Earth's Tectonic Evolution

Spring, 19xx
Geology 230:
Test # 3

Name:______________________________

Date:______________________________

Time Begun:_______ Time Ended:_______

Rules for All Lecture Tests

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☺ You have a several day period in which to take this test. You may take it any time during that several day period. The days available will be announced in lecture.

☹ You may *not peek* at these questions in any way until just at the moment you are ready to take the test.

☺ The test will probably take more than 50 minutes, but you must take the whole test *in one sitting.* Pit stops are allowed. There are no time limits.

☺ You must sit and *work alone* while taking the test.

☺ When you sit down to take the test you may have only the following items:
- ☺ The test paper and scantron card.
- ☺ Any writing instruments [rulers, colored pencils, etc.] you need to write your answers.
- ☺ Any refreshments you require for the duration.

☹ Once you have taken the test you are expressly forbidden talk about it in any way, shape, or form with anyone else, except me, until everyone has finished taking the test.

HONOR: Scientific and Personal

Science and honesty must go hand in hand. Science is the search for a true understanding of the universe, not what we wish it to be, or need it to be. But the universe is complex and for all our success science has had to struggle mightily to learn what it has. Dishonesty thus is very detrimental. Not only does it deliberately lead us down the wrong path, actions taken on the basis of that false knowledge can be deadly. Besides good ideas are hard enough to discover even when struggling honestly.

Personal dishonesty is also detrimental. Dishonesty in science, when discovered, destroys a career, and ruins a reputation. And dishonesty is always discovered because science's goal is to uncover false ideas.

Because each of you take this test individually, and without supervision, whether you cheat or are honest is your very personal and private responsibility. Not cheating means no notes, and not talking with anyone until everyone has finished the test - following the spirit of the law rather than just the letter. Putting your name at the top of the test page is equivalent to signing the James Madison University Honor Pledge.

Total points _210_

Test score _____

Grade/12 point scale _____

Name:____________________

Date:____________________

Geology 230 - Evolution of the Earth - Test # 3

Earth s Tectonic Evolution

L. S. Fichter - James Madison University

INSTRUCTIONS:

SCANTRON PORTION

- ☞ ***Write your social security number on the Scantron card.***
- ☞ Most of the questions are True/False or Multiple Choice
- ☞ Multiple choice questions may have 3, 4, 5, or as many as 20 choices. When there are more than 5 choices they are distributed among more than one question number; for example, a question may have 20 choices with choices 1-5 in question 12, choices 6-10 in question 13, etc.
- ☞ Different questions may have different values, as indicated with each set of questions.
- ☞ Drawing, diagrams, figures required for certain questions are often at the back of the test. You may pull that sheet off to make it easier to answer questions.
- ☞ Observe that on some of the questions the scoring will be "rights minus wrongs." Such questions are labeled. That is, you get points for a right answer, zero for no answer, and a negative score for wrong answers. Don't guess!
- ☞ Wrong spellings are not part of the test. I do not deliberately make minor errors, or try to be confusing or ambiguous. If something seems strange assume it is an honest mistake and answer the question as best you can.
- ☞ However, questions may be subtle and complex, read them carefully.

PLATE TECTONIC THEORY

RIGHTS MINUS WRONGS MULTIPLE CHOICE QUESTIONS: 3 point each; 21 points total:

At the back is a cross section labeled **Plate Boundaries and Relationships . . .** Below is a list of 15 features that could be found on that cross section. For the questions below Identify the ***one most appropriate name*** that corresponds to the lettered features on the cross section.

Names to choose from to identify features on cross section (This same list is with the illustration at the back)		
1A - Backarc basin 1B - Collision orogeny 1C - Convergent plate boundary 1D - Cordilleran orogeny 1E - Craton	2A - Divergent continental margin 2B - Divergent plate boundary 2C - Foreland 2D - Hinterland 2E - Island (volcanic) arc orogeny	3A - Melange 3B - Remnant ocean basin 3C - Rift plate boundary 3D - Suture zone 3E - Transform boundary

Feature A on the cross section is identified by which ***ONE*** of the terms.

1. 1A, 1B, 1C, 1D, 1E
2. 2A, 2B, 2C, 2D, 2E
3. 3A, 3B, 3C, 3D, 3E

Feature F on the cross section is identified by which ***ONE*** of the terms.

4. 1A, 1B, 1C, 1D, 1E
5. 2A, 2B, 2C, 2D, 2E
6. 3A, 3B, 3C, 3D, 3E

Feature D on the cross section is identified by which ***ONE*** of the terms.

