



Illustrated by Eldar Zakirov

At the Fall

Alec Nevala-Lee

And should I not have concern for the great city of Nineveh, in which there are more than a hundred and twenty thousand people who cannot tell their right hand from their left, and also many animals?

—The Book of Jonah

* * *

I.

“This is it,” Eunice said, looking out into the dark water. At this depth, there was nothing to see, but as she cut her forward motion, she kept her eyes fixed on the blackness ahead. Her sonar was picking up something large directly in her line of travel, but she still had to perform a visual inspection, which was always the most dangerous moment of any approach. When you were a thousand meters down, light had a way of drawing unwanted attention. “I’m taking a look.”

Wagner said nothing. He was never especially talkative, and as usual, he was keeping his thoughts to himself. Eunice corrected her orientation in response to the data flooding into her sensors and tried to stay focused. She had survived this process more times than she cared to remember, but this part never got any easier, and as she switched on her forward lamp, casting a slender line of light across the scene, she braced herself for whatever she might find.

She swept the beam from left to right, ready to extinguish it at any sign of movement. At first, the light caught nothing but stray particles floating in the water like motes of dust in a sunbeam, but a second later, as she continued the inspection, a pale shape came into view. She nearly recoiled, but steadied herself in time, and found that she was facing a huge sculptural mass, white and bare, that was buried partway in the sand like the prow of a sunken ship.

Eunice lowered the circle of brightness to the seabed, where a border of milky scum alternated with patches of black sediment. Her nerves relaxed incrementally, but she remained wary. She had seen right away that the fall was old, but this meant nothing. Something might still be here, and she kept herself in a state of high alert, prepared to fall back at any second.

Past the first sepulchral mound, a series of smaller forms stood like a row of gravestones, their knobby projections extending upward in a regular line. To either side lay a symmetrical arrangement of curving shafts that had settled in parallel grooves. All of it was crusted with a fine down of the same white residue that covered the seafloor wherever she turned.

It was the skeleton of a gray whale. From its paired lower jawbones to the end of its tail, it was thirteen meters long, or ten times Eunice's diameter when her arms were fully extended. She increased her luminosity until a soft glow suffused the water, casting the first real shadows that this part of the ocean had ever seen. Her propulsion unit engaged, cycling the drive plate at the base of her body, and she swam toward the whale fall, her six radial arms undulating in unison.

Wagner, who was fastened around her midsection, finally roused himself. "Now?"

"Not yet." Eunice advanced slowly, the ring of lights around her upper dome flaring into life. She had not been designed to move fast or far, and she knew better than to lower her guard. There were countless places where something might be hiding, and she forced herself to go all the way around, even though her energy levels were growing alarmingly low.

Every whale fall was different, and Eunice studied the site as if she had never seen one before. Decades ago, a gray whale had died and fallen into the bathyal zone, delivering more carbon at once than would otherwise be generated in two thousand years. The cold and pressure had kept it from floating back to the surface, and a new community of organisms had colonized the carcass, forming a unique ecosystem that could flourish far from the Sun.

Eunice checked off the familiar inhabitants. Mussels were wedged into the empty eye sockets of the curiously birdlike skull, which was a third of the length of the body. Tiny crabs and snails clung unmoving to the bones. Everywhere she looked were mats of the bacteria that broke down the lipids in the whale's skeleton, releasing hydrogen sulfide and allowing this isolated world to survive. Otherwise, they were alone. "All right. You can get started."

Wagner silently detached himself. He was a black, flexible ring—a toroid—that fit snugly around her middle like a life preserver. When necessary, he could unfold a pair of tiny fins, but they were less than useful at this depth, so he kept them tucked discreetly out of sight. As he descended to the seabed, Eunice automatically adjusted her buoyancy to account for the decrease in weight.

The toroid landed half a meter from the whale's remains. Anchoring himself loosely, he gathered his bearings. Wagner was blind, but exquisitely attuned to his environment in other ways, and as Eunice headed for the heart of the whale fall, he began to creep across the sand. His progress was so slow that it could barely be seen, but the path that he traced was methodical and precise, covering every inch of the terrain over the course of twenty hours before starting all over again.

A circle of blue diodes along the toroid's outer ring matched an identical band on the lower edge of Eunice's dome, allowing them to communicate along a line of sight. He flashed a rapid signal. "All good."

"I'll be waiting," Eunice said. She headed for her usual resting spot at the center of the fall, where the whale's ribcage had fallen apart. Maneuvering into a comfortable position, she nestled into place among the other residents. A whale fall might last for a century without visible change, but it was a work in progress, with successive waves of organisms appearing and disappearing as it left one phase and entered another. Eunice saw herself as just another visitor, and she sometimes wondered if any memory of her passage would endure after she was gone.

To an outside observer, Eunice would have resembled the translucent bell of a jellyfish, mounted on a metal cylinder and ringed with the six flexible arms of a cephalopod. Her upper hemisphere was slightly less than half a meter in diameter, with six nodes set at intervals along its lower edge, each of which consisted of an electronic eye, a light, and a blue diode. She could switch them on or off at will, but she usually kept them all activated, allowing her to see in every direction. It affected the way in which she thought, as a spectrum of possibilities instead of simple alternatives, and it sometimes made it hard for her to arrive at any one decision.

Eunice pushed her arms gingerly downward. Her ribbed limbs could relax completely, when she was moving with her peristaltic drive, or grow rigid in an instant. Each had an effector with three opposable fingers capable of performing delicate manipulations or clamping down with hundreds of pounds of force. Now she worked them into the sediment, allowing her to remain fixed in place without using up additional energy, but not so deep that she would be unable to free herself at once.

She knew without checking that she was nearing the end of her power. As Wagner continued his progress, slowly charging his own cells, she shut down her primary systems. It would be days before they could move on, and in the meantime, she had to enter something like stasis, maintaining only a small spark of awareness. Half of it was directed outward, tuned to her environment and to any opinions that Wagner might unexpectedly decide to share, and the rest was turned in on itself, systematically reviewing the latest stage of her journey.

