Topographic and Geologic Maps

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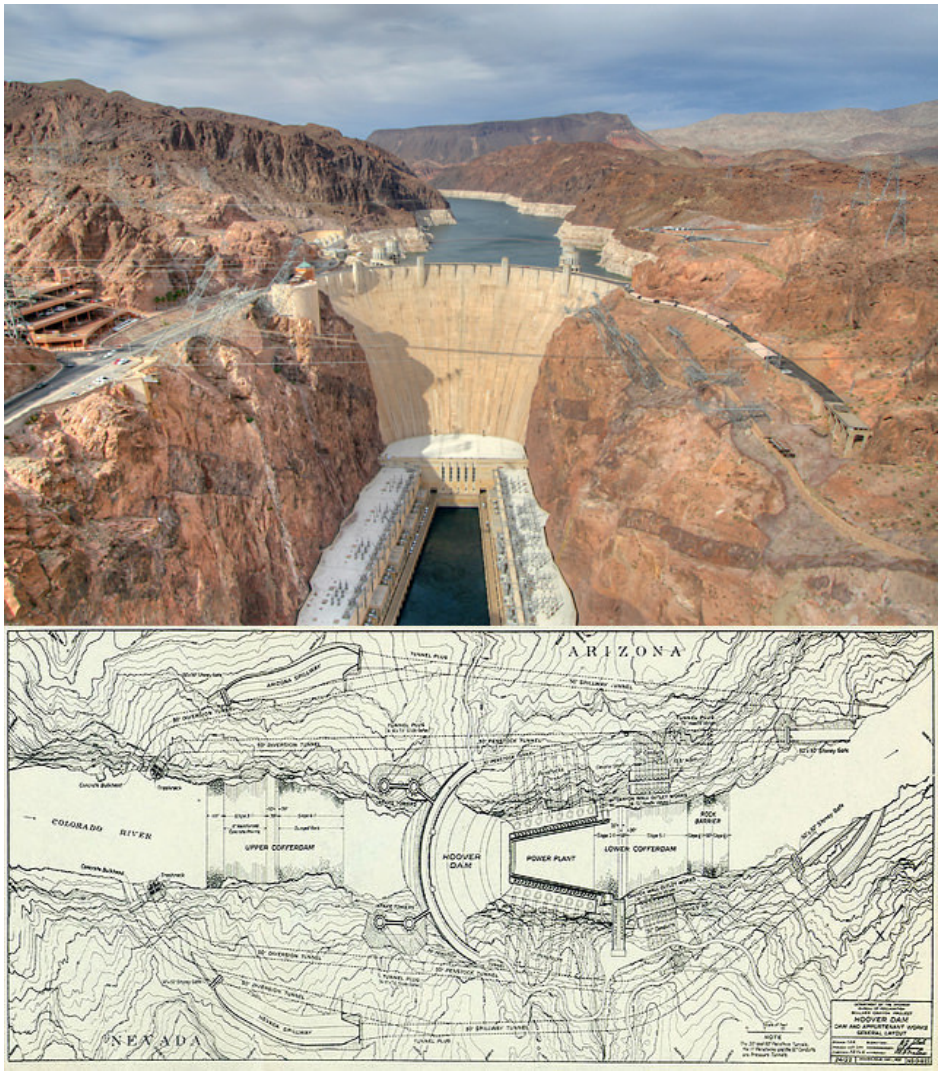
CHAPTER 1

Topographic and Geologic Maps

- Define topographic map and contour line.
- List the rules of topographic maps.
- Understand contour maps.
- Explain a geologic map.



Can a map help you understand a place even if you've never been there?

Hills, streams, valleys, and snowfields all show up on some types of maps. With practice, people can look at a topographic map and see what the landscape is really like. Of course, it's not the same as being there! But a topographic map can give you a good feel for an area before you go. It can also help you to identify features once you are there. What does this map tell you about the region? Can you identify features that appear in the photo on the map?

Topographic Maps

The topography of a region can be shown on a map. **Topographic maps** represent geographical features, such as hills and valleys. Topographic maps use contour lines to show geographical features. A **contour line** is a line of equal elevation. If you walk along a contour line, you will not go uphill or downhill. Topographic maps are also called contour maps. The rules of topographic maps are:

- Each line connects all points of a specific elevation.
- Contour lines never cross. After all, a single point can only have one elevation.
- Every fifth contour line is bolded and labeled.
- Adjacent contour lines are separated by a constant difference in elevation (such as 20 feet or 100 feet). The difference in elevation is the **contour interval**. The contour interval is indicated in the map legend.
- Scales indicate horizontal distance and are also found on the map legend.

