Core Stories Episode 1:
Recognizing Patterns In Earth's Climate History
Student Exercise

In this exercise, you will be asked to make observations about marine sediments. Cores of sediment are obtained by drilling into the seafloor by a scientific ocean drilling research vessel, the *JOIDES Resolution*. You will examine and describe images of sediment cores in this activity.

Materials Required:

- Drillhole Location Map
- Image of Core Section 303-1308A-6H-1
- Image of Core 303-1308A-6H
- Composite image of cores retrieved from Hole 1308A [need to find image source file]
- Glacial-Interglacial figure (source, image): Use this to guide the synthesis discussion of this exercise; it reflects the global climate evolution of the last 5 million years, as it is a measure of changes in global ice volume and deep-water temperature.

1. Use the Drillhole Location Map (Figure1) to describe the location around Hole 1308A (labeled U1308 on the map); you will be examining sediment cored at this location.

2. Using either the Mini-Core replica or the online photo (Figure 2) you should individually examine and make written observations of the core. Explore the image using the zoom and scroll tools, noting measurements at each point of interest you describe.

3. In small groups, compare your written descriptions and then formulate questions about the core. Based on your observations and discussions, create a hypothesis about what you believe has happened over time based within the core.

4. Using either a color copy of the core image (Figure 3), or the online equivalent, make additional observations about the complete core sample photo and compare and contrast the first core section with the second core record. Share your observations and questions.

5. Using either a color copy of the composite photo of all cores (Figure 4) the online equivalent, compare your observations between all three photos to draw conclusions about how Figures 2, 3, and 4 are related.

6. From these three images, use the pattern you collectively identified in Figure 2 to determine the placement of Figure 2 within Figure 3 and then within Figure 4. Draw a rectangle on Figure 4 that represents the core section depicted in Figure 3.

   The composite core sequence shown in Figure 4, extends from the seafloor down to a depth of ~350 meters below the seafloor. Scientists have used fossils in these same cores to convert sub-seafloor depth to geologic age. Based on these data we know that the sediments in Hole 1308A extend from today back to ~5.6 million years ago. Other data on changes in global ice volume and related global average temperatures for this same time span are shown in Figure 5.

7. Using the Glacial and Interglacial diagram (Figure 5) or the online equivalent, share observations and ideas to make connections between the core images and Figure 5.

   How might the observations you made about the changes in marine sediments (Figure 4) relate to the changes in ice volume and temperature shown in Figure 5? List your ideas.

8. Mark on Figure 4, where you think the onset of Northern Hemisphere glaciation is recorded in this sediment record and explain your reasoning.

