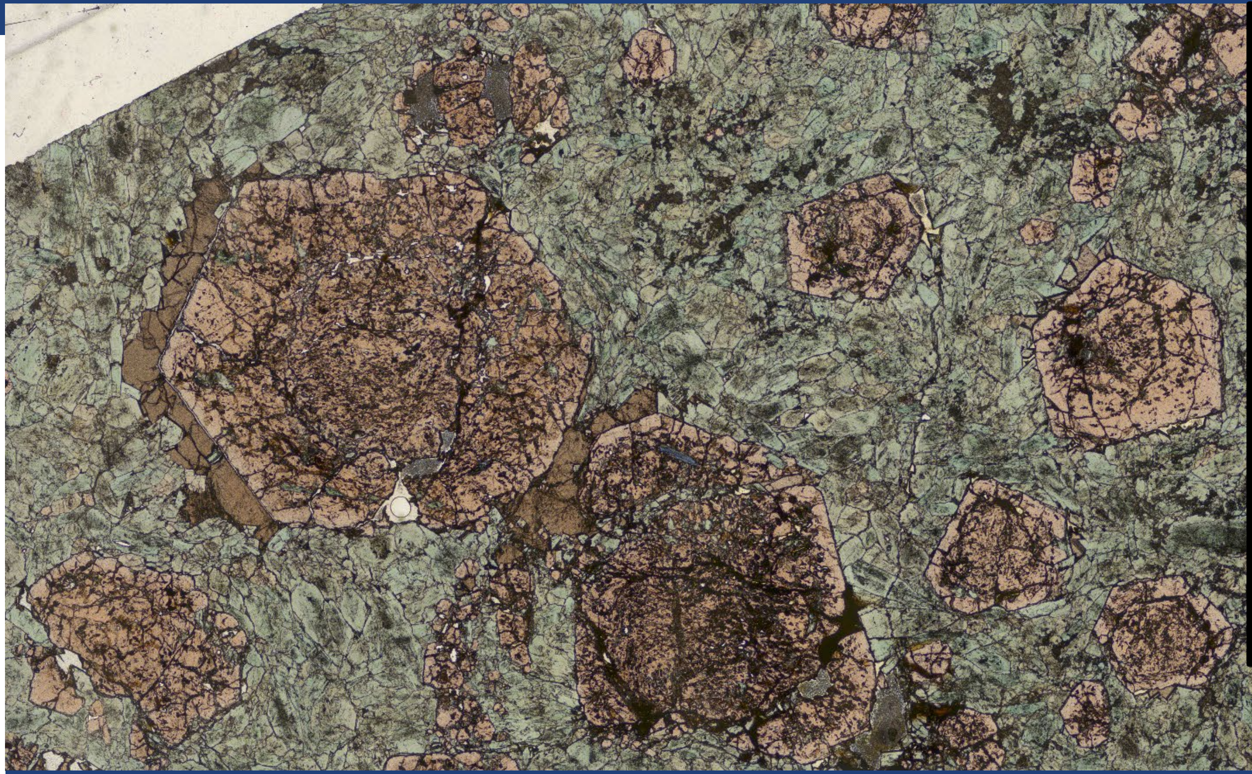
ETH zürich



Study and Findings:

- Comparison of eclogite pressures from Northern and Southern Franciscan.
- Northern Franciscan eclogites record similar peak pressures.
- Similar pressures inconsistent with significant pressure differences between Northern Franciscan eclogite blocks (mélange).

Formation pressures of eclogites from the Franciscan Complex, California, from quartz-in-garnet elastic barometry

Miguel Cisneros, Whitney Behr, John Platt

Franciscan Complex Eclogites: A mélange of techniques and pressures

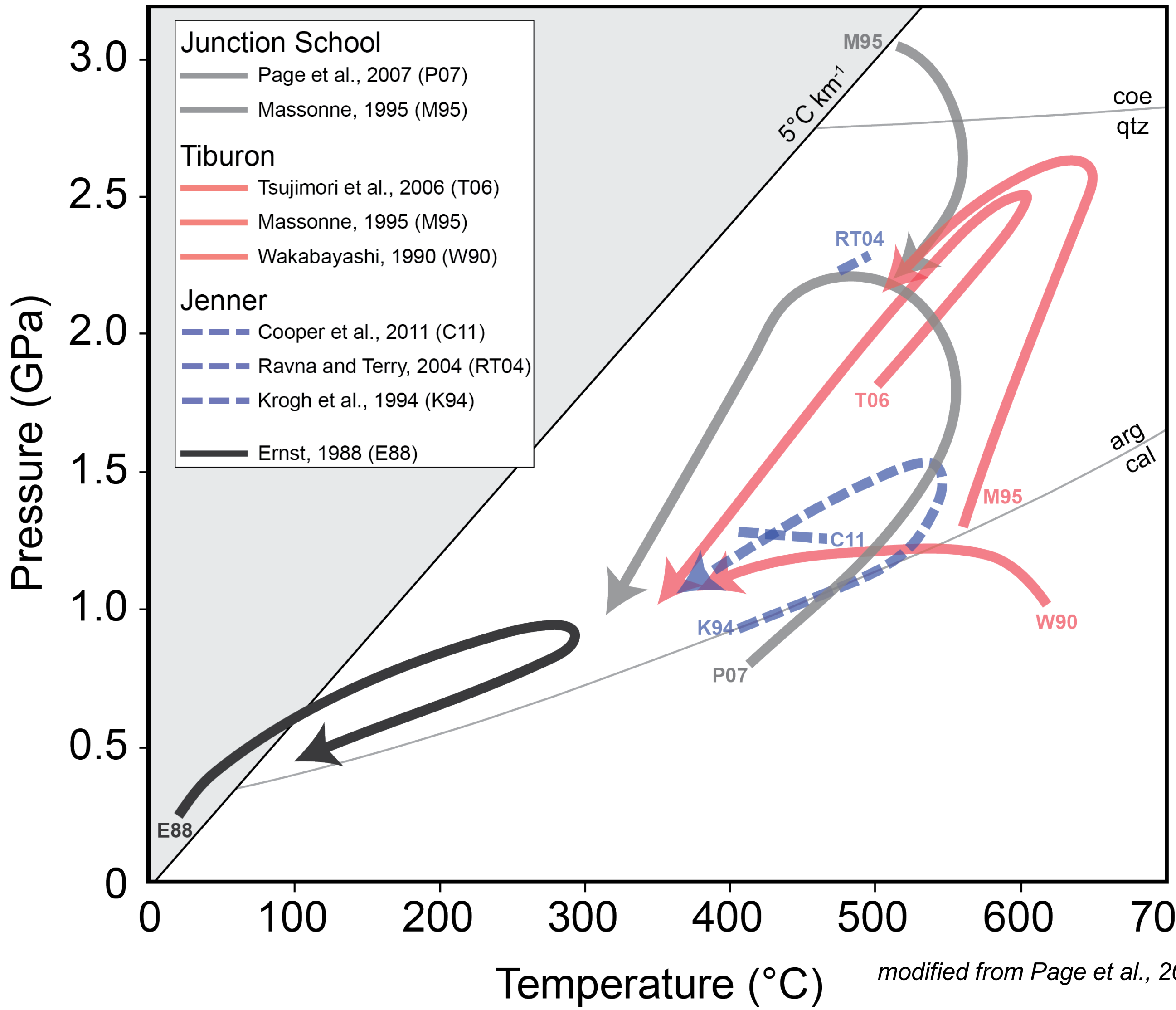
Challenges:

