

Extreme Oxygen Isotope Zoning In Metasedimentary Garnet From Catalina Island, California Reveals Progressive Metasomatism During Subduction



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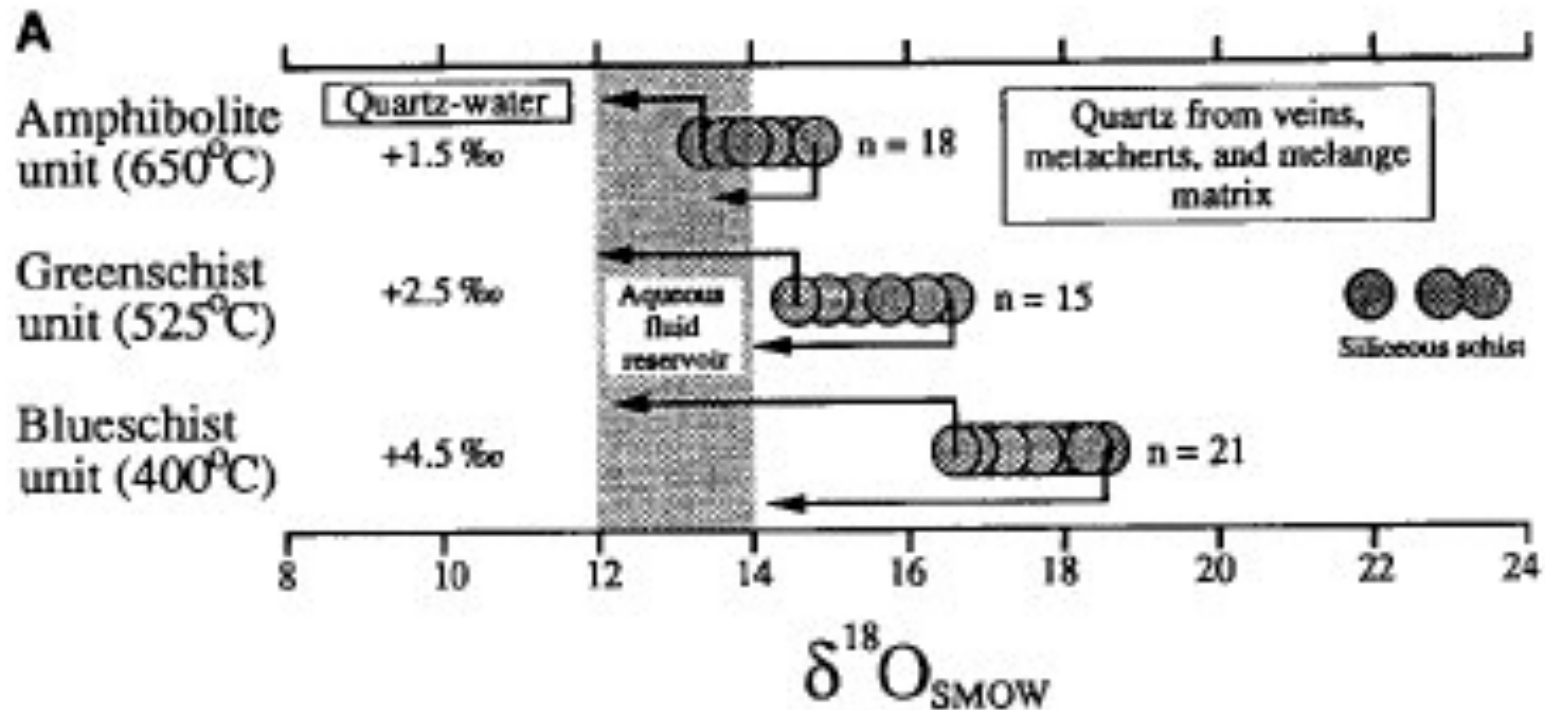
John W. Valley, Kouki Kitajima
University of Wisconsin – Madison Geoscience



Field-Based Evidence for Devolatilization in Subduction Zones: Implications for Arc Magmatism

GRAY E. BEBOUT

Science 1991



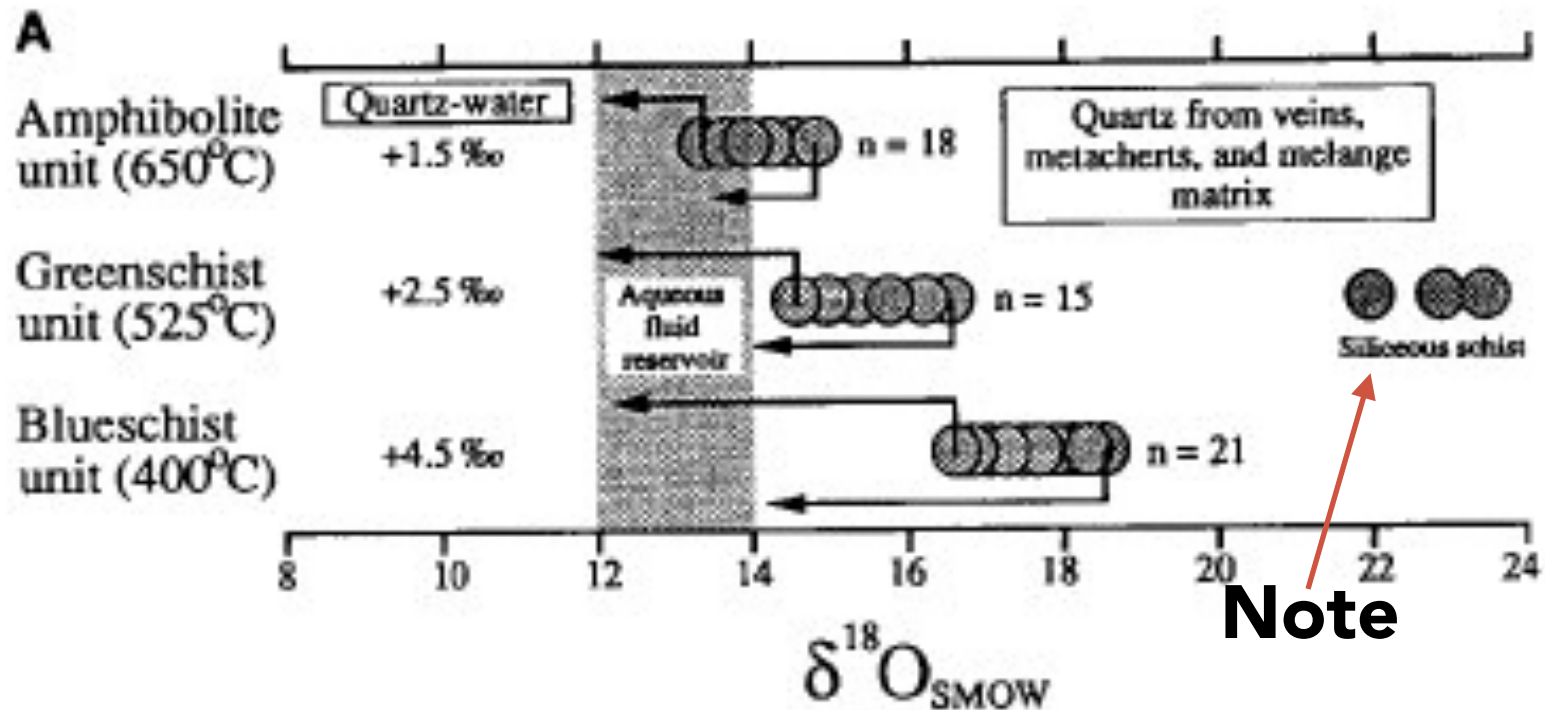
Catalina: famous laboratory for fluid flow in subduction zones

Quartz veins record a homogenous fluid on the kilometer scale

Field-Based Evidence for Devolatilization in Subduction Zones: Implications for Arc Magmatism