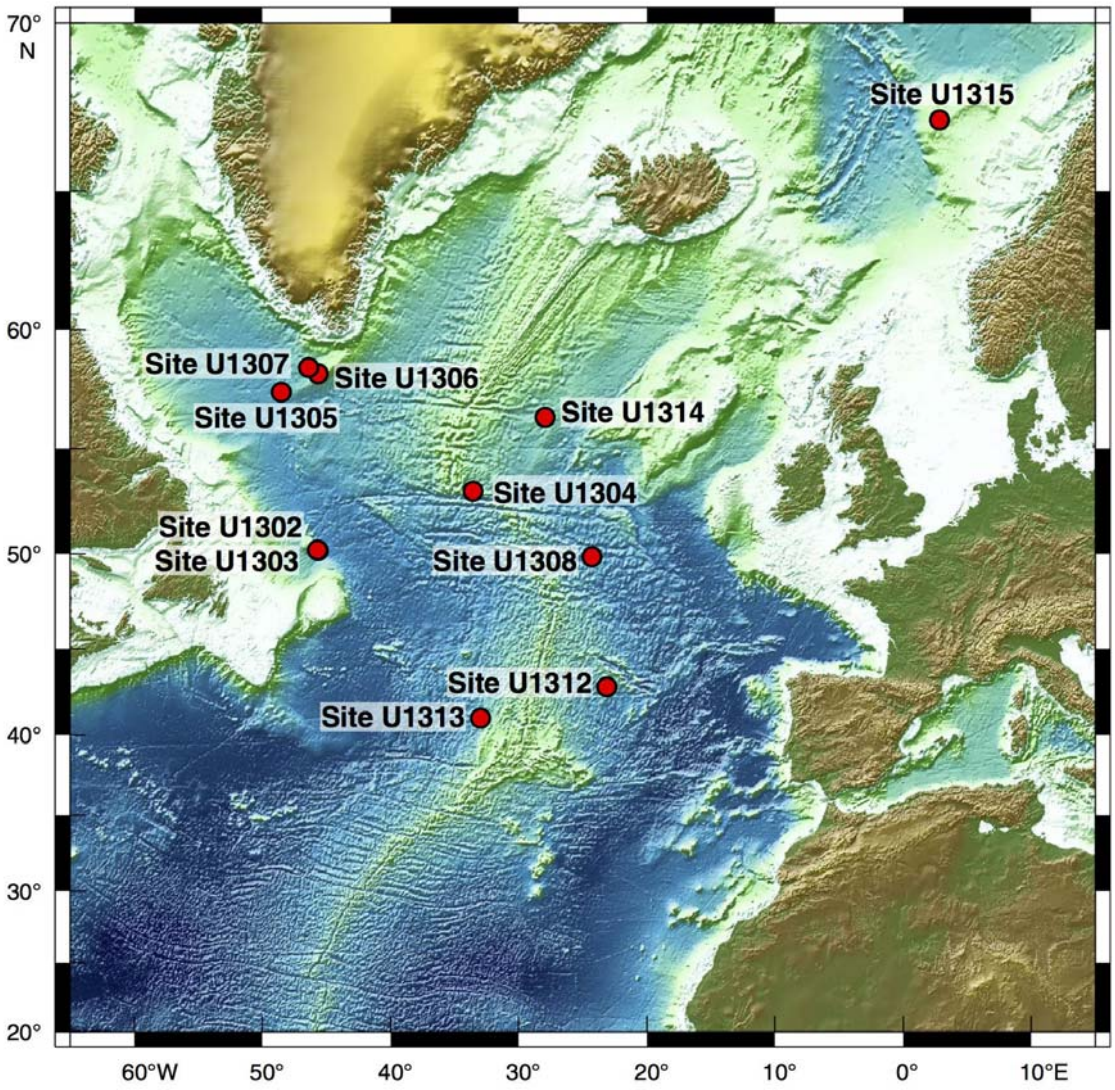

Figure 1: Map depicting the location of drilling location from the IODP Expedition 303/306 (source).

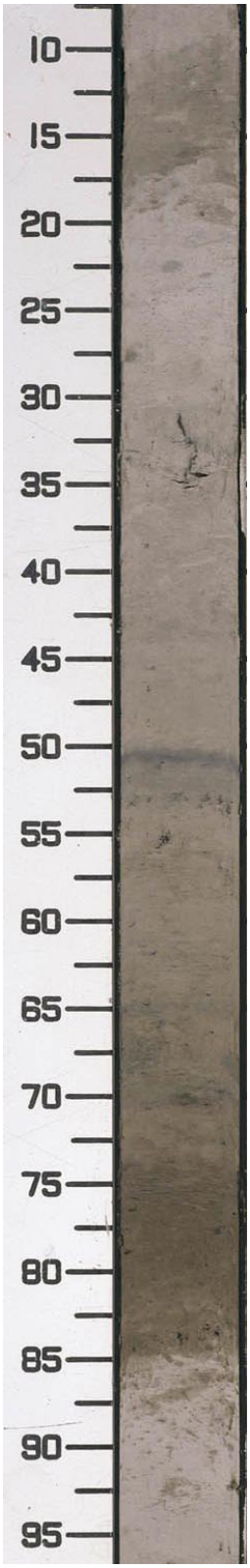

Figure 2: Photo showing part of a marine sediment core recovered from ~50 meters below the North Atlantic Ocean seafloor (source). For an online interactive core, please visit here.

