

MACRO-EVOLUTION

Patterns, Trends, and Rates of Change

Introduction:

An outcropping of rock has recently been exposed on Grand Bahama Island. Several layers (strata) of fossils have been exposed. The fossils, arranged in the same layers where they were found, have been replicated on a separate sheet of paper ("The Desktop Fossil Record"). The top layer (closest to the surface) is labeled #1 on your lab sheet. The layers are in order of position as they were found in the wild.

Materials:

Handouts, (and, if needed) scissors and colored pencils (5 different colors, one for each layer).

Student Objectives:

You should be able to develop a graph showing possible phylogenetic relationships over time of the organism known as Cerion (a land snail), and demonstrate its pattern of evolution as gradualism, or punctuated equilibria.

Procedure:

1. Work cooperatively in groups as assigned by your teacher. Be sure everyone has a part in each task. Give each member of your team a turn at placing shells. Look also for changes in the snails over time. Look for patterns and trends. Try to figure out if these changes were slow and gradual, or happened relatively fast. Discuss pros and cons of any difference of opinion encountered; try to reach consensus.

NOTE: If you are given an envelope labeled "Desktop Fossil Record: Shells", skip to step 4.

2. On the "Desktop Fossil Record" sheet, color the shells in each row a different color (e.g. red for layer #1 shells, blue for layer #2 shells, etc.)
3. Cut out each shell individually (as a small square, keeping the small letter next to each shell).
4. Place the shells in their appropriate layers on the Time/Morphology layout sheet (figure 1): only the first layer shells (top, or closest to the surface) should be placed in layer #1, at the top, and so on, for all layers.
5. Place similar-looking shells so that they tend to be more-or-less aligned in vertical columns, still keeping them in their assigned layers (where they were found). Their appearance is called their morphology, so you are shifting them horizontally according to their morphology.
6. Now for the final placement detail: study the shells in each vertical column. Starting at the bottom and moving up, layer by layer, give each shell a slight shift to left or right if it is a little different than the shell below it. Don't shift it at all if it's virtually identical; shift it more if there is a larger difference. You should begin to see a pattern of lines of shells, with some lines running almost vertically, and other lines at an angling up and to one side or the other. You may find that some lines of shells may show branching. That's ok.
7. On the special graph paper provided (Figure 2 Time/Morphology Graph), draw a few continuous lines to match the pattern of lines of shells as you arranged them on the layer diagram. Be sure to show branching lines if the pattern of shell types had branches.
8. From your graph, determine whether it shows gradual change, or abrupt changes alternating with little or no change (punctuated equilibria). See Figure 3 (Sample Graphs) for examples; these may be shown by your teacher on the overhead.

Assessment: (Answer on back, or during class discussion)

1. What do the lines on your graph represent?
2. What pattern do you see (if any) over time in the morphology of the shells left in the fossil record?
3. Does change take place over a relatively long or relatively short period of time?
4. Are there any intermediate or transitional forms between the dissimilar fossils? If so, in which layers?
5. Are there any periods of stability (little or no change) in the fossil record?