- Eclogites are a challenging bulk-rock assemblage: many components, few phases
- Different thermobarometric techniques for different eclogites

Goals:

- Constrain garnet growth pressures by using one technique for multiple eclogites
- Compare pressures of different eclogites blocks

Reference P-T Constraints: Franciscan Eclogites

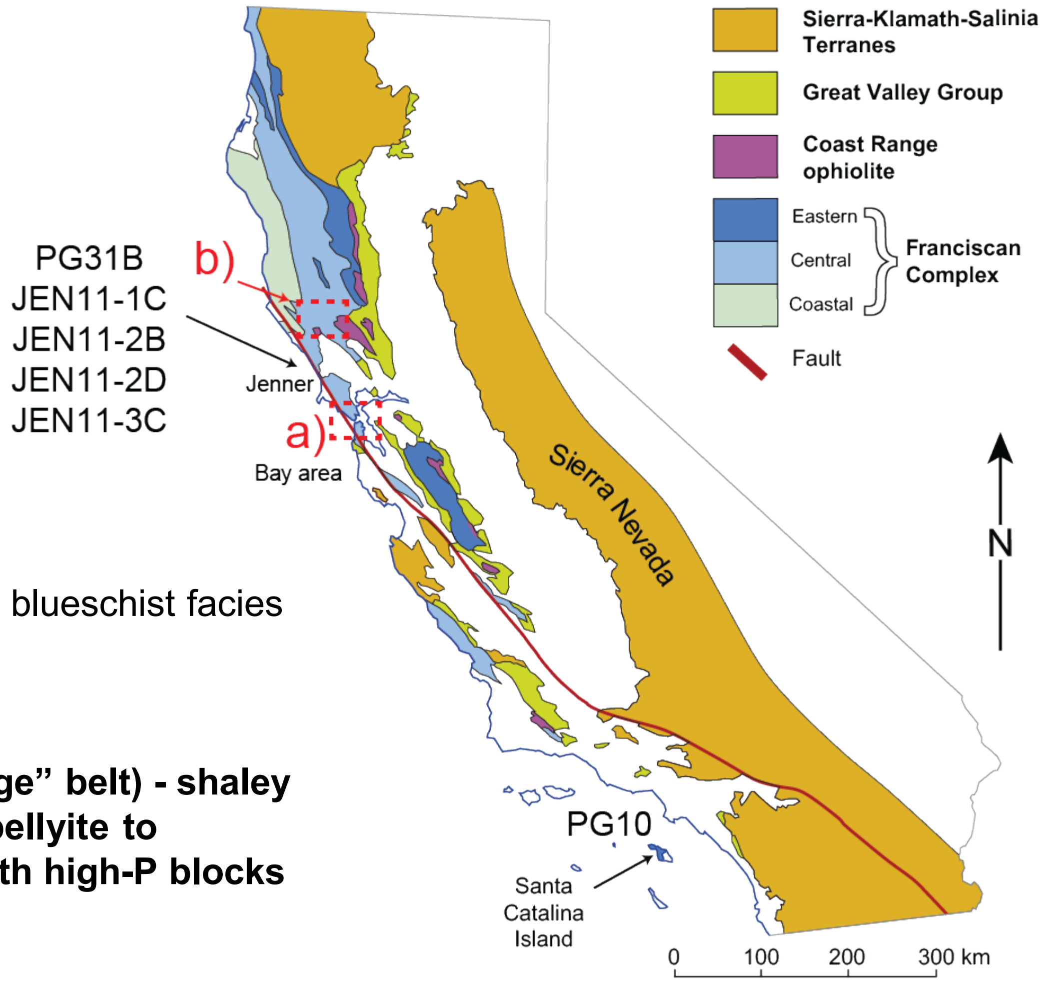


modified from Page et al., 2007

Eclogite sample localities

8 eclogite samples*:

Jenner Beach (n = 5)*
Ring Mountain (n = 1)*
Junction School (n = 1)*
Catalina Island (n = 1)



