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# Insights into chemical mobility in titanite driven by low-temperature crystal-plastic deformation

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The U-Pb system in titanite has been shown to be reset during a variety of high-temperature processes including high-temperature deformation, but post-deformation modification and recovery of crystal-lattice strain have so far made U-Pb equilibration mechanism from deformed titanites equivocal. Microstructures, including mechanical twinning and subgrain rotation recrystallization are more likely to be preserved at low-temperatures, but the systematics of chemical equilibration have not been established for these conditions. This study identifies progressive crystallographic misorientation and deformation twins in titanite porphyroclasts from the Wasatch Fault Zone, Utah, USA. The microstructures, mapped using electron backscatter diffraction (EBSD), developed at ~11 km depth during 300–400 °C crystal-plastic deformation within the ductile fault zone. These microstructural maps were used to guide laser ablation-split stream ICP-MS analysis: U-Pb isotopes measured in tandem with major and trace element contents. Despite the low temperature, U-Pb and trace element contents in titanite equilibrated, at least partially, during deformation. Both major and trace elements in titanite also likely partitioned with a fluid and in response to the (re)crystallization of other mineral phases in the fault zone. Chemical zoning and crystal lattice recovery suggestive of fluid-aided recrystallization are absent, and the main mechanism for this resetting may instead be an enhancement of element mobility along microstructure dislocations. These processes are interpreted to record complex open-system behavior of titanite caused by crystal-plastic deformation during the initiation of the WFZ. This presentation will summarize the comparative analysis of microstructure by EBSD and titanite chemistry by LASS-ICP-MS, and how it bears on the understanding of elemental mobility in titanite during low-temperature crystal-plastic deformation.