Marine Geologist Hopes to Hear The Heartbeat of the Planet

University of Washington marine geologist John Delaney extols the science—and the poetry—of building a network of observatories on the ocean floor

Many scientists turn to poets for inspiration. But marine geologist John Delaney actually took one along for a voyage to the bottom of the sea.

The 1991 submarine dive that sent Maryland poet laureate Michael Collier 2200 meters down to boiling volcanic vents off the Pacific coast typifies Delaney's expansive vision, say friends and colleagues. "John's a dreamer, an instigator. … He rejects limits," says Margaret Tivey, a geochemist at the Woods Hole Oceanographic Institution in Massachusetts. And the University of Washington, Seattle, researcher knows how to make that vision appeal to others. "The first time I heard John give one of his talks, I felt like I was at a rock concert—I wanted to pull out a lighter and salute him," says Oscar Schofield of Rutgers University in New Brunswick, New Jersey.

Delaney calls himself "rather impractical." Still, he's shown a pragmatic bent, from helping establish a long-running program to study underwater volcanism to leading a herculean expedition that hauled massive "black smoker" chimneys off the sea floor. Now the tall, 62-year-old researcher stands on the verge of realizing one of his wildest dreams: a $200 million plan to wire an entire tectonic plate off the Pacific Northwest with a spider web of sensors, pumping gigabytes of real-time data directly to scientists ashore. Dubbed NEPTUNE—for North-East Pacific Time-series Undersea Networked Experiments—the project is jockeying to become part of a broader National Science Foundation (NSF) plan to build a trio of ocean observatories that would enable scientists to keep a constant watch on the sea. "We're going to listen to the heartbeat of the planet," Delaney says in his sonorous baritone, displaying the poetic turn of phrase that has become a hallmark of his public persona.

But funding for the observatories isn't yet certain, and not all marine scientists are on board. Some fear that the program will siphon funds from other projects; others question the approach itself. Physical oceanographers, for instance, "would probably not go down this road first to solve their problems," says Carl Wunsch of the Massachusetts Institute of Technology in Cambridge.

Buying into geology

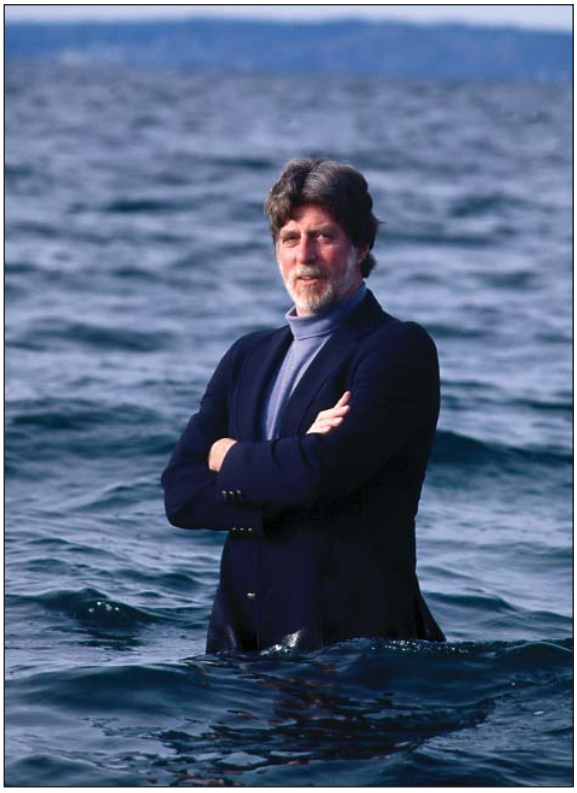
Fittingly for a man captivated by volcanoes, Delaney made his debut in the afterglow of another kind of explosion. The son of a Navy engineer and his wife, he was born beside the U.S. Navy base in Pearl Harbor, Hawaii, on 8 December 1941, the morning after Japanese bombers had reduced much of the U.S. fleet to smoking hulks. Growing up in Charlotte, North Carolina, he developed basketball skills that won him a scholarship to Lehigh University in Bethlehem, Pennsylvania. Graduating with a geology degree, he turned down an offer to assist a hometown college basketball coach named Al Maguire, who went on to win a national championship, and headed to graduate school instead. "Al said I couldn't dribble, but I could think," Delaney says.

