# Oxygen fugacity of the oceanic upper mantle as recorded by basalts and peridotites from the Southwest Indian Ridge

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The oxygen fugacity ($fO_2$) of the upper mantle controls volatile speciation, phase stability, and the depth of the peridotite solidus, and is thus critical to our understanding of melt production at mid-ocean ridges. Both basalts and peridotites have historically been used as proxies for calculating mantle $fO_2$ beneath ridges. Studies of peridotite $fO_2$ suggest a variable and relatively reduced mantle (QFM-2.5 to QFM+0.5, averaging QFM-0.88 (±0.72, n=33)) [1], while studies of basalts suggest a more uniform $fO_2$ around QFM+0.13 (±0.09, n>100) [2]. This offset is not yet understood, but may result from a sampling bias as peridotites and basalts from the same location have never been assessed for $fO_2$. The Oblique Segment of the Southwest Indian Ridge offers a unique opportunity to compare the $fO_2$ recorded by basalts and peridotites, as both lithologies have been dredged along-axis.

In this study, we calculate the $fO_2$ of 18 basalt glasses and 14 peridotites from the Oblique Segment. Results show peridotite $fO_2$s are highly variable and overlap with the ridge array, but also extend beyond it to more oxidized values (QFM-0.96 to QFM+1.45, averaging QFM+0.45 (±0.77)). Basalts, corrected for low-P fractional crystallization, have a more limited range, averaging QFM+0.29 (±0.10). Importantly, we observe no offset between average basalt $fO_2$ and average peridotite $fO_2$ in this study. Our data further suggest that basalt $fO_2$s may record homogenization of a mantle that is heterogenous with respect to $fO_2$ on the sub-segment scale. We also investigate factors that may impact differences between MORB-source $fO_2$ and recorded $fO_2$, including peridotite fertility, source heterogeneity, and projection of peridotite measurements to the P-T conditions of last equilibrium with basalt.

[1] Bryndzia and Wood, Am. Jour. Sci. (1990); [2] Cottrell and Kelley, EPSL (2011)