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Mineral and whole rock compositions of peridotites from Loma Caribe (Dominican Republic): insights into the evolution of the oceanic mantle in the Caribbean region

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Several mantle peridotite massifs crop out as isolated dismembered bodies in tectonic belts along the northern margin of the Caribbean plate, especially in Cuba, Guatemala, Jamaica, Hispaniola and Puerto Rico. Among these bodies, the Loma Caribe peridotite forms the core of the Median Belt in central Dominican Republic and is considered to have been emplaced in Aptian time as result of the collision between an oceanic plateau (the Duarte plateau terrane) and the primitive Caribbean island arc.

This peridotite massif is mainly composed of clinopyroxene-rich harzburgite, harzburgite, lherzolite and dunite which mainly have porphyroclastic texture with strongly deformed orthopyroxene porphyroclasts, as commonly observed in ophiolitic mantle tectonites. Mg# [100*Mg/(Mg+Fe2+)] of olivine increases from lower values in lherzolite (89-90), to higher values in harzburgite (89-91) and dunite (91-92). Orthopyroxene in harzburgite has higher Mg# (91-92) and lower $Al2O_3$ (0.89 to 1.12 wt.%) than in lherzolite (Mg# = 89-91; $Al2O_3$ = 2.4-3.5wt.%), similarly to clinopyroxene (Mg# = 94-95 and $Al2O_3$ = 0.89-1.10 wt% in harzburgite, versus Mg# = 86-94 and $Al2O_3$ = 2.3-4.0 wt% in lherzolite). Cr# [Cr/(Cr+Al)] of spinel spans from 0.30 in lherzolite to 0.88 in dunite. These variations in terms of Mg# in olivine and Cr# in spinel overlap the mineral compositions in both abyssal and supra-subduction zone peridotites.

The sample/chondrite REE concentrations of peridotites are variable (0.002 < LREE chondrite-normalized < 0.11 and 0.002 < HREE chondrite-normalized < 1.02) and their HREE contents generally reflect the clinopyroxene proportions in the samples, i.e. harzburgite has lower HREE abundances than lherzolite. These trace element abundances are transitional between those of highly depleted supra-subduction peridotites from ophiolites in eastern Cuba and those of fertile mantle rocks in ultramafic massifs from Puerto Rico. Chondrite-normalized patterns are U-shaped (i.e. relatively rich in LREE) with steep fractionated HREE segments in harzburgite and hump-shaped MREE segments in lherzolite. Peridotites are enriched in the most incompatible trace elements (Cs, Rb, Ba, Th, U) and Pb, and show negative anomaly in Nb and Ta. HREE contents in whole rock indicate that the Loma Caribe peridotites are residues after moderate to high degrees (10-25%) of fractional partial melting in the spinel stability field. The relative enrichment in incompatible elements (e.g., LILE and LREE) in these rocks probably reflects the capture of percolating melt fractions along grain boundaries or as micro-inclusions in minerals and resulted from interaction of melting residues with ascending melts. We interpret the Loma Caribe peridotite as a portion of heterogeneous sub-oceanic mantle lithosphere generated in Jurassic-Cretaceous time, which has been modified at a supra-subduction zone environment related to the Cretaceous Greater Antilles arc.