Wadsleyite Synthesis for Laser Driven Shock Experiments

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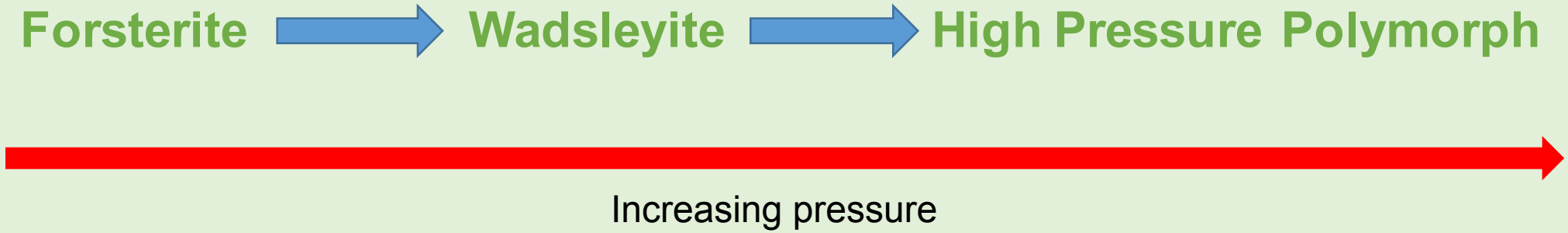
Laser Driven Shock

- Laser beams shock material producing high pressure and temperature conditions similar to those found in the deep interiors of the Earth or in large Earth-like exoplanets.
- Shock experiments require a dense starting material to then transform to its high pressure polymorph.
- If a less dense material is used, upon shock, the material will act as a fluid.



