast cooling histories (~100 °C/My) have induced TL peak temperatures of ~220 °C. This variation in TL peak temperature can be reproduced by heating the present feldspar samples, meteorites and lunar samples prior to the TL measurement. Most of the present samples in their natural state had TL peak temperatures of ~120 °C. Heating below 750 °C in the laboratory caused no change in TL peak temperatures or the structural disorder of the feldspar, while heating >750 °C caused TL peak temperatures to move to ~220 °C and disordered the feldspar structure. We suggest that induced TL peak temperature in feldspar is influenced by the degree of Al-Si ordering in the feldspar. Thus, induced TL peak temperature can be used as an indicator of cooling rate for igneous and metamorphic rocks.