Hydrothermal Vent Communities

A 1977 Woods Hole Oceanographic Institute expedition to the Galápagos Rift in the Pacific Ocean made what some have called the oceanographic discovery of the century (figure 1). The rift (an opening made by splitting) is over 2,700 m (over 1.5 mi) below the surface and part of an extensive midoceanic ridge system that develops where the tectonic plates of the earth's crust move apart *(see box on Continental Drift)*. In such places, a flow of lava (magma) occasionally emerges, and **hydrothermal vents** spew out hot water rich in hydrogen sulfide and other minerals.

One unusual finding of the expedition was that the life of a vent community is based not on the "rain" of material that the producers in the surface zones generate, but on a rich community of chemolithotrophic bacteria that derive all of the energy they need from the oxidation of inorganic compounds, such as hydrogen sulfide. They live in total darkness because the vents are far below the level of light penetration.

The expedition also noted that clams, crabs, polychaete annelids, and one species *(Riftia pachyptila)* of pogonophoran covered the substrate around each vent. Like other pogonophorans (tube worms), *Riftia* is nourished in part by the endosymbiotic bacteria found in its trophosome *(see Lesser Known Invertebrates Two)*. These bacteria can oxidize hydrogen sulfide to sulfate and reduce carbon dioxide to organic compounds, which nourish both the symbiont and host. The worms' two kinds of hemoglobin carry oxygen and hydrogen sulfide. This chemical bonding keeps these two molecules from reacting in an unproductive fashion before they are delivered to the bacteria. They also protect the host's tissue from the toxic hydrogen sulfide. These vent communities are among the few on earth that do not depend on solar energy for life.

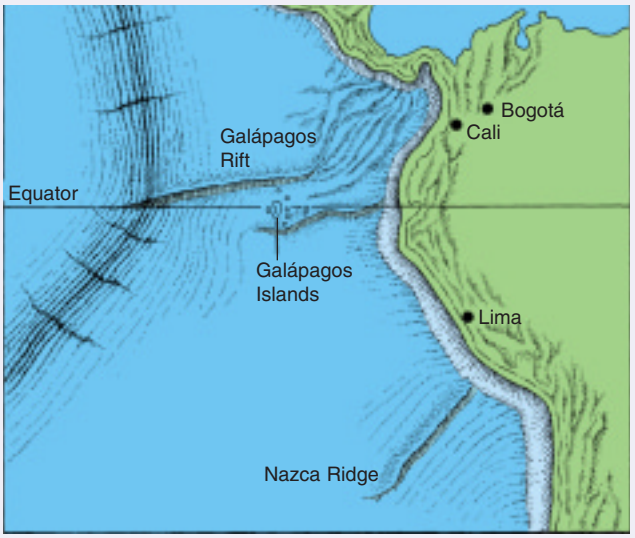

FIGURE 1 **Hydrothermal Vent Communities.** The Galápagos Rift is the site of an extensive ocean-bottom community living on inorganic nutrients issuing from hydrothermal vents. (Miller/Harley: *Zoology*, 5th ed. © The McGraw-Hill Companies.)