Advancements in $^{40}Ar/^{39}Ar$ dating of Mafic Phenocryst Phases

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Recent work has demonstrated that clinopyroxene (CPX) is a viable phase for $^{40}Ar/^{39}Ar$ age determinations using modern high-sensitivity mass spectrometers. As CPX is resistive to alteration in marine environments, these new advancements have potential for providing ages for submarine igneous rocks that were previously considered un-datable by the 40Ar/39Ar method due to a lack of K-bearing phenocrysts and/or altered groundmass. Konrad et al. (2019) recently reported preliminary successes with dating CPX phenocrysts separated from submarine basalts. The study found 75% success rate in producing incremental heating plateaux that include > 60% of ^{39}Ar released and probabilities > 0.05. CPX age results from both Konrad et al. (2019) and Ware and Jourdan (2018) display elevated K/Ca values (0.002-0.4) for the steps used in calculating the age. The origin of the elevated K and corresponding $^{40}Ar^*$ in these CPX is debated. Potential phases include secondary melt inclusions, nano-silicate inclusions along grain defects (Konrad et al. 2019) or variability in inter-crystalline Ca concentration (Ware and Jourdan, 2018). As of yet, no definitive answer exists to which phase is responsible for the successful age determinations and whether the ages represent pre-, syn- or post-eruptive processes.

Konrad et al. (2019). G3, 20(2), 1041-1053.

Ware and Jourdan (2018), GCA, 230, 112-136.