# Relationship between tectonism, volcanism, and hydrothermal venting along the Mariana back-arc spreading center between 12.7°N and 18.3°N

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The 2015 "Hydrothermal hunt in the Marianas" expedition on *R/V Falkor* (FK151121) systematically surveyed ~600 km of the Mariana back-arc spreading center. The collection of near-continuous multibeam bathymetry from 12.7°N to 18.3°N allow us to examine the relationship between tectonic processes, magmatism, and hydrothermal venting in the backarc, through quantitative assessment of volcanic geomorphology and structure. We distinguish four morphologically-distinct segment types: magmatic segments (Type I); magmatically-focused segments (Type II); tectonic segments (Type III); and tectonic segments currently undergoing

magmatic extension (Type IV). Type I segments occur in the southern back-arc and are characterized by axial rises similar to fast-spreading mid-ocean ridges—despite the slow-spreading rate—associated with high-level magmatism and shallow-crustal hydrothermal circulation. There is a gradual change in segment morphology with proximity to the volcanic arc, supporting earlier suggestions that the southern back-arc is strongly influenced by melt contributions from the arc. Type II, III, and IV segments occur in the central Mariana back-arc, and bear a close resemblance to slow-spreading mid-ocean ridges. Cross-arc seismicity highlights tectonic complexities that extend from the arc into the backarc, promoting N-S extension and faulting along the 14.5°N segment, and N-S compression and magmatism along the 16.5°N and 17.0°N segments. The backarc segments are separated by three first-order transform offsets characterized by oblique orientation to the spreading axis and strong dextral shearing, as well as numerous second-order non-transform discontinuities (overlapping spreading centers). A transform zone at 17.5°N has reoriented spreading in the 17.0°N segment, resulting in oblique extension that may promote focused magmatism. Hydrothermal venting occurs in all segment types. By comparison with mid-ocean ridges, we expect the largest massive sulfide deposits to form along Type II segments, associated with high-intensity magmatism and deeply-penetrating boundary faults (particularly along the 17.0°N segment), and Type III segments, which are also heavily faulted (particularly along the 14.5°N segment).