



## **Colville Ridge: new clues about the history of northern Zealandia and petrogenesis in the Kermadec arc system**

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The intra-oceanic Kermadec arc subduction zone system northeast of New Zealand comprises a number of major bathymetric features, including a ~1,300 km long Miocene remnant arc –the Colville Ridge– that bounds the Havre Trough back-arc to the west. Until recently, seafloor exploration in this region was largely focused on the Kermadec arc front volcanoes and little was known about the Colville Ridge. In 2013 and 2015, detailed bathymetric mapping and rock sampling was conducted between 36°S and 33°S on two expeditions with the R/V Tangaroa. The new bathymetric maps reveal that a number of split volcanoes and few intact volcanic cones are dotted along Colville Ridge, consistent with their formation during different episodes of volcanism.

Recovered lavas range from mafic micro-basalts (MgO = ~8 wt.%) to basaltic andesites that have arc-type patterns such as high fluid-mobile large ion lithophile elements (e.g., Ba, Rb, Pb Sr) and slightly negative sloping rare earth element and negative Nb and Ta patterns on multi-element diagrams. Based on crystal content and chemical composition the Colville lavas can be grouped into an almost aphyric to highly crystal phyric group. Although the Sr- and Pb-isotopic compositions of both groups overlap, the crystal-poor Group 1 lavas have generally lower alkali contents, La/Sm, Ce/Yb and Th/Zr values but higher  $^{143}\text{Nd}/^{144}\text{Nd}$  characterizing the predominant composition of the subarc mantle. Conversely, the porphyric Group 2 lavas have similar to higher alkali contents, La/Sm, Ce/Yb, Th/Zr values and lower  $^{143}\text{Nd}/^{144}\text{Nd}$  suggesting that high-alkali mantle (and crustal) domains with high, Ce/Yb, La/Sm, Th/Zr and low  $^{143}\text{Nd}/^{144}\text{Nd}$  contributed to the geochemical composition of these melts. Geochemically diverse lavas, including high-K shoshonites and arc-type lavas occur at the Norfolk-Three Kings Ridges and the Northland Plateau and back-arc and ocean island-type lavas in the South Fiji Basin, are all located immediately west of the Colville Ridge. In particular, the high-K shoshonitic lavas from the Three Kings Ridge and South Fiji Basin have high Ce/Yb, Th/Zr and low  $^{143}\text{Nd}/^{144}\text{Nd}$  suggesting that domains from initial Eocene (or earlier) arc rifting are preserved in the Colville subarc mantle. Existence of such subarc mantle domains can also account for some of the geochemical composition observed in Kermadec arc lavas. The Colville Ridge therefore provides another piece of the puzzle to understand the geochemical evolution of the Kermadec arc system and its role in present day Kermadec arc volcanism.