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Tonga trench peridotites revealing forearc extension

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The Tonga trench is one of the deepest trenches in the world. We retrieved samples of peridotite from dredge hauls collected from Boomerang Leg 8 Cruise aboard R/V Melville in 1996 at the deep landward trench slope (19'15.19S, 172'56.29W; depth 8,194-9,371m). Most of samples are remarkably fresh despite of their ocean-floor origin, indicating that intense tectonic erosions have been taken place in the Tonga trench. The samples are harzburgites and show some variation in microstructure consisting of dominantly coarse (>5mm) equigranular texture to minor fine-grained (~0.5mm) parts. They contain high-Cr# spinels in a range between 0.5 and 0.8 with very low Ti contents, suggesting that these peridotites were derived from the Tonga forearc. Olivine fabrics are characterized by intense [100]-fiber pattern. Such olivine fabrics could be developed by transtension type of strain according to a numerical study (Tommasi et al., 1999, EPSL). It suggests that rapid slab rollback of the Tonga trench resulted in substantial extension within the overlying plate.

Keywords: Tonga Trench, peridotite, crystal-preferred orientation, forearc, slab rollback