

Earth Systems
Mr. Varner
Topographic and geologic maps
Lab experiment

Making and Reading a Geologic Map

Purpose: to understand how the types and ages of rocks and sediments are shown on a geologic map, and to interpret the information the map provides.

Materials:

USGS website (see below)
Black and white geologic map of the southwest quarter of the Valley Center quadrangle
Key to the Geologic Map of the Valley Center 7.5' Quadrangle
Geologic Map Color Codes
Geologic Time Chart

Part 1 — Introduction to Geologic Maps

Go to the USGS geologic map page: <https://geomaps.wr.usgs.gov/parks/gmap/index.html>
A **link** can be found on the Unit 5 web page.

1. Read the first page.

Q1. What are some of the geologic features shown on a geologic map?

Q2. What is a **geologic unit** (also called a map unit)?

Q3. How is a single geologic unit represented on a geologic map?

Q4. Who gets to name the geologic units on a particular map?

2. Continue to Map Symbols (page 2). Read page 2.

Q5. What does the capital letter mean in the geologic unit letter symbol?

Q6. List what J, K, T, and Q represent, and their time periods.

a) J

b) K

c) T*

d) Q

* This single period has now been divided into two new periods: **Paleogene** and **Neogene**. See your geologic time chart.

Q7. What does it mean if the letter symbol has two capital letters?

Q8. What do the small letters in the letter symbols represent?

Q9. What does it mean if there is no capital letter at all?

Q10. What are the two types of contact shown by unit lines on a geologic map?

Q11. What does a **thick line** usually represent on a geologic map?

Q12. How is a **fold axis** (crest of an anticline, trough of a syncline) shown on the map?

Q13. What does a **dashed** line mean for a contact (or fault) between geologic units?

Q14. What does a **dotted** line mean for a contact (or fault) between geologic units?

3. Continue to Strike and Dip (page 3). Read page 3.

Q15. Draw a strike and dip symbol below, and explain what each part of the symbol means.

Q16. What is the purpose of the **map key**?

Q17. What is the order in which the geologic units are usually presented on the key? (In other words, which comes first, and which goes last?)

Q18. What are the other symbols shown in the key after the unit symbols and colors?

Q19. List several things (given in the summary) that geologic maps can tell us about an area.

Part 2 — Coloring the map and key

1. Examine the geologic map, the map key, and color codes sheet. Notice how capital and small letters are used to distinguish different types of rocks and sediments (example: “Qaf”). You will color in regions with the same rocks or sediments with a **single color**. These regions are called **geologic units** or **map units**. Note: the contact lines on this map have been made thicker to help you see them. They are not all fault lines!
2. Read through the entire color codes sheet.
3. Use the color codes chart to find colored pencils (or crayons) close to the color listed. The most **important thing** is that the color you put on the key is **exactly** the same color you put on the map!
4. Color in **one** of the map unit rectangles **on the key** under **both** Description of Map Units and Correlation of Map Units. Then color that same map unit on the map. For example, you may color in the “Qaf” map unit on the key with a light gray pencil, then color in that same “Qaf” unit on the map in the same color. Don’t get your colors mixed up. **Do one unit at a time**. If you do miss one location, you can always use the key you made to find the right color.
5. Continue coloring until all 13 map units are colored in.

Part 3 — Questions from the map and key

Q1. Most of the city of Escondido is covered by sediment from Escondido Creek, which was once not cement, as shown at lower right near Washington Avenue. The creek heading north is Reidy Creek. What symbol is used for Escondido Creek and Reidy Creek, **and** how old are these sediments? [**Ma** = megaannum = millions of years ago]

Q2. The rest of Escondido is a large flood plain created by the shifting creek. What is the letter symbol for this large area **and** what does “permeable” in the key description mean? (See your 4-4 notes on soils.)

Q3. Based on the key description and your geologic time chart, what is the age range of these sediments covering the Escondido valley floor? [0.0117 Ma = 11,700 years ago]

Q4. The Correlation of Map Units in the key for a geologic map always shows the youngest rocks and sediments on top, and the oldest on the bottom. What is the youngest map unit? **Also** use the description to explain why it is really young. [By the way, Interstate 15 was not built when this version of the topographic base map was made. Centre City Parkway was U.S. Highway 395 at this time (1968).]

Q5. Most of the map is covered with bedrock rocks starting with a “K”. What does “K” represent, **and** what is the time range for this geologic period?

Q6. All of the rocks marked with only a capital K (not KJ) are the same class of rocks. Look at the key for the description of each of the seven units. What types of rocks are these that we studied earlier, **and** where did they have to form?

Q7. The oldest rocks, which are marked "KJ", are described as "metavolcanic" and "metasedimentary." What class of rocks is this?

Q8. KJ is described as described as "low grade greenschist." Look up greenschist online. What does the "low grade" in the description mean? (Two things are "low", what are they?)

Q9. Greenschist in this area usually forms from basalt. What specific type of rock is basalt?

