Does the depth profile of chemical properties in Ogasawara(Bonin)-Mariana trench peridotites indicate a vertical profile of mantle?

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The supra subduction zone mantle is the place where partial melting results in the formation of continental crust. Peridotites consisting of the upper mantle have various chemical compositions depending on the degree of partial melting during ascending processes. Olivine and spinel, which are the major constituent minerals in peridotites, preserve signs for degree of partial melting as their major chemical compositions such as Mg# (=Mg^{2+}/(Mg^{2+} + Fe^{2+})) and Cr# (=Cr^{3+}/(Cr^{3+} + Al^{3+})). In general, both Mg# and Cr# increase with the degree of partial melting. However, it is not so clear where in the uppermost mantle such melting processes are taken place. Here, we show for the first time a vertical chemical profile of more than 6000 meters in Challenger Deep of Mariana Trench and a similar profile of ca. 1000 meters in Umigame seamount of Ogasawara (Bonin) Trench. We found that the most fertile chemical composition has been preserved at the shallowest peridotites, whereas the most depleted chemical compositions such as boninitic source mantle tend to occur in peridotites at the deeper sites, suggesting the active partial melting producing boninitic magma could occur mostly at several thousand meters below the crust-mantle boundary in the supra subduction zone mantle. It means that peridotites locating to the crust-mantle boundary in the uppermost mantle could preserve less depleted earlier conditions in mantle, presumably, in the vicinity of the spreading center.

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