Oxidized Mantle Sources in Cretaceous Komatiites from Gorgona Island: Insights into Mantle Redox Structure and Impacts on Ore-Forming Systems

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The Gorgona Island, located 50 km off the Pacific coast of Colombia, is a well-known locality for the only known Phanerozoic examples of komatiites. These ultramafic volcanic rocks are suggested to be formed as part of the Caribbean Large Igneous Province (CLIP) during the Late Cretaceous (~88 Ma) within a complex, compositionally and thermally heterogeneous mantle plume (Kerr, 2005). This study aims to analyse the spinifex-textured komatiites on Gorgona Island to determine the mantle conditions during the Cretaceous, evaluating whether there are any differences between these and the Archean komatiites.

In this study melt oxygen fugacity has been estimated at ΔQFM + 3 ± 1 by spinel-olivine pairs (Ballhaus et al., 1991) using adquired data, and ΔQFM + 2.1 ± 0.1 by the partitioning of V between olivine and melt (Shishkina et al., 2018) using published data from Kamenetsky et al (2010). This discovery extends the evolutionary record proposed by Nicklas et al. (2019) of a relative reduced mantle in the Archean with ΔQFM values near 0 at ~3.6 Ga, that transitioned to ΔQFM ~ +1.3 by ~1.7 Ga, at least until the Cretaceous.

This determination by two independent methods challenges the conventional model that place komatiites origin from reduced mantle sources, raising questions about the heterogeneity of the mantle and the redox evolution of magma sources. These insights are critical for the genesis of ore models in which redox state influences metal solubility, and transport. To understand if there is an oxidised mantle domain that contribute to magmatic fertility may be critical to define new exploration criteria and expand the range of considered metallogenic settings previously underestimated.