Interpreting Contour Maps

How does a topographic map tell you about the terrain? Let's consider the following principles:

1. **The spacing of contour lines shows the slope of the land**. Contour lines that are close together indicate a steep slope. This is because the elevation changes quickly in a small area. Contour lines that seem to touch indicate a very steep slope, like a cliff. When contour lines are spaced far apart, the slope is gentle. So contour lines help us see the three-dimensional shape of the land.

Look at the topographic map of Stowe, Vermont (**Figure** 1.1). There is a steep hill rising just to the right of the city of Stowe. You can tell this because the contour lines there are closely spaced. The contour lines also show that the hill has a sharp rise of about 200 feet. Then the slope becomes less steep toward the right.

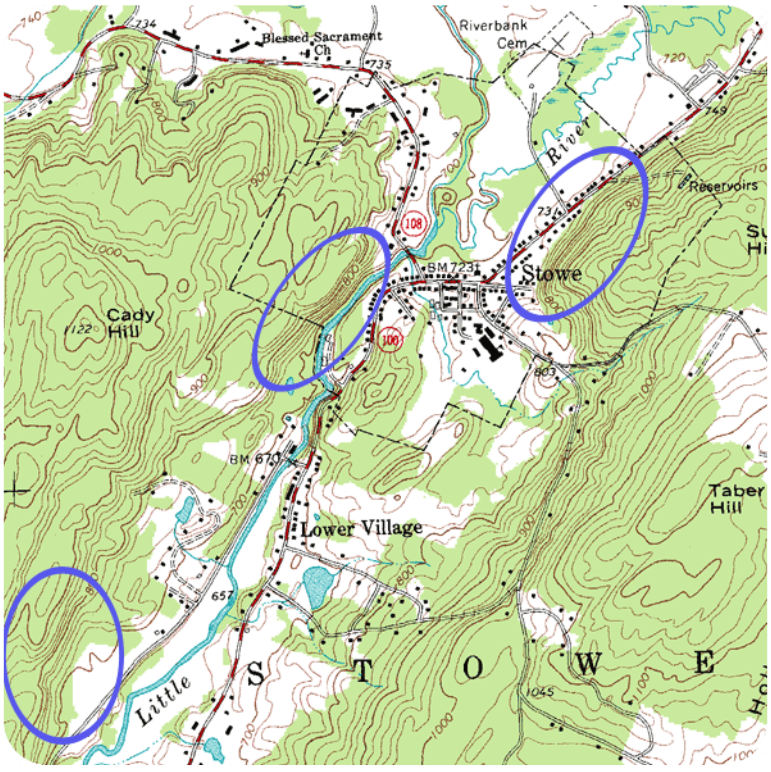


FIGURE 1.1

Portion of a USGS topographic map of Stowe, VT.

2. **Concentric circles indicate a hill**. Pictured below is another side of the topographic map of Stowe, Vermont

(**Figure** 1.2). When contour lines form closed loops, there is a hill. The smallest loops are the higher elevations on the hill. The larger loops encircling the smaller loops are downhill. If you look at the map, you can see Cady Hill in the lower left and another, smaller hill in the upper right.

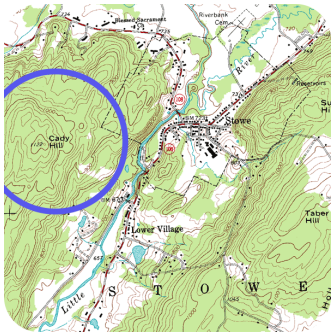


FIGURE 1.2

Portion of a USGS topographic map of Stowe, VT. Cady Hill (elevation 1122 feet) is shown by concentric circles in the lower left portion of the map. Another hill (elevation ~ 960 feet) is on the upper right portion of the map.

3. **Hatched concentric circles indicate a depression**. The hatch marks are short, perpendicular lines inside the circle. The innermost hatched circle represents the deepest part of the depression (**Figure** 1.3). The outer hatched circles represent higher elevations.

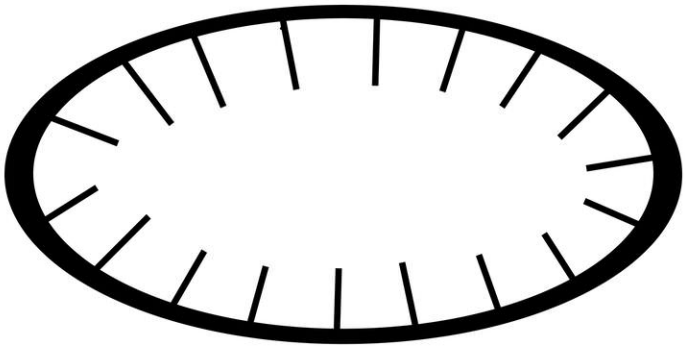


FIGURE 1.3

On a contour map, a circle with inward hatches indicates a depression.

