IMAGING OPPORTUNITIES FOR HIGH-PRESSURE MATERIALS RESEARCH

David Walker

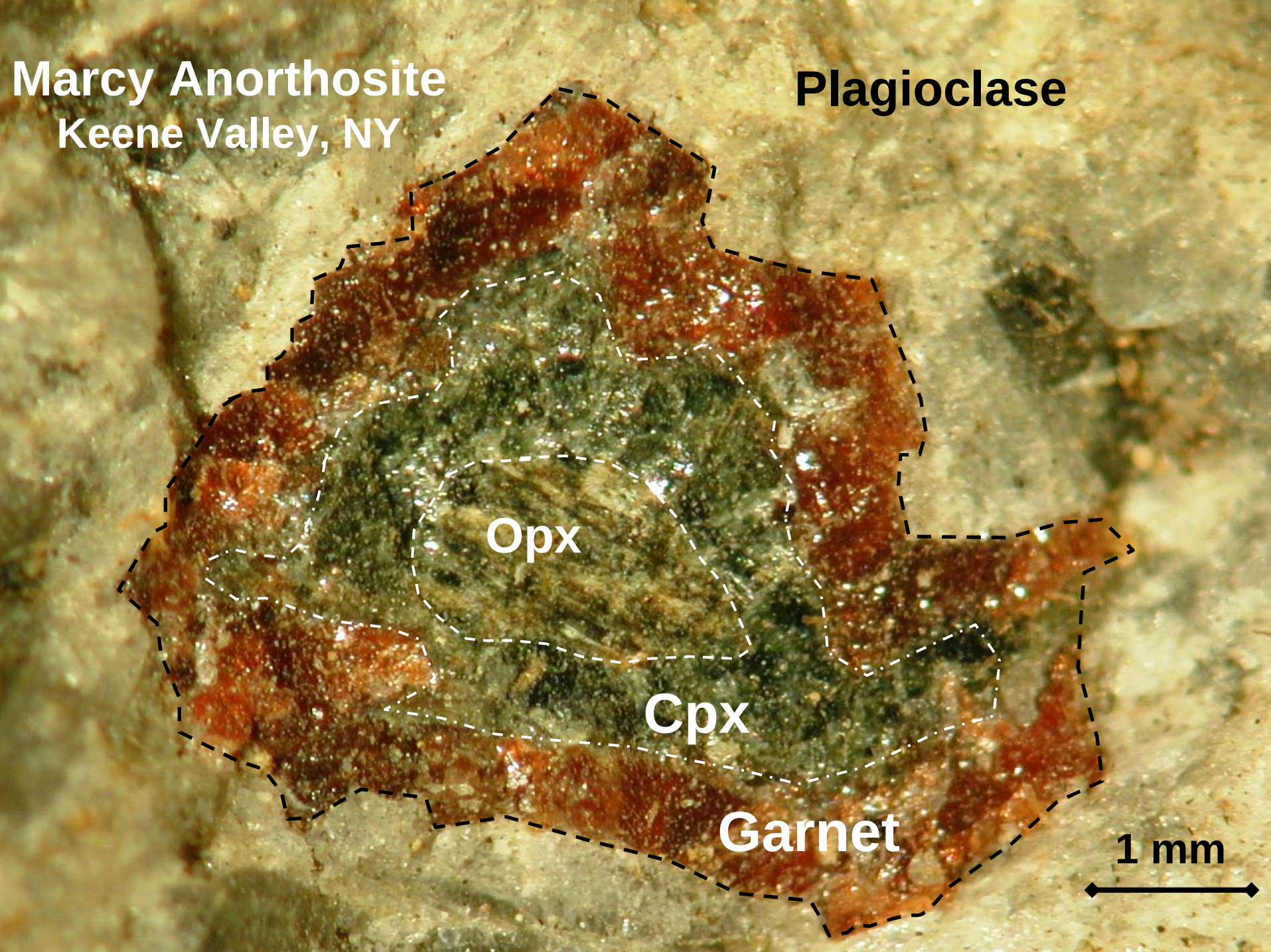
Lamont-Doherty Earth Observatory, Columbia Univ.

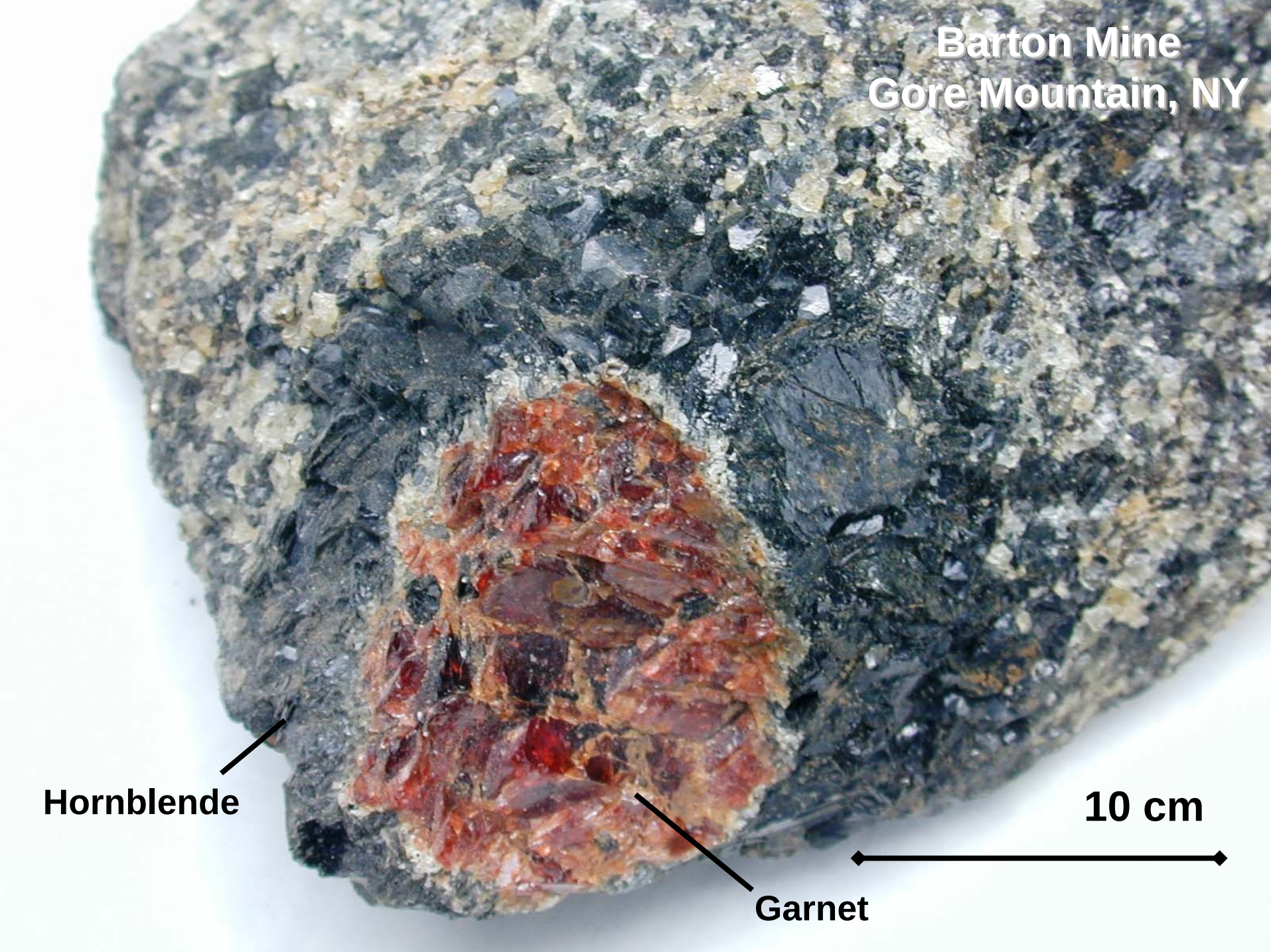
Spatial resolution of reactants and products
Maps! (2D or tomography)

