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Using multiple chemical systems in zircon to unravel the evolution of high-grade terranes

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Since the turn of the century the rare earth element (REE) partitioning between zircon and garnet has facilitated the coupling of U–Pb ages to metamorphism, particularly in the granulite facies. The combination of in situ analysis and rapid data acquisition, particularly through combined techniques such as Laser Ablation Split Stream (LASS), means that complex terranes can be interrogated with increasing detail. However this detail provided by large datasets must also be combined with an understanding of the processes involved, for example the relative mobility of the REE and U–Pb systems with zircon grains that have withstood intense P–T conditions to varying degrees. For example, some high-temperature metapelites that seem to have all the right ingredients for the "equilibrium" to be achieved (e.g. they contain garnet, zircon, monazite and rutile, they've melted and experienced temperatures in excess of 900 °C) display variations in the REE partitioning between zircon and garnet that varies over the length-scale of a single thin section. This presentation seeks to highlight some complexities in the application of these undoublty useful techniques to high-temperature metamorphic rocks from a number of terranes and hopefully provide some useful comments on developing more efficient strategies to characterise the P–T–t evolution of high-grade terranes.