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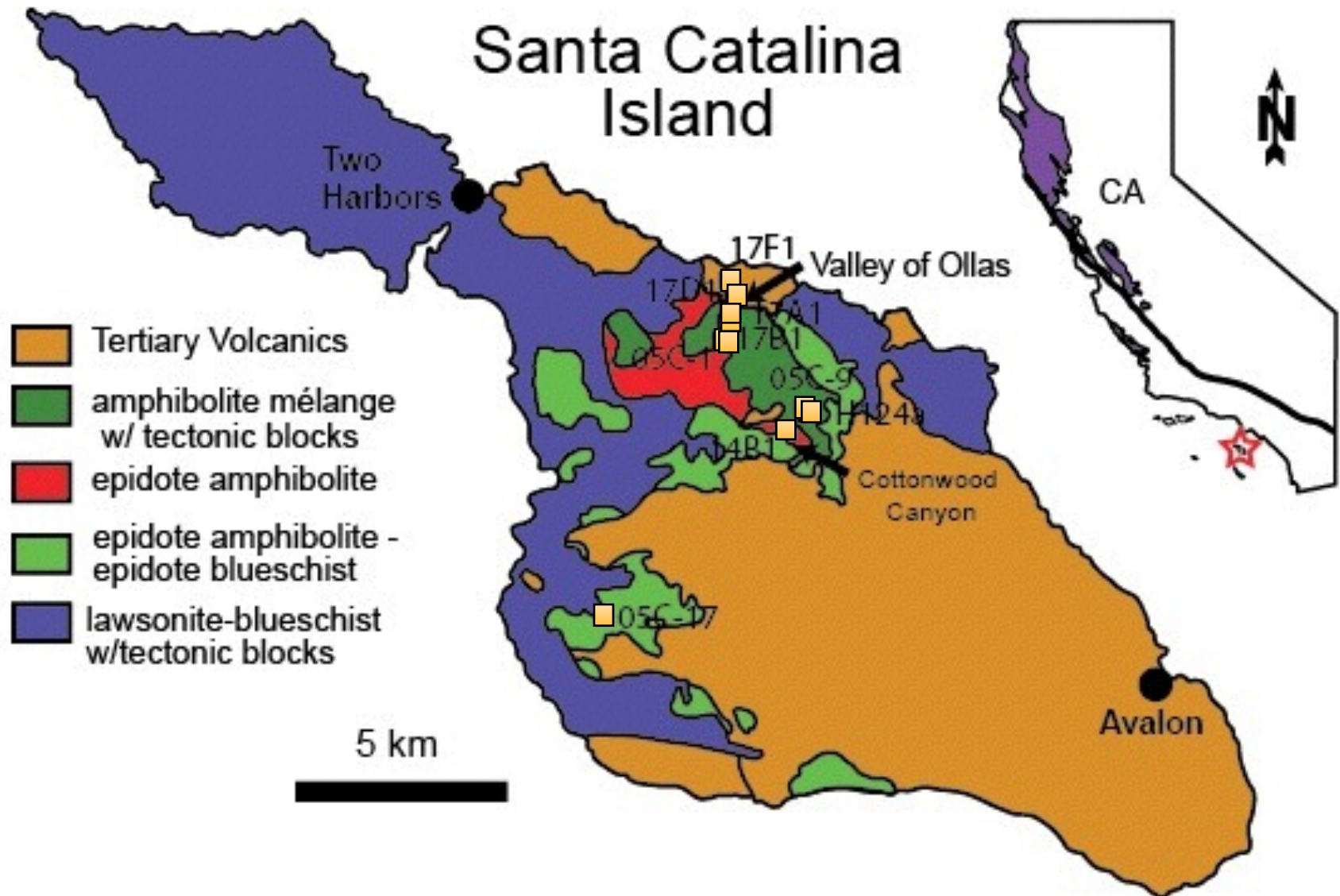
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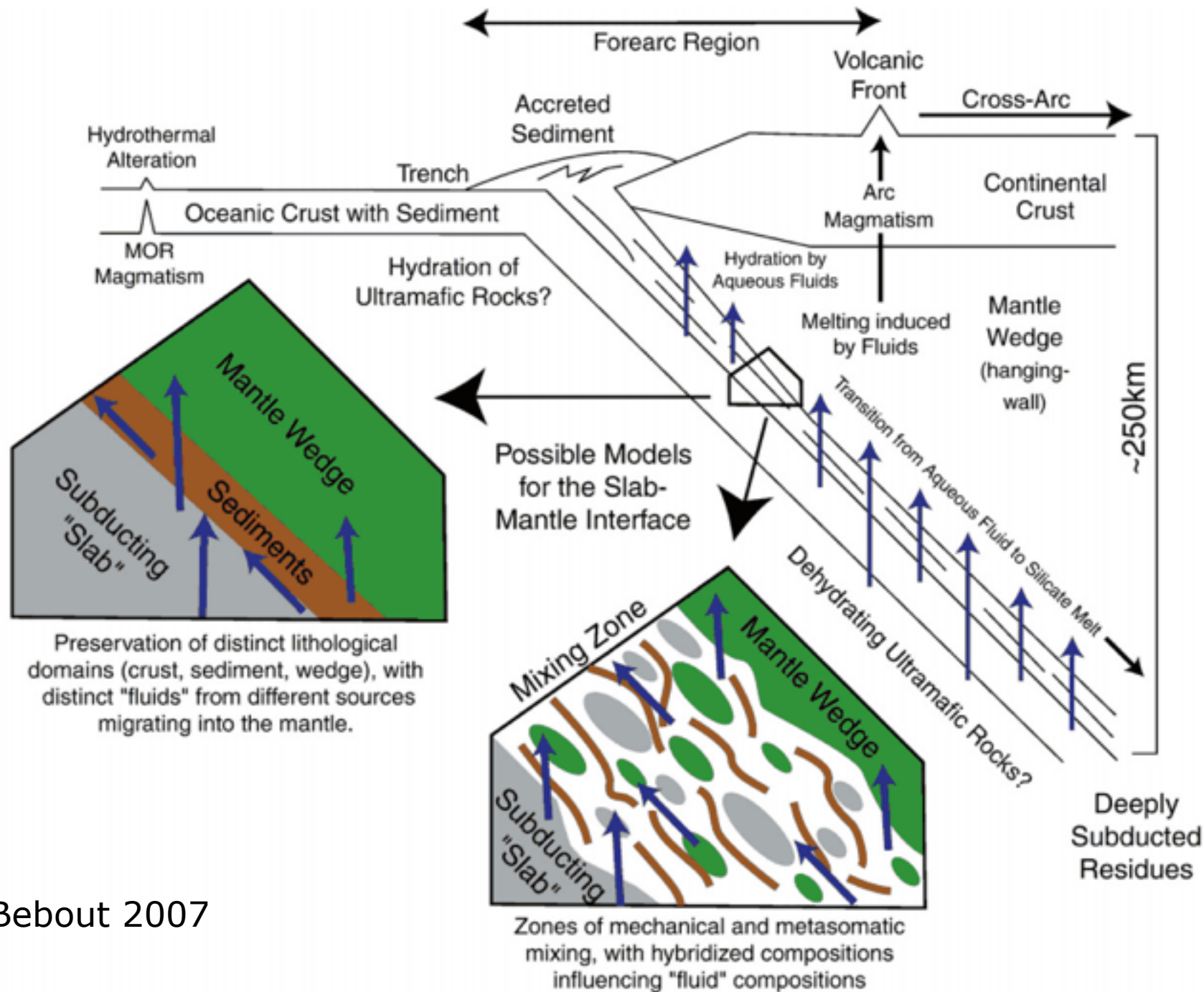
Santa Catalina Island



