

A dendritic growth mechanism for producing oscillatory zoning in igneous zircon

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The concentric oscillatory zoning pattern of igneous zircon is generally interpreted as evidence for core to rim growth during magmatic crystallization. This interpretation anchors a wide variety of qualitative and quantitative studies of zircon age, chemistry, and texture. Here, we show via detailed trace element mapping that euhedral magmatic zircon with apparently typical CL oscillatory zoning instead show evidence of dendritic growth. This observation challenges the unique interpretation of oscillatory zoning in zircon. Dendritic growth occurs under conditions of substantial undercooling, resulting in disequilibrium trace element concentrations in the zircon. Geochronological and geochemical analyses of zircon with this type of growth history require a different interpretative framework with significant implications for timescales of magmatic and volcanic systems.