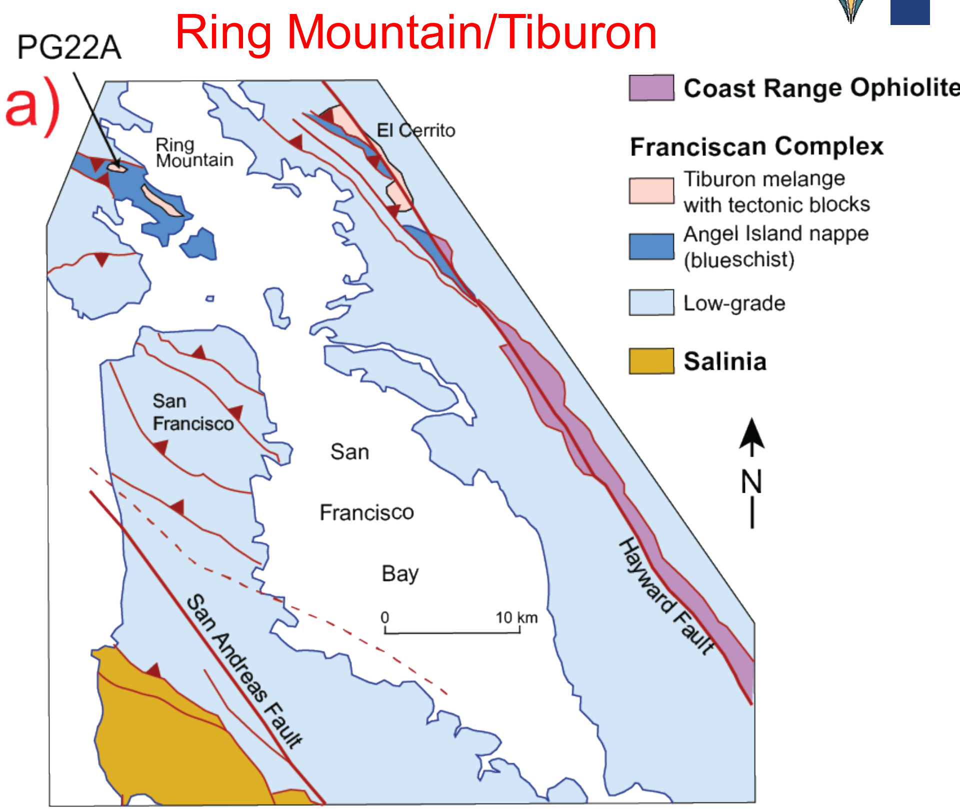
modified from Cooper et al., 2011

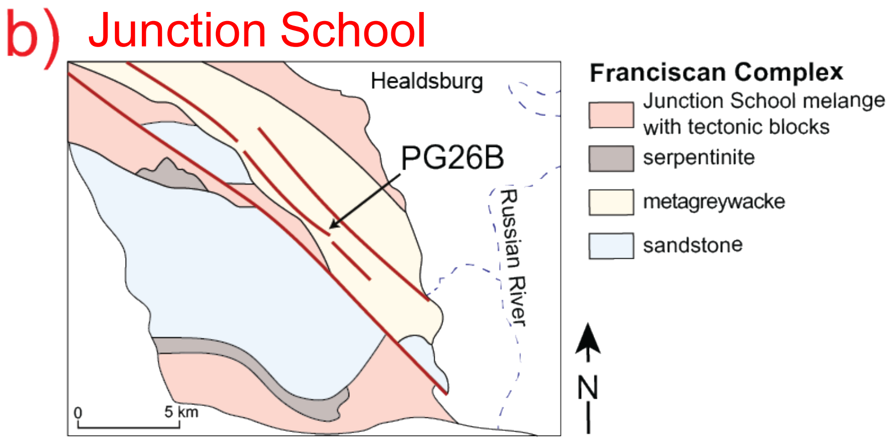
younging

Eastern belt - coherent blueschist facies terranes

***Central belt ("mélange" belt) - shaley matrix prehnite-pumpellyite to greenschist facies with high-P blocks (sample localities)**

