Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24107

# Influence of subduction component oxidation state on platinum group element geochemistry of arc magmas

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The chemical compositions and oxidation states of arc magmas are strongly affected by subduction components, melts and fluids derived from subducting slabs. The oxidation state of the slab controls the relative stabilities of sulfate and sulfide in the subducting lithologies. This, in turn, influences chalcophile element budgets of the subduction components due to differing affinity of chalcophile elements between sulfate and sulfide phases. Lithophile incompatible element to Cu ratios (e.g., Ce/Cu) of arc magmas have been suggested to be controlled by the oxidation state of the subduction components. However, the detailed process behind the hypothesis requires further investigations.

Platinum group elements (PGE) are strongly chalcophile with partition coefficient between sulfide and silicate melt of ~$10^5$-$10^6$. Therefore, PGE geochemistry of arc magmas can serve as a more sensitive indicator of the oxidation conditions during partial melting of the mantle wedge. In this study, we measured PGE contents in basaltic lavas from the Aeolian and Central American volcanic arcs to constrain factors controlling the PGE geochemistry of arc magmas. These arc systems are recognized to be influenced by diverse subduction components.

The results show that relatively oxidized magmas with low Ce/Cu (0.04-0.25) and high V/Ti (0.04-0.10) ratios have systematically higher Pd contents (7.2-11.2 ppb) with high Pd/Ir ratios (87-1094) than the relatively reduced magmas with high Ce/Cu (0.36-2.34) and low V/Ti (0.03-0.06) ratios (Pd=1.4-5.2 ppb; Pd/Ir=13-239). These trends persist across lavas from Lesser Antilles, Tonga and Vanuatu arcs. Mantle partial melting models indicate that the higher Pd contents of the low Ce/Cu group lavas can be attributed to earlier sulfide exhaustion during melting under higher oxidation states modulated by sulfate-dominant subduction components. Conversely, the lower Pd contents of the high Ce/Cu group can be explained by Pd retention in residual sulfides under lower oxygen fugacity, influenced by sulfide-dominant subduction components. Additionally, the slab partial melting model suggests higher Pd contents in sulfate-dominant subduction components compared to sulfide-dominant ones, further augmenting Pd contents in arc magmas. This study shows the pivotal role of the oxidation state of the subduction components as the first order controlling factor for the PGE geochemistry of arc magmas.