**Diffusion and thermochronology: Theory and geological reality**

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The rates and timescales over which plates interact during subduction or collision provides constraints on the mechanisms by which crust is buried, transformed, deformed and recycled.

Precise and accurate measurement of isotope ratios in geochronometer and thermochronometer minerals is now routine.  We traditionally interpret “dates” yielded by thermochronometers such as 40Ar/39Ar as recording cooling.  But other processes such as deformation, fluid flow or recrystallization can also affect when the Ar/Ar clock started or stopped ticking.  Robust interpretation is hampered by traditional assumptions, especially in metamorphic rocks that have experienced complex and lengthy crystallisation and cooling histories.

The applicability of these assumptions is testable using (1) modern analytical approaches, (2) chemical and/or textural data that tie the evolution of the thermochronometer mineral to the pressure-temperature-deformation evolution of the rest of the rock, and (3) numerical diffusion models that test “perfect case” closed system simple cooling scenarios.

Together these approaches allow a range of assumptions to be robustly interrogated, facilitating identification of the processes that affected the rock during its evolution.