

Metamorphic Microstructures

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NNIN Facility Utilized: CharFac (JEOL6500)

- Lattice orientation of minerals in metamorphic rocks applied to:
 - Origin of garnet polycrystals
 - Deformation mechanisms of silicates & carbonates (P=0.5-2.5 GPa, T=300-700C)
 - Lawsonite vorticity as indicator of subduction kinematics
 - Recrystallization of high-pressure textures
 - Record of deformation in partially molten rocks
 - Trace element distribution in deformed quartz

● MAJOR OBSERVATIONS

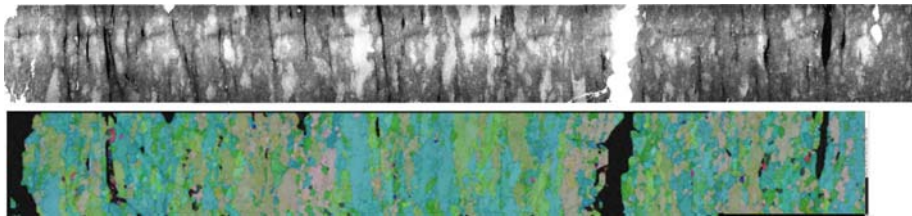
- Garnet polycrystals are much more common in metamorphic rocks than previously thought
- Carbonate minerals preserve high-P microstructures during overprinting; quartz microstructures are easily overprinted, but high-P mineral compositions preserved
- Magnetic lineation in paramagnetic migmatite is from zone axis orientation of biotite oriented in direction of flow



EBSD map of lawsonite crystals in high-pressure rock

● Publications

- Kruckenberg SC, Vanderhaeghe O, Ferre EC, Teyssier C, Whitney DL (in press) Flow of partially molten crust and the internal dynamics of a migmatite dome, Naxos, Greece. *Tectonics*
- Whitney DL, Teyssier C, Toraman E, Seaton NCA, Fayon AK (2011) Metamorphic and tectonic evolution of a structurally continuous blueschist-to-Barrovian terrane, Sivrihisar Massif, Turkey. *J Met Geol*
- Teyssier C, Whitney DL, Toraman E, Seaton NCA (2010) Lawsonite vorticity and subduction kinematics. *Geology* 38, 1123-1126
- Kruckenberg S, Ferre E, Teyssier C, Vanderhaeghe O, Whitney DL, Skord J, Seaton NCA (2010) Viscoplastic flow in migmatites deduced from fabric anisotropy: an example from the Naxos dome, Greece. *JGR*
- Whitney DL, Seaton NCA (2010) Garnet polycrystals and the significance of clustered crystallization. *Contrib Min Pet* 160 591-607
- Gordon SM, Whitney DL, Miller RB, Bowring S, McLean N, Seaton NC (2010) Metamorphism and deformation at different structural levels in a strike-slip fault zone, North Cascades, USA. *J Met Geol* 28, 117-136



Top: Cathodoluminescence image of deformed quartzite, showing CL variation in relict grains vs. recrystallized grains. Bottom: EBSD (Euler) map showing lattice orientation of quartz grains. These maps were used to guide ion microprobe analyses (Stanford; Woods Hole) of titanium content in quartz.