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2A: The Evolution of Life

"Pod 1 is about to make contact!" called the booming voice of Ethan Howey, the dark haired expedition leader operating the navigational controls at the head of Pod 2. His voice reverberated through the inner metal walls of the small enclosed space, earning an excited whoop from Malachi.

Malachi, Ginger, and Doctor Tom sat together at the rear of Pod 2 circled around a screen displaying the video feed from the external forward facing camera. On the screen, the circular silhouette of Pod 1 glided through the dark water ahead toward an incredible spherical phenomenon. The sphere's image grew on the screen as they approached, expanding into view like a ring around the dark circle of Pod 1. The portal was like a mirage. It was colorless in and of itself, but distorted the light around it in sporadic fluctuating waves. The edges of the sphere blended into the surrounding water smoothly, while the middle churned with chaos. The portal was at least three times bigger in diameter than the round width of the pods, which were shaped like oblong pill capsules.

No dramatic bursts of light or noise occurred as Pod 1 touched the portal. The vessel slid smoothly into and through the sphere, and simply disappeared. The small crew of Pod 2 braced themselves as the now unobstructed camera view of the wild, chaotic center mass of the portal drew them in next. Then, it swallowed them.

In the blink of an eye they were through the time portal and out the other side, billions of years into Earth's past. On all camera feeds appeared a vast, greenish-black open ocean.

The small crew of Pod 2 released a collective breath of relief.

The process of rising to the surface of the ancient ocean took hours. Malachi was explaining as best he could to Ginger why, how, and in what current stage the expedition was progressing. She understood the technical concepts easily enough, such as the need for the pods to ascend *slowly* to protect the crews from decompression sickness ("the bends"), but it was the paradoxical aspects of time travel that she struggled to wrap her mind around.

"We're traveling *billions* of years into the past," she said. "Before we could even breathe our atmosphere, right? So, plants haven't even evolved yet."

"Yes," Malachi confirmed. "We're pretty sure cyanobacteria were the earliest biological photosynthesizers back when the atmosphere was still heavy with methane. The portal opens in a time that predates the great oxidation event."

"Does that mean that *no* life on Earth has evolved yet? Are we the only living things on the planet?" Ginger's words rose with an edge that bordered exhilaration and anxiety. "Except, Doctor Tom, you said that living creatures from the twilight zone go through the portal all the time, right? Doesn't that affect the long term evolution of life here?"

"We know there were other forms of life on Earth that predate the rise of oxygen," the doctor pointed out. "Single-celled microorganisms. Bacteria and viruses. Stromatolites, for example."

"And," Malachi added quickly. "The animals that go through the portal don't survive very long unless they come back to our side again. The oceans before life were *very* hot compared to the climate of our time. The pods had to be built to handle temperature extremes for that reason. Also, both sides of the portal open into an equivalent twilight zone. Remember what I told you about things that live in the twilight zone? How they survive?"

"...By eating each other, or plants that sink from above," Ginger recalled slowly. She chewed on her bottom lip, thinking. "So, if they don't die of the heat there's still nothing for them to eat billions of years ago. But, if they die on this side, couldn't the bacteria left in their bodies taint the evolution of the environment around it?"

"Keep in mind," Doctor Tom said. "The portal is a naturally occurring phenomenon. We don't control everything that passes back and forth through it, and we still aren't certain which time travel theory might explain why the portal hasn't altered our evolution. Maybe it has. Maybe we evolved *because* of something that went through the portal. There are other portals all around our planet, though almost all of them exist out in space where Earth's magnetic field interacts most strongly with solar winds. The Lemuria portal is a rare thing, because these portals almost never open *inside* the planet."

The discussion continued along the thread of time travel paradoxes and multiverse theories as the hours passed and the expedition's two pods continued to decompress. Lemuria sent two vessels to create a buddy system in case of emergency, and to provide two separate collections of data for comparison. A crackling voice blared through the radio from Pod 1 when they had almost reached the surface, confirming their proximity and arrival time.

"Looks like we missed most of the daylight hours," Ethan informed the crew as he examined the camera feeds and the screens of scrawling data. He was a big man, with beefy fingers that manipulated the pod's controls with deft familiarity. "Looks like we'll catch the sunset just as we break the surface."