7. 1A, 1B, 1C, 1D, 1E
8. 2A, 2B, 2C, 2D, 2E
9. 3A, 3B, 3C, 3D, 3E

Feature B on the cross section is identified by which ***ONE*** of the terms.

10. 1A, 1B, 1C, 1D, 1E
11. 2A, 2B, 2C, 2D, 2E
12. 3A, 3B, 3C, 3D, 3E

Feature I on the cross section is identified by which ***ONE*** of the terms.

13. 1A, 1B, 1C, 1D, 1E
14. 2A, 2B, 2C, 2D, 2E
15. 3A, 3B, 3C, 3D, 3E

Feature H on the cross section is identified by which ***ONE*** of the terms.

16. 1A, 1B, 1C, 1D, 1E
17. 2A, 2B, 2C, 2D, 2E
18. 3A, 3B, 3C, 3D, 3E

Feature G on the cross section is identified by which ***ONE*** of the terms.

19.	1A,	1B,	1C,	1D,	1E
20.	2A,	2B,	2C,	2D,	2E
21.	3A,	3B,	3C,	3D,	3E

TRUE/FALSE QUESTIONS: 2 points each; 4 points total. On the same cross section as for the previous questions are three locations labeled "Plate." True or false, they are in fact plates.

22. T/F. "Plate A" is in fact a plate.
23. T/F. "Plate C" is in fact a plate.

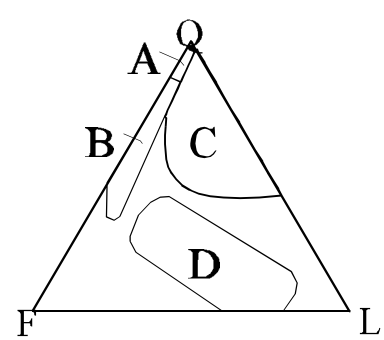
TRUE/FALSE QUESTIONS: 2 points each; 20 points total. At the back is a page titled "A Selection of Cross Sections", with labels. These questions refer to that page.

24. T/F. Rock A will most likely be feldspar rich.
25. T/F. Rock B will be from the tholeiite suite.
26. T/F. Rock C will be a basalt.
27. T/F. Rock D would be from the komatiite suite.
28. T/F. Rock E will be both a granulite rock and belong to the granulite facies.
29. T/F. Rock F will be calcalkaline.
30. T/F. Rock G will be feldspar rich.
31. T/F. A rock at location H will have over 50% quartz.
32. T/F. Rock I is most likely a slate or phyllite.
33. T/F. The calcalkaline suite develops from the alkaline suite via fractionation.

THE WILSON CYCLE

TRUE OR FALSE: 2 POINTS EACH, 28 POINTS TOTAL:. At the back of the test is a copy of the **WILSON CYCLE.** The questions below are concerned with the rocks and structures developed at various stages of the cycle.

34. T/F. Stage B - Igneous rocks generated here would be both mafic and felsic in composition.
35. T/F. Stage B - sediments from this stage would be found primarily in field B of the QFL diagram.
36. T/F. Stage B - the structures (faults) developed during this stage are principally the result of tension caused by uplift due to heat.
37. T/F. Stage D - subsidence is caused principally by the weight of accumulating sediment.
38. T/F. Stage E - the volcanic arc is made principally of diorite and granodiorite batholiths of the calkalkaline suite.



39. T/F. Stage E - sediments derived from the volcanic arc typically have more than 50% quartz.
40. T/F. Blueschist is being actively generated in Stages E, G, I.
41. T/F. Stage G - the right side is an island arc orogeny.

42. T/F. Stage H - the sediments in the foreland basin of I would be more quartz rich than would be the sediments in the foreland basin of Stage F.
43. T/F. Stage G - the marginal basin most likely is receiving feldspar rich sediments.
44. T/F. No Stage is likely to exhibit a shield volcano.
45. T/F. No stage is likely to exhibit a fissure volcano.
46. T/F. No stage has a hot spot derived shield volcano.
47. T/F. The primary evidence we have for believing the earth began with an ultramafic parent rock is that some original parts of the earth are still preserved and can be studied.

RIGHTS MINUS WRONGS MULTIPLE CHOICE QUESTIONS: 3 points each, 24 points total: On the Wilson cycle are locations identified by a series of letters "1" through "18". For each of the location letters below identify the ***ONE*** rock type out of the 15 choices most likely to form at that location, selected from the table below.

