



# Using Image Data to Explore Paleoclimate

## Student Guide

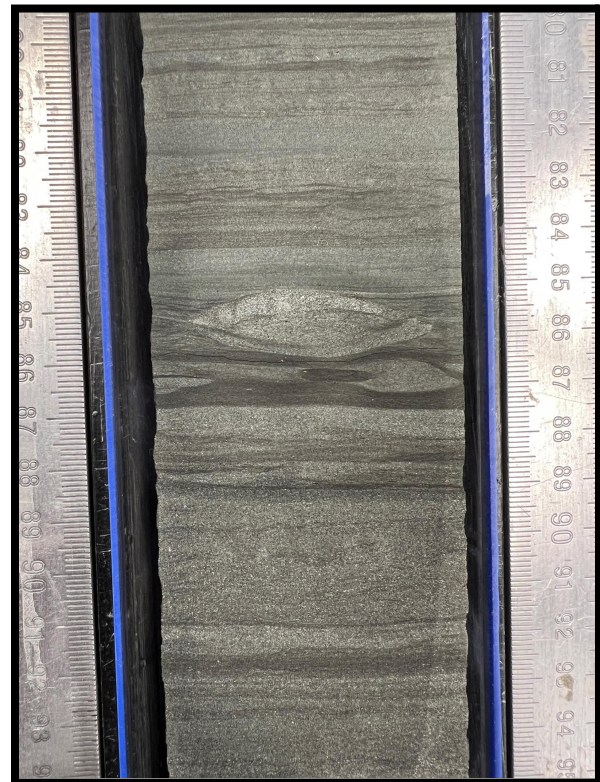
Credits: Jennifer Field, IODP Expedition 395, Reykjanes Mantle Convection and Climate

Name \_\_\_\_\_ Date \_\_\_\_\_

### Background

Scientific Ocean Drilling is used to retrieve cores of sediments and rocks from below the ocean. These cores can be used as snapshots of climate history. The images that are being used in this activity came from the JOIDES Resolution which is a scientific research vessel. To obtain these samples, a drill was sent down through more than two kilometers of the North Atlantic Ocean and into the ocean floor. A series of 10m cores from depths to 1300m was retrieved and examined; the cores for this activity were from approximately 50m to 300m in depth.

The images in this activity were analyzed by **micropaleontologists** for small fossils left from foraminifera. **Foraminifera** are zooplankton which float in the water column. There are many types of foraminifera, and each type is adapted to living in certain ocean environments. When they die, they sink to the bottom of the ocean and become buried in the sediment. By analyzing these fossils, micropaleontologists can determine whether the Earth was in a period of glaciation when the sediment layer was forming.

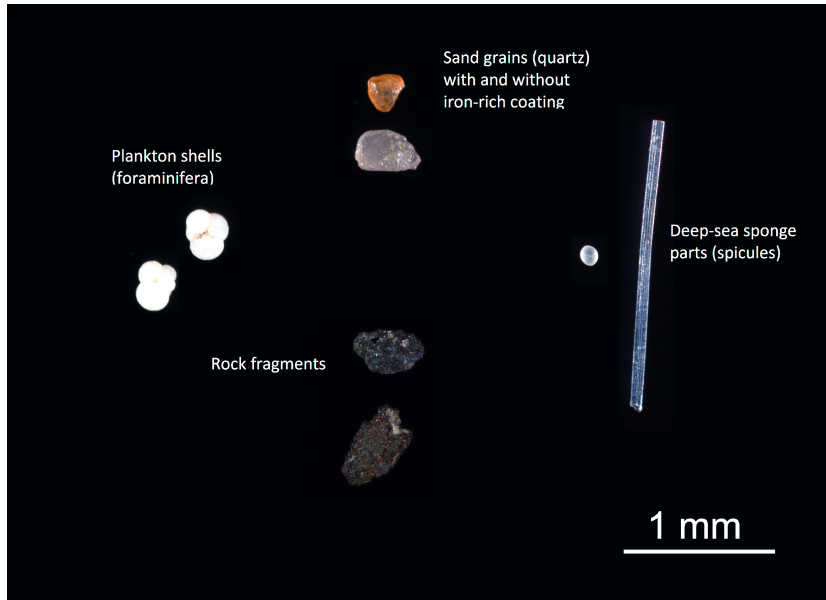


*Sediment core from IODP Expedition 395. This core shows sediment layers. Photo credit: Jennifer Field & IODP*


Another way to infer **glacial** and **interglacial** time periods is by using Carbon Dioxide data from ice cores. Atmospheric carbon dioxide levels change through time, with increasing levels of atmospheric CO<sub>2</sub> comes an increase of global temperature. These levels can be measured from hundreds of thousands of years ago by using data from ice cores. When ice forms and freezes, it traps some of the atmosphere inside. These pockets of gas can be used as time capsules to see how much CO<sub>2</sub> was in the ancient atmosphere. Marine microfossils and ice cores are called **climate proxies** because they help scientists extrapolate climate data using indirect measurements.

