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The influence of CO_2 and H_2O on the glass transition in synthetic phonolite and jadeite.

Y. Morizet (1), A.R.L. Nichols (4), S.C. Kohn (2), R.A. Brooker (3), D.B. Dingwell (4)

(1) Department of Planetology and Geodynamic, University of Nantes, France, (2) Department of Earth Sciences, University of Bristol, UK, (3) Department of Earth Sciences, University College London, UK, (4) Department of Earth and Environmental Sciences, University of Munich, Germany.

(yann.morizet@univ-nantes.fr / Phone: +33-25112-5491)

CO_2 plays an important role in degassing and eruptive processes. Recent spectroscopic studies established that CO_2 speciation is strongly temperature dependent and that CO_2 speciation preserved in quenched glasses is different from the true CO_2 speciation observed in the melts. It is yet not clear what is the effect of CO_2 on the glass transition, Tg: either CO_2 has an influence on Tg, or the CO_2 speciation is decoupled from the bulk silicate melt structural relaxation.

We conducted calorimetric measurements to investigate Tg on synthetic phonolite and jadeite glasses synthesised in piston-cylinder at $1300<T<1550^{\circ}C$, $1.0<P<2.5$ GPa. CO_2 and H_2O concentrations were measured using LECO bulk analyser and FTIR. Volatile concentrations studied is CO_2 up to 2.29 wt.%, H_2O up to 5.49 wt.%.

For both compositions, H_2O has a large effect in reducing Tg, but CO_2 appears to have little or no effect on Tg. For all range of H_2O content, Tg is decreased exponentially from 870 to 523K and 1036 to 636K for phonolite and jadeite respectively, regardless of the CO_2 content. For all range of CO_2 content and almost constant H_2O content, only small variations in Tg are observed and an average value of 880K and 903 was derived for phonolite and jadeite respectively.

These results suggest CO_2 contribution to the change in physical properties is negligible compared to H_2O. It is also a strong evidence of the decoupling of CO_2 speciation from the bulk silicate melt structural relaxation.