Garove Island: degree of melting and melt modification processes in the New Britain Arc

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A key goal remaining in subduction zone studies is to quantify the link between water and the degree of partial melting. It is proposed that a quantitative estimate of melt fraction in arc lavas may be obtained using ratios between the HFSE's Nb and Ta using the approach previously applied to MORB and OIB [1].

The New Britain Arc, Papua New Guinea, allows a unique 3D insight into an island arc, with sub-aerial volcanoes spanning large transects both parallel and perpendicular to the trench. Detailed studies of selected volcanic centres throughout the arc will be used to identify magma modification processes and their effect on relevant geochemical proxies. These data will provide the means of removing the effects of the crystallisation history of the magmas, thereby revealing trends otherwise blurred by such processes.

As a precursor to this comprehensive study, Garove Island was chosen to test the proposed method. This volcano lies 580km above the Wadati-Benioff zone and existing data are consistent with a greatly reduced influence from slab-derived components compared with volcanoes closer to the trench [2].

Initial major and trace element data from 25 Garove Island samples (ranging from 49 to 73wt% SiO_2) support previous assumptions that magma composition is primarily modified by low pressure fractionation processes. HFSE ratios show no systematic variation with degree of fractionation indicating that it is unnecessary to limit analysis to primary magmas (liquid lines of descent suggest that all Garove Island magmas are derived from similar primary melts).

References

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