Solution Manual for Exploring Geology 4th Edition by Reynolds Johnson Morin Carter ISBN 0078022924 9780078022920

Chapter 01 – The Nature of Geology

SCOPE

This chapter is designed to be an engaging introduction to geology. It introduces students to a number of different topics, all meant to convey the idea that geology is important and exciting. It covers fundamental topics, like the rock cycle and origins of rocks, to provide a foundation for subsequent chapters. Additionally, the chapter should help students understand that geology is a dynamic science that involves connections and interactions with other sciences such as biology.

The main topics covered are:

1. Geology as a Science
2. The Practical Aspects of Geology
3. Overview of the Geology of Earth

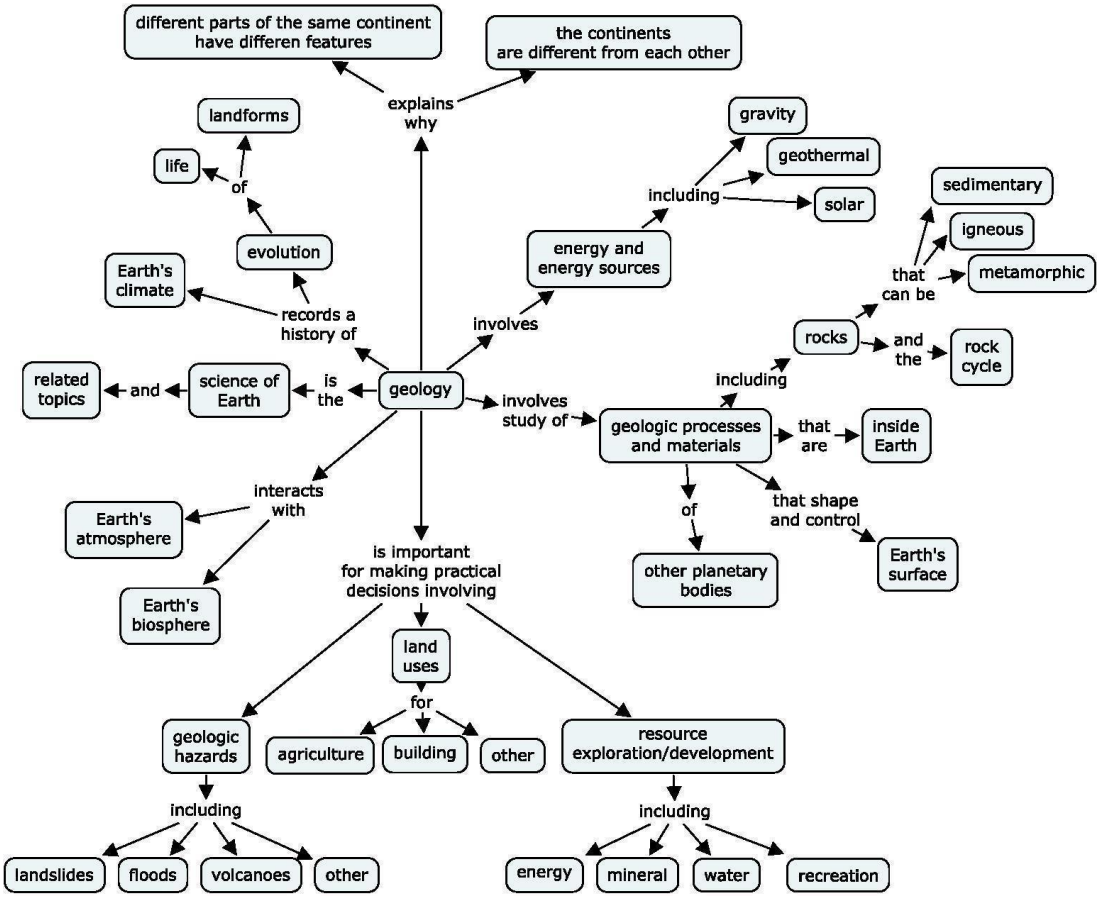
GOALS

After reading this chapter, student s should be able to:
• Explain the importance of geology in their daily lives.
• Describe some of the most important geological materials and processes.
• Describe how geology interacts with Earth's biosphere and atmosphere.

(see the *What-To-Know List* for specific objectives for each two-page spread)

THEMES

The main concepts in this chapter are shown in *Concept Map 1.1.* The map appears as a spider diagram because the ideas are, in some cases, not directly linked to one another.



Concept Map 1.1

There is no reason to lecture on all of the ideas/concepts presented. As is the case for most content in the textbook, most spreads in the chapter will stand on their own if an instructor chooses not to cover that material during lecture.