He ultimately enrolled in a doctoral program at the University of Arizona in Tucson, working as a prospector for mining firms on the side. But he didn't get "serious about school," he says, until he was nearly trapped in an abandoned mine while sampling. A trip to the Galápagos, which included camping inside a recently active volcano, hooked him on studying volcanism. The journey almost didn't happen: Delaney's adviser "couldn't afford to take me," he recalls. "So I put $2500 on his desk and said, 'I'm going.' "

Using samples donated by another researcher, Delaney ultimately wrote a thesis that examined how the volatile gases in sea-floor basalt—a volcanic rock—behave when bottled up by the sea's crushing pressure. "It was magic," he says. "I was given this garbage bag full of basalt that came from *the sea floor*!"

The work won him a temporary post at Washington, where he was assigned to teach oceanography—a course he'd never taken. Although the head of his hiring panel soon suggested that Delaney start looking for another job, it wasn't long before students began to praise their 36-year-old lecturer. Within a few years Delaney had won a top teaching prize and secured a permanent position.

But Delaney still hadn't found his niche as a scientist. That occurred during a 1980 dive in the submersible *Alvin*. "It changed my life. I realized I wasn't a laboratory researcher." His work increasingly revolved around understanding the dynamics of the nearby Juan de Fuca Plate, a relatively small and accessible chunk of the Pacific crust rife with earthquakes, volcanoes, and thriving chemosynthetic communities of tubeworms and bacterial snow.



CREDIT: MARY LEVIN

Hearing Neptune's call. John Delaney has become a forceful voice for ocean observatories, including his own proposed NEPTUNE network off the Pacific coast.

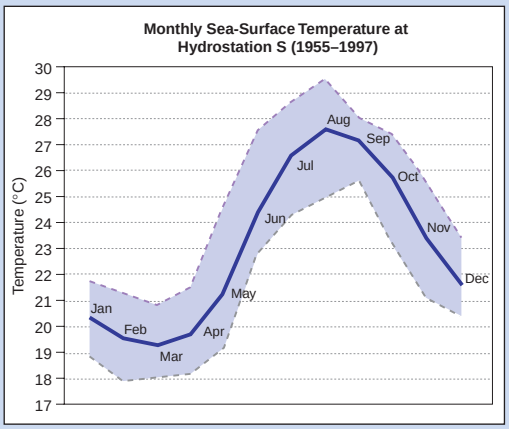
Delaney was also honing his administrative skills. He helped organize the NSF-funded RIDGE program, a multidisciplinary assault on the midocean ridges where crustal plates creep apart. Within RIDGE, Delaney and others sparked controversy by proposing to divert already-planned cruises to undersea eruptions along the Juan de Fuca immediately after they had been pinpointed by newly available sensors. The rerouting paid off, however, giving researchers an unprecedented firsthand look at the almost apocalyptic events that shape the sea floor.

Still, many researchers were frustrated by the limitations of traditional ship-based studies. In the early 1990s, Delaney, Alan Chave, a Woods Hole geophysicist, and others began to explore what it would take to install instruments that could keep a constant watch on the plate—and stream data back to

A Cautionary Tale From Bermuda

Fifty years ago, legendary oceanographer Henry Stommel of the Woods Hole Oceanographic Institution in Massachusetts set out to establish his own ocean observatory. Its fate offers both hope and caution to advocates of today's crop of underwater facilities, such as NEPTUNE (see main text).

Like today's architects, Stommel designed a multipart observatory to collect a steady, long-term stream of data on ocean conditions, recalls physical oceanographer Carl Wunsch of the Massachusetts Institute of Technology in Cambridge, a former student of Stommel's. One element is now known as "Hydrostation S": a spot 20 kilometers southeast of Bermuda, at a depth of 3000 meters, where scientists regularly measured temperature, salinity, and dissolved oxygen from the sea's surface to its floor. Another was a set of drifting buoys, fitted with radio transmitters, for tracking water movements. There was also a power cable connected to several instruments located thousands of meters off Bermuda. Then, as now, the cable was seen as a promising way to provide power and accurate timing and to move data ashore.



Historical record. Sea-surface temperature and other basic ocean characteristics have been tracked for a half-century off Bermuda.

But Stommel's dream turned into a nightmare, Wunsch says. The weather didn't cooperate, electrical connectors sprung leaks, instruments failed, and good help and steady funding proved hard to find. "Funders didn't want to commit to open-ended data collection," he says. Within a few years, most of the station was abandoned—with one significant exception. Today, Hydrostation S is the source of one of the world's few long-term records of a changing ocean.