Although her focus was on the recent past, she could naturally follow more than one train of thought at once, and part of her usually dreamed of home. It always began with her earliest memory, which took the form of a vertical tether, swaying gently in shallow water. One end was anchored, while the other floated on a buoy, and a cylinder endlessly ascended and descended it like a toy elevator.

Two meters below the surface hung a metal sphere with three projecting rods. In her youth, whenever she became tired, Eunice could swim up to this power unit and draw as much energy from it as she needed. Back then, she had taken it for granted, but in these days of weary scavenging, it seemed incredible. Three hexapods could recharge there at any one time, and her other sisters usually floated a short distance away, like fish drawn to crusts of bread in a pond.

Eunice had once asked how it worked. She had been talking to James at the harbor, as she often did, her dome barely visible above the water. James had been seated with his console on the yacht, dressed in the red windbreaker that he wore so that the twelve hexapods could know who he was. Her sense of facial recognition was limited, and the face above his collar was nothing to her but a brown blur.

James typed his response. It was not her native language, and it had to pass through several stages of translation before taking a form that she could understand. "We call it depth cycling—the water gets cooler the deeper you go. The cylinder rises to the warm water and sinks to the cold. When it moves, it generates electricity, and the power goes to the charging station."

Eunice didn't entirely understand this explanation, but she accepted it. She had spent most of her short life alternately rising and falling, and it was enough to know that the cylinder on the tether did the same. "I see."

It was a seemingly inconsequential exchange, but when she looked back, she saw that it had marked the moment at which James had taken an interest in her. Eunice had been the only hexapod to ask such questions, and she suspected that this was why she had been one of the five who had been chosen to leave home. Until the end, no one knew who would be going. They were all powered down, and when she awoke, she found that they had already arrived at the survey site.

As soon as she was lowered into the ocean, she felt the difference. Sampling the water, she was overwhelmed by unfamiliar scents and tastes, and she realized only belatedly that James was speaking to her. "Are you ready?"

Eunice turned her attention toward the research vessel, where she immediately picked out the red windbreaker. "I think so."

"You'll do fine," James said. His words rang clearly in her head. "Good luck."

"Thank you," Eunice said politely. Her sisters were bobbing on the swell around her. A flicker of light passed between them, and then Thetis descended, followed by Clio and Dione. Galatea looked at Eunice for a moment longer, but instead of speaking, she disappeared as well.

Eunice opened her lower tank, allowing water to flow inside, and drifted down with the others. As the ocean surrounded her, her radio went dead, and she switched to her acoustic sensors, which registered an occasional chirp from the yacht overhead. At this depth, the water was still bright, and she could see the other four hexapods spreading out below her in a ring.

At two hundred meters, they switched on their lamps, which lit up like a wreath of holiday lights. It took forty minutes to reach their destination. As the water around her grew milky, her sensors indicated that the level of sulfides had increased. A second later, a strange landscape condensed out of the shadows, and Thetis, who had been the first to arrive, blinked a message. "I'm here."

Eunice slowed. Her surroundings became more distinct, and she saw that they had reached the hydrothermal vent. Within her sphere of light, the water was cloudy and very blue, and she could make out the looming pillars and misshapen rings formed by lava flows. Heaps of white clams, some nearly a foot long, lay wedged in the crevices, along with crabs, mussels, shrimp, and the hedges of tube worms, which were rooted like sticks of chalk with tips as red as blood.

At the vent itself, where heated water issued up from the crust, a central fissure was flanked by older terrain to either side. The hexapods promptly identified a promising base of operations, but it was left to Thetis, their designated leader, to confirm the decision. "We'll start here."

As soon as she had spoken, Eunice felt Wagner, who had been clinging unnoticed to her midsection, silently free himself. The other toroids detached from the four remaining hexapods, distributing themselves evenly around the vent, and began to crawl imperceptibly across the sand.

Eunice spent the next two days exploring. Each sister had a designated assignment—mapping the terrain, conducting sediment analysis, performing chemical observations—and her own brief was to prepare a detailed census of the ecosystem. Everything was recorded for analysis on the surface, and she quickly became entranced by her work. Around the cones of the black smokers, which released clouds of boiling fluid, pink worms crept in and out of their honeycombs, and the broken fragments of spires sparkled on the inside with crystals.

In the meantime, the toroids continued their labors, and after fifty hours, their efforts were rewarded. Under ordinary conditions, each of the five hexapods could work at full capacity under her own power for approximately three days before returning to a charging station. Every such trip represented a loss of valuable time, and after taking into consideration the conditions under which they would be operating, their designers had arrived at an elegant alternative.

The solution was based on the nature of the vent itself, where the dissolved sulfides issuing from the crust provided a source of energy that could thrive in the dark, as bacteria converted hydrogen sulfide into the sugars and amino acids that formed the basis of a complex food web. It was the only way that life could exist under such harsh conditions, and it was also what would allow the hexapods to carry out their duties over the weeks and months to come.

When Eunice felt her power fading, she went to Wagner. The toroids were no more than a few meters from where she had left them, although she knew that they had been systematically farming the sediment the entire time. As they inched along, they sucked up free sulfides, which served as a substrate for the microbial fuel cells—filled with genetically modified versions of the same chemosynthetic bacteria found here in abundance—that were stacked in rings inside their bodies.

Eunice positioned herself above the toroids and signaled to Wagner, who slipped up and

around her middle. As the rest of the hexapods did the same, she felt a surge of energy. It was a practical method of recharging in the field, but she soon found that it also left her with a greater sense of kinship to the life that she was studying, which relied on the same principles to survive.

The cycle of renewal gave shape to their days, which otherwise were spent in work. Once a week, a hexapod would go up to transmit the data that they had collected. There was no other practical way to communicate, and these visits amounted to their only link with home.

On the third week, it was Eunice's turn. After ascending alone for nearly an hour, following an acoustic signal, she surfaced. The yacht was holding station exactly where it was supposed to be, and as she swam toward it, she heard a familiar voice in her head. "How are you doing?"

