EGU General Assembly

This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

SUBSOLIDUS CRYSTALLIZATION IN THE A-TYPE PIKES PEAK BATHOLITH

L. M. Fonseca Teixeira, J. Troch, J. Allaz, O. Bachmann

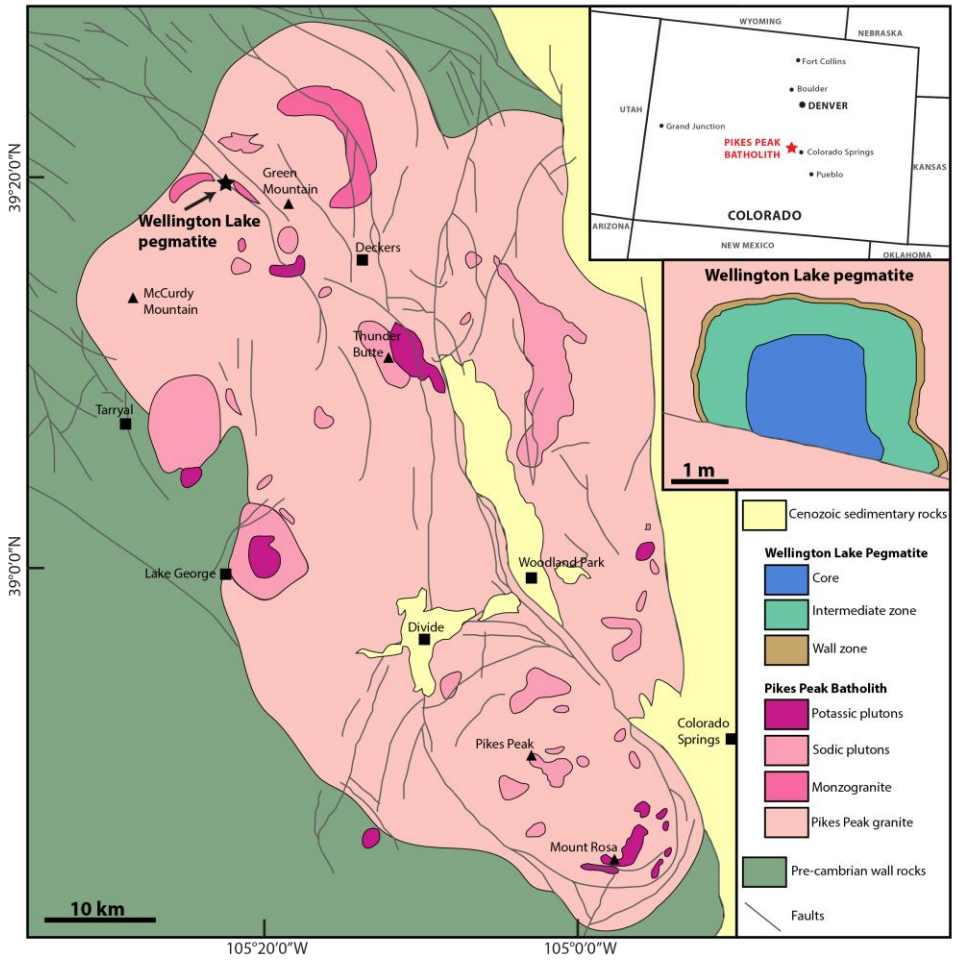
ETH zürich D ERDW

GOAL: TO UNDERSTAND AND QUANTIFY SUBSOLIDUS CRYSTALLIZATION IN A-TYPE GRANITES

- Granite solidus curve: 700-650°C (Luth et al., 1964; Piwinskii, 1968; Tuttle and Bowen, 1958)
- Evidence of up to 80% subsolidus crystallization in granitic systems (e.g. Ackerson, 2018)
- Nature of the subsolidus crystallization: melt or fluid?
- Pegmatites: link between the hydrothermal and magmatic realms

