Spatial Relationship Between Olivine Polymorphs in Shocked L6 Chondrites

Northwestern University SHyNE REU

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SHyNE Soft Hybrid Nanotechnology Experimental Resource

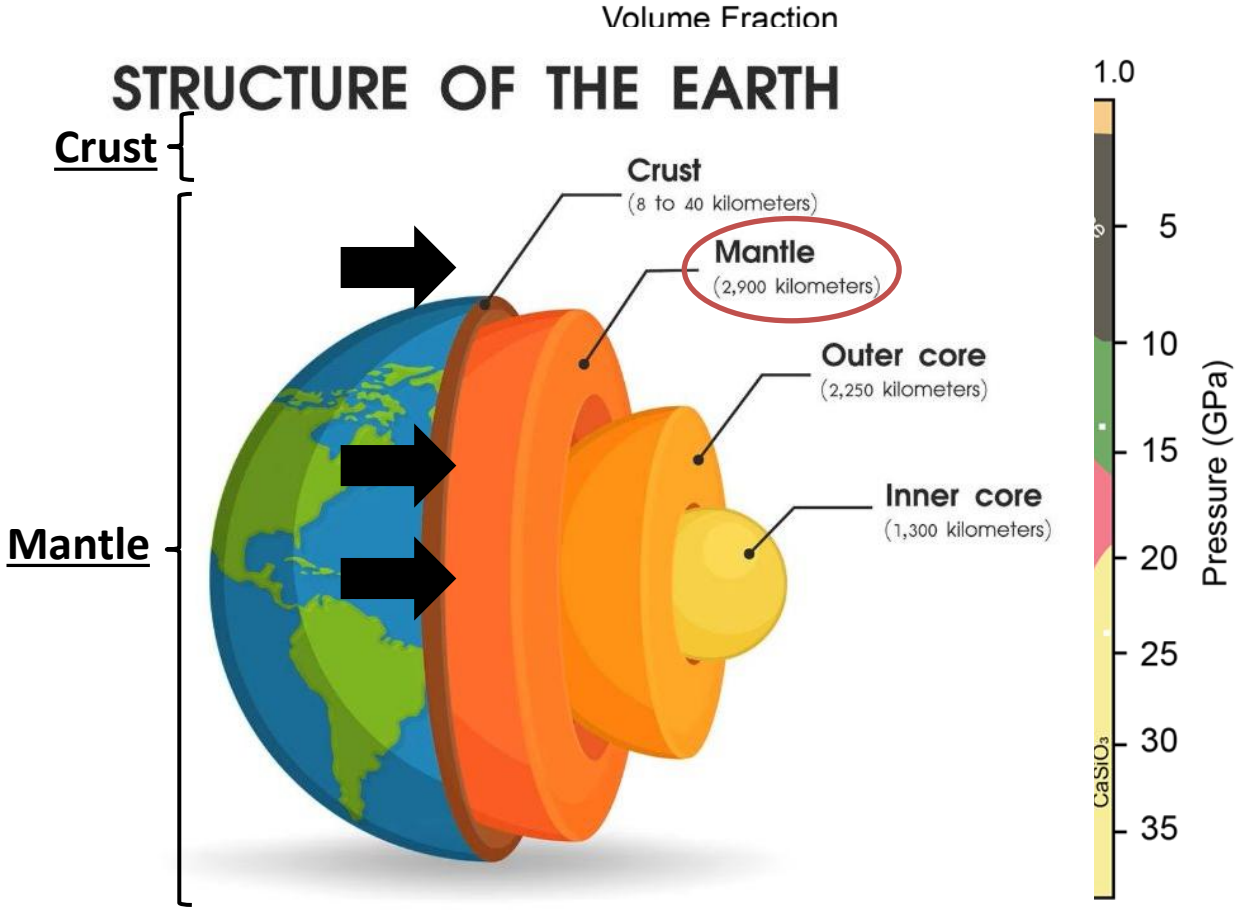
National Nanotechnology Coordinated Infrastructure

NSF

What is Olivine?

- Olivine $(Fe,Mg)_2SiO_4$ is the most abundant mineral in earth mantle

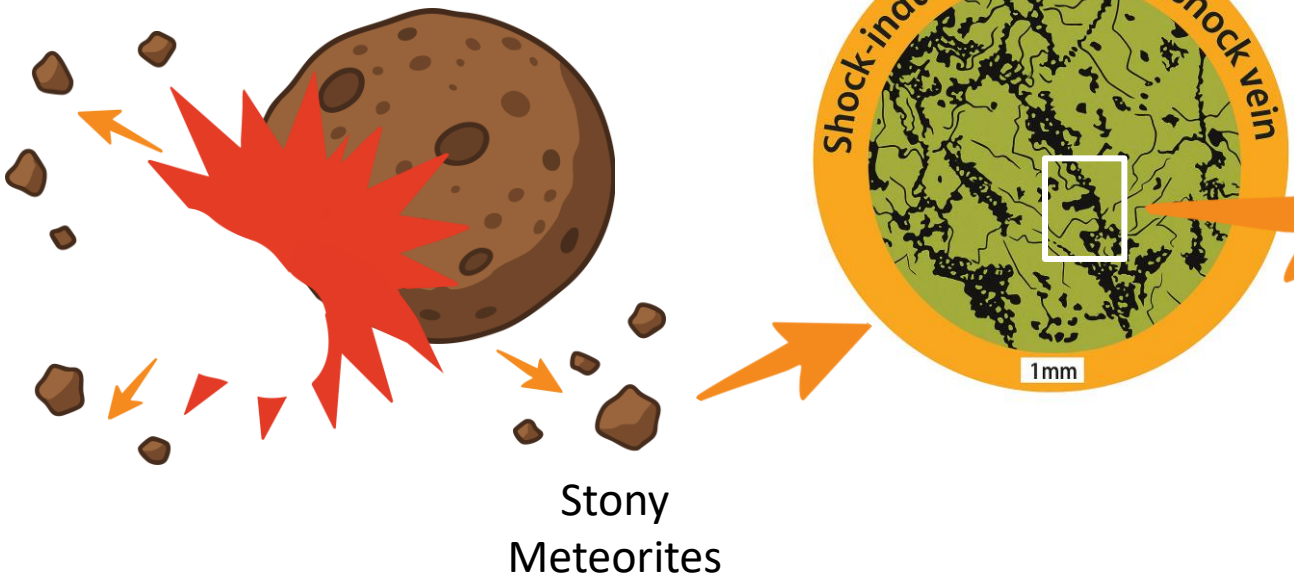
- Forms two polymorphs
  - Wadsleyite
  - Ringwoodite