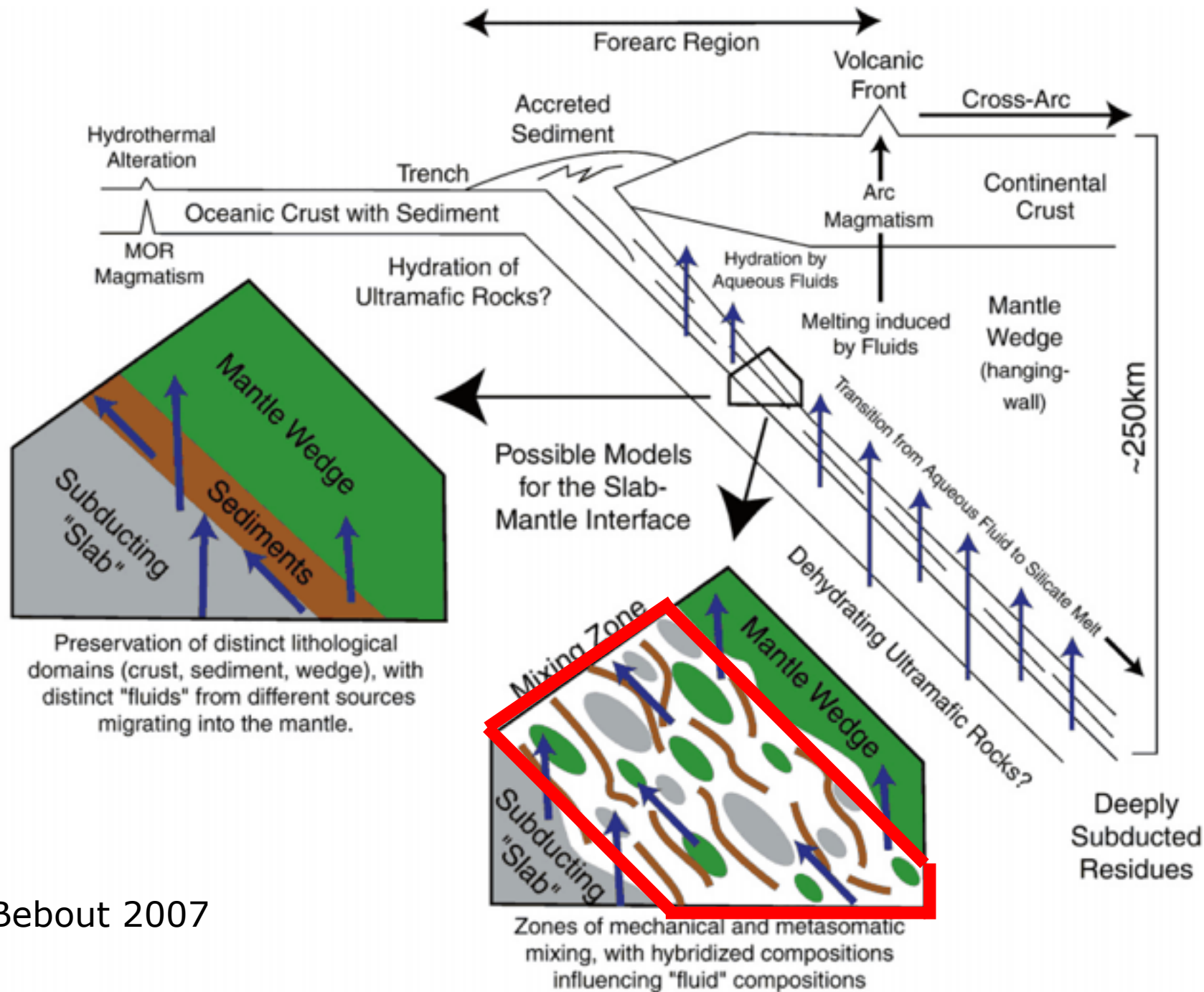


17A1 block

Amphibolite metasedimentary mélange



Bebout 2007



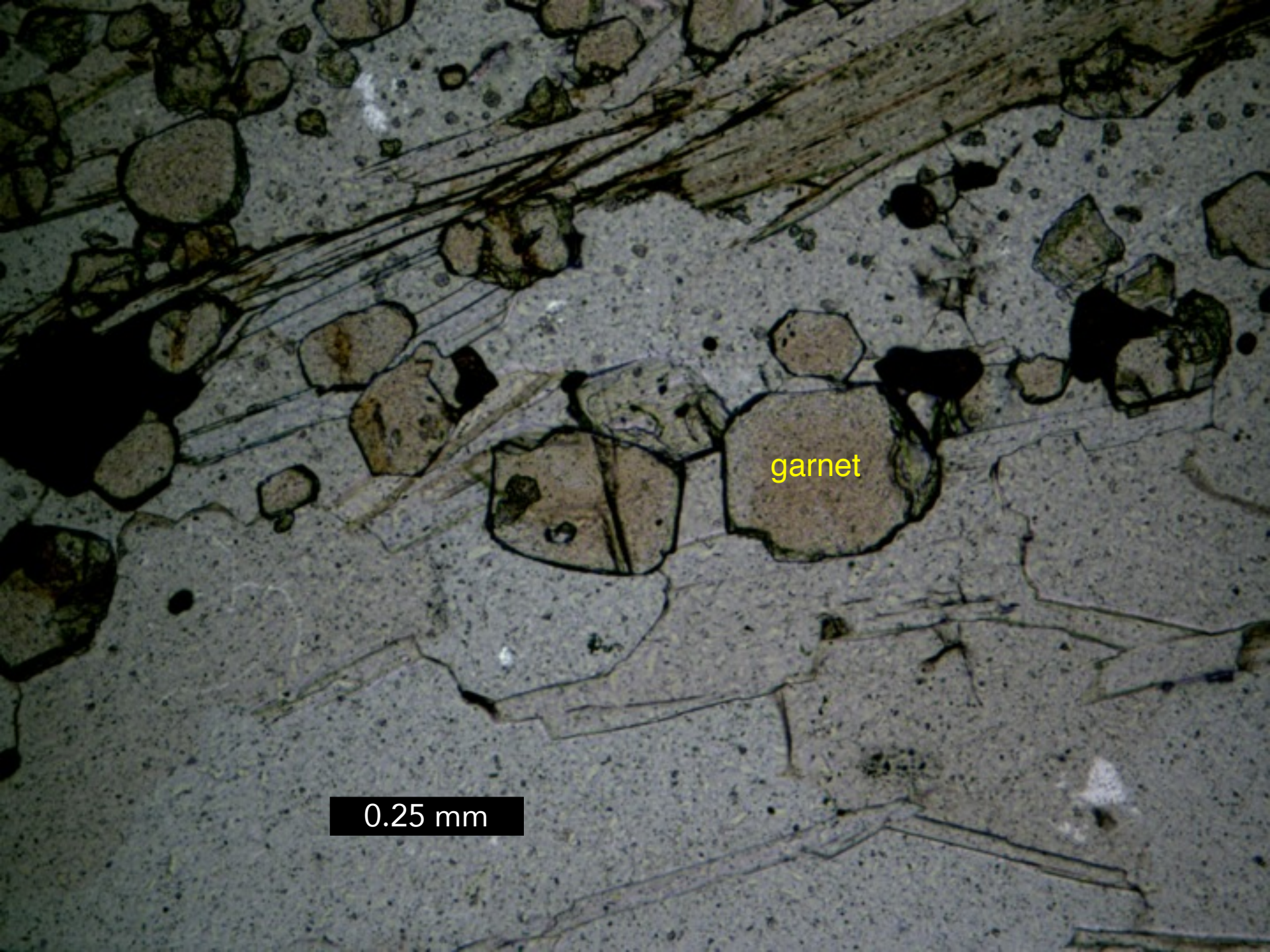
Bebout 2007



0.25 mm

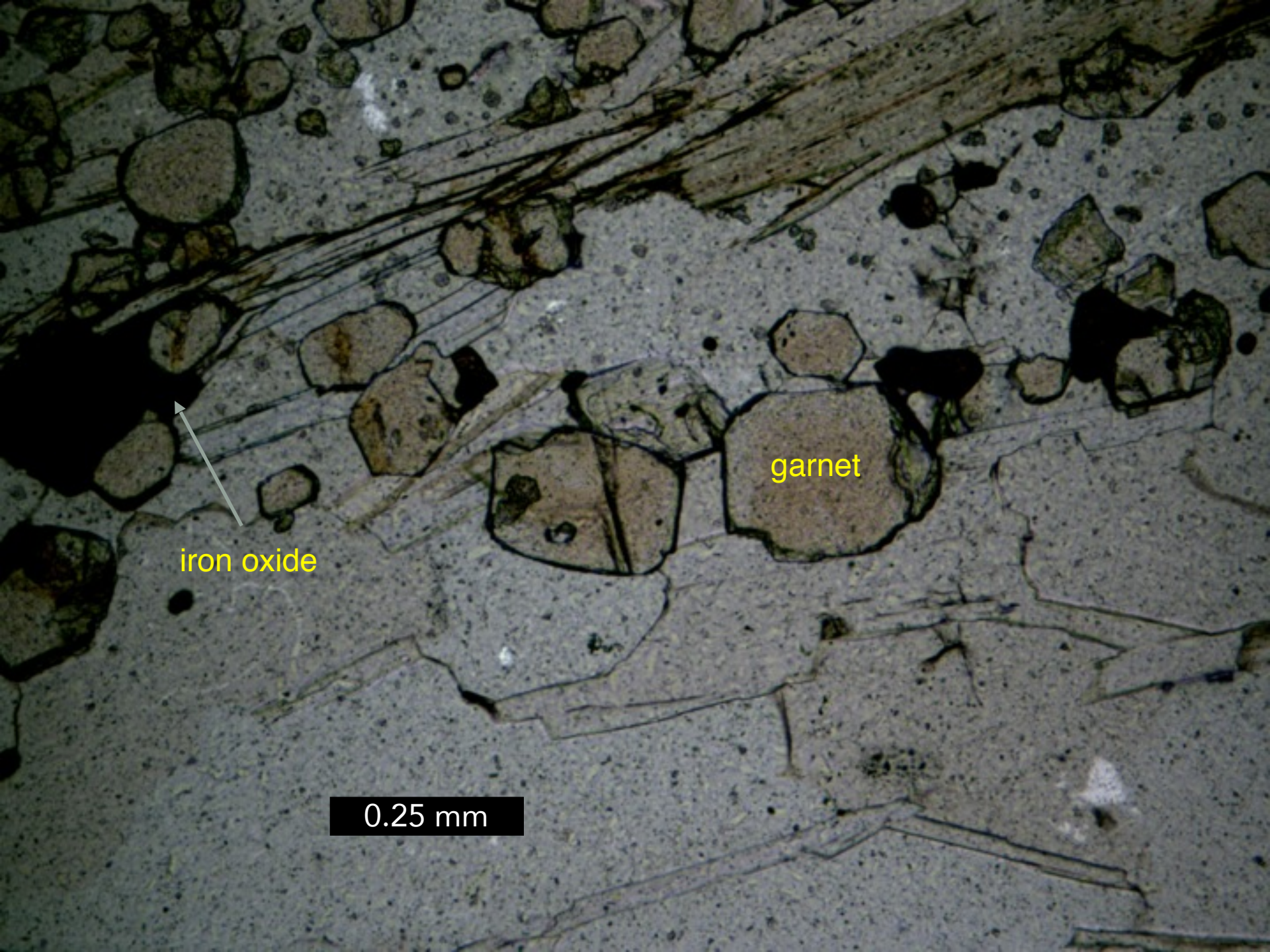


0.25 mm



garnet

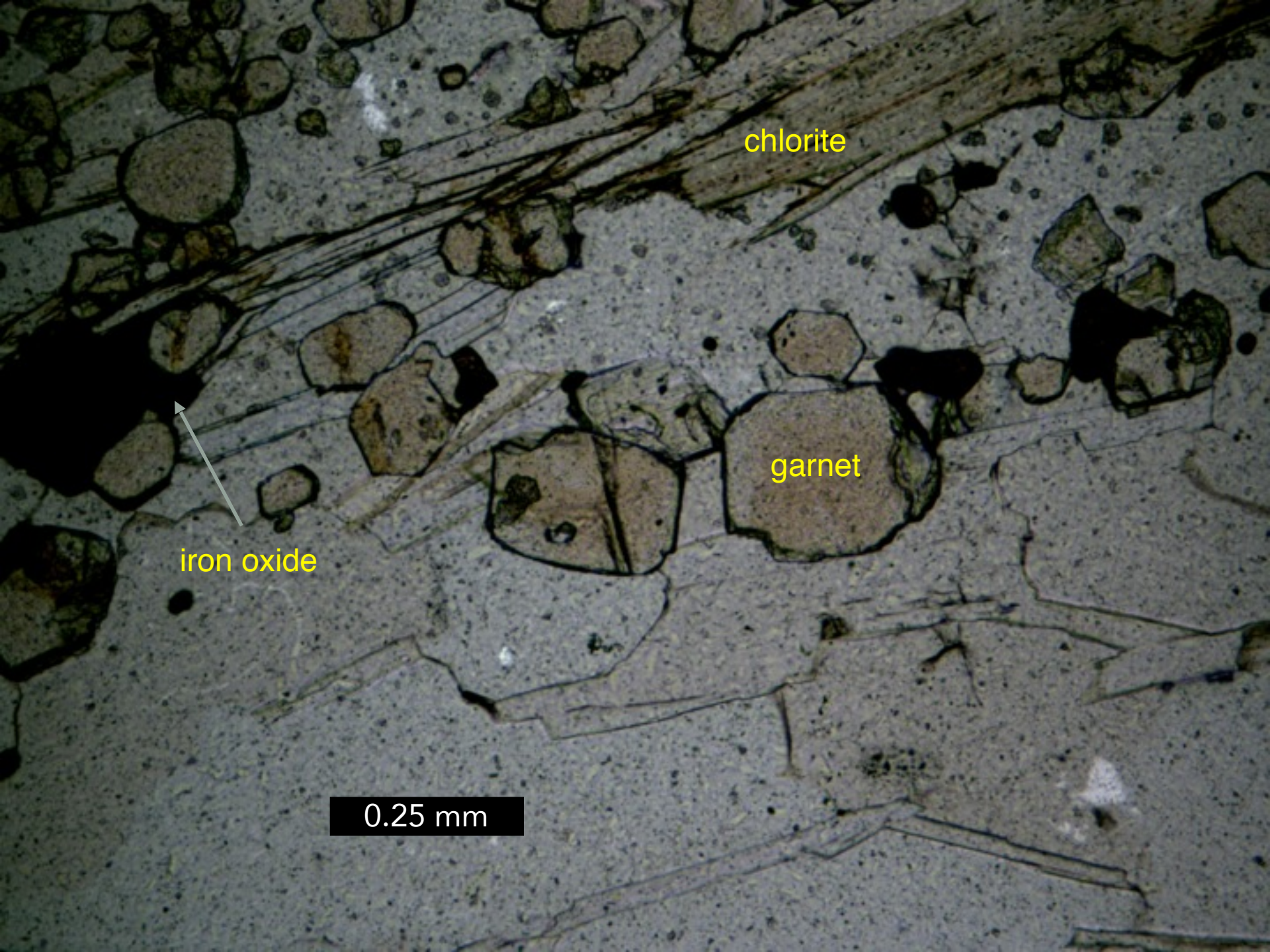
0.25 mm



garnet

iron oxide

