

GGY/GLY 335: GEOMORPHOLOGY
MID-TERM ESSAYS, SPRING SEMESTER 2008

DUE DATE: hand in your essays by 12:00 noon on Friday, Feb. 29. You can bring the essays to me in class, or drop them under my door (DL 220), or bring them to the Earth Sciences office (DL 102) to put in my mailbox. I will also accept the midterm as an email attachment in Microsoft Word or Adobe PDF format. Don't miss this deadline! No essays will be accepted after spring break.

INSTRUCTIONS: Answer any 5 questions from the list below. Each answer should be roughly 2-3 short paragraphs, or about one page of double-spaced 12-point type. Use information from lectures, labs, the textbook, your notes, web searches, or any other sources to prepare your answers. You will be graded mainly on the completeness and clarity of your answers.

EXAMPLES: Many of these questions ask you to provide examples in your answer. The best examples will be relevant (related to the question asked), specific (include place names and other details if possible), and original (not just rehashing material we have covered). Your answer may include textbook definitions where appropriate, but the examples will show that you understand the meaning of those definitions and how they might apply to situations we did not specifically discuss in class.

1. The geoid. What is the geoid? How does the geoid differ from an "oblate spheroid," which is often used to describe the hypothetical shape of the earth? How is the geoid measured or estimated? Describe an example where an understanding of the geoid might be important to understanding a geomorphic process or solving an environmental problem.

2. Geographic variations in weathering. Ch. 3-4 of the textbook make the point that rock weathering, soil formation, and erosion rates are strongly dependent on climate. Discuss the relative strength of physical weathering and chemical weathering in tropical wet environments, polar environments, and arid environments. For each environment, name one type of weathering process that is especially effective and briefly describe how it works. In which of the three environments would erosion of a mountain range occur most rapidly?

3. Slope shear strength. The variables that determine the shear strength of slope materials are represented by the equation $S = c + (\sigma') (\tan \phi)$. Name and briefly describe each of the 3 variables on the right side of the equation. For each of these three variables, give an example of a natural process that could cause this variable to change, thus reducing the shear strength and potentially leading to mass movement on a slope. In each example, what kind of mass wasting event would likely occur?

4. Stream runoff. Briefly explain the differences between a Type I hydrograph and a Type II hydrograph. First, describe an example of a drainage basin that has at least 2-3 environmental factors (climate, vegetation, soils, geology, topography, etc.) that would favor a Type I response. Where might this type of basin be located? Second, describe an example of a place with at least 2-3 environmental factors that tend to favor a Type II response. Where might this type of basin be located? Which basin would probably have the greatest problems with flood control, soil erosion, and water quality?

5. Downstream changes in rivers. Choose a large drainage basin somewhere in North America and discuss some of the main differences between a headwater tributary (1st or 2nd order stream) and the main outlet river in that basin. (A "large" river, the Cape Fear River for example, is at least 7th order.) Where are the "headwaters" and the "outlet" of this basin? What sort of topography and sediment would you expect to find on the floodplain surrounding the headwater stream and outlet river? How would the headwater and outlet streams compare in terms of channel variables such as flow depth, velocity, and gradient? Which of the two would have greater problems with flood control? Which would have greater problems with water quality?

6. Colluvium, alluvium. What is the difference between colluvium and alluvium? (Briefly describe their physical properties and how they form.) How would you tell the two apart if you were looking at them in an exposed roadcut or riverbank? Within the category of alluvium, what is the difference between vertical accretion deposits and lateral accretion deposits? (Physical properties and how they form.) How would you tell the two apart if you were looking at them in an exposed riverbank?

7. Braided rivers. Describe some of the factors that favor a braided channel pattern over a meandering pattern in rivers. What causes the "braiding" of multiple channels, bars, and islands? Give an example of a drainage basin in North America where braided rivers would likely be found. What environmental factors (climate, vegetation, soils, topography, etc.) are most responsible for the braiding behavior in that environment?

8. Video: *Grand Canyon Flood!* Briefly describe the experimental flood that was performed on the Colorado River in the Grand Canyon in 1996. In general, what were the intended purposes (both physical and biological) of the experimental flood? Describe one of the specific experiments that was conducted during the flood – what was the experiment designed to measure and what were the results?