

Through the Porthole 30 Years Ago

BY KRISTEN M. KUSEK

Today's technology-enhanced experience of the colorful, deep-sea vent ecosystems makes it easy for anyone to fall head over flip-flops for this otherwise pitch-dark place. This faraway world has become "up close and personal" and easy to explore in full color from the windows on our desktops.

Now roll back the clock 30 years to 1977, a time when Windows were merely wall features and Macs were trucks. This was the year most often credited as the one when hydrothermal vents were first discovered along the Galápagos Spreading Center. The task of seeing them was much more daunting than the click of a mouse, the sight of them not all that colorful at first. It involved a tag team of two ships that mobilized in the Panama Canal, chock full of fuel, geologists, and geochemists from Oregon State University, Scripps Institution of Oceanography, Stanford University, and Woods Hole Oceanographic Institution—and chutzpah.

The very first images from the 1977 expedition, sorted frame-by-frame from 400-foot-long strips of film, were much fuzzier than those that spoil us in high

definition today, and far from charismatic. They were grainy images of black and white with a few shades in between, but to those whose eyes first blinked before them, they were perfect.

"The water was cloudy and milky and loaded with white clams," said Bob Ballard, describing the landmark images captured by a towed camera system that became the deep submergence vehicle *Alvin's* bread crumbs, leading the way for the first human visit to this world that very next day. From that moment on, Earth's darkest reaches would forever be seen in a more colorful light, the understanding of life on Earth exponentially expanded.

"I remember it not for the year but as the time that I reached the peak of my career," said 83-year-old Tjeerd "Jerry" van Andel, the details of the first ever dive to the vents rolling off his tongue as if it happened yesterday. "It was 11:30 on the 17th of February. I knew so clearly that I couldn't do any better in oceanography than this."

Following are brief excerpts from interviews with four of the "vent pioneers" who were reached for comment:

van Andel, who masterminded the idea with Dick Von Herzen, and had the first *Alvin* dive; Kathy Crane, who made the maps from an exploratory expedition in 1976 and was the navigator for the 1977 expedition; Bob Ballard, who had the tools for the "hunt"; and Fred Grassle, who led the first biology expedition in 1979^{1,2}. Some details of the story changed depending upon who was recalling these early days, but here it is, nevertheless, in black and white and maybe a few shades in between.

KATHY CRANE: THE MAP

"The actual discovery of the vents in my mind occurred in 1976," said Crane, then a 25-year-old marine geology graduate student at Scripps Institution of Oceanography, and part of the team that operated the Scripps Deep Tow system. Deep Tow recorded seawater temperatures, sampled water and plankton, mapped the seafloor by side-looking sonar, and took the first pictures of vents. "In '76 we were in prime exploration mode, searching for evidence of hydrothermal springs on the seafloor, when we sampled the near-bottom water at high-enough tem-

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¹The principal investigators on the 1977 expedition included Jerry van Andel, Bob Ballard, Jack Corliss, Jack Dymond (deceased), John Edmond (deceased), Louis Gordon, Dick Von Herzen, and David Williams (according to the first *National Geographic* article by Corliss and Ballard, 1977, 152 (4):441–453).

²Where they are now: Kathy Crane (National Oceanic and Atmospheric Administration Arctic Research Program), Bob Ballard (University of Rhode Island and Institute for Exploration in Mystic, CT), Jerry van Andel (University of Cambridge, UK), Fred Grassle (Rutgers University, Census of Marine Life program).

peratures to really indicate that this was where the heat was coming from the mid-ocean ridge. It was obvious and beautiful at the same time,” she said.

Crane also said the Deep Tow imaged some of the seafloor biota. Therefore, she knew that an easy way to find the vents was to look for the large white clams, which one senior scientist told her were likely leftovers from a clambake (hence the name of one of the first-seen vent sites: Clam Bake). “You could find the hot water by looking for the white amidst all the black volcanic rock,” she said. Crane was charged with leaving behind the Scripps transponders so that *Alvin* could be navigated back to the vent sites in 1977. She placed one of the transponders near Clam Bake. Crane later went to work with Dick Von Herzen at Woods Hole Oceanographic Institution to plan *Alvin* dives and to develop a photo mosaic of the seafloor surrounding the newly discovered springs. She participated in the 1977 expedition as a navigator, operator of Ballard’s towed camera system, and diver (in *Alvin*) to the seafloor.

