Petrology of the reaction zone between gabbro and peridotite from Nain melange, Central Iran

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In the northwestern corner of the Nain mélange (Central Iran) there is an outcrop ~600 m-long where peridotites are associated with an intrusion of gabbro. Gabbro contains variable amounts of hornblende (5-22 modal %). The contact between gabbro and peridotite is transitional. The gabbro grades to peridotite via olivine (ol) gabbro, wehrlite, troctolite and dunite. Wehrlite mostly appears as discontinuous layers or lenses inside ol-gabbro and contains 6-10% plagioclase. Along the border with peridotite, ol-gabbro turns into troctolite by an increase in modal content of olivine. Cumulus olivine forms clots or thin layers of dunite in troctolites. The complete section is frequently crosscut by thin dikes (several centimeters wide) of hornblende-bearing pyroxenites.

Although, modal composition changes abruptly over the described sections. Major-element chemistry, however, shows limited variations. Minerals such as spinel and clinopyroxene, which are main petrological indicators, show highly restricted and residual chemistry. The restricted chemical variation of the minerals over the transitional zone strongly suggests that magmatic differentiation played only a minor role in the formation of the transition zone forming-rocks. It is strongly suggested that these rocks are products of reaction between melt and peridotite, which is harzburgitic in composition. However, the chemistry of minerals from the reaction zone is incomparable with similar transition zones reported from abyssal settings. Relatively depleted chemistry of spinels (Cr# =(Cr/(Cr + Al)) = 0.54-0.67 and TiO_2 = 0.25-1.10 wt%) and clinopyroxenes (Cr_2O_3 = 0.39-1.27 wt% and TiO_2 = 0.05-0.37 wt%), in particular their low Ti content, suggests that the reactant melt had a composition typical for subducion-related melts. This is in agreement with the hydrous composition of gabbro. Therefore, we suggest a subduction related setting for the Nain ophiolite.