Understanding preservation of primary signatures in apatite by comparing matrix and zircon-hosted crystals from the Eoarchean Acasta Gneiss Complex (Canada)

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(in review G-cubed)

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1.Introduction

How do we learn about the petrogenesis of multi-metamorphosed Archean terranes?

Accessory minerals : **zircon** and **apatite**

- Zircon is ubiquitous and robust to metamorphism.

Good for dating but little REE variability.

- apatite is ubiquitous and is sensitive to melt compositions: wide range of REE compositions

Good for petrogenesis but easily reset by metamorphism.

Apatite inclusions in zircon give insights into the primary isotopic and REE composition of granitoïds and are *in theory* protected from external effects like metamorphism (Jennings et al., 2011; Bruand et al., 2016; Emo et al., 2018).

Is the U-Th-Pb system and the REE composition really primary in zircon-hosted apatite from Archean terranes?

2.Geological Setting

Acasta Gneiss Complex, Canada

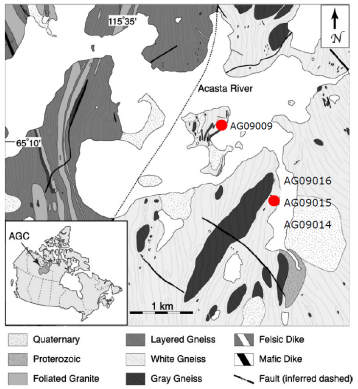
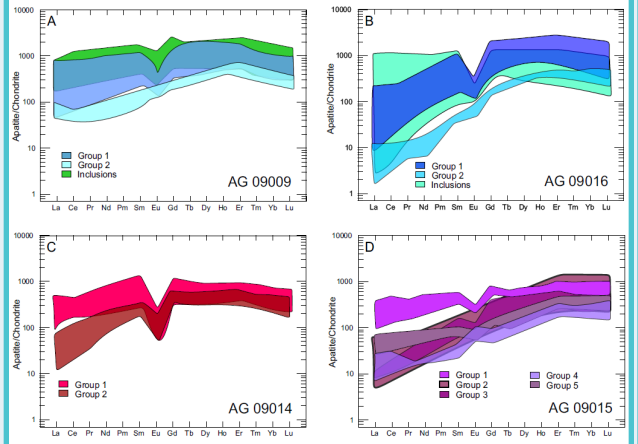


Figure modified from Guitreau et al., 2018

3.Methods and Results

Matrix apatite and as inclusion in zircon have been dated (U -Th-Pb) and their trace elements analysed by LA-ICP-MS at the university of Clermont -Ferrand

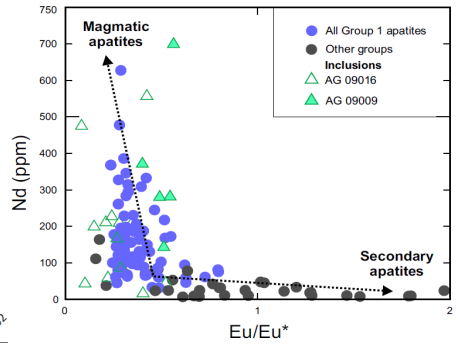
- Group 1 REE patterns have negative Eu anomaly and LREE depleted compared to HREE.
- Other groups have small to no Eu negative anomaly on their REE pattern and are highly depleted in LREE compared to HREE.

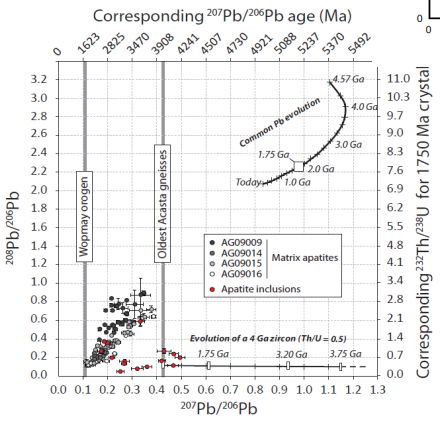


4.Discussion

Chemistry

- Matrix apatite cores and inclusion apatite have magmatic signatures
- Overgrowths and secondary apatites have reset REE signature, with low concentration linked to metamorphism and/or fluids.





Geochronology

- Inclusion apatites are mostly concordant between 1700 Ma and 4000 Ma.
- Matrix apatites, polymineral inclusions and open system inclusions are reset to Wopmay ages (1800-1700Ma).
- Analytical limitations: spot size + Pb_c correction

5.Conclusions and Implications

- Apatite inclusions in Archean zircon and the core of matrix apatite (> 100 µm) keep their primary magmatic REE composition
- U-Th-Pb isotopic system preserves primary signature only in pristine zircon crystals (monomineral inclusion, no frac-tures, low metamictization).
- If these texture conditions are not present, then primary ages and to some extend, trace elements will be reset at the last HT metamorphic event.

This study provide new data highlighting new horizons for (i) provenance studies and (ii) the understanding of Hadean detrital material to better constrain crustal evolution.

6.Bibliography

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