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Water speciation in silicate melts investigated by Raman spectroscopy: implication for volcanic process

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In addition to temperature, pressure and main chemical components, volatiles exert a strong influence on the physical properties of magmas. In particular, water plays a fundamental role in the dynamics and evolution of magmas in the deep interior and during volcano eruption. However, water speciation in silicate melts is not fully understood. Infrared and NMR spectroscopy had provided some valuable information about the H2O/OH- speciation. We already know that this speciation is a function of temperature, pressure, and water contents of melts. However, some issues still remain unsolved about the OH-/H2O linkage to the silicate network.

Raman spectroscopy already allows quantifying the proportion of water dissolved in an aluminosilicate melt. Raman spectra are composed of i) a low wave number region that corresponds to vibrations of the silicate network (0-1500 cm-1), and ii) a high wave-number region, which corresponds to the OH- stretching vibrations and H2O molecular vibrations (3100-3750 cm-1). We have performed a first set of in situ experiments using a micro-furnace at ambient atmosphere. An evolution of the high wave-number region in function of the time and temperature of the experiments is observed. New Raman peaks can be distinguished, particularly near 3650-3700 cm-1. In this communication, we will present our first results on this subject and then discuss them in term of relation between water and silicate network in melts.

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