X-ray absorption contrast imaging
to watch chemistry occur

Scale limits to high pressure experiments

ERL Imaging of DAC reactions?


Marcy Anorthosite
Keene Valley, NY
Plagioclase
Opx
Cpx
Garnet
1 mm

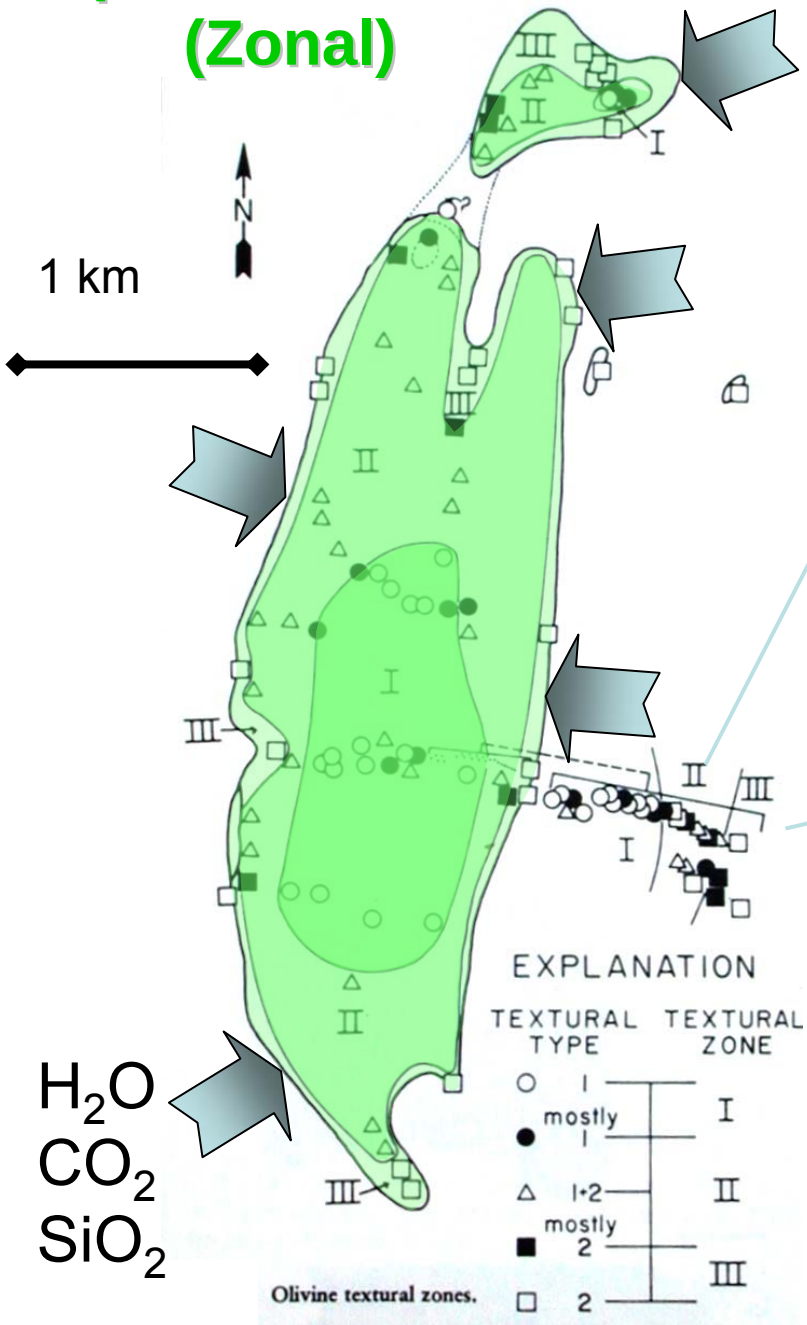

Barton Mine
Gore Mountain, NY
Hornblende
Garnet
10 cm

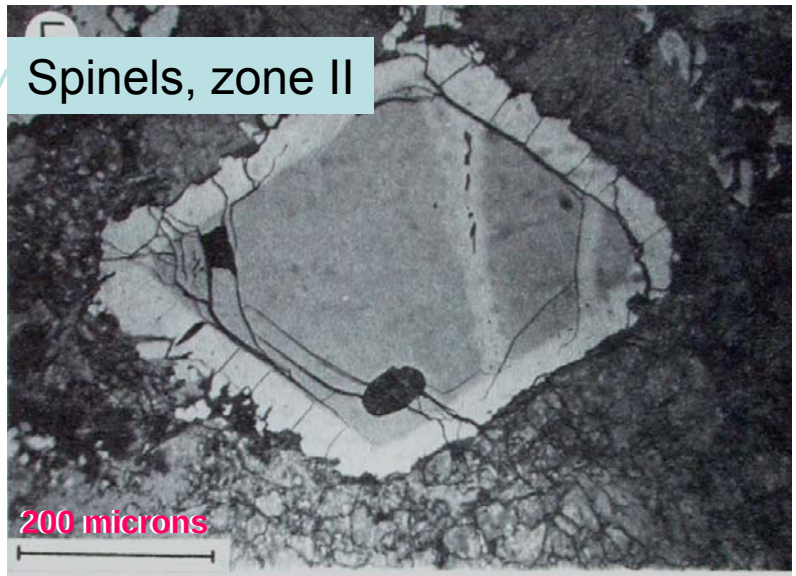
Serpentinization of Olivine and Opx (Zonal)

