Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20499

Controls on compositional zoning of zircon from the Catedral granite, Torres del Paine

JACK GILLESPIE, JOSEPHINE MOORE AND LUKAS P. BAUMGARTNER

University of Lausanne

Presenting Author: jack.gillespie1@gmail.com

The internal zoning of crystals record the conditions of their growth, and these patterns are used to understand the evolution of the host magmatic system. However, it remains uncertain to what extent these zoning patterns are the result of equilibrium or non-equilibrium crystallisation growth processes and to what degree external forcing (P,T, composition) is responsible. Understanding which of these processes dominantly controls the crystal composition is critical to our ability to accurately link textural, chemical, and isotopic data obtained from these crystals to the evolution of the wider system.

This study focuses on zircon crystals from the Catedral granite of the Torres del Paine composite laccolith in Patagonia, which is remarkable due to the spectacular exposure of the intrusive complex. This has allowed for detailed three-dimensional field characterisation of the architecture of the magmatic system, which comprises an early mafic feeder zone, three distinct granitic sills, and a late mafic sill complex that underlies the granitic units. Previous high-resolution U-Pb zircon geochronology places good controls on the timespans of magmatism across the entire system, with CA-ID-TIMS dates of 12.50 ± 0.01 and 12.49 ± 0.02 Ma obtained from samples of the Catedral granite [1].

EPMA elemental mapping and high-resolution CL imaging of zircon from the Catedral granite reveals periodic truncation features that disrupt oscillatory growth zoning. These resorption interfaces indicate periods of zircon dissolution followed by growth, likely driven by an external forcing mechanism that belies the apparently short-lived and simple crystallisation history implied by the zircon age data obtained from this intrusion. The abundance of apatite inclusions implies the existence of a phosphorus enriched boundary layer in the melt during zircon crystal growth. This suggests that kinetic factors may also play a role in determining the trace element composition of the zircon and explain some elements of the internal zoning patterns. These conditions and the roles of external vs internal factors are further explored through numerical models of zircon growth from a felsic melt.

[1] Michel, Baumgartner, Putlitz, Schaltegger, & Ovtcharova (2008), *Geology*, 36(6), 459-462.