SULFUR BEHAVIOR IN TERRESTRIAL BASALTIC MAGMAS: INSIGHTS FOR THE BEHAVIOR OF VOLCANIC SULFUR ON VENUS. Peter J. Michael[1] [1]Department of Geosciences, The University of Tulsa, 800 S. Tucker Dr., Tulsa, OK 74104, pjm@utulsa.edu.).

Introduction: When considering the possibility of volcanic degassing of sulfur to the atmosphere of Venus, it is instructive to consider the behavior of Sulfur in terrestrial basaltic magmas. Terrestrial submarine basaltic glasses provide a good indication of magmatic sulfur content and behavior because they produce a basaltic glass (a super-cooled liquid) when they erupt on the seafloor.

H_2O, CO_2 and Sulfur Degassing: Sulfur degassing on earth almost never takes place in the absence of significant H_2O degassing. H_2O is much more soluble in magmas than CO_2. Mantle-derived mid-ocean ridge basalts (MORB) contain about 0.1% H_2O and perhaps 0.1% CO_2. When they ascend, basaltic magmas become oversaturated with a mixed vapor phase that starts off as nearly pure CO_2 because of the greater solubility of H_2O. Significant amounts of H_2O and sulfur are degassed from basaltic magmas only where they ascend to much lower pressures, such as at Iceland and other subaerial volcanoes. The pressure of eruption of submarine MORB is sufficient (100-500 bars) that this point is not reached, so that degassing rarely involves much loss of H_2O (or sulfur). Plateau basalts such as Ontong Java or Deccan traps have similar H_2O contents and degassing behavior. In contrast to MORB and plateau basalts, subduction-related magmas have much higher initial H_2O contents (0.2-5.0 wt.%) and therefore they often lose H_2O and sulfur by degassing at greater pressures during their ascent through the crust. Ocean island basalts such as Hawaiin basalts have intermediate H_2O contents and may degas H_2O and sulfur depending on the initial H_2O content and the depth of eruption.

On Venus, the atmospheric pressure of 95 bars is sufficient to retain about 1.0% H_2O in solution. It is unlikely though, that basalts from Venus would contain such high water contents. The present lack of subduction recycling on Venus, and the low H/D ratios in the atmosphere suggest that Venus' interior is rather dry and that magmas are also dry, perhaps similar to MORB. If so, it implies that most basaltic eruptions on Venus will not be accompanied by degassing of water or sulfur. If Venus' mantle has a higher sulfur content than Earth's mantle, it is likely that the additional sulfur would form additional immiscible sulfide blebs in basalt, not a vapor phase.

Sulfur in solid basalts: Most basaltic magmas on earth have low oxygen fugacity and contain dissolved sulfide (S^{2-}). The sulfide solubility of the silicate liquid is determined largely by its FeO content. Mid-ocean ridge basalts (MORB) almost always erupt saturated or oversaturated with S^{2-}, as shown by the immiscible sulfide liquid blebs their glasses contain and by their linear trend on a plot of FeO *versus* S. Plateau and flood basalts and some MORB that form by very large extents of melting are undersaturated with sulfide. Their silicate glasses have lower S^{2-} contents at a given FeO content and contain no sulfide blebs. In either case, the crystallized (non-glassy) basaltic rocks should contain disseminated metallic sulfide minerals that would form whether or not the initial liquids were sulfide saturated. These sulfides are available to equilibrate and react with Venus' atmosphere.