Synthesizing Wadsleyite

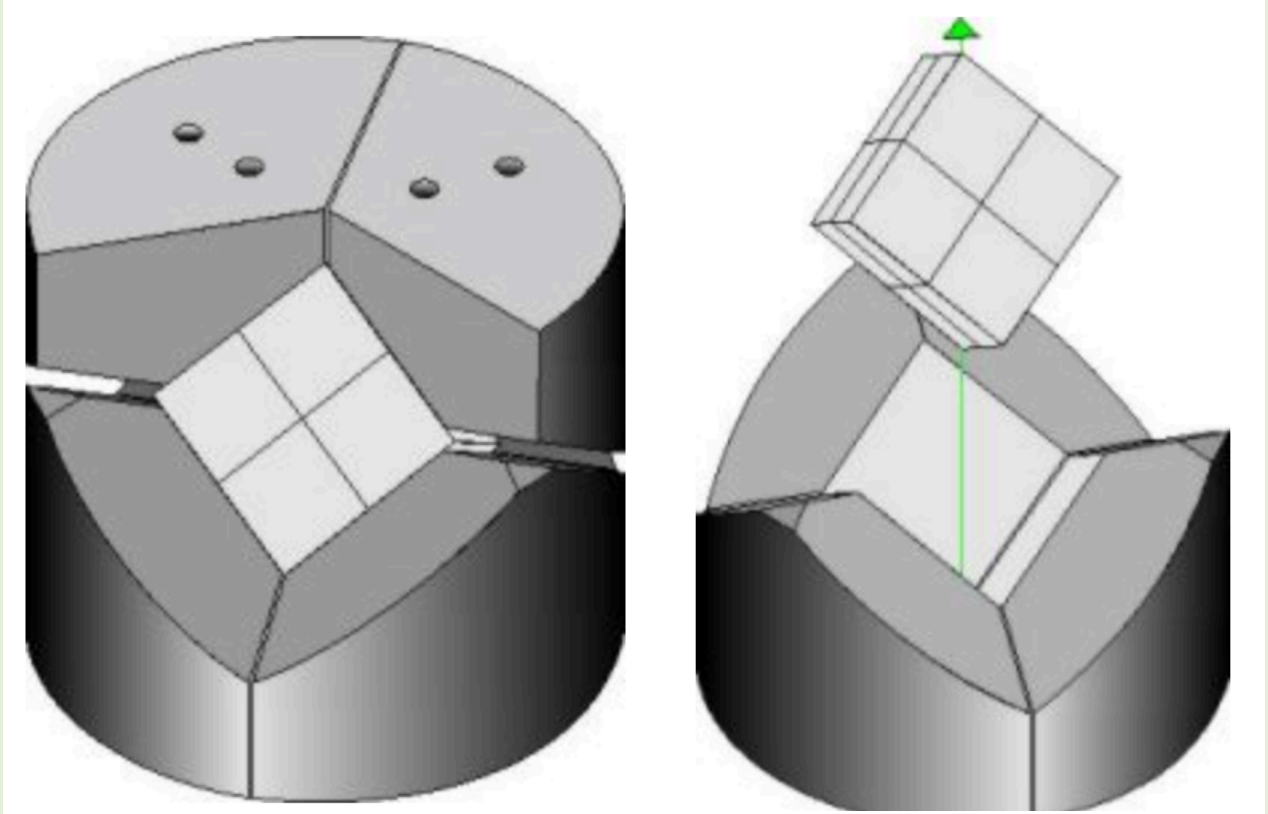
Forsterite → **Wadsleyite**

Synthetic forsterite (Mg_2SiO_4) was used as a starting material

A high pressure/high temperature multi-anvil press was then used to apply desired conditions to the sample

