



Investigating the Grenville Orogeny in the Adirondack Lowlands in Northeastern New York

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Geologic Background

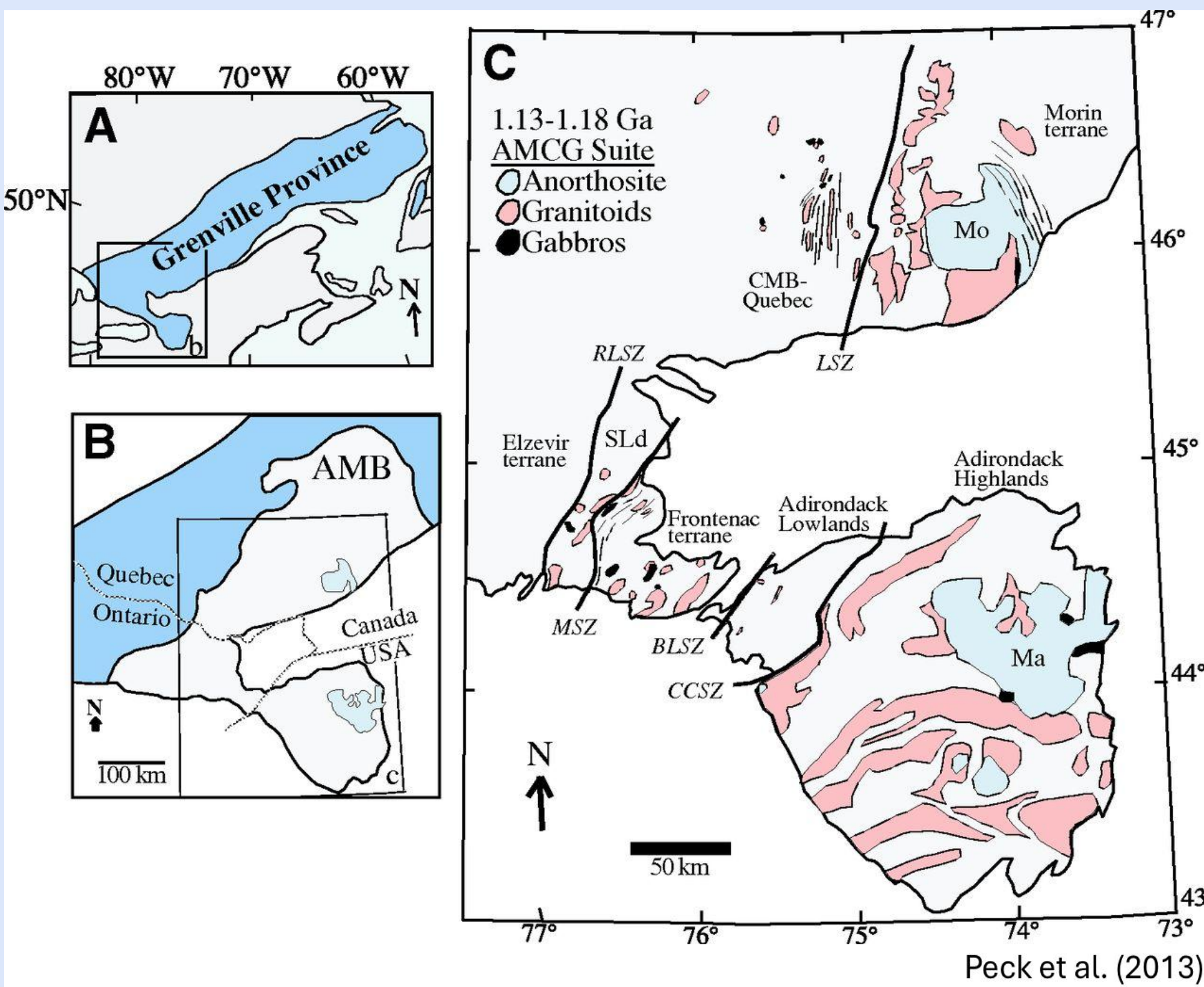


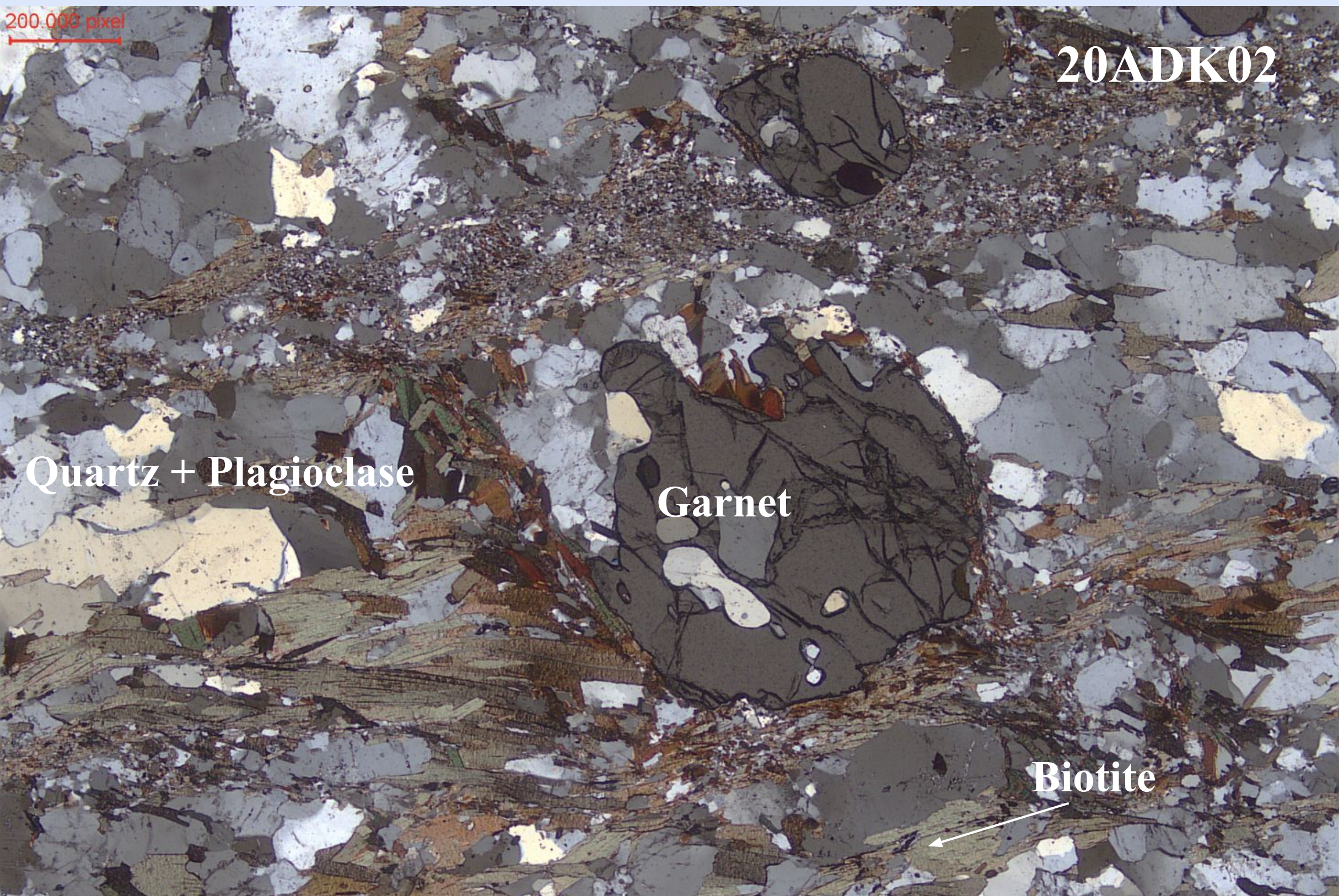
Figure 1: Geologic map of the Adirondack Mountains in Northeast New York, United States.

The Adirondack Mountains are part of the Grenville Province and were formed through a multi-episodic orogeny involving high-grade metamorphism and tectonic collisions. The region is divided into northwestern lowlands and southeastern highlands by the Carthage-Colton