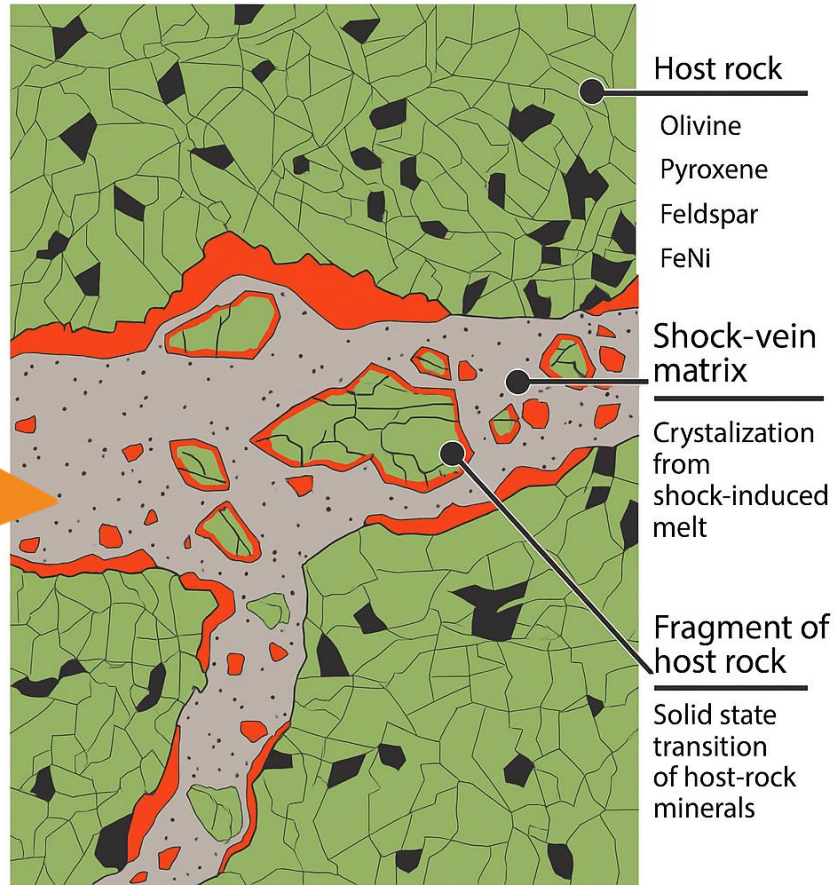


[1] Frost, D., *Elements*, 2008

Shock Melt Veins and Pockets

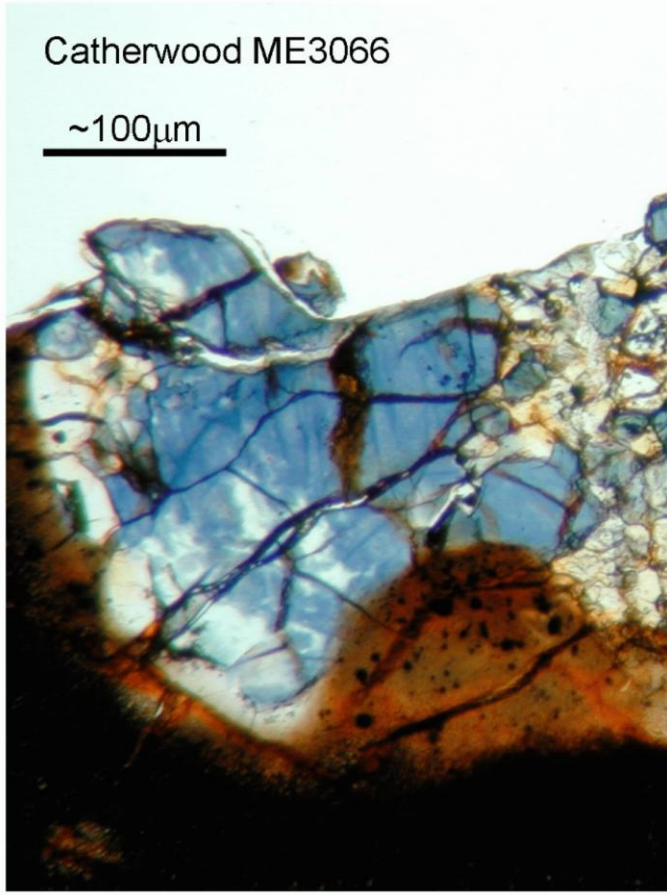
Shocked Meteorites → Stable HP Phases

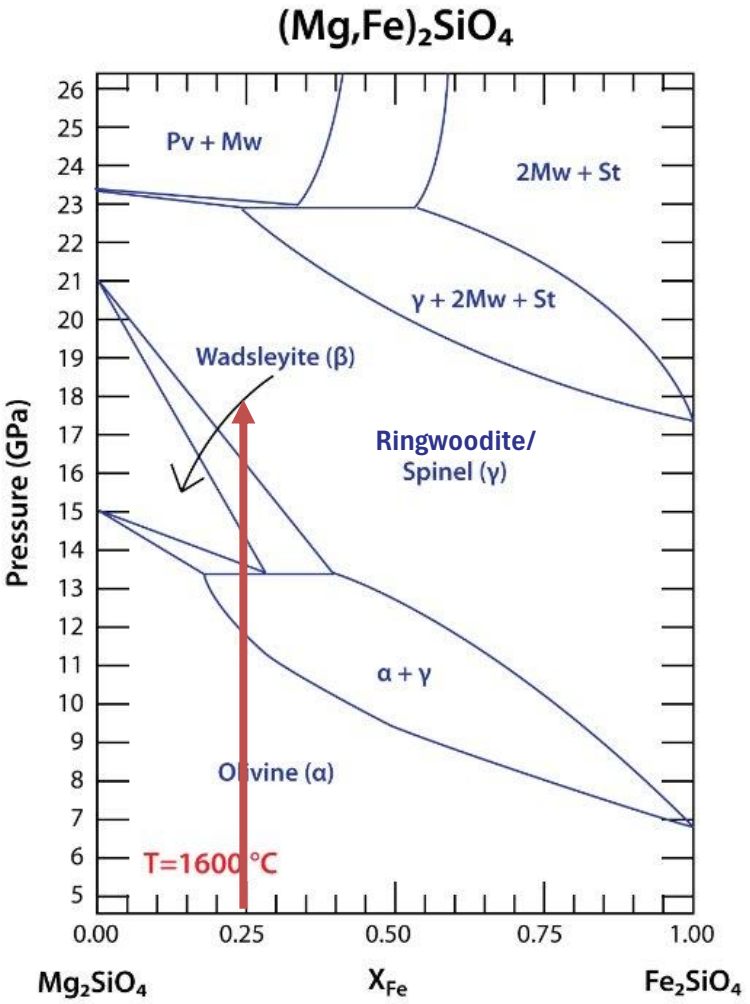




[2] Tomioka, N., and Miyahara, M., *Meteoritics & Planetary Science, 2017*

Catherwood Chondrite



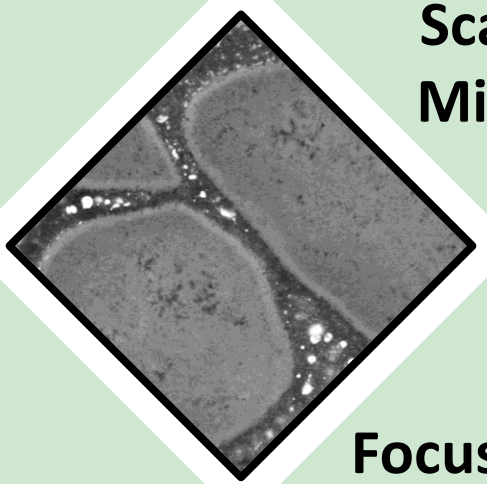


[1] Frost, D., *Elements*, 2008

Methodology

Backscatter Electron (BSE) Imaging

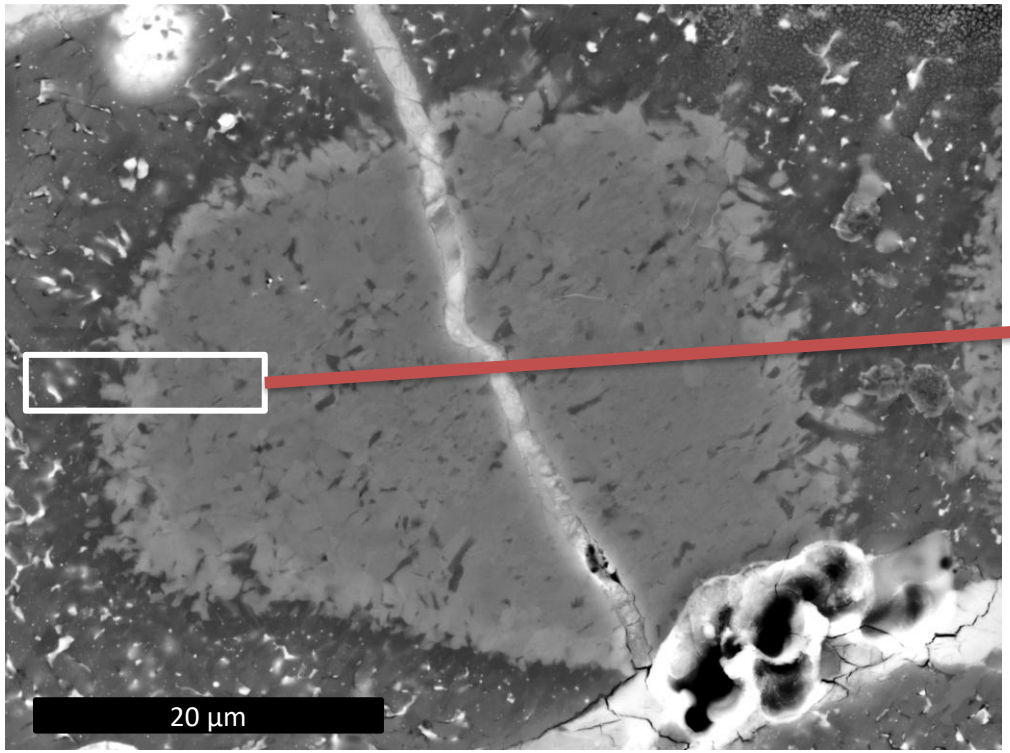
Energy Dispersive Spectroscopy (EDS) – Scanning Electron Microscopy (SEM)