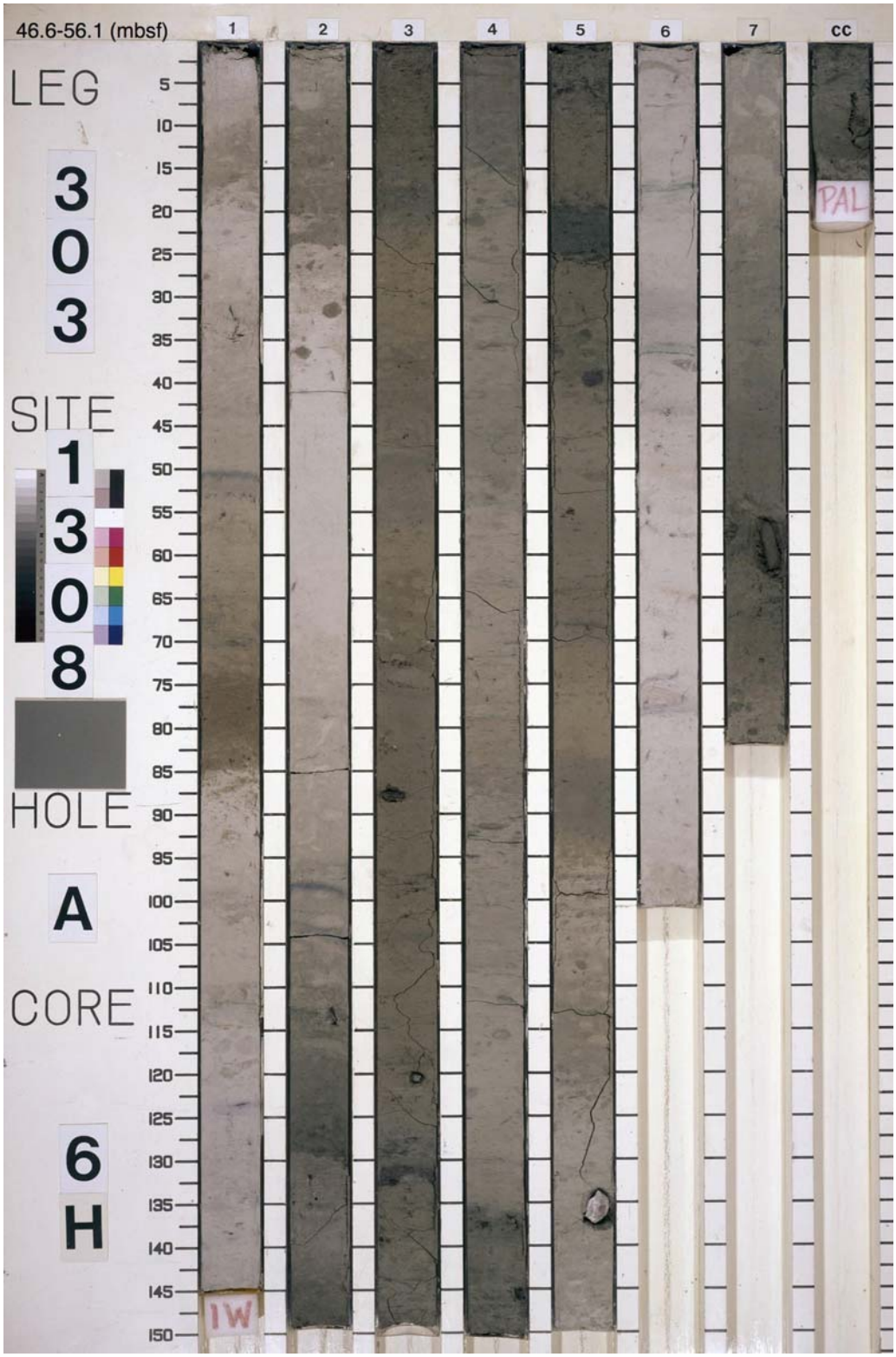

Figure 3: A composite image of 1.5 meter sections of sediment collected from 303-1308A-6H (source). Each 9.5 meter of core is cut into these 1.5 meter sections to facilitate research efforts and storage. For more information on core nomenclature please review this exercise. **Note**: The first section in this image (6H-1) is the same section provided in Figure 2.

