# An integrated petrochronological and thermochronological approach for the detrital record

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Rocks exposed near suture zones can record the timing and style of orogenic accretion events. However, in long-lived accretionary orogens, subsequent orogenesis often obscures original terrane relationships and suture rocks may not be preserved or exposed. A detrital record of the suture may be captured by adjacent sedimentary basins. This is the case for the long-lived northern Canadian Cordillera, where sutures between terranes accreted during the early Mesozoic are not generally preserved. The Whitehorse trough syn-orogenic basin contains an E. Jurassic, ~300 m thick horizon of (ultra-) high pressure metamorphic detritus that includes mm-sized eclogite clasts.

Isolation and study of heavy mineral fractions, a common approach in basin analysis, results in disaggregation of small lithic clasts, limiting identification of equilibrium assemblages and temporal constraints. Since petrochronology and thermochronology techniques are performed by micro-analysis, it is feasible to apply them to the intact detrital eclogite clasts to examine timing, style and conditions of accretion. We integrated thermobarometry, geochronology, thermochronology and thermal diffusion modeling methods to demonstrate that the eclogite clasts likely reached peak metamorphic conditions of 2.2-2.9 GPa and ≥800 °C, cooled and exhumed during E. Jurassic and were deposited into the basin by earliest Toarcian. Minimum mean cooling and exhumation rates are ~38 °C/myr and ~4.1 km/myr, respectively. Based on these findings, the most likely source for the clasts is a suture between the Yukon-Tanana and Stikinia terranes, involving a latest Triassic collision, followed by rapid Early Jurassic exhumation of the lower plate Yukon-Tanana terrane. Our study demonstrates how micro-analytical techniques used for petrochronology can be applied to very small lithic clasts in the sedimentary record towards the tectonic reconstruction of accretionary orogens.