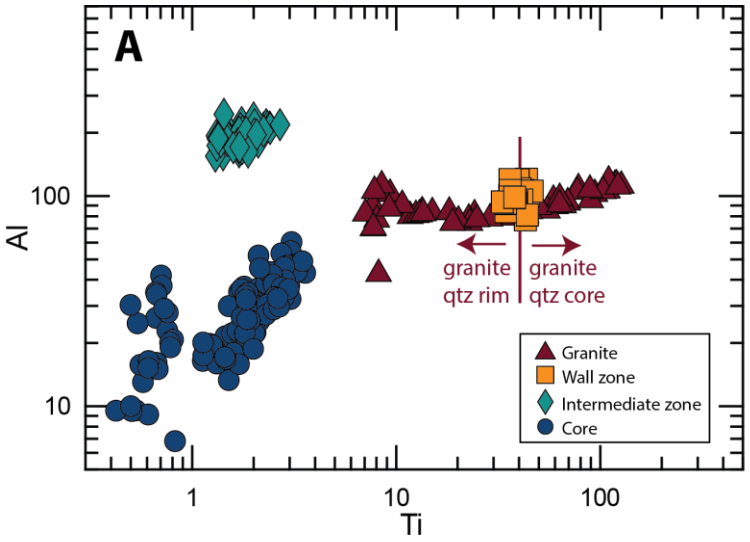
SAMPLES AND METHODS

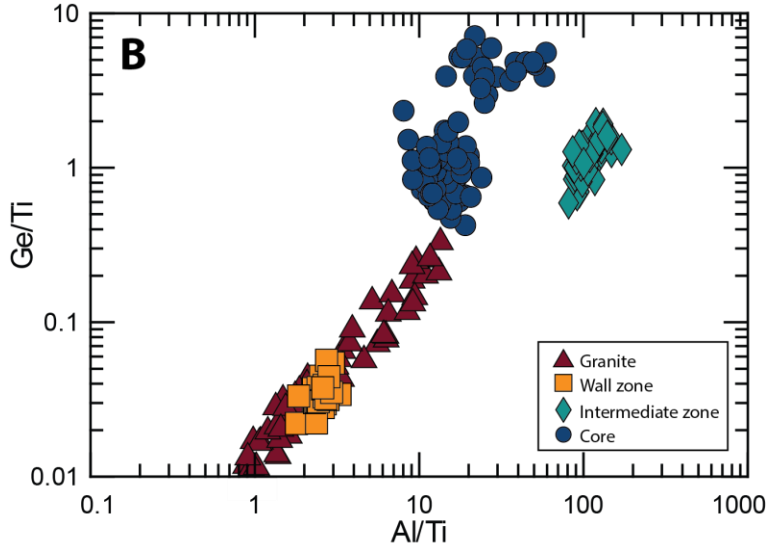
- The Pikes Peak batholith: 1.1 Ga A-type anorogenic granite in Colorado (USA)
  - Hosts over 200 pegmatites, many with a REE-dominated mineralisation
- Wellington Lake Pegmatite
  - Wall zone: fine grained graphic granite (kspar + qtz)
  - Intermediate zone: coarse grained albite + qtz
  - Pure blocky quartz
- Methods:
  - Cathodoluminescence images
  - Trace elements in quartz of the different zones
  - Ti-in-quartz thermometer (Huang & Audétat, 2012)

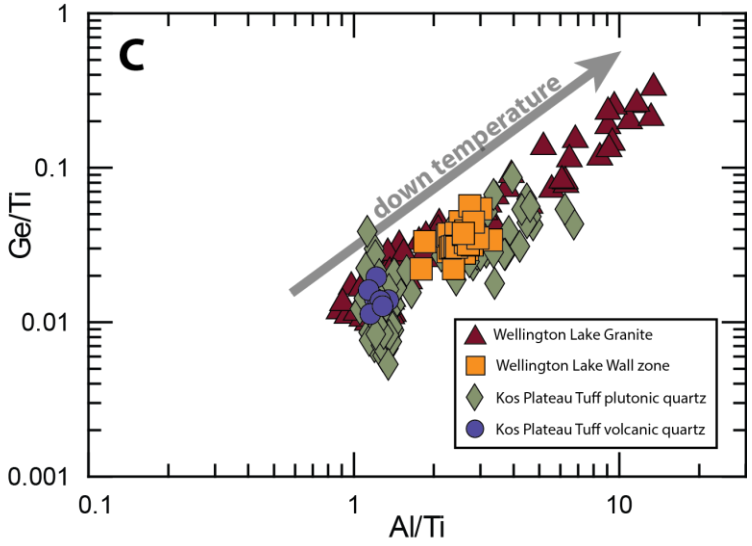


TRACE ELEMENTS IN GRANITE AND PEGMATITE QUARTZ

- Granite and wall zone ranges
- Overlap with Kos Plateau tuff data
- Gap between wall and intermediate zone: change of the precipitating medium



