

Brachiopods and Bivalves: paired shells, with different histories.

Goal: The purpose of this assignment is to compare the Phanerozoic history of two animal groups that are commonly confused with one another: the bivalves and the articulate brachiopods. Specific objectives include: recognizing the different stratigraphic histories of the two groups; comparing rates of change to absolute change; and placing the two groups in context of Evolutionary Faunas.

Brief Background: Although both animals lived primarily in seafloor environments and each were protected by a pair of shells (bi-valved), brachiopods and bivalves are otherwise very different, unrelated animals. Brachiopods are lophophorates, whereas bivalves are mollusks – these differences are shown by their soft-part anatomy, feeding mechanism, shell construction and musculature. Classical hypotheses on these two animals suggested that brachiopods were replaced by bivalves as the dominant bi-valved animal group; although more recent quantitative studies have called this assertion into question (e.g., Fraiser & Bottjer 2007, *Paleobiology* 33:397)

Eleven FossilPlot graphs will be needed for this assignment:

1. Plot the diversity, origination, and extinction curves for all bivalves (Cl. Bivalvia) using the DOX type graph, Count, Relative = Stage. Total: 3 graphs
2. Plot the diversity, origination, and extinction curves for all articulate brachiopods (Cl. Articulata) using the DOX type graph, Count, Relative = Stage. Total: 3 graphs
3. Plot the origination and extinction curves for all bivalves (Cl. Bivalvia) using the DOX type graph, Rate, Absolute = from 550 to 0 every 10 MY. Total: 2 graphs
4. Plot the origination and extinction curves for all articulate brachiopods (Cl. Articulata) using the DOX type graph, Rate, Absolute = from 550 to 0 every 10 MY. Total: 2 graphs
5. Plot the Sepkoski Curve as a measure of diversity, Relative = Stage. Total: 1 graph

**Note: If you need help understanding the timescales, especially in recognizing how Epochs relate to Periods, go to the Help/Glossary/Time Chart*

Part I.

- a) What is the overall visual trend of the diversity curve of brachiopods and bivalves through time?
- b) What time interval shows the greatest increase in diversity for the brachiopods and bivalves? How does this compare to the timing of greatest origination for the brachiopods and bivalves?
- c) What time interval shows the greatest decline in diversity for the brachiopods and bivalves? How does this compare to the timing of greatest extinction for the brachiopods and bivalves?
- d) Summarize the differences in the diversity curves between brachiopods and bivalves.

Part II.

- a) At what time is the origination rate of brachiopods and bivalves greatest? How does this compare with your answer to Question Ib.
- b) At what time is the extinction rate of brachiopods and bivalves greatest? How does this compare with your answer to Question Ic.

- c) Compare the magnitude of the origination and extinction rates of brachiopods to that of bivalves. Which of these two animal groups recorded the highest rate of origination? And which group recorded the highest rate of extinction?
- d) Looking at the full Phanerozoic histories of brachiopods and bivalves, summarize the differences in origination and extinction rates for these animals? Speculate on what this difference may tell us about the comparative evolution of bivalves and brachiopods.

Part III. *Note: The Sepkoski Curve is a stacked graph.*

- a) During what Periods of time is the Paleozoic evolutionary fauna most diverse, as compared to the Cm or Md faunas?
- b) During what Periods of time is the Modern evolutionary fauna most diverse, as compared to the Cm or Pz faunas?
- c) Compare the Sepkoski curve of diversity to the graphs you have made for the brachiopods and bivalves. Identify which animal group belongs to the Paleozoic (Pz) evolutionary fauna, and which belongs to the Modern (Md) evolutionary fauna.
- d) How well does the diversity pattern of the bivalves correspond to their evolutionary fauna? Similarly, how does the diversity pattern of the articulate brachiopods correspond to their evolutionary fauna? Are there discrepancies?
- e) Speculate on the potential significance (or differences) of the Pz and Md faunas based on your observations of the brachiopods and bivalves.