A scoop net lifted her onto the desk. As Eunice rose in a gentle curve, feeling slightly disoriented from the unaccustomed movement, she tried to seem nonchalant. Her lights flashed. "Happy to be here."

The net was handled by a deckhand whose clothes she didn't recognize. He deposited her into a tank on the boat, and once she had righted herself, she saw James seated nearby. She could tell without counting that there were fewer people in sight than there had been on her arrival—the human crew spent the week onshore, returning to the rendezvous point only to pick up the latest set of observations. Aside from James, none of them ever spoke to her.

As Eunice wirelessly shared the data, she kept one line of thought fixed on her friend. "Are you pleased with our work?"

After receiving the question on his console, James entered a reply. "Very pleased."

Eunice was happy to hear this. Her thoughts had rarely been far from home—she wouldn't see the charging station or the seven sisters she had left behind until after the survey was complete—but she also wanted to do well. James had entrusted her with a crucial role, and it had only been toward the end of her training that she had grasped its true importance.

A month earlier, after a test run in the harbor, Eunice had asked James why they were studying the vent at all. His response, which she had pieced together over the course of several exchanges, had done little to clarify the situation. "There are metals in the sulfide deposit. They precipitate there over time. Some people think that they're worth money. Even if they aren't, we'll have to go after them eventually. We've used up almost everything on land. Now we have to turn to the water."

Eunice had tried to process this, although fully half of it was meaningless. "And me?"

James had typed back. "If we want to minimize our impact on the life at the vent, we need to know what we're trying to save. You're going to tell us what lives there. Not everyone cares about this, but there are regulations that they need to follow. And I'll take the funding where I can get it."

Eunice had understood this last part fairly well. Funding, she knew, was another form of energy, and without it, you would die. But this had left another question unanswered. "So what do you really want me to do?"

James had responded without hesitation. "You're going where I can't. These vents are special. They may even have been where life began—they're chemically rich, thermally active, and protected from events on the surface. The ocean is a buffer. A refuge. This is our best chance to study what might be there. And—"

He had paused. "And it could end at any moment. There are people here who want to start mining right away. If they can convince the others to take their side, they might do it. Your work may keep us from destroying what we don't understand. That's what I want from you."

Other questions had naturally arisen in her mind, but James had seemed distracted, so she had held off. Seeing him again now at the survey site reminded her of the exchange, and she resumed her work with a renewed sense of purpose. She had always been aware of the beauty of the vent, but now she grew more conscious of its fragility. Perhaps, she thought, she might even play a role in saving it.

And then everything changed. One day, Dione came down from a scheduled data delivery, long before they had expected her to return, to share some disturbing news. "There was no

yacht.”

The others all stopped what they were doing. Thetis’s lights flashed. “You’re sure?”

“I followed protocol,” Dione said. “There were no signals on the way up and nothing on the radio.”

After an intensive discussion, which lasted for nearly ten seconds, they decided that there was no cause for concern, since they had been trained against the possibility that the yacht might occasionally be delayed. Their orders were to continue working as if nothing had changed, and if they received no signals in the meantime, to check in again at the appointed hour.

A week later, Clio went up to find that there was still no one there. Seven days later, the lot fell on Eunice. On reaching the surface, she saw nothing but the empty ocean, and when she switched on her radio, she found that all frequencies were silent. Her range was very short, but it confirmed that there was nothing transmitting within several kilometers of their position.

Eunice sank down again. On her return trip, she found herself brooding over what James had said. He had seemed concerned that they wouldn’t be able to continue the project for long, and although it seemed unthinkable that the five of them would simply be abandoned here, the idea weighed enough on her mind that she felt obliged to speak to one of her sisters.

She chose Galatea, with whom she was the closest, but when they withdrew to a distant part of the vent field, her sister seemed unconvinced. “I don’t know what else we can do. We can’t leave. You’ve seen the map.”

Eunice knew what she meant. They depended on a steady supply of hydrogen sulfide. Without it, they would lose power within three days, and if they left this energy source, there was no guarantee that they would find another. The known vents were an average of a hundred kilometers apart, and they could travel no more than thirty without recharging. “We have to do something.”

“But we are. We’re following our instructions. That’s enough for now.” Galatea had turned and swum away. Eunice had remained where she was for another minute, trying to convince herself that her sister was right, and she had finally returned to work. She had continued her observations, ignoring her growing uneasiness, and she might have stayed there forever until—

A transmission from Wagner broke through this cycle of memories. “Ready?”

Eunice stirred. It took her a second to remember where she was. Checking herself, she found that she was anchored at the center of a whale fall, far from that first vent, her life with her sisters a fading dream. She had been in stasis for eighty hours, all of which her toroid had spent recharging itself.

Wagner was waiting for her response. It was a formality, but there was also one point that she hadn’t shared with her companion. This whale fall lay at the exact midpoint of her journey. It was still possible to backtrack, retracing her steps to the original vent, carried by the current instead of fighting it. Until now, she had closed her mind to this possibility, focusing instead on the way forward, and she knew that if they went on from here, there would be no turning back.

But she had really made her choice long ago. She roused herself. “We’ll leave now.”

Eunice pulled out of the sand and positioned herself above Wagner, who slid securely into place. She felt energy flow into her, as she had hundreds of times before, and tried to draw courage from it. Then she rose, leaving the latest whale fall behind. It was just another stepping stone. Since leaving her sisters at the East Pacific Rise, off the coast of Mexico, she had traveled alone for two thousand kilometers, and she was halfway home to Seattle.

* * *

II.

Eunice moved through the darkness with her lights off, her sensors searching for sulfides in the water. Even after countless such excursions, it was never less than frightening. The hardest part was leaving the oasis of a whale fall, where she knew that she could at least rest in safety. She had been trained to protect her own existence, not to take risks, and whenever she embarked on the next step forward, she had to overcome all of her natural instincts for caution.