BOB BALLARD: THE TOOLS

Ballard was invited to join the expedition because of his technological expertise conducting submersible programs. “Those who mounted the 1977 expedi-

tion had no experience with the technology needed to find the vents. I had the tools for the hunt,” said Ballard, who was based at Woods Hole Oceanographic Institution at the time.

“My biggest anxiety was that I would lose my toys [vehicle systems such as ANGUS, the towed camera system]. It was very dangerous, very rugged terrain. It was a scary, nerve-racking process to tow a camera in a quarry [the rift valley]. We almost lost the vehicle on numerous occasions. And working 24 hours a day was exhausting, but we were finding vents left and right. It was real hand-to-hand combat.”

The expedition was executed from two ships, *Knorr* and *Lulu* (with *Alvin*), and mobilized in the Panama Canal. Ballard, aboard *Knorr*, felt *Lulu* was going too slowly, so *Knorr* ran ahead. “We needed to find some vents,” he said. They arrived on site two days before *Lulu*.

“We began hunting in the valley right away,” Ballard said, “and we found the vents on the first lowering of ANGUS. Nothing’s happening, nothing’s happening, nothing’s happening, and then BAM!, we get a temperature anomaly. It was a mere fraction of a degree, but that’s substantial in a big ocean that sucks up heat like a sponge,” he said. “Obviously, we went right over the vent.”

“*Alvin* wasn’t even there at the time

of the actual discovery. It arrived the next day,” Ballard said. “We had already nailed it before *Alvin* got there. ... We said, ‘Go to this spot,’ so we told *Alvin* where to go.”

JERRY VAN ANDEL: THE FIRST ALVIN DIVE

Van Anel, then of Oregon State University, was responsible for getting the 1977 expedition funded by the US National Science Foundation and the Navy along with Dick Von Herzen. Soon after it was funded, van Anel moved to Stanford University and the principal duties of the Galápagos trip were left to his student, Jack Corliss. (Note: Van Anel said that while he recalls seeing the Deep Tow data mentioned by Crane and hearing the description of the lava flows by the 1976 team, he does not recall any mention of giant clams or vents having already been discovered. Until the *Alvin* dives, he said, “I was unable to convince myself that I saw any real vents. Later we learned the indicators, but they were much different from what we originally thought, and mostly rested on fauna.”)

Van Anel’s landmark dive with Corliss and pilot Jack Donnelly was filled with surprises. “First, we hadn’t really calculated that the temperature would be so high that you would actually see the shimmer in the water,” he said. “The

INTERVIEW EXCERPTS

Kathy Crane

According to your book Sea Legs, the vent discovery was among the best of times and worst of times for you. What was your most memorable moment?

I was most amazed by the incredible beauty of the life and the warm water. I was also more amazed by the tubeworms (and I had never seen these before in a photo). Stunning colors of reds, whites, and pink set in a backdrop of black velvet... I also remember on the '77 expedition they thought what we now know to be the "dandelions" were a mistake from the chemistry of the film processing.

Bob Ballard

How far has vent research come, and is it headed in the right direction?

It started out at zero, so it's come a long way. It's obviously significant science, but it's been almost the obsession of the oceanographic community for the last 30 years. It's almost dominating, to the exclusion of other discoveries that aren't being made. We are so ridge-focused that very little real exploration is being done right now... Vent scientists aren't generalists anymore. They go to a vent and camp out and don't look much at the area around it. But I think the generalists make better explorers. They make the discoveries. When you get too focused, you miss the forest for the trees. We need to return to exploration and see what else we're missing.

Jerry van Andel

What has been a comparable discovery?

The Ocean Drilling Program, which has sent the complete history of the earth upside down. I would think that was far more weighty in terms of learning more about the earth. Taking cores of ocean sediments ultimately helped us prove the global change, which was in many ways bigger than the hot springs discovery. The vents were far more important biologically than geophysically. The biology was the bigger deal.

Fred Grassle

What's the next big earth science discovery?

Microbial life in general: I think there are lots of discoveries to be made there. The discovery of the vents completely changed the general view of the deep sea. Parts of the deep sea were a desert, but we learned that there were these places with extraordinary, rich life. And we keep finding more chemosynthetic communities. We knew it had to be the sulfur bacteria [fueling the ecosystems]. But even that part of the story is not fully worked out because there are all sorts of bacterial primary producers down there. One of the untold stories is the importance of the ones that don't require oxygen.

second major surprise was the animals. I didn't really give a damn about the hot springs themselves at that point. By the time I saw the fish and all, I knew that was the bigger discovery," said the seasoned geophysicist, who considers himself "half a biologist."

"When I got out of *Alvin* after that first dive ... everyone looked at me like I was crazy [when I mentioned the animals]. ... About an hour into the dive, the pilot said to me, 'What are those white things down there?' We went down another meter or so to see... [pause]...and they were clam shells. You know, clam shells are not all that exciting, but at two feet in length, they are! They were in a little heap or dome on the seafloor in a very narrowly defined point, nothing outside the inner circle. I said to myself, 'This is really weird because how could they get there?' And then we found a second clam shell place and cruising a little further found the first hot spring—which wasn't a very impressive one, only about 15 degrees [Celsius]—but that's still warm. And then there was this big round rosy face, maybe two hands across, that came right to my porthole. Never in my life had I seen a more stupid face. And we couldn't get rid of him. We would turn *Alvin* and move again and yet he was always there at my porthole. It was a rattle."

Van Andel said he went through his tapes (recordings from the *Alvin* dive) the following day, listening to his description of the things he saw. "It was all so exciting, but I couldn't find anyone on the ship who was interested in the fauna down there," he said. "Everyone was into the hot springs and the cracks and tak-

ing pictures... I couldn't get too excited about that. But I was lying in my bunk for hours wondering what the animals eat 2500 meters down where they obviously have no food from the surface ...and there was no biologist on board. Everybody thought that I was wasting my time."

That's when van Andel said he discovered that the cook's helper had a bachelor's degree in marine biology from a college in Florida, and he enjoyed talking about the biology with him for the rest of the cruise. "Then, on the next dive, Bob Ballard got his chance. He went down and was lucky enough to see the tubeworms. I only saw those on a later dive. So he came up all excited, and much to my distress, the crew believed *him* and not me!"

Van Andel said the situation changed mid-cruise when word about the biology spread by way of news reports. "There was a science writer from the *San Francisco Examiner* on the cruise who wrote nice reports about our progress. After my dive, he sent a report off to the *Examiner*, who published it two days later. Maybe six hours after it came out, I got a note from Woods Hole Oceanographic Institution signed by three biologists who said: RETURN TO PORT INSTANTLY. ... BIOLOGISTS COMING." (The first biology expedition would take place two years later, in 1979, under the leadership of Fred Grassle, then of Woods Hole Oceanographic Institution.)

"And then the drama of who found what and when first began," van Andel said.

FRED GRASSLE: FIRST BIOLOGIST

"We first heard about the animals in a press release, and we knew there had to be a biology expedition. We knew it had to be right because no one could make that up. We were astonished. It was certainly contrary to our knowledge of the deep sea at the time."

Here's what the biologists were given by the geologists and geochemists from the 1977 expedition: "a vestimentiferan, some clams, and a galatheid crab," he said. It was a three-leg expedition in 1979, Grassle recalled, and they collected just about everything they could. "Everyone was a little anxious, a little anxious about just about everything. Generally these were people who were each used to being chief scientists. We also had a huge amount of trouble with the submarine [*Alvin*]. It got so bad that we had to go in early."

Nevertheless, he said, it was terrific. "We all shared the wonderment and privilege of being there."

Grassle was on the first biology dive, which never made it to the vents. "Finally," he said, "we could see a cobweb appearance of worms, large clams, and so on. We did very well on just about every dive after that... that is, once we found it! In fact, when you add it up, we had something like 50 publications from just the first series of dives. These included descriptions of things no one had ever seen before."

Among the biggest surprises were things they simply didn't know how to identify, like the siphonophores, Grassle

said. There was also no curator on board, so Grassle had to take over that responsibility on the first cruise.

"It was almost like you didn't think about it because the opportunity was so huge. ...Coming back from the vents, the material was huge and easy to describe and there weren't a lot of species. So everyone dropped what they were doing to describe it," he said.

CONCLUSION

While they were seasoned oceanographers on the sea surface, the vent pioneers were squirmy, wide-eyed preemies in *this* place, a brand new world that added tremendous depth to the understanding of how Earth works as a dynamic system. Thirty years have passed since the landmark dive that turned biology on its head. "We didn't know we were going to make this discovery. I mean, my God, that's what made it so amazing," said Ballard. "We thought we'd find a crack in the ocean with water coming out. Big deal: that wouldn't be very photographic. We didn't expect the animals. That's what surprised us. We didn't know this was going to be as gigantic a deal as it was." 