0.25 mm

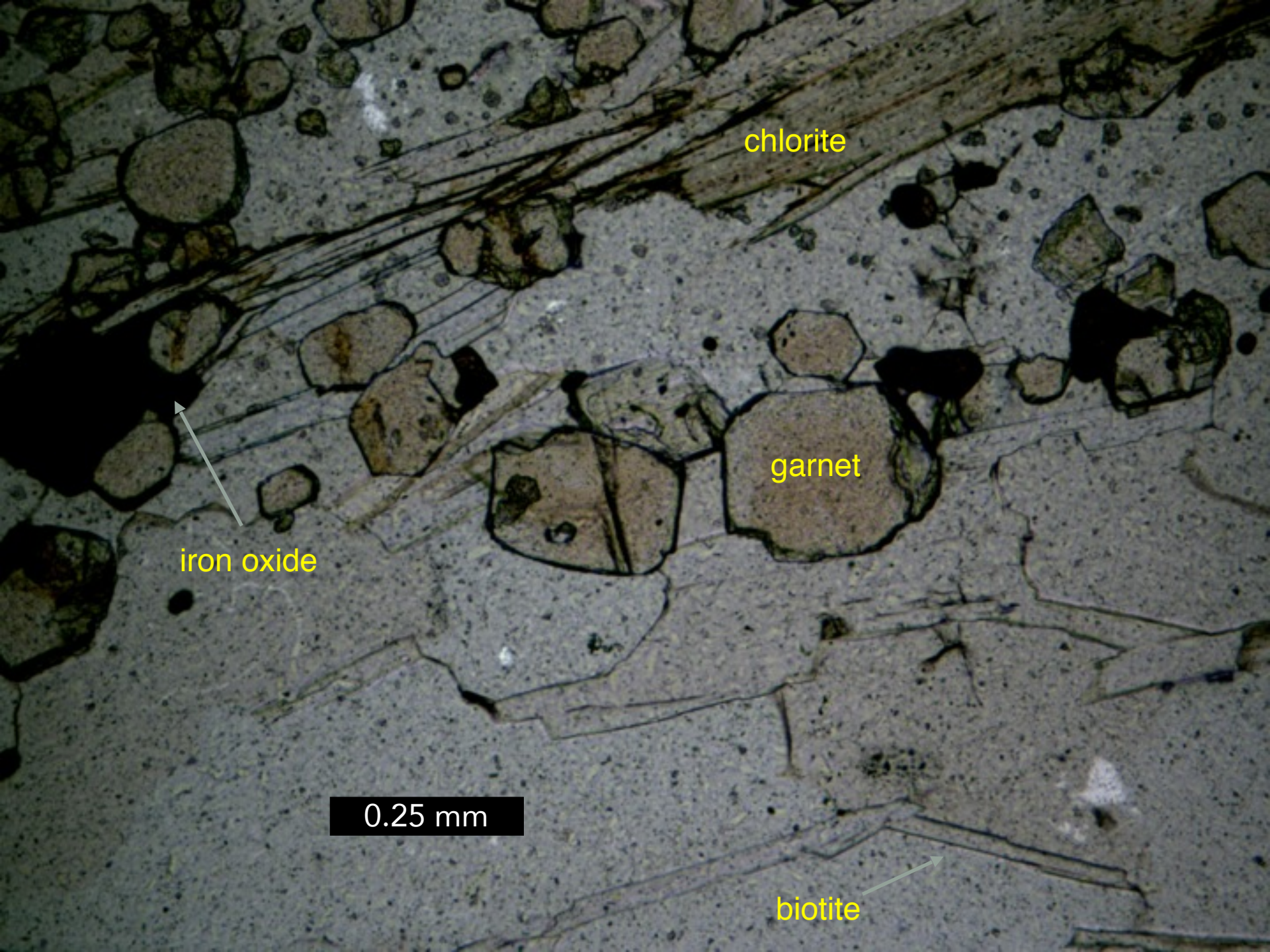


chlorite

garnet

iron oxide

0.25 mm



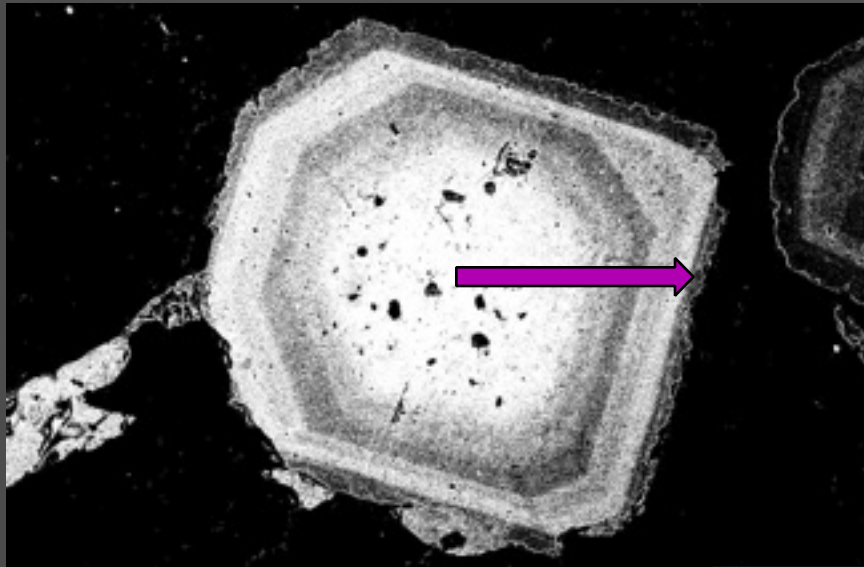
chlorite

garnet

iron oxide

0.25 mm

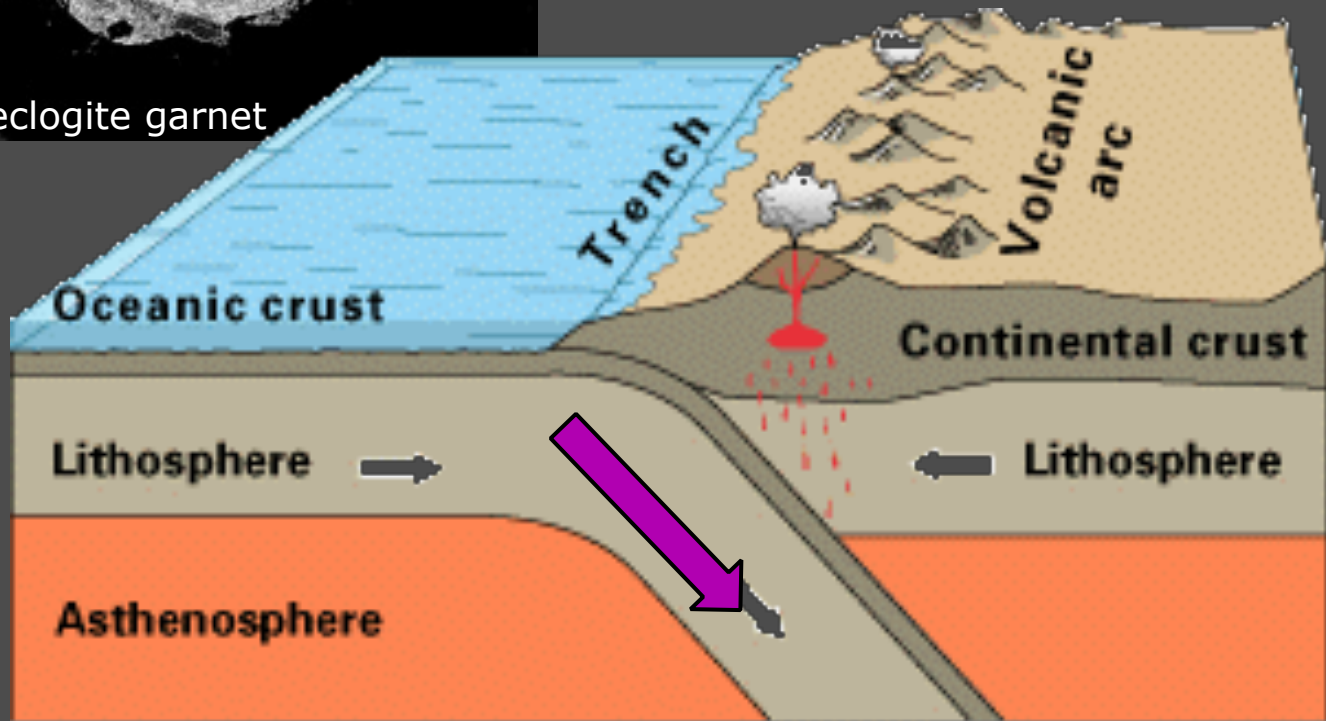
biotite



Garnets grow during subduction recording pressure, temperature, and fluid conditions.

