Age dating clinopyroxene phenocrysts with the $^{40}Ar/^{39}Ar$ method: preliminary results and future prospects

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The ability to date altered submarine basaltic lava flows is often hindered by a lack of K-bearing phenocrystic phases or suitable holocrystalline groundmass. Clinopyroxene (cpx) is a common phenocrystic phase in alkaline basalts and is highly resistive to low-temperature seawater and hydrothermal alteration. Preliminary experiments show that phenocrystic cpx separated from basalt are a viable phase for $^{40}Ar/^{39}Ar$ age determinations. Nine cpx incremental heating experiments have been undertaken, five of which from samples with dated coeval phases. The cpx ages range from 11.5 to 112 Ma with uncertainties ranging from 0.65 to 8.8% (2σ; median of 1.3%). The ages are concordant or fall within 6% of their coeval phase. Age plateaus range from 50-95% of the total ^{39}Ar released for individual step heating experiments. The cpx contain relatively elevated K/Ca of 0.01-0.5 for the low to moderate temperature steps, which forms those age plateaus, inferring that some other K-bearing phase hosted within the cpx is degassing. The current best fit for the K-bearing phase are secondary melt inclusions, trapped along re-annealed grain boundary defects. Preliminary Arrhenius diffusion experiments indicate that cpx phenocrysts can display both single and polydomain diffusion patterns during relative low temperature heating (<1200°C). Clinopyroxene dating by the $^{40}Ar/^{39}Ar$ method has the potential to provide a wealth of information for previously undated, altered seafloor lithologies.