Skeptics predict that the next generation of observatories will face similar crippling problems. But supporters take heart from the continuing stream of data from Hydrostation S. It is a model, they say, that new observatories can first replicate and then expand. **–D.M.**

land through a cable that could also provide the instruments with a steady source of desperately needed power.

A passion for networks

It wasn't a new idea. Marine scientists had been experimenting with cabled instruments for decades (see sidebar), and Japan had already instrumented several offshore sites. But Delaney's allies envisioned more: a sensor net that could dispatch robotic observers to fast-moving episodes—from eruptions to plankton blooms—that researchers often miss, and a communications grid that would offer anyone with a computer an instant window onto the sea. Thus was born NEPTUNE, which aims to link dozens of nodes bristling with physical, chemical, and biological sensors with more than 3000 kilometers of fiber-optic cable.

The idea initially made little headway, but Delaney was "incredibly persistent," says Kendra Daly, a biological oceanographer at the University of South Florida in St. Petersburg. "He kept going, cajoling, long after most people would have given up and gone away." Adds Wunsch: "John may not be the world's greatest marine geologist, but he's got this spark and passion that we as a community sometimes lack."

The commitment has paid off. Four years ago, NSF formally endorsed the "regional observatory" concept, bundling it into a $245 million initiative that also includes coastal sensors and open-ocean buoys. About half the funds would go to the regional system, with NEPTUNE a leading candidate. The next step is up to Congress, which next year will be asked to open the spending spigot.

Delaney's allies, however, didn't wait for Congress. Last October, the Canadian government gave the University of Victoria nearly $50 million for a northern leg of NEPTUNE, starting with a project off Vancouver Island dubbed VENUS. And Delaney's team has raised about $25 million for related work in the United States, including a second pilot project—MARS—set for California's Monterey Bay.

MARS and VENUS will tackle what Delaney admits are a host of daunting technical issues, from building workable sensors to waterproof sockets—often an Achilles' heel for cabled instruments. Even if the pilots pan out, however, NEPTUNE still must overcome a flat NSF budget and concerns that it could overtax a thin research fleet. Another fear is that the observatories will become oceanography's version of the space station: a huge infrastructure that supports relatively little science.

Delaney welcomes the debate, saying that NEPTUNE and its sister observatories "will only benefit from more discussion, more ideas." But he fiercely challenges the notion that the projects will monopolize resources. "I want to find exciting, important ways to argue for decades of new funds, not get by on what we've got," he says.

Delaney drives home that message in the dozens of talks he gives each year before everyone from congressional aides to schoolteachers. The word is also getting out through the media: His work has been featured in books and documentaries, including a PBS *NOVA* show on a dramatic 1998 mission he led to recover several "black smokers"—chimneys that belch superhot water—from the Juan de Fuca Ridge. The mission recovered bacteria that thrive in the chimney's record-high temperatures, and several of the formations are now on display at the American Museum of Natural History in New York City. But Delaney doesn't want to become a similar kind of display: fascinating to outsiders but no longer useful to fellow scientists. "I'd like to reach a broader audience," he says, but not at the cost of his credibility.

Delaney's desire to communicate may also explain the poetry that leavens his technical talks and the shipboard "poetry nights" that have become a tradition on his cruises. His selections, often delivered from memory, range from the earthy rhythms of Robert Frost and Robert Service to the ethereal images of the Japanese haiku master Basho. And he is fond of T. S. Eliot's observation that "we shall not cease from exploration."

Indeed, Delaney says that if he were starting his career today, he'd probably want to work in planetary exploration. He's participated in NASA workshops on a probe to Europa, the jovian moon that some believe holds an ocean under its frozen surface. Submerged fires on Europa, he believes, could be fueling life beneath the ice—just as they did on Earth. "When it comes to life, it takes an ocean," he jokes, borrowing from a slogan popularized by Hillary Clinton.

Collier, the University of Maryland, College Park, poet and longtime friend who went down in *Alvin* more than a decade ago, believes poetry "is another way for John to articulate his wonder and his enthusiasm for science." Delaney is "incredibly inclusive," he says. "He wants to share." **–DAVID MALAKOFF**

SOURCE: BBSR