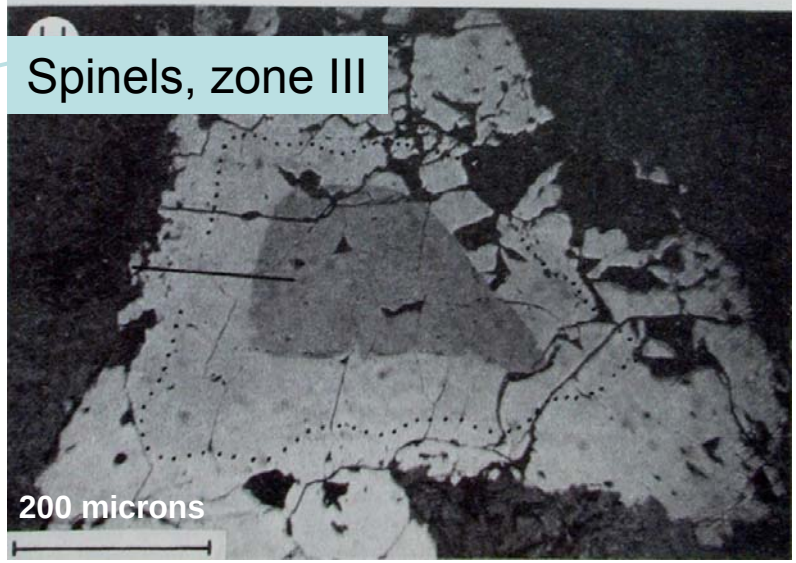
East Dover, Vermont

Alpine Ultramafic in Moretown schist

Amphibolite grade metamorphism





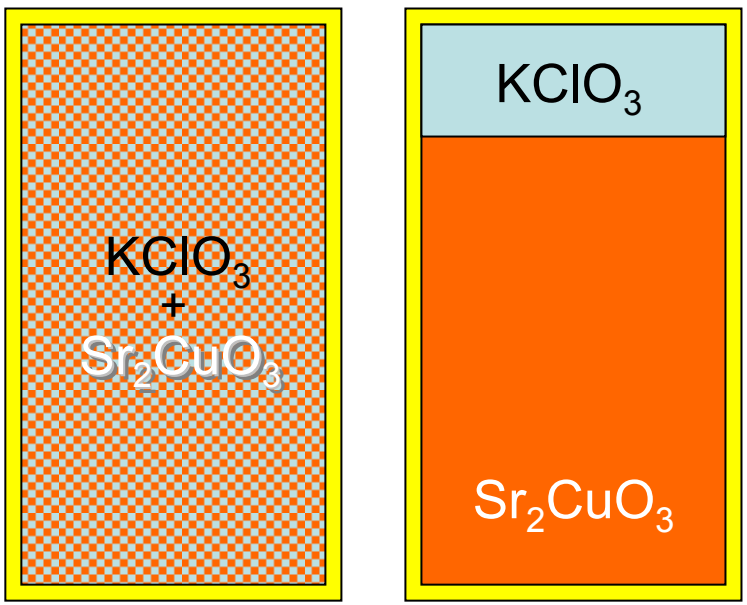


