

# **Submarine hydrothermal activity along the mid-Kermadec arc, New Zealand: Large-scale effects on venting**

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The 2002 NZAPLUME II cruise surveyed ~580 km of the mid-part of the Kermadec arc (MKA), NE of New Zealand. This included mapping of hydrothermal plumes for 12 submarine volcanic centers including: Kibblewhite, Sonne, Ngatoroirangi, Cole, Kuiwai, Hungaroa, Speight, Wright, Havre, Curtis, Macauley and Giggenbach. When combined with results from the 1999 NZAPLUME I cruise to the southern Kermadec arc (SKA), a total of 840 km of active arc front has now been investigated for hydrothermal emissions.

A long-arc profile shows depth to the seafloor increases between White Island, immediately offshore of New Zealand, and the Kibblewhite volcanic center. Thereafter, the seafloor remains at a constant (~3,000 m) depth until the Hungaroa Volcanic Center. From here the active arc front merges with the Kermadec Ridge with the seafloor shoaling to the north, where the northern-most MKA centers such as Curtis and Macauley sit right on top of the ridge. Spacing of the volcanic centers increase, on average, from 30 km in the backarc of the SKA, to 45 km in the backarc of the MKA, to 58 km on the Kermadec Ridge. The centers are dominated by cones in the backarc and by caldera volcanoes where they merge with the ridge.

Hydrothermal plume surveys show that the incidence of venting is 82% (9 of 11) for MKA volcanic centers. This compares with 67% (8 of 12, now including Kibblewhite) for centers of the SKA. However, the relative intensity of venting, as given by plume thickness, areal extent, and concentration of dissolved gases and ionic species, appears much weaker for most of the MKA centers than for the SKA centers, with more intense venting appearing again in the northern section of the MKA.

Projection of the northern margin of the ~17-km-thick Hikurangi Plateau towards the Kermadec arc shows that it intersects the arc near Kibblewhite. Subduction of the Hikurangi Plateau would ensure unusually large amounts of fluids are released by the down-going slab, initiating melting in the upper mantle wedge and supplying the magmas needed to sustain hydrothermal systems south of Kibblewhite.