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Shallow-level processes at Krakatau volcano: crystallisation and late stage crustal contamination

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Anak Krakatau, the post-collapse cone of the infamous Krakatau volcano, is growing at an average rate of 13cm a week. This activity may represent the initial stages of an evolutionary cycle that could culminate in the type of catastrophic rhyolite eruption witnessed in 1883 and which produced the even larger pre-1883 caldera. Analysis of a suite of samples from the 1883 and 2002 eruptions may therefore provide crucial information concerning evolutionary cycles of subduction zone volcanoes.

Plagioclase phenocrysts with complex zoning and the presence of meta-sedimentary and plutonic xenoliths within the erupted products provide a record a variety of shallow level differentiation processes. The xenoliths show variable degrees of chemical equilibration, thermal overprinting, plastic deformation and partial melting.

Here we present new major and trace element data, combined with whole-rock Sr, Nd and Pb isotope ratios; and LA-MC-ICP-MS Sr analyses of feldspar phenocrysts. The 2002 event erupted a plag-phyric basaltic-andesite with Sr ratios ranging from 0.704406 ± 9 to 0.704442 ± 6, with xenoliths displaying values of 0.704429 ± 6 to 0.709154 ± 6. The 1883 pumices and obsidians range between 0.704378 ± 10 and 0.70469 ± 9. The significant overlap between the igneous and crustal samples, from both 1883 and 2002 samples, suggests crustal contamination during shallow magma storage at Anak Krakatau. This combination of data suggests a complex interplay of processes ranging from fractional crystallisation to assimilation of chamber wall fragments coupled with an input of volatiles, probably from the same crustal source.