

Board 0092: Titanite petrochronology records multiphase construction of the Little Cottonwood stock, Utah U.S.A. accommodated by an upper crustal shear zone



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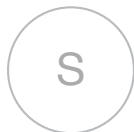
Poster Hall, Hall A (South, Level 3, McCormick Place)

Abstract

The Wasatch Mountains expose an oblique profile through the Alta and Little Cottonwood stocks (LCS) owing to 20° eastward tilt in the footwall of the Wasatch Fault. The cross section spans the upper 11 km of the crust beneath the Eocene paleosurface exposed in Park City, UT. Previous titanite and zircon U-Pb petrochronology established 10 Myr of simultaneous magmatism and hydrothermal metamorphism both in the deeper LCS and in the shallower Alta stock which likely was the conduit between the LCS and cogenetic Keetley volcanic deposits. Hydrothermal metamorphism within and surrounding the Alta stock was synchronous with and most likely driven by emplacement of LCS and migrated from within the Alta stock and contact aureole to margins of the stock suggesting an evolving permeability structure during and after the crystallization of the LCS. New titanite U-Pb petrochronology from the LCS and stock-bounding Wasatch Fault Zone indicate that 1) the LCS was constructed in two phases, an earlier ~36–34 Ma and a younger ~32–25 Ma phase, 2) the presence of both magmatic and hydrothermal titanite as recorded by trace element chemistry, and 3) a pre-Wasatch Fault ductile shear zone likely accommodated magma emplacement at crustal strain rates beginning around 32 Ma. Principal component analysis of LCS trace element data distinguishes

two end-member titanite populations along the first component axis: a magmatic population with high REE and a metamorphic population with low REE and high Sr, Sc, V, Cr, Fe, Al, Pb, and particularly W. The second principal component is defined by variance in the REE interpreted to record fractionation by titanite crystallization from melt. The initial ~36–34 Ma phase of LCS construction overlaps with magmatism within the Alta stock conduit and Keetley volcanic rocks and is only found on the western, deepest portion of the LCS. Trace element chemistry of ~36–34 Ma titanites lacks the low REE, high W population suggesting that hydrothermal water released by crystallizing magma did not percolate through these rocks. Low REE, high W titanites are restricted to the structurally higher second phase of the LCS. Despite this relationship, not all samples in the second LCS phase contain the hydrothermal population, which suggests spatially complex magma emplacement and/or later hydrothermal permeability structure.

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