# Ultra-low temperature luminescence thermochronometry of the northern Japanese Alps

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Thermochronometry enables exhumation rates to be determined from the measurement of rates of rock cooling. Luminescence thermochronometry is a recently introduced ultra-low temperature thermochronometry system, which is capable of resolving the low temperature (<100 °C) thermal histories of rocks. It can be used to determine cooling rates over $10^{4-5}$ yr timescales at high resolution, allowing recent exhumation histories in rapidly exhuming environments such as the northern Japanese Alps to be constrained for the first time.

Luminescence thermochronometry is based on the established Quaternary dating technique of Optically Stimulated Luminescence dating and is applicable to quartz and feldspar minerals. Electrons become trapped within such minerals when they are exposed to natural ionizing radiation. However, the trapped charge population is thermally sensitive and electrons are able to escape their traps at elevated temperatures (i.e. >30 °C). Luminescence thermochronometry thus comprises relating the trapped charge population to a thermal history. Using quartz or feldspar minerals extracted from bedrock, sample-specific laboratory measurements first comprise quantifying the total concentration of trapped charge. The rate of charge trapping (i.e. luminescence signal dose response), thermal and athermal detrapping are then also quantified using laboratory measurements. Because it is possible to constrain these processes accurately in the laboratory, it is possible to invert laboratory data into cooling histories, in turn enabling geomorphological questions to be addressed.

Applying this technique to bedrock samples from the Hida range of the Japanese Alps reveals preliminary rapid cooling rates of ~400 °C/Myr over the past 200 ka. Coupling these data with a thermal model, and combining them with other higher-temperature thermochronometric data (e.g. Ito et al., 2013) will provide insights into landscape evolution within this important geological setting.

## References

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