



Paleoclimate proxies, Part I: foram coiling direction activity

Background: Foraminiferids (“forams”) are unicellular organisms (“protists”) that are mostly planktonic, meaning that they float in the upper (sunlit) portions of the ocean water. They are heterotrophic – that is, they need to eat – and their food consists of phytoplankton they snag out of the water with leglike “pseudopods.” Forams have hard external skeletal material, like a snail has a shell. Technically, these skeletons are known as “tests.” They are made of calcite, CaCO_3 . Forams grow by adding new chambers to their tests, like we might add newer, bigger rooms to a house. Each chamber looks a bit like a bulb or a globe. Interestingly, when ocean water temperatures are cooler than 8° to 10° C, forams add these new chambers in a counterclockwise spiral (“left-coiling”). When temperatures are warmer than 8° to 10° C, they add their new chambers in a clockwise spiral (“right-coiling”). The coiling direction of fossil forams can therefore serve as an indication of ancient temperatures. We call this sort of evidence a “proxy” of paleotemperature. Proxies are not direct measurements of temperature, but they are evidence of ancient temperatures.

In this activity, you will calculate the proportions of left- and right-coiling individuals of one of the most common foram species, *Neogloboquadrina pachyderma*. The specimens were collected from seafloor sediment samples from different periods of time over the last 160,000 years. Your calculations will make a graph. Then you will interpret that graph to arrive at an interpretation of what Earth’s climate was doing during this interval of time.

Instructions: Use the Excel spreadsheet distributed by your instructor. Calculate the values needed to fill in the yellow columns. This will automatically draw a graph for you. Then examine the graph, and answer the following three questions. After you answer them, you will share your answers with the rest of the class.

Questions:

1. Which geological epochs are included in your study’s sampled time period? (Hint: <http://www.stratigraphy.org/upload/QuaternaryChart1.JPG>)
2. According to the coiling direction of the sampled forams, when was the temperature hotter? When was it colder?
3. What famous event was happening in Earth history during this interval of time?
4. According to this data set, when did that event end?
5. What questions do these data raise about paleoclimate? What additional information would you like?