Shear Zone. These terranes, dominated by igneous rocks, reflect a sequence of depositional and collisional events spanning from 1.25 Ga to 1.03 Ga.

Objectives

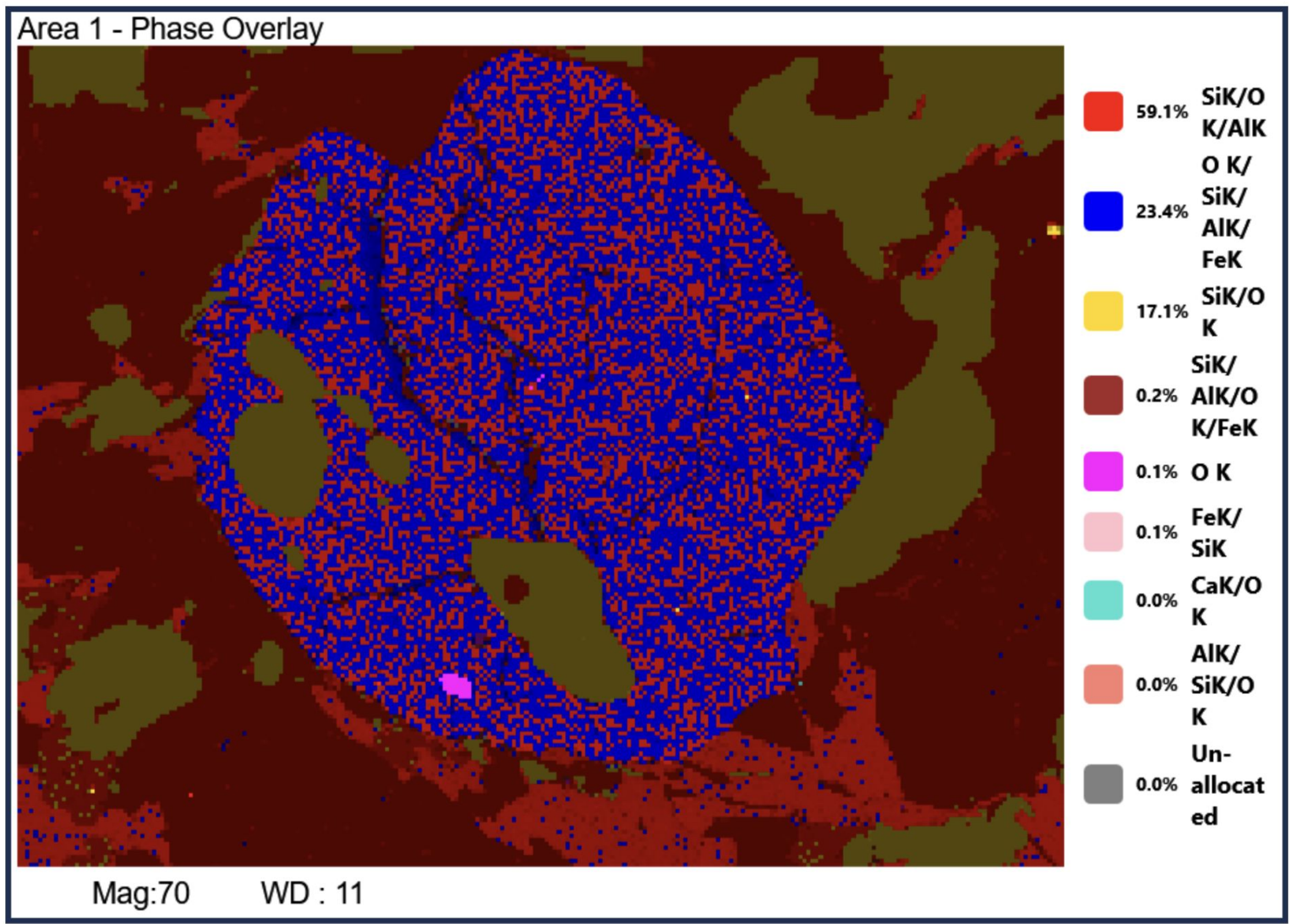
- Utilize accessory minerals such as zircon, apatite, rutile, monazite, and garnet to determine age of emplacement and metamorphism by Neptune MC-ICP-MS.
- Constrain metamorphic pressure conditions of the Adirondack lowlands through EMPA compositions and thermodynamic modeling.
- Apply new geochronological ages and geochemical data to interpret the Grenville orogeny throughout the Mesoproterozoic.