BSE Franciscan eclogite garnet

Resistant to crystallization

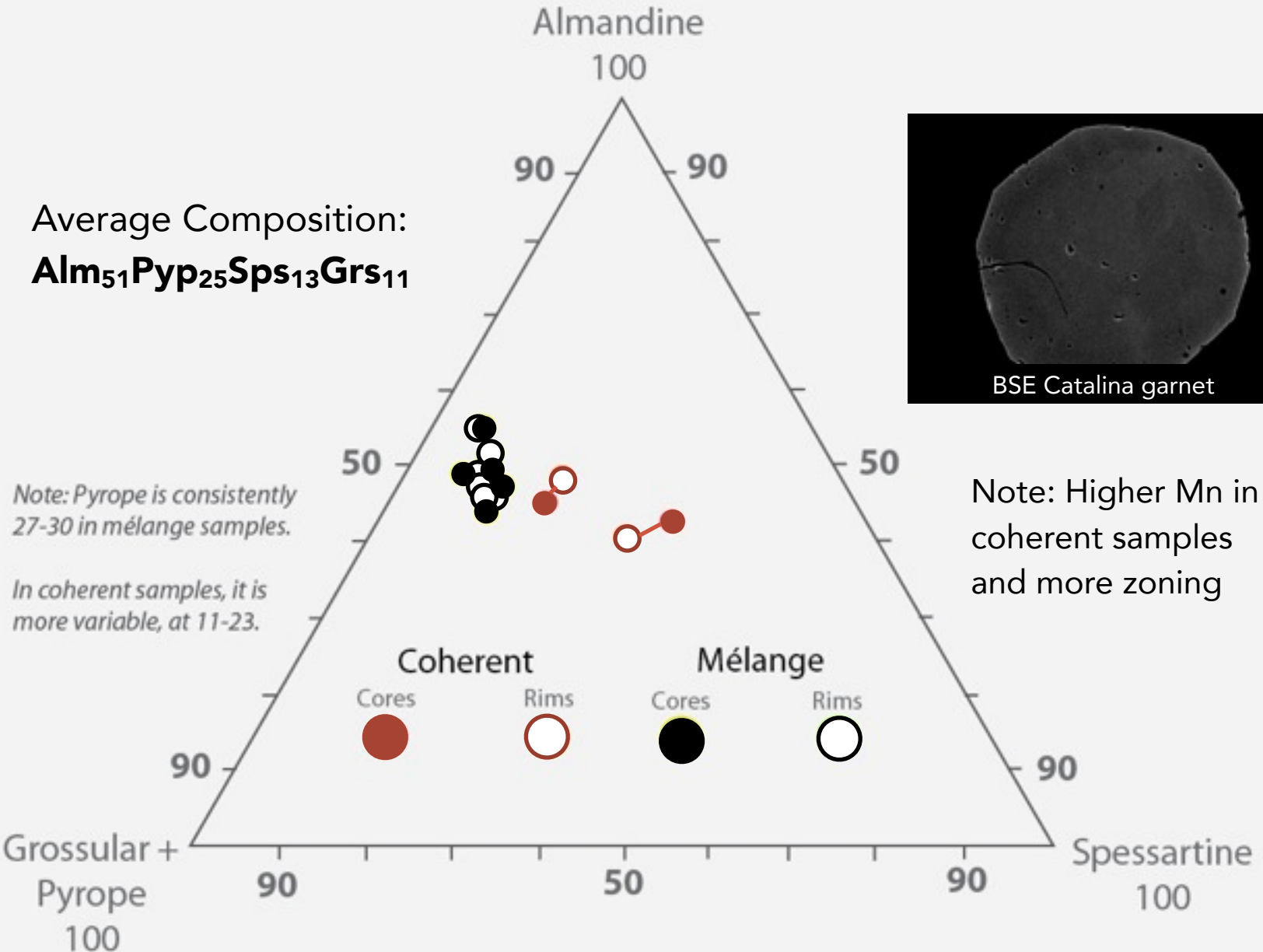
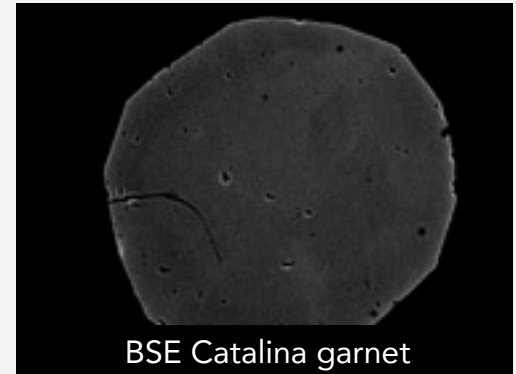


