Evaluating the Potential Influence of Magmatic Degassing on Magma Ascent Models: 9°46'-9°52'N East Pacific Rise

M.F. Meana-Prado, K.L.Von Damm, J.G. Bryce, J.A. Dibb*

A recent study employing U-series techniques on Mid-Ocean Ridge Basalt (MORB) erupted in 1991 from the EPR 9°50'N showed a ^{210}Pb- ^{226}Ra-^{230}Th disequilibrium that, in a system closed since melting, would have taken only a few decades to form. Rubin et al. (2005) used these data to propose a model of extreme rapid time for magma ascent of sixty-six years. This is contradictory to previous physical models, which suggest magma ascent rates that are slower by one to three orders of magnitude (Kelemen et al., 1997). The rapid magma ascent model of Rubin et al. (2005) assumes negligible magmatic degassing and assimilation. If magma degassing does not play a significant role in physical fractionation of ^{222}Rn from the melt phase, then the measured ^{210}Pb deficit can be attributed entirely to melt formation and rapid ascent rates. One way to test this assumption is by analyzing high temperature hydrothermal vent fluids for excess ^{210}Pb.

High levels of CO_2 and ^{3}He/heat in vent fluids collected in November 2003 from the 9°46'-9°52'N vent field area may be associated with shallow level magmatic degassing (M. Lilley & J. Lupton, Pers. Comm.) Most of the CO_2 and heavier rare gases such as Ar, Kr, Xe, Rn separate from a melt phase. If degassing occurs at shallow levels, Rn may partition into the convecting seawater, producing an ingrowth of ^{210}Pb that is not supported by ^{226}Ra decay. Excess ^{210}Pb from vent fluids associated with the high CO_2 could be indicative of ^{222}Rn fractionation from a shallow degassing magma source. The degassing of ^{222}Rn from the magma to the fluids could be indicated by ^{226}Ra/^{210}Pb ratios much less than one. As the Pb content of vent fluids varies as a function of chlorinity, temperature and other parameters, the ^{210}Pb data must be normalized to the concentrations of stable Pb in the fluids.

The ^{210}Pb/Pb ratios in the vent fluids will be compared to end member CO_2 concentrations in order to establish whether or not the two are correlated, thus suggesting that degassing from the melt phase is occurring.

**Presenting Author: Department of Earth Sciences and Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Durham, NH 03824*