Petrographic Analysis

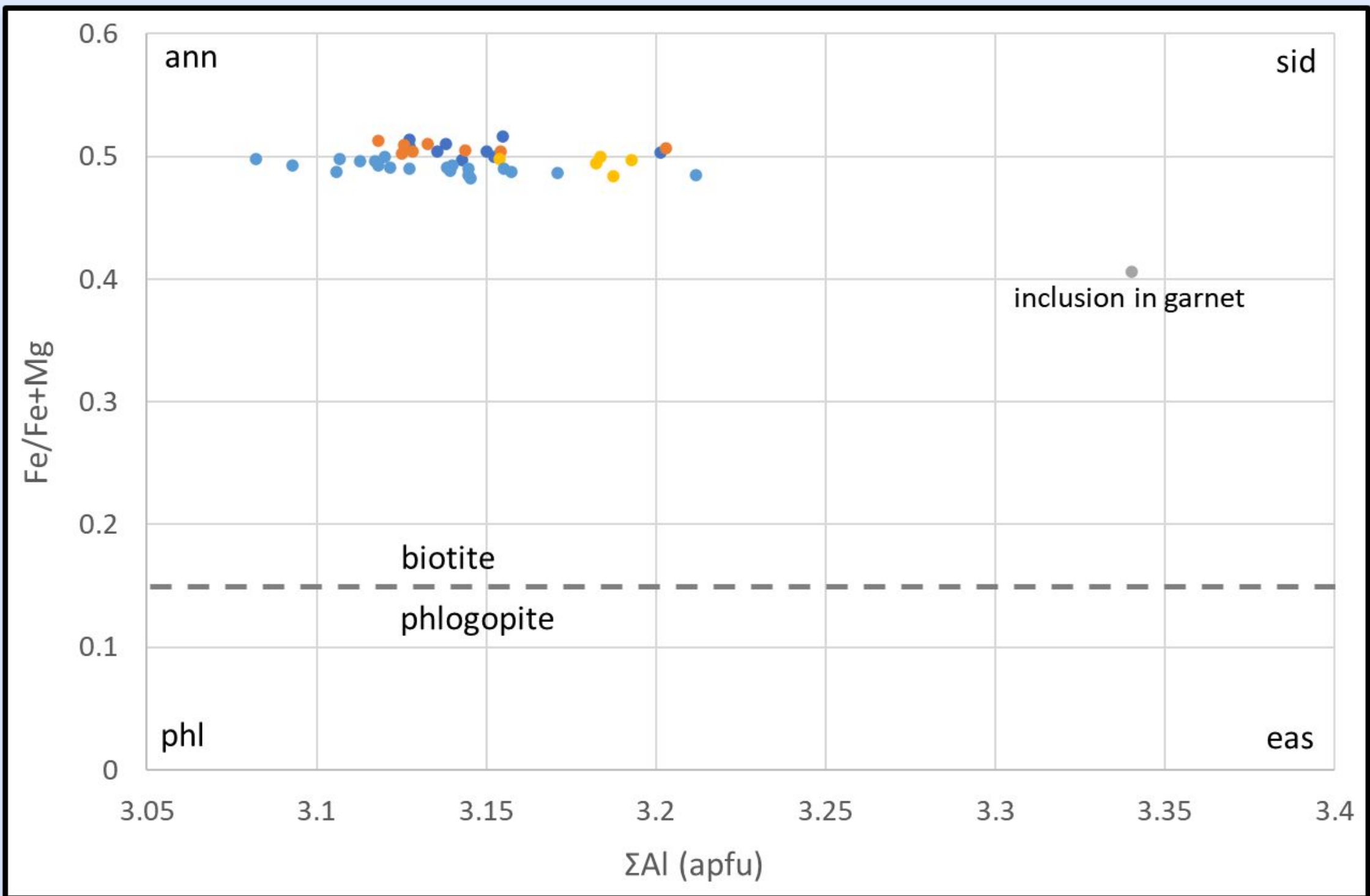


XPL image from petrographic microscope. Phyllosilicate minerals are present as foliation, and surround garnet porphyroblasts. Microcrystalline quartz and plagioclase distributed throughout sample.

