

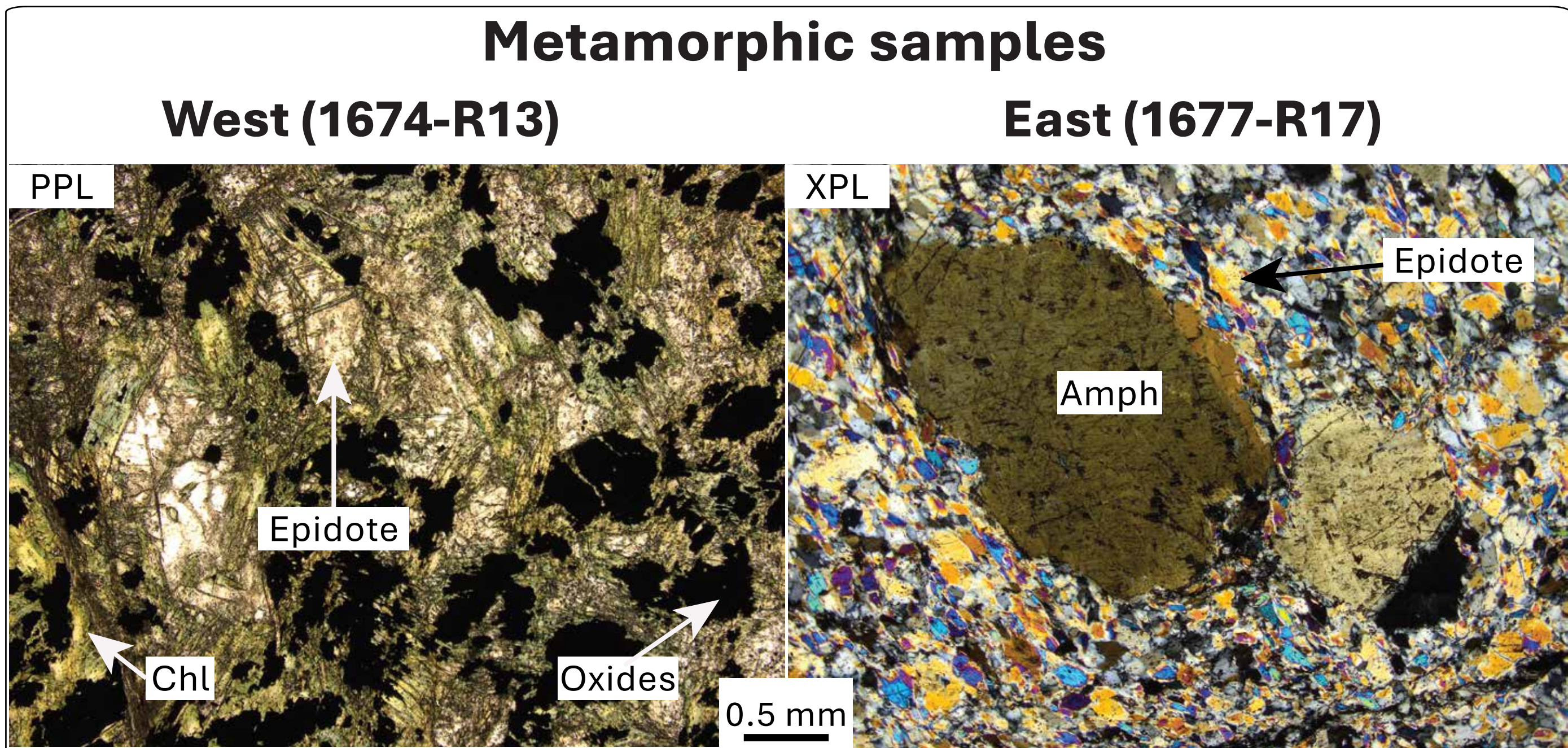
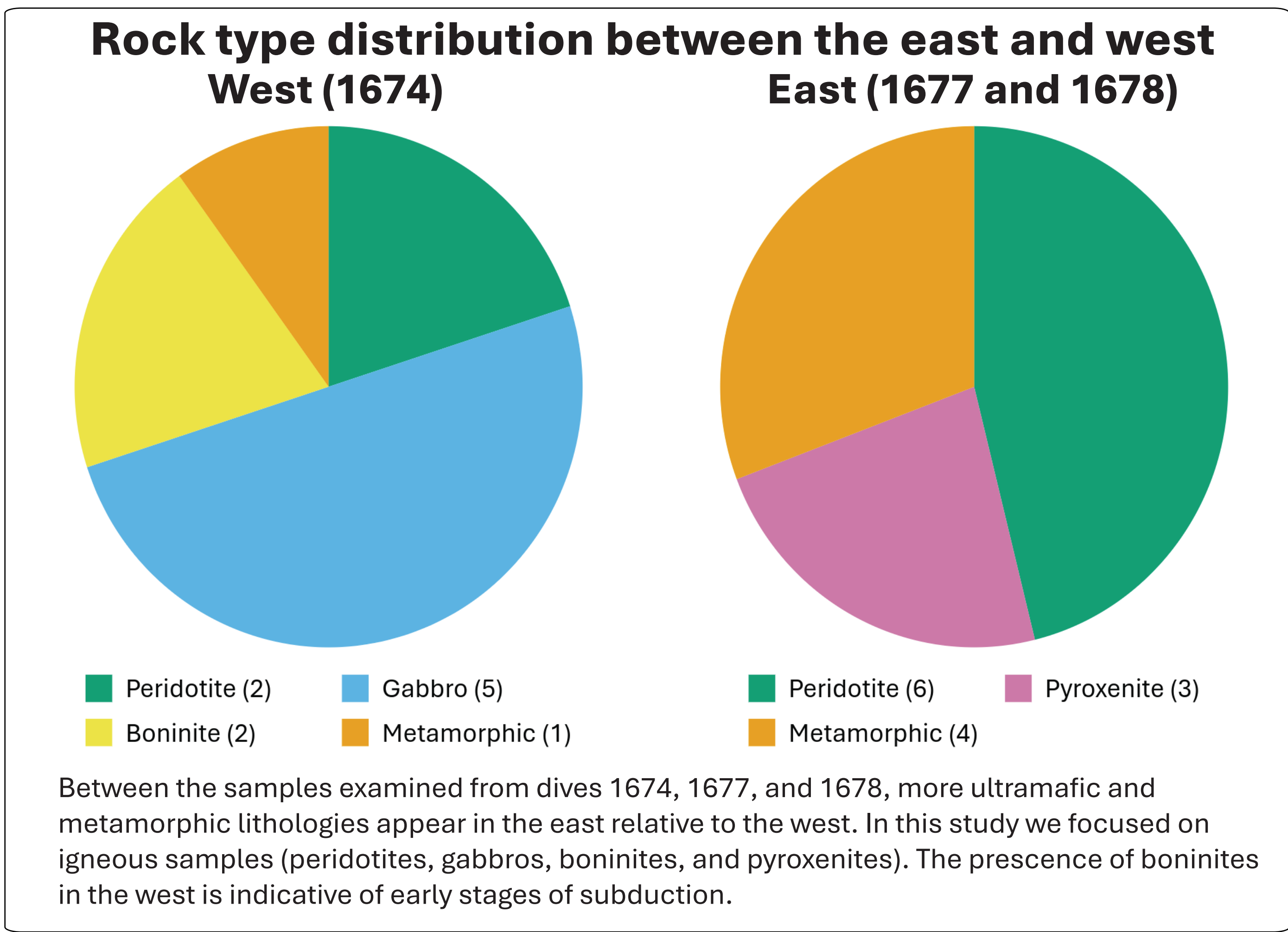
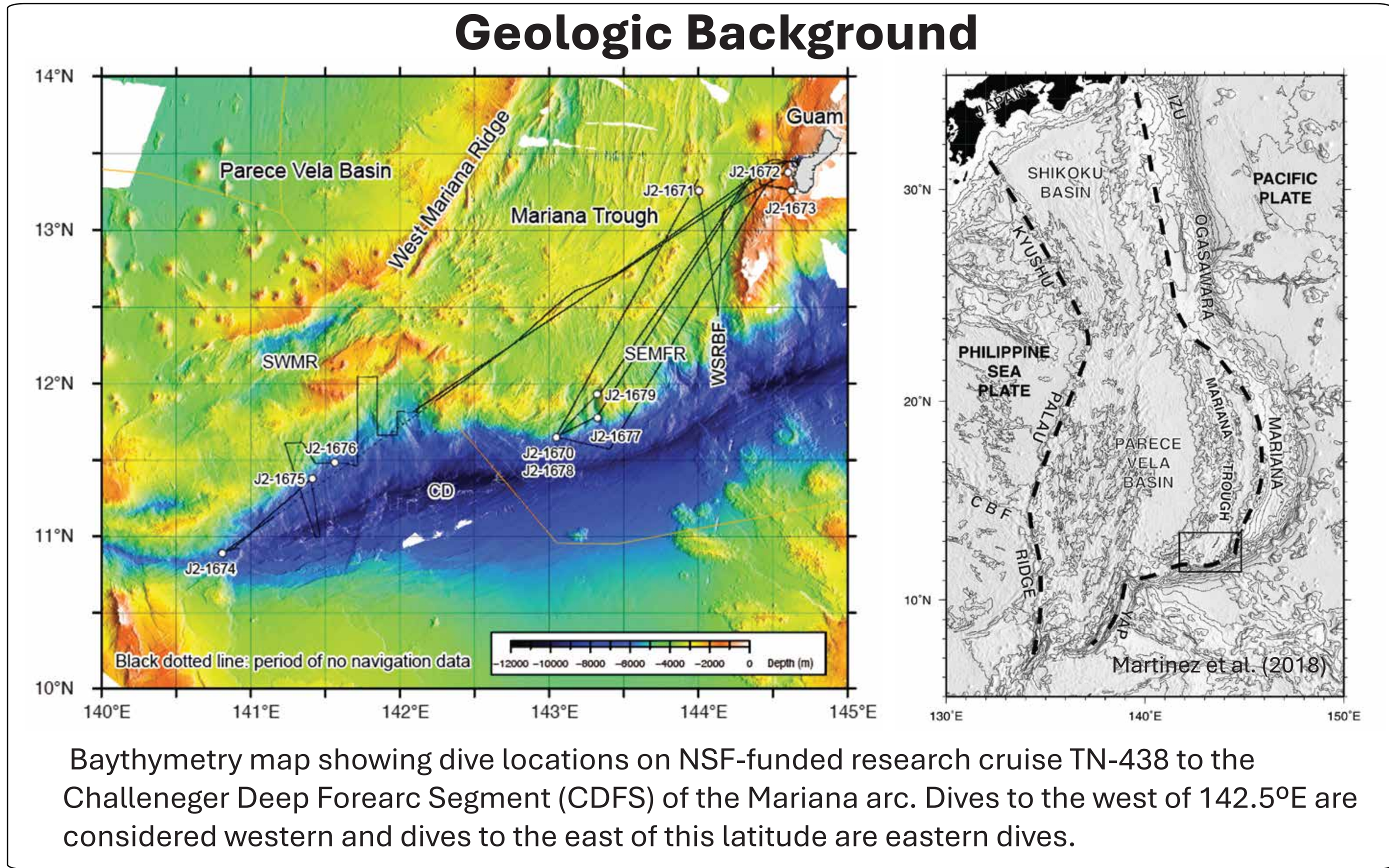
Exploring chemical variations and thermal history of the lower crust and upper mantle within the Mariana Trench: Signatures of subduction?

