Origin of orthpyroxene in primitive gabbros generated at East Pacific Rise

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Some of the primitive gabbros sampled during IODP Expedition 345 at Hess Deep (EPR) were surprisingly rich in orthopyroxenes (Opx). The high content of these gabbros in olivine and their high Mg# whole rock chemistry show their primitive nature (Gillis et al., 2014). On the basis of mineral composition, two types of Opx may be distinguished: (1) Opx which composition is in the MORB trend, and (2) Opx plotting out of the MORB domain. The first show a more differentiated chemistry, with Mg# in Opx and olivine lower than 82%. They were probably generated after a certain degree of fractional crystallization of a MORB melt. They show however that Opx may crystallize much earlier than previously thought from a still primitive magma.

The latter show a narrow range of Mg# (84-86%) and primitive chemical characteristics, suggesting that the Mg/Fe ratio of their parental magma was buffered during their formation. Mg# calculations on all the ferro-magnesian minerals show that Opx and olivine are in equilibrium while Cpx has a higher Mg# than the calculated Cpx in equilibrium with Opx. The concentrations in minor elements in Opx from the second group gabbros are uncommonly high (e.g. same TiO_2 content in both pyroxenes). These data point to a origin that may involve melt-rock reaction buffering the Mg# and mixing of MORB with an enriched melt leading to enrichment in Ti, Cr and Al.