	IGNEOUS ROCKS	2A	Carbonates	3A	Eclogite
1A	Felsic igneous	2B	Lithic rich sediments	3B	Granulite
1B	Intermediate igneous	2C	Quartz rich sediments	3C	Greenschist
1C	Mafic igneous		METAMORPHIC ROCKS	3D	Schist/Gneiss
1D	Ultramafic igneous	2D	Amphibolite	3E	Slate/Phyllite
	SEDIMENTARY ROCKS	2E	Blueschist [melange]		
1E	Arkosic sediments				

Location 1: choose the one rock type most likely to form or be found at this location.
48. 1A, 1B, 1C, 1D, 1E
49. 2A, 2B, 2C, 2D, 2E
50. 3A, 3B, 3C, 3D, 3E

Location 3: choose the one rock type most likely to form or be found at this location.
51. 1A, 1B, 1C, 1D, 1E
52. 2A, 2B, 2C, 2D, 2E
53. 3A, 3B, 3C, 3D, 3E

Location 7: choose the one rock type most likely to form or be found at this location.
54. 1A, 1B, 1C, 1D, 1E
55. 2A, 2B, 2C, 2D, 2E
56. 3A, 3B, 3C, 3D, 3E

Location 10: choose the one rock type most likely to form or be found at this location.
57. 1A, 1B, 1C, 1D, 1E
58. 2A, 2B, 2C, 2D, 2E
59. 3A, 3B, 3C, 3D, 3E

Location 11: choose the one rock type most likely to form or be found at this location.

60.	1A,	1B,	1C,	1D,	1E
61.	2A,	2B,	2C,	2D,	2E
62.	3A,	3B,	3C,	3D,	3E

Location 16: choose the one rock type most likely to form or be found at this location.

63.	1A,	1B,	1C,	1D,	1E
64.	2A,	2B,	2C,	2D,	2E
65.	3A,	3B,	3C,	3D,	3E

Location 17: choose the one rock type most likely to form or be found at this location.

66.	1A,	1B,	1C,	1D,	1E
67.	2A,	2B,	2C,	2D,	2E
68.	3A,	3B,	3C,	3D,	3E

Location 18: choose the one rock type most likely to form or be found at this location.

69.	1A,	1B,	1C,	1D,	1E
70.	2A,	2B,	2C,	2D,	2E
71.	3A,	3B,	3C,	3D,	3E

ARCHAEAN OUTCROP MAPS

These questions refer to rock bodies on the map at the back labeled “ARCHAEAN OURCROP MAPS” The maps are for reference purposes to help orient you.

RIGHTS MINUS WRONGS MULTIPLE CHOICE QUESTION: 3 point each; 15 points total: Below is a list of 10 rock bodies that are found on the Archaean maps. For the questions below Identify ***any and all rock units*** that answer the question.

1A	Calcalkaline complexes	2A	Mica schists
1B	Fiskenaesset complex	2B	Nickel/chromium ultramafics
1C	Granulite-gneiss	2C	Ophiolite suite
1D	Layered igneous complexes	2D	Pyroxenites
1E	Meta-volcanic amphibolites	2E	Quartzites

Archaean Oceanic Lithosphere: which rock unit(s) represent this feature (any and all)?

72.	1A,	1B,	1C,	1D,	1E
73.	2A,	2B,	2C,	2D,	2E

Early Proto/Microcontinental Basement: which rock unit(s) represent this feature (any and all)?

74.	1A,	1B,	1C,	1D,	1E
75.	2A,	2B,	2C,	2D,	2E

Supracrustals: which rock unit(s) represent this feature (any and all)?

76.	1A,	1B,	1C,	1D,	1E
77.	2A,	2B,	2C,	2D,	2E

Greenstone Belts: which rock unit(s) represent this feature (any and all)?

78.	1A,	1B,	1C,	1D,	1E
79.	2A,	2B,	2C,	2D,	2E

Archaean Oceanic Lithosphere: which rock unit(s) represent this feature (any and all)?

80.	1A,	1B,	1C,	1D,	1E
81.	2A,	2B,	2C,	2D,	2E

TRUE/FALSE QUESTIONS: 2 points each; 20 points total. Referring to the same "ARCHAEAN OURCROP MAPS" as for the previous questions.

