Magmatic controls on tholeiites from Mauna Loa volcano, Hawaii

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Tholeiitic lavas from Mauna Loa volcano, Hawaii, display extensive chemical heterogeneity, the cause of which remains poorly understood within the framework of our current understanding of mantle plume melting and source formation. We have built a comprehensive geochemical data-base of the major element, trace element, and radiogenic isotope compositions for ~180 tholeiitic submarine samples from the western flank of Mauna Loa, with the aim of constraining the magmatic processes that control erupted lava chemistry. These data indicate primary control of major and trace element chemistry by olivine fractionation at high MgO values, and clinopyroxene (± plagioclase) fractionation in more evolved samples. $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios indicate significant variability, spanning the entire documented range of Mauna Loa compositions and a significant fraction of the documented range for global ocean island basalts. Correlations between La/Nb and Th/La ratios and $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios are consistent with varying amounts of recycled oceanic crust in the source. Rb/Th and Ba/Th form hyperbolic arrays with variation in $^{87}Sr/^{86}Sr$ as do Nb/Y, Zr/Nb, and La/Yb with $^{143}Nd/^{144}Nd$. The utility of these systematics as indicators of melting degree is assessed, and the absence of significant correlations between $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios and major or trace element concentrations, which may discount source chemistry control of element concentrations, is investigated.