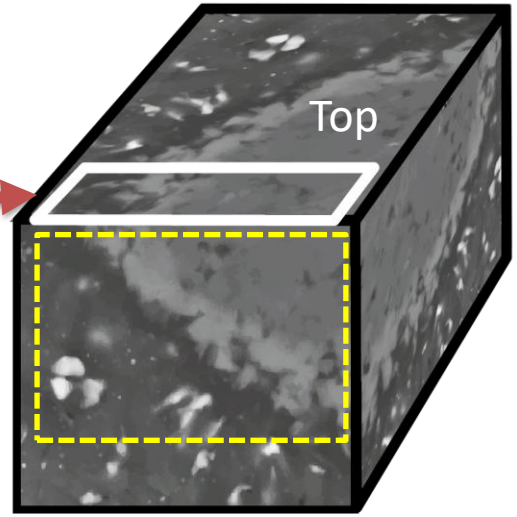


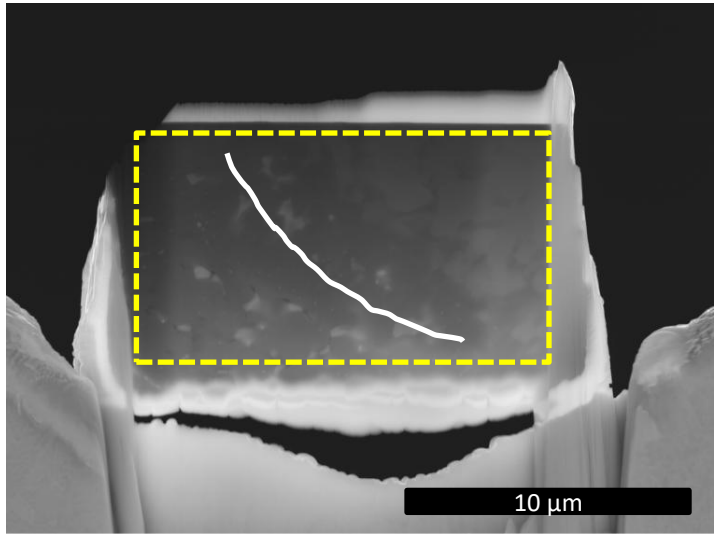
Raman

Focused Ion Beam (FIB) & Transmission Kikuchi Diffraction (TKD)