82. T/F. The calc-alkaline suite is most likely associated with the granulite gneiss belts.
83. T/F. The proxenite is most likely associated with the ophiolite suite.
84. T/F. The mica schists are of sedimentary origin.
85. T/F. The Ni/Cr ultramafics are generated by subduction fractionation.
86. T/F. The quartzites really don't begin to appear until the Proterozoic.
87. T/F. In the Archaean the calc-alkaline suite is generated only during subduction processes.
88. T/F. In the Archaean the komatiite suite is deposited in both oceanic rifting and in the greenstone belts.
89. T/F. The "quartzofeldspathic gneiss" in Scotland and the "mostly gneiss" in Greenland are referring to the same kind of rock.
90. T/F. These maps indicate that clearly defined continents had come into existence in the Archaean.
91. T/F. Because of the high heat flow, subduction during the Archaean was generally much steeper than that going on today.

MODEL OF ARCHAEAN CRUSTAL DEVELOPMENT

WRITES MINUS WRONGS MULTIPLE CHOICE QUESTION: 3 point each; 44 points total:

The cross section at the back labeled "MODEL OF ARCHAEAN CRUSTAL DEVELOPMENT" represents a summary of the Archaean crustal evolution of continental masses showing the spatial/temporal development of various rock bodies. For each of the locations/rock bodies identified by number, specify all of the rock names from the table that apply to that body of rock.

NOTE: that the same rocks often go by different names, names that describe their **COMPOSITION,** or their **INTERPRETATION**, or their **TECTONIC ASSOCIATIONS**. Therefore, apply any and all terms that apply, including if the rock unit in question is just part of an association incorporating rocks in addition to the one in the question.

1A	Alkaligranites	2A	Greenstone belt	3A	Plagiogranites
1B	Meta-volc Amphibolite	2B	Komatiite suite	3B	Sediments
1C	BIF	2C	Layered Ign complex	3C	Supracrustals
1D	Calcalkaline suite	2D	Ni/Cr ultramafic	3D	Tholeiite suite
1E	Granulite-gneiss belt	2E	Oceanic lithosphere	3E	Ultramafic parent

Rock Body 1 on the cross section is . . . (identify all rock names that apply.)

92. 1A, 1B, 1C, 1D, 1E
93. 2A, 2B, 2C, 2D, 2E
94. 3A, 3B, 3C, 3D, 3E

Rock Body 2 on the cross section is . . . (identify all rock names that apply.)

95. 1A, 1B, 1C, 1D, 1E
96. 2A, 2B, 2C, 2D, 2E
97. 3A, 3B, 3C, 3D, 3E

Rock Body 3 on the cross section is . . . (identify all rock names that apply.)

98. 1A, 1B, 1C, 1D, 1E
99. 2A, 2B, 2C, 2D, 2E
100. 3A, 3B, 3C, 3D, 3E

Rock Body 4 on the cross section is . . . (identify all rock names that apply.)

101. 1A, 1B, 1C, 1D, 1E
102. 2A, 2B, 2C, 2D, 2E
103. 3A, 3B, 3C, 3D, 3E

Rock Body 5 on the cross section is . . . (identify all rock names that apply.)

104. 1A, 1B, 1C, 1D, 1E
105. 2A, 2B, 2C, 2D, 2E
106. 3A, 3B, 3C, 3D, 3E

Rock Body 6 on the cross section is . . . (identify all rock names that apply.)

107.	1A,	1B,	1C,	1D,	1E
108.	2A,	2B,	2C,	2D,	2E
109.	3A,	3B,	3C,	3D,	3E

First rock to form: Which is the first rock unit to form on the cross section?

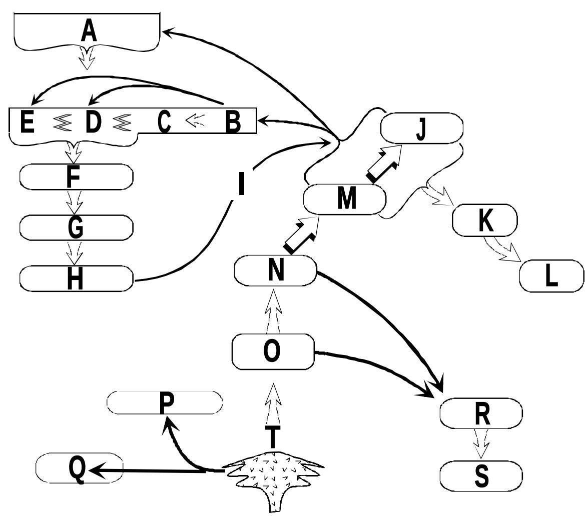
110.	1A,	1B,	1C,	1D,	1E
111.	2A,	2B,	2C,	2D,	2E
112.	3A,	3B,	3C,	3D,	3E

Last rock to form: Which is the last rock unit to form on the cross section?