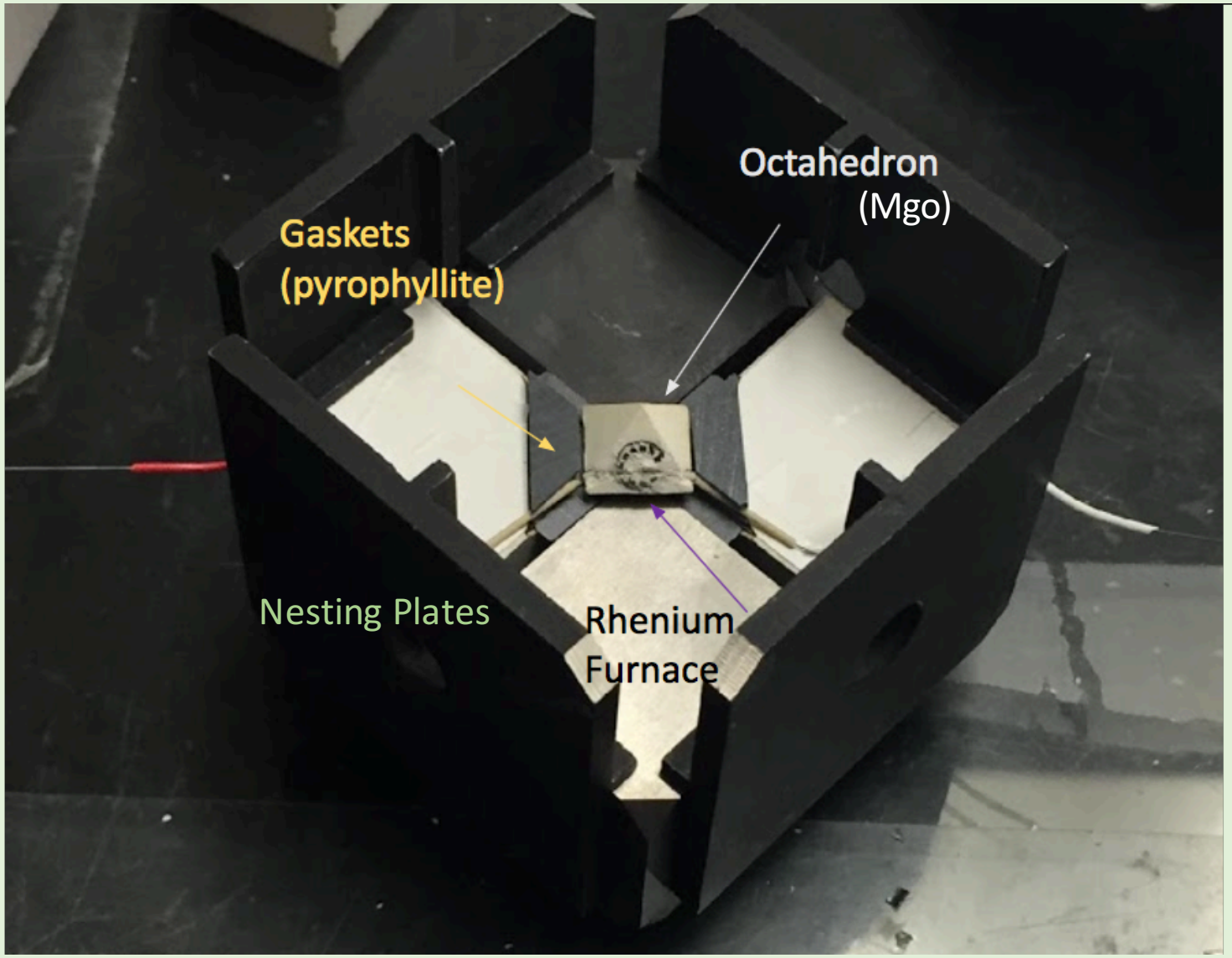
Multi-Anvil Press

- 6-8 Kawai and Endo type Multi Anvil was used in this experiment at Arizona State University
- 6 steel wedges and 8 Tungsten Carbide cubes



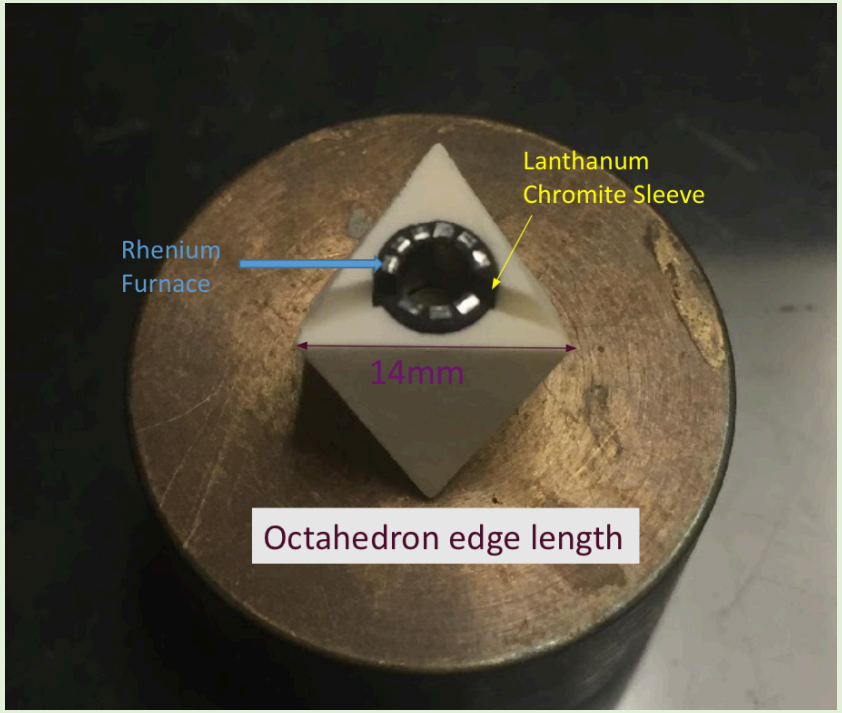
The National Centre of Experimental Mineralogy and Petrology. (n.d.). Retrieved from http://ncemp.org/MultiAnvil.htm