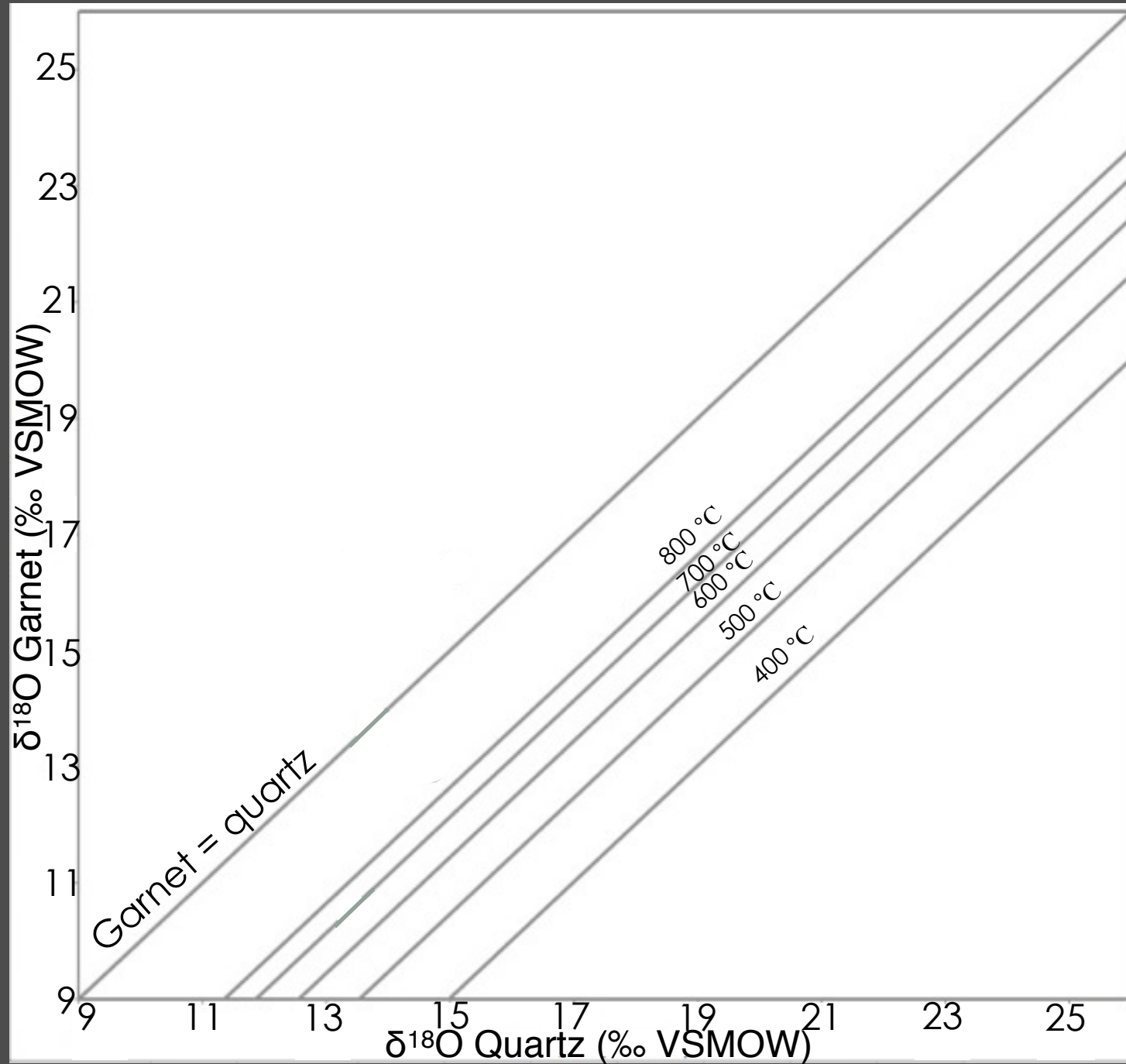
Subduction Zone

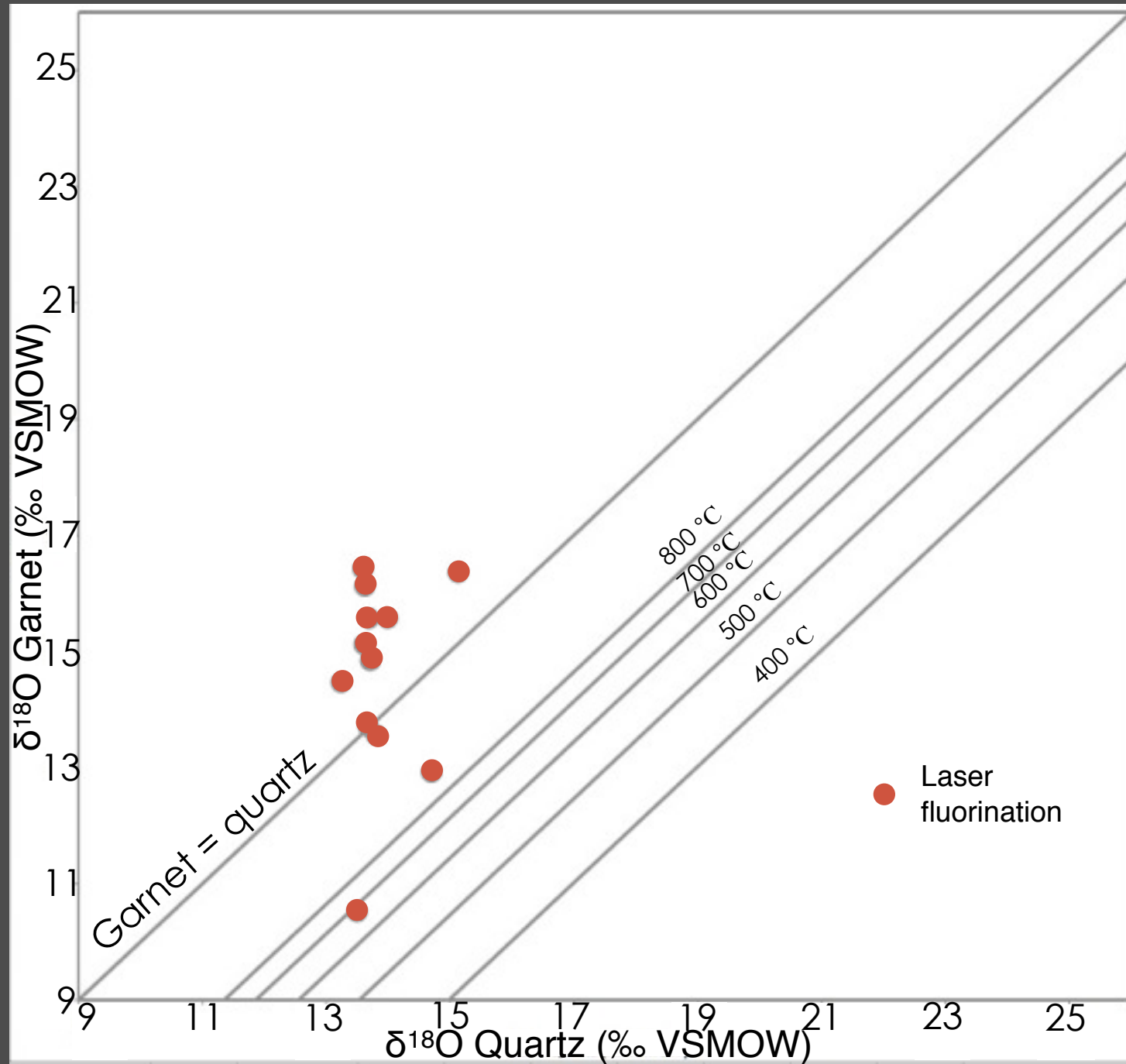
USGS

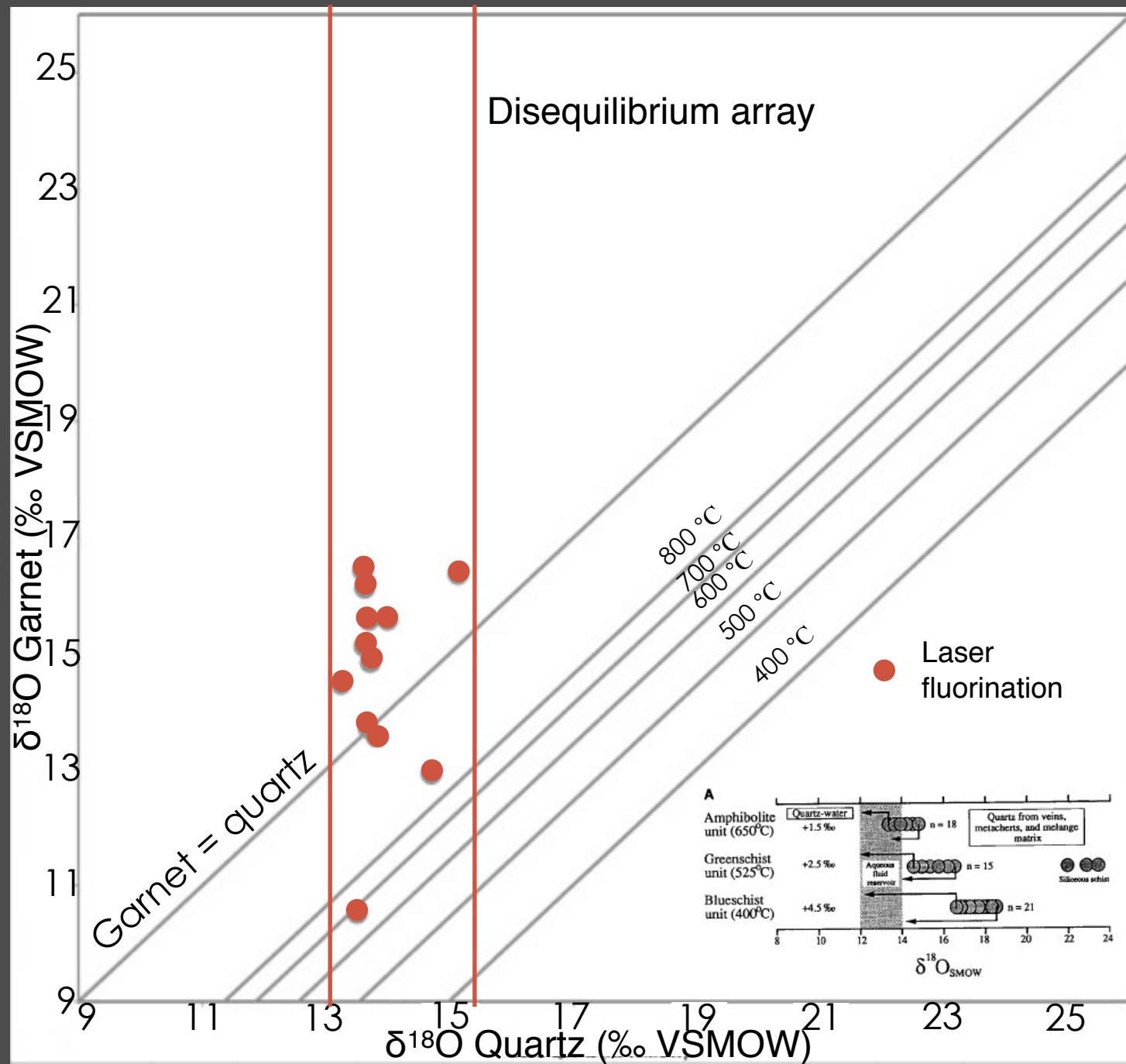
Average Catalina Garnet Compositions

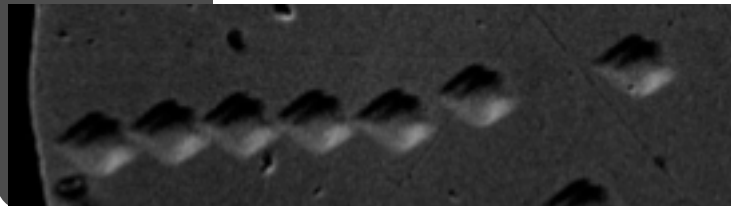
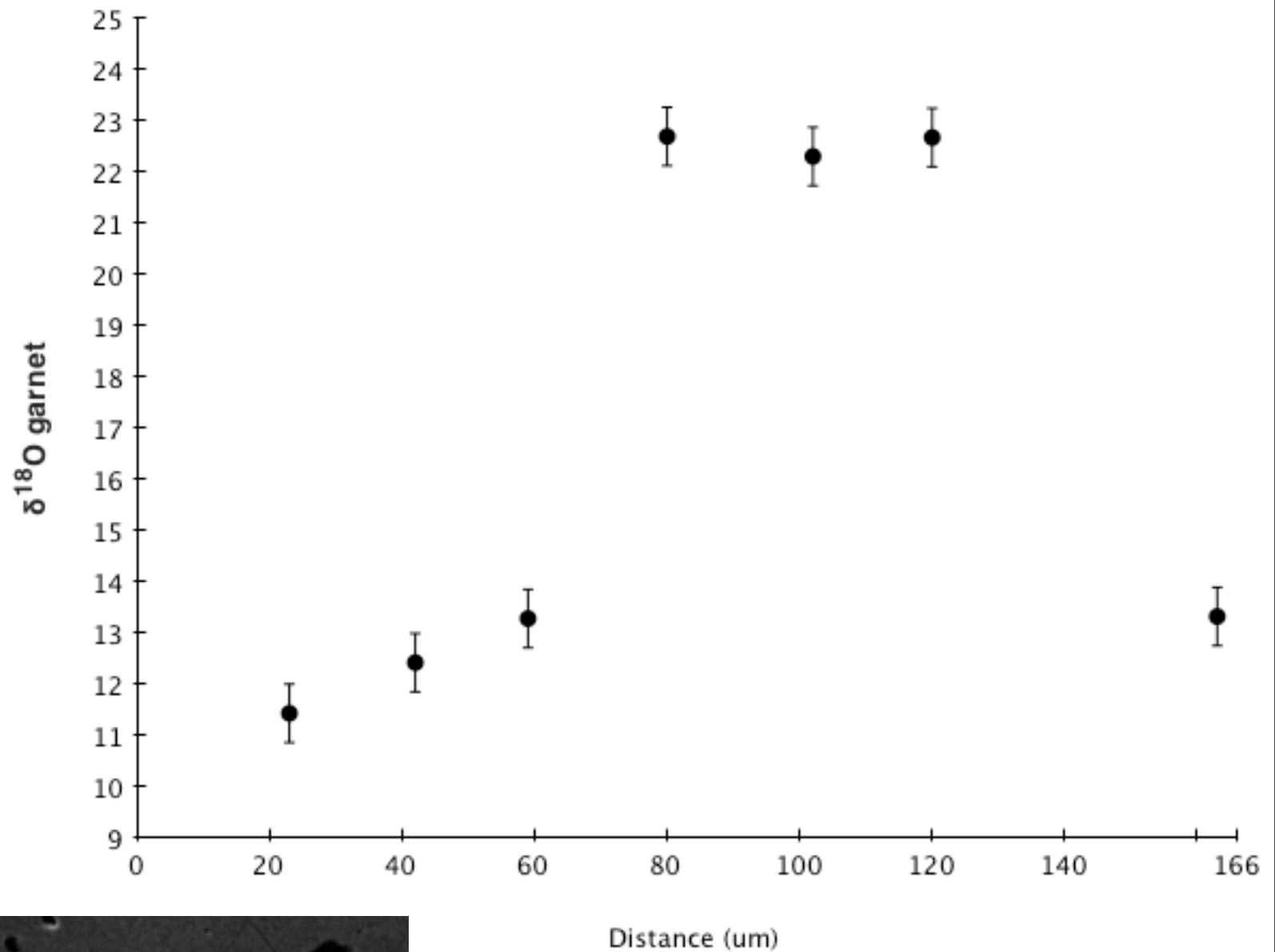
Average Composition:
Alm₅₁Pyp₂₅Sps₁₃Grs₁₁



