Gas Transport by Magmas and Gas Emissions from Volcanoes

M R Carroll (Department of Earth Sciences, University of Camerino, 62302 Camerino, MC, Italy; ph. +39-0737-402608; fax +39-0737-402644; e-mail: michael.carroll@unicam.it

Magmas are multi-phase systems that consist of melt +/- crystals +/- gas bubbles. They may show wide variations in composition, and in crystal and gas content and this can results in orders-of-magnitude variations in their viscosity, which in turn has major implications for eruption dynamics. The transport of volatile components in magmas and their eventual release to the atmosphere depends on a wide range of parameters, including (but not limited to): original volatile content, magma oxidation state, eruptive style, pressure and temperature. Common magmatic volatile components include H, C, F, Cl, S and these may occur in many different gas species (e.g., H2O, CO2, CO, H2S, SO2, S2, HF, HCl), with the relative abundances mainly controlled by P,T and magma oxidation state. A major driving force for volcanic eruptions is exsolution of volatile components as magmas migrate towards the earth s surface. Because most volatile components show decreasing solubility with decreasing pressure the volume fraction of gas phase in magmas typically increases as pressure decreases. Some notably gas-rich volcanic eruptions (e.g., Pinatubo) suggest that some magmas may be saturated with a vapor phase prior to initiation of eruption.