Emily N. Etheridge¹, Nicholas J. Dygert¹, Molly Anderson², Anah Bogdan¹, Emily J. Chin³, Yumiko Harigane⁴, George Denny¹, Véronique Le Roux⁵, Matt Leybourne⁶, Yasuhiko Ohara⁷, Tomoyo Okumura⁸, Ignacio Pujana⁹, George Segee-Wright¹⁰, and Robert J. Stern⁹

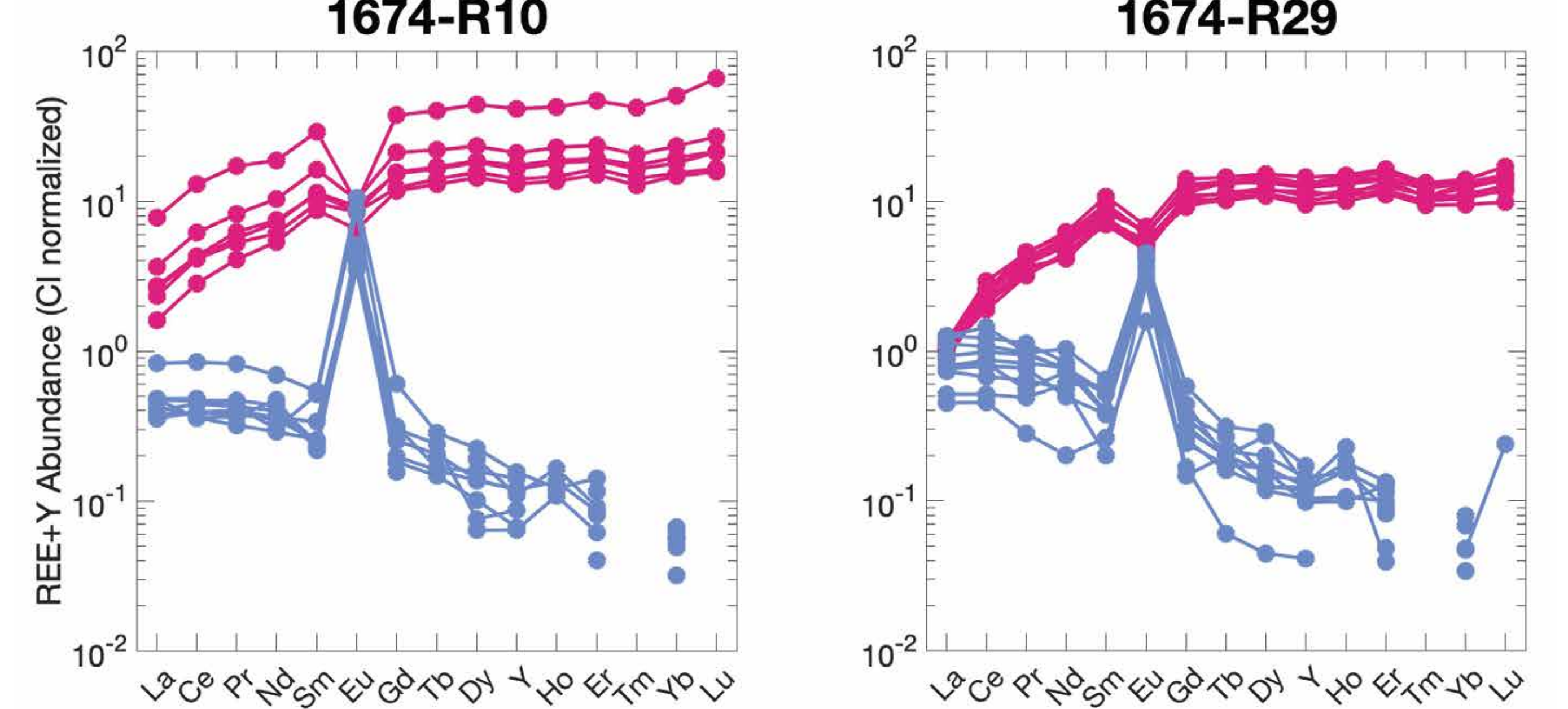
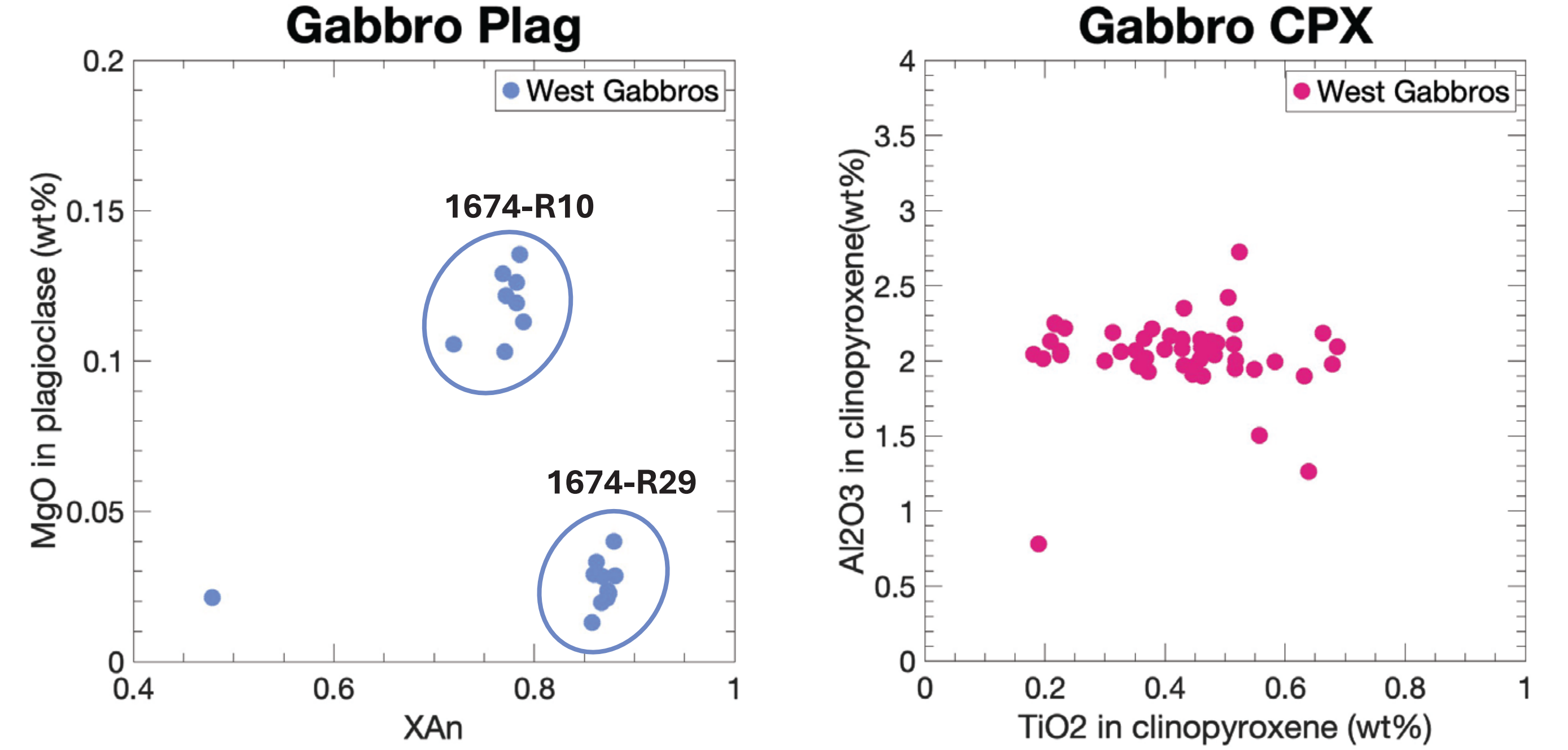
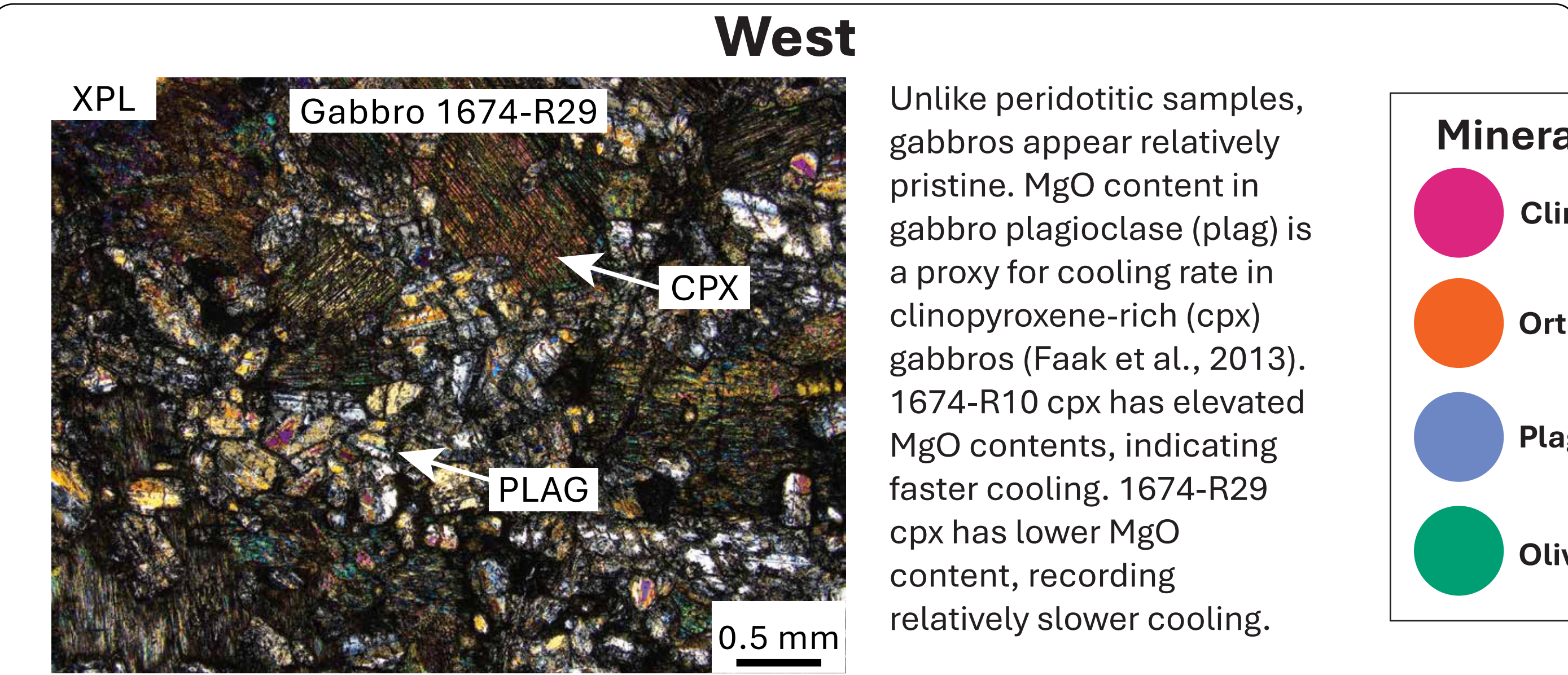
¹Department of Earth, Environmental and Planetary Sciences, University of Tennessee; ²Woods Hole Oceanographic Institution; ³UC San Diego, Scripps