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Zircon growth and dissolution in low temperature environments

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Investigations of zircons in low-grade slates, quartzites and their sedimentary equivalents, using electron microscopy and back-scattered diffraction techniques, have revealed several different populations with a wide range of textural characteristics. Many original detrital grains show evidence of later growth, together with a record of partial dissolution and alteration. New growth occurs on the crystal faces of existing grains either as discrete (2-3 μm) overgrowths or as part of an engulfing crust intergrown with xenotime. Evidence of two distinct types of dissolution is observed; some zircons showing partial dissolution strongly controlled by original zoning within the individual crystals, others display a more homogeneous dissolution that seems to affect the whole crystal independent of composition. Alteration appears intimately linked to the dissolution process and is reflected in the production of a highly heterogeneous texture where vestiges of original internal zoning are partly preserved around porous, recrystallized areas containing inclusions of other Zr-bearing phases (baddellyite and zirconolite). Some of these zircon textures appear to be constrained by lithology. New growth appears to be favoured by zircons in mud-rich sediments and slates, whilst zircons within the quartz-rich lithologies are more strongly influenced by the effects of later deformation. All these documented zircon textures form both during diagenesis and low temperature greenschist facies metamorphism and are believed to be strongly linked to fluid activity and deformation. The concept that all zircon populations remain stable and unaffected by the processes involved during its sedimentary and metamorphic history must be re-evaluated. Previous studies of zircons in mineral separates result in a highly biased sample of the populations in sedimentary and metasedimentary lithologies that are, in reality, dominated by grains that have a low temperature history. Zircon grains that display new growth and recrystallization may

ultimately provide a reliable tool to date both diagenesis and low grade metamorphic events.