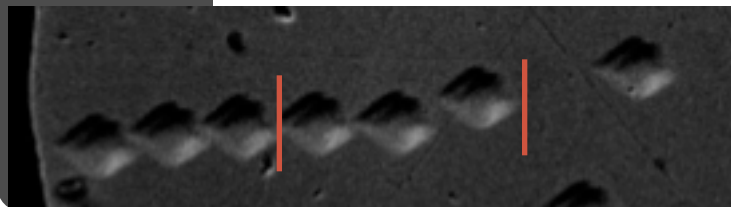
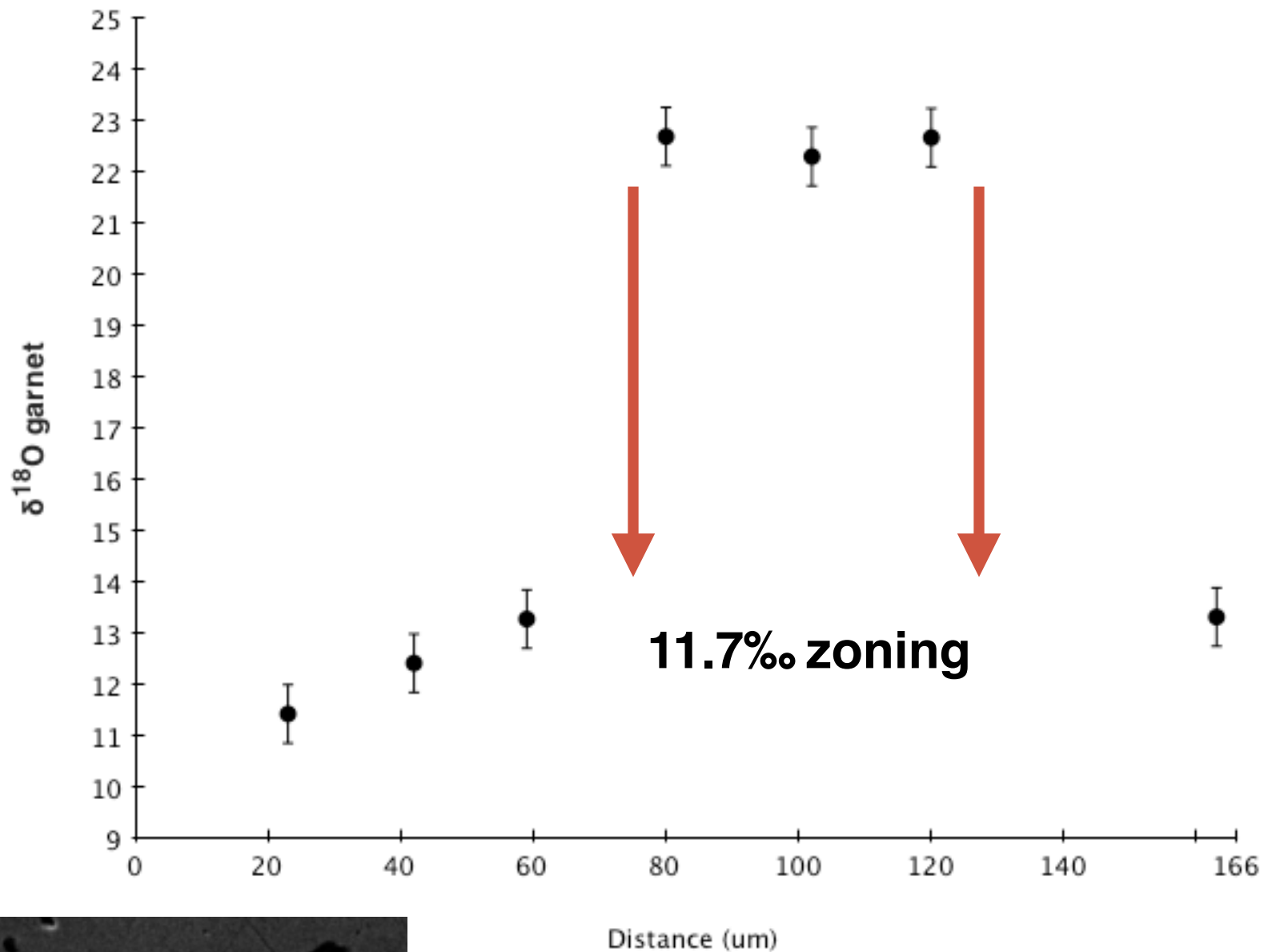




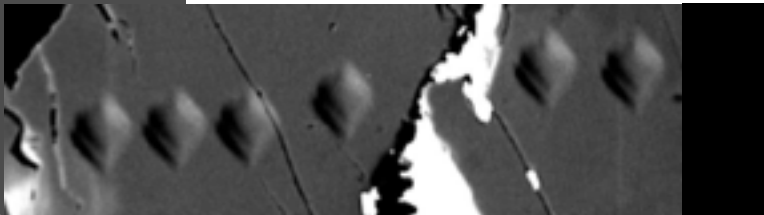
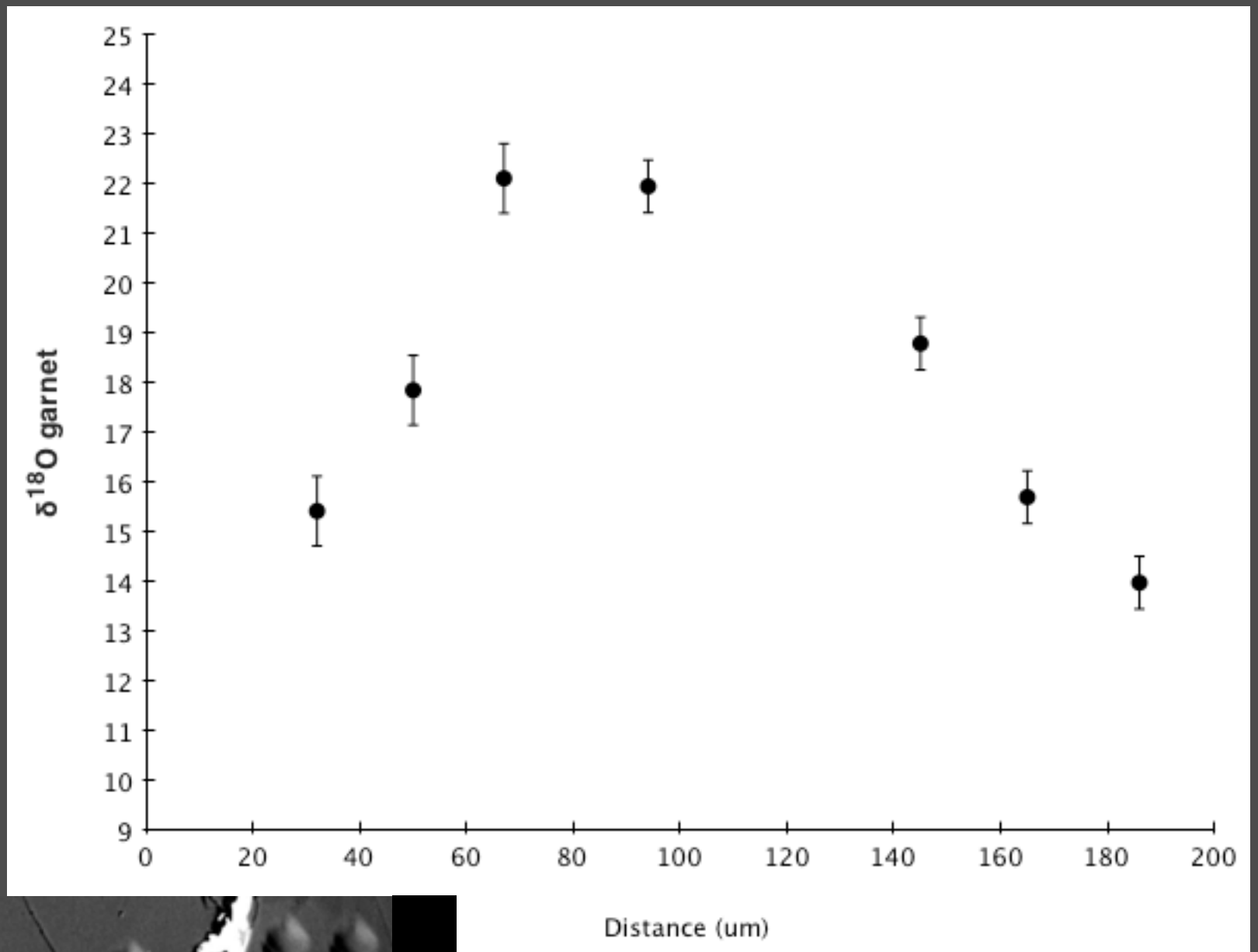