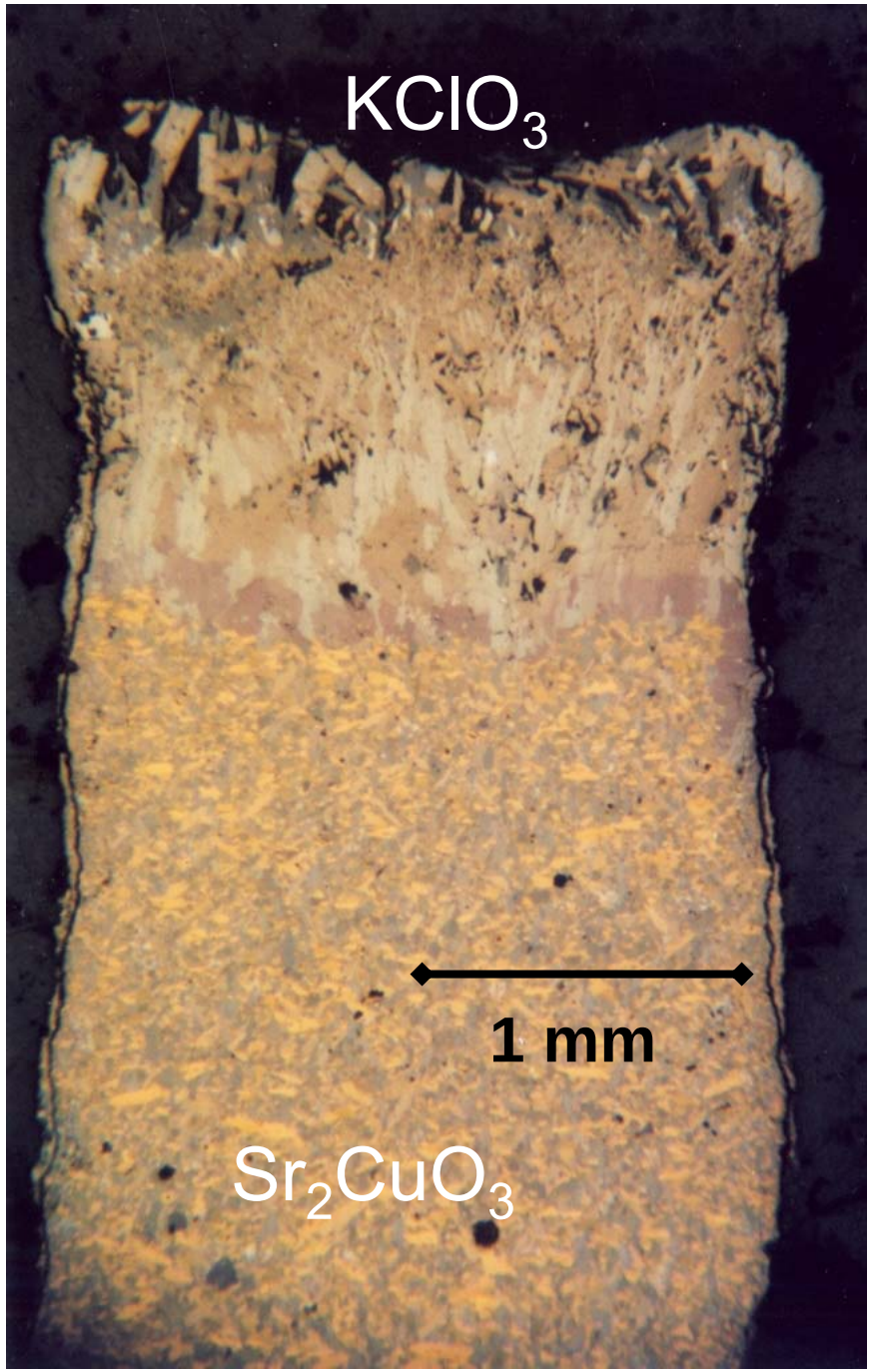
Hoffman & Walker (*GSA Bull.*,1978)

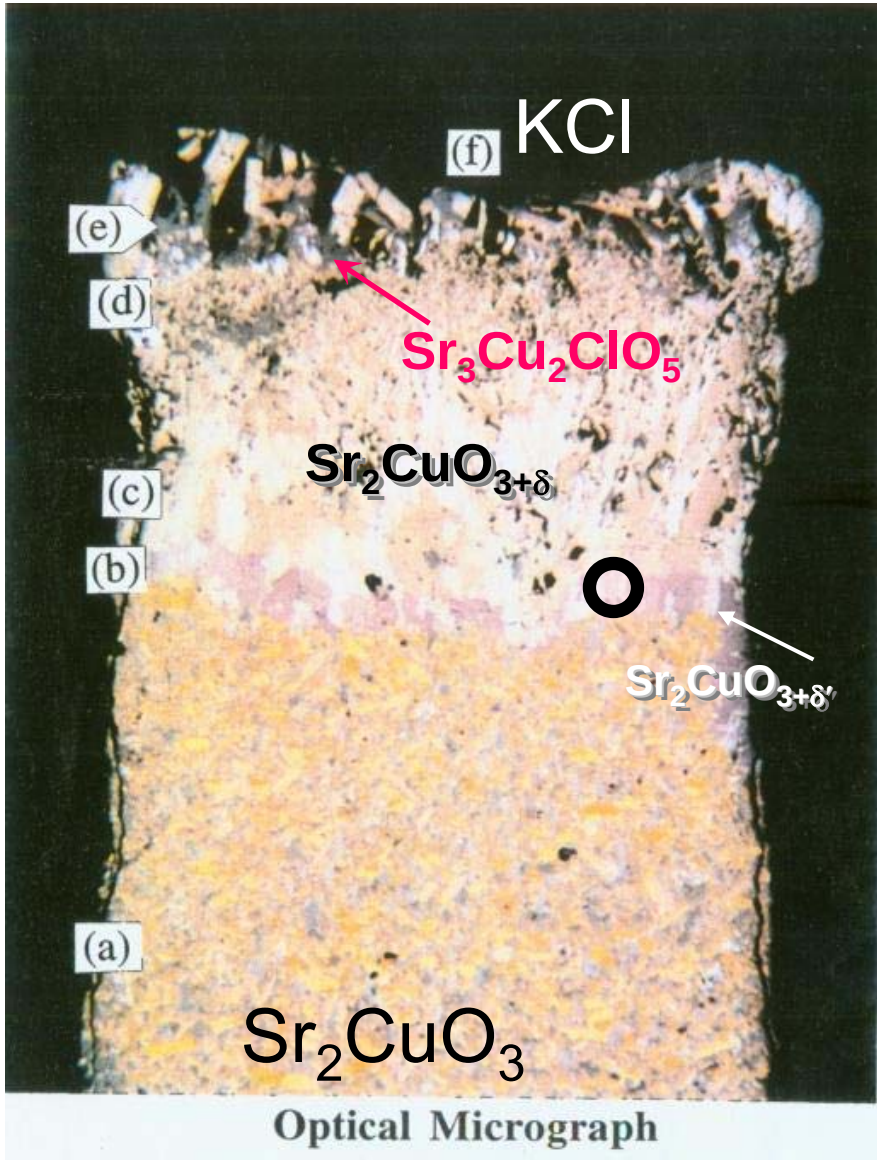
On a laboratory spatial scale:
for 60 kilobar (multi-anvil)
superconductor synthesis

