Compositional relationships between mafic inclusions and host andesite at Mount Hood (Oregon), Cascade Range, USA

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Mount Hood has erupted compositionally similar calc-alkaline andesite, in which slightly more mafic inclusions are found within the andesite (host lavas), but are not found in lavas erupted from satellite flank vents (flank lavas). We investigated six inclusion bearing sites (23 inclusions and 15 host lavas) younger than 150 ky. Major mineral phases present in the inclusions and host lavas are plag + opx ± cpx ± amp + oxides, whereas the mineral assemblage of the flank lavas, contain olivine rather than amphibole. The average silica content of samples analyzed range from 57.6 to 62.7 wt %; however the incompatible trace element compsosition is more variable at lower silica contents leading to "enriched" and "depleted" samples and becomes less variable at higher silica contents.

Petrogenetic modeling of the compositional relationships among mafic inclusions and host lavas suggest the following. Fractional crystallization and AFC processes may explain some relationships but both fail to explain the overall key geochemical feature of constant or decreasing incompatible trace element abundances with increased silica contents. On the other hand, the greater variability in the degree of incompatible element enrichement at lower silica is likely due to variability in trace element concentration among mafic end members similar to those erupted as flank lavas and during the Pliocene in the vicinity of Mount Hood. Flank lavas and Pliocene mafic lavas compositionally overlap with modeled mafic endmembers. This suggests that various mafic magmas have been fed into the Mount Hood magmatic system and yield inclusion and host andesite compositions through mixing ± fractionation. Increased mixing causes evolved magmas to become increasingly compositionally focused and monotonous towards increased silica contents leading to great similarity among Mount Hood andesites and suggesting that silicic mixing endmembers are compositionally narrow.