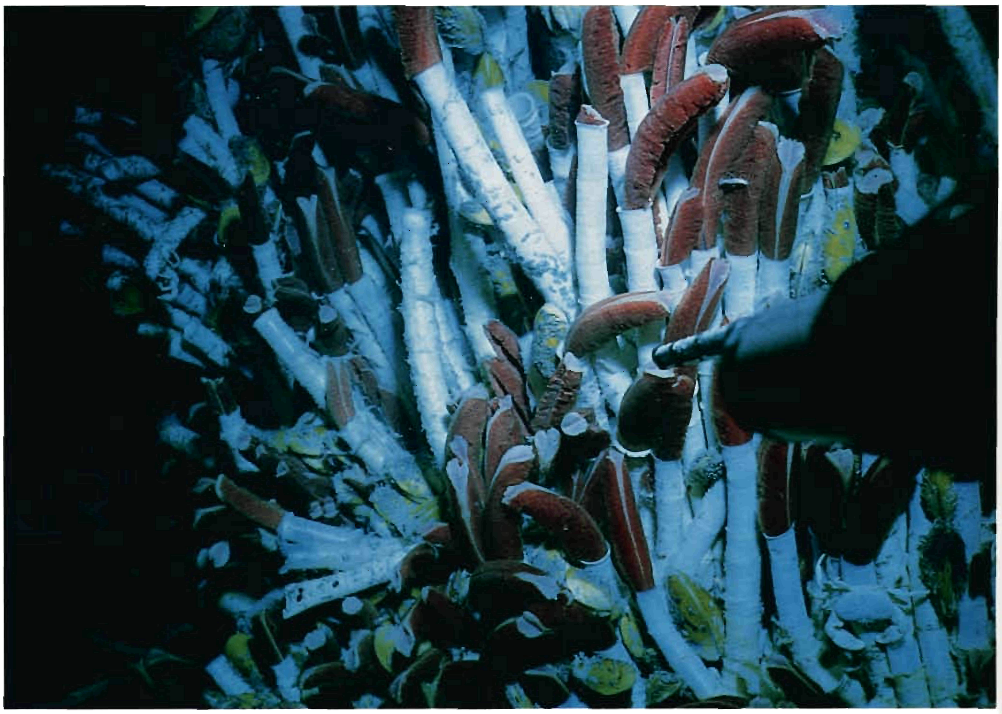
"DEEP-SEE" SHRIMP



TWENTY YEARS AGO, OUR VIEW OF the oceans was forever changed by one of the most startling discoveries in the history of oceanography and marine biology. The tiny submersible *Alvin,* operating out of the Woods Hole Oceanographic Institution, came across small oases of life clustered around deep-sea hydrothermal vents on the sea floor off the Galapagos Islands.

In general, the deep sea has been considered rather depauperate when compared to other marine habitats. The *Alvin* had descended to great depths to explore the hot vents themselves, which had been detected earlier by the temperature anomalies they created: no one involved in the expedition anticipated finding a new world of organisms. But around the vents, in contrast to what is found on the nearby abyssal plain, were thriving communities of giant worms, fishes, molluscs, crustaceans, and other forms. Not only were most of the species present new to science, but more significantly the base of their food chain was found to be chemosynthetic rather than photosynthetic: the tiny bacteria fed upon by the worms and molluscs were deriving their energy not from sunlight but from chemicals issuing from the vents.

