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Sr, Nd, Pb and Li isotope geochemistry and Ar-Ar dating of alkaline lavas from northern James Ross Island (Antarctic Peninsula) - implications for back-arc magma formation

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The elemental and isotopic (Sr, Nd, Pb and Li) composition of Cenozoic back-arc alkaline basalts emplaced east of the Antarctic Peninsula in James Ross Island Volcanic Group (JRIVG) is different from the compositions of the fore-arc alkaline volcanic rocks in Southern Shetlands and nearby Bransfield Strait. The variability in elemental and isotopic composition is not consistent with the JRIVG derivation from a single mantle source but rather it suggests that the magma was mainly derived from a depleted mantle with subordinate OIB-like enriched mantle component (EM II). The isotopic data are consistent with mantle melting during extension and possible roll-back of the subducted lithosphere of the Antarctic plate in Miocene to Pliocene times, as indicated by the existing geochronological data and the new Ar-Ar age determinations. Magma contamination by Triassic – Early Tertiary clastic sediments deposited in the back-arc basin was only localized and affected Li isotopic composition in two of the samples, while most of the basalts show very little variation in delta 7Li values, as anticipated for “mantle-driven” Li isotopic composition. These variations are difficult to resolve with radiogenic isotope systematics but Li isotopes may prove sensitive in tracking complex geochemical processes acting through the oceanic crust pile, including hydrothermal leaching and seawater equilibration.