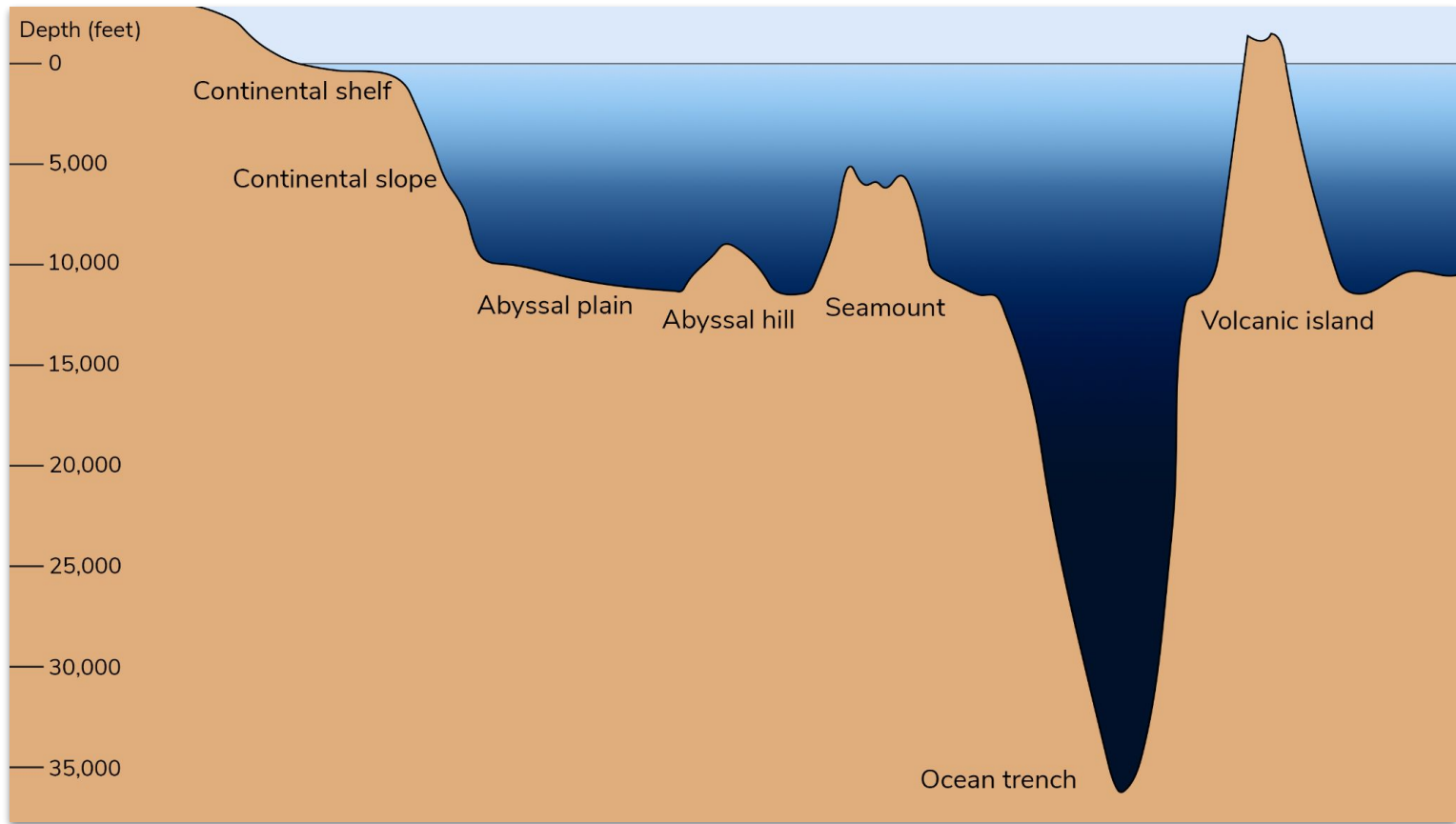




# Evolution in the Deep Sea





Depth of the Ocean

Deep Sea





# Agenda

---



# Outline

Evolution at the Dawn of Life

Evolution Today

Evolution Tomorrow?

