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Crystal scale isotopes from plutonic xenoliths reveal lower crustal melt evolution in the plumbing system beneath Mt. Adagdak, Aleutian arc.

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Subduction zone magmas represent the integrated result of both source heterogeneity and an array of crustal processes, such as differentiation, mixing, homogenisation and assimilation. Therefore, disentangling the relative importance of the compositional heterogeneity of the mantle source, versus subsequent modification of melts in the crust is difficult when targeting the volcanic end products. Mt. Adagdak on Adak Island, Central Aleutians, has erupted a range of plutonic xenoliths ranging from ultramafic wehrlites and clinopyroxenites to more evolved hornblendites and amphibole gabbros. These plutonic samples provide a window into the deep crust and have the potential to reveal both previously obscured heterogeneity of melts generated in the sub-arc mantle and the extent and depth of subsequent assimilation within the crust.

We characterised the major element distribution of 33 plutonic xenoliths by SEM mapping. Of these, we selected a sub-set (covering the range of types from least to most evolved) for trace element (LA-ICPMS) and isotopic analysis. Selected core and rim domains from clinopyroxene, amphibole and plagioclase were then milled for Sr-Nd isotopic analyses by TIMS to determine the extent to which the geochemical and isotopic heterogeneity of volcanic arc magmas are imprinted as they pass through the crust (due to crustal and/or sediment assimilation) or are reflective of their mantle source.

Here, we present the trace element and crystal scale Sr and Nd isotope record of phases contained in plutonic xenoliths and compare these to the previosuly published whole-rock record. Isotopic heterogeneity within Adagdak plutonic xenoliths covers most of the whole-rock variation observed on Adak Island. In particular, amphibole gabbros show the greatest heterogenety ($^{87}Sr/^{86}Sr$ 0.703257-0.703521). Within each sample, crystal cores typically record larger isotopic variation than their rims. These findings indicate that mantle melts entering the crust are homogenised within lower- and mid- crustal storage regions in the Adagdak plumbing system.