Reconstructing final H_2O contents of hydrated rhyolitic glasses: Insights into H_2O degassing and eruptive style of silicic submarine volcanoes

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H_2O degassing during magma ascent plays a fundamental role in determining eruption style and deposit characteristics, hence volcanic hazard. H_2O contents of pyroclast glasses offer insight into eruptive processes, but secondary hydration (i.e. the addition of H_2O from the surrounding environment at low temperature in the time following deposition) can alter this record. In order to obtain meaningful final H_2O data from hydrated glasses it is necessary to distinguish between the original final dissolved H_2O content and the H_2O added subsequently during hydration. Since H_2O added during hydration is added as molecular H_2O (H_2O_m), and the species interconversion between H_2O_m and hydroxyl (OH) species is negligible at ambient temperature, the final OH content of the glass remains unaltered during hydration. By using H_2O speciation models to find the original H_2O_m content that would correspond to the measured OH content of the glass, the original total H_2O (H_2O_t) content of the glass prior to hydration can be reconstructed. These H_2O speciation data are obtained using FTIR spectroscopy. In many cases OH cannot be measured directly and instead is calculated indirectly as $OH = H_2O_t - H_2O_m$. Here we demonstrate the importance of using a species-dependent H_2O_t molar absorptivity coefficient to obtain accurate H_2O_t and H_2O speciation data and outline a methodology for calculating such a coefficient for both hydrated and unhydrated rhyolite and andesite glasses. Using this method we present reconstructed final H_2O_t contents of hydrated silicic pumice from submarine volcanoes in the Japanese Izu-Bonin Arc and use these data to investigate submarine silicic eruptions and the processes that produce submarine pumice, in order to understand their associated hazards. In particular, we show that pre-hydration final H_2O_t contents for pumice from Kurose Nishi and Oomurodashi volcanoes were typically <0.3 wt% H_2O_t, equivalent to quench depths of <50 mbsl, and that pre-hydration final H_2O_t contents vary with pumice texture.