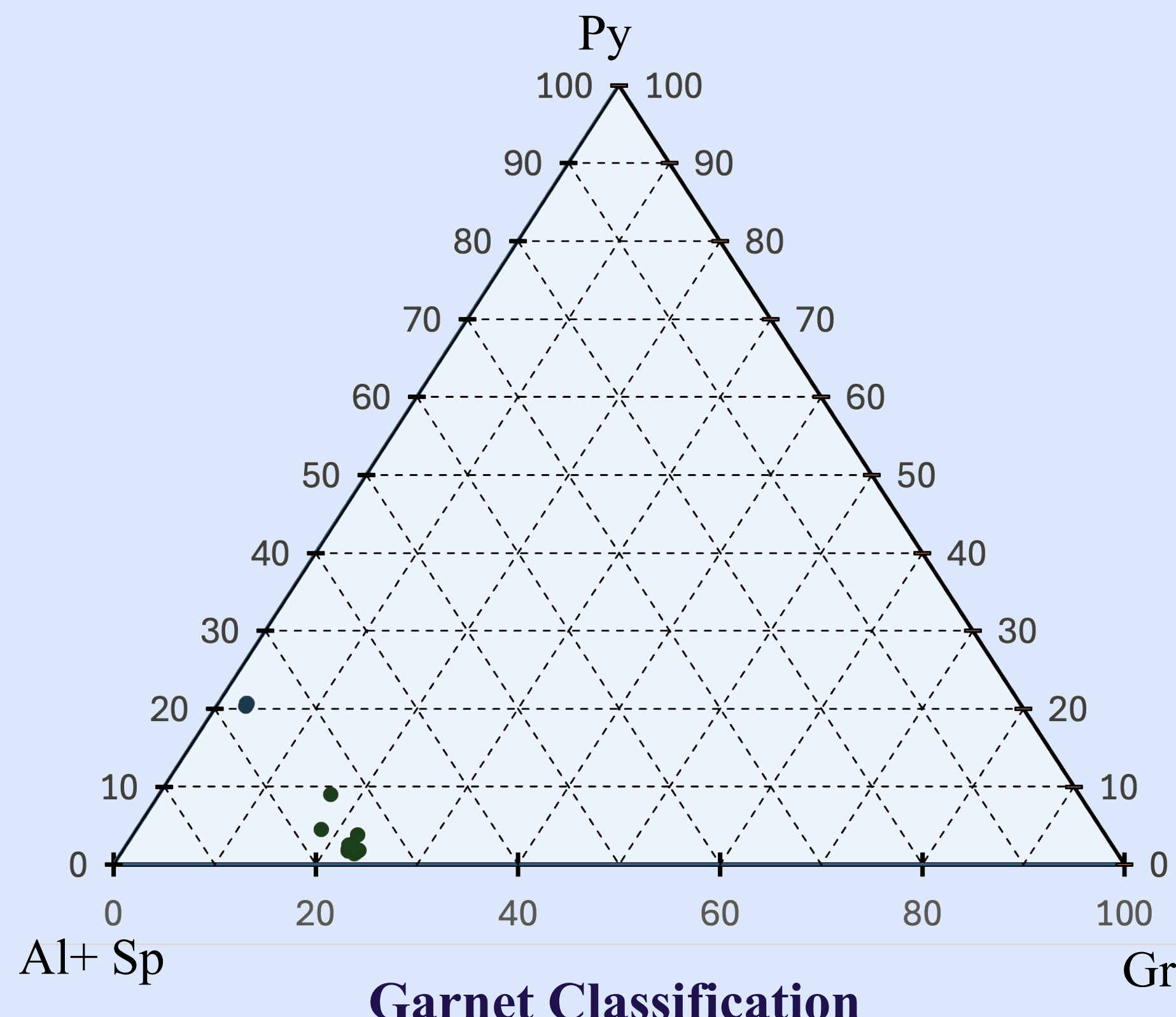
Geochemical Analysis



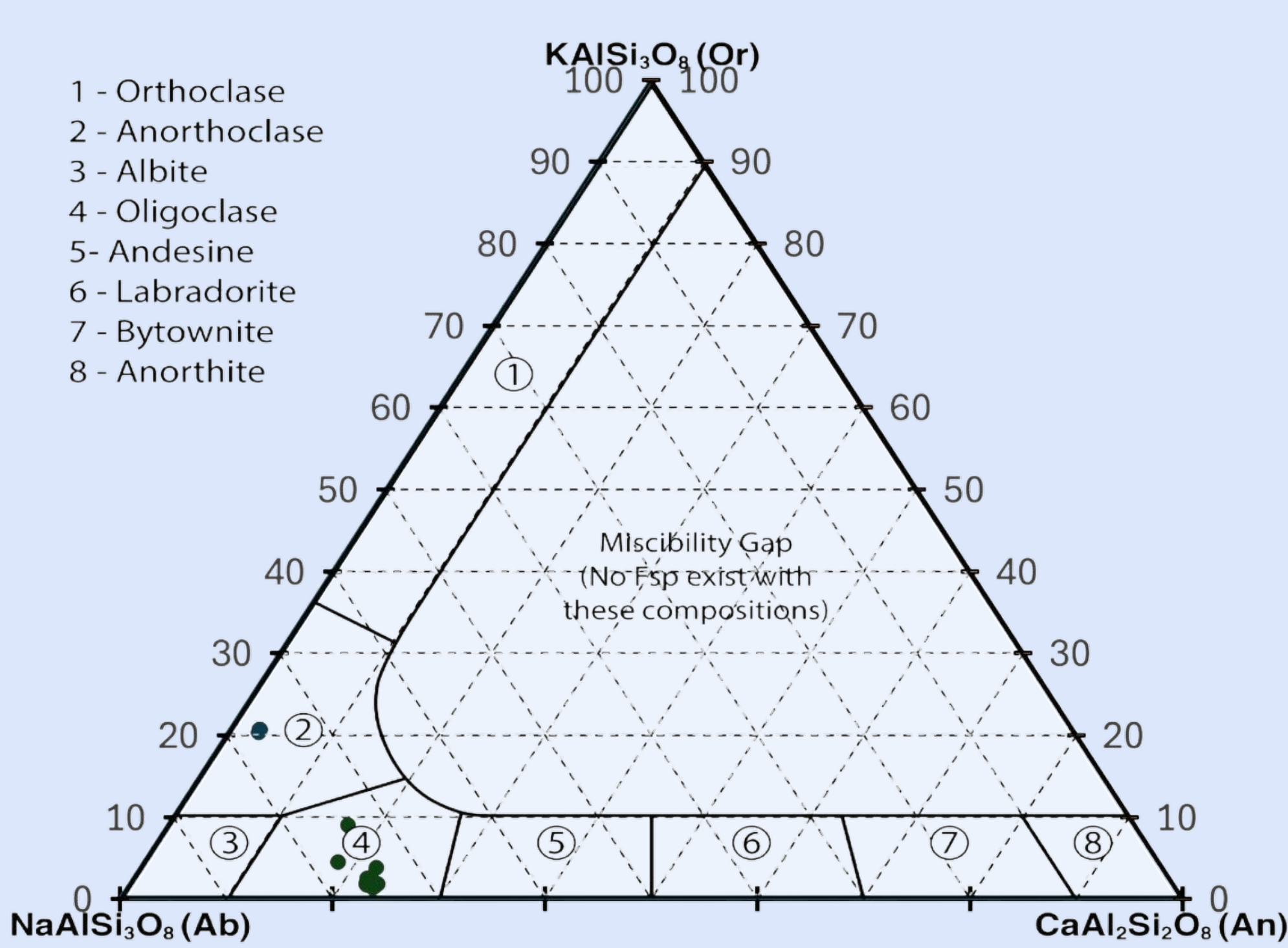
EMPA Garnet Image



Mica Classification



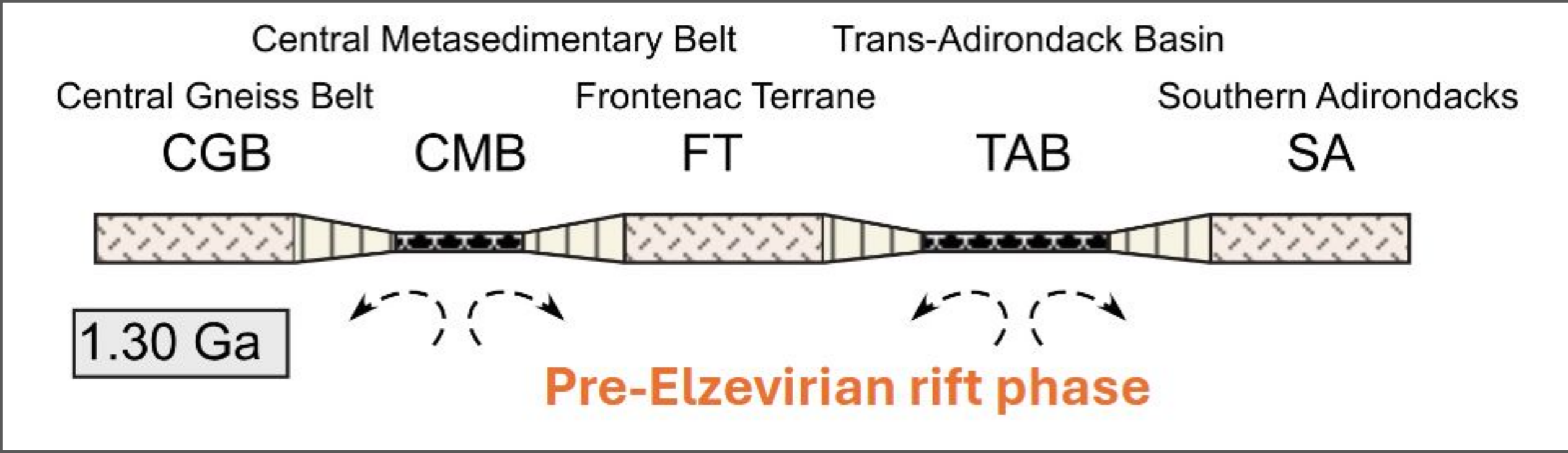
Garnet Classification



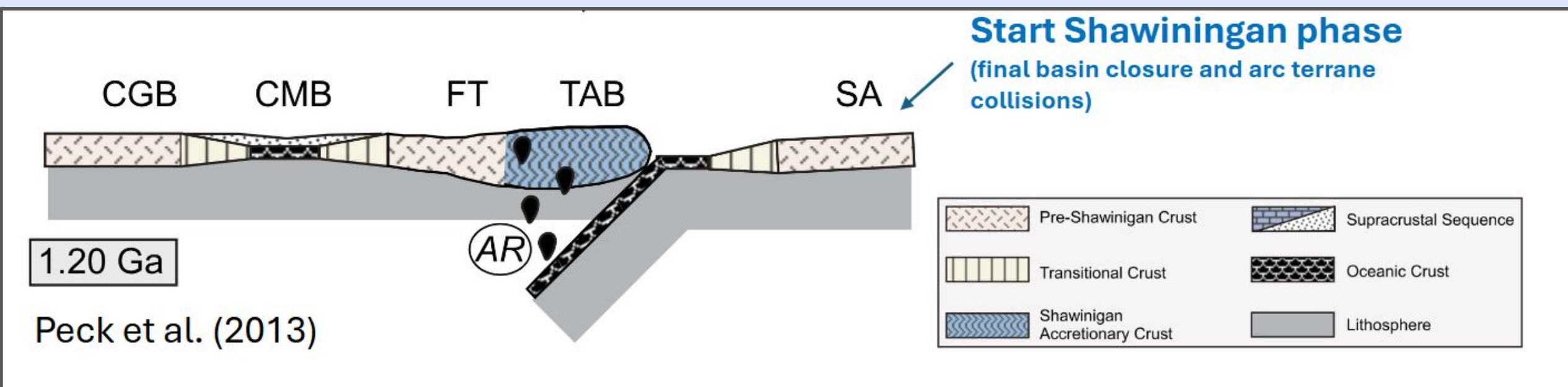
Feldspar Classification

Discussion & Interpretation

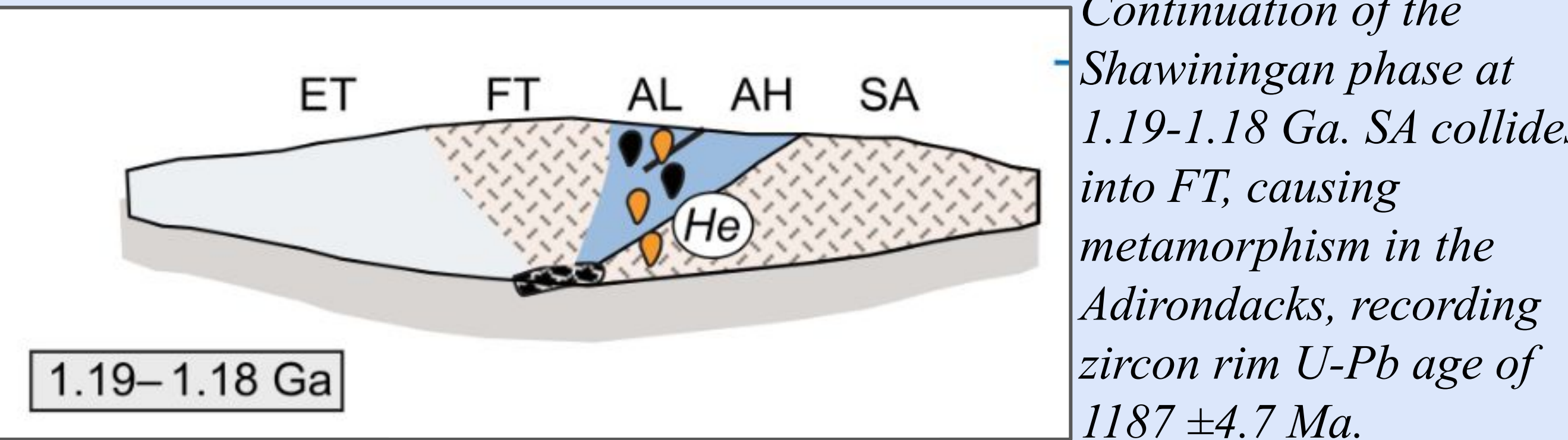
The U-Pb zircon ages obtained were 1322.7 ± 2.7 Ma for the cores and 1187 ± 4.7 Ma for the rims. 1322.7 Ma correlates to deposition during the Pre-Elzevirian rift phase with the opening of the Trans-Adirondack Basin. 1187 Ma correlates to the Early Shawinigan Phase with the closure of the basin and underthrusting of sediments. Metamorphism happened during this phase and created conditions to form garnet, plagioclase, and biotite.



Start of the Adirondack region at 1.30 Ga. Trans-Adirondack Basin (TAB) begins opening, corresponding zircon core U-Pb age of 1322 ± 2.7 Ma.



Start of the Shawinigan phase of the Grenville Orogeny. Subduction begins under the Trans-Adirondack Basin, and the basin begins to close.



Continuation of the Shawinigan phase at 1.19-1.18 Ga. SA collides into FT, causing metamorphism in the Adirondacks, recording zircon rim U-Pb age of 1187 ± 4.7 Ma.

Future Work

- Interpretation of U-Pb and Lu-Hf data to reconstruct the tectonic implications and metamorphic history of the Adirondack mountains.
- Thermodynamic modeling of the Adirondack Mountains during the Grenville Orogeny.
- Thermobarometry via electromicroprobe results.

