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Noble gas isotope and halogen analyses of Cr-spinels within beach sand from Gorgona Island to constrain the origin of volatiles in the youngest komatiite magmatism on the Earth

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Gorgona Island, Colombia, is a ~90 Ma volcanic island where picrites and the youngest komatiites known on the Earth are present. The origin of magmatism of Gorgona is considered a part of the Caribbean–Colombian Oceanic Plateau resulting from the initial melting stages of the Galapagos mantle plume head (Trela *et al.*, *Nature Geo.* 2017). Shimizu *et al.* (*EPSL* 2009) reported high chlorine concentrations in melt inclusions in chromian spinels (Cr-spinels) separated from beach sand on the eastern coast of Gorgona Island. The melt inclusions were also characterized by high CO_2 and low H_2O contents. However, the origin of the volatiles remains unknown. We report noble gas isotopes and halogens in the beach-sand-collected Cr-spinels from Gorgona to constrain the volatiles' origin.

$^3He/^4He$ ratios of crush-released noble gas from Cr-spinels showed a systematic decrease from 20 Ra to 3 Ra (where Ra denotes atmospheric $^3He/^4He$ ratio) with the progress of crushing. This seems to result from more significant contributions of matrix-hosted radiogenic He in the latter crushing steps, confirmed by the low $^3He/^4He$ ratio (0.3 Ra) obtained with the melting of the crushed Cr-spinel powder. Therefore the original $^3He/^4He$ value of the magmatic He is higher than 20 Ra, showing good agreement with the reported $^3He/^4He$ ratios of olivines separated from gabbro and peridotites from the island (8-18 Ra, Révillon *et al.*, *EPSL* 2002). The high $^3He/^4He$ value of the Gorgona komatiite and/or picrite magma is consistent with the involvement of the Galapagos mantle plume, where the highest $^3He/^4He$ of 29 Ra has been reported (Kurz *et al.*, *EPSL* 2009), to their mantle source. The halogen compositions, Br/Cl and I/Cl ratios were close to those of MORB and OIB sources, indicating the mantle origin of halogens and other volatiles. The Cl/K and Ba/K ratios were similar to those reported for individual melt inclusions in Cr-spinels. Combined with the high $^3He/^4He$ ratio, volatiles in the Gorgona komatiites and/or picrites would be derived from a less-degassed reservoir in the deep mantle, possibly in the core-mantle boundary.