

## A PEEK AT THE PAST: Fossil Patterns, Gradualism, or Punctuated Equilibria?

Every now and then, paleontologists uncover what appears to be a complete series of fossils. They find batches of fossils which seem to represent a population of one species, living at one period of time, and showing a typical range of variation, but still clearly members of one species. As they search layers of sediment above and below, they find more fossil groups of what appear to be the same species.

As paleontologists study the entire series of fossils, they tend to find two kinds of patterns. Sometimes there appear to be slight shifts in the average features of the fossils over time, eventually becoming so different from the earliest form that they have to say a new species has formed. But with another series of fossils (may be a totally different kind of organism), they find very little difference for long periods of time, then, all of a sudden, they begin to find fossils similar to the earlier ones, but showing some striking differences, clearly a new species. Sometimes, in both cases, the original species continues to exist along with the new species, and sometimes the original species can no longer be found.

The purpose of this exercise is to reconstruct these patterns, compare and contrast them with each other, and arrive at some conclusions about what happens to the species over time. (The "fossils" in this study are imaginary, for easier analysis, but they do accurately represent what we find in the fossil record). One group of fossils represents the genus *Molluscaformis* (elongated, sausage shaped), the other represents the genus *Pedivarious* (short thick body, with thick black markings on it).

You will be provided with a collection of fossils representing one of these genera. You will also be provided with a two-page layout which shows the layers of sedimentary rock from which the fossils were taken (the "Stratigraphic Sequence"). Each layer ("Formation") is identified with a unique name, and an indication of how long it took to form (its "duration").

1. Place the two "Stratigraphic" sheets so that the title sheet is above the other, and the identical parts of their ends overlap perfectly.
2. Place the fossils in the "Fossil Sequence" column) according to the "Formation" from which they were taken. "Upper" means it was found in the upper (more recent) portion of that formation; "Lower" means it was found in the lower (older) portion of that formation. (The little numbers in parentheses indicate the number of fossils which are represented by that one "average" fossil shown).
3. Once all the fossils are arranged chronologically (from the oldest at the bottom, to the youngest near the top), start adjusting their horizontal positions (representing their overall morphology, or appearance of form). This usually works best if you place the lowest (oldest) fossil in the lower left corner of the work space column. If the next fossil above it is identical in appearance, place it directly above the first. If it appears slightly different, place it above and slightly to the right of the one below it. If there is a major difference in form (appearance), shift it even more to the right. Repeat this with each fossil as you move up the column.
4. If there appears to be two kinds of fossils at the same level, check the fossils further up, and look for a consistent pattern of change away from (different from) the lower sequence; locate those fossils further to the right. If the differences are very slight, show this with very slight shifts to the right. If they have major differences, shift them even more to the right.
5. Once you have your pattern developed, ask your teacher to check it. If it represents the arrangement described above, then diagram the pattern on the appropriate chart, using simple lines to represent the sequence of fossils through time. The result may look like a leaning branching tree, or it may look like a couple of vertical or near vertical lines.
6. Assign a proper species name to the original species, and to any other species which may have formed. You can invent the trivial part of the name, reflecting some unique feature of that species, e.g. "M. megawings". Print their names next to each somewhat vertical line on your chart. Use the form "M. species" or "P. species" in each case.
7. Answer the discussion questions for that particular genus.

Name \_\_\_\_\_ SN \_\_\_\_\_ Date \_\_\_\_\_ Per. \_\_\_\_\_

### A PEEK AT THE PAST: DISCUSSION

Molluscaformis Fossils (color: \_\_\_\_\_)

1. How would you describe these fossils generally through time (except for any "sudden" major change)?  
[ ] static (generally unchanging), or [ ] non static (gradually changing)?

2. Have any new species evolved? \_\_\_\_\_. If so, how many? \_\_\_\_\_. In which formation did it/they first appear?

3. Have any species apparently become extinct? \_\_\_\_\_. If so, which one(s)?  
(For each extinction, indicate in which formation its last fossils were found?)

4. Which pattern of evolution seems to be occurring here?  
[ ] "Gradualism", in which changes to new species are gradual, followed by continuous little changes, or  
[ ] "Punctuated Equilibrium", in which changes to new species appear to be sudden, followed by little or no change

5. Would you be likely to find any intermediate or transitional fossils if we searched more thoroughly in the formation just below the first appearance of changed fossils? \_\_\_\_\_ Why?

Pedivarious Fossils (color: \_\_\_\_\_)

1. How would you describe these fossils generally through time (except for any "sudden" major change)?  
[ ] static (generally unchanging), or [ ] non static (gradually changing)?

2. Have any new species evolved? \_\_\_\_\_. If so, how many? \_\_\_\_\_. In which formation did it/they first appear?

3. Have any species apparently become extinct? \_\_\_\_\_. If so, which one(s)?

(For each extinction, indicate in which formation its last fossils were found?)

4. Which pattern of evolution seems to be occurring here?  
[ ] "Gradualism", in which changes to new species are gradual, followed by continuous little changes, or  
[ ] "Punctuated Equilibrium", in which changes to new species appear to be sudden, followed by little or no change

5. Would you be likely to find any intermediate or transitional fossils if we searched more thoroughly in the formation just below the first appearance of changed fossils? \_\_\_\_\_ Why?