

Name: _____ Grade ____/100 (+2 bonus) Percent: _____

GY 112L Lab Assignment 6

Biostratigraphy and Foraminifera

Note: We want you to become familiar with these beasties and one of the most effective ways to do this is to draw them. In this lab, you will be asked for the first time to draw one of the fossil specimens. We know that most of you are not art majors, nevertheless, we ask that you try to do the best job that you can. Use pencil, add shading where possible, and add scales (You will be told about this in class). Part of your mark will be based upon quality. Also, please try to label significant features of the beasties you draw. Google “foraminifera” if you want reference help.



Part One

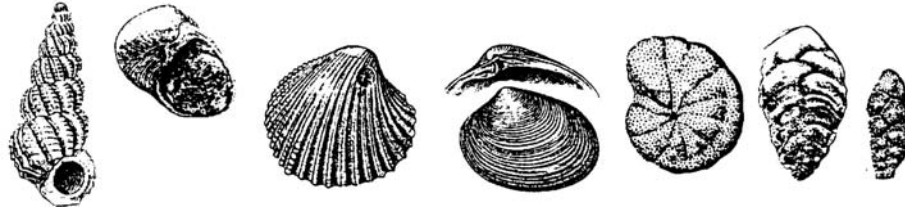
The Problem: You are a budding young geologist and have spent an entire summer field session examining (in detail) several Tertiary-aged outcrops in western Nevada. In total you measured 6 sections (Good Job!). They were spectacular cycles of sandstone and shale with lesser amounts of siltstone and volcanic ash. Everything was unconformably underlain by Cretaceous-aged limestone.

Unfortunately, the outcrops were many miles apart, and as is frequently the case, you were left unsure about lateral correlations between sections. You realize that different lithologies can come and go due to facies changes, pinch outs, unconformities etc. So you decide to hire a pseudo-paleontologist to help you sort out the stratigraphy. (The person you hire is really a biologist pretending to be a real scientist, but luckily for you, this person actually knows something about Tertiary fossils). You admit defeat and opt to correlate the rock layers with the help of biostratigraphy.

The paleontologist that you hired collected samples from many locations at each section. Fortunately, there were only 3 different types of fossils (bivalves, gastropods and foraminifera) and only 6 or 7 different species of each. In another area, you might have seen many hundreds of different fossils. The beasties that the pseudo-paleontologist found are listed in Table 6-1.

Just when you thought things were starting to take a turn for the better, disaster! The pseudo-paleontologist was offered a much more lucrative job than he was used to as a biologist (a greeter at the nearest Walmart) and leaves your employment before helping you to do the biostratigraphic correlation. So you are now on your own. However, being the clever geologist that you are, you stole all of his notes (and his wallet) before he left your employment. You have everything you need to do the correlation (and money for popcorn).

Table 6-1: Fossils found in your sections by the paleontologist/biologist.



Gastropods	Bivalves	Foraminifera
0 <i>Yokelthoe lei</i>	7 <i>Eumaricia plana</i>	14 <i>Sebastiana dabossus</i>
1 <i>Pelicaria convexa</i>	8 <i>Meghani lenora</i>	15 <i>Uvigerina maynei</i>
2 <i>Pelicaria acuminata</i>	9 <i>Tawera spissa</i>	16 <i>Ammonia beccarii</i>
3 <i>Taniella sp.</i>	10 <i>Stephaniae capellea</i>	17 <i>Virgulopsis davisae</i>
4 <i>Alcithoe mariea</i>	11 <i>Clarki miniae</i>	18 <i>Anomalinoidea sp.</i>
5 <i>Cominella hamiltoni</i>	12 <i>Ostrea sp.</i>	19 <i>Lauria quinni</i>
6 <i>Charlynia girlyi</i>	13 <i>Jasonella hurelli</i>	20 <i>Allisani davidania</i>

The Data: The pseudo-paleontologist examined fossils from several levels in each section. He identified which beasts were in each site via number (e.g., #1 refers to the gastropod *Pelicaria convexa*, # 10 to the bivalve *Stephaniae capellea* etc.). In addition, you have background data about the age ranges and water depths for each of the beasts that the paleontologist identified. An ash bed that occurs near the top of the section has been radiometrically dated and serves as the **datum** by which the sections are tentatively correlated. Think you can complete the correlation? Just remember that not all fossils were **cosmopolitan**. Some lived in different environments (e.g., shallower water) than others. Take this into account when you are correlating rock units. Figure 6-4 shows a sample biostratigraphic correlation. Your section will be different, but it might give you a bit of guidance to finish it.