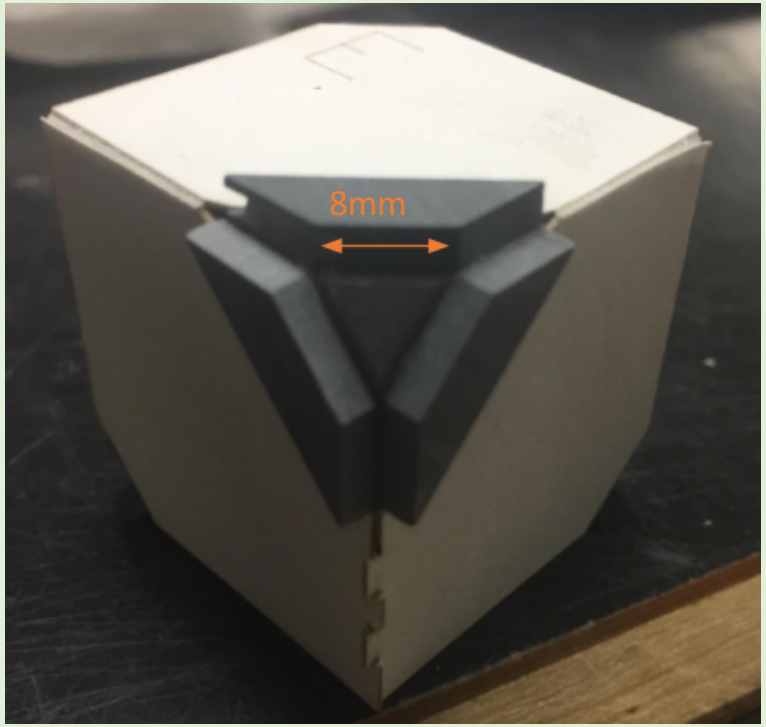
A look Inside the Assembly



14/8 Assembly

- 14/8 refers to the edge length of the octahedron and the truncation on the tungsten carbide cubes.
- 14mm = Octahedron edge length 8mm = Truncation Length

