Relative Age-dating -- Discovery of Important Stratigraphic Principles

Example 1:

Four different rock units (layers of different rock types), labeled Y, S, P, and Q, are seen in a road cut, as shown schematically above:

1.) Are the rocks igneous, sedimentary, or metamorphic? (Which?)

2.) S and Q are the same kind of rock called ________________________________
   (Example: Granite, marble, limestone, etc.)

3.) Y is the rock type called ________________________________

4.) P is the rock type called ________________________________

   *(Think carefully about the simple classroom demonstration by your instructor of the deposition of sediments.)*

5.) Which rock layer in Example 1 above is oldest? ________________

6.) Which rock layer in Example 1 above is youngest? ________________

7.) List all four of the rock units of Example 1 in chronologic sequence, with the oldest on the bottom. (Geologists always order rock units and events with the oldest on the bottom and the youngest on the top.)

   ________________ Youngest
   ________________
   ________________
   ________________ Oldest

8.) This example illustrates one of the most fundamental and useful principles for relative age-dating of rocks.
   Describe and *invent a name* for the general principle useful in relative age-dating that is represented here:
Example 2:

Four different rock units (different rock types) are seen in a road cut and labeled T, N, L, R:

1.) Are the rocks igneous, sedimentary, or metamorphic?

2.) Give a more specific identification (name) for all of the layers:

   T __________________________
   N __________________________
   L __________________________
   R __________________________

   (Example: Granite, marble, limestone, etc.)

   (Think carefully about the simple classroom demonstration by your instructor of the deposition of sediments.)

3.) Do you think that when the layers in this example formed, they were already tilted?
   If not, when would the tilting (or deformation, a type of geologic event) have occurred, relative to their formation?

4.) Which rock layer is oldest? __________________

5.) Which rock layer is youngest? __________________

6.) List all four of the rock units in chronologic sequence, with the oldest on the bottom. (Geologists always order rock units and events with the oldest on the bottom and the youngest on the top.) Include "Deformation" in its correct chronologic position, relative to the rock layers T, N, L, and R.

   __________________ Youngest
   __________________
   __________________
   __________________ Oldest

7.) Describe and invent a name for the general principle (or principles) useful in relative age-dating represented by this example:
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Example 3a:
The Grand Canyon is a spectacular example of the erosive power of rivers. The Canyon stretches for almost 100 miles in northern Arizona, and is one mile deep in some places. The walls of the Grand Canyon exhibit an exceptionally well-exposed sequence of sedimentary rocks. These are extremely useful when illustrating the remarkable geologic history of the Colorado Plateau, as well as various stratigraphic principles and geologic history in general.

Note in the cross section of the Grand Canyon, on the next page, that similar rocks (same age, thickness, and rock type) can be seen on both the North Rim and the South Rim, with a very large gap (many miles wide) in between.

1.) What used to be where the gap is now?

2.) What, in general, caused the gap to form?

Example 3b:
Now, consider another example, closer to home (a thought experiment):
You are driving in the Hill Country, heading NW along Interstate 10, just west of San Antonio. As you zoom along, you notice a very distinct sequence of sedimentary rocks on your right (East). You glance to the rocky roadcut on the left (West) side of the highway and quickly note the same distinctive sequence of rocks.

3.) What used to be where the large highway road cut (you are driving through) is now?

4.) What, in general, caused the gap (road cut) to form?

5.) Describe and invent a name for the general principle useful in relative age-dating represented by these two examples:
(Hint: What could you infer about the rocks on the North Rim of the Grand Canyon if you only knew details about the South Rim rocks, such as age, thickness, and rock type of the various layers?)
### DIAGRAMMATIC CROSS SECTION OF THE GRAND CANYON

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<td>PERMIAN</td>
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<td>Zoroaster Granite</td>
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Denver.

Precambrian.

Permiian.

Colorado River.

Tonto Platform.
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Example 4a:
Two different rock units (of different rock types) are seen in a road cut:

1.) Describe what you see:

2.) What kind of rock is represented by Z? _______________________
   (Example: Granite, marble, limestone, etc.)

3.) What kind of rock is represented by R? _______________________

4.) What kind of rock are the small pieces? _______________________

5.) What do you think is represented by the uneven line of contact between the two different rock types?

6.) Would your thoughts change if you examined this contact and were able to detect a thin layer of shale exactly at the contact, and realized it was probably an ancient soil layer?

Example 4b:
The two examples below show the same general rule for relative age relationships as illustrated by Example 4a above:

1. Example 1 is very similar to the Example 4a above. The contact between the two different rock types exhibits an ancient, well-preserved soil layer.

2. Example 2 shows an igneous intrusion that has intruded up and into overlying layers of shale.

7.) Describe and invent a name for the general principle useful in relative age-dating that is represented by these examples:
   (Hint: Consider, in particular, the relative age of the small pieces of rock that appear to be included within a different rock type in all of the examples.)
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Example 5a:

Two different rock units (of different rock type) are seen in a road cut:

1.) The rock unit labeled 'A' is a type of sedimentary rock called ____________________________.

2.) The rock unit labeled 'B' is an igneous intrusion ____________________________ (it cuts across overlying layers).

3.) Describe what you see:

4.) Which rock unit, A or B, is older? ____________________________

5.) Why?

Example 5b:

In this next example, there are three kinds of sedimentary rocks:

6.) ____________________________ . (rock type)

7.) ____________________________ . (rock type)

8.) ____________________________ . (rock type)

9.) What kind of geologic feature curves from the top of the diagram to the bottom?

10.) What are the relative ages of the rocks compared to this feature?

11.) Why?

12.) These two examples illustrate one of the most fundamental and useful principles for relative age-dating. Describe and invent a name for the general principle that is represented by both Example 5a and 5b: