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Primary magmas of Grenada (Lesser Antilles Arc): light trace elements and stable isotopes supply

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Grenada island is located at the southern end of the Lesser Antilles arc, generated by the subduction of the Atlantic plate beneath the Caribbean plate. Grenada lavas display an unusual compositional diversity from MgO-rich, olivine-bearing basalts to CaO-rich, clinopyroxene phyric ones [1]. Moreover, Grenada is an exceptional site, because of the presence of basalts carrying a large variety of metasomatized mantle xenoliths (from peridotite to wehrlite) testifying of multistage peridotite-melt interactions [2,3]. Magnesian basalts are believed to be generated by the melting of a MORB mantle source that would have experienced depletion by melt extraction and enrichment by fluids derived from the subducted slab [1-3].

We present here a detailed study of melt inclusions trapped in olivines (Fo_{82-91}) from one of the most recent basaltic scoria cones (Queen's Park). Magmatic and mantle olivines coexist in this sample. Their zoning testifies to complex mantle-melt interactions. Major elements were analyzed in melt inclusions (113) of both mantle and magmatic olivines, by electron microprobe SX50. They point out a broad variability (SiO_2 from 40.2 to 56.7 wt%, K_2O from 0.4 to 2.5 wt% and CaO from 7.0 to 17.7 wt%). The compositional range of melt inclusions representative of poorly-differentiated melts (SiO_2 from 40.2 to 48.8 wt%, K_2O from 0.4 to 0.9 wt%) fairly matches that of the M-Series lavas. A part of these inclusions (48) was analyzed for B, Cl, F, H_2O, δ^7Li, δ^{11}B, δ^{18}Ognd δD by SIMS. Melt inclusions reveal as large range of dissolved water contents (0.2-6.4 wt%) that is regarded, here, as the testimony of the presence of a H_2O-enriched magma and a MORB-like magma MORB-like magma. Their B, Cl

and F contents are also variably enriched compared to those of MORB (from 2 to 150 times more). They show either B selective enrichment associated with variable δ^{11}B (B up to 50 ppm; δ^{11}B from -10 to -6 per mill) or moderate B contents ($\sim$ 10 ppm) with strong negative δ^{11}B values (down to -19.6 per mill). These B chemical and isotopic compositions, associated with other light elements signatures, are used to track the respective contribution of the crust and sediments to the mantle wedge.

References

[1] Thirlwall et al., 1996

[2] Parkinson et al., 2003

[3] Vannucci et al., 2007