Geophysical Research Abstracts
Vol. 20, EGU2018-18230, 2018
EGU General Assembly 2018

Remobilization of crustal carbon may dominate volcanic arc emissions

Emily Mason, Marie Edmonds, and Alexandra V. Turchyn
University of Cambridge, Department of Earth Sciences, Cambridge, United Kingdom (em572@cam.ac.uk)

The flux of carbon into and out of Earth's surface environment has significant implications for Earth's climate and habitability. The mantle is the largest reservoir for carbon in Earth, and therefore any imbalance in the cycling of carbon between the surface environment and the mantle (via volcanic outgassing and subduction of carbon-bearing minerals) has huge significance for the amount of carbon at Earth's surface, which in turn impacts atmospheric CO_2 concentration and thus global temperatures over geological timescales. Volcanic outgassing is the primary mechanism of carbon transfer from Earth's interior to the atmosphere, yet the flux and source of the carbon, particularly from arc volcanoes, is poorly understood. The combination of helium and carbon isotopes can provide a means to isolate the sources of carbon at volcanic arcs. We compiled a global data set for carbon and helium isotopes from over 80 arc volcanoes and demonstrated that the carbon isotope composition of mean global volcanic gas is considerably higher, at –3.8 to –4.6 per mil (‰, than the canonical mid- ocean ridge basalt value of –6.0‰̇The largest volcanic emitters outgas carbon with higher 13C and are located in mature continental arcs that have accreted carbonate platforms, indicating that reworking of crustal limestone is an important source of volcanic carbon. The fractional burial of organic carbon is lower than traditionally determined from a global carbon isotope mass balance using a 13C input of –6.0‰̇We suggest the 13C of volcanic input may have varied over geological time, modulated by supercontinent formation and breakup.