Deformation and magma transport in a crystallizing plutonic complex, Coastal Batholith, central Chile

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Resumen

The Carboniferous-early Permian Santo Domingo complex in coastal Chile (33.5 degrees S) preserves magmatic structures that allowed us to partially reconstruct and compare the deformation histories of two intrusive units within a mid-upper crustal zoned pluton. The oldest history is preserved in the Punta de Tralca tonalite, where microgranitoid enclaves record the emplacement and partial assimilation of mostly mafic magma into an intermediate host. Enclaves record early foliation development by a mechanical sorting and alignment of minerals during hypersolidus flow in melt-rich magma currents, followed by diffusion creep and sliding along melt-coated crystals. Structures in a weaker, tonalitic matrix record compaction, flattening, and near-solidus deformation as porous flow, aided by brittle deformation, drained residual melts. These processes produced penetrative S > L fabrics (i.e., planar more dominant that linear fabric) in an increasingly viscous, crystal-rich mush and promoted folding, fracturing, shearing, and crystal-plastic deformation as the mush approached its solidus. The deformation disrupted igneous layering and helped mobilize and concentrate melt-rich aggregates, forming diffuse patches and dikes that intruded previously deformed enclaves and matrix and aided pluton differentiation. A different deformation history is recorded by the Estero Cordoba dike, which intruded and interacted comagmatically with the Punta de Tralca tonalite. The dike records how magma flow near stiff boundaries resulted in velocity gradients that drove deformation during magma replenishment. This deformation reset inherited enclave fabrics, increased ductile stretching and winnowing, and formed linear (L > S) fabrics. This example illustrates how different styles of deformation assisted magma movement through a mid-upper crustal magma chamber and highlights the diverse origins and significance of structures generated by deformation in magmas of variable crystal-melt ratios.

Palabras clave

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