Magma differentiation processes and pre-eruptive conditions of MORBs (7-11°S) near Ascension Island – Constraints from experiments and phase equilibria modeling.

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Recent investigations on rocks from the Mid-Atlantic Ridge (MAR) near the Ascension Island indicate that major differentiation processes of basaltic melts occurred at relatively low pressure (less than 500 MPa). Preliminary results indicate that each of the four investigated segments along the MAR have a distinct history with different crystallization depths (and fractionation paths), temperature and volatile contents of melts. However, the current experimental database meets certain difficulties to interpret the fractionation trends. In particular, below 500 MPa, even small amounts of volatiles dissolved in the melt result in relatively high volatile activities which may influence significantly the stability of phases and differentiation processes. The aim of this research project is to clarify the influence of pressure, oxygen fugacity and fugacities of the volatiles (in particular water) on the differentiation of basaltic melts along the MAR near Ascension. To achieve these goals, three approaches are used: (1) phase equilibria are modeled in a wide range of $a\mathrm{H_2O}$ and f_{O2} and include equilibrium, fractional, and polybaric crystallization calculations; (2) high pressure and high temperature experiments are performed with natural compositions to model the effect of very small amounts of water on the liquidus temperature of the main minerals (Olivine, plagioclase, clinopyroxene); (3) glass inclusions in minerals and water contents of glasses are investigated to understand the behavior and importance of volatiles in differentiation processes and during ascent. The ultimate goal of this study is to depict the degree of differentiation and the evolution of pre-eruptive conditions of magmas along the MAR. Combined with results from other approaches (geophysics, geochemistry), our data will contribute to the understanding of the temperature distribution in the oceanic crust and to locate possible magma chambers along MAR.