Coastal belt – zeolite facies





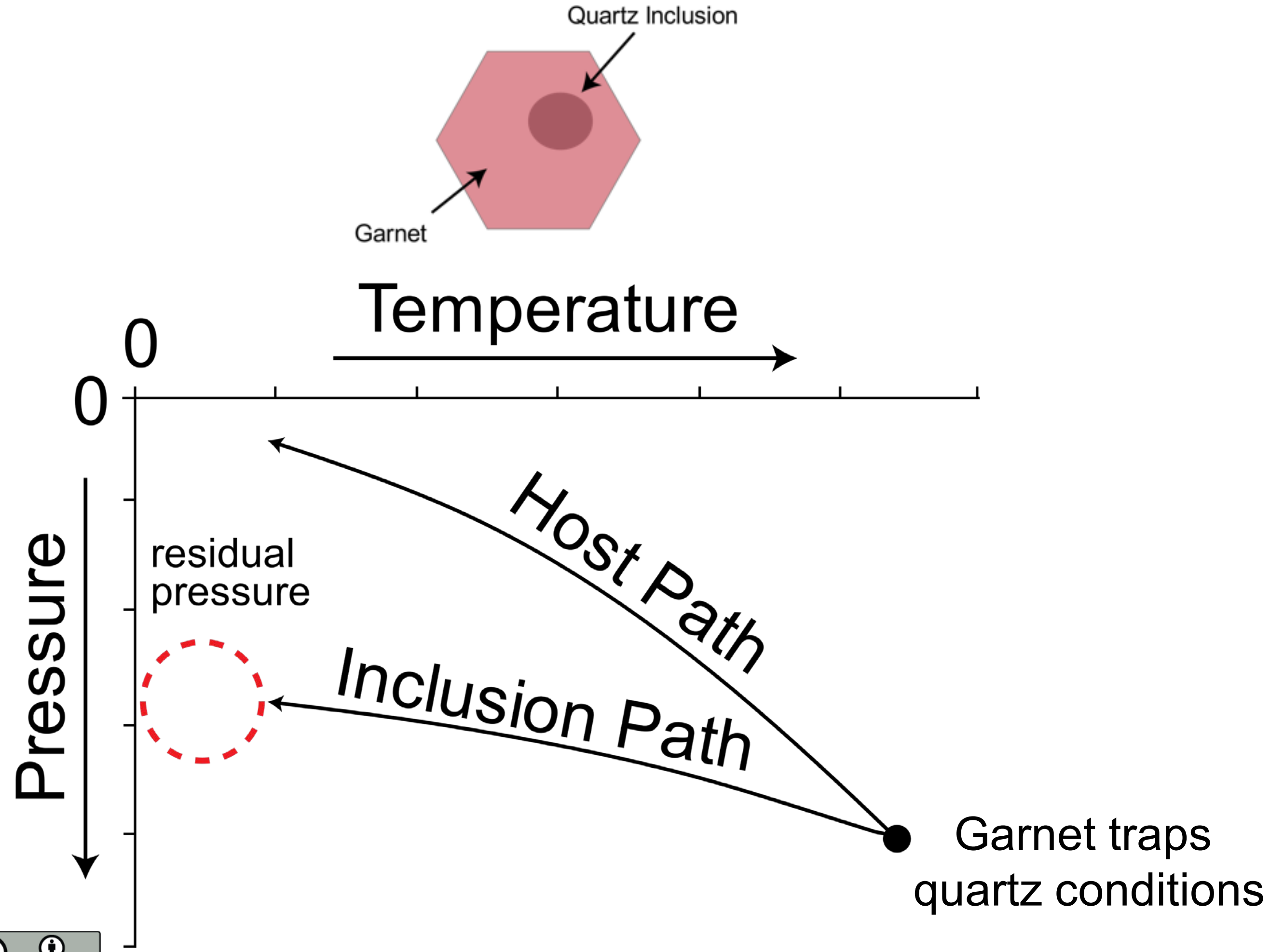
modified from Page et al., 2007

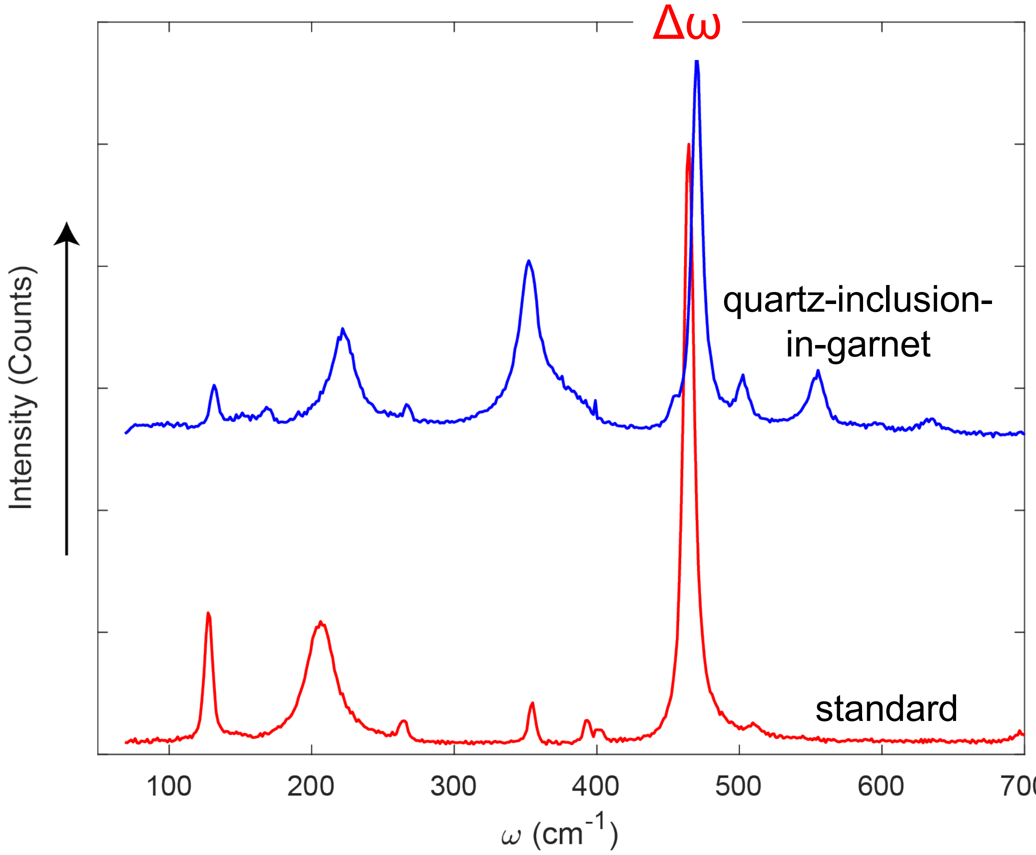
Elastic thermobarometry methodology

STEPS

1. Measure Raman shifts (Δω)
2. Calculate residual strains
3. Convert strains to residual pressure
4. Calculate initial (entrapment) conditions

After a host traps an inclusion, differences in the thermodynamic and physical properties of an inclusion and host can cause the inclusion to preserve a residual pressure.