They could all feel it when Pod 2 reached the open air. The vessel bobbed and swayed gently, before it settled into a steady rocking motion with the calm waves. From the topmost external camera view they could see the bobbing of Pod 1 in the green water less than than a dozen meters away. In the distance beyond was the setting sun at the edge of a vast orange sky.

The beams of sunlight were fading fast at the edges of the watery horizon, stretching streaks of gold into the thick gorgeous orange, flecking the sky with tinges of soft royal purple. Silence fell inside both pods. They were first humans to witness a sunset predating complex life on Earth. They huddled around video screens with rapturous awe. Malachi's gaze broke away just long enough to see tears sliding down Ginger's cheeks. He watched the soft haze at the edge of the sky where the light dimmed gently into dark, and shuddered as he felt his own eyes brimming with water, too.

When it was over, it felt like a very long time before anyone was ready to speak. As darkness fell, stars flickered sharply into being across the sky. Without the light pollution of modern day, the darkness of the world fell as thick and heavy as a blanket. It was the stars, the textures and intoxicating shades of color across nebulae and galaxies in the sky, that returned depth and perspective to the world. Finally, the radio crackled as the teams began communicating back and forth, and sending messages down through the chain of transponders to Lemuria billions of years into the future.

"Wait," Ginger murmured, eyes still on the screen. "Something's not right."

Malachi and Doctor Tom were babbling back and forth, something about Malachi's senior project and whether Lemuria might welcome him back as an employee after graduation. They hadn't heard her. Ginger raised her voice and tried again.

"There's something *wrong*," she insisted, waving a hand between the two men to draw their attention. Her eyes never left the camera feed. "I think… I don't see…"

Then she gasped, jerking abruptly with wide eyed panic. Malachi and the doctor became immediately alert and concerned, dropping their conversation as they oriented themselves to Ginger.

"Oh my god," she gasped, clapping her hands over her mouth and shaking her head back and forth rapidly, eyes round and wild. "Oh my god, *oh my god*-"

"What?" Malachi demanded, moving in front of Ginger and trying to block the screen from her view. Alarm and worry marred his face as he tried to catch Ginger's eye. "What is it? Calm down, breathe! What's wrong?"

Doctor Tom stood and was trying to see the video feed from over Ginger's shoulder without crowding too close. His bushy grey eyebrows pulled together with confusion and concern.

"C-can we move the camera? Can we point it at the rest of the sky?" Ginger finally choked out, looking back and forth between the two men urgently. By now she had attracted the attention of the rest of the crew, unable to hide her reaction from anyone in such a small shared space. Dwight Robinson, a thin wiry man who happened to be an Antioch College alum, was leaning against the opposite wall and hovering as he watched the scene unfold. He spoke up.

"We can control the camera angle," he said in a gravely baritone. "But first you need to explain what's got you so spooked. Do you think we're in danger? What's scaring you?"

"The stars," Ginger said, shaking her head at Dwight. "They're not right. The stars aren't right. The constellations aren't there. None of them."

"Maybe they're just hard to make out," the doctor mused, eyes narrowing through his glasses at the screen. "We can see so many more stars than usual because there's no light outside, so maybe the ones you're looking for are just drowned out."

"Ginger," Malachi asked quietly, raising a hand slowly. "Can I put my hand on your shoulder?"

She looked at him blankly, blinked, and then nodded with a sharp jerk. He dropped a hand on her shoulder and rubbed gently, which did seem to help her calm down. She took a deep breath and relaxed a fraction.

"I know Earth's night sky better than I know my own face," she explained to her uncomprehending audience. "That portal didn't take us back in time. It took us to a different planet."

There was a flurry of activity as word spread through the crew of Pod 2, and then to Pod 1 over the radio. Both teams were examining the visual footage of the starry night sky. They rotated the cameras, trying to catch a glimpse of the familiar constellation map that humanity had used for hundreds of thousands of years to orient themselves in the universe. It didn't take long to confirm Ginger's hypothesis; they were no longer on planet Earth.