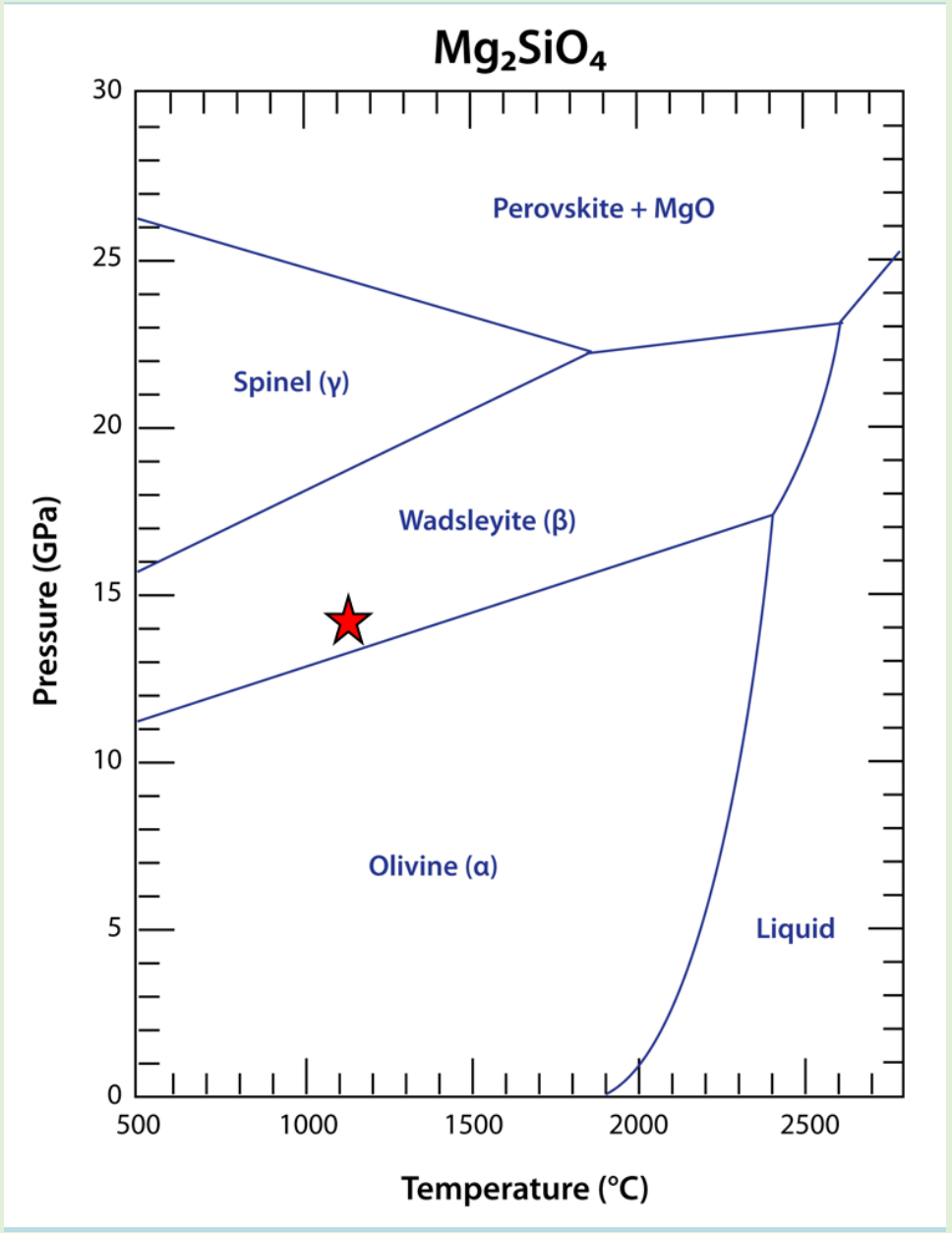




Run Conditions

- 1150° C
- 14 GPa
- dwell for 2 hours before quenching

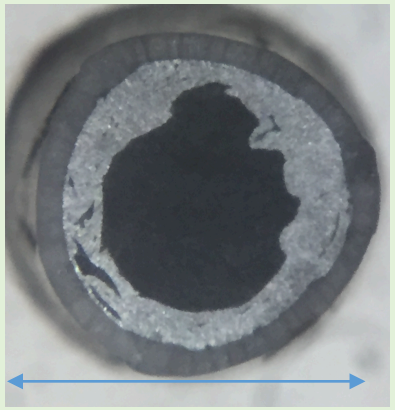
= Run Conditions plotted on Mg_2SiO_4 Phase Diagram

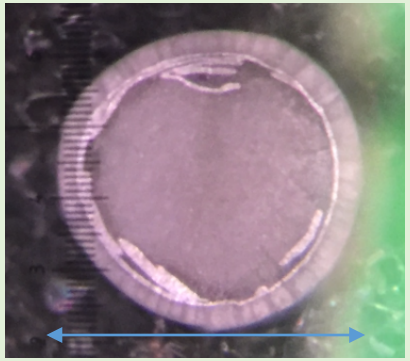


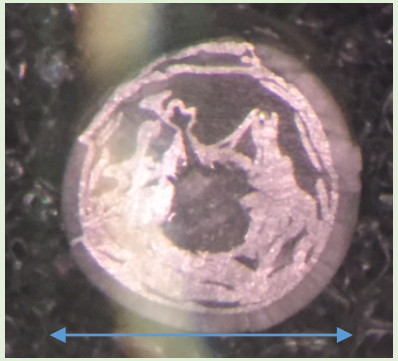
Burnley , P. (2016, November 15). Phase Equilibria at High Pressure

