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Investigating shallow submarine eruption processes recorded in dissolved H_2O contents of marine tephra: example of Oomurodashi volcano tephra in drill core C9010E, Japan

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Magmatic volatiles (such as H_2O, CO_2, Cl, S) drive volcanic eruptions through bubble nucleation and growth as magma ascends. Their solubilities vary in response to changes in pressure, temperature and co-existing volatile concentrations. Accordingly, volcanic processes can be reconstructed based on dissolved volatile concentrations recorded in volcanic glasses. H_2O is often the most volumetrically abundant volatile in silicic magmas such as rhyolite, and therefore is a key volatile record of eruption processes. However, the strong susceptibility of high silica glasses to secondary hydration (i.e. slow diffusive addition of non-magmatic water in the time after eruption and deposition that alters eruptive H_2O concentrations) has limited the use of dissolved H_2O concentrations in high surface area material such as tephra and pumice, particularly in submarine deposits.

H_2O is dissolved in melts and glasses as two species, molecular H_2O (H_2O_m) and OH, which can be measured using Fourier Transform Infra Red spectroscopy (FTIR). Low temperature secondary hydration increases H_2O_m but does not alter OH. Using imaging FTIR analyses and a species-dependent H_2O_t molar absorptivity coefficient [1] to overcome analytical issues relating to thin glasses, it is now possible to accurately measure OH concentrations and thus to investigate volcanic processes even in glasses affected by secondary hydration.

We present here an example of silicic tephra contained in the marine sedimentary core C9010E drilled by the D/V Chikyu in 2009 at a site ~40 km south of the entrance to Tokyo Bay. Geochemical analysis has identified the shallow submarine Oomurodashi volcano as the source of this tephra. Oomurodashi has an active hydrothermal field today, and this ~14 ka tephra layer is evidence of its past eruptive activity. Here we present FTIR H_2O species concentrations for different size fractions from this tephra and use them to investigate eruption processes of this explosive shallow marine eruption. We highlight that similar FTIR volatile analysis has the potential to yield new insights into tephra deposits contained in marine sedimentary archives.

[1] McIntosh et al (2017), *American Mineralogist* 102, 1677-1689.