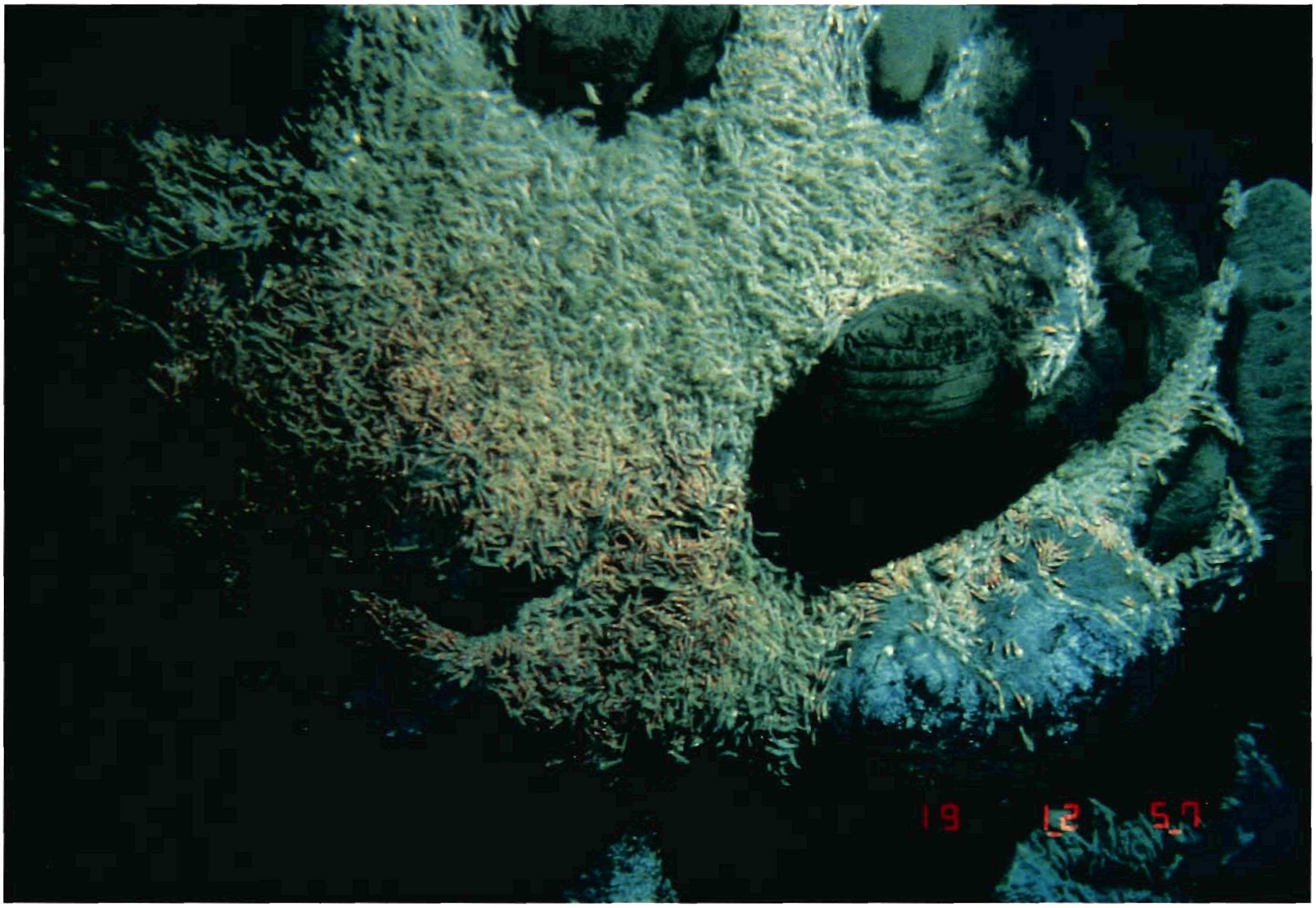
Since that initial discovery, hydrothermal vents supporting communities of unusual organisms have been found along most of the major oceanic plate boundaries in the Atlantic and Pacific, and there may be hundreds or thousands more on the floors of the world's oceans.

THE STAFF OF THE NATURAL HISTORY Museum includes some of the world's foremost authorities on deep-sea life, and these scientists became involved in studies of the vents early on. Dr. James McLean, a specialist in deep-sea molluscs, has written a number of papers on hydrothermal vent limpets; Deputy Director Emeritus Dr. Daniel Cohen is renowned for his work on deep-sea fishes, including populations of unusual species found near some vents; and I study crustaceans. We continue to be asked to examine or describe newly discovered organisms from the vents, and the museum's collections now contain a number of vent specimens, including several that we refer to as "types," the all-important and irreplaceable reference individuals that form the basis of the description of a new species.

Our ongoing research on the numbers and kinds of organisms found at the vents is not only a challenge but a pleasure: we are privileged to be laying the foundation upon which further knowledge of the origin and evolution of the vent species can be built.