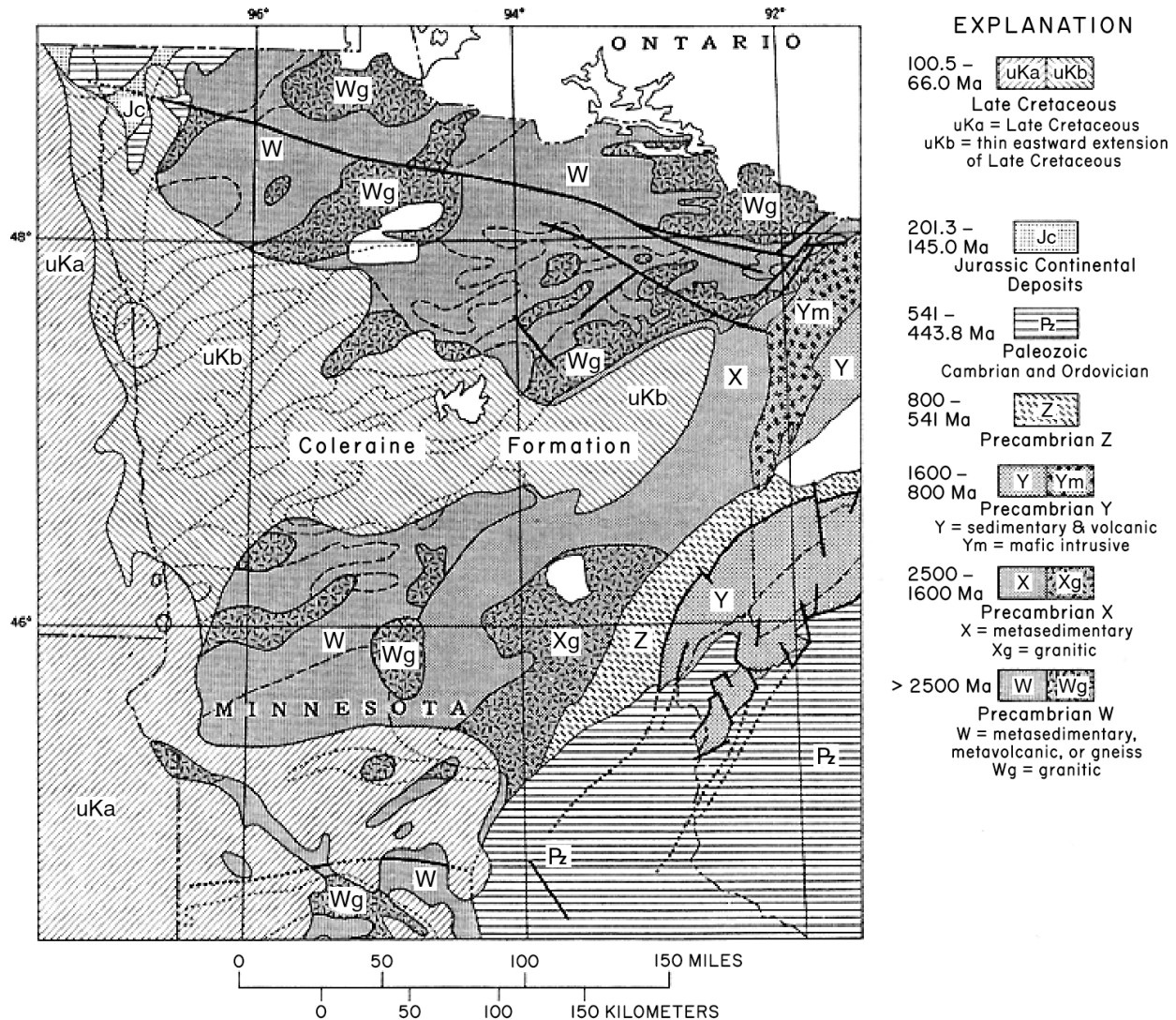
Q10. KJd is described as metavolcanic dikes that cut through the KJ rocks. They are also described as dark gray and very fine grained (tiny crystals). What is a dike in geology?

Q11. Based on your answers in questions 6, 9, and 10, what kind of environment existed in the Escondido area during the Jurassic and Cretaceous periods?

Q12. No rocks are listed anywhere in the general Escondido area between the end of the Cretaceous (66 Ma) and the late Pleistocene (after 500,000 years ago). This particular gap is called a **nonconformity**. What might have happened to any rocks and sediments from this time range if they are completely missing?

Part 4 – Geologic map of Minnesota

In contrast to southern California, rocks in the Great Lakes and northeastern Canada are part of the Canadian Shield, the **craton** of the North American Plate. Some of these rocks are over 2.5 billion years old. The map below is a grayscale version of a small section of the *Geologic Map of the United States* showing the state of Minnesota.



Q1. What are the youngest rocks shown on this map? Where are most of these rocks within the state?

Q2. What are the oldest rocks shown on this map? How old are they?

Q3. If you wanted to look for dinosaur bones, which deposits would you have to look in?

Q4. What is the age range for the Coleraine Formation?

Q5. What kind of fossils would you likely find in southeastern Minnesota? (i.e. What types of animals?)

Q6. Would you be likely to find fossils in the units marked Ym, Xg, or Wg? **Explain** fully.

Q6. Southern California has fossils of many large mammals such as dire wolves, saber-toothed cats, camels, giant ground sloths, mastodons, etc. Would you be likely to find these same fossils in Minnesota? **Explain** fully.

Q7. There are **thick lines** (some with dashes) cutting across geologic units at the top of the map. What do these symbols, represent?

Q8. How does this map indicate that the older Precambrian rock units can actually be found **underneath** the Cretaceous Coleraine Formation?