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Dating pegmatites from southern British Columbia: What minerals work?

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Well-developed deposit genetic models are key for improving exploration success, but in the case of Li-bearing pegmatites, such models require accurate emplacement ages . Although these pegmatites are mineralogically similar to I-type granites, which are commonly dated using zircon, pegmatitic zircon are typically poor candidates for dating. This is due to the high levels of uranium they incorporate into their structure, leading to the creation of highly metamict grains over geologically short timescales. Therefore, there has been significant efforts to develop other mineral geochronometers for pegmatites.

The pegmatites of the Monashee Complex in the southern Canadian Cordillera are an excellent case study to determine the reliability of different techniques, due to their young age (~ 50 Ma) and lack of disturbance due to subsequent thermal events affecting the area. We have determined the crystallization age of highly-evolved pegmatites from Mount Begbie to be 50.3 ± 0.08 Ma, based on ID-TIMS analyses of monazite, as well as (rare) non-metamict zircon. The nearby Boulder Mountain pegmatites have been dated using U-Pb LA-ICP-MS analyses on apatite and produce similar ages of 49.3 ± 1.4 Ma. These pegmatites also contain numerous other minerals that have the potential to be extremely useful for dating pegmatites when more traditional geochronometers cannot be used, including columbite (U-Pb), rutile (U-Pb), titanite (U-Pb), and micas (Rb-Sr; Ar-Ar). Here, we synthesize the results from data collected in this study as well as others from the southern Canadian Cordillera to assess how well these different geochronological tools work in pegmatitic systems.