

EBSD imaging of monazite: A tool for directly dating deformation textures?

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Recent advances in in-situ U-Th/Pb monazite petrochronology allow dates obtained from micron-scale portions of texturally-constrained, individual crystals to be placed directly into a quantitative Pressure-Temperature framework. There remain major unresolved challenges in linking monazite ages to specific deformation events and discerning the effects of deformation on the isotopic and elemental tracers in these phases. Recent work has successfully dated dynamically recrystallised neoblasts in one deformed monazite grain (Erickson et al., 2015). However, it remains unclear how continual recrystallisation is reflected in the monazite crystal structure from a variety of geological settings.

Here, combined laser ablation split-stream analysis and Electron Backscatter Diffraction (EBSD) imaging of deformed monazite, from several different geological settings, is used to characterise a catalogue of monazite deformation textures. The combined micro-textural, U-Th/Pb-trace element data is used to quantify the influence of deformation on monazite (re)crystallisation mechanisms and its subsequent effect on the crystallographic structure, ages and trace-element distribution in individual grains. These data provide links between ages and specific deformation events, thus helping further our understanding of the role of dynamic recrystallisation in producing age variation within crystals in a deformed rock. These data provide a new dimension to the field of petrochronology, demonstrating the benefits and pitfalls of fully integrating the Pressure-Temperature-time-deformation history of accessory phases to better interpret the meaningfulness of ages yielded from deformed rocks.

Erickson et al., 2015, Geology. 43.5: 383-386