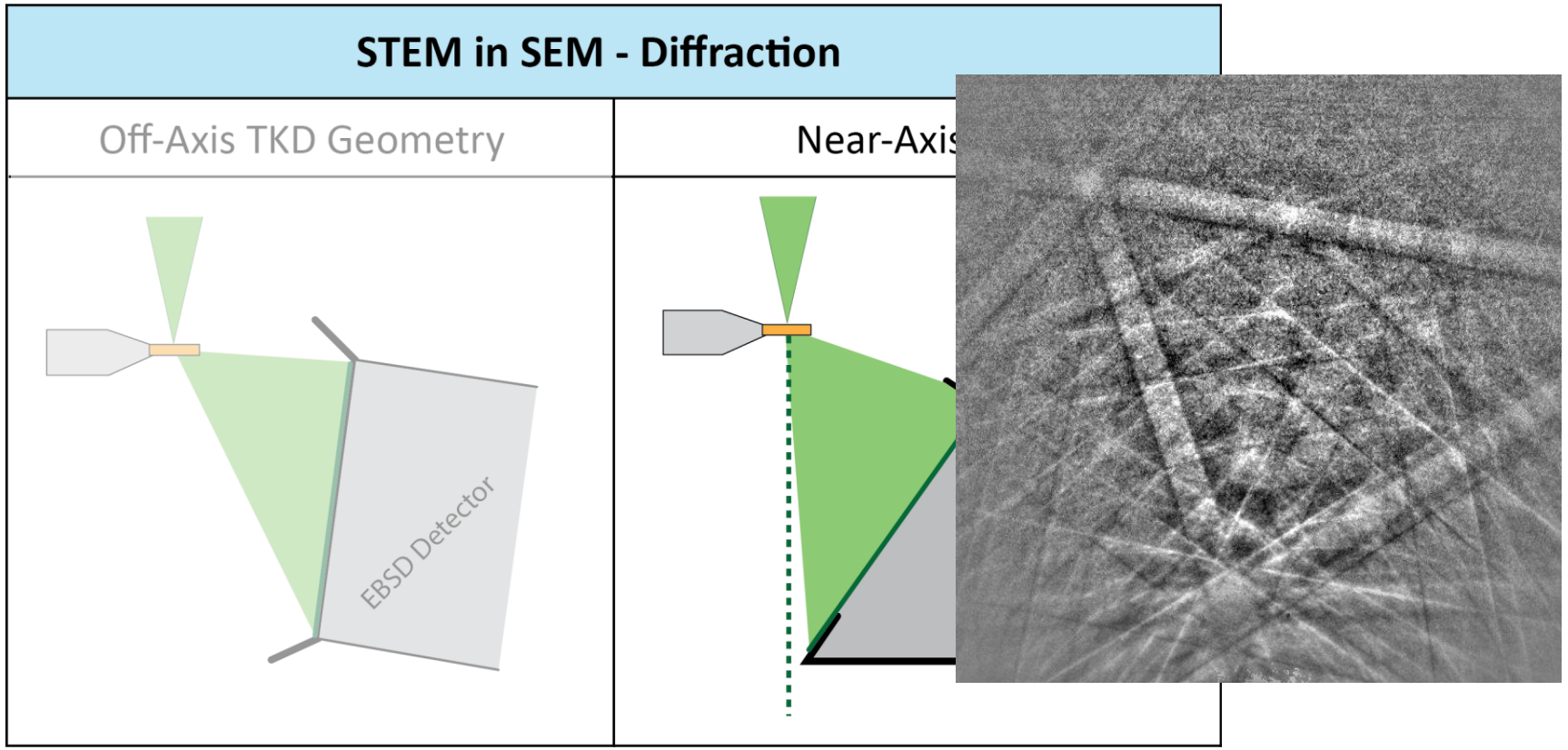
Focused Ion Beam Lift-Out



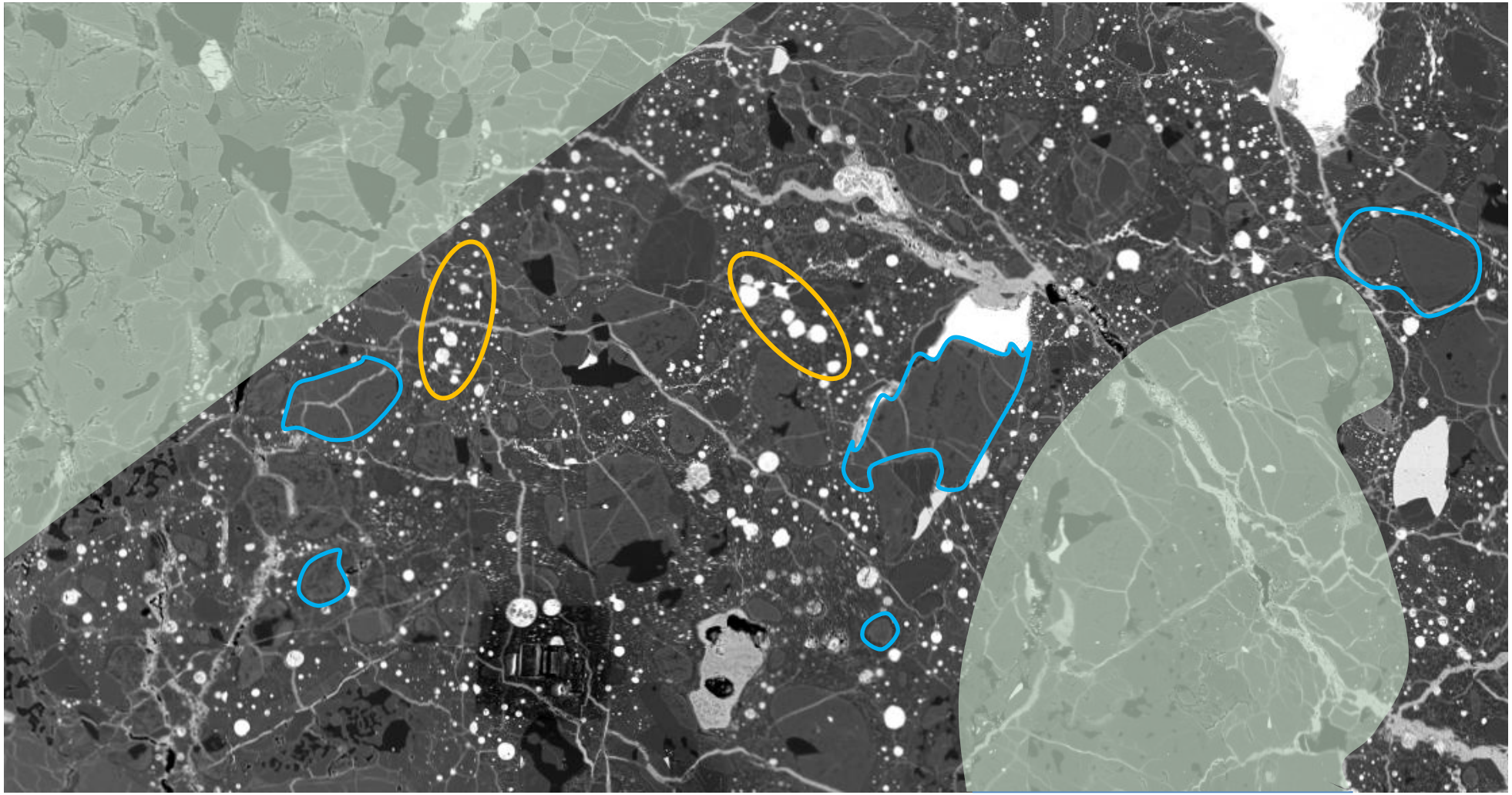




Near-Axis Transmission Kikuchi Diffraction



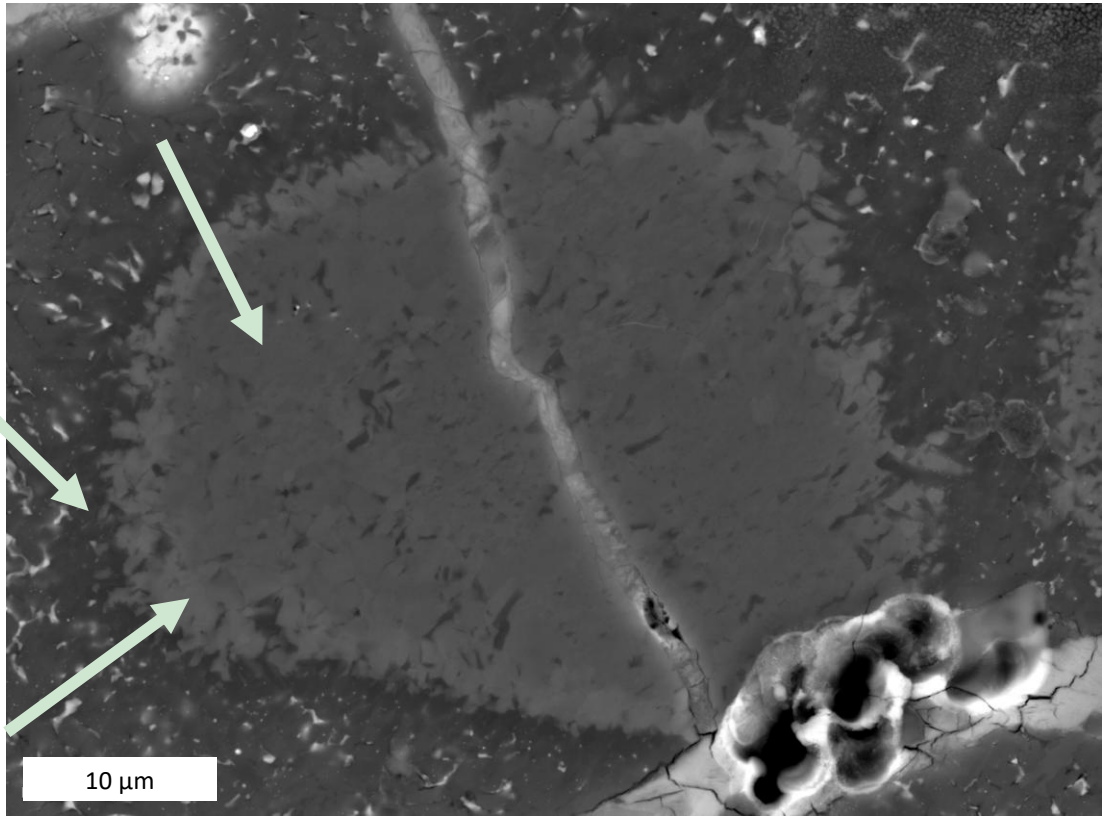