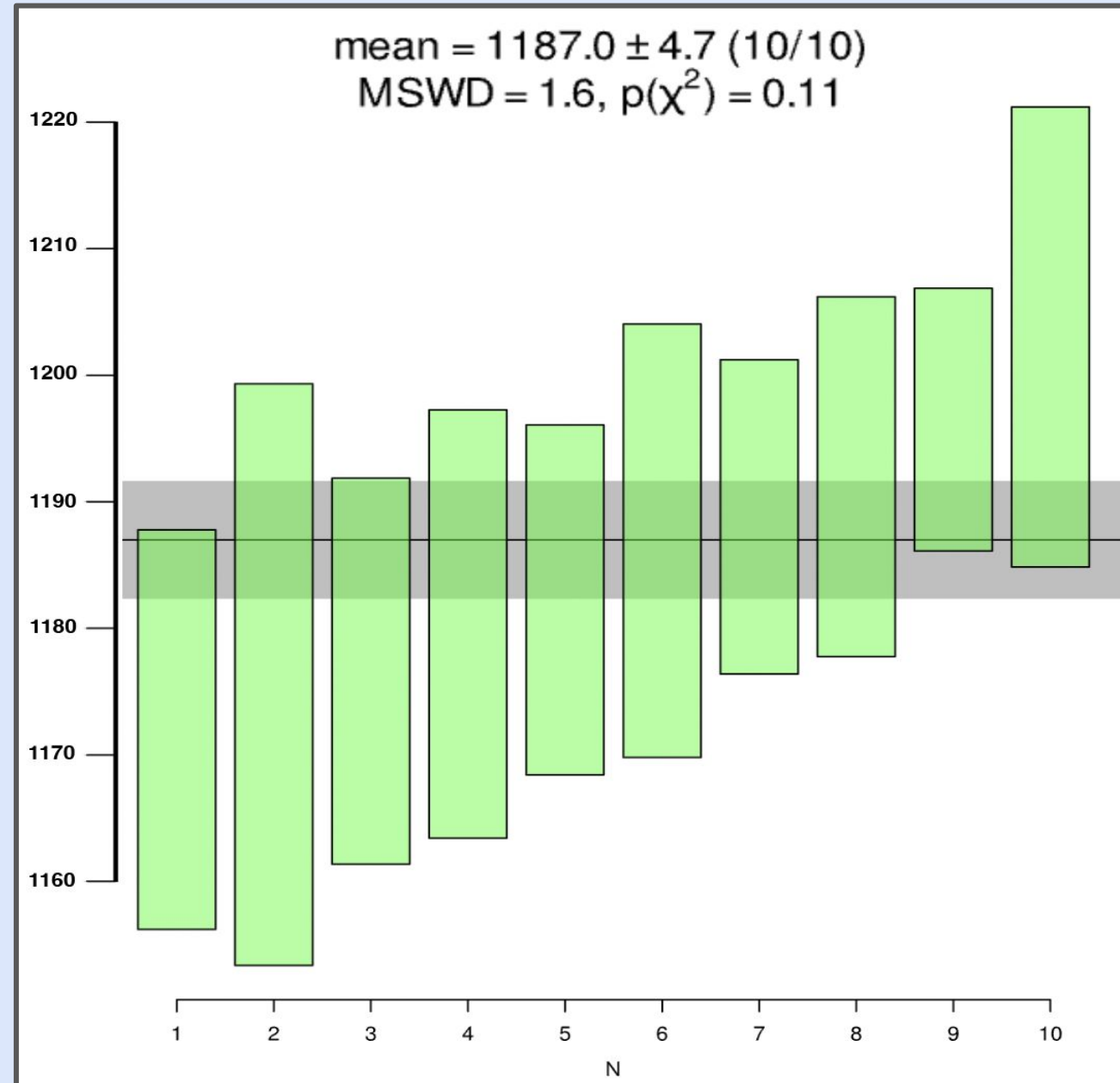
References

Peck, W. H. et al. Orogenic to post-orogenic (1.20-1.15 Ga) magmatism in the Adirondack Lowlands and Frontenac terrane, southern Grenville Province, USA and Canada. *Geosphere* 9, 1637–1663 (2013).