Institution of Oceanography; ⁴Geologic Survey of Japan; ⁵Centre de Recherches Pétrographiques et Géochimiques; ⁶Queen's University; ⁷Hydrographic and Oceanographic Department of Japan; ⁸Kochi University; ⁹University of Texas at Dallas; ¹⁰CPRG U.Lorraine



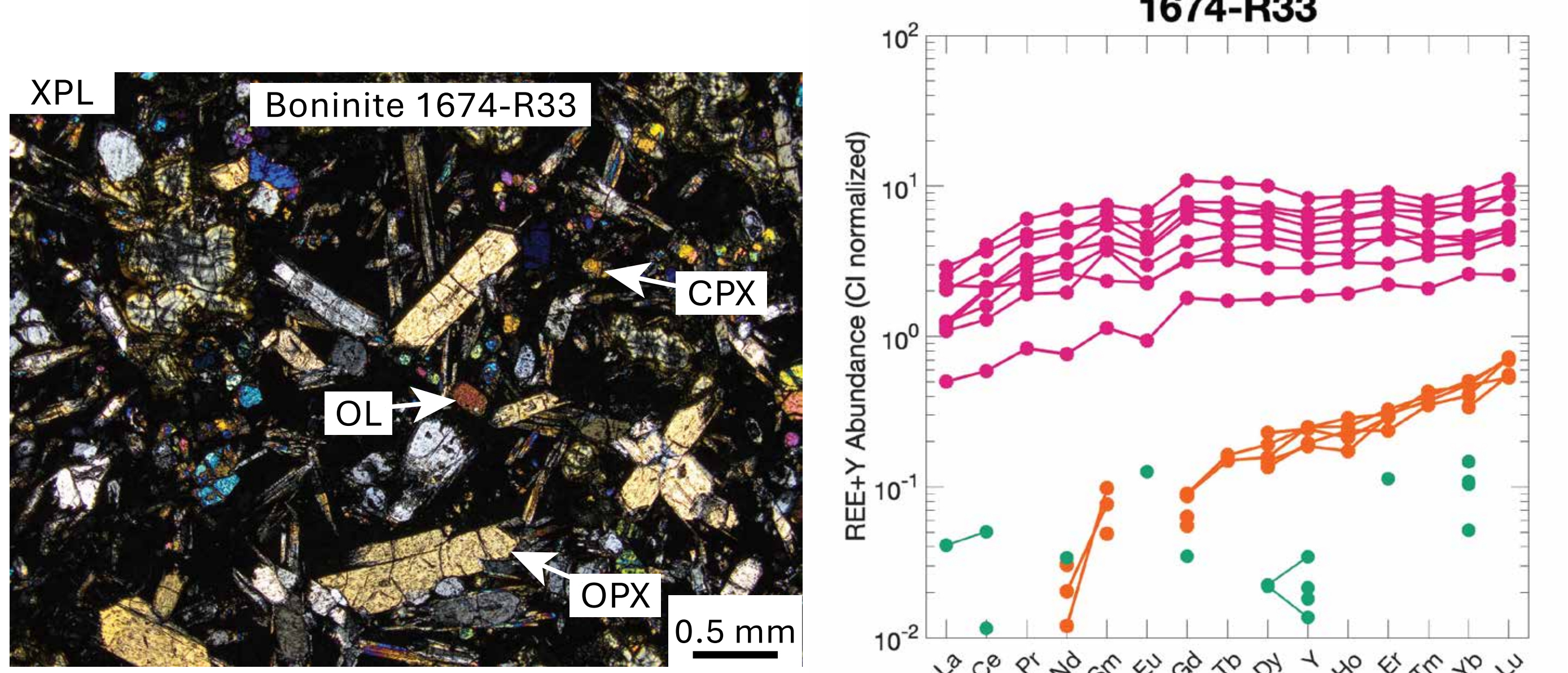
Hypothesis: Based on tectonic interpretations, more recent subduction initiation of the western component of the Challenger Deep Forearc Segment (CDFS) relative to the east will result in observable chemical heterogeneity.



