**Antecrysts – angels or devils in 40Ar/39Ar geochronology? Examples from Cape Verde seamounts.**

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The traditional concept of magmatic systems has changed from high-melt fraction “magma chambers” to low-melt-fraction “mush reservoirs” [e.g., 1]. This new hypothesis now more easily explains the presence of older antecrysts/xenocrysts found within younger magmas. These older crystals can offer important information on the formation, crystallisation, mixing, and storage of minerals in magmatic systems, but they can also greatly complicate 40Ar/39Ar geochronological analyses. We present an extensive laser 40Ar/39Ar single-crystal total-fusion and single-/multiple-grain step-heating dating study of individual K-bearing crystals (K-feldspar, biotite and nepheline) from two Cape Verde seamounts, in the central Atlantic Ocean, to explain these complications.

The Cape Verde Archipelago (10 volcanic islands and several seamounts) originates from igneous activity related to a mantle plume over a period of 26 Ma to present. A sample from the Senghor Seamount yields a single population of 40Ar/39Ar ages from biotites and K-feldspars, indicating a simple co-magmatic age of 14.622 ± 0.027 Ma (all errors are 2σ; n = 70). Alternatively, 5 samples from the active Cadamosto Seamount, located ~425 km SW of Senghor Seamount, yield a much more complicated range of K-feldspar and nepheline single-crystal 40Ar/39Ar ages. The K-feldspars record ages ranging from 11.5 ± 6.5 to 611.9 ± 8.8 ka (n = 140), whereas the nephelines yield ages from 169.5 ± 16.5 ka to 1.522 ± 0.008 Ma (n = 27). K-feldspars in the 5 samples yielded 3 different eruption ages (21.14 ± 0.62, 51.8 ± 2.4, and 97 ± 14 ka), but some petrologically-identified K-feldspar and nepheline antecrysts yield orders of magnitude older ages [2]. Step-heating of one multi-crystal K-feldspar sample gives plateau ages of 126.5 ± 3.3 and 131.9 ± 3.7 ka, ~30-35 ka older than the 97 ka eruption age, thus highlighting the danger of multi-grain step-heating 40Ar/39Ar dating in antecryst-bearing samples.

A better awareness of the possibility of the presence of antecrysts in geological material can be coupled with careful petrological examination of samples to determine the most appropriate 40Ar/39Ar dating technique. In addition, advances in high-sensitivity multi-collector noble gas mass spectrometers now allow higher resolution 40Ar/39Ar dating on much smaller samples (e.g., laser step-heating of ~765 ka single K-feldspars [e.g., 3]). This should help to resolve the complications of antecrysts in samples, and turn them from potential foes to friends.

[1] Jackson et al. 2018. Nature 564:405-409.

[2] Samrock et al. 2019. Lithos in review.

[3] Anderson et al. 2017. PNAS 114:12407-12412.