Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.22152

Melt inclusion and volcanic gas perspectives on volatiles in subduction zones

KATHERINE KELLEY[1] AND **TOBIAS P FISCHER**[2]

[1]University of Rhode Island
[2]University of New Mexico
Presenting Author: fischer@unm.edu

Volatile elements play a central role in driving numerous processes within Earth's subduction zones, including mass transfer of materials from the subducting plate to the overlying mantle, melting of mantle rocks to produce hydrous arc magmas and the degassing associated with magmatic and eruptive activity. Here we synthesize major volatile data sets from melt inclusions and volcanic gases in subduction zones as presented in Kelley and Fischer (2024). We use updated constraints on global arc volatile and magma fluxes to compute volatile contents of primary basaltic arc magmas of 4 wt.% H_2O, 1,500 ppm S, and 5,000 ppm CO_2. Based on available data sets, we focus on four arcs (Mexico-Central America, Alaska-Aleutians, Kurile-Kamchatka, and Izu-Bonin-Mariana) that are well constrained in terms of melt inclusion volatiles and gas emissions and draw the following conclusions: 1. there is no need to invoke a non-magmatic source for CO_2 to balance the output flux of C; 2. sulfur fluxes from oceanic arcs may be significantly underestimated due to undetected degassing on the ocean floor or extensive interaction of magmatic gas with seawater; 3. magmatic water fluxes are broadly consistent with gas emissions for dominantly island arc systems (IBM, Alaska-Aleutians), but continental arcs show a significant imbalance, suggesting that either the H_2O content of arc melt inclusions is significantly underestimated, the H_2O contents of high temperature gases from arc volcanoes are overestimated, or magma production rates are highly variable. Our evaluation identifies several potential avenues for future inquiry, including apparent imbalances between magmatic- and gas-based constraints on arc H_2O and S output fluxes. Ways forward will include focused and coupled studies of both the magmatic and gas systems of arc volcanoes.

Kelley and Fischer (2024) Melt inclusion and gas perspectives on volatiles in subduction zones. Treatise on Geochemistry, 3rd Edition, Section 1 "Earth's Interior"