4. **V-shaped portions of contour lines indicate stream valleys**. The "V" shape of the contour lines point uphill. There is a V shape because the stream channel passes through the point of the V. The open end of the V represents the downstream portion. A blue line indicates that there is water running through the valley. If there is not a blue line, the V pattern indicates which way water flows. Below, you can see examples of V-shaped markings (**Figure** 1.4). Try to find the direction a stream flows.

5. **Like other maps, topographic maps have a scale so that you can find the horizontal distance**. You can use the horizontal scale to calculate the slope of the land (vertical height/horizontal distance). Common scales used in United States Geological Service (USGS) maps include the following:

- 1:24,000 scale - 1 inch = 2000 feet
- 1:100,000 scale - 1 inch = 1.6 miles
- 1:250,000 scale - 1 inch = 4 miles

Including contour lines, contour intervals, circles, and V-shapes allows a topographic map to show three-dimensional information on a flat piece of paper. A topographic map gives us a good idea of the shape of the land.

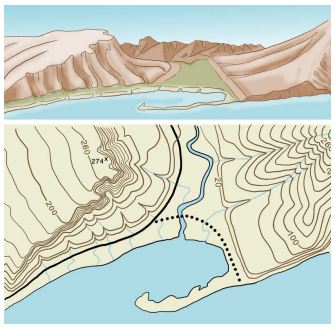


FIGURE 1.4

Illustrations of three-dimensional ground configurations (top) and corresponding topographic map (bottom). Note that the V-shaped markings on the topographic maps correspond to drainage channels. Also, the closely-spaced contour lines denote the rapid rising cliff face on the left side.

Geologic Maps

A geologic map shows the different rocks that are exposed at the surface of a region. The geology is often put on a contour map. Rock units are shown in a color identified in a key. On the geologic map of the Grand Canyon, for example, different rock types are shown in different colors. Some people call the Grand Canyon "layer cake geology" because most of the rock units are in layers. Rock units show up on both sides of a stream valley.

A geologic map looks very complicated in a region where rock layers have been folded. Faults are seen on this geologic map cutting across rock layers. When rock layers are tilted, you will see stripes of each layer on the map. There are symbols on a geologic map that tell you which direction the rock layers slant. Often there is a cut away diagram, called a **cross section**. A cross section shows what the rock layers look like below the surface. A large-scale geologic map will just show geologic provinces. They do not show the detail of individual rock layers.

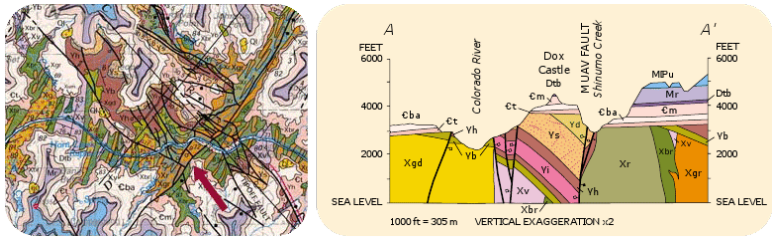


FIGURE 1.5

A portion of the geologic map of the Grand Canyon, Arizona.

Summary

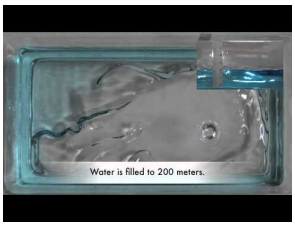
- Topographic maps reveal the shape of a landscape. Elevations indicate height above sea level.
- Contour lines are lines of equal elevation. Contour intervals are the difference in elevation between two contour lines.
- Geologic maps show rock units and geologic features, like faults and folds.

Review

1. What is a contour line? What is a contour interval?
2. What will a hill look like on a topographic map? How will a basin look different from a hill?
3. How do contour lines indicate a steep slope? How do they indicate a stream?
4. Why might a geologic map be useful to geologists?

Explore More

Use the resource below to answer the questions that follow.



MEDIA

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1. What is sea level?
2. How far apart are topographic lines?
3. What do the contour lines represent?
4. How do you know that there's a crater at the top of the volcano rather than a peak?
5. What is the purpose of a topographic map?

References

1. Courtesy of the US Geological Survey. Closely spaced contour lines on a topographic map indicate a steep s lope . Public Domain
2. Courtesy of the US Geological Survey. Concentric circles on a topographic map indicate a hill . Public Domain
3. Sam McCabe. On a contour map, a circle with inward hatches indicates a depression . CC BY-NC 3.0
4. Laura Guerin, based on image by the U.S. Geological Survey. A 3D ground model and its topographic map . CC BY-NC 3.0
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