Microbial Communities of the Mariana and Kermadec Trenches

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Hadal trenches are convergent margin oceanic locations extending from 6,500 m to almost 11,000 m seawater depths. Quantitative analyses of the microbes present in trenches are lacking, although these habitats could be home to distinct microbial communities, compared to those at shallower depths, as a result of high hydrostatic pressures, topographical funneling of organic matter, tectonic activity, carbon and energy sources arising from below the seafloor, and biogeographical isolation. Here we characterize the microbial communities present in the Mariana and Kermadec trenches, located in the northern and southern Pacific Ocean respectively, using culture-independent and dependent approaches. Benthic boundary layer seawater and surficial sediments (n=160) were recovered using the HROV *Nereus* and free-vehicle landers. Estimates of pelagic microbial activity were higher under *in situ* hydrostatic pressures, suggesting the presence of piezophilic (high pressure adapted) members within these communities. Illumina-tag sequence analyses of the V4-V5 region of the 16S rRNA gene indicated that hadal communities were distinct from abyssal communities and also varied between the two trenches. Taxa affiliated with organic matter were more abundant in the hadal relative to the abyssal zone and in the Kermadec Trench relative to the Mariana Trench. These findings are consistent with analyses of phospholipid fatty acid (PLFA) concentrations, which increased with increasing depth and showed higher abundances in the Kermadec relative to the Mariana. Hadal-enriched taxa, including members of the Marinimicrobia and the genus *Aquibacter*, show a cosmopolitan hadal distribution, indicating that geographical isolation of trenches does not limit microbial dispersal. Isolates obtained as pure cultures at high hydrostatic pressures were distinct from those obtained at atmospheric pressure. While these piezophiles were at low abundances in our *in situ* Illumina-tag dataset, they became dominant members during static, long-term storage of sediment samples at low temperature and high pressure. These analyses provide insight into some of the most remote ecosystems on Earth.