Table 6-2: Fossil content at each section. See columns for locations of each site.

Site	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6
A	0,15,19	Barren	Barren	Barren	Barren	Barren
B	1,2,15,20	11,17,20	0,8,11,17	8,11,13,17	0,8,11,13	4,8,10,13
C	1,3,14,19,20	0,2,4,15	4,8,10,17	0,2,4,13	0,4,8,10	2,3,9,10
D	2,10,14,19	1,13,15,19	0,2,4,15	2,13,19	0,2,4,10	2,3,7,9
E	3,18,20	1,3,14,19	1,2,13,19	1,2,3,19	1,2,13,19	2,7,9,12
F	2,12,14,18	14,19,20	1,2,3,19	2,3,10,19	2,3,10,19	5,7,9
G	5,9,16,18	3,14,18,20	3,10,14	2,3,7,9	2,3,7,9	
H	6,12,16,18	12,14,18	2,10, 14	2,12,14	2,12,18	
I		5,9,16,18	2,3,7,20	5,7,9,16	2,7,9,12	
J		5,9,16	2,12,18	5,6,16	5,7,9,12	
K		5,6,16,18	5,7, 9,18			
L			5,6,7,18			

BARREN: no fossils

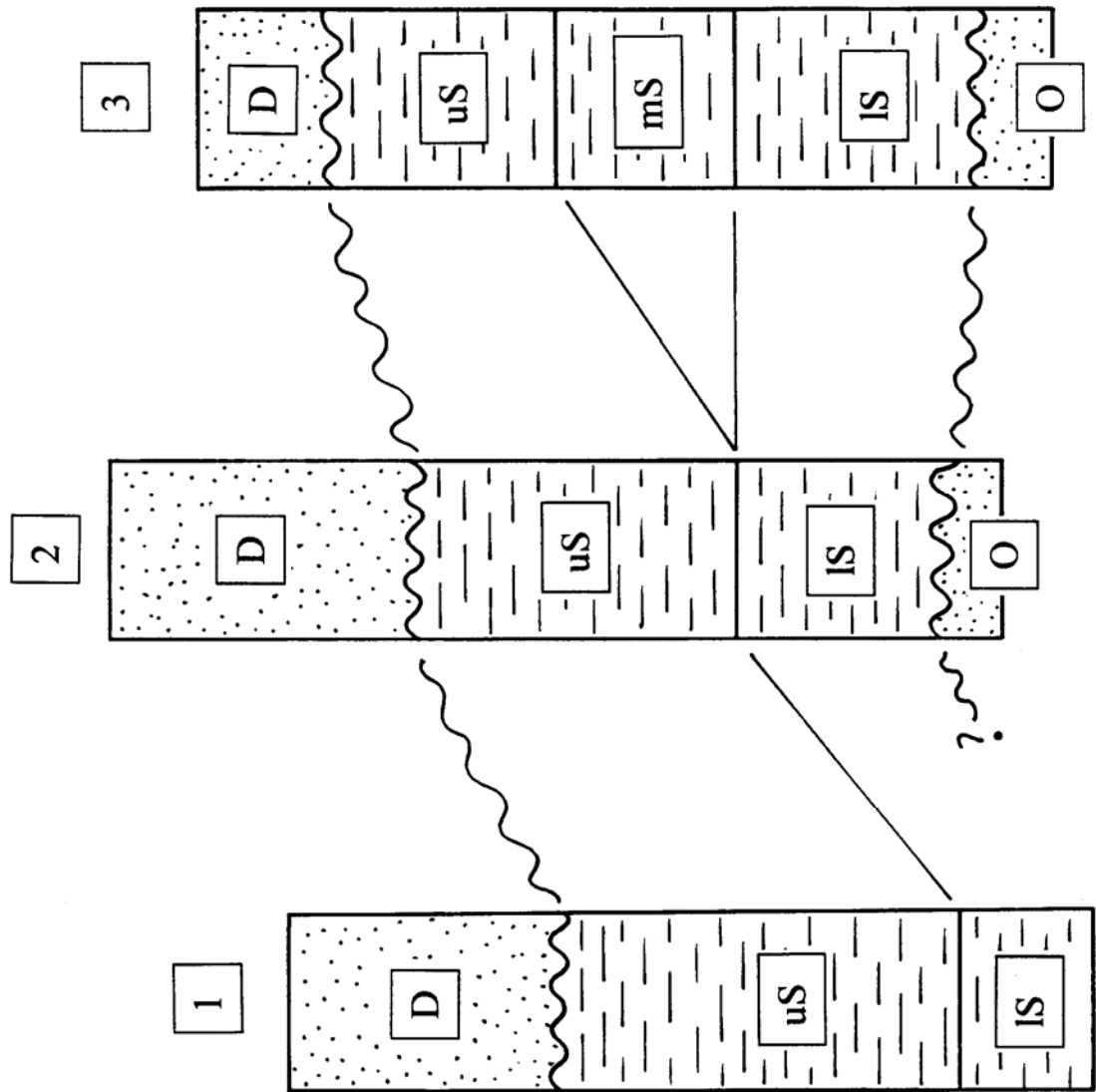
Table 6-3: Depth and age data of fossil species as provided by the Paleontologist.
(u) - upper; (l) – lower

