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# Lattice distortion in oscillatory zoned zircon: implications for impurity poisoning

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Fine oscillatory compositional zoning is a common feature of magmatic zircon, but its origin remains controversial. Zircon crystals record valuable information about magmatic histories and the oscillations have been variously attributed to changes in pressure, temperature, melt composition, or some kind of surface kinetic effect [1]. Here, we investigate the chemical and structural properties of young (<38 Ma, [2]) oscillatory zoned zircon from the Adamello batholith.

Scanning transmission electron microscope (STEM) bright field (BF) and high angular annular dark field (HAADF) imaging shows that high-impurity growth zones that are apparently homogeneous when imaged at the lower resolution of scanning electron microscope (SEM) cathodoluminescence and backscattered electrons (BSE) are made up of smaller, variably distorted impure layers. Low-impurity growth zones are structurally and compositionally homogeneous at all scales imaged. In CL, oscillatory zonations range in thickness from about 500 nm to 2 μm and are laterally continuous. The same region of interest imaged with BF-(S)TEM and HAADF-(S)TEM shows layers ranging in thickness from about 100 nm to 2 μm. The (S)TEM images show that the BSE-bright zones are structurally distorted. Visual comparison allows for distinct zones to be cross-identified between SEM-CL/BSE and BF / HAADF-(S)TEM. Thick (≥1 μm) CL-dark zones are identifiable as BSE-bright zones. In the (S)TEM images, uniform, high impurity CL-dark/BSE-bright zones comprise multiple, smaller (100 nm – 500 nm) layers that have distorted lattices. Low impurity CL-bright/BSE-dark zones are homogeneous at all observed scales.

We interpret these observations within the framework of oscillatory zone formation by impurity poisoning during growth.

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