Shock Vein Features

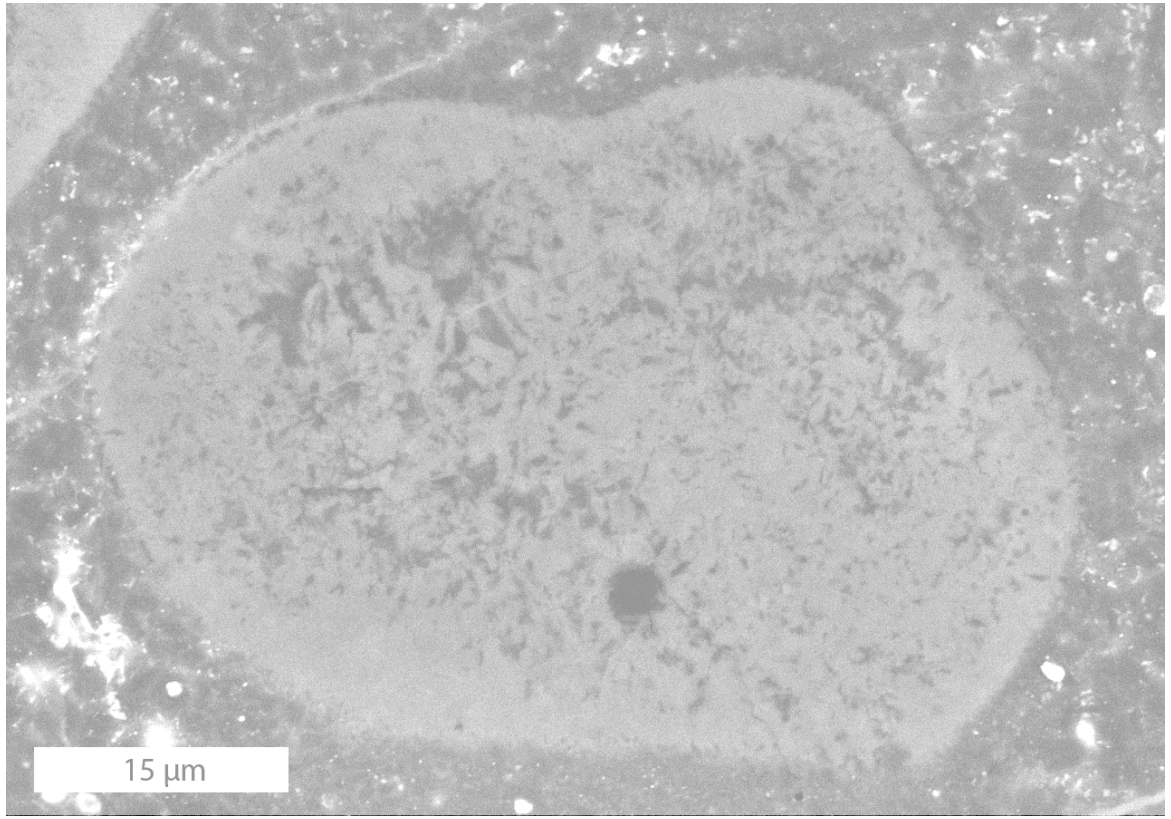


Aggregate Types

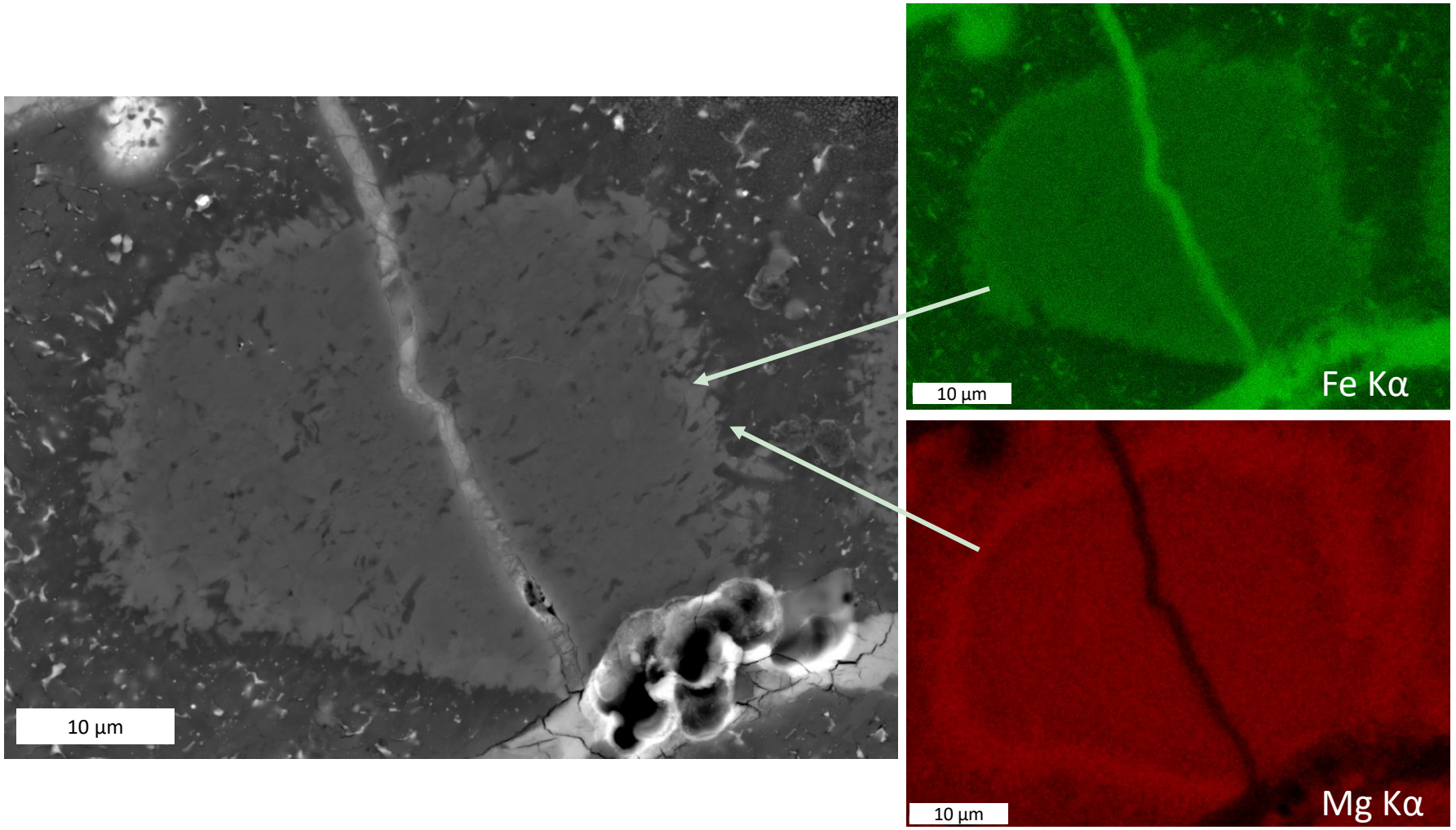
Form 1

Form 2

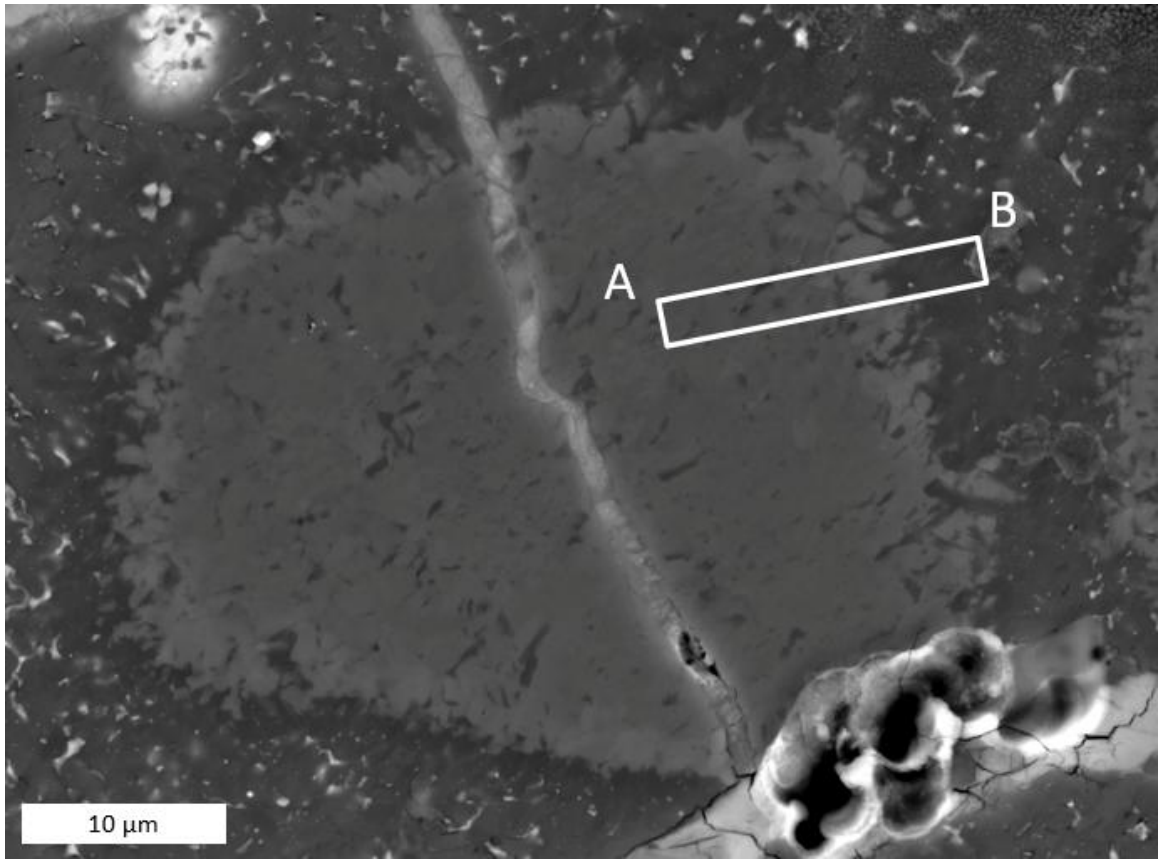


