

# Geological Map Problem– A method of assessing critical thinking?

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## Introduction

Like many other colleges, Green River Community College has identified critical thinking as a campus-wide goal for all students. We are required by the college and our accrediting body to measure the effectiveness of our instruction in achieving this outcome. I propose to use a Geological Map Problem for this type of assessment. Please use the attached post-it notes to offer suggestions.

## Campus-wide Outcomes

Green River Community College has identified several learning outcomes that are campus-wide in importance: written and oral communication, quantitative reasoning, student responsibility, and critical thinking. The Science Division has determined that all science classes will promote and assess critical thinking.

Critical Thinking has been defined by a faculty committee as thinking that "finds expression in all disciplines and everyday life. It is characterized by an ability to reflect upon thinking patterns, including the role of emotions on thoughts, and to rigorously assess the quality of thought through its work products. Critical thinkers routinely evaluate thinking processes and alter them, as necessary, to facilitate an improvement in their thinking and potentially foster certain dispositions or intellectual traits over time".

## Competencies

To evaluate critical thinking five competencies have been defined by a faculty committee. To demonstrate critical thinking students:

1. apply relevant standards when evaluating information, claims, and arguments.
2. use appropriate reasoning to evaluate problems, make decisions, and formulate solutions
3. give reasons for conclusions, assumptions, beliefs, and hypotheses.
4. seek out new information to evaluate and re-evaluate conclusions, assumptions, beliefs, and hypotheses.
5. exhibit traits evidencing the disposition to reflect, assess, and improve thinking or products of thinking.

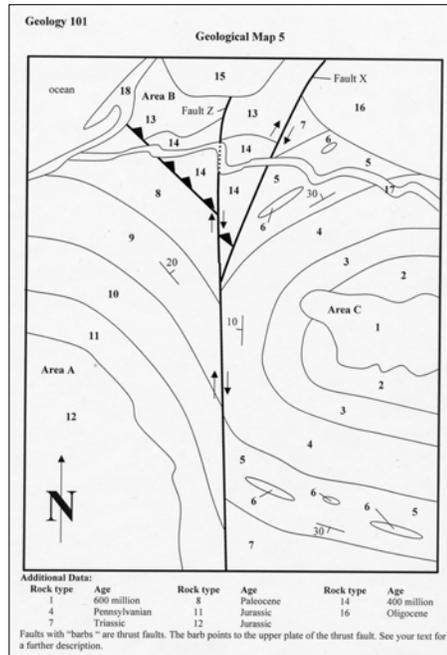
## Geological Map Problem

Students in our introductory geology course for non-science majors work in groups of 3-4 on the geological history of a sketch geological map such as the one illustrated below. The tasks in this lab are:

• **Part I:** The numbers on the map are keyed to a suite of samples that represent the rock types on the geological map. Students determine the rock types on the map with very little assistance from the instructor.

• **Part II:** Students determine the relative age sequence of the geological events in the areas bounded by the major faults. The students must also determine the order of other events, such as the history of faults in the map area.

• **Part III:** Students construct a written history of their map area.



We have developed seven geologic maps for this lab. I submitted the maps as materials for the on-line materials for this workshop.



## Assessment

Students work on the maps for about three weeks of lab time. When I first started using this exercise I required a paper from each group. However, it became clear that, in most groups, one or two students did all the work. After I started giving a quiz on the map problem, nearly all the students are actively involved in their groups. Individual responsibility is critical in this type of exercise.

The quiz covers all three parts of the map problem. Part I covers the rock types on the map. Part II consists of objective-type questions on the relative age history of the areas bounded by the major faults. There are also questions that require the students to know the geological principle they are using to answer the question (superposition, cross-cutting relationships, etc.). Part III is a written essay on the geological history of a part of their map.

## Geologically, it seems to work!

This lab exercise fosters discussion among the students in their groups and helps them pull together many of the ideas covered in the course. This exercise is rated as one of the best lab assignments on course evaluations. Many of the students like the "puzzle" aspect of the exercise.

## Help!

I believe that students use critical thinking as they work through this exercise. However, it is not clear to me how to measure students' critical thinking with this type of exercise. If you have thoughts or ideas about approaches that I could use to analyze the student responses on this exercise as a measure of critical thinking abilities, please write your thoughts on the post-it notes and attach to the space below.

Thanks for your help!

Please post your ideas/thoughts below: