Neutron diffraction studies of amorphous materials at high pressure

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Amorphous materials have been traditionally used to provide information on the structure of liquids. Neutron and X-ray diffraction provide unequivocal information on the structure of amorphous materials including coordination numbers and information on short and intermediate range ordering. There is however evidence to suggest that the structure of liquids and amorphous materials at high pressure are substantially different from the ambient pressure equivalents. This has important implications for any process dominated by liquids at high pressure, such as Earth formation and evolution in which structure dependent-properties such as viscosity may bear little resemblance to the same properties measured routinely at one atmosphere. The situation is further complicated because high pressure structures of glass cannot be quenched requiring *in situ* measurement.

Diffraction studies of amorphous materials are challenging, the scattered signal is weak and interpretation requires data to high values of scattering vector Q in order to achieve good real space resolution. Diffraction studies at high pressure require the contributions from the sample environment to be removed, contributions that are pressure dependent and require careful correction.

In this contribution we will present the results of studies of simple silicates compressed to pressure of up to 9GPa, illustrating that quantitative structure factor data can be obtained and insight into liquid behaviour achieved. We demonstrate the a silica poor magnesium silicate glass shows an abrupt change in structure between 9 and 9 GPa, this is an increase in Mg-O coordination and a corresponding change in the topography of the silicate network. We suggest that this change correlates with a decrease in viscosity and increase in the so-called melt fragility. We further discuss how the correction techniques and experimental protocols that we have developed can be applied to a wider range of compositions extending pressure ranges, using combined X-ray and neutron techniques to extract partial structure factors.

Extreme bone diagenesis: Implications for reconstructing palaeoenvironmental parameters

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Palaeoenvironmental parameters can be established from studying both the concentrations, and distribution in fossil, or archaeological bone, of a range of trace elements, including Strontium, Rare Earth Elements and Uranium. However, overprinting from elements or isotopes derived from the burial environment can mask, or at worst case, completely destroy any inherent *in vivo* signals. In this presentation, examples will be shown of extreme diagenetic alteration in mammal bones in sites including Olduvai Gorge, Tanzania [1, 2], and from Pb-lined coffin burials at Spitalfields, London, UK [3]. These extreme examples instead, can provide information about the burial (or local) environment itself, and can identify characteristic signatures that establish the presence of diagenetic overprinting in fossil or archaeological bone.

[1] Williams *et al*. (1997) *Appl. Geochem*. **12**, 537–547.
[2] Dauphin *et al*. (1999) *J. Sed. Res*. **69**, 612–621.
[3] Molleson *et al*. (1998) *Bull. Soc. Géol. France* **169**, 425–432.