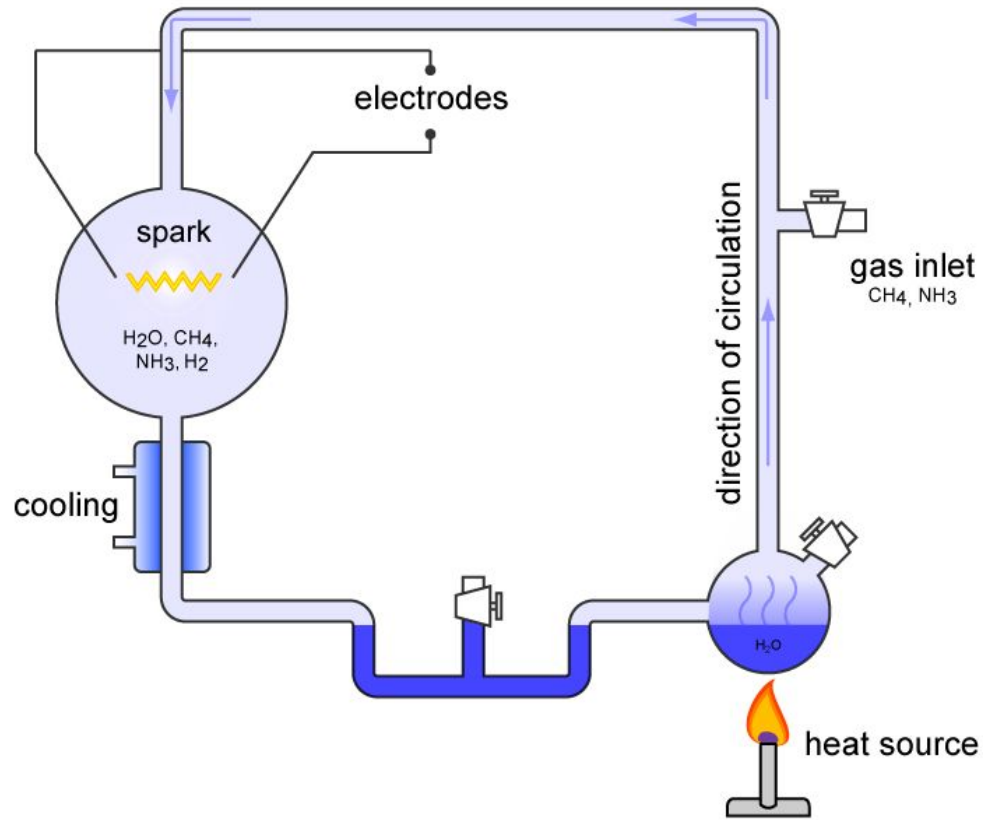
# §1: The Origin of Life?