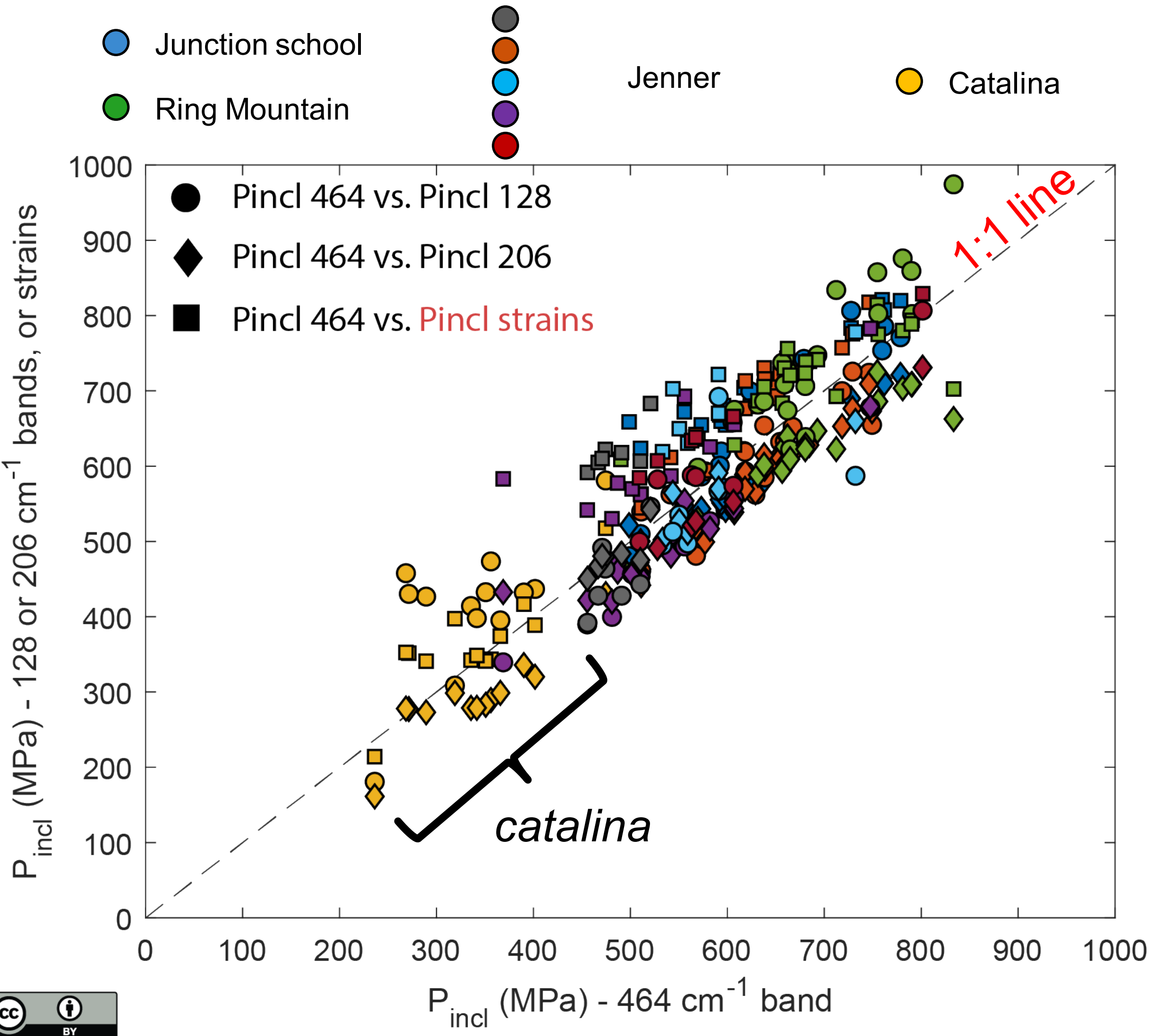


$$\Delta\omega = \omega_{inclusion} - \omega_{standard}$$

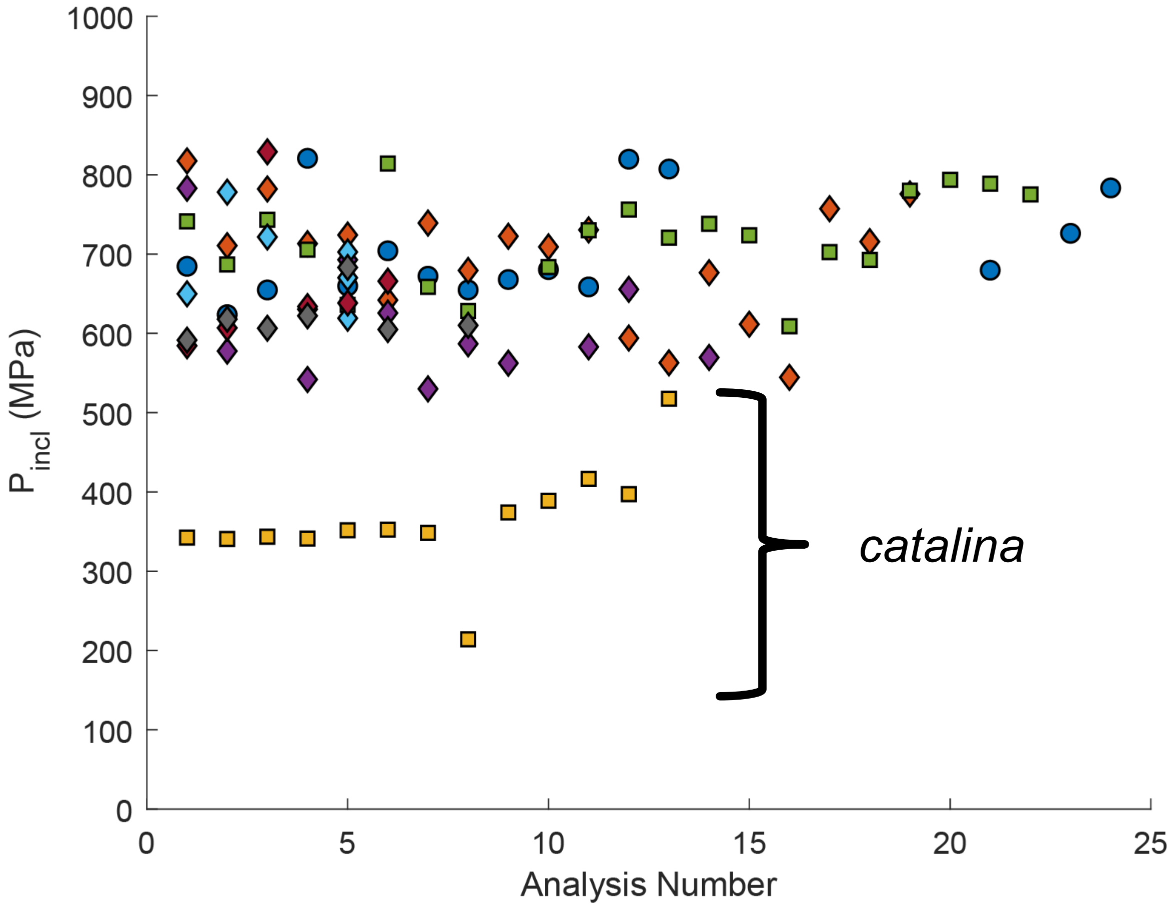
Use Δω to calculate residual quartz pressure

Calculated residual inclusion pressures

Inclusion pressures calculated from hydrostatic calibrations and by accounting for quartz anisotropy (strains)

