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Olivine-quartz association in a gabbro-peridotite hybrid rock of the Kane Fracture Zone: evidence for hydrous Si-rich melt percolation in abyssal context.

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Felsic plutonic rocks, such as plagiogranites, are commonly found in minor proportions in the lower oceanic crust. The presence of quartz of magmatic origin in the oceanic lithosphere, especially in the mantle, is therefore rarely documented. Here, we present microstructural and petrological observations of a gabbro-peridotite hybrid rock collected *in situ* by HOV Nautile along the southern wall of the Kane Fracture Zone, at the base of the Kane megamullion, during the KANAUT expedition (Mid-Atlantic ridge, 23°N; Auzende, 1992). This sample, a strongly deformed gabbro containing a peridotite fragment, shows evidence of mantle reacting with hydrous SiO_2-rich melt at the contact between both lithologies.

The gabbro is composed of oriented plagioclase-rich layers alternating with polymineralic layers of plagioclase, clinopyroxene, orthopyroxene (Opx) and Fe-Ti oxides, and of mm-thick quartz-rich layers. These gabbroic layers locally enclose an aggregate of weakly deformed olivine grains with few Opx grains (up to 1 mm in size). The high Mg# of both olivine and Opx (up tp 85% for both), and the low TiO_2 (< 0.1 wt.%) of Opx and of the rare spinels in the aggregate, support a mantle origin. The contact between the two lithologies is marked by a rim of small, polygonal to interstitial Opx grains, forming bulges into the adjacent olivine grain boundaries. The cusp-shapes of olivine grains at contact with Opx, the bulges of Opx along olivine grain boundaries, and the presence of phlogopite and edenitic amphibole, indicate local dissolution of olivine and precipitation of Opx and phlogopite in presence of a hydrous melt, as documented in peridotite from subcontinental contexts.

Temperatures estimated from geothermometry in Opx, plagioclase-amphibole and quartz all indicate that this melt-rock reaction occurred around 900-1000°C. This is also consistent with the crystallographic preferred orientation (CPO) of plagioclase showing a main direction of [100]. The CPO of all minerals forming the gabbroic layers have a main direction parallel to the foliation, which also follows the contours of the peridotite fragment. By contrast, the olivine CPO in the peridotite fragment, showing a clear [100](010) slip system typical of high temperature, low stress conditions prevailing in the asthenosphere, has a direction orthogonal to the foliation. Taken together, the Mg# of olivine and Opx in the peridotite fragment, and the gabbro foliation

orthogonal to the presumed foliation in the peridotite, provide evidence that this peridotite fragment preserved the deep mantle conditions during exhumation, despite its reaction with a hydrous melt. To our knowledge, this is the first time in an abyssal context that the reaction between a mantle component and hydrous Si-rich melt, leading to olivine-quartz association in a same sample, is reported.

AUZENDE Jean-Marie (1992). KANAUT cruise, RV Le Nadir, https://doi.org/10.17600/92003211