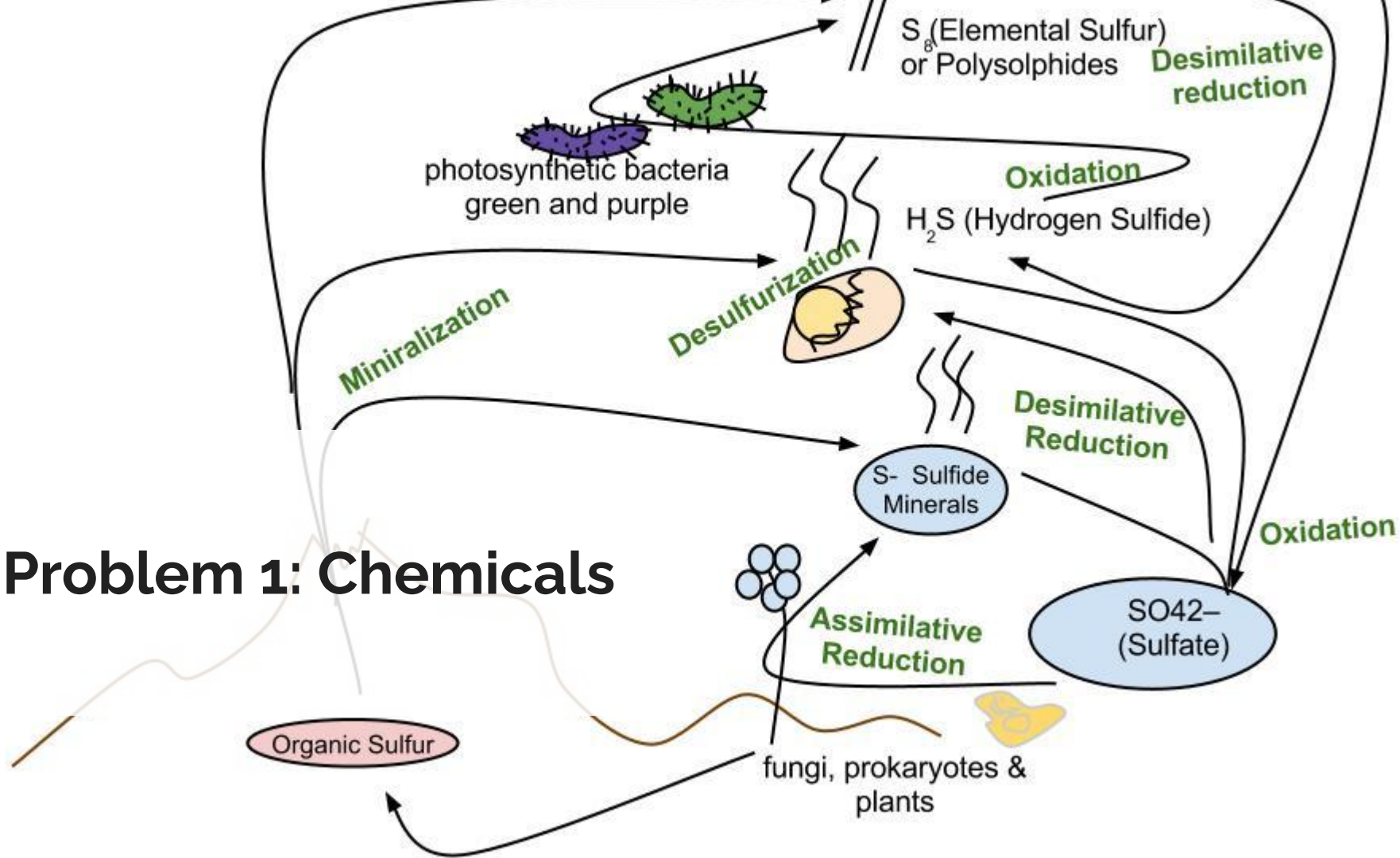
---

# Life's Origin: The High School Version




Miller-Urey Experiment

# Problem 1: Chemicals



A grayscale microscopic image showing numerous bubbles of various sizes. The bubbles are circular and have a bright, reflective rim, giving them a three-dimensional appearance. They are scattered across the frame, with some overlapping. A white rectangular box is overlaid on the left side of the image, containing the text 'Problem 2: Bubbles'.

## **Problem 2: Bubbles**



## **Problem 3: Energy**

---

# Life's Origin: An Alternate Hypothesis



An underwater photograph of a hydrothermal vent. A large, billowing white plume of superheated water rises from the seafloor. The surrounding water is a deep, dark blue-green. The seafloor is covered in dark, jagged, and porous rock formations, likely composed of iron sulfide. The lighting is dim, highlighting the textures of the rocks and the density of the white plume.