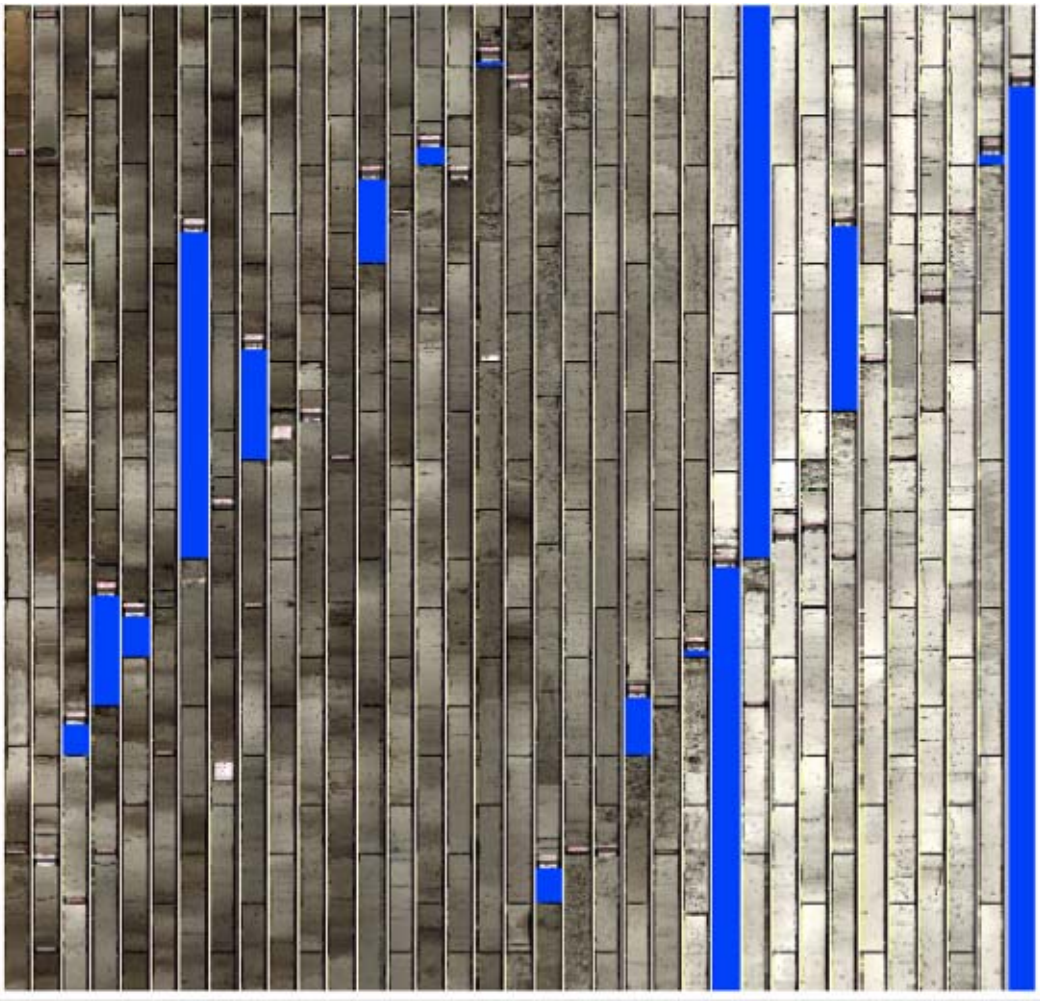

Figure 4: A composite image of all cores collected from 303-1308A-6H (source).

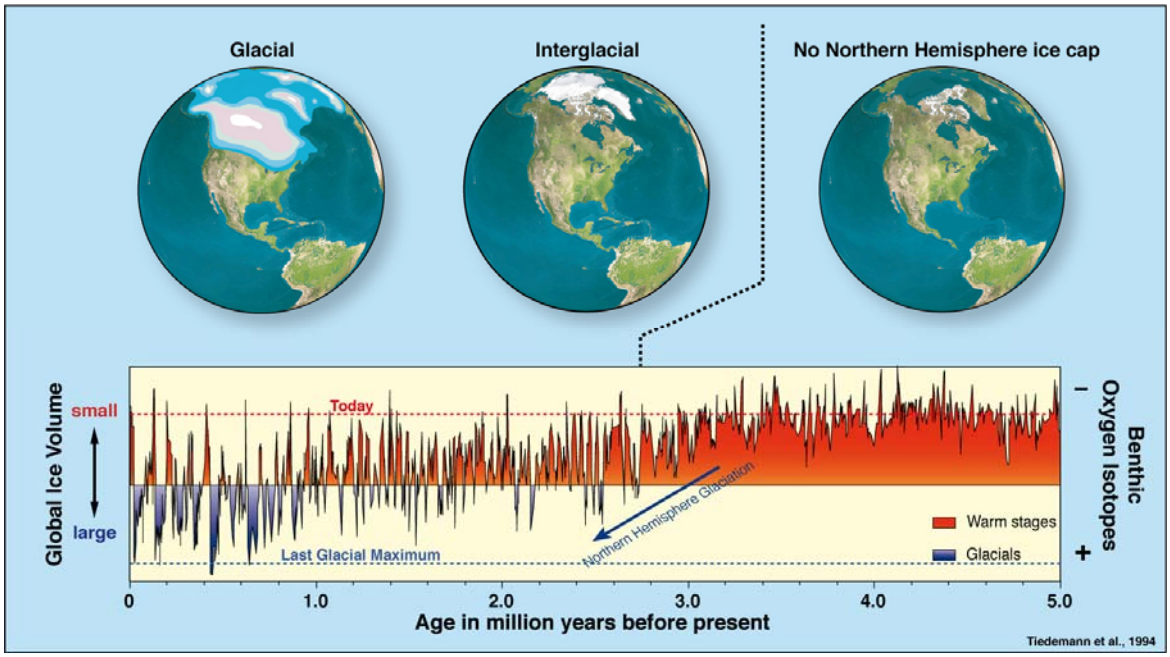

Figure 5: The benthic oxygen isotope curve reflects the global climate evolution of the last 5 million years, as it is a measure of changes in global ice volume and deep-water temperature. The Pliocene warm period from ~5 to ~3 million years ago is believed to hold clues for assessing future climate change. This time interval, with atmospheric CO2-concentrations close to modern ones, was significantly warmer than today. High-latitude sea surface temperatures were up to 7°C higher, the modern Northern Hemisphere ice cap over Greenland was absent, and the sea level was about 30 m higher than today. Hence, it represents a possible future climate scenario predicted by numerical models. The long-term increase in oxygen isotope values from ~3–2.5 million years ago marks the development of a permanent Northern Hemisphere ice cap with varying size. The last 3 million years are characterized by alternating glacial and interglacial climate stages, while glacial ice sheets reached their largest size during the last 700.000 years (source).