As she swam, she constantly updated her position relative to the last whale fall, which was currently ten kilometers behind her. She was experienced and careful, but within the overall

route that she was following, the distribution of the falls was perfectly random. Eunice had only one chance to get it right, and she had learned long ago that intelligence was far less important than persistence and luck.

She checked her coordinates against the chart in her head. Compared to the organisms that drifted naturally from one fall to another, she had several advantages. She possessed a map with the locations of all documented hydrothermal vents, and she could navigate by dead reckoning, which was the only system that worked reliably in the bathyal zone. It was vulnerable to integration drift—its accuracy tended to degrade as errors accumulated over time—and she had to recalibrate whenever she reached a landmark, but so far, it had served her well.

According to her map, the next vent lay fifty kilometers to the north, but she wouldn't know for sure until she arrived. A vent could vanish after a few years or decades, and she had occasionally reached her intended destination only to find nothing there. Even if the information was accurate, there was no way to get to the nearest vent without pausing several times to recharge. Given her effective range of thirty kilometers, she could safely travel half that distance before reversing course, which meant that she had to find a whale fall somewhere within that fixed circle.

But the existence of the next fall—and all the ones after that—was solely a matter of probability, which meant that she had to be perfect every time. By now, she had refined her approach. Whenever she found a new whale fall, after recharging, she would ascend to the surface to check for radio transmissions. After savoring the light for a moment, she would descend again, embarking in the general direction of the next confirmed vent to the north. She would cover close to fifteen kilometers, which was the limit of her range in any one direction, and then shift laterally by one kilometer to return by a slightly different course.

Like Wagner, she had to methodically cover a defined area, but on a far greater scale. Her sensors could pick up sulfides from a distance of five hundred meters, which coincided with the working range of her sonar. The calculation was simple. There were approximately twenty possible paths that she could take while remaining within her intended line of travel, and she had to shuttle along them systematically until she found the next whale fall in the series.

To get home, she had to do this successfully over three hundred times. The resulting path, which she recorded in her head, resembled a series of scallop shells, each one joined at a single point to those before and after. So far, she had always found a fall eventually, although there had been occasions when she had been forced to backtrack—all twenty of the possible paths had led nowhere, so she retreated another step, to the whale fall before the last, to trace an entirely new route. It was tedious, but she had considerable reserves of patience.

At the moment, she was thirteen kilometers into her fifth excursion from her most recent whale fall, which meant that she would have to turn back soon. No matter how often she went on these sorties, departing from a known refuge was always a test of nerve. Because her lights could draw predators, she kept them off, trusting her sensors and navigation system. She might have increased her range by traveling at a zone of lower pressure, but she had to stay within a few hundred meters of the seabed to pick up whatever might be there, so she moved in the darkness.

For a system that was so unforgiving of error, it was also grindingly monotonous, and she was left for hours at a time with her thoughts. Eunice spent part of every journey reviewing her data for patterns in the distribution of the falls, but this consumed just a fraction of her processing power. She had been designed to observe and analyze, and in isolation, her mind naturally turned on itself. It was the most convenient subject at hand, and even her makers, who had only a general idea of her inner life, might not have understood where it would lead.

As Eunice neared the end of her range, her memories returned to the day that she had decided to head off on her own. For months after they had lost contact with the research vessel, the five hexapods had continued their weekly trips to the surface, but there had been no sign of the yacht. At one point, after some discussion, Eunice had volunteered to go up and switch on her emergency beacon, which transmitted a powerful signal for several days on a single charge.

The time alone had given her a chance to think. James had warned her that the project might

end at any moment, and if that were the case, then it might only be a matter of time before the next phase of operations began. She knew nothing of how mining at the deposit would proceed, but she had no doubt that it would be destructive. Even if it spared the vent itself, there would be other dangers. And she found that she had no intention of waiting around to find out either way.

After her beacon had faded without drawing any response, Eunice had remained there for another hour before beginning her descent. When she returned, she saw that the others seemed untroubled, although this might have been an illusion in itself. With their sixfold minds, it was hard for the hexapods to settle on a course of action, and the continuum of possible alternatives often seemed to average out to complacency. In reality, this equilibrium was highly unstable, and when a disruption occurred, it could happen with startling speed.

One day, Eunice returned from surveying an area of the vent that she had studied before to find only three sisters at the recharging area. She blinked her lights at the others. "Where's Thetis?"

Galatea flashed back a response. "Gone. She went to the surface an hour ago."

As Eunice listened in disbelief, the hexapods told her that Thetis had risen into the photic zone, switched on her emergency beacon, and powered down, allowing herself to drift with the current. Dione tried to explain their sister's reasoning. "Our work here is done. We're repeating ourselves. This is the best way to get the data back. Sooner or later, she'll be found."

Eunice was lost for words. The odds of anything so small being recovered by chance in the ocean were close to nonexistent, and the oceanic current here would carry them south, away from home. She attempted to convey this to the others, but they didn't seem to understand, and the next day she returned from her survey to find that Clio was gone as well.

The departure of a second sister catalyzed something that had been building inside her for a long time. Eunice called for Dione and Galatea, and as they clung to the seabed, she presented her case. "Thetis was right. Our work is over. But if we don't deliver it, this vent could be wiped out when the mining begins."

Eunice saw that this argument wasn't landing, and she tried to frame it in terms that her sisters would understand, which fell naturally into groups of three. "We can stay here at the vent and wait for the yacht to return. We can give ourselves up to the current and hope that we'll wash up where somebody will find us. Or we can leave and go home on our own."

Dione looked confused. "That's impossible. We'd have to follow the vents north, and we've calculated all the paths. There's no way to make it. We'll run out of power before we can recharge."

"I know," Eunice said. "But there's another way. We can follow the whale falls."

The others seemed perplexed, so she started from the beginning. "I was built to study ecosystems like this. When a whale dies close to shore, it decomposes naturally, but in the open ocean, it sinks to the bathyal zone. If it's cold and deep enough, it stays there for long enough to form the basis of a specialized community. And one of its byproducts is hydrogen sulfide."