# Hydrothermal Vents



The image shows a deep-sea hydrothermal vent environment. Two prominent black smoker chimneys rise from a rocky, mineral-rich seafloor. The chimneys are composed of dark, porous material and are surrounded by a variety of colorful mineral structures, including white and yellow sulfide deposits. The background is dark, with some faint light reflecting off the surrounding rocks and the base of the chimneys.


# **Solution 1: Chemicals**



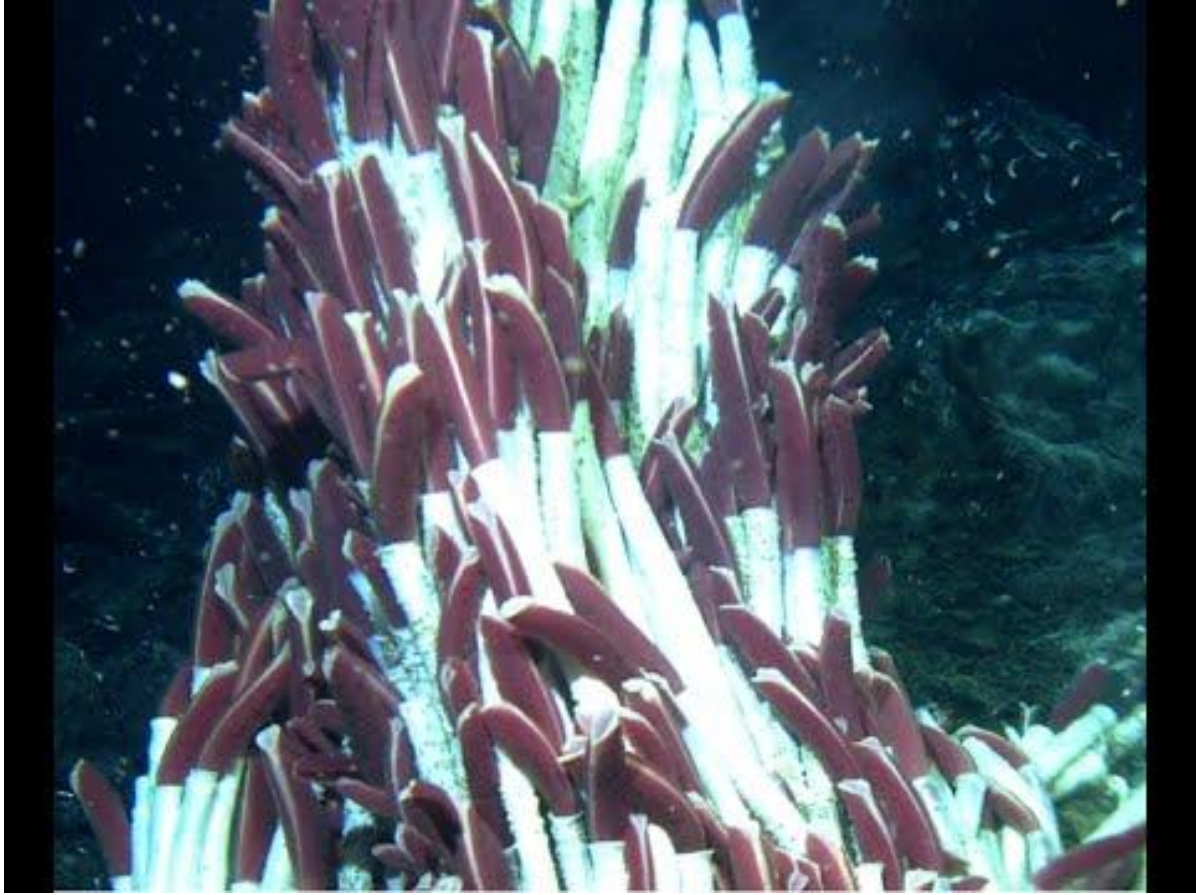


## **Solution 2: Bubbles**



An underwater photograph showing a volcanic eruption. Two large, billowing plumes of dark grey ash or smoke rise from the seafloor. In the foreground, there are hydrothermal vents, including a prominent white mineral structure on the left and a smaller one in the center. The seafloor is covered in dark, rocky terrain with patches of green and yellow mineral deposits. The water is dark and slightly hazy.

