

## **Life Signatures and Organic Matter Preservation at Cathedral Hill Hydrothermal Vent Site, Guaymas Basin, Gulf of California**

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Guaymas Basin is a submarine depression at the northern end of the East Pacific Rise, mid-oceanic spreading ridge in the Gulf of California. Various hydrothermal vent complexes occur along the margin; one of which is named Cathedral Hill in which four push cores (down to 23 cmbsf, 34 samples) were collected along a transect line running from the center sulfide chimney complex to the outside of the microbial mat using HOV Alvin. Thermal-probe measurements yielded dramatic increases with depth. By 7-9 cm, pore-fluid temperatures were 105°C in the vent center marking the most shallow expected habitable limit to the microbiome (from 18-122°C). Projected porewater temperatures reach up to 155°C within only 21cmbsf. These higher temperatures should not only be capable of pyrolyzing in situ organic matter, but also begin to thermochemically break down these newly formed compounds to generate a petroleum-like fluid. The diversity and abundance of polar and apolar compounds including intact polar lipids (IPLs – derived from living cell membranes), core lipids (CLs), and aliphatic biomarkers were examined. Identified lipids include archaeol (AR, 1G-AR, 2G-AR, 1MeC-AR), glycerol dialkanol diethers (GDDs, OH-GDDs), and glycerol dialkyl glycerol tetraethers (1G- and 2G-GDGTs, iGDGTs, brGDGTs) as well as multiple unknown phospholipids that are likely bacterial in origin. IPLs 2G-GDGTs, possibly derived from anaerobic methanotrophs, were extracted from sediments ranging up to ~50°C. In contrast, The 1G-GDGTs are observed in sediments reaching ~145°C, indicating hyperthermophilic archaea at these temperatures. Subtracted GC×GC chromatograms reveal elevated levels of high-temperature pyrolytic hydrocarbons, including relatively high abundances of higher molecular weight PAHs (pyrene to coronene) and equivalent perhydro-PAHs, at 6-10 cmbsf consistently across the transect. Lastly, ratios of low to intermediate molecular weight *n*-alkanes and acyclic isoprenoids show increasing levels of biodegradation. The lipidomic and hydrocarbon data suggests microbial life may exist beyond current known temperature limits.