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In situ Experiments Unveil Planktonic Bacterial High Productivity in Hydrothermal Vent

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Since gutless tubeworms inhabiting deep-sea hydrothermal vents were found to derive their nutrients from sulfur-and-methanechemolithotrophic bacterial endosymbionts, the idea that the dense colonies of invertebrates in the vicinity of vents were supported by suspension feeding was ignored. As a consequence, the paradigm of endosymbiosis came to occupy most trophic studies of hydrothermal vent and cold seep ecosystems in the deep sea. If only invertebrates capable of harboring chemolithotrophic endosymbionts were able to inhabit these ecosystems, colonization by new taxa would be limited. However, it is not clear if these ecosystems are really so closed or how they were initially colonized. While marked chemoautotrophic activity has been confirmed where the plumes of hot water meet the surrounding seawater, planktonic bacterial production has never been directly estimated *in situ.* Consequently, specific aspects associated with ecosystem functioning and microbial food web dynamics in hydrothermal vent communities have not been fully addressed. After several manned and unmanned submersible investigations in the Okinawa Trough we succeeded in *in situ* measurementsof bacterial growth. At a doubling-time of 22 to 27 hours, planktonic bacterial production was remarkably high immediately above the densely colonizedmussel beds, decreasing rapidly further away from the plumes where it was as long as 7,200 hours. Small subunit ribosomal RNA gene analysis showed that the bacteria found in gut of bivalve were closely related to the chemolithotrophic species appeared in the hot water of hydrothermal vent. Thus, microbial loop is veiled to exist in this hidden ecosystem.