## **Solution 3: Energy**



Hydrothermal Oasis

# §2: Evolution Today





**Too Much Pressure**





Fat Cell Liquefaction

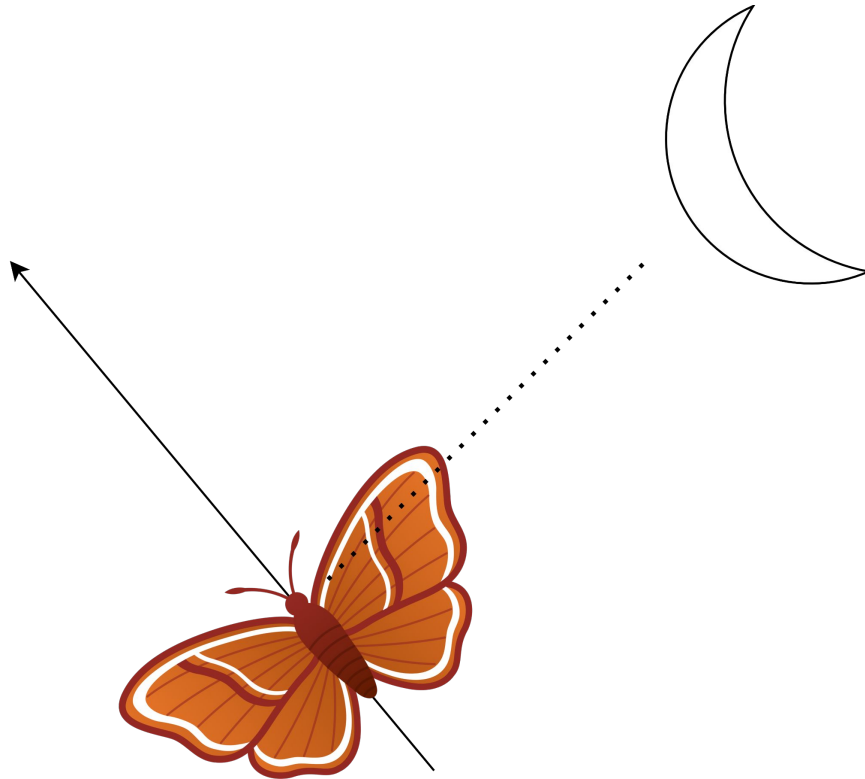


—

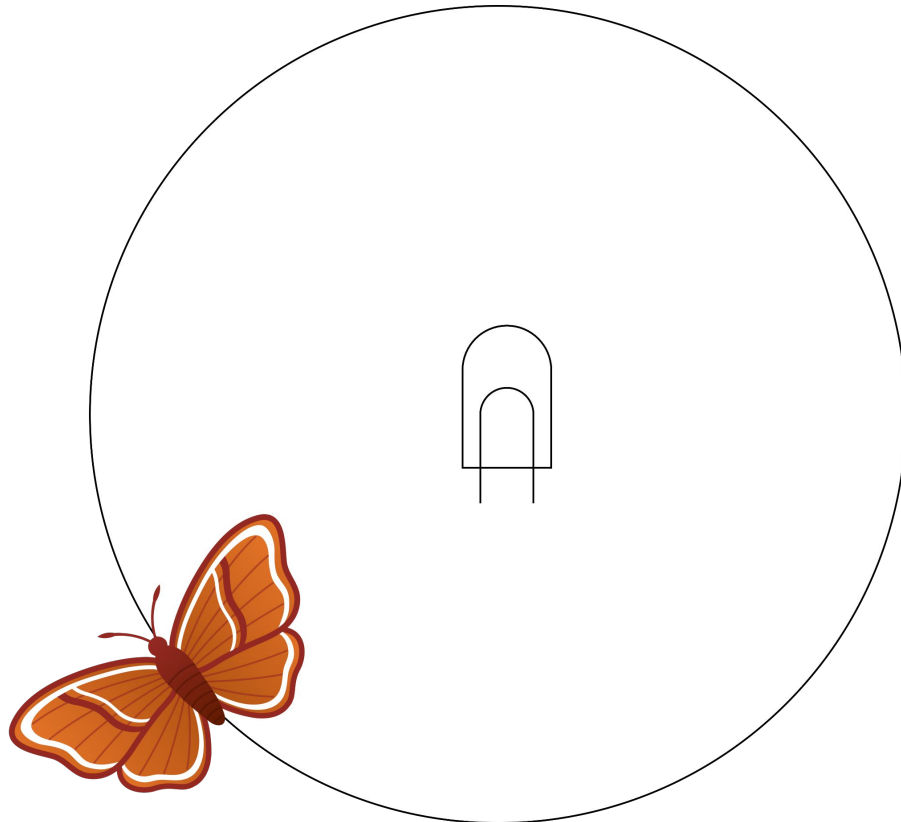