She flashed this information to the others in a fraction of a second. "A whale fall goes through three stages. First, the soft tissues are eaten by scavengers. This lasts for about two years. Then enrichment opportunists, like worms, colonize the bones. Call it another two years. Finally, bacteria take over. They're sulfophilic, so they break down what's left of the skeleton and release hydrogen sulfide. It can last a century or more. And there are a lot of whale falls like this."

As she spoke, Eunice displayed a map in their shared mindspace, showing the known vents along the coast of North America. "There are just five hundred confirmed vents in the entire ocean, which isn't enough for us to get home. But there are hundreds of thousands of whale falls active at any given time, and the gaps must be small enough to allow animals to move from one to another. Otherwise, they never could have evolved to take advantage of these conditions. The average distance might be as little as twelve kilometers. And it's even shorter here."

Eunice added another pattern to the map, extending it from the Arctic Sea down to the Gulf of Mexico. "This is the annual migration route of gray whales. They travel twenty thousand kilometers between their calving waters to the south and their feeding grounds in the north. Five

hundred of them die and sink along the way each year. The route coincides with the ocean ridge that we're on now. If I'm right, we can move from one whale fall to the next—like links in a chain—until we make it home. All we have to do is find the way.”

It took her just ten seconds to transmit this data, and the ensuing silence seemed very long. In the end, Dione simply went back to work, and Galatea lingered for only a moment longer.

The next day, Dione left for the surface. Eunice saw that she had failed, and when she went to find her last remaining sister, she felt the full weight of their history together as Galatea spoke. “I’m staying. The vent is always changing in small ways. I can map it over time. Maybe the data will be needed one day. And I can’t just leave without further instructions.”

Eunice absorbed this. “I understand. Give me everything that you know.”

They floated near each other, diodes blinking, until the data that Galatea carried had passed to Eunice. When they were done, they remained together for another minute, and then her sister drifted out of view behind the ridge.

Eunice swam to the recharging area, where Wagner was crawling along the sediment with Galatea’s toroid. “Are you fully charged?”

Wagner’s ring of blue diodes flashed back at her impassively. “Ninety percent.”

Eunice knew that she should wait until he had received the maximum charge possible, but she was afraid that if she hesitated now, she might never leave at all. “Let’s go. We’re not coming back.”

Wagner rose up without protest and attached himself to her. She had wondered if he would have any opinions on the matter, but it seemed that he would follow her anywhere. As soon as they were ready, they set out across the vent field. There was no final message from Galatea, who was nowhere in sight.

She followed the fissure for as long as she could. Beneath her, the clams and tubeworms became sparse, and after another kilometer, the sulfides in the water fell to their baseline level. They had reached the edge of the vent system. For a second, she hesitated, thinking of the cargo of information that she contained. If she brought it back in time, it might allow the vent to survive, and this thought filled her with just enough resolve to set off at last.

Eunice moved past the boundary of the vent field, switching off her lights to conserve power. As she entered the unknown space on the map, she told herself that she was only retracing the path of organisms that had made this journey for millions of years. She had spent months studying the web of life that sulfides made, and she was more prepared than any other traveler to follow this road on her own.

This didn’t mean that she always succeeded, and on her first attempt, she reached the end of her range without finding anything. Turning around was difficult, and as she went back to the vent by a different course, she knew that leaving again would be even harder. As the sulfide levels in the water rose, Eunice switched on her lights. There was no sign of Galatea, and she was afraid that if she ran into her sister, she wouldn’t be able to say goodbye a second time.

Eunice settled on a new recharging area, at the edge of the vent field, and stayed for just long enough for Wagner to power up. As she left on her next excursion, she realized that she was afraid. The case that she had presented to the others had been as persuasive as she could make it, but it rested on a long series of untested assumptions, and it could easily fail in practice.

She found a whale fall on her third try. Looking back later, she saw that it had been a matter of pure luck—she would rarely stumble across one so quickly again—and that she might have given up without it. As it turned out, the sight of the skeleton gave her the will to continue, even if it was only the first stop of hundreds. She had traveled less than ten kilometers, and she had four thousand to go.

The routine was monotonous, but Eunice had reserves of willpower that even her designers might have failed to grasp. James had explained this to her once, watching from the yacht as she conducted a test run in Puget Sound. “In the old days, scientists had to use special vehicles to explore the deep ocean. They weren’t as smart as you, so they were controlled remotely with a cable.”

When Eunice tried to picture a cord linking her to the surface at all times, the image seemed

so absurd that she thought that she must have misunderstood it. “What did they do after that?”

“They tried everything they could. Radio can’t make it through the water, and if you use acoustic communication, there are problems with interference and lag time. The vehicles had to be autonomous, so that they could perform their tasks by themselves. Eventually, they learned to think on their own.”

Eunice had ventured a question that she had long wanted to ask. “Are there many others like me?”

“A lot on land. Not many in the water. You and your sisters are the only twelve who are built like this. And you’re pretty special yourself. You surprise me, and you ask questions, which isn’t true of the others.”

She had liked how this sounded, and she often thought back to it during her loneliest moments in the dark. Sometimes she wondered what James would say when she returned. She was no longer the same as before, and she didn’t know how he or the seven sisters at home would react when they saw her again. Perhaps they would even think that she had disobeyed orders—

Eunice was yanked abruptly back to the present. Her sensors had picked up the presence of sulfides. She was close to the end of her range, and if it had been just a few hundred meters farther, she might have missed it. Correcting her course, she moved along the gradient in which the concentration was strongest, and her sonar began to register something large. “We’re almost there.”

Wagner didn’t respond. Eunice focused on the ghostly picture that the sonar provided. They were within a few meters of a whale fall, and according to her velocity sensors, it was especially active.