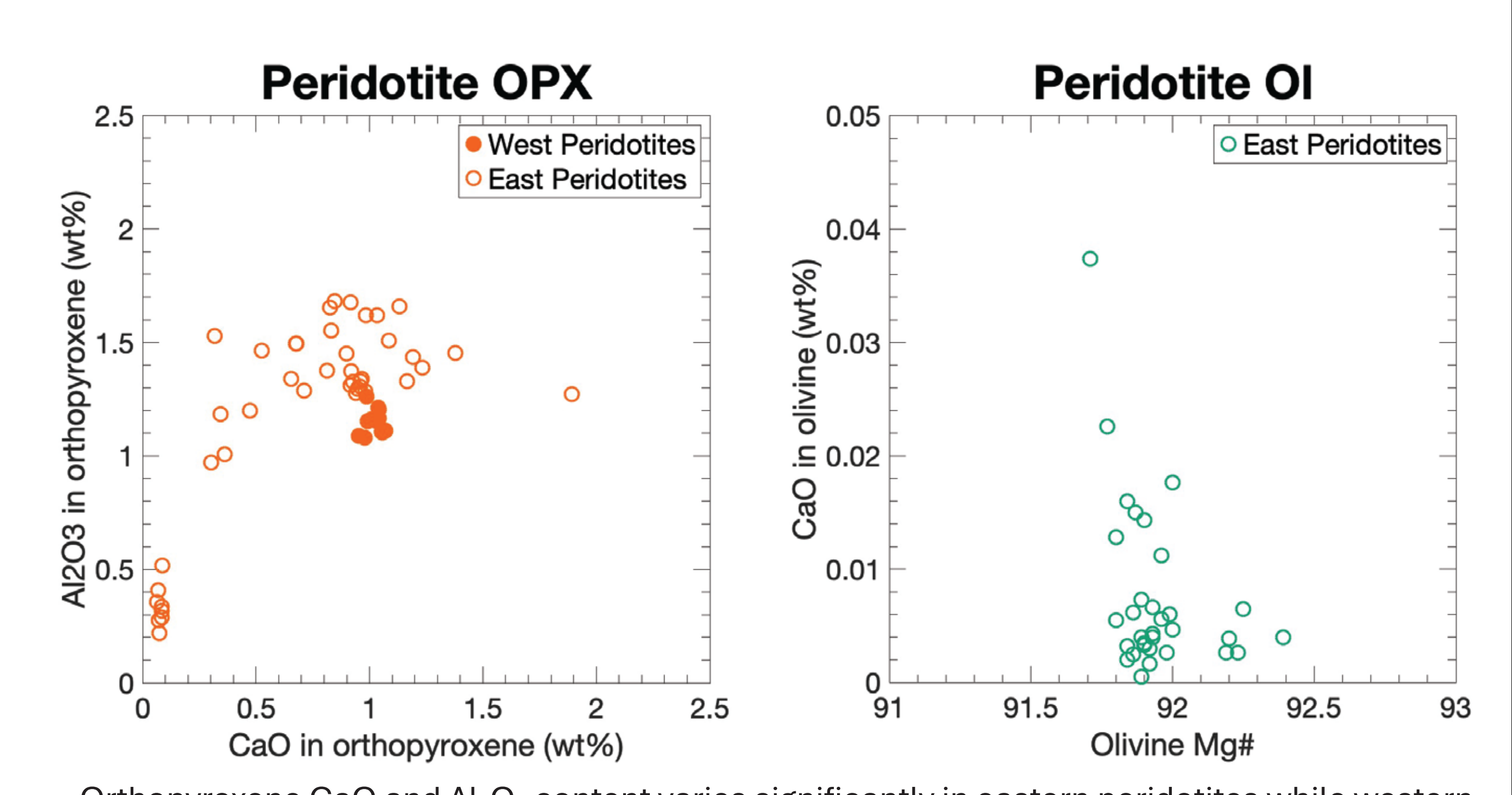
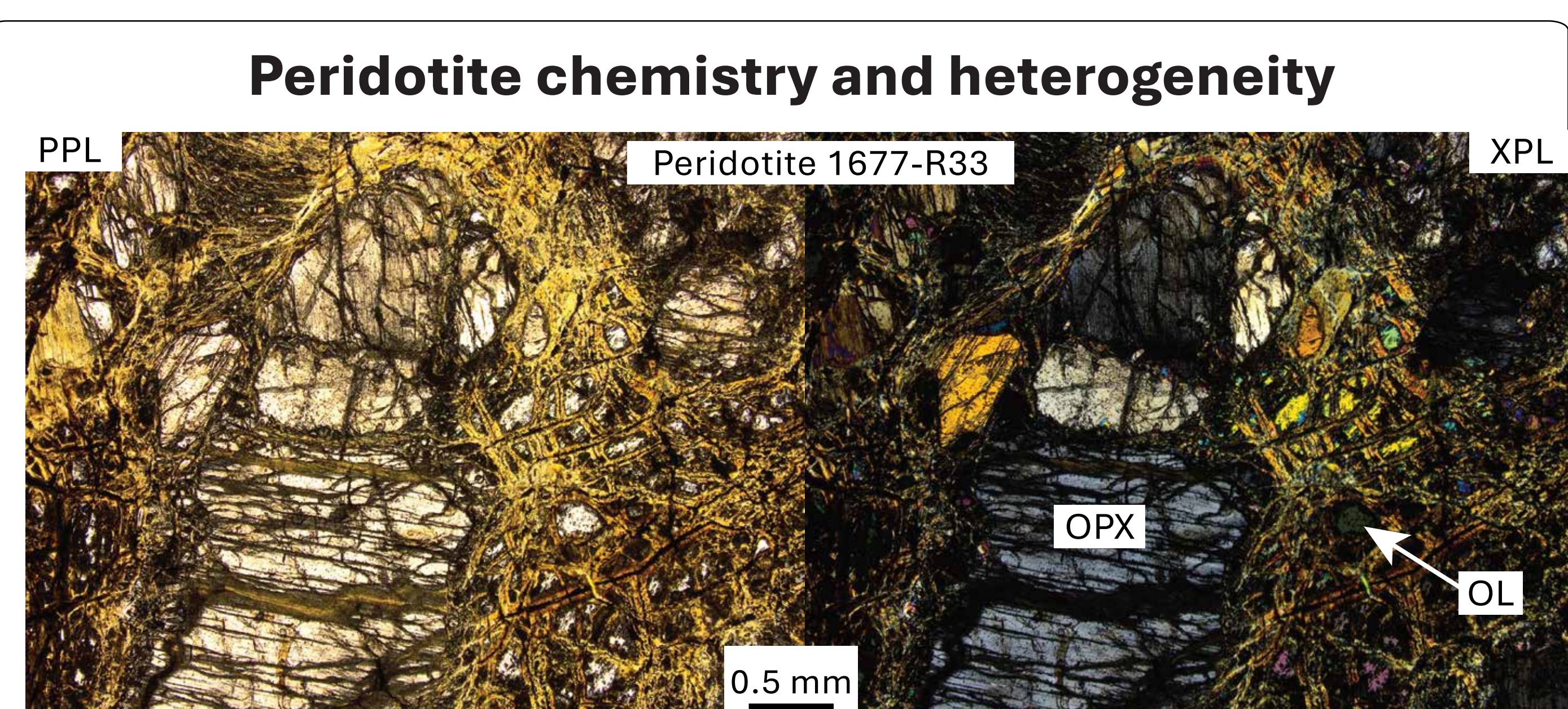
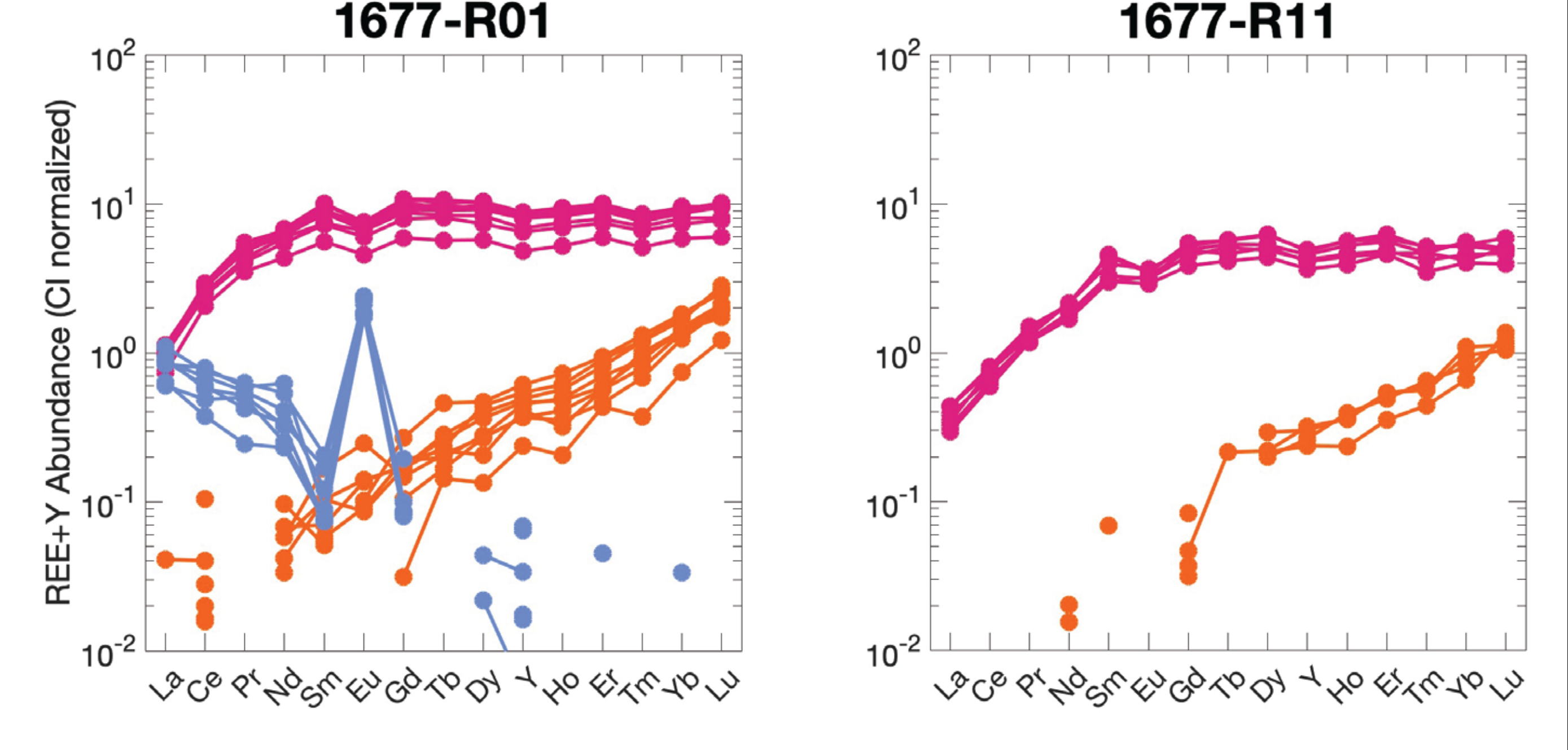
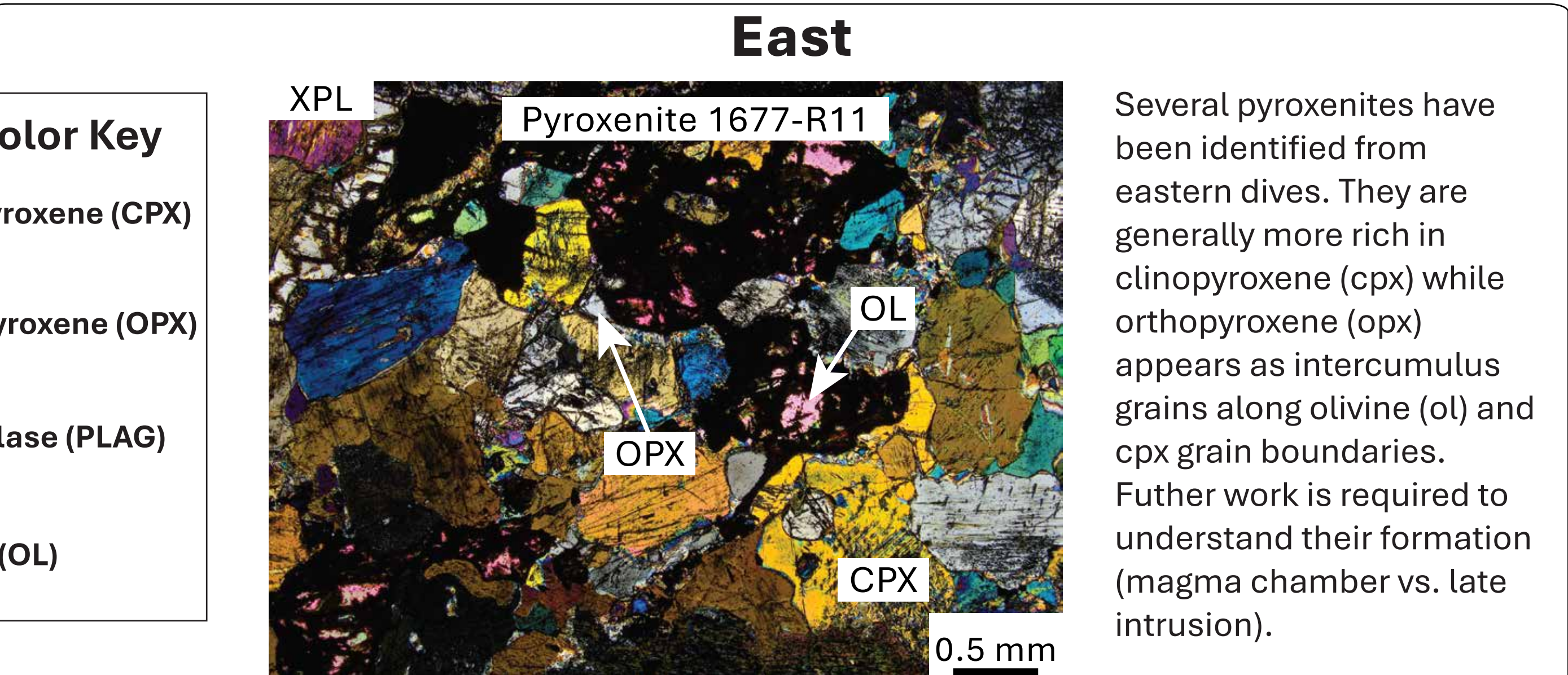
Common phases within collected metamorphic rocks include epidote, amphibole, chlorite, zoisite, clinozoisite, and various opaque phases. Metamorphic rocks have not yet been explored in depth, but further characterization will help to clarify how they were produced.



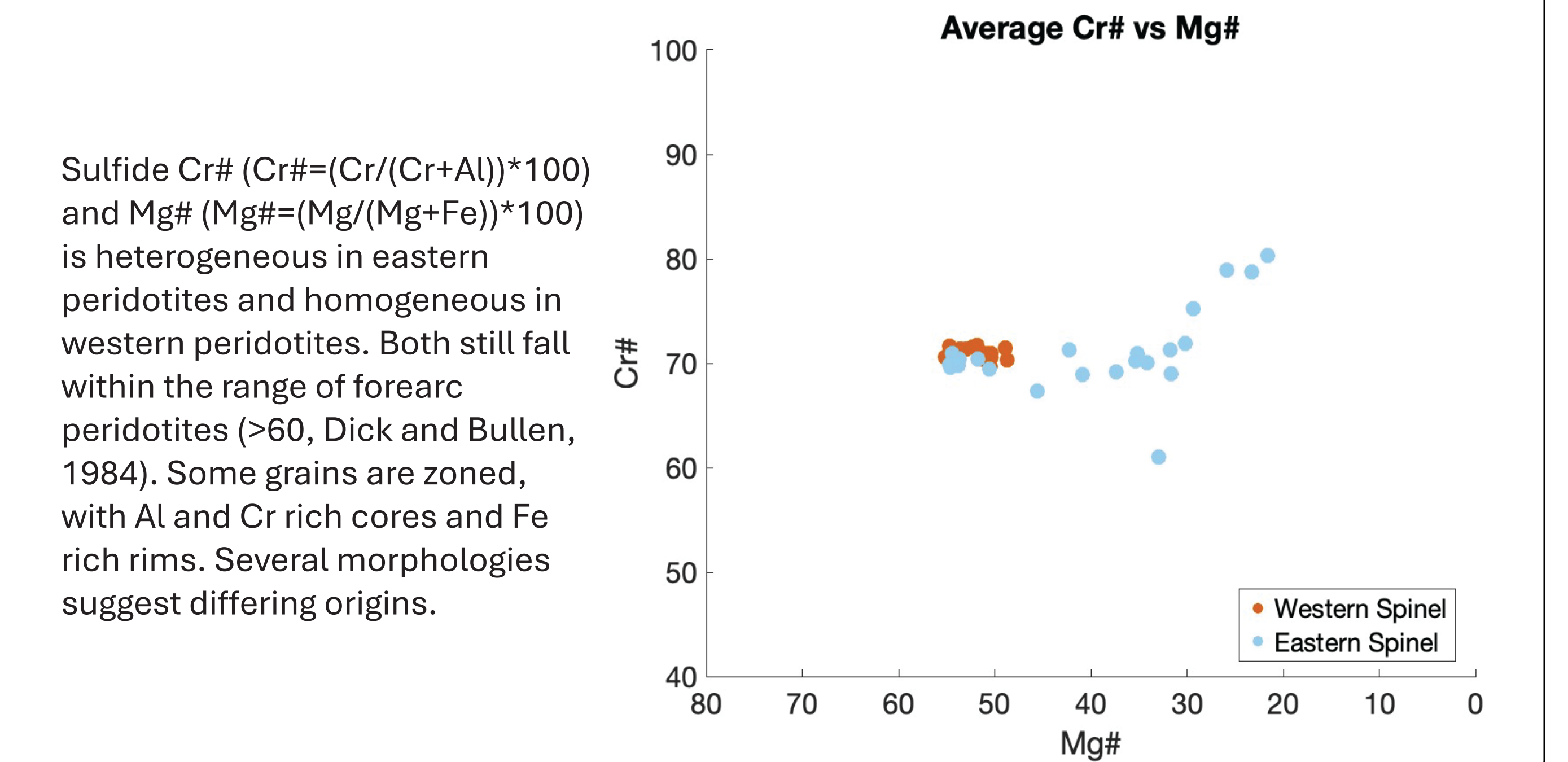
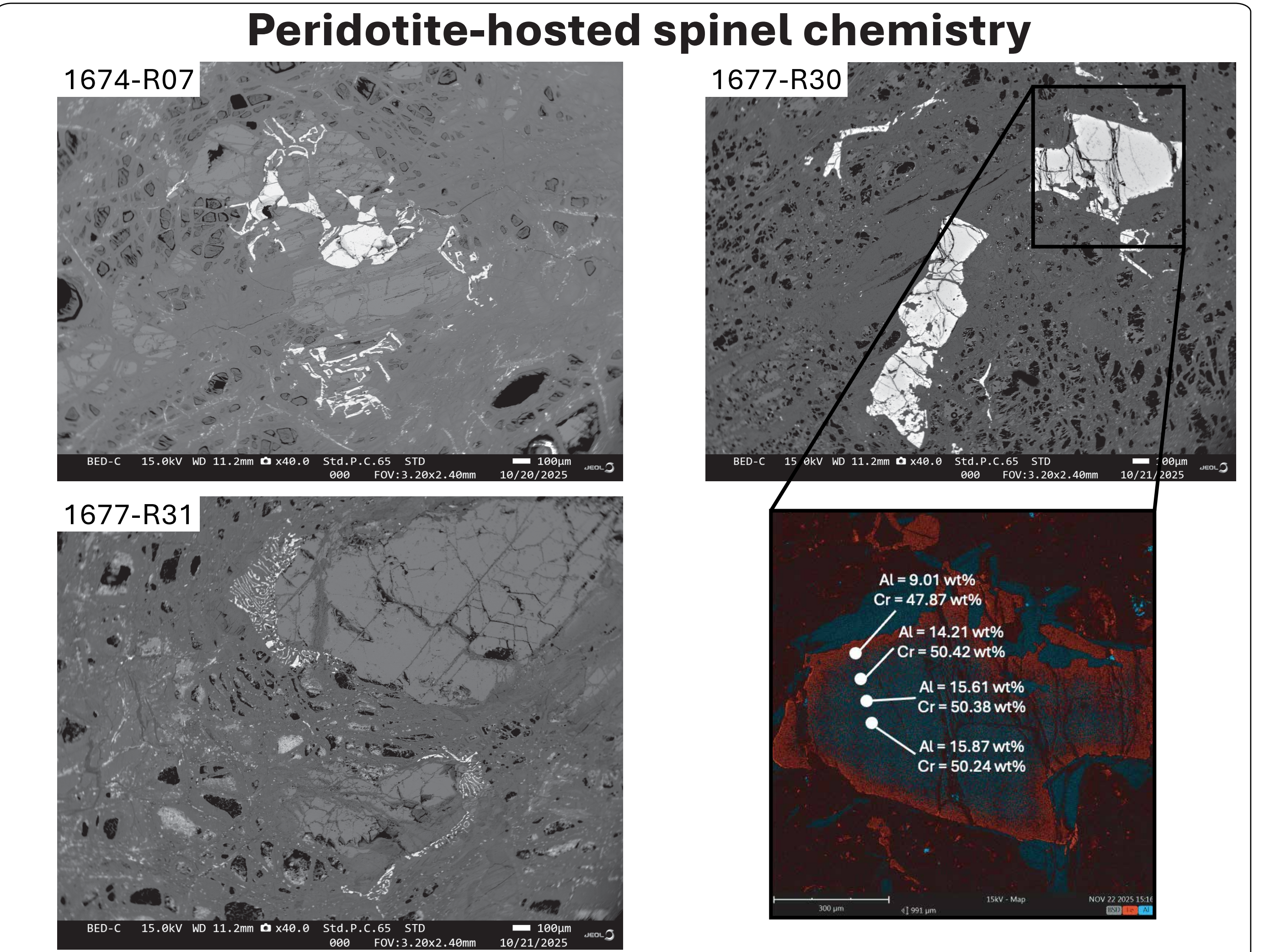