$$Sr_2CuO_3 + \delta^3I_2O_2 = Sr_2CuO_{3+\delta}$$

$$KClO_3 = KCl + {}^3I_2O_2$$







High Meissner Fraction

Quenchable

Optical scale

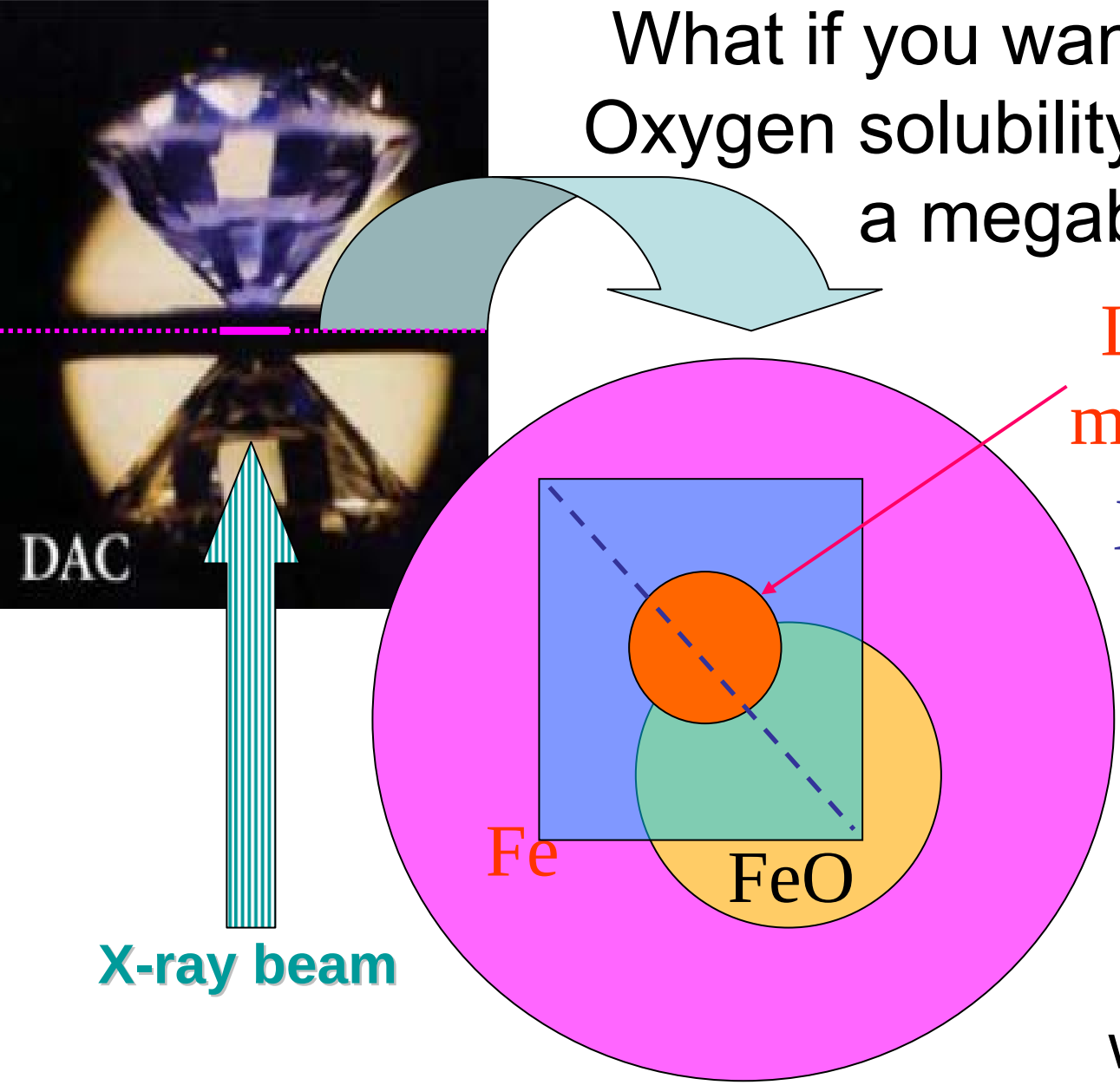
EMP/SSM scale

DAC scale? o

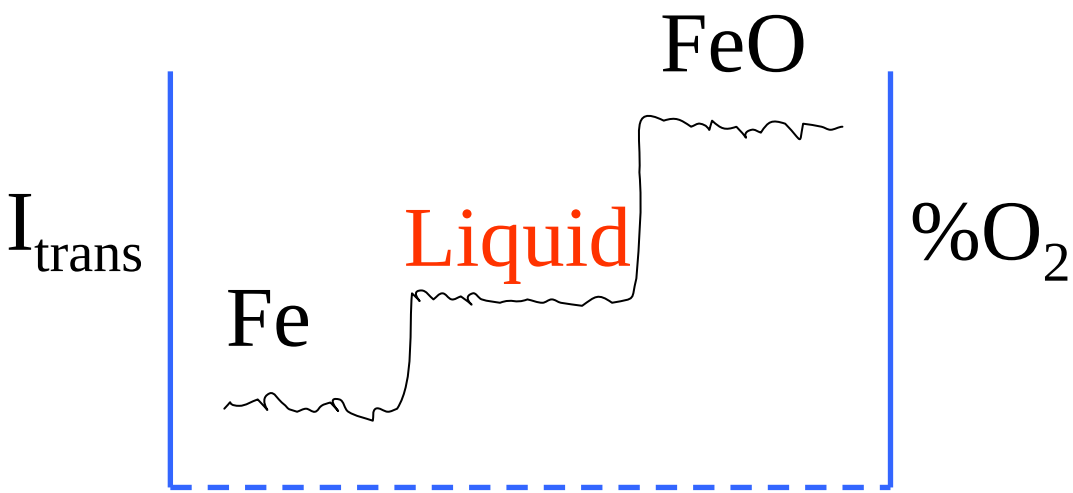
DAC transparency

From Scott, Kirtley, Walker et al. (*Nature*, 1997)

What if you wanted to measure Oxygen solubility in molten Fe at a megabar? [core issue]

