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Oxygen isotope fractionation in tholeiitic and calc-alkaline magma, Gunung Guntur, west Java, Indonesia

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In the last two decades, significant analytical advances have revolutionised our understanding of oxygen isotope variations in the silicate components of magmatic systems. Sufficient precision and accuracy are available to resolve the small variations in δ^{18}O values that characterise different components of igneous rocks, and to relate these variations to bulk rock chemistry. During the same period there have also been advances in the use of experimental petrology to determine oxygen isotopic fractionation between different minerals at magmatic temperatures. However, there remain relatively few studies that have attempted to reconcile fractionation factors determined in real and synthetic systems. In this study laser fluorination was used to determine the oxygen isotope ratios of co-existing olivine, clinopyroxene, orthopyroxene and plagioclase phenocrysts in tholeiitic basalts and calc-alkaline andesites from Gunung Guntur volcano in the Sunda Arc Java, Indonesia.

Differences in δ^{18}O values between the co-existing phases vary systematically with one another and with bulk rock chemistry. The fractionation measured between olivine, clinopyroxene and orthopyroxene agree well with other studies of natural systems and with the fractionation factors predicted by experimental petrology. Differences between plagioclase and other phases are larger than found in the most recent studies of basalts from subduction zones. However, these differences are consistent with the less calcic nature of plagioclase phenocrysts at Guntur, when compared to

basaltic rocks from other island arc volcanoes.

Coupled oxygen and radiogenic isotope data indicate that tholeiitic magma interacted with a relatively low-δ^{18}O component in the arc crust beneath Guntur prior to eruption. Evidence for a similar component can be found from other volcanic centres in western Java. In contrast, calc-alkaline lavas from Guntur display relatively little variation in δ^{18}O values, despite strong evidence from trace elements and radiogenic isotope ratios for interaction with the arc crust. The Guntur data suggest that using only elevated δ^{18}O values to identify contamination of magma by arc crust may be an oversimplification