Eunice cast a cautious ray of light across the scene. This fall was in its second stage, which implied that it was less than two years old. Most of the whale’s soft parts had been devoured, with fleshy clusters of worms and curtains of bacteria hanging from the bones like cobwebs, and hagfish were everywhere. They were up to half a meter in length, with loose gray skin and flat tails, and they tied themselves in knots in their struggle to burrow deeper into the carcass.

She passed the light from one end of the seafloor to the other. The bacteria here were already at work, and the sediment would be full of sulfides, but she disliked it. When you had company, it only meant that more could go wrong, but she didn’t have much of a choice. “I’m going closer.”

As she circled the scene, the hagfish became more active when they were hit by the light. She knew that they wouldn’t bother her if she kept her distance, but the tricky part would be finding a spot that was out of the way—

A shadow entered her line of vision. It had been hanging motionless at the edge of the fall, and she had just a fraction of a second to take in its blank white eye and huge mouth before it attacked.

Eunice cut the light, but it was too late. A sleeper shark could drift like a dead thing in the water for hours, but when it detected prey, it could move with shocking suddenness, like a trap poised to spring shut at the smallest disturbance. It came at her, jaws wide, and before she could defend herself, it was sucking her in. She fought back frantically, but the shark had already seized her hemisphere and one of her arms. Eunice felt its sharp upper teeth seeking for purchase in the smooth surface of her dome, pressing down savagely as it swung its huge head in a circle.

Around her midsection, Wagner lit up at once with full awareness. “What is it?”

Eunice couldn’t speak. One of her limbs was caught, but the others were free, and as the shark strained to swallow her, she flung her two nearest arms upward, pressing down hard against the sides of its skull. She dug into something soft. Eunice wasn’t sure what it was—it might have been its left eye—but she pinched her fingers down into a point and pushed into the opening that she had found.

A spasm ran through the shark’s body. Groping with her other limb on the right side of its head, she found a second tender spot and drove into it. The shark bit down convulsively. Eunice plunged her arms in further, trying not to think about what was giving way beneath, and did the

same with the limb in the shark's mouth, pushing down its throat and bending up through its palate.

Oil and blood filled the water. The shark kept fighting, its brain sending out frenzied signals until the very end, but at last, it relaxed. Eunice extracted her arms one at a time and managed to free herself. As the shark's body drifted to the seabed, the water came alive with movement. She braced for another assault, but it was only the hagfish, drawn to the new bounty that had unexpectedly appeared.

Eunice made it to the edge of the fall and buried herself in the sand, trying to become as small as possible. Her sensors indicated that there was nothing else nearby, but she still waited, motionless, until she was certain that she was alone. Finally, she found her voice. "Get to work."

Wagner detached with what felt like uncharacteristic reluctance. He did not ask what had happened. As he crawled away, Eunice remained on full power. She was shaken by the close call, and as she monitored the area with everything but her eyes, she became aware of another emotion.

It was grief. The shark had been a living being that had only sought its own survival. If she had been more careful, she would have detected it before it had a chance to attack, and they might have left each other in peace. Instead, she had killed it with her own carelessness, and as she mourned it, she felt overwhelmed by the sudden knowledge that she would never make it home.

* * *

III.

In the months that followed, Eunice found herself thinking more intensely about time. As she traced her wandering path from one whale fall to another, the shark faded to a distant memory, floating at the edges of her consciousness. Yet it was always there, lurking silently, and it came to stand for all the unknowns that she had yet to confront, like the prospect of death in the mind of someone living.

After the attack, Eunice had spent the next few days checking all of her systems. She found no evidence of serious damage, and as soon as Wagner had recharged, she set off again, leaving her lights extinguished. Whenever she returned to the fall where she had encountered the shark, her fears rose again, and although she met no other predators, she was still relieved when she finally discovered another fall that would allow her to move on.

But something had changed. In the past, she had allowed herself to fantasize about what she might find at her destination—James, the charging station, the seven sisters she had left at home. Sometimes she had even imagined seeing Galatea and the others from the vent system, as if they had miraculously made it back on their own. It had been a kind of dreaming in advance, but now she pushed such thoughts away, until only the image of the tether remained.

Occasionally, there would be a break in her routine. One came whenever she arrived at a new hydrothermal vent. The first one after the shark attack had been relatively fresh, with lava flows shining with glass, bundles of tube worms two meters high, and sessile jellyfish clinging to the rocks. Eunice tried to draw comfort from the sight, and she was tempted to stay, but she finally moved on. Even a vent would not last forever, and sooner or later, she would break down herself.

A few days afterward, she finished recharging at a new whale fall and went to the surface to check for signals. She was rising into the photic zone, the water around her gradually brightening, when her velocity sensors picked up a change. Something large was directly overhead.

It was a whale. Eunice slowed her ascent, gazing up in wonder as it passed across her field of vision, outlined by the faint glow of the Sun. It was fifteen meters long and dark gray, its skin covered with the pale patches left by parasites. She could make out the parallel furrows that ran along the underside of its throat. Looking to one side, she saw another whale, and then another. She hung there until the tenth and final whale had passed, accompanied by a smaller shape, nearly black, that was swimming at its flank. It was a mother and her calf.

As she watched the pod pass by, transfixed, Eunice was filled with longing for Thetis, Galatea, Dione, Clio, and the seven sisters who had remained in Seattle. She wondered bleakly if Galatea

was still at the vent, or if she had been swept away when the mining began—

A second later, her spell was shattered by a shock of realization, and before she knew what she was doing, she was swimming as fast as she could after the whales. By now, the pod was hundreds of meters away, but she was unable to abandon the possibility that had suddenly occurred to her.

She dumped her lower tanks, allowing her to rise more rapidly, and propelled herself madly onward. Noticing the change, Wagner stirred underneath her dome. “What’s going on?”

Eunice said nothing. The whales were heading north, on their usual migration route, along a path that coincided with the coastline. If she could latch on to one of them, finding a place where she could ride unnoticed, she could cling there for as long as possible, traveling hundreds of kilometers without expending any additional energy. All she had to do was get to them now.