ONE OF THE MORE CURIOUS FINDS IN my own field is that some of the vent shrimp from along the Mid-Atlantic Ridge are eyeless in the classic sense, although not blind. In these shrimps, from the genera *Rimicaris* ("vent shrimp") and *Chorocaris* ("dancing shrimp"), the ocular apparatus has apparently shifted from the usual frontal position, leaving them with what are essentially eyes on their backs. The eyes themselves are unusual: they contain the visual pigment rhodopsin and a retina-like tissue, but there is no faceted cornea or lens as is found in "normal" shrimp eyes. The shrimp obviously have the ability to detect light, but what they are seeing at these depths where sunlight does not penetrate is still anyone's guess.

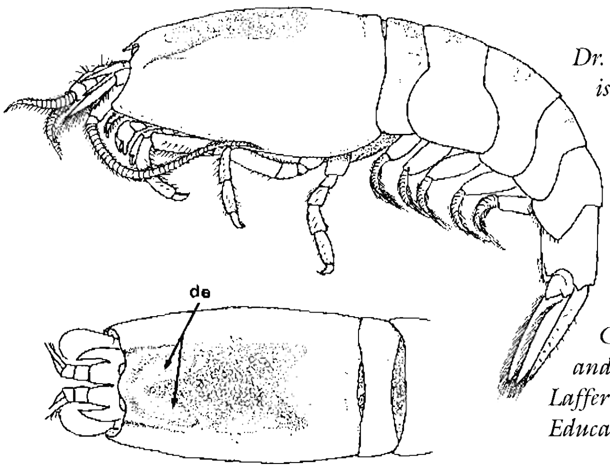
The Natural History Museum's Museum Research Apprenticeship Program provides local high school students the opportunity to work alongside curators, to the benefit of both the young scientists and their mentors. During summer 1996, while working with me, Hema Patel (St. Lucy's Priory High School, Glendora) and James Signorovitch (Palos Verdes Peninsula High School, Rolling Hills Estates; now at Cornell University) discovered a new species of *Rimicaris* from the Lucky Strike vents of the Mid-Atlantic Ridge. The new shrimp is named *Rimicaris aurantiaca;* its second name is derived from the Latin word for orange, in reference to its color when alive and also as a tribute to the Orangemen of Syracuse University, where the initial neuroanatomical work on the optical systems was carried out. The new shrimp is a



beautiful example of a link between the *Rimicaris* and *Chorocaris* genera of vent shrimp. It has eyes on its back, like true species of *Rimicaris.* But it also has a feature previously known only in species of *Chorocaris*—a pad of bristles on its claw for keeping its antennae clean.

Assisting our team in its research was the museum's World Wide Web site, the Crustacean Biodiversity Survey (http://www.nhm.org/cbs/), which I wrote and Jim Angus, our Web Site Manager, designed. The site allows investigators from around the world to at any time add information on any of the more than 800 families of living crustaceans, and this in turn helps keep our Crustacea staff up to date about new developments in the field. I estimate that the hydrothermal vents alone will yield more than 100 new species of crustaceans over the next decade, provided that research and exploration can continue as in the past.

JOEL W. MARTIN



Dr. Martin, who is Curator of Crustacea, is now on a year's leave of absence from the museum, serving as Program Officer for Biotic Surveys and Inventories in the National Science Foundation's Division of Environmental Biology. MRAP 1996 was funded by a National Science Foundation grant to Dr. Karen Wise, Assistant Curator of Archaeology in the Research and Collections Branch, and Susan K. Lafferty, Science Education Specialist in the Education Division.

OPPOSITE PAGE: A hydrothermal vent site from near the Galapagos Islands. The communities at such sites are dominated by huge red "tube worms"; also present are clams, mussels, and large crabs, one of which is particularly obvious here near the lower right corner of the photograph. Photograph by Robert R. Hessler, Scripps Institution of Oceanography; used with permission.

ABOVE: One of the unusual vent sites along the Mid-Atlantic Ridge. At these sites, there are no worms or clams; instead, the dominant organisms are shrimp new to science. Photograph by Cindy Lee Van Dover, University of Alaska, Fairbanks, and National Undersea Research Program; used with permission.

LEFT: A new species of vent shrimp, genus *Rimicaris,* that is being described by Dr. Martin and former MRAP students James Signorovitch and Hema Patel. Most individuals are between 1 and 2 inches long. Drawing by Joel W. Martin.

As in some previously described vent shrimps, the new species has no true eyes but instead has "dorsal eyes" (de in the drawing), which might represent an evolutionary migration of the "normal" eye's retina and pigments toward the top of the animal. The purpose of this novel optical arrangement is as yet unknown.