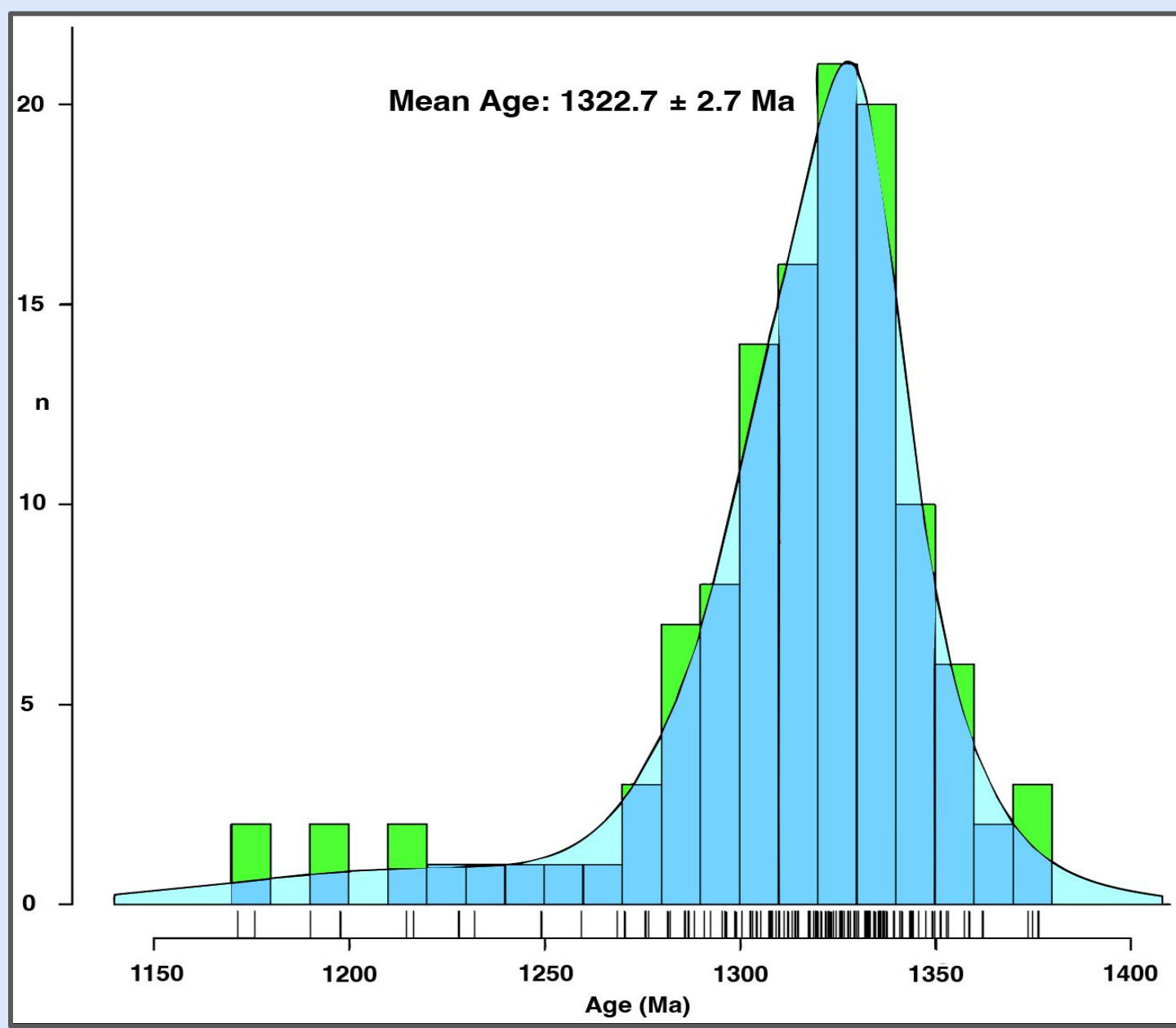
Acknowledgements

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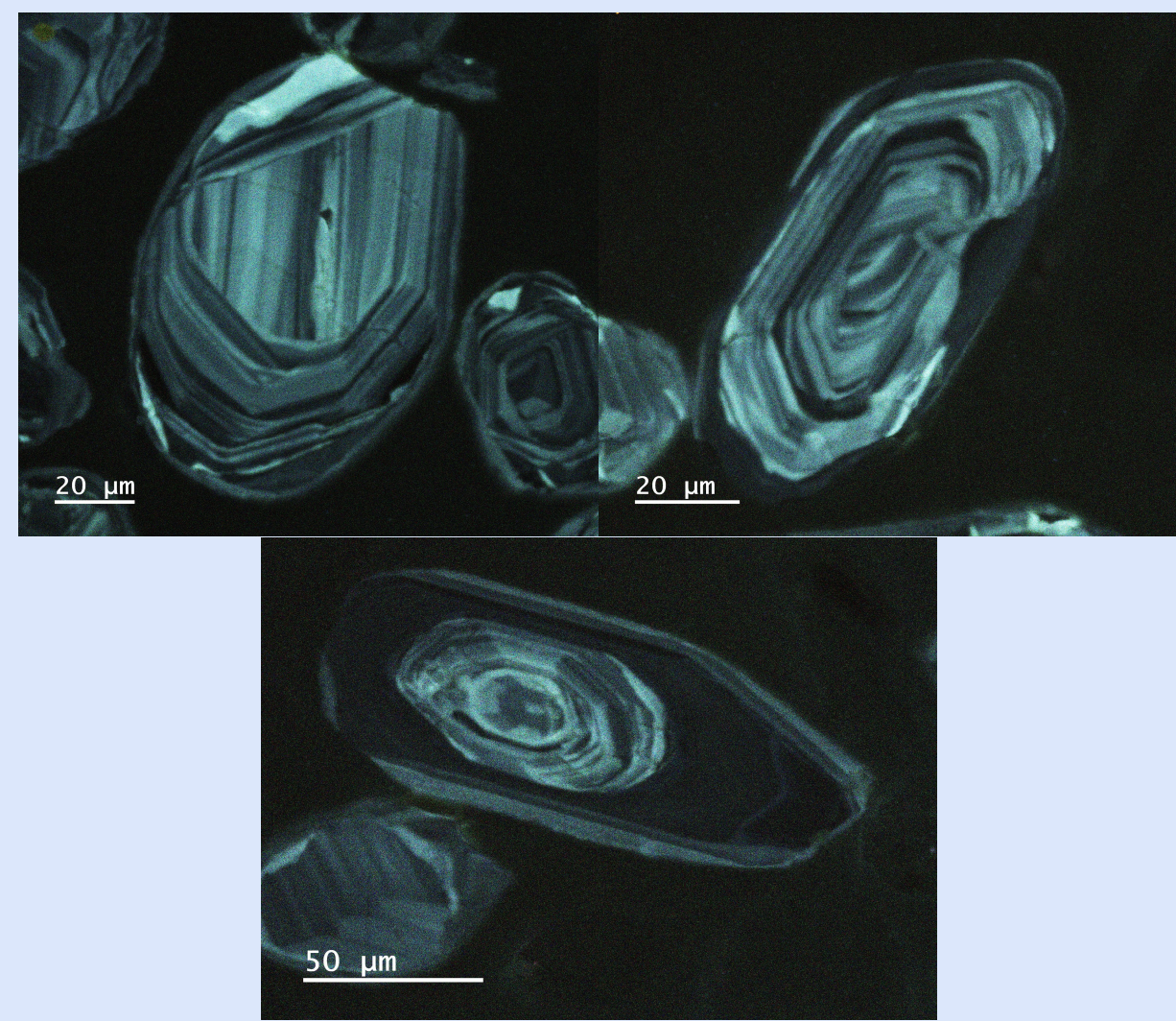
U-Pb Geochronology



Weighted mean average plot of zircon rim U-Pb ages.



Kernel density estimate (KDE) plot and age distribution histogram of zircon core U-Pb ages.



Cathodoluminescence images of zircons with cores and profound rims.

U-Pb analysis was analyzed on both zircon cores and rims. Core ages were measured using the Neptune (MC-ICP-MS) with 20 μ m spots, while metamorphic rim ages were determined using the Neoma (MC-ICP-MS) with 5 μ m spots.