Results

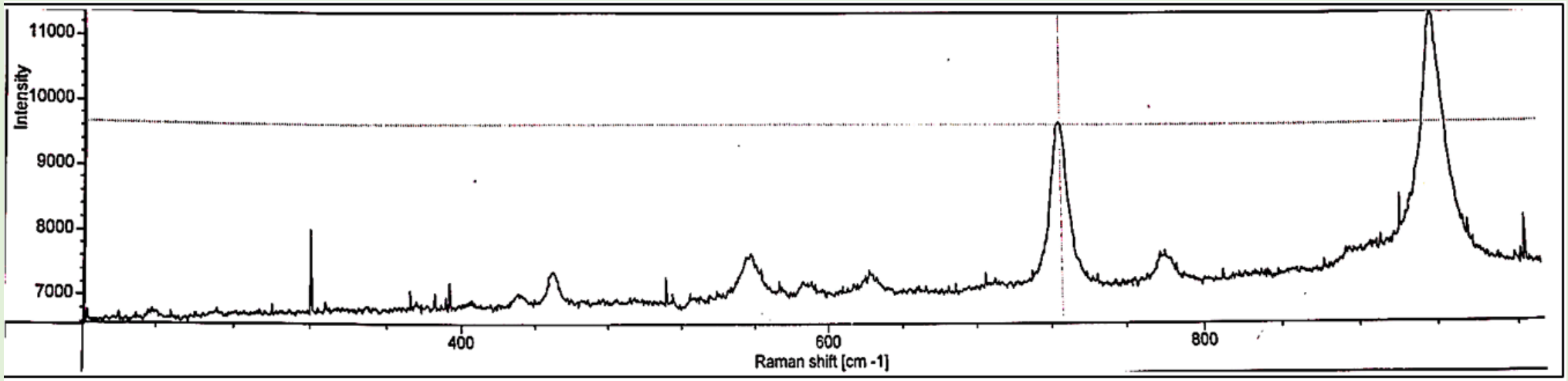
A total of 5 multi-anvil runs were done at these conditions, each checked with Raman Spectroscopy to confirm that they were indeed wadsleyite

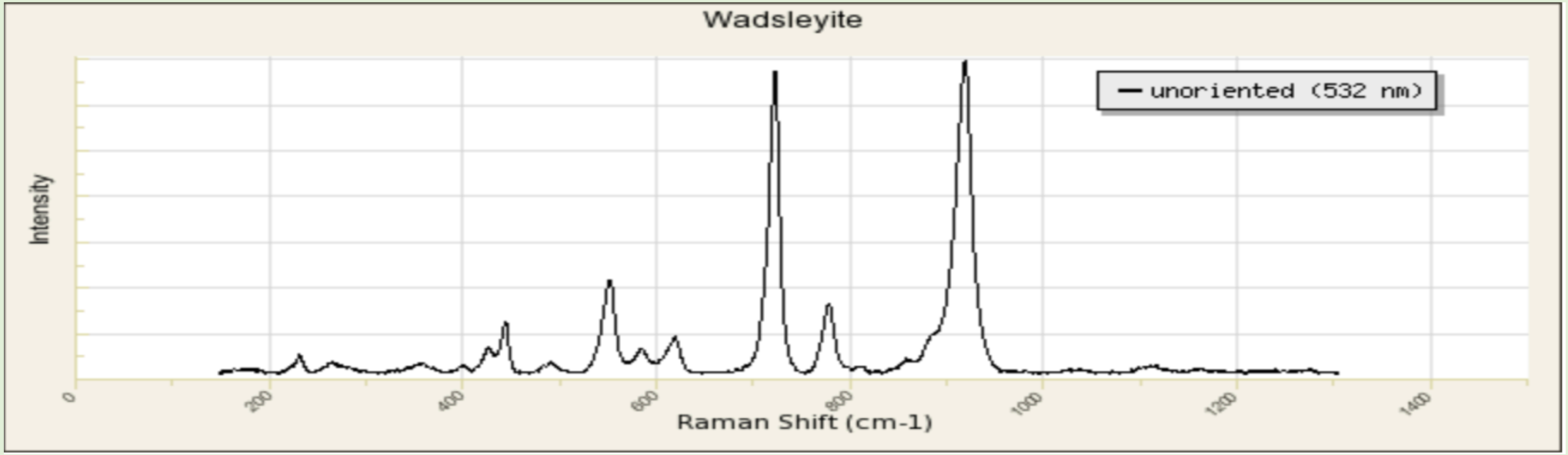






Raman Spectrum





http://rruff.info/wadsleyite/display=default/

Future Research

- Synthesizing Akimotoite, Majorite, and Bridgmanite at different conditions to understand the triple point in the $MgSiO_3$ system.