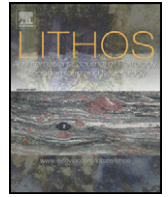




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## Corundum-bearing garnet peridotite from northern Dominican Republic: A metamorphic product of an arc cumulate in the Caribbean subduction zone

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### ABSTRACT

Garnet peridotite in oceanic subduction complexes has been reported only in two locations in the world. One of these examples occurs in the late Cretaceous to early Tertiary subduction complex in northern Dominican Republic. The garnet peridotite (wehrlite and olivine-bearing clinopyroxenite) occurs as large ( $\leq 4$  m) boulders together with boulders of eclogites and serpentinites along a narrow ( $< 10$  m) stream of the Rio Cuavas in the southern part of the Rio San Juan Complex. The peridotite is composed of garnet, diopsidic clinopyroxene (partially altered to magnesiohornblende), olivine (extensively altered to serpentine), Al-spinel and minor corundum; the latter two are mostly enclosed in garnet. Coarse-grained garnet also encloses small grains of early-formed garnet that contain Ca- and Al-rich cores and Mg-rich rims.

The garnet peridotite contains low Cr, Ni, and Ir-group platinum group elements in bulk rock compared to primitive mantle values, low Mg (Mg#; 0.74–0.83) and NiO ( $< 0.1$  wt.%) in olivine, and elevated concentrations of fluid-mobile elements (Sr, Pb and U) in clinopyroxene and bulk rock. Combined with the rare earth element data of bulk rocks and clinopyroxene, these data suggest that the peridotite originally solidified as a plagioclase-bearing cumulate of an arc melt at a shallow depth,  $< 35$  km, in the mantle wedge. The cumulate was later dragged by mantle flow from the subarc mantle towards the subduction plane. Subsequent downward movement along the subduction plane resulted in the crystallization of corundum and Ca- and Al-rich garnet at the expense of plagioclase, at a depth of  $\sim 50$  km. The garnet peridotite continued to be subducted to a depth of  $\sim 120$  km, causing a progressive increase in pressure and temperature that resulted in the crystallization of Mg-rich garnet. The garnet peridotite was then exhumed in the serpentinite subduction channel. These events likely took place during the very early stages of the subduction system, where a strong mantle corner flow was likely produced by poor lubrication along the interface between the subducting plate and the overlying Caribbean Plate.

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### 1. Introduction

Occurrences of garnet peridotite are reported in many continental collision zones, such as in the Western Gneiss Belt of Norway and the Sulu ultra-high pressure (UHP) belt of China (e.g., Brueckner and Medaris, 2000; Zhang et al., 2003), but it is very rare in oceanic subduction zones. So far only two examples have been reported in the interior of an oceanic subduction zone: in the Sanbagawa belt in

southwestern Japan (Enami et al., 2004; Hattori et al., 2009) and in the Rio San Juan Complex of northern Dominican Republic (Abbott et al., 2005, 2006, 2007; Fig. 1a). In both locations, garnet peridotite occurs in close spatial association with eclogites in high grade parts of these metamorphic terranes. Garnet peridotite in the Dominican Republic is unique in containing minor amounts of corundum,  $Al_2O_3$ . Corundum is rare in mafic–ultramafic complexes and reported only from a few locations; the Beni Bousera massif of northern Morocco (Kornprobst et al., 1990), the Ronda massif of southern Spain (Morishita et al., 2001), the Horoman peridotite complex in northern Japan (Morishita and Arai, 2001; Morishita et al., 2007), and Cabo Ortegal Complex in Spain (Girardeau and Ibarguchi, 1991). Corundum in these mafic–ultramafic complexes occurs in mafic layers and lenses, but corundum in the Rio San Juan Complex occurs within peridotite and clinopyroxenite. Therefore, the presence of corundum and garnet makes the peridotite in northern Dominican Republic a rare example of an ultramafic rock in

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