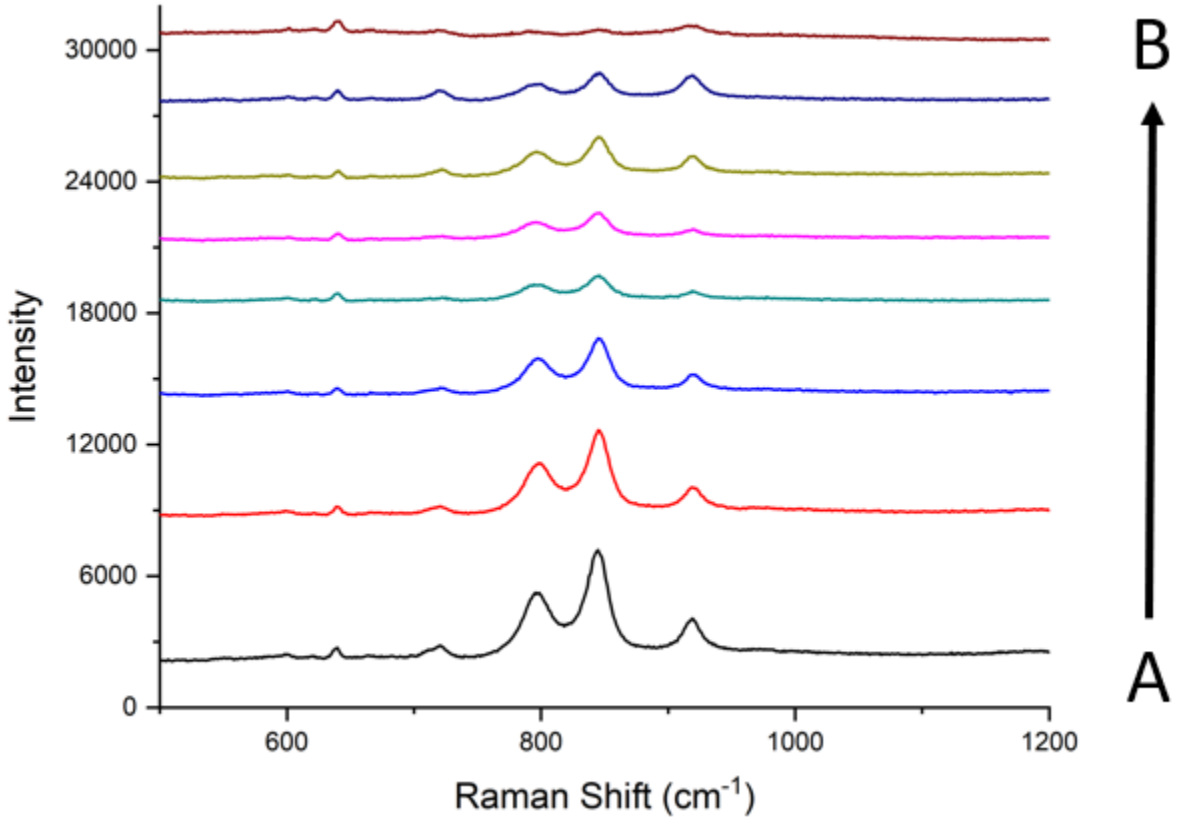


Chemical Separation in Aggregate



Phase Conformation with Raman





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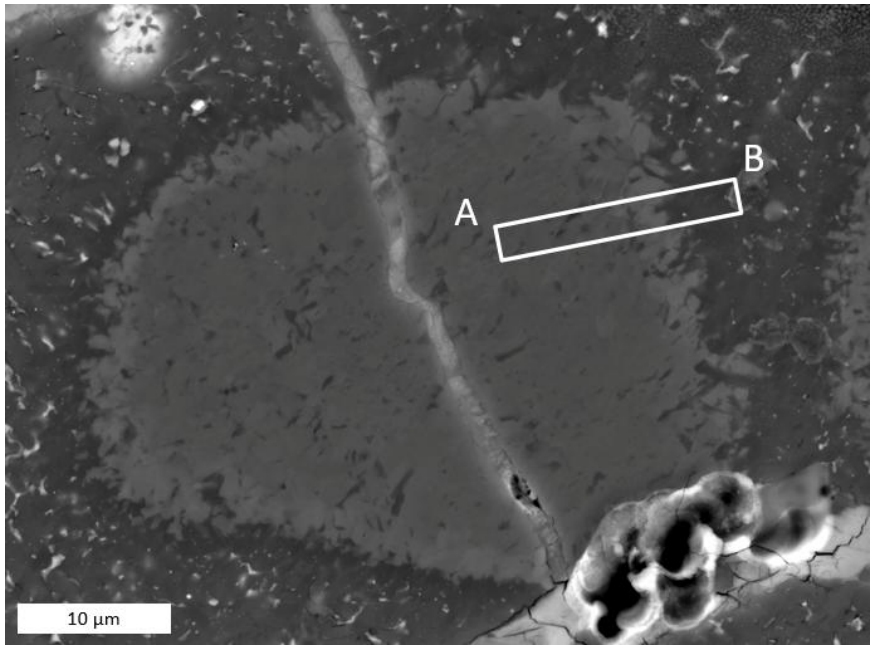