Gastropods	Age	Depth*
0 <i>Yokelthoe lei</i>	Cretaceous – (l) Eocene	75 – 150 m
1 <i>Pelicaria convexa</i>	(u) Eocene- (l) Oligocene	100 - 200 m
2 <i>Pelecaria acuminata</i>	Eocene - Miocene	25 – 200 m
3 <i>Taniella sp.</i>	Oligocene- Miocene	25 -100 m
4 <i>Alcithoe mariea</i>	(u) Paleocene-Eocene	25 - 200 m
5 <i>Cominella hamiltoni</i>	Pliocene-Pleistocene	25 - 100 m
6 <i>Charlynia girlyi</i>	(u) Pliocene - Pleistocene	75 - 150 m

Bivalves	Age	Depth*
7 <i>Eumaricia plana</i>	Miocene - Pliocene	0 - 25 m
8 <i>Meghani lenora</i>	Paleocene	75 – 150 m
9 <i>Tawera spissa</i>	(u) Oligocene- Pliocene	0 - 50 m
10 <i>Stephaniae capellea</i>	(u) Paleocene -Oligocene	25 – 100 m
11 <i>Clarki miniae</i>	(l) Paleocene	150 – 200 m
12 <i>Ostrea sp.</i>	(u) Miocene-Pleistocene	25 – 200 m
13 <i>Jasonella hurelli</i>	Paleocene-Eocene	25 – 200 m

Foraminifera	Age	Depth*
14 <i>Sebastiana dabossus</i>	Oligocene-Miocene	75 – 150 m
15 <i>Uvigerina maynei</i>	Eocene	150 – 500 m
16 <i>Ammonia beccarii</i>	Pliocene	25 – 2000 m
17 <i>Virgulopsis davisae</i>	Paleocene	100 – 500 m
18 <i>Anomalinoides sp.</i>	Miocene-Pliocene	25 – 200 m
19 <i>Lauria quinni</i>	Eocene-Oligocene	25 –100 m
20 <i>Allisani davidania</i>	Paleocene- Miocene	25 – 200 m

* Most common range of depth. Occasionally, some organisms may be found in shallower and/or deeper water environments.



Legend
 D- Devonian
 uS- upper Silurian
 mS- middle Silurian
 IS- lower Silurian
 O- Ordovician

Figure 6-4:
 Sample correlation of sedimentary units on the basis of ages determined through biostratigraphy. Although the Silurian-aged strata are all the same lithology (shale), it is still possible to trace distinct units on the basis of ages. Note that the middle Silurian shale bed pinches out between sections 2 and 3.

Exercise 1: Here is where you start to earn your points for this laboratory assignment. The first thing you need to do is to establish the age ranges of each of the gastropods, bivalves and foraminifera found in the rocks. To do this, fill in the appropriate field in Tables 6-4, 6-5 and 6-6 below. I have done *Cominella hamiltoni* (gastropod #5) for you as an example.