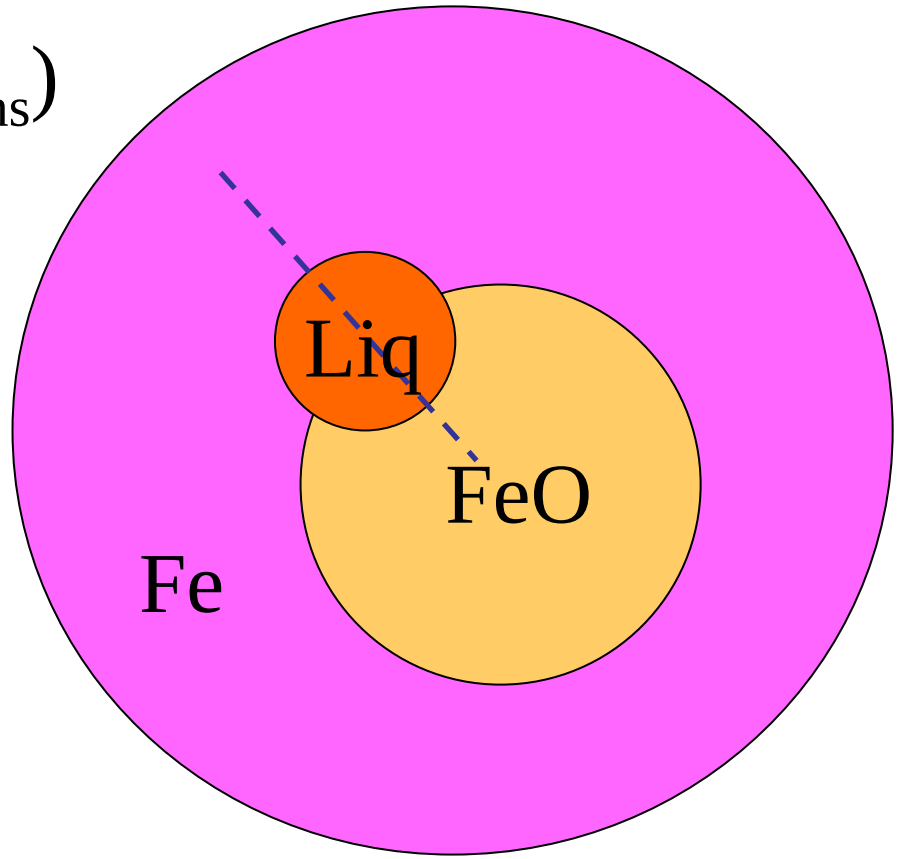


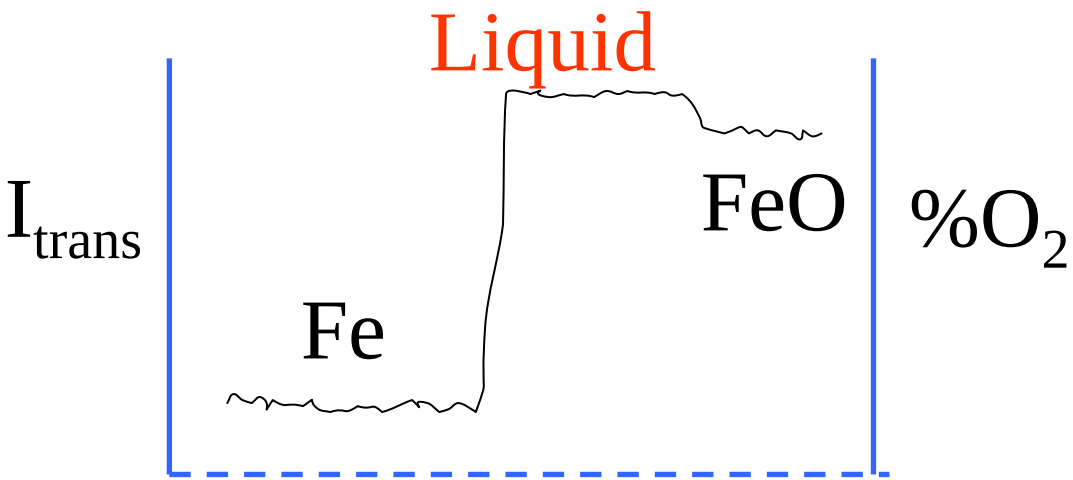
[I am doing this with Mike Walter, Simon Clark, Martin Kunz, and the COMPRES-supported ALS 12.2.2 team]



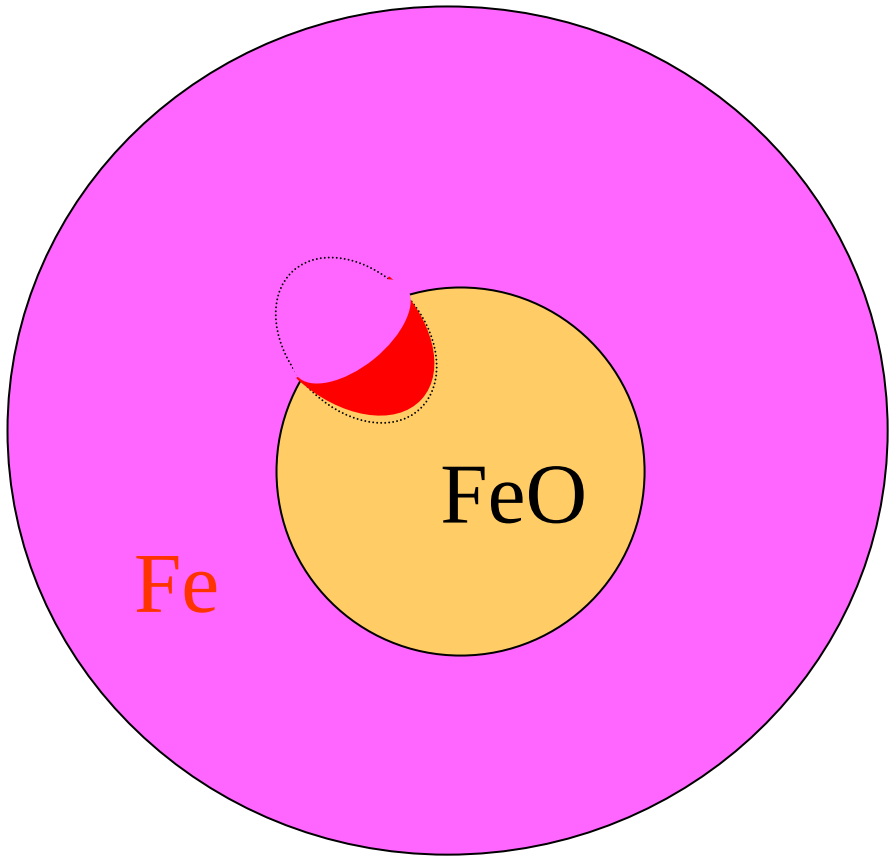
Single *in situ* property (I_{trans}) needed to characterize chemistry along a binary join.

