Understanding CO_2-S Degassing from San Cristóbal Volcano

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A sudden increase in CO_2/SO_2 ratio in high-temperature gas has been observed in many arc volcanoes and can be used as an eruption precursor. However, this ratio remains tricky to interpret due to large variability displayed by one volcano over time and between eruption cycles. The San Cristóbal volcano in Nicaragua shows abnormally high CO_2/ SO_2 ratio in its high-temperature gas and has actively degassed and erupted over the past 50 years, which makes a great endmember to study the factors that control the volcanic gas compositions. Melt Inclusions (MIs), ideally, preserve volatile contents of magma at the time of entrapment, and can be used to infer the degassing depths and gas composition. However, shrinkage bubbles in MIs can cause a significant underestimate of the CO_2 budget. This study uses olivine-hosted melt inclusions from a primitive Holocene sample (SC11D) of San Cristóbal volcano to constrain the CO_2 and S contents along degassing and in the parental magma. To address the shrinkage bubble issue and reconstruct the CO_2 concentration, we conduct piston cylinder experiments at 7 kbar and 1150°C to rehomogenize shrinkage bubbles back into the melt. We then used Fourier Transform Infrared (FTIR) Spectroscopy to analyze the H_2O and CO_2 concentration of the treated and untreated melt inclusions. Our new rehomogenized melt inclusion measurements, with 2700 ppm maximum CO_2, increase CO_2 estimates for San Cristóbal volcano 50% over previous Raman measurements (~1800 ppm) and ~3x relative to untreated samples (<1000 ppm CO_2). Our new data increase the depth at which San Cristóbal volcano gas derives to > 20 km. Future sulfur analyses and degassing modeling will quantify the CO_2/S degassing trend throughout the volcanic system.