**No Light**



Anglerfish



Moth vs Moon



Moth vs LED



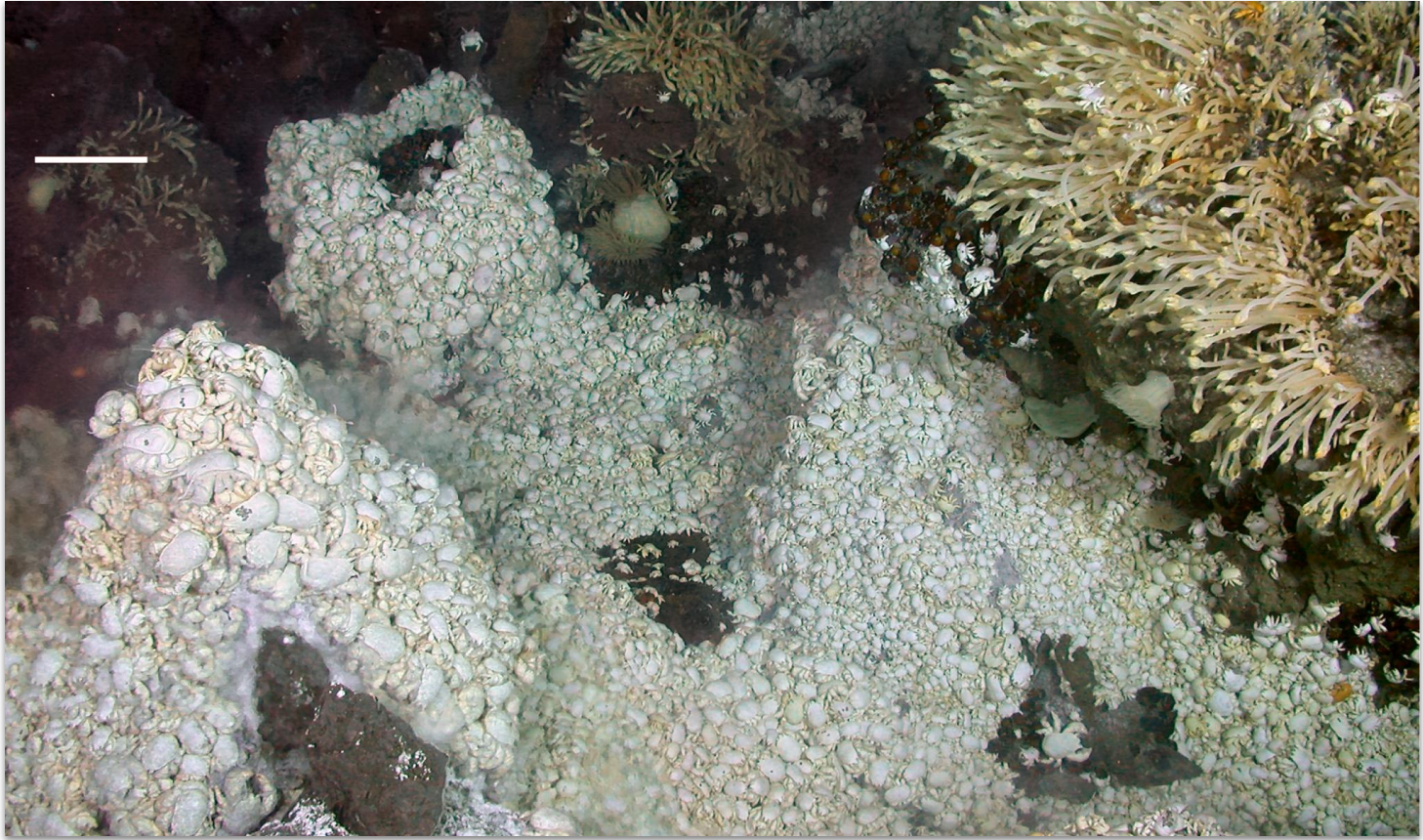
Coral Bloom





**No Food**





Hydrothermal Oasis



Marine Snow





Whalefalls

---

