Contamination matters – insights into oceanic basalt generation from Ne, Ar and Cl

NICOLE A. STRONCIK[1], SAMUEL NIEDERMANN[2]

[1]GFZ, Sec.3.3 Earth surface geochemistry, Telegrafenberg, 14473 Potsdam, stroncik@gfz-potsdam.de
[2]GFZ, Sec.3.1 Inorganic and isotope geochemistry, Telegrafenberg, 14473 Potsdam, nied@gfz-potsdam.de

Scientists studying the formation, structure and evolution of the Earth’s mantle based on geochemical and petrological data are in the unfortunate situation that they will never be able to prove their findings by direct evidence. They mostly rely on secondary evidence provided by the study of magmatic samples found at the surface of the Earth. Oceanic basalts, being free of continental crust contamination, are thought to provide the most undisturbed access to the Earth’s mantle. However, even oceanic basalts only partly reflect the chemical and physical properties of the mantle because various stages of magmatic evolution during ascent to the surface are part of their production. It is of ample importance to quantitatively decipher each of these processes when studying mantle formation and evolution. In this contribution, based on Ne, Ar, Mg, K, and Cl data of fresh glasses from different mid-ocean ridge segments we show that magmatic contamination is an integral part in basalt production along mid-ocean ridges globally. Ne and Ar isotopes are especially sensitive tracers of any atmospherically sourced component in a magmatic rock due to their large concentration in air and the isotopic differences between the atmosphere and the mantle. By combining Ne and Ar isotope and concentration data with Cl/K ratios, a tracer for seawater contamination of basalts, we show that the atmospheric Ne and Ar isotope signal observed in mid-ocean ridge basalts is a signal inherited during magmatic evolution at depth, produced by the assimilation of altered oceanic crust.