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In situ HT Raman spectroscopy study of the amphoteric behavior of water in hydrous melts

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Magma generation, migration and volcanism in subduction zones are strongly controlled by the release of water from subducting slabs, hence by the properties of hydrous magmas. Water speciation in a variety of melt compositions was investigated via Raman spectroscopy by performing in-situ HT analyses from ambient temperature up to 1600°C. Consistent with recent theoretical advancements and other spectroscopic evidences, our results point to the amphoteric behavior of dissolved water in melts. Increasing the temperature enhances the amphoteric behavior, depending on composition. When modeled in the frame of a revised polymeric model, it allows interpreting the variation of viscosity and diffusivity of studied samples upon hydration. The results of this study lead us to argue that continuous water addition may tend to limit melt depolymerization rather than favoring it, particularly at the depths of the melting of the mantle wedge. This may help explaining why the slab-derived fluids change drastically at the so-called second critical end-point. These effects have important consequences for the upward fluxing of fluid-mobile elements in subduction settings.