**Petrochronology of UHT garnet-free granulites: Linking zircon geochemistry to metamorphic reactions**

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**References**

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**Introduction**

Partial melting plays an important role in the redistribution of elements within the lower continental crust in space and time. Ultimately, these processes affect the crust's chemical and mechanical properties, transport and enrich metals, and locally result in (hazmatous) volcanism.

Petrochronological investigations (i.e., linking time and duration to specific rock-forming processes and their physical conditions) (Engi et al., 2017) may provide insights into crustal reworking throughout the evolution of the Earth. The high temperatures to which mafic granulites are subjected to often overprint pregrain mineral assemblages and produce protracted zircon geochemical records, rendering pressure-temperature-time reconstructions a challenging task. In addition, garnet-free rocks lack the possibility of linking petrological information recorded in garnet with geochronological constraints obtained from zircon or monazite, the most widespread petrochronological mineral pairs.

Can trace element compositions of amphibole, orthopyroxene and clinopyroxene combined to zircon be used to link timing data to petrological processes?

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**Geological Context**

Southern Brasilia orogen (SE-Brazil)

A complex framework of east-verging nappe systems developed during the collisional stage in the Neoproterozoic (670-590 Ma):

The Soconó-Guaxupé nappe: metamorphic remains of a pre-collisional magmatic arc formed at 790-640 Ma and metamorphosed at 660-600 Ma.

Migmatites record ultra-high temperature metamorphism:

\[ T = 800-1050 \, ^\circ\text{C} \text{ and } P = 6-14 \text{kbar} \]

**Field relationship**

From north to south transitional migmatitic granulite to schollen diatexites passes to schollen to transitional migmatitic complexes.

Metamorphic zircon grains (620-680 Ma) that crystallized in the residue, where the transition from Cpx to Amp occurred in the absence or presence of fluid, were depleted in HREEs. This suggests that HREEs from Cpx were directly incorporated by Amp and is supported by the light Eu anomalies of these Zm grains when compared to the HREE-rich Zm.

Eu negative anomalies in Zm increase where Kfs crystallizes, in volumes without Cpx. In C-838-A, Amp is less enriched in HREEs because in the presence of melt, HREE likely enters the structure of Zm. The absence of external fluid/melt as demonstrated by Hf isotope for some Zm reduces the mobility of REEs. For C-838-A the absence of fluids corroborates a subsolidus crystallization of the protolith.

At least partially, the protracted geochronological records potentially reflect domainal reactions in different stages of a prolonged metamorphic event.

**Petrochronology**

Protracted U-Pb zircon geochronological records prevent the determination of "ages". However, different samples record same age peaks distribution.

\[ ^{140}\text{La} / ^{142}\text{Nd} \text{ and } ^{176}\text{Hf} / ^{177}\text{Hf} \text{ allowed to constrain the crystallization age of the protolith.} \]

Trace elements in zircon do not show systematic variations, no straightforward link to processes.

**Trace elements in Opx, Cpx and Amp**

**Aknowledgments**

**References**