"We would have found out once we got back to Lemuria," Dwight mused to Ginger with apparent nonchalance. "We're recording the camera feeds and taking a lot of three-sixty images. Even if we hadn't noticed right now, we'd have caught it pretty quick once we got back and analyzed the footage."

"How did nobody know about this before, though?" Ginger wondered.

"All the data we've gathered until now has been showing us something that looked like Earth," Dwight said with a shrug. "An ancient, earlier version of Earth, anyway. Who would have guessed? Time travel seemed more likely, based on what we knew about the portal."

Ginger stood from the bench to stretch. Her lab coat, which she'd removed and laid across her lap during the ascent, fell in a crumpled heap on the floor. There was a ringing, clattering noise as something fell from the coat pocket and rolled across the metal floor. Malachi swooped to recover the objects before they could roll out of reach under anything. He held them up to the light with raised brows.

Ginger made a noise of surprise. "I completely forgot about those. They're from the lab in West Biome. The algae samples. I thought I put them all back, but I was in a rush."

"Don't worry about it," Doctor Tom assured with a dismissive glance as he paused from typing something on a thin notebook computer. "They're not important. There's plenty of algae in the world. Well, the world of Earth, I mean."

Malachi was rolling the two cylinders between his hands with a thoughtful look. A few moments passed. Ethan confirmed via radio with Pod 1 that they were lagging behind schedule for their descent. The crew was wrapping things up when Malachi lifted his head and spoke.

"I just thought of something. It might be crazy, but I have an idea," he said to Doctor Tom. Dwight seemed to have heard and was listening with interest. Malachi held up the two algae samples. "What if we released these into the environment?"

When he received only blank looks, Malachi continued, "This place is just like our world, right? So much that we couldn't even tell it wasn't Earth. What if we released these algae, photosynthetic life, into the environment? It would be like the first step to terraforming. We might kickstart another great oxidation event, so maybe we could eventually breathe the air here. We could make a second Earth!"

With a small frown Dwight turned away and began speaking in murmurs to one of his colleagues. Doctor Tom's brows had risen halfway to his hairline with thought.

"Would that really work?" Ginger asked doubtfully.

"It might," Doctor Tom reflected. "If the conditions of this world are primed for it. If the algae can survive here, eating light, carbon dioxide, and whatever else. With enough time they might multiply and spread, producing oxygen."

"It's possible," Dwight interjected, the conversation with his colleague apparently finished. "We won't know for sure until we take our findings back to Lemuria, but what we can analyze here suggests the atmosphere is just what we'd expect to find billions of years in Earth's evolutionary past. There's hardly any variation. We sent word to Lemuria to see what they think of your idea."

Malachi's expression fell slack, as if he hadn't actually expected his idea to be seriously considered. Dwight shrugged.

"There are things we don't control passing through the portal all the time. Causing change was a risk we were willing to take even when we thought we were traveling into our world's past. Why not now?"

"Keep in mind," Doctor Tom mused carefully. "An environment that's good for us isn't good for all forms of life. The 'great oxidation event' on Earth is also sometimes called the 'oxygen crisis,' or the 'oxygen holocaust.' This planet might have its own forms of life out there that wouldn't survive. Think of obligate anaerobes, for instance."

Malachi winced at the thought. Ginger, confused, asked the doctor what he meant.

"Obligate anaerobes are microorganisms that are killed by oxygen. It's poisonous, toxic to them," Doctor Tom elaborated. "Additionally, by doing this we might trigger an ice age. Earth's great oxidation event caused the Huronian glaciation."

At an urging wave from Ethan, Dwight walked away to speak into the crackling radio. He returned a few minutes later with a thumbs up.

"The director says it's up to us," he explained. "Who knows? Some oxygen making bacteria might have already slipped through on its own, for all we know. We get to decide whether to toss algae into the water and see what happens, or not."

All heads were turning as everyone looked to gauge each other's thoughts, reactions.

"Then again," Doctor Tom picked back up casually. "Things might happen differently on this world than it did on Earth. It might not even work, if the algae doesn't survive and spread. What do you think, Malachi? What should we do?"

3A: Release the algae to begin terraforming the alien world's environment.

3B: Don't attempt terraforming by releasing the algae.