Characterisation of iodine redox in borosilicate glasses by Raman spectrometry

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Iodine is a volatile, halogen element. Its low abundance in the terrestrial reservoirs (295 ppb in the bulk Earth's crust, mainly in the deep-sea carbonates and clays [1]) makes it a little-known element. The study of its geochemical behaviour can thus provide valuable information in diverse fields such as civil (immobilization of nuclear waste), military nuclear power (Comprehensive Nuclear Test Ban Treaty (CTBT 1996)) or cosmochemistry. Moreover, radioactive iodine isotopes produce as much xenon isotopes, noble gas also studied in many areas of research.

This work focuses on the characterization of the iodine's geochemical behaviour in molten materials such as glasses. It aims to understand the mechanisms related to the solubility of iodine depending on the composition of the glass, the temperature or the pressure and to analyse its redox speciation and distribution in the glass network.

A first study on alkali borosilicate glasses, wherein the incorporation of iodine is made under pressure and at high temperature, shows that iodine can take various redox forms (iodide, iodine and iodate with different degrees of oxidation (-I, 0 and +V respectively)) within the same glass. The redox of iodine can be known by the Raman spectrometry. An iodine reduction (incorporated as iodate ($IO3^-$)) in iodine or iodide can also be noticed during the experiment. Based on these initial observations, further experiments will allow a better understanding of the influence of different parameters on the redox state of iodine.

[1] Muramatsu & Wedelpohl,1998. *The distribution of iodine in the Earth's crust*, *Chemical Geology*, **147**, 201-216