Table 6-4: Age ranges of gastropods found in the stratigraphic sections [5 points]

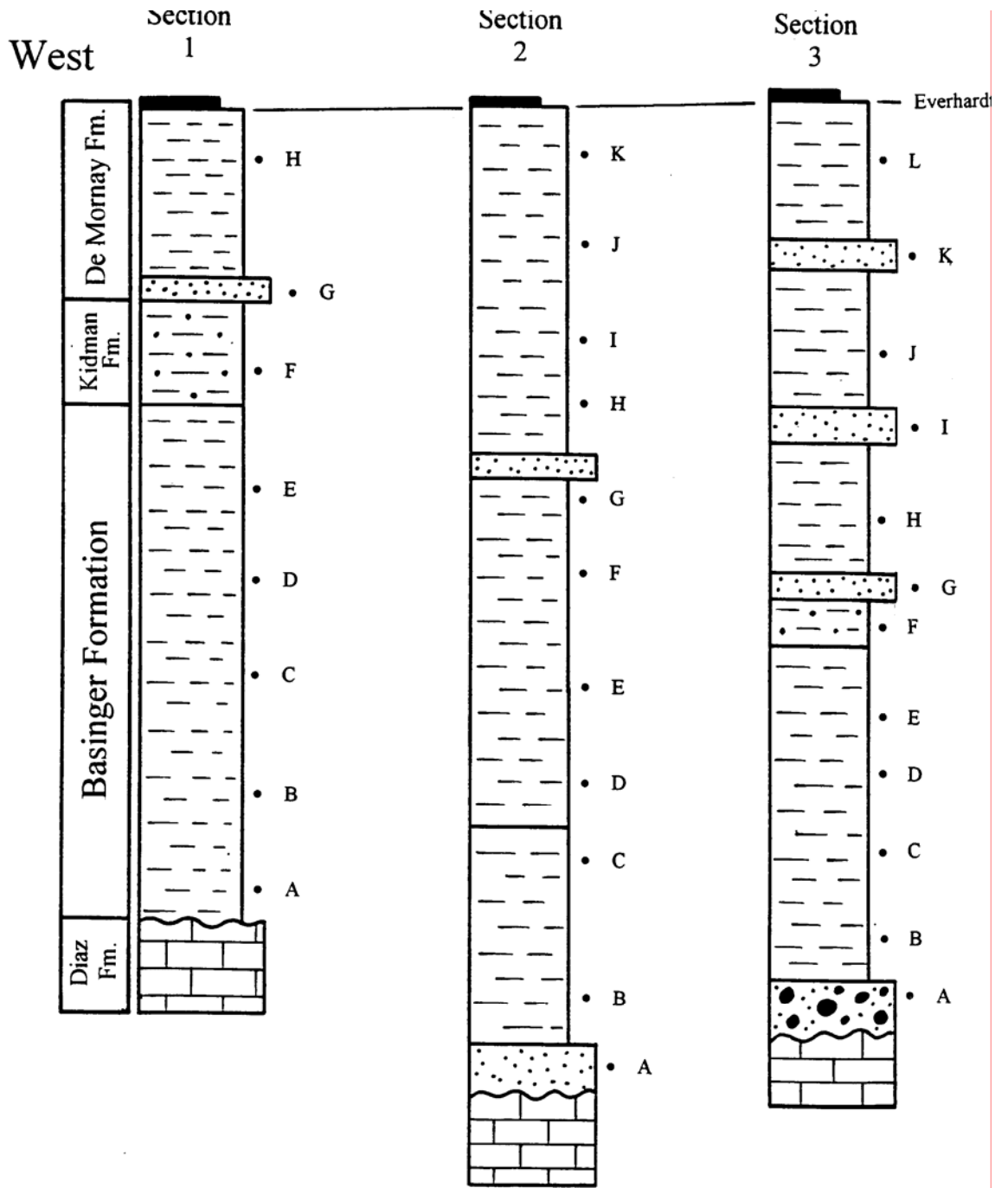
Gastropods	Tertiary				
	Paleocene	Eocene	Oligocene	Miocene	Pliocene
0 <i>Yokelthoe lei</i>					
1 <i>Pelicaria convexa</i>					
2 <i>Pelecaria acuminata</i>					
3 <i>Taniella sp.</i>					
4 <i>Alcithoe mariea</i>					
5 <i>Cominella hamiltoni</i>					
6 <i>Charlynia girlyi</i>					

