

Heterogenous trace and Rare earth element (REE) compositions of plagioclase phenocrysts from mid-ocean ridge basalts of South Atlantic Transect, IODP Exp 390 & 393

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Physico-chemical characteristics of MORBs are known to provide key information about the nature of mantle, melt generation and crust forming processes at mid-ocean ridges. Compositional and textural changes in mineral phases like plagioclase prove useful for delineating various processes occurring within a magmatic system. The South Mid-Atlantic Transect - IODP Expeditions 390 & 393 recovered basalts at the slow/intermediate spreading Mid-Atlantic ridge (MAR) aged ~7 to 61 Ma. Major, trace and rare earth element (REE) compositions of plagioclase phenocrysts show that plagioclase compositions vary across the transect. Plagioclase phenocrysts and micro-phenocrysts are zoned and range in compositions from bytownite-labradorite-anorthite in the cores to bytownite-labradorite-andesine in the rims across all sites. Large plagioclase phenocrysts exhibit heterogeneous major element compositions between cores and rims especially elements like SiO₂, Al₂O₃, CaO, Fe₂O₃ etc. The degree of heterogeneity is variable between phenocrysts, with some elements exhibiting minor heterogeneity (eg. V, Ni, Zr, LREE's) and others exhibiting a wide range of trace element zoning (viz. Cr, Ti and Sr). The observed trace and rare earth element patterns is indicative of a complex set of processes that include mixing of melts, fractional crystallization, and diffusive re-equilibration operating beneath the mid-ocean ridges.