**Why are they Scary?**

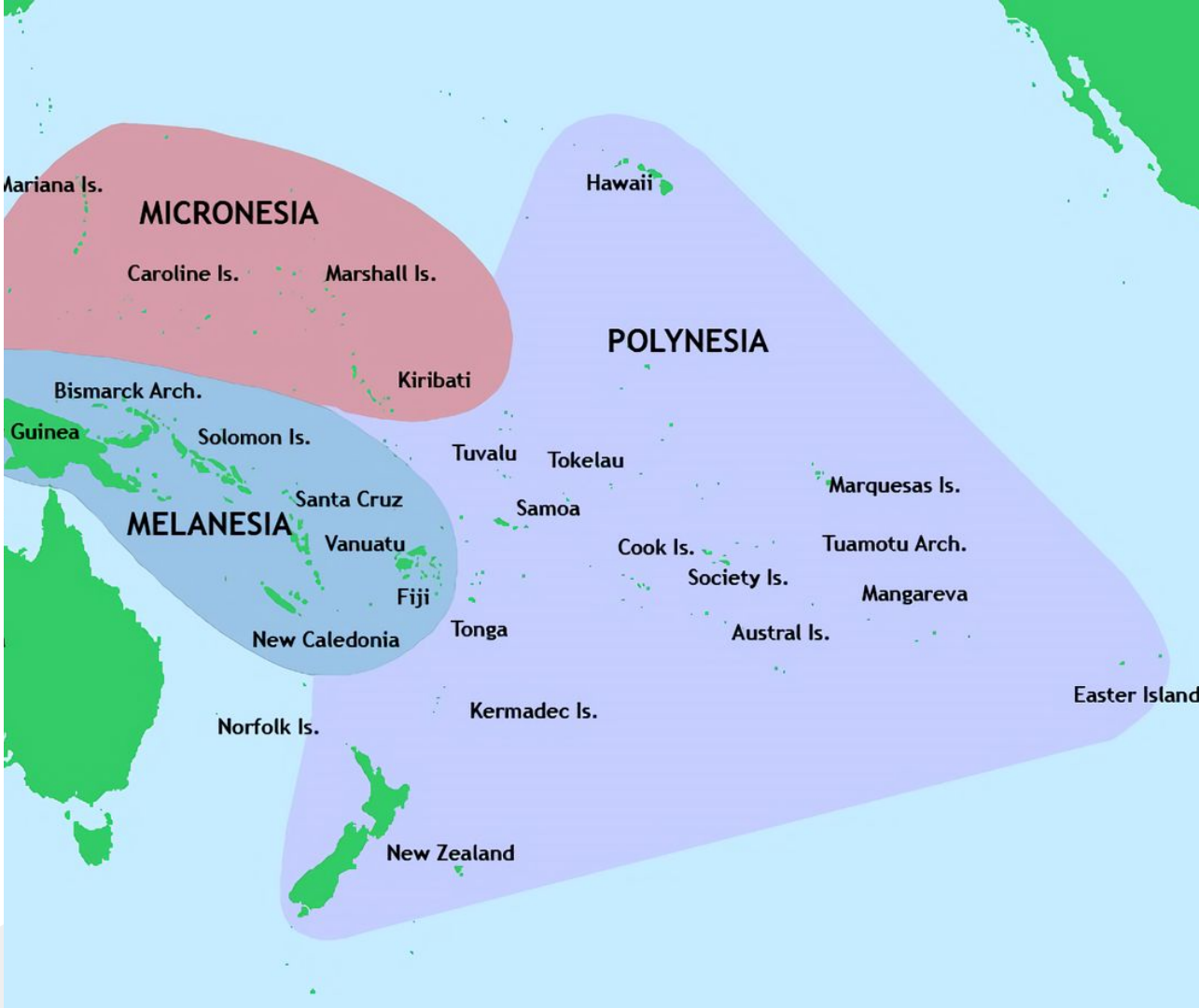




## Factors Behind Deep Sea Gigantism

1. Klieber's Rule: Larger animals are more power efficient
2. Bergman's Rule: Colder animals are Larger