SUGGESTED IN-CLASS ACTIVITIES

- The Henry Mountains photograph in Spread 1.1 works extremely well for a short initial active-learning activity. It will get students to begin to understand how geology affects their lives. As described in the Notes field in the PowerPoint file, ask students to think about how the geology in the scene is influencing the lives of the horses and cows.
- The Connections spread (1.9) is a good spread to further convey the relevance of geology, and you may wish to spend some time talking about the geology around Rapid City. Be sure to show good photos of the National Parks and Monuments (Devils Tower, Jewel Cave, Wind Cave, Badlands, Mt. Rushmore) as well as the Homestake Mine and Harney Peak. It is also worth showing pictures of the Mammoth site in Hot Springs, South Dakota. (Many photos of all these places are available on the

web if you don't like the ones provided with the textbook or in this Guide.) There is so much in the Black Hills – students should be impressed by the diverse and spectacular geology.

- The Connections spread (1.10) is a good one to use as an in-class group exercise, but the aerial imagery used to construct the 3D perspective is bit out of date since the region around St. George has grown in population faster than just about anywhere else in the country during recent years. You can use this as an opportunity to discuss how humans interact with geology, such as viewing the area in Google Earth to discuss the changes and the challenges of a rapidly growing population (in a desert). The link in the *In-Class* PowerPoint file drapes the aerial imagery from the textbook onto Google Earth topography, but you can view Google Earth's more recent (but perhaps less detailed) data by toggling off the St. George layer in your *Temporary Places* panel in Google Earth.

Chapter 02 – Investigating Geologic Questions

SCOPE

This chapter is an introduction to geological investigations and to the scientific method. It introduces students to the nature of observations, data and data collecting, predictions and hypotheses, and scientific theories. Although there are many different kinds of geological investigations, many of the spreads are focused on interpreting geological landscapes – in large part because landscapes are emphasized in many subsequent chapters. This works out well because many/most students have seen geologic landscapes, whereas they may not be familiar with some of the other things that geologists study. The main topics covered and relevant spreads are:

1. Investigating Landscapes and Other Geologic Features
    - 2.0 Investigating Geologic Questions • 2.1 What Can We Observe in Landscapes?
    - 2.2 How Do We Interpret Geologic Clues?
    - 2.3 How Do We Depict Earth's Surface?
    - 2.4 How Do We Depict Earth's Heights, Slopes, and Subsurface Geology?
2. The Scientific Method and Geological Science
    - 2.3 How Do We Depict Earth's Surface?
    - 2.4 How Do We Depict Earth's Heights, Slopes, and Subsurface Geology?
    - 2.5 How Are Geologic Problems Quantified?
    - 2.6 How Do Geologists Refer to Rates and Time?
    - 2.7 How Do We Investigate Geologic Questions?
    - 2.8 How Do Scientific Ideas Get Established?
    - 2.9 What Does a Geologist Do?
    - 2.10 Connections: How Did This Crater Form?
    - 2.11 Investigation: What Is the Geologic History of Upheaval Dome

GOALS

After r eading this chapter, students should be able to:

- Explain the scientific method and how scientific theories are established.
- Describe some of the ways that geologists study geology, and give examples of some different kinds of data they might collect.
- Explain the differences between field and laboratory studies, between quantitative and qualitative data, and between direct observations and remote sensing and experimental studies.

(see the *What-To-Know List* for specific objectives for each two-page spread)