Gabbroic samples sourced from the lower crust are candidates for geothermometry and oxybarometry. 1674-R10 exhibits grain-scale variation in rare earth element (REE) abundances consistent with magmatic zonation or subsolidus reequilibration.



Boninites, a volcanic rock specific to the early stages of subduction, were collected in western dive J2-1674.



Orthopyroxene CaO and Al₂O₃ content varies significantly in eastern peridotites while western opx is homogeneous. CaO in peridotite olivine is a proxy for the extent of depletion and cooling rate. Eastern peridotite olivines have high Mg# (>91) consistent with extensive melting.



Summary and interpretations

- Metamorphic and ultramafic lithologies are more present in the eastern CDFS whereas the western returned samples favor mafic intrusive and extrusive lithologies.
- The presence of boninites in the west is consistent with more recent subduction initiation there.
- Within peridotites, high Mg# in olivines and the lack of clinopyroxene suggests depletion by extensive melting.
- Elemental variations in eastern samples suggest greater extents of depletion than in the west and subsequent metasomatic influence.
- Relative extents of depletion in eastern and western samples are consistent with E-W variations in subduction maturity.
- Future application of geothermometry, oxybarometry, and kinematic modeling will clarify the formation history of selected samples.

Acknowledgements: This work was supported by National Science Foundation award 2054551.