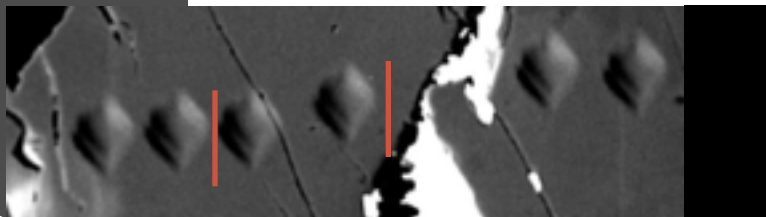
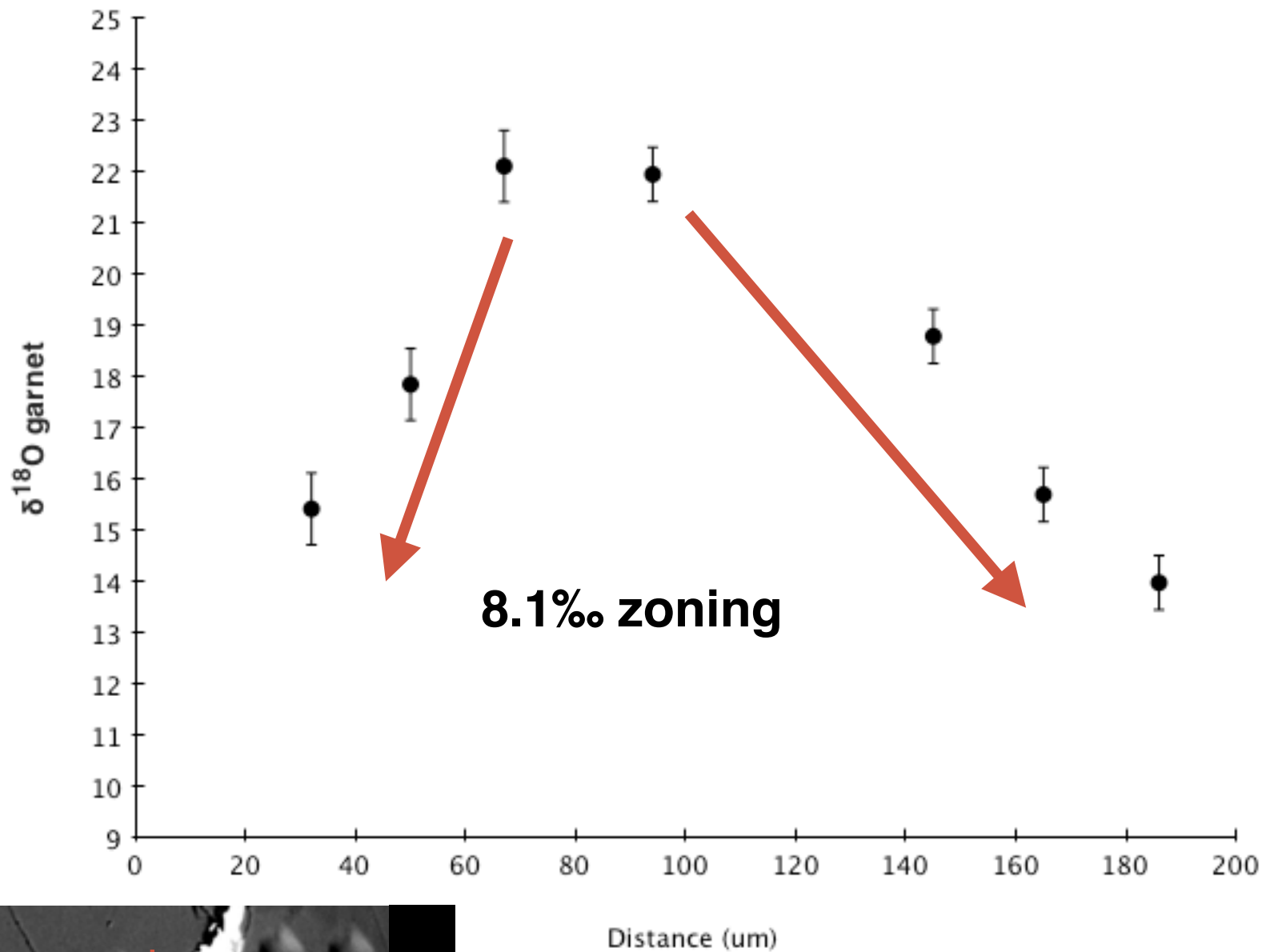
11B2



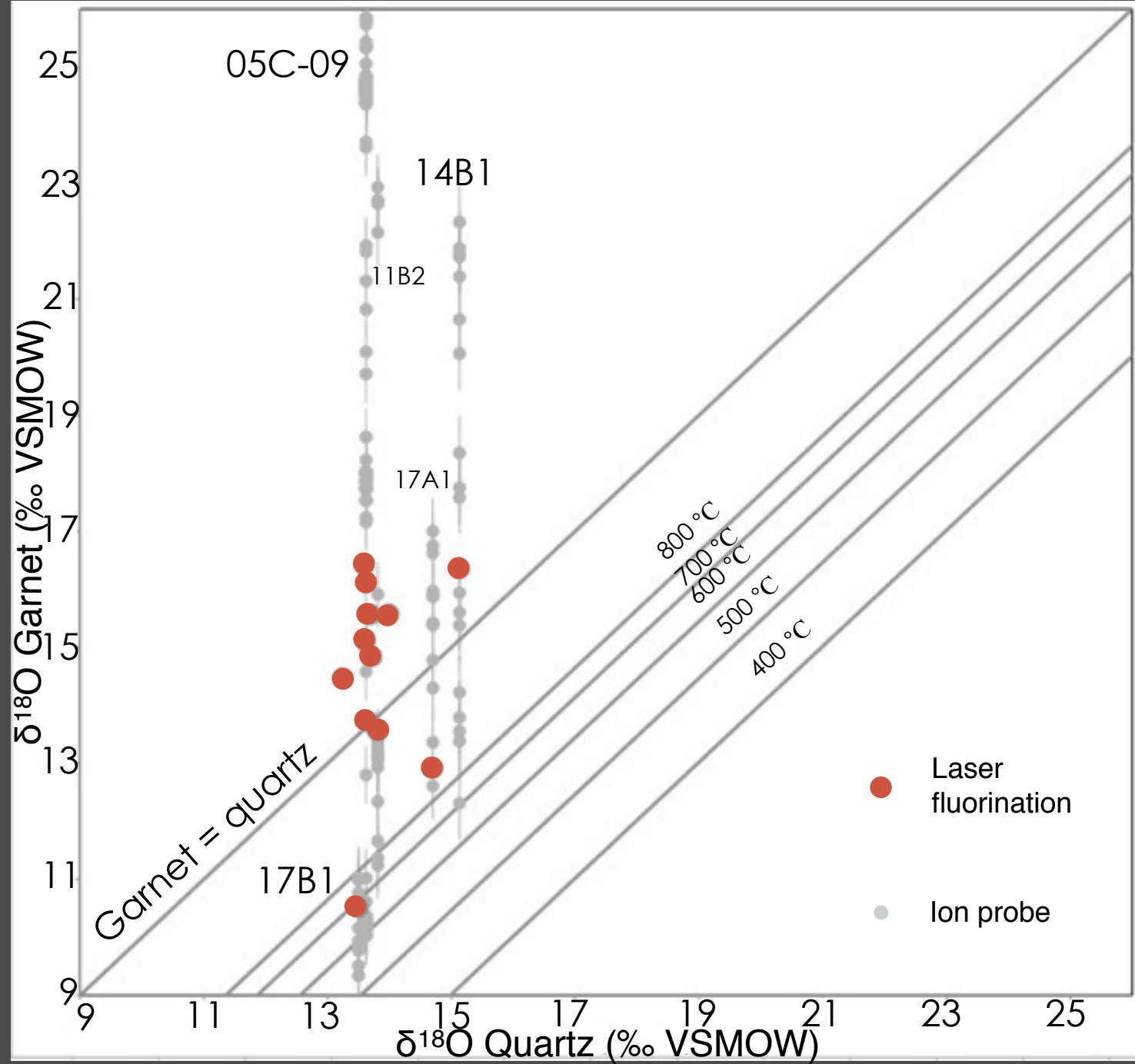
11B2



14B1



14B1



Implications for Fluid Flow

- Garnet record provides additional detail that the quartz record cannot explain alone.
- Fluid flow may be pulsed with continuous garnet growth or continuous with pulsed garnet growth.
- Samples have high and variable core values, possibly recording different protoliths (metachert?), but similar rim values suggest that high $\delta^{18}\text{O}$ inputs into the subduction factory may be pushed to lower values by “pretreatment” from fluids.

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