

DIRECT OBSERVATION OF WATER SPECIATION IN RHYOLITE AT TEMPERATURES UP TO 850°C

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We have studied the speciation of water in a rhyolitic obsidian with ~2% total H₂O using high-T IR spectroscopy. Molecular water and OH groups were present at all T studied, up to and including 850°C.

The Ag-gasketed, polished sample was compressed between 3/8" dia. Al₂O₃ windows with a force of ~660 lbs. This assembly was heated and spectra were recorded at T. The concentration of molecular H₂O was determined from the intensity of the 1630 cm⁻¹ bending mode unique to H₂O.

The concentration of molecular H₂O in these experiments is slightly (and reversibly) T dependent, increasing by about 20% from 750°C to 500°C, and an additional 10% on slow cooling to room T. Equilibrium molecular H₂O concentrations are achieved after ~10 min. on heating to 750°C from room T. The relatively long time required for equilibration and the similarity of the results to those previously reported for quenching experiments strongly suggest that glasses rapidly quenched from high T preserve their ratios of molecular H₂O to OH.

The stretching mode of both OH and H₂O at ~3500 cm⁻¹ changes shape reversibly and almost instantaneously with T, with a narrower half-width at high T. This probably reflects a change in the distribution of H-bond lengths in the glass (e.g., an increase in average H-bond length) with increasing T.

