Along-arc geochemical and isotopic variations in Javanese volcanic rocks: constraints on the crustal architecture of the Sunda arc, Indonesia

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Understanding the genesis of volcanic rocks in subduction zone settings is complicated by the multitude of differentiation processes and source components that exert control on lava geochemistry. However, through detailed studies of individual magmatic systems it is possible to identify and establish the relative importance and contributions of various potential source components and differentiation processes that modify composition, such as crustal contamination. Geochemical and isotopic constraints on the 'crustal' end members involved in assimilation at individual volcanoes, can then be combined to gain insight into the nature of the arc crust on an island- or arc-scale. Along-arc changes in lava geochemistry have long been recognised on Java in the Sunda arc, Indonesia, but debate still prevails over the cause of such variations and the relative importance of shallow (crustal) versus deep (subduction) contamination. We present new Pb isotope data for Javanese volcanoes, which, when combined with our recently published geochemical and isotopic data of Javanese volcanic rocks and results from other detailed geochemical studies, elucidate the potential changing nature of the arc crust and its control on lava chemistry. In $^{207}Pb/^{204}Pb$-$^{206}Pb/^{204}Pb$ isotope space the Javanese volcanic data reveal two distinct trends. One trend, which consists of one West Javanese and the Central Javanese volcanoes, exhibits a wide range in $^{207}Pb/^{204}Pb$ at relatively constant $^{206}Pb/^{204}Pb$ (a steep positive correlation) and is attributed to strong control by crustal assimilation processes. The second trend shows a shallower positive correlation between $^{207}Pb/^{204}Pb$ and $^{206}Pb/^{204}Pb$ and is consistent with source contamination by local sedimentary material on the down-going plate. Sr isotope ratios of volcanic rocks generally increase from West to Central Java, showing a wide range within individual volcanic centres and broadly correlating with inferred crustal thickness implying a strong, shallow level control on isotopic composition. However, East Javanese volcanic rocks show significantly lower Sr and Pb isotopic ratios and extremely restricted isotopic variation at individual volcanoes. Key trace element ratios combined with radiogenic isotopic data of Javanese volcanoes reveal three distinct trends, which roughly equate with the geographical boundaries West, Central and East Java. These results provide evidence for major transitions in the crustal architecture of Java.