113.	1A,	1B,	1C,	1D,	1E
114.	2A,	2B,	2C,	2D,	2E
115.	3A,	3B,	3C,	3D,	3E

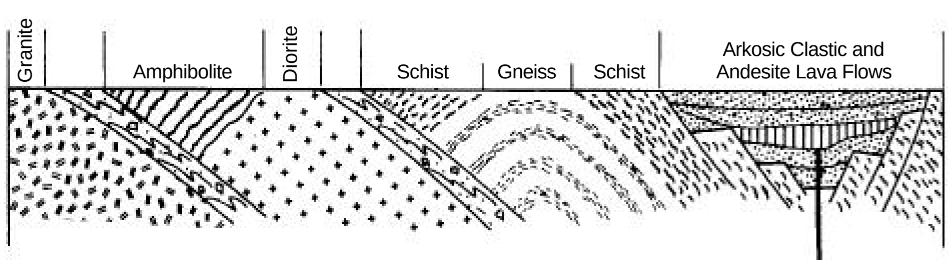
PLATE TECTONIC ROCK CYCLE

TRUE OR FALSE; 2points each; 18 points total. The next few questions relate the stages in the ***WILSON CYCLE*** *(illustration at back)* with the rocks generated in the ***PLATE TECTONIC ROCK CYCLE***, illustration to the right.



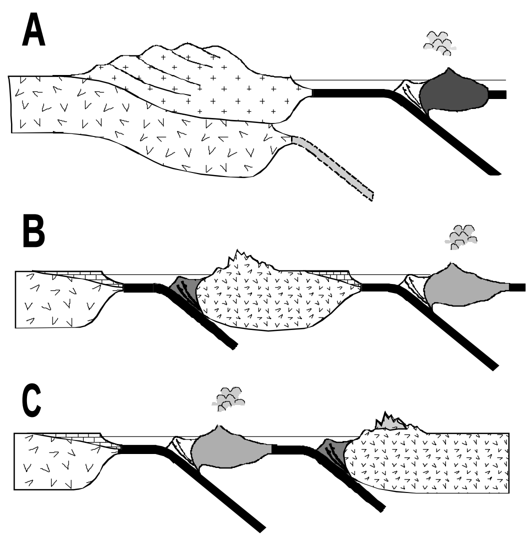
116. T/F. **Stage A** - rocks B, C, D, and E are most likely generated in this stage.
117. T/F. **Stage E (c**enter)most likely generates rocks J, K, L, M, and N.
118. T/F. **Stage G (right side)**- rocks F, G, and H will be generated in this stage.
119. T/F**. Stage G (left side)** - rock C will be prominent in this stage.
120. T/F. Rocks T, Q, and P will be generated in **Stage C** but not **Stage E**.
121. T/F. Rocks T, P and Q are not generated in the Ophiolite suite.
122. T/F. Rock P is prominent in the Archaean
123. T/F. Rock S is likely to be a common constituent of continental crust.
124. T/F. Rock B is likely to be a common constituent of the oldest land masses to appear on the earth.

TECTONIC INTERPRETATIONS

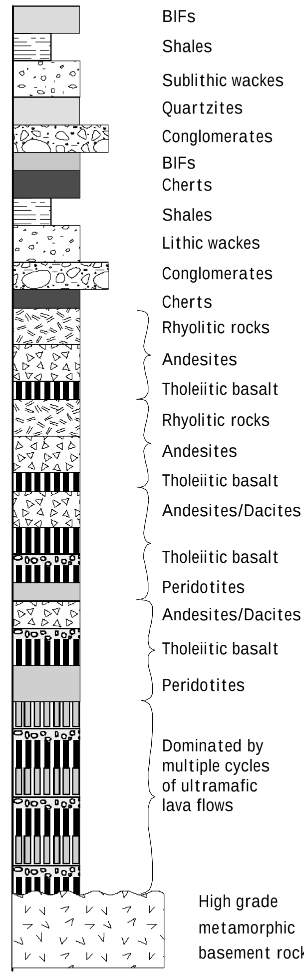


MULTIPLE CHOICE QUESTION: 8 point total: The cross section above was most likely generated by which tectonic scenario to the right.

125. A= Tectonic Scenario A
B= Tectonic Scenario B
C= Tectonic Scenario C



MULTIPLE CHOICE QUESTION: 8 point total: The strip log to the right was most likely deposited in which cross section below.



126. A=Cross Section A
B=Cross Section B
C=Cross Section C