

Sculpt Wisconsin's aquifers using modeling clay

David J. Hart, Wisconsin Geological and Natural History Survey | 2021

Students will use modeling clay to create a model of Wisconsin's four main aquifers. This activity helps them envision Wisconsin's aquifers in three dimensions while learning about the geologic concepts that guide how geologists interpret the rocks below ground.

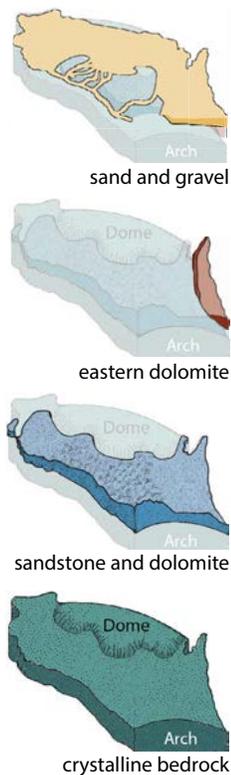
Background

An aquifer is a rock or soil layer that can store or transmit water. Wisconsin's groundwater reserves are held in four principal aquifers: the sand and gravel aquifer, the eastern dolomite aquifer, the sandstone and dolomite aquifer, and the crystalline bedrock aquifer.

What you will need

- *Groundwater: Wisconsin's Buried Treasure* (Wisconsin Department of Natural Resources, 2006). Available online: <https://dnr.wi.gov/education/documents/groundwater/WisconsinsBuriedTreasure.pdf>
- Modeling clay, four colors—about 1–2 cups
- Template map of Wisconsin's bedrock aquifers—two sizes are attached. The smaller map uses less clay and is a good choice for larger classes, the larger map works well using standard 3 oz cans.
- Large plastic straw (¼-inch diameter) to collect modeling clay plugs (core)
- Cotton swab or pencil to use as a plunger to extract plugs from the straw
- Plastic knife to cut cross sections

Wisconsin's aquifers



Concepts to learn

Wisconsin's aquifers have different thicknesses and abilities to let water flow.

Geologists use wells and geologic cores and the following principles to understand rock layers in three dimensions:

- **Principle of superposition:**
Younger rocks overlie older rocks; aquifers often overlie each other.
- **Principle of original horizontality:**
Aquifers are generally deposited in flat layers.
- **Principle of lateral continuity:**
Aquifers are usually continuous.

What to do

1. After you have familiarized yourself with *Groundwater: Wisconsin's Buried Treasure*, use the descriptions on pages 8 and 9 of the booklet to sculpt Wisconsin's aquifers. Shape aquifer layers in the following order on a copy of the map:
 - a. Begin with the **crystalline bedrock aquifer** layer. Include the Wisconsin arch and the Wisconsin dome shown on the template. The top of the aquifer should be lowest along the east and west edges of the state.
 - b. Place the **sandstone and dolomite aquifer** on top of the crystalline aquifer using a second color of clay. This layer is thickest in the southwest, thins to the north, and ends at the base of the Wisconsin dome. Simulate hills and valleys of the Driftless Area by adding texture in the southwest corner.

- c. Use a third color to make the **eastern dolomite** aquifer. This aquifer is located in a narrow strip along eastern Wisconsin, from the thumb of Door County down to the southern border. Include the ridge of the Niagara Escarpment along the western edge of this aquifer.
 - d. Make the **sand and gravel aquifer** using your fourth clay color. For this aquifer, you'll need to create your own outline, following the image on the template. In southwestern Wisconsin, make a network of narrow bands for the river valleys.
5. Use the straw to collect cores (or plugs) along the two dashed lines. These will be used to create cross sections. Extract the core from the straw using your plunger (pencil or swab) and arrange them along the edge of your template at approximately the same position they were collected from. Collect four or five cores along each line.
 6. Using your cores, the exposed aquifers, and the principles of superposition, original horizontality and lateral continuity, draw two cross sections, or vertical slices, of Wisconsin's geology from east to west and from north to south. This is what the first geologists did in Wisconsin. They connected the information collected at outcrops and in limited drilling to draw cross-sections. By the early 1900s, they had a rough idea of the geology. We still do similar work today to map the geology around the state. **Note to teachers:** *This is one of the most challenging tasks a geologist faces, drawing a map of what can't be seen and inferring what is in the third dimension.*
 7. Use your knife to cut along the east–west cross-section line. Spread the clay apart along the cut to view the layers. Compare the layers to your sketch.
 8. Use your knife to cut along the north–south line and compare the layers against your drawing.



Kevin Masarik

Revealing the aquifer layers (steps 7 and 8)

Questions to consider

- From the descriptions of the aquifers in the *Wisconsin's Buried Treasure* booklet, which part of Wisconsin do you think can supply the most groundwater? Where would it be hard to get lots of water?
- How do the cross sections you drew compare to the actual aquifer cross-section cuts you made with the knife? How could you make them better?