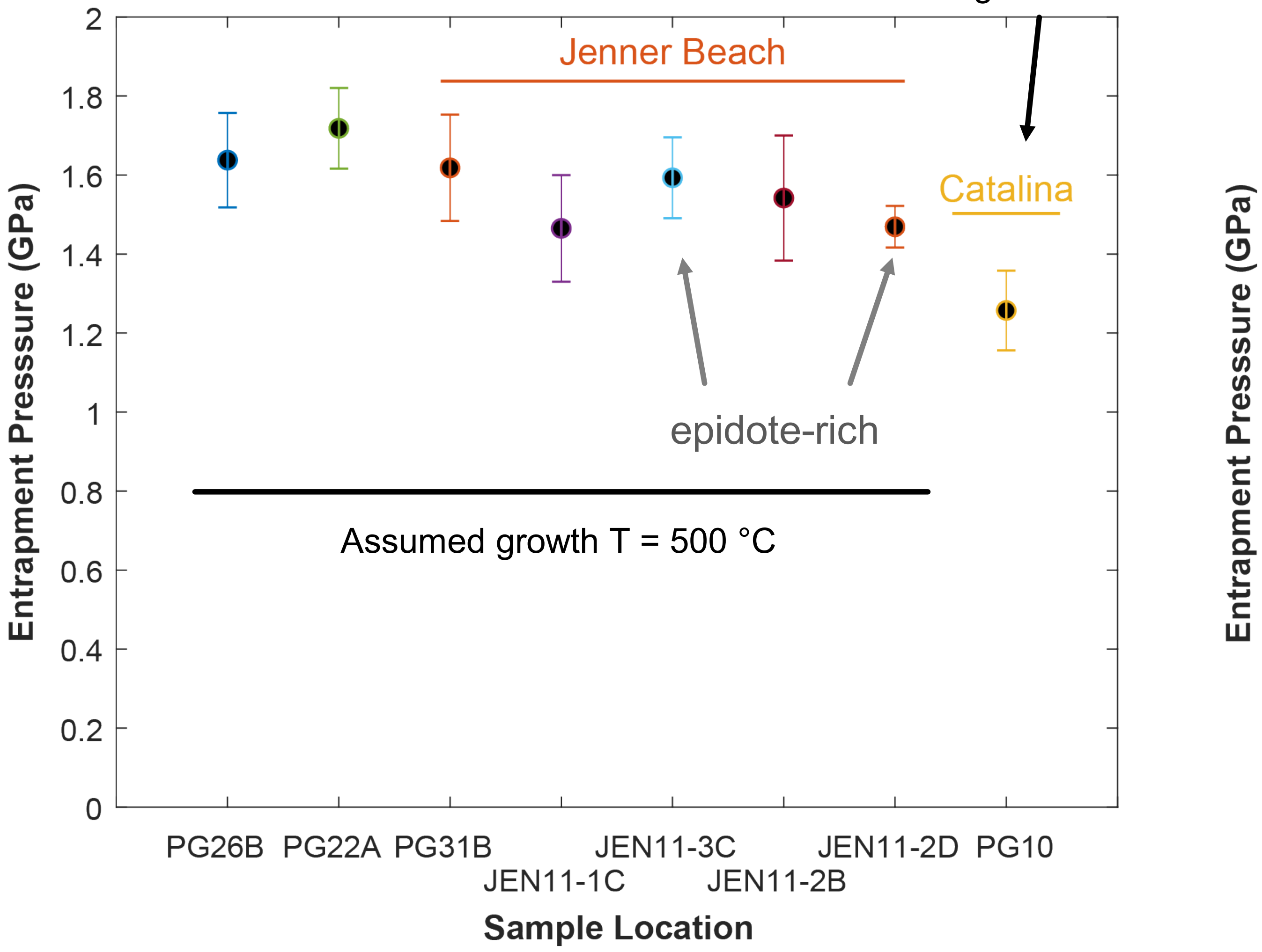


Inclusion pressures calculated by accounting for quartz anisotropy (strains)