## PART I: Using Microfossil Images to Infer Paleoclimate

Use the key below to identify what is in the following images:



<p><b>Image 1</b> This material came from deep under the ocean floor. It was pulled up with a sediment core and washed through a sieve to clean it off.</p>	<p><b>Object(s) seen</b></p>	<p><b>% of total (approx.)</b></p>
<p><i>Photo Credit: Tiffany Liao &amp; IODP</i></p>		

<p><b>Image 2</b> This material came from deep under the ocean floor. It was pulled up with a sediment core and washed through a sieve to clean it off.</p>	<p><b>Object(s) seen</b></p>	<p><b>% of total (approx.)</b></p>
		
<p><i>Photo Credit: Tiffany Liao &amp; IODP</i></p>		

**Image 3** This material came from deep under the ocean floor. It was pulled up with a sediment core and washed through a sieve to clean it off.

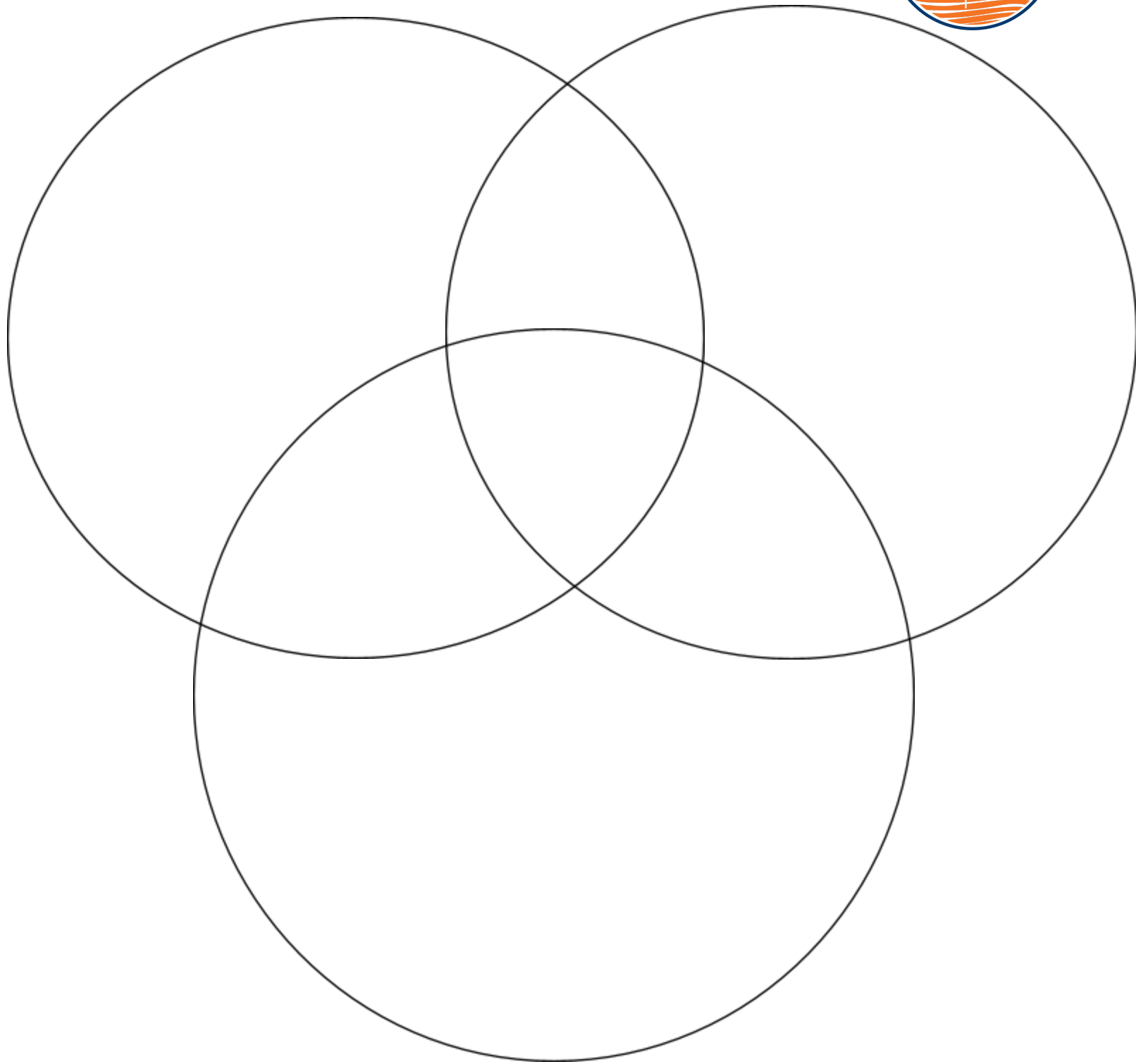


*Photo Credit: Tiffany Liao & IODP*

Object(s) seen	% of total (approx.)



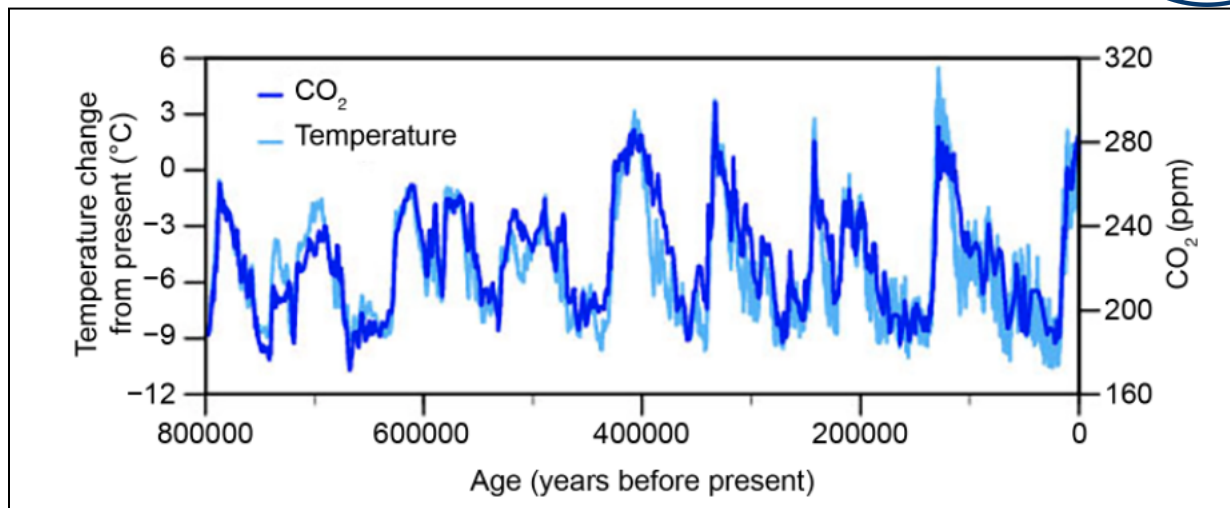
1. Use a Venn diagram to compare and contrast the three images:





## PART II: Glacial and Interglacial Periods in the Earth's History

Look at this graph of atmospheric CO<sub>2</sub> levels and temperature:



Temperature change (light blue) and Carbon Dioxide change (dark blue) measured from the EPICA Dome C ice core in Antarctica. (Jouzel et al. 2007; Luthi et al. 2008).

1. Describe the relationship between temperature and CO<sub>2</sub> levels in the atmosphere:
2. The cycles that are visible indicate the cycling of the Earth's Climate between glacial periods (when much of the poles and higher latitudes were covered in ice) and interglacial periods (when the poles and higher latitudes were mostly ice free). Label the glacial periods on the graph.
3. Is the Earth currently in a glacial or interglacial period? Explain your reasoning using the data from the graph.



### PART III: Putting in Together

1. Using what you know about paleoclimate proxies, label the graph with an arrow and 1, 2, & 3 at a time when you think these sediments could have been deposited.

### PART IV: Extension

Research another type of climate proxy. Create an infographic that explains this proxy and how it can tell scientists about paleoclimate. You should include:

- The definition of a climate proxy.
- Where/how your climate proxy is found.
- What information your climate proxy provides.
- An original image that relays the importance of the proxy you chose.