	Experiment title: Behaviour of Y and Zr in silicate melts at high pressure: an in-situ HP/HT EXAFS experiment to track trace element speciation in magmas	**Experiment number**: ES189
Beamline: BM23	**Date of experiment**: from: 22/10/2014 to: 27/10/2014	**Date of report**: Feb. 11, 2016
Shifts: 18	**Local contact(s)**: Innokenty Kantor	*Received at ESRF:*

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Report:

Trace elements provide invaluable information on processes that have caused magmatic activity on the Earth, Moon and other rocky planets since their formation. It has been shown that extensive variables such as composition, pressure, temperature, and oxygen fugacity have an effect on mineral/melt partitioning of trace elements such as Y, and Zr. Coordination of Y is known to increase from 6 to 8 with changing glass polymerisation, corresponding to a doubling of the partition coefficient. An increase in P can similarly alter melt structure and could therefore have a yet undetermined but considerable impact on trace element partitioning. A basic understanding of how melt structure influences the partitioning of these elements between minerals and silicate melts is thus critical to interpreting early planetary differentiation events

In October 2014 we investigated the local structure around both Y and Zr in silicate melts up to 10 GPa and <1400^{o}C using a Paris-Edinburgh press. The local environment around the trace elements was determined through EXAFS and XANES at the Y and Zr K-edges. At these energies a low enough concentration of trace element could be used in the sample to accurately represent how trace elements behave in-situ in the melt structure. Nano-polycrystalline diamond capsules were used in the Paris-Edinburgh press sample assembly in order to minimise any interference from diamond Bragg peaks. The data collected was of high quality up to 8 A^{-1} in reciprocal space.

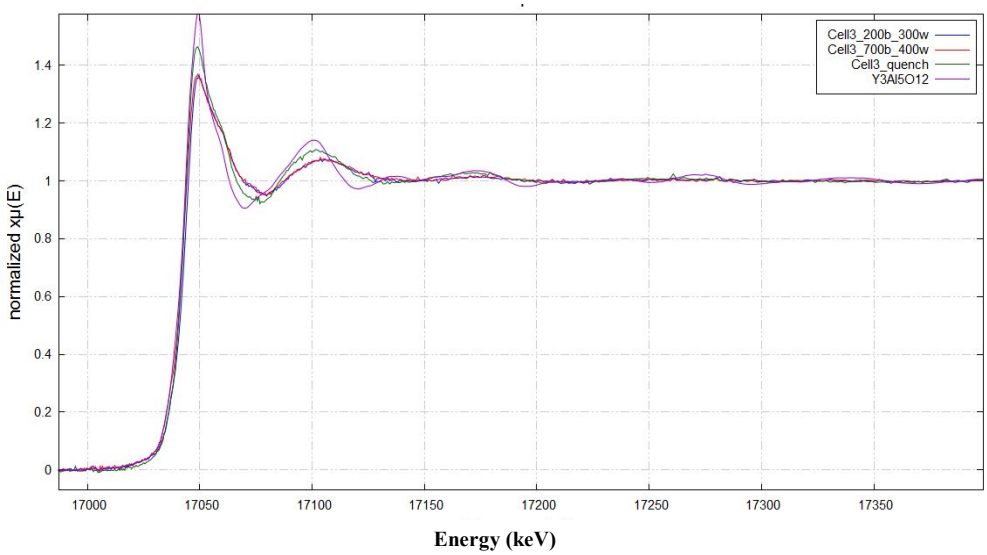

Figure – Normalised EXAFS spectra collected on Y doped haplogranite melts at different pressure points and in the quench. The reference spectra for $Y_3Al_5O_{12}$ is also shown.

Preliminary analysis suggests there is a significant effect of water on the trace element speciation in the glass structure. Coordination number of both Y and Zr in hydrous and anhydrous melts will be determined after analysis is complete, as well as the bond distances and any effects of pressure.
Full analysis will reveal:

- Any quench effects of Y and Zr speciation between the melt and the glass.
- Coordination and bond distance of Y and Zr in both hydrous and anhydrous melts.
- Any pressure evolution of the Y and Zr speciation.

List of Publications and Presentations

- De Grouchy, C., Sanloup C., Cochain, B., Drewitt, J., *Trace Element Speciation in Silicic Melts at High Pressure*, Poster Presentation at Goldschmidt Conference, California June 2014.

- Future: De Grouchy, C., Sanloup C., Cochain, B., Drewitt, J., Daisenberger, D., Kantor, I., *Trace Elements in Silicate Melts: Understanding Bonding Environments at High Pressure*, Presentation at Goldschmidt Conference, Prague August 2015.