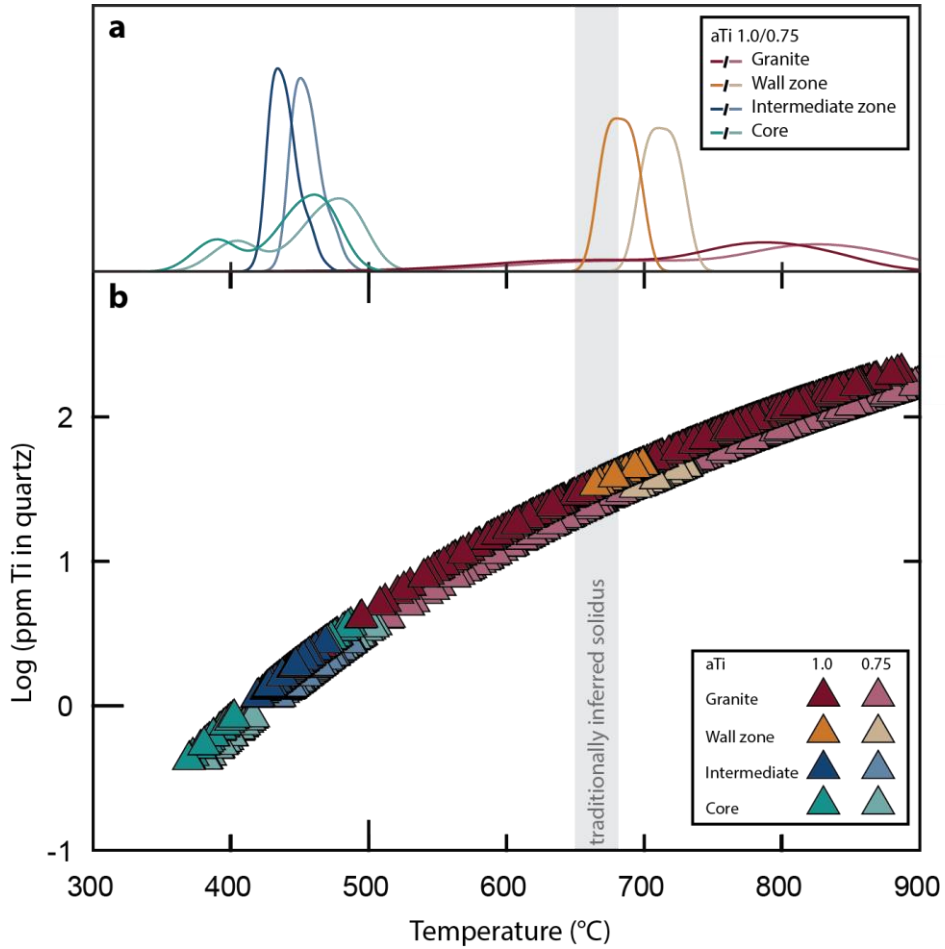




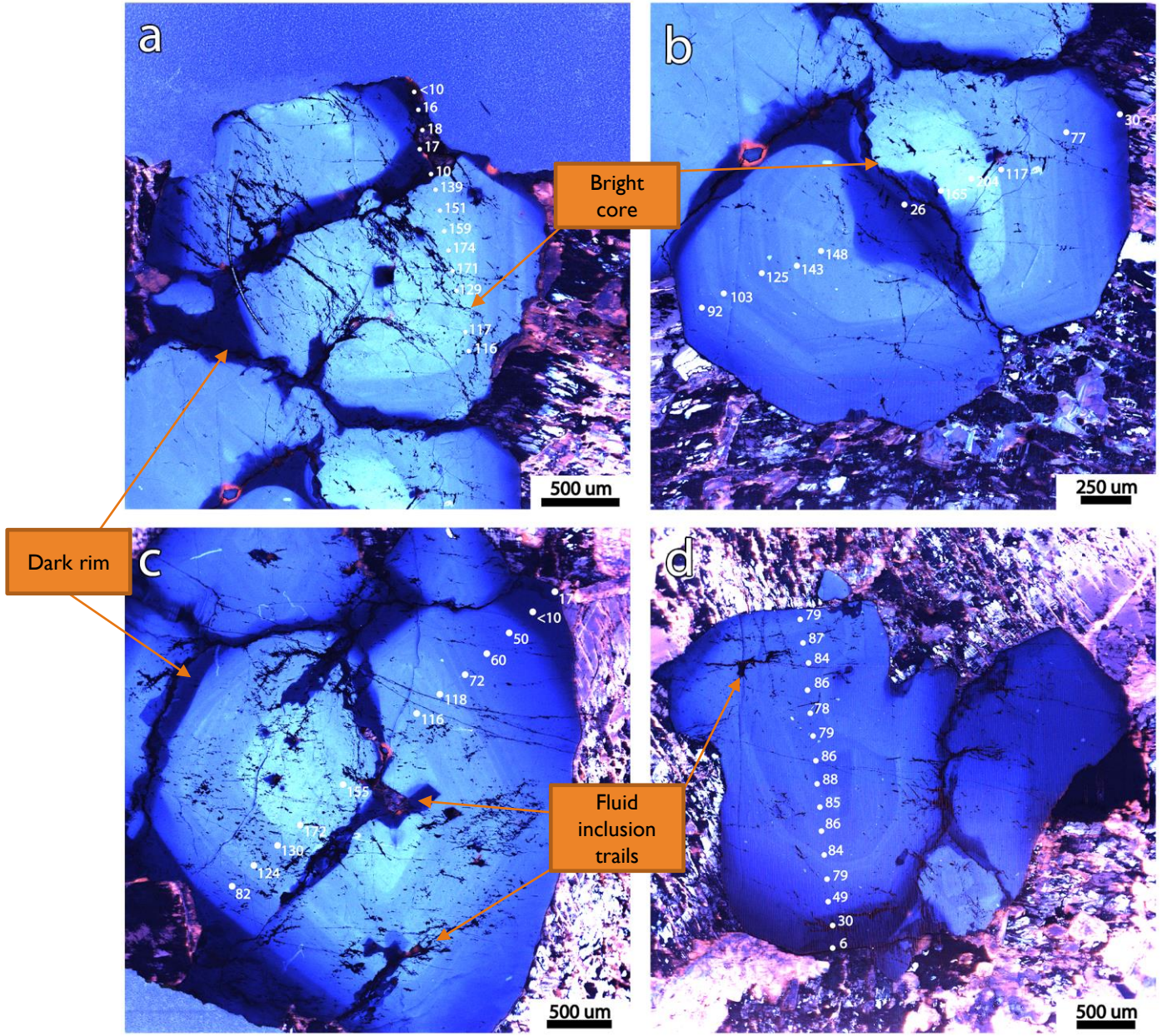
Kos Plateau Tuff data from Fiedrich et al. (2020)

CRYSTALLISATION TEMPERATURES

- Ti-in-quartz thermometer (Huang & Audétat, 2012)
- Granite: 900-500°C
- Pegmatite wall zone: 700-670°C
- Pegmatite intermediate and core zones at cold conditions (< 500°C)



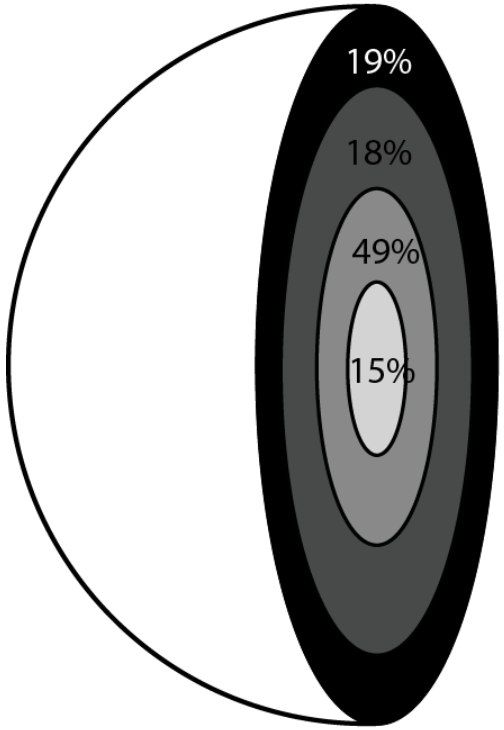
SUBSOLIDUS QUARTZ: RIMS AND DARK FRACTURES



CL images with Ti content measured by EPMA

QUANTIFYING THE RIM

- Approximation of 25 quartz crystals to spheres to obtain the volume
- Division into 4 subzones based on CL response and Ti content
  - > 810°C (bright core)
  - 810-720°C (fluid exsolution)
  - 720-660°C (solidus)
  - <660°C (rim)



SUMMARY

- Granite and wall zone above 660°C, precipitation from a silicate melt
  - Fluids likely already abundant near solidus
  - Wall zone: melt runs out
- Precipitation medium shift near solidus
- Granite quartz rim and fractures continue to ca. 500°C
- Pegmatite intermediate and core zones at cold conditions (< 500°C)