Absorption(ε) &/or emission

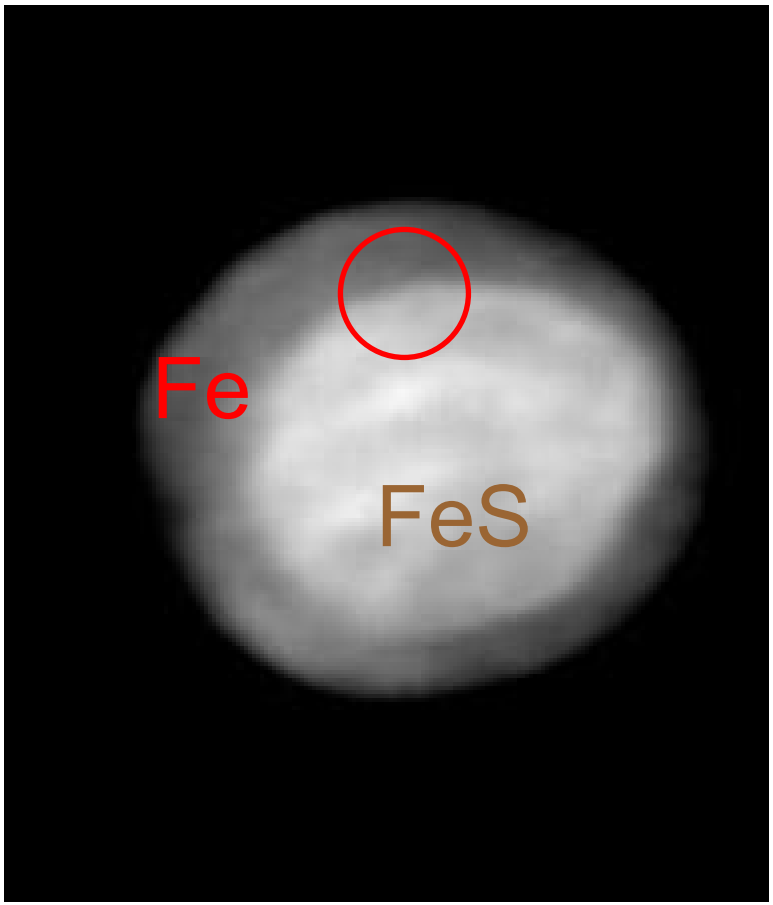


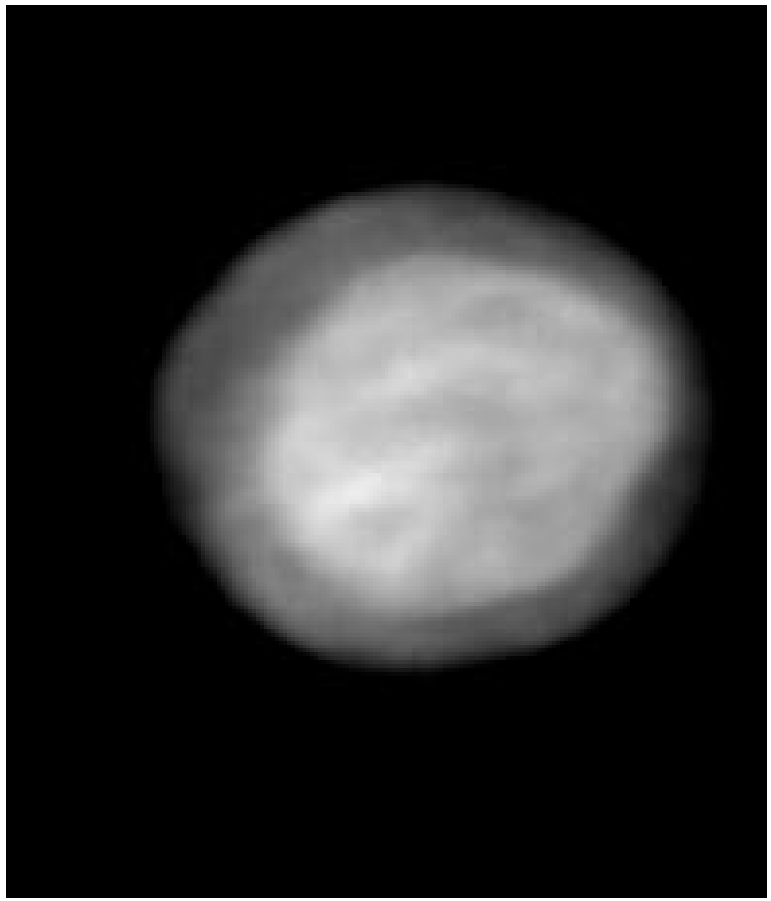


Peritectic
possible
to recognize
when reactants
are spatially
resolved.



