Iron speciation in olivine-hosted melt inclusions inferred from Mössbauer spectroscopy

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XANES spectroscopy is widely used to provide the oxidation state of magmas by determining their $Fe^{3+}/\Sigma Fe$ ratios. This technique applied to glasses and olivine-hosted melt inclusions suggests that arc basalts are generally much more oxidized ($Fe^{3+}/\Sigma Fe$ ratios from 0.190 to 0.344; [1-4]) than MORBs ($Fe^{3+}/\Sigma Fe$ ratio of 0.14 ± 0.01; [5]).These results imply that the mantle beneath arcs is more oxidized by one log unit relative to the QFM buffer than the mantle source of MORBs [1-5]. However, a recent study demonstrates that hydrous glasses can be affected by beam-induced oxidation during XANES analysis that can lead to an over-estimation of their $Fe^{3+}/\Sigma Fe$ ratios [6].

In this study, and for the first time, $Fe^{3+}/\Sigma Fe$ ratios in olivine-hosted melt inclusions from various arcs, OIB and MORB localities were analyzed by synchrotron Mössbauer spectroscopy. $Fe^{3+}/\Sigma Fe$ ratios obtained with this method allow us to constrain the oxidation state of those magmas by avoiding the effect of photo-oxidation that occurs during XANES analysis. A comparison between $Fe^{3+}/\Sigma Fe$ ratios obtained by XANES and Mössbauer is carried out to determine whether a correction for beam-induced oxidation can be applied. Then, $Fe^{3+}/\Sigma Fe$ ratios in these magmas will be used to constrain the oxidation state of the primary magmas formed in these different geological settings.

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