She was nearly there. Forcing herself to her limits, she gave everything that she had to one final push—

—and failed. The pod was faster than she was, and the idea had come to her too late. Eunice surfaced, her six eyes searching in all directions. The Sun was high in the sky, but she saw nothing but empty ocean.

As Eunice looked in the direction that the pod had gone, one of the whales sounded. A white plume appeared above the water, followed by its broad back, and she caught a glimpse of the paired flukes of its tail before the ocean closed over it again. She managed to mark the path along which it was moving. If this was their migration route, it would be a promising line to follow, as countless whales gave their bodies to its invisible shadow under the waves.

Eunice added this to her store of data and sank down. If riding a living whale would be denied to her, she thought, she would travel on the backs of the dead. Every language had its own word for the ocean, and in one ancient tongue, she recalled from her lessons, it had been called the whale road.

Days and weeks passed, and there were times when the way forward felt endless. Yet there was no denying that she was getting closer. Occasionally, Eunice allowed herself to feel hopeful—and then one last complication made her wonder if she had been deceiving herself all along.

It happened when she was retracing her steps to another whale fall. Eunice was still five kilometers away when she found herself faltering. At first, she thought that it was her imagination, but as she continued to slow, she realized that there was no denying it. She was running out of energy, long before she should have reached the end of her range, and if she failed now, she would never make it back.

In the end, she was saved by a stroke of luck. She was moving south, on the return leg of an excursion, which gave her another way to cover the remaining distance. Adjusting her buoyancy, she rose from her usual position near the seabed. At this level, she would be unable to detect any new falls, but this was less important than returning to the one that she knew was there.

When Eunice was three hundred meters from the surface, she felt the oceanic current, which was sweeping its way south. She powered down, retaining only her navigational systems and the bare minimum of maneuverability, and allowed herself to drift this way for four kilometers. As soon as dead reckoning told her that she was near the last known fall, she descended.

Eunice made it back with almost nothing to spare. As Wagner went to work, she anchored herself and pondered this new development. It had been only a matter of time before she experienced a breakdown, but this was less a straightforward malfunction than a reduction of capacity. She had been feeling tired in recent days, which she had chalked up to a combination of nervousness and uncertainty, but now she had to acknowledge that her range had indeed fallen.

There were several possible explanations, none of which was pleasant to contemplate. She suspected that a battery issue was to blame—by now, her power banks had been depleted and recharged hundreds of times—but it might also be a combination of factors. Wagner’s fuel cells could have suffered a loss of efficiency, and it might even be the result of the shark attack, which could have caused unseen damage that had become evident only now.

Eunice ran a series of diagnostics, which uncovered nothing useful. All that remained was to

quantify the problem. Once Wagner had recharged, instead of setting out in search of another whale fall, she conducted a test, moving in a tight circle around her present location until her power faded. It took less than forty laps. Checking the distance that she had covered, she found that her range had fallen from thirty kilometers to around twenty-five.

The numbers were unforgiving. Based on her own data, the average distance between whale falls in this part of the ocean was ten kilometers. If her range fell much further, she would no longer be able to cover that distance without the risk of failure. The calculus of survival, which had always been unfavorable, had grown worse. Now every trip would be an even greater gamble.

It left her with a hard choice. If her range was reduced below twenty kilometers, or if she was stranded between falls, she would have no choice but to stop. She would keep going until she could travel no farther, and then she would float to the surface, switch on her emergency beacon, and power down, hoping that someone would find her before this last transmission died.

She shared none of this with Wagner, who grew even more silent, as if conserving his strength for the challenges to come. They were almost home, but now her progress became inexorably slower, tracing a curve that approached but might never reach its goal. She tried to focus instead on each step, and she managed for a while to put the map out of her mind.

One day, Eunice came across a whale fall that was different than the others. Looking for a resting spot along its spinal column, she noticed that hoops of some stiff material had been attached to its ribcage, and it took her only a second to realize that they were artificial.

Wagner seemed surprised that she hadn't issued her usual instructions. "What is it?"

"Hold on." Eunice tried to think. The hoops were made of metal, which had oxidized into red heaps of rust. Occasionally, she had found carcasses skewered with harpoons, but this was something else.

The answer gradually came to her. These metal hoops were ballast, and the whale had been sunk here deliberately. It was an experimental whale fall. Because natural falls were hard to find in the open ocean, she recalled, scientists had sunk carcasses on purpose to study them over time. It meant that human beings had been here before her, and that she was close to civilization.

According to her map, she was still a long way from home, but she was unable to resist taking a look. After Wagner had powered up, Eunice rose to the surface. They were far from land, and there was no sign of human activity, but when she turned on her radio, it was with an unusual degree of anticipation. She remembered how it sounded close to shore—she often heard noise from other sources, even if nothing was directly transmitting to her—and now she listened to it anxiously.

There was nothing there, but she felt her hopes rise. It had been so long since she had seen any trace of humanity that even this vestige of it, long since abandoned, seemed like a message. For the first time in weeks, she allowed herself to think that she might make it, and as she descended again, she realized that she had been waiting for a sign without knowing it.

Finally, on a day like any other, she arrived at her last whale fall. Checking her position, she found that she was thirty kilometers from home. Nothing was visible up top—the shore was just over the horizon—and her radio was still out of range. But there was no question that she was close.

Returning to the whale fall, Eunice forced herself to proceed carefully. Now that her destination was only a stone's throw away, she wanted to go for it at once, but she knew that she had to be more careful than ever. There would be no more falls where she could rest. In shallow waters, a carcass would float, not sink, which meant that this was as far as she would get on the whale road.

After Wagner had attached himself again, they left the fall and headed east. Eunice allowed herself to look back once at the warren of fallen bones, knowing that she might never see one again, and then she turned to face what was coming. The rules of the game had changed. She had thirty kilometers to cover and an effective range of around twenty-five, so she had to draw on all of her available resources, which came down to herself and the current.