50 kilobars

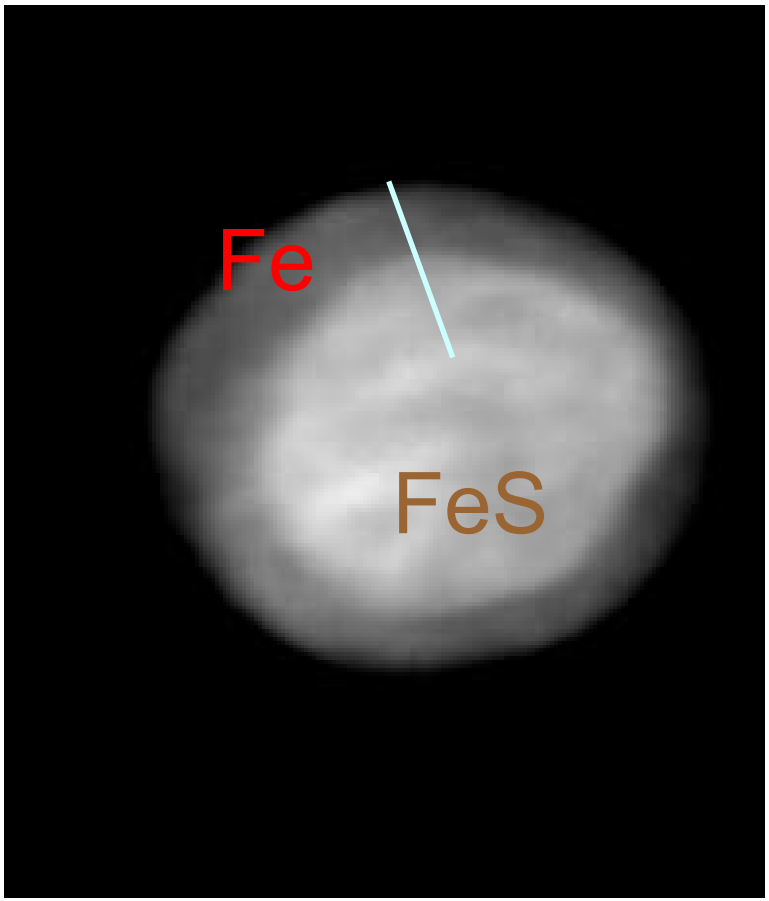


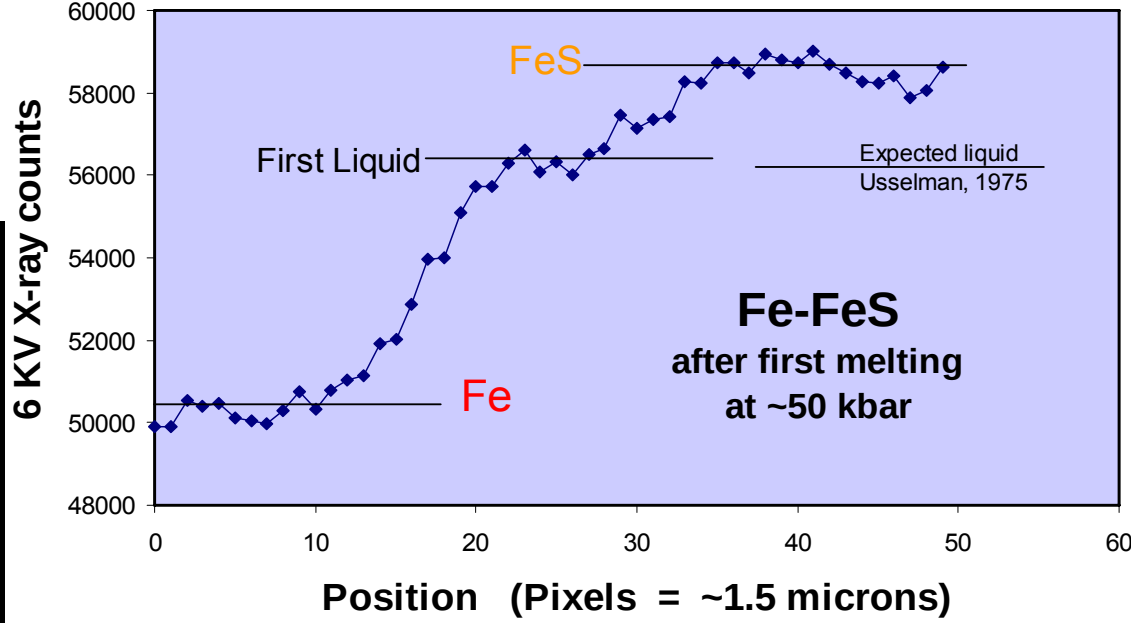


Station 12.2.2 ALS

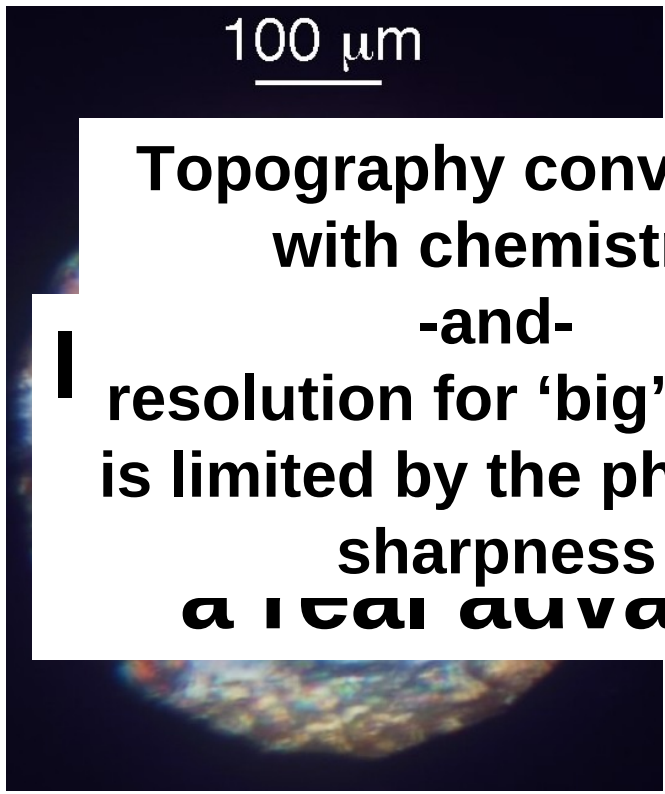
Melting shows erosion

50 kilobars





Melting shows erosion



Topography convolved with chemistry -and- resolution for 'big' beams is limited by the phosphor sharpness

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a real advance!

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Spatial resolution at sub-micron scale

-- needed to look at micron-scale DAC rxns --

will need ERL-like resolution

Challenges:
- achieve ERL prospectus
- master the raster strategy
- master optimal sample fabrication strategy
- choose problems wisely