For more information

Dave Hart

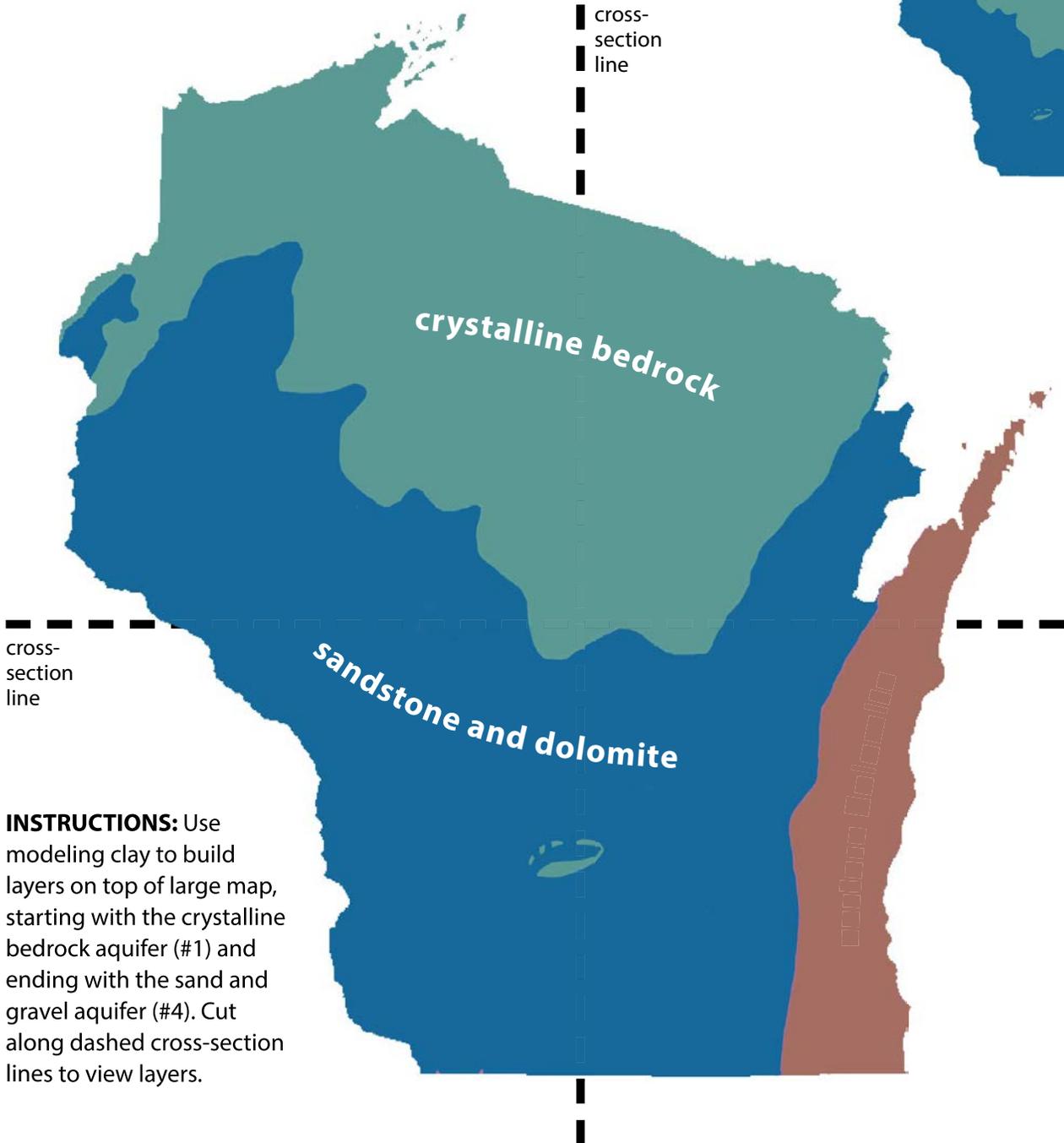
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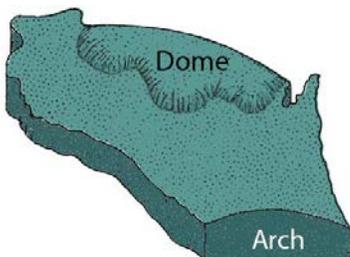
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Wisconsin's aquifers

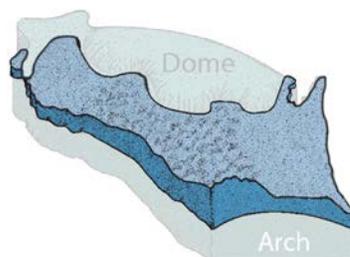


INSTRUCTIONS: Use modeling clay to build layers on top of large map, starting with the crystalline bedrock aquifer (#1) and ending with the sand and gravel aquifer (#4). Cut along dashed cross-section lines to view layers.