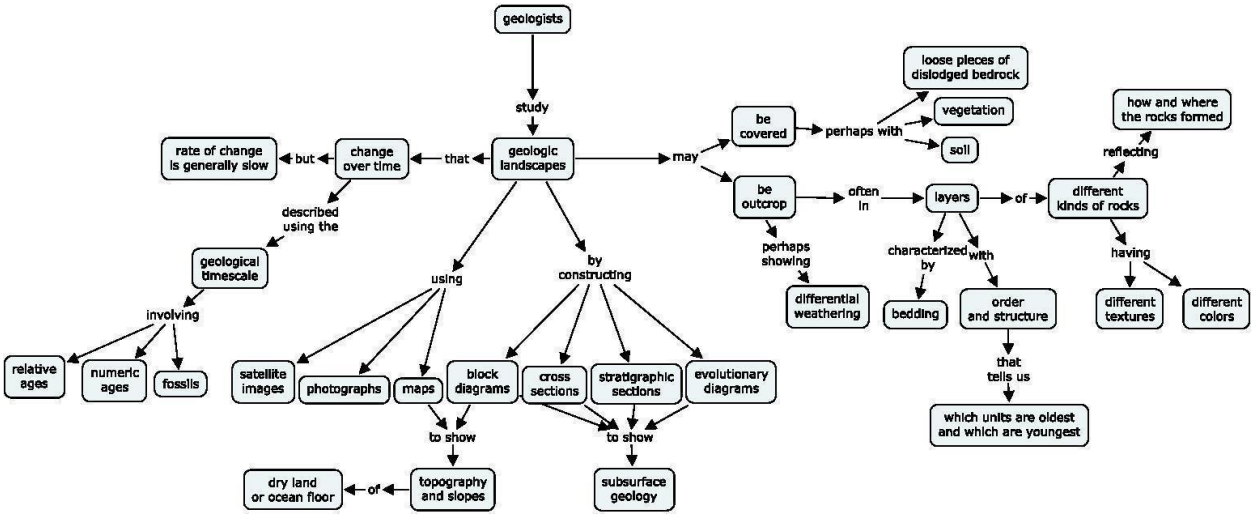
THEMES

Geological Landscapes

The concepts shown in *Concept Map 2.1* include all those that a geologist might encounter when investigating an outcrop or region. Thus, one excellent way to approach these concepts is by example. The

book does this by using photographs of landscapes from the arid western United States. But, we recommend that you substitute your own examples – use the local geology where you are, if possible and appropriate. The main points to make are that (1) good scientists take care to make careful observations,

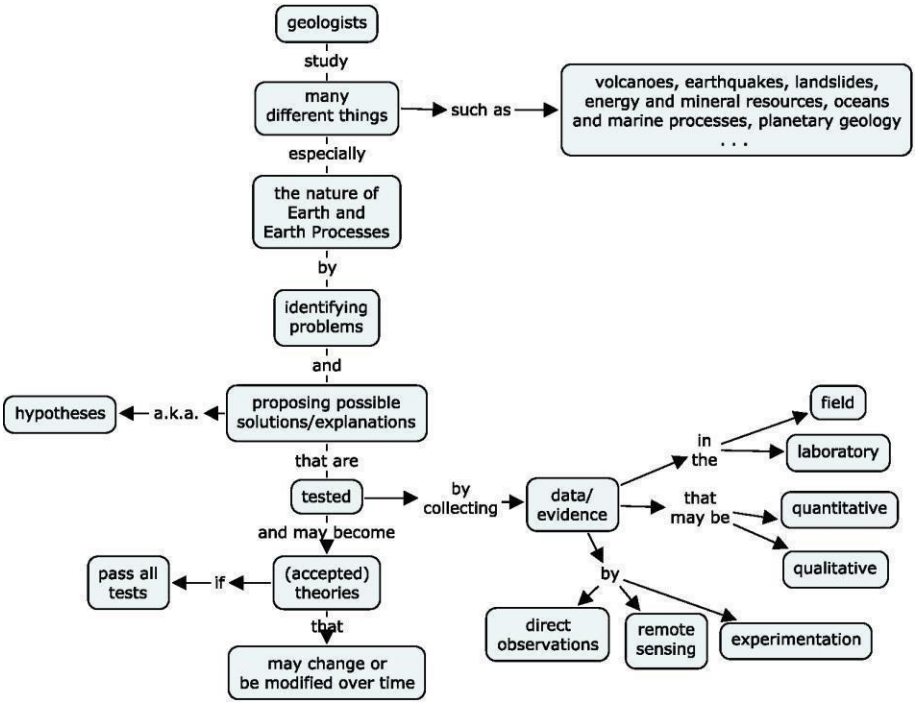
(2) there are many kinds of geologic data, and (3) geologic data can be gathered and depicted in many ways.



Concept Map 2.1

The Scientific Method and Geological Investigations

The left-hand side of *Concept Map 2.2* is the standard summary of the scientific method. The right-hand side expands a bit more on the nature of geological studies, and of observations, data, and evidence. Perhaps the best way to present these ideas is by example. For example, you can describe how the meteorite impact hypothesis for the extinction of dinosaurs is now on its way to becoming (or maybe it is there?) an accepted scientific theory.



Concept Map 2.2

SUGGESTED IN-CLASS ACTIVITIES

- Show a photograph (like the one from Spread 2.1) and have students observe it. Working with nearby students, they should discuss the differences between observations and interpretations, and between the qualitative and quantitative data they could collect at the site.
- As noted above, the concepts in this chapter are best introduced by example. So, as you give your examples, ask students some pointed questions. For example, if you talk about the extinction of dinosaurs (alluded to above) you could ask them what kind of evidence they would look for to "prove" this hypothesis. And you can ask them if it is really possible to absolutely prove such things.
- The Connections spread (2.10) is intriguing to students and connects well with the dinosaur extinction theme. It also is a good warm-up for the Investigation (2.11) – which is a very good in-class exercise.