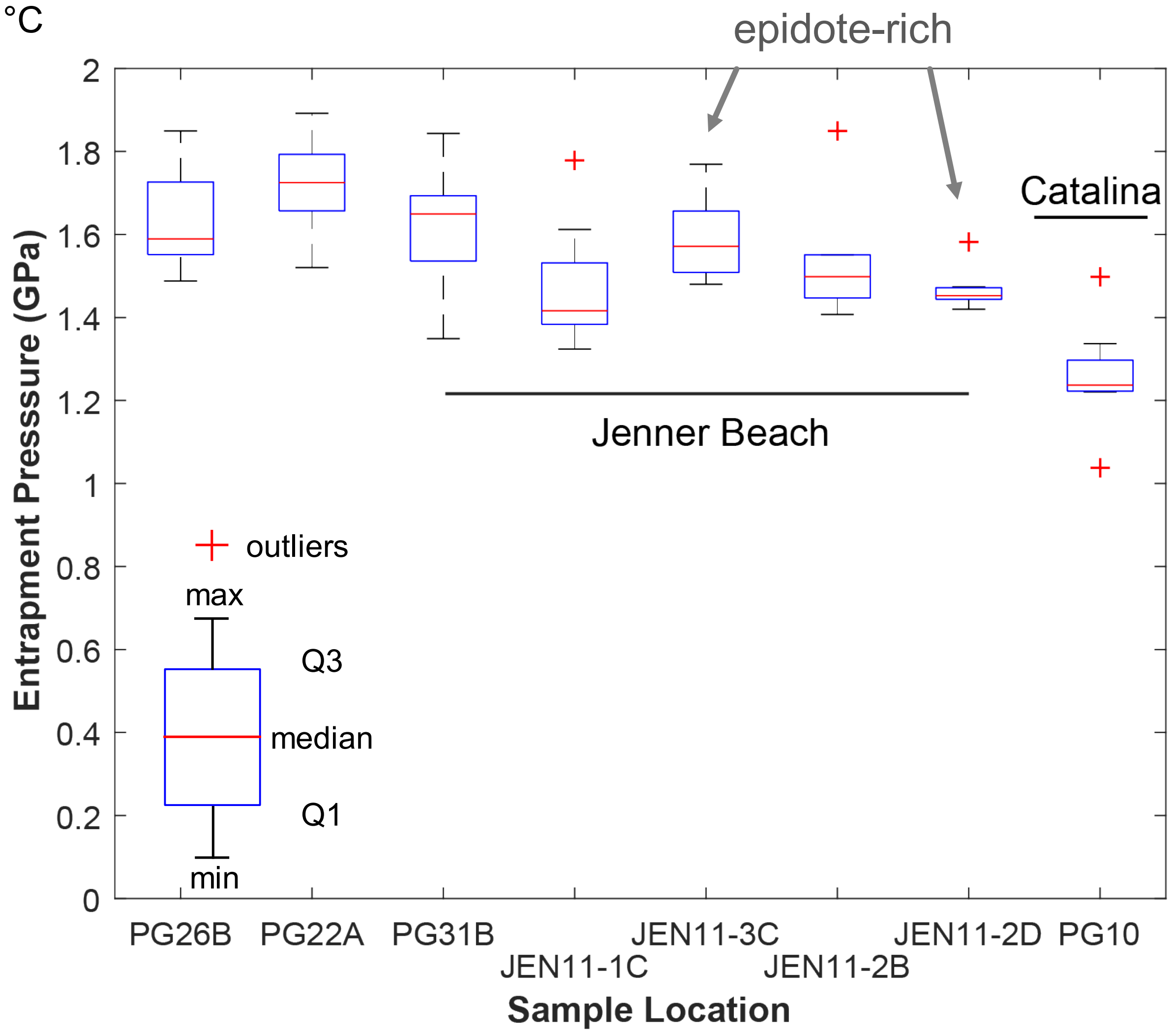


Calculated garnet growth conditions

Mean entrapment pressures* (and st. dev)



Whisker plots*

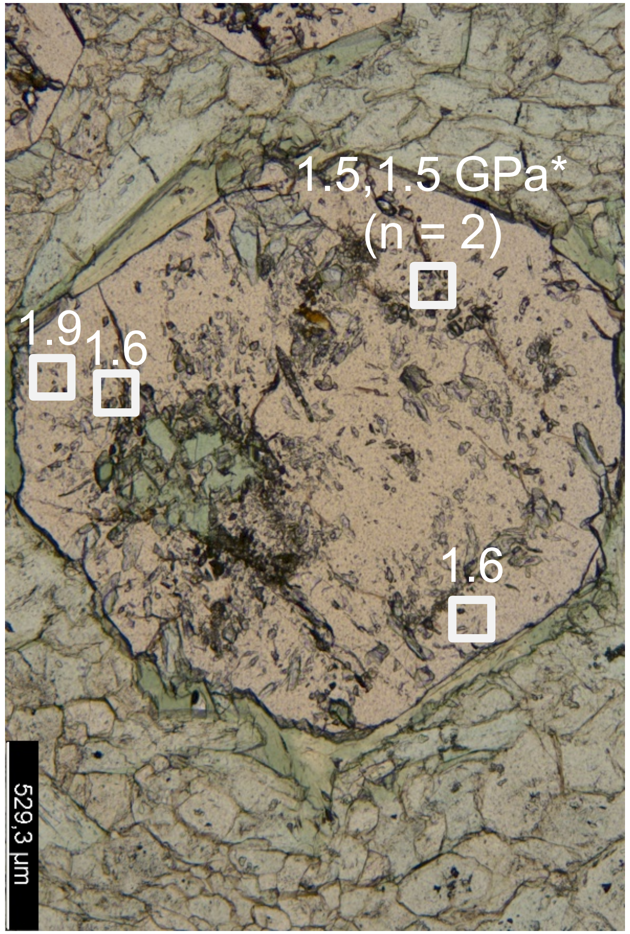


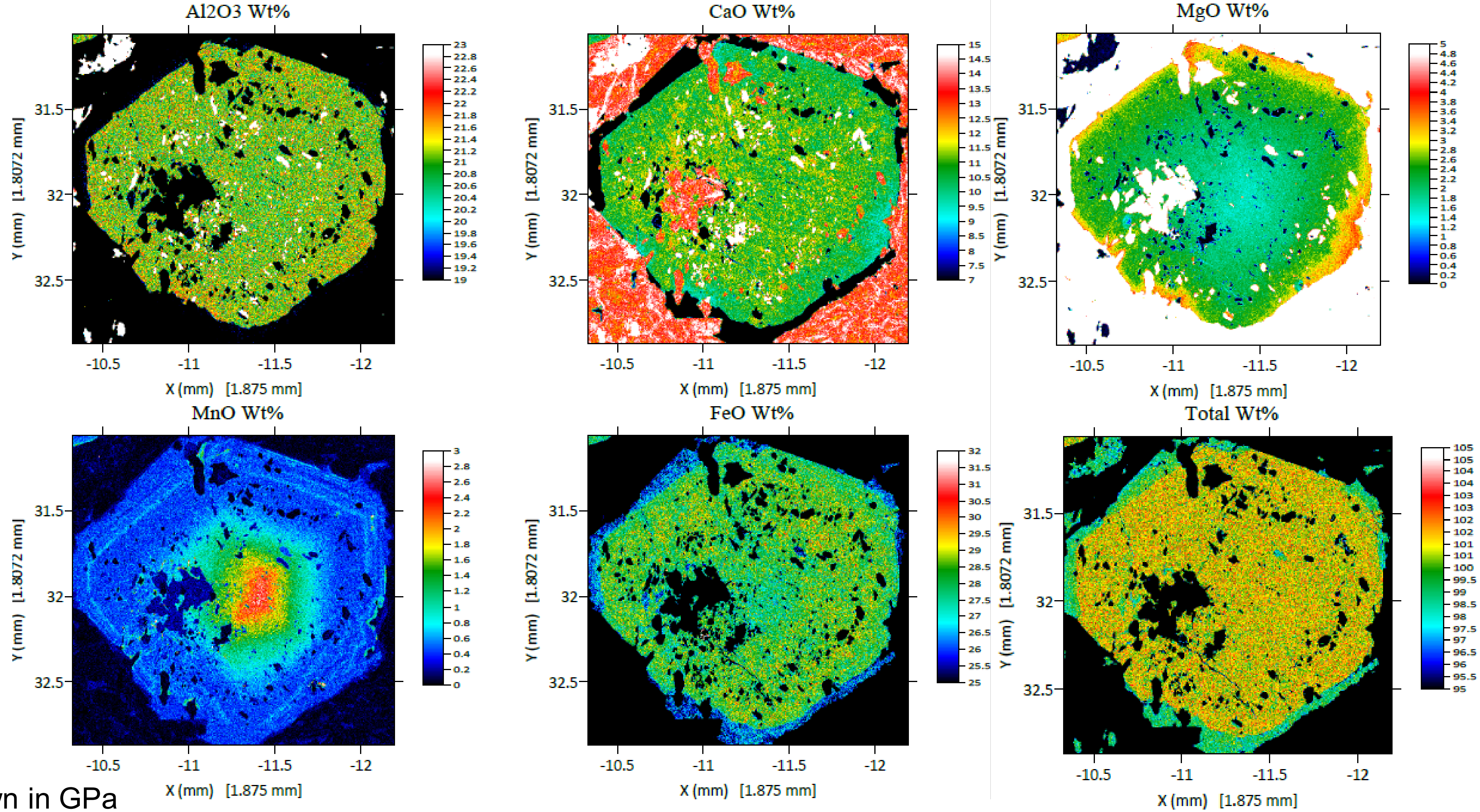
*Calculated by accounting for quartz anisotropy

Garnets in eclogites: chemical zonation

Garnets primarily record prograde zonation, as shown by Mn decrease from core to rim.
Garnets record higher pressures near garnet mantle.

Junction School (PG26B)*





*Garnet growth pressures shown in GPa

*Boxes are locations of measured inclusions

Comparison of P-T conditions

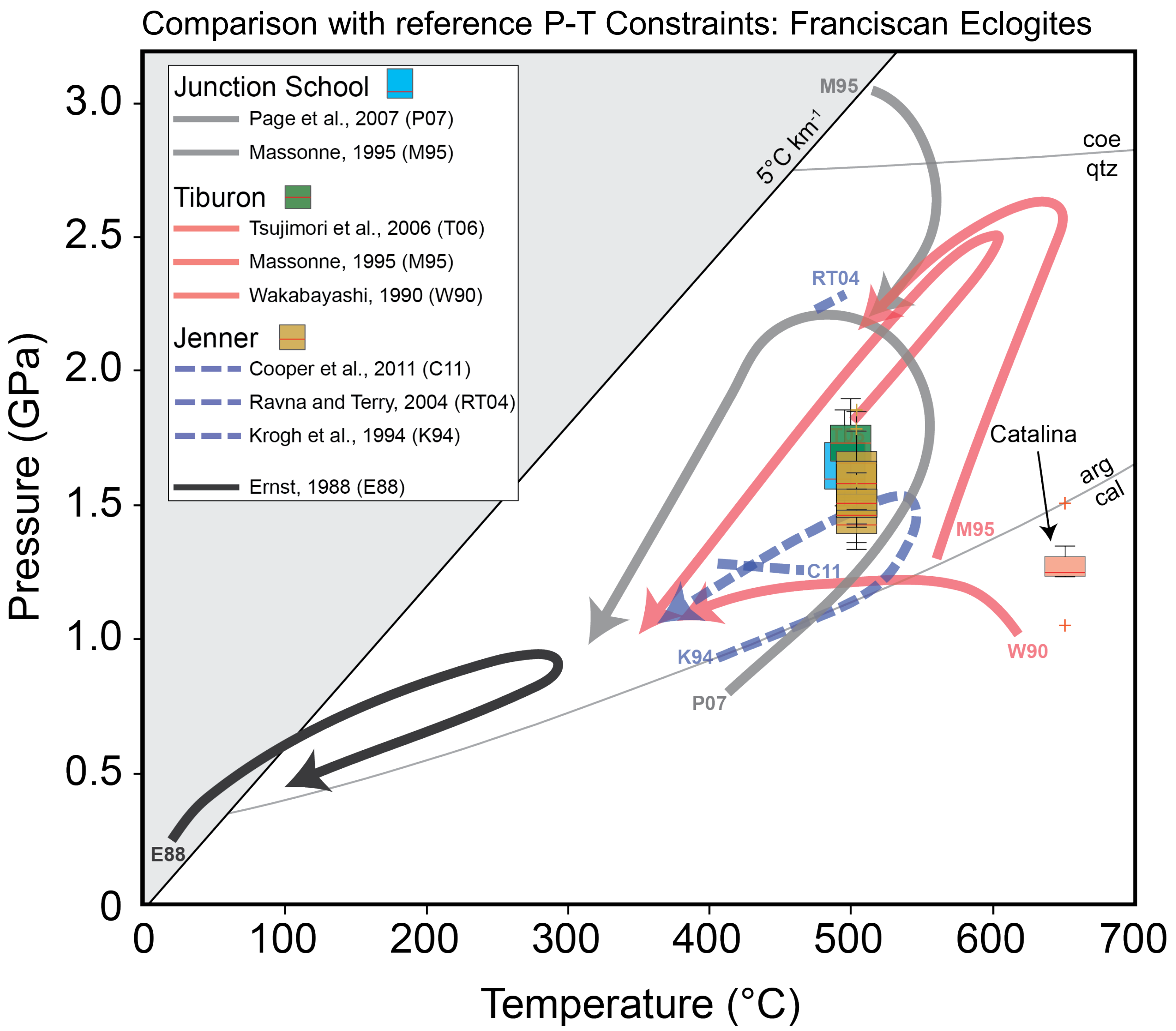
Previous work

Large P range, smaller T range

This work

Pressures do not reach coesite stability field
- No evidence of coesite radial fracturing

Similar average and maxima P amongst different eclogites from the northern Franciscan



Findings and Implications

- Similar pressures for different eclogites from the northern Franciscan.
  - Pressures below the quartz-coesite transition.

- Results from northern Franciscan not consistent with a ‘mélange’ of pressures.

- Lower pressures from Catalina samples, consistent with previous constraints.