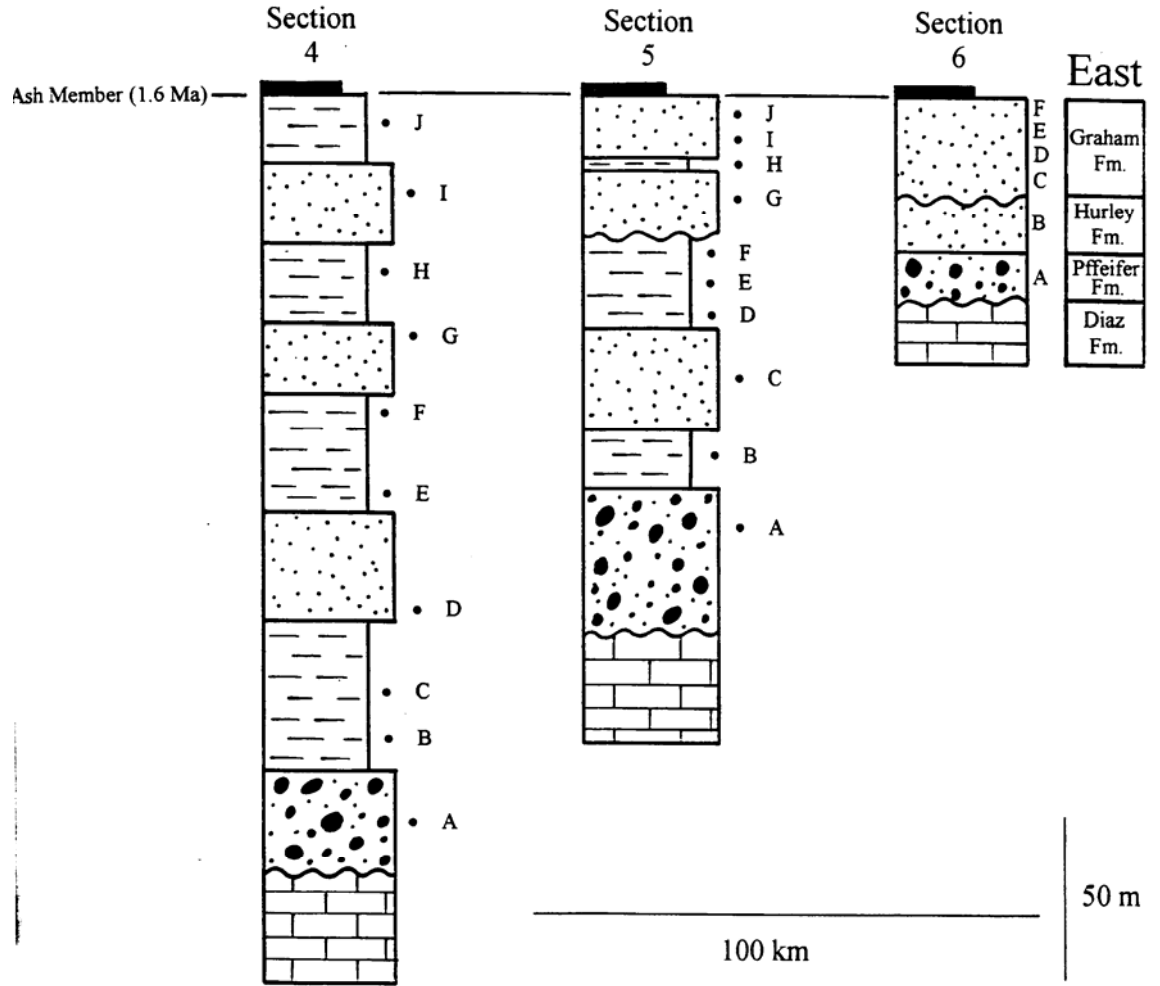
Table 6-5: Age ranges of bivalves found in the stratigraphic sections [5 points]

Bivalves	Tertiary				
	Paleocene	Eocene	Oligocene	Miocene	Pliocene
7 <i>Eumaricia plana</i>					
8 <i>Meghani lenora</i>					
9 <i>Tawera spissa</i>					
10 <i>Stephaniae capellea</i>					
11 <i>Clarki miniae</i>					
12 <i>Ostrea sp.</i>					
13 <i>Jasonella hurelli</i>					

Table 6-6: Age ranges of foraminifera found in the stratigraphic sections [5 points]

Foraminifera	Tertiary				
	Paleocene	Eocene	Oligocene	Miocene	Pliocene
14 <i>Sebastiana dabossus</i>					
15 <i>Uvigerina maynei</i>					
16 <i>Ammonia beccarii</i>					
17 <i>Virgulopsis davisae</i>					
18 <i>Anomalinoides sp.</i>					
19 <i>Lauria quinni</i>					
20 <i>Allisani davidania</i>					





Lithology			
	Lithic Sandstone		Conglomerate
	Shale		Limestone
	Volcanic Ash		Siltstone

Exercise 2: Now that you have established the age range of the various beasts in your sections, it's time to use these data to establish the biostratigraphy of the strata. The fold out in this chapter shows the locations of all of the samples in each of the sections. Using the age range data in Tables 6-4, 6-5, and 6-6, determine the age of each sample site and then correlate the major epoch boundaries from section to section. [50 points]

Short Answer Questions: Once you have completed the correlations, answer the following short written questions about your interpretation.