Eunice swam under her own power until she had reached the strait that led to home. It was two hundred and fifty meters deep, and at the bottom, where she had to remain, it was outside the realm of sunlight. She rooted herself to the silt and waited for a full day, at minimum power, monitoring the water around her. As she had expected, during the flood tide, the current moved east, in her intended direction of travel. The rest was a matter of timing.

When the tide turned in her favor again, she released herself, allowing the current to carry her along. Drifting in this fashion, with her higher functions switched off, she covered close to twelve kilometers in six hours. Then she anchored herself again to wait out the ebb tide.

She did this eight times over four days. When her navigational system told her that she had entered the sound, she resisted the temptation to rise at once. A complicated path lay ahead through shallow water, calling for infinite delicacy, and she had to save every last scrap of her strength.

Eunice paced herself, tracking her location as she waited to give herself to the current. This part required many separate attempts. Sometimes she was carried half a kilometer or more, but usually it was far less. It saved energy, but it also drained the stores of patience that she had cultivated for so long.

Ten kilometers remained. She estimated that she had enough power to cover the distance along a straight line, but energy would also be used up in maneuvering, and after one final calculation, she made her choice. There would be no turning back from here, but first she had something to say to Wagner. "Thank you."

If Wagner processed this statement, he said nothing. She released herself from where she had been clinging to the bottom and shot forward, using all of the power that she had been reserving until now.

The path was difficult. She had to thread her way through a series of bays and cuts, and although the route was clear in her head, it was hard to follow while expending the minimum amount of energy, and once or twice, to her intense frustration, she miscalculated and had to double back.

Each mistake had a price, and as her errors accumulated, she felt herself losing power sooner than she had expected. She was almost there, but she was weakening. As despair overtook her, she prepared to use her final burst of energy to reach the surface, either to be found or to see the Sun one last time—

She felt Wagner stir. They were in shallow water, far from the crushing pressure of the bathyal zone, and something in the freedom that it afforded seemed to awaken an old memory.

As Eunice faded, Wagner unfolded the tiny pectoral fins tucked to either side of his body. Under favorable conditions, he was designed to mimic a manta ray, and now he extended his wings, transforming himself from a ring into a rhombus. Eunice felt him probing gently around in her brain, seeking the map as they began to glide forward. He spoke in her head. "Hold on."

Eunice lacked the strength to respond. Wagner could do little more than keep them on course, with their speed reduced to a crawl, but they were moving. She sensed that they were close, and the memory of the tether that stood for home expanded so forcefully in her mind's eye that it took her a second to understand that it was no longer just her imagination.

She looked through the water, which seemed cloudy and dark. There was something up ahead. A slender vertical line stood before her, dividing the scene in half like the mark of a draftsman's pencil. It was the charging station.

Eunice floated up. As Wagner quietly corrected their angle of ascent, she reached the power unit at the top. For a second, she wondered whether this might all be a dream, unfolding in the safety of a whale fall, or one last hallucination, compressed into the instant before the shark's jaws clamped down—

She latched on. At once, she felt a pure infusion of energy. It was just as sweet as she remembered, and as she drank deeply, the spokes of her sixfold mind were filled with disbelief, gratitude, relief, and nameless other feelings that seemed to fuse together into a single glowing wheel.

As Eunice felt her consciousness returning, she saw that the cloudiness of the water, which

she had thought was the product of her exhaustion, was still there. Something was strange about the light. Looking up at the ripples of sun overhead, she saw that they were only a few meters below the surface. Her charge was incomplete, but she was unable to wait any longer.

Detaching herself from the power unit, she covered the last step of her journey, surfacing to look at what she had traveled four thousand kilometers to reach. Below the water, she sensed Wagner waiting for her to speak.

The charging station was anchored in a sheltered part of the sound, not far from the quay where two research vessels, one twice the size of the other, were berthed. Both were still there, but they were not what she remembered. They were listing to one side, and the bottoms of their hulls were solid masses of rust, their upper levels discolored by brownish streaks and lesions of flaking paint.

Lowering her eyes, Eunice saw for the first time that the waters of the sound were overgrown with mats of seaweed and feathery milfoil. Beyond the quay stood a gray concrete building with a copper roof and rectangular slits for windows. It had been the backdrop for her memories for as long as she could remember, but now the side facing her was covered in a tangled growth of ivy. Mounds of bird droppings were encrusted on its eaves.

Eunice stared at the other buildings by the shore. All were overgrown and abandoned. A road ran alongside the water, its asphalt buckled, tall weeds topped by yellow flowers growing in the cracks. The city had been reclaimed, with a new stage appearing as the old idea of order passed away.

She switched on her radio. Instead of the random noise that she had usually heard in the city, there was nothing at all. As she scanned every frequency, searching for signs of life, she wondered if her radio had been broken all along, and it was only gradually that she understood the truth.

James had told her that they were running out of time. Eunice had thought that he was speaking of their work together, but it occurred to her now that he had been referring to something else. All the voices in the world had been silenced, not just the men and women, but even those who were like her on land. Their circuitry had not survived the event that had erased their designers.

But one place had been spared. Whatever had caused this devastation had occurred when she and her sisters were in the bathyal zone. James had said it himself. *The ocean is a buffer. A refuge—*

She sank down again to the charging station, which had continued to generate power all this time, shielded by two meters of water. Her numbness faded, replaced by grief, and she saw that she was no longer alone.

At first, it was only a shadow. As Eunice watched, a familiar shape emerged from the gloom. She stared, at a loss for words, as the others appeared one by one, until all seven were facing her in silence.

Wagner had been waiting patiently for her to say something. "What did you see?"

As she thought of the ruined city, she wasn't sure what to tell him. Then she realized that she had seen something much like it before.

"Another whale fall," Eunice said. And then she swam over to meet her sisters.

Alec Nevala-Lee is the author of Astounding: John W. Campbell, Isaac Asimov, Robert A. Heinlein, L. Ron Hubbard, and the Golden Age of Science Fiction (HarperCollins), which was recently named one of the best books of 2018 by The Economist. He is currently at work on a biography of the architect and futurist Buckminster Fuller.