3. Island Rule: Small animals grow larger on islands

# Analogy: Pacific Islands









# §4: Life's Last Refuge?

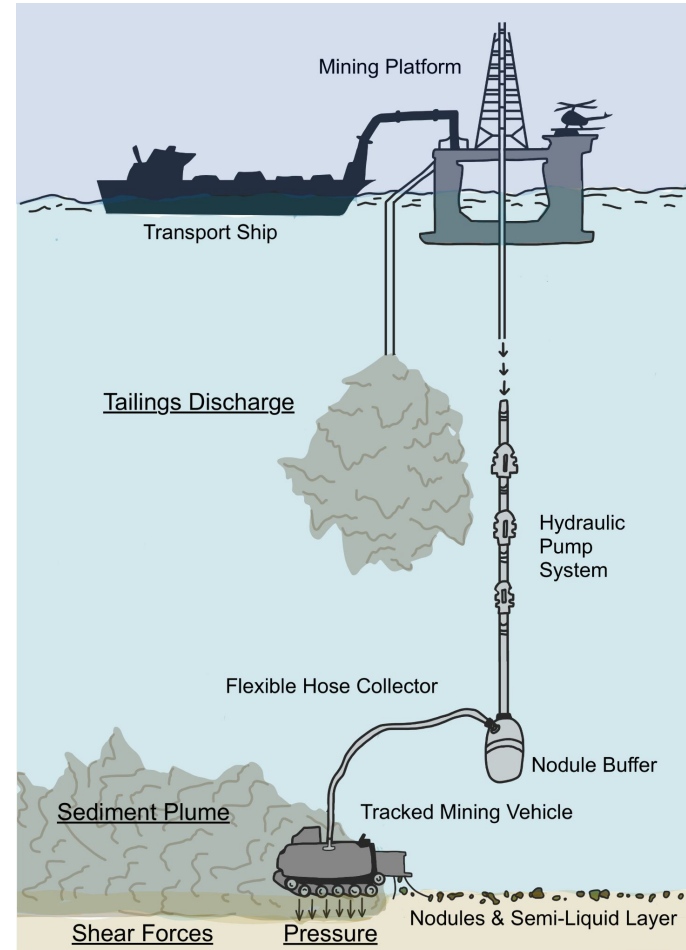






# Deep Sea Mining

Volcanogenic Massive Sulfide (VMS) Ore







**The End**