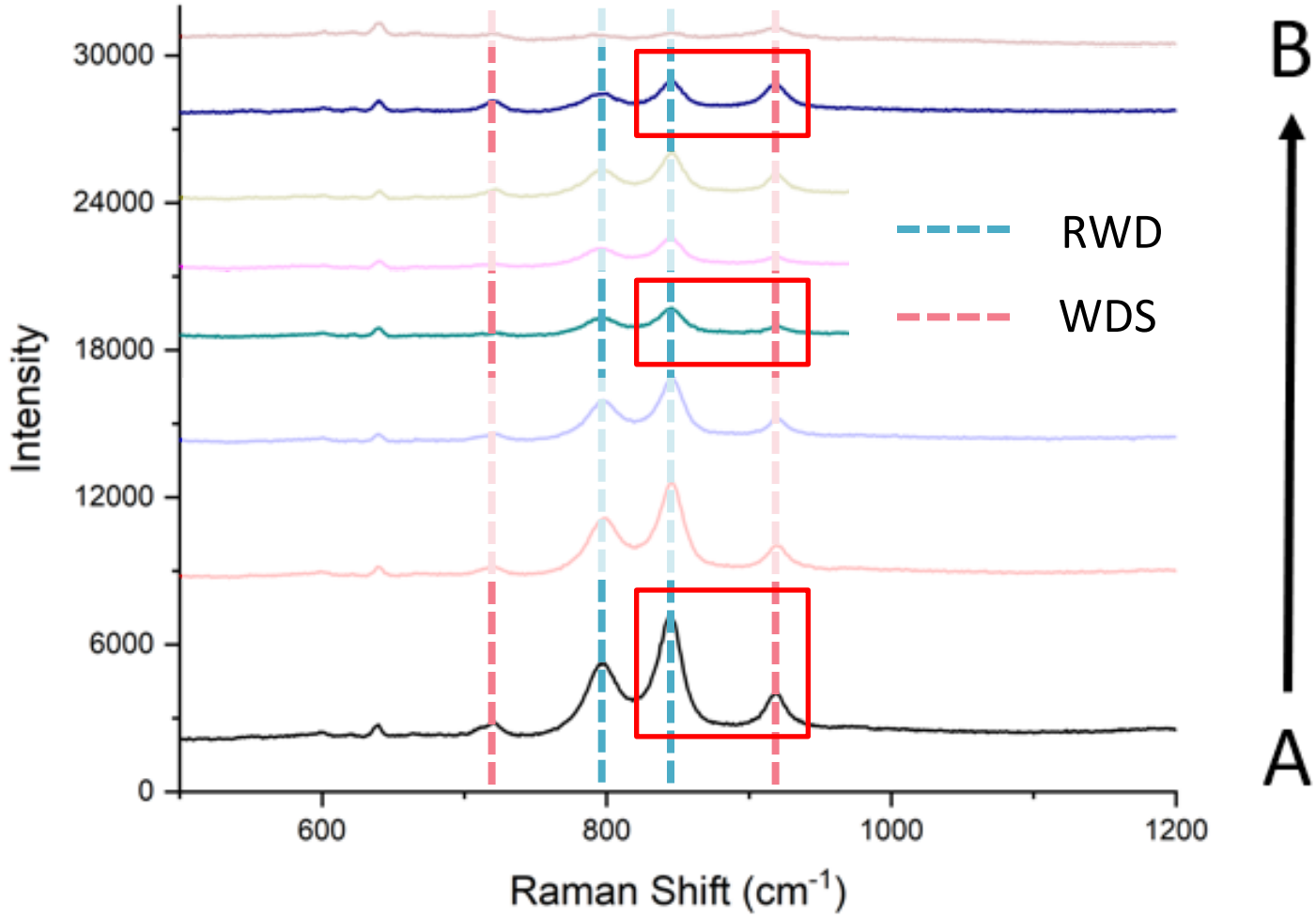
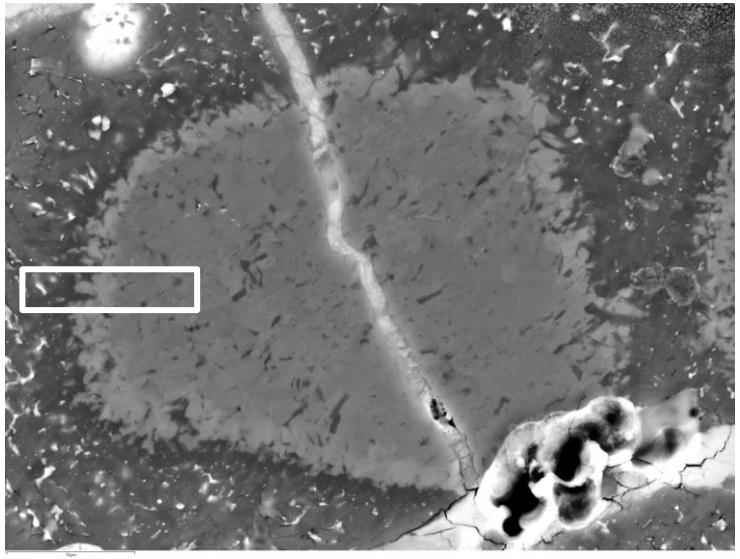
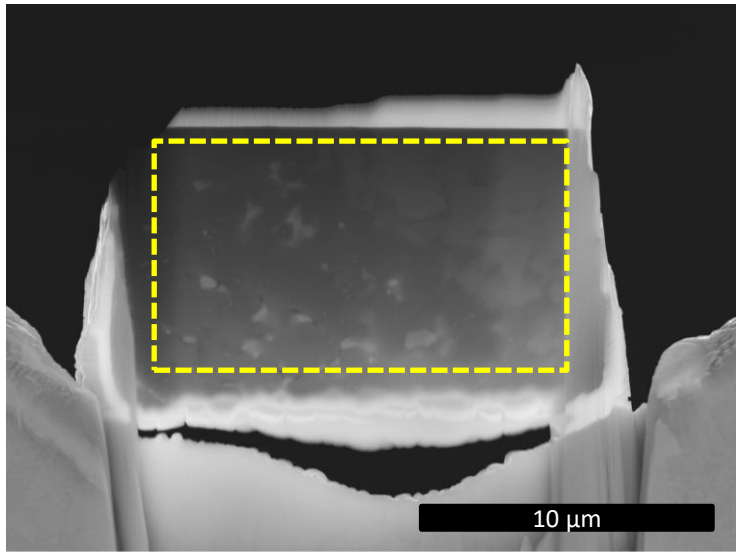




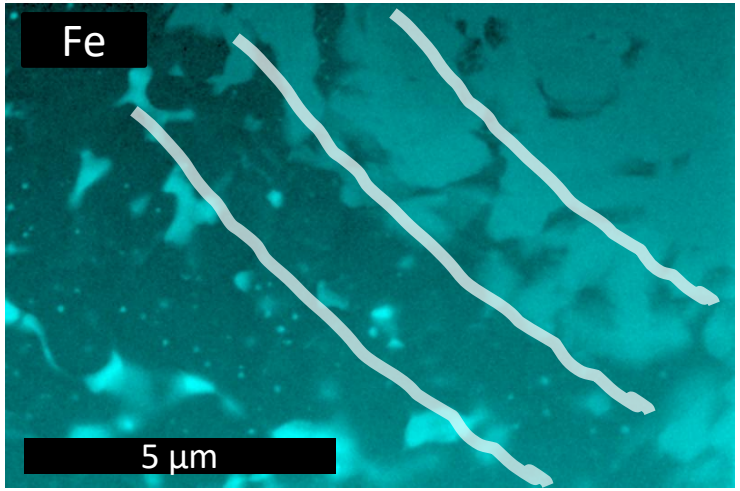
Phase Separation of Wadsleyite and Ringwoodite

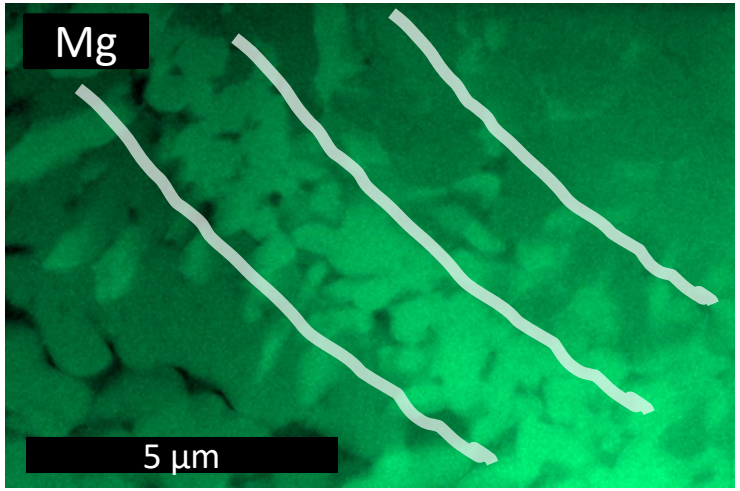


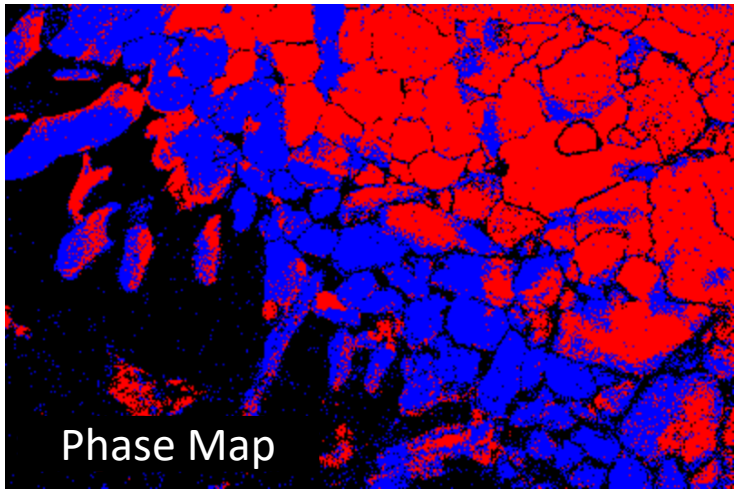


Ringwoodite

Wadsleyite







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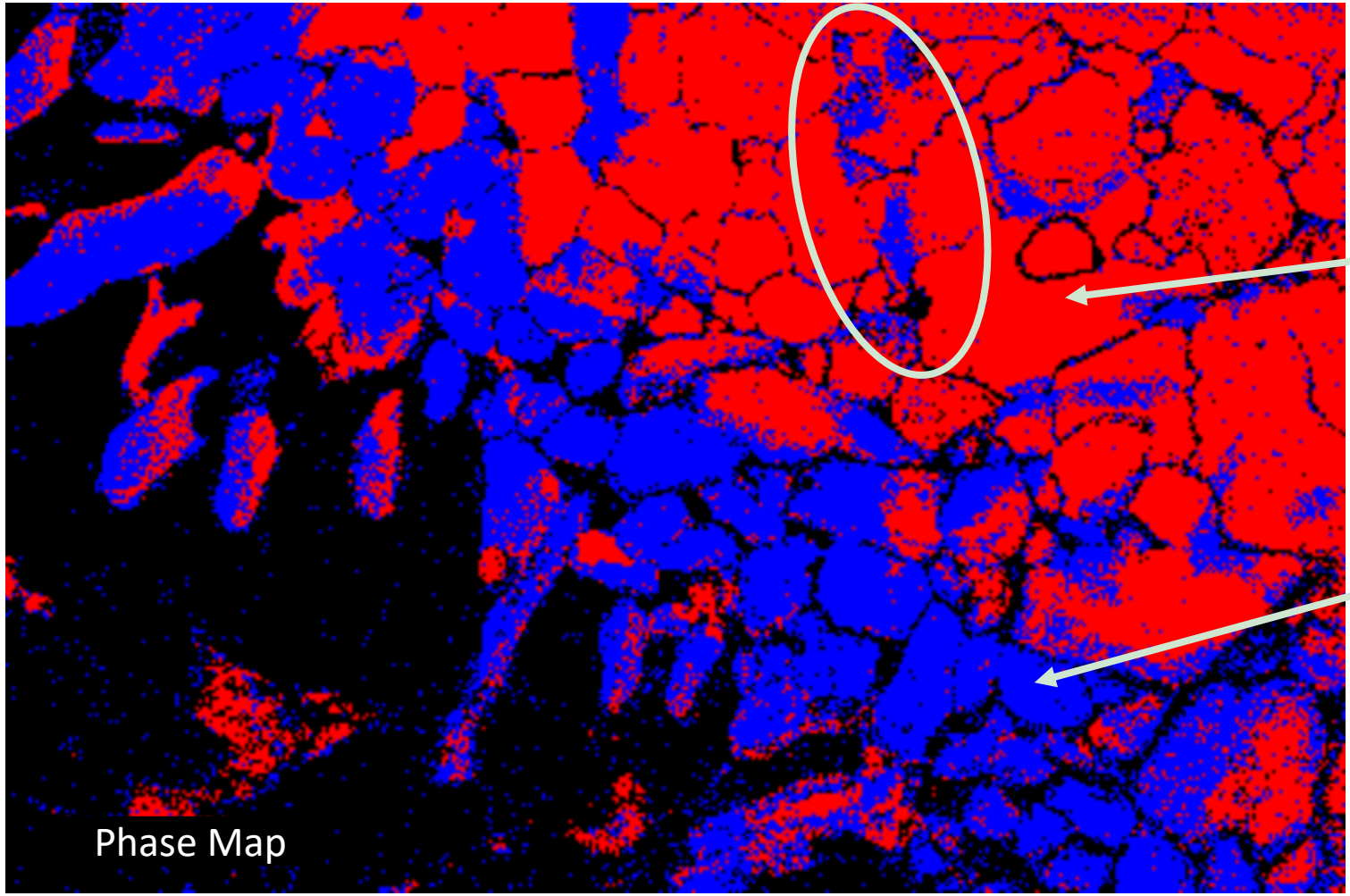
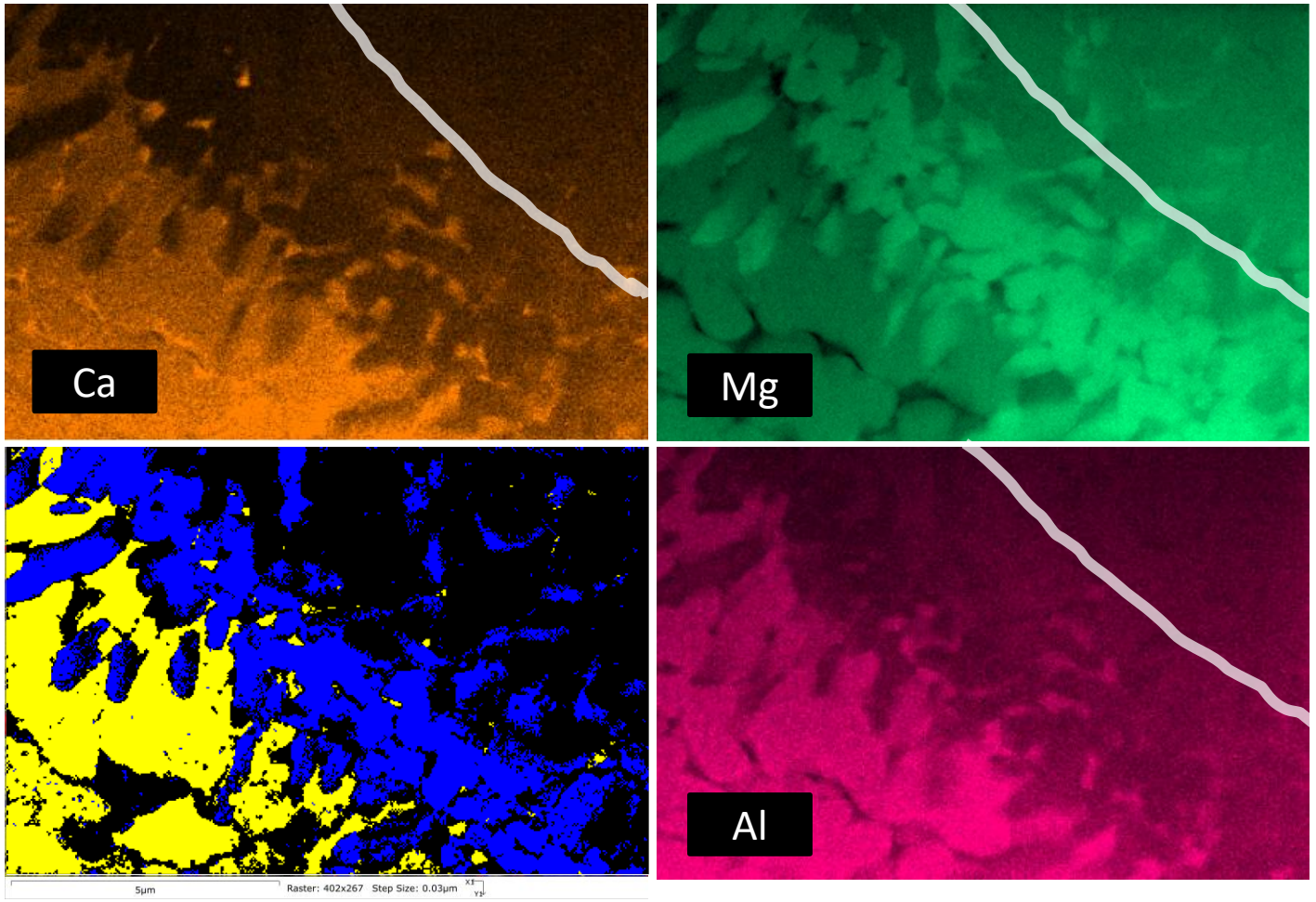


Crystallization of Wadsleyite from Melt

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