How to form picritic basalts: An example from Panay island, Philippines

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High-Mg volcanic rocks such as picrites are commonly associated with mantle plumes and large igneous provinces and are reported to be rare in convergent plate margin settings. The formation of this type of rocks is often attributed to anomalously hot mantle sources or when the down-going slab is unusually hot [1,2]. Olivine-rich picritic basalts comprise the Serawagan Formation in Panay island, central Philippines. Large grains of olivine and clinopyroxene are set in fine laths of pyroxenes and glass. The textures of the olivines range from well-formed euhedral crystals, rounded subhedral grains and as aggregations of smaller olivine crystals. Kink banding and zonation are evident in most of the grains. Forsterite and NiO contents of the olivines range from 76-93 and 0.14-0.46 wt%, respectively. The clinopyroxenes are large euhedral grain with strong zonation. At times, the clinopyroxenes form spinifex-like textures with the grains forming swallow tails at the edges. Clinopyroxenes show variable Mg # (=0.74-0.91) and CaO is at 20-22 wt%. Minute magnetite with FeO = 30-86 wt% also occur as inclusions in some of the olivines. Bulk rock data of the picritic basalts reveal high MgO = 16-18 wt %) except for one sample which has MgO = 12 wt%. The picritic basalts also exhibit high total alkali content (Na_2O+K_2O = 3-7 wt%) and TiO_2 = 0.5-0.6 wt%.

The textural and geochemical variability of the olivines in the picritic basalts from Panay suggest different origins of the olivine “phenocrysts”. We identify at least three types of olivine: restitic, peritectic and real phenocrysts. The reaction of a silicate melt with the orthopyroxene in a harzburgite under low-P conditions can lead to the formation of the peritectic olivine. Remnants of the original olivines in the harzburgite could be preserved as xenocrysts showing clear restitic or mantle olivine characteristics. Some of the olivines are phenocrysts which may have been crystallized from the melt. Lastly, the emplacement of such dense magma is possibly related to the arc-continent collision which occurred in this region in the Philippines.

[1] Rohrbach et al., (2005) *Contrib Mineral Petrol* **149**, 685-698. [2] Ichiyama et al., (2012) *Geology* **40**, 411-414.