1) What happens to the Pfeifer Formation from east to west?

_____ [2 points]

2) What happens to the Eocene aged strata from east to west?

_____ [2 points]

3) Paleo-water depths can also be determined from fossil data, but it is trickier because you frequently get mixtures of shallow water pelagic beasts and deeper water benthic beasts (or visa versa). Some beasts also live over very wide depth ranges. Despite these limitations, useful data can often be obtained. In the data you have here, fossils 1, 11, 15 and 17 are generally found in deeper water (>100m) while fossils 7 and 9 are found in shallower water (<50m). Given their distribution in the sections studied, were the sandstones deposited in deeper or shallower water than the shales?

_____ [5 points]

4) Was the paleoshoreline to the east or west of the sections?

_____ [2 points]

5) For what reason(s) can you conclude this? (refers to question 4)

_____ [3 points]

Part 2: Phylum Protozoa.

Specimen 6-1a: *Tricities* sp. (a Fusulinid foraminifera; Penn – Perm).

Specimen 6-1b: Various modern foraminifera.

Note: Both beasts are best viewed under a binocular microscope or with your hand lens.

Fusulinids are important Paleozoic animals. To which class do they belong?

_____ [1 point]

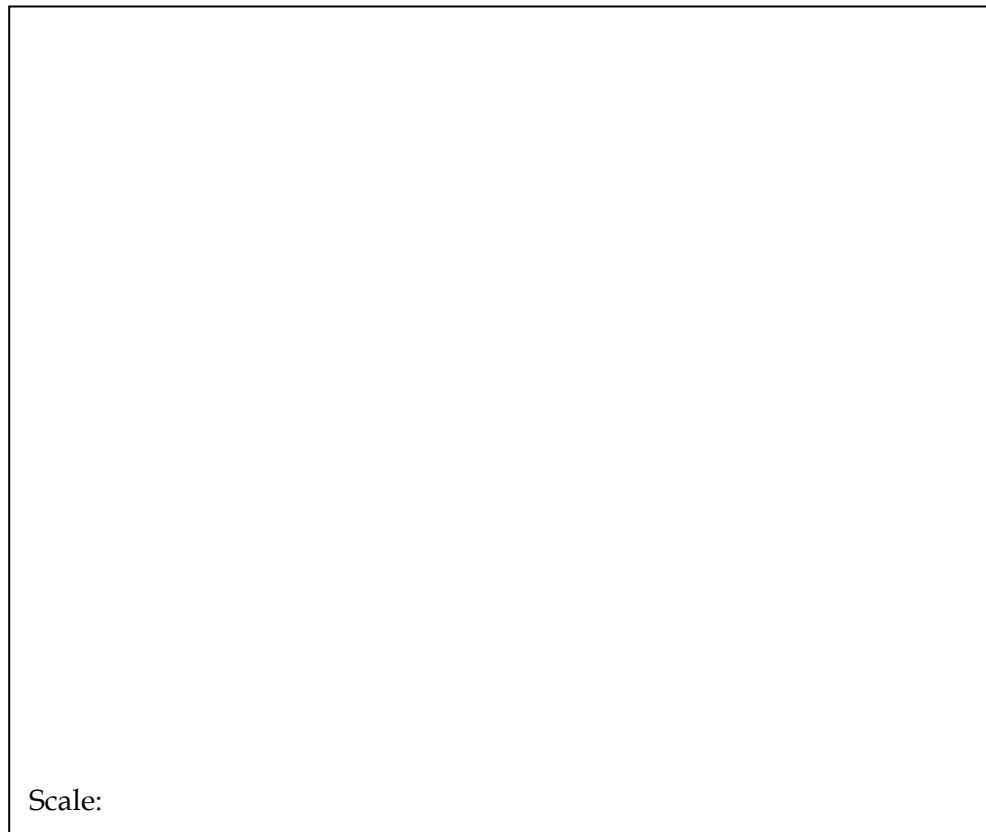
In what way(s) do the foraminifera differ from other fossils that you have seen so far in this class?

[5 points]

Why are forams useful in paleogeographic reconstructions? _____

[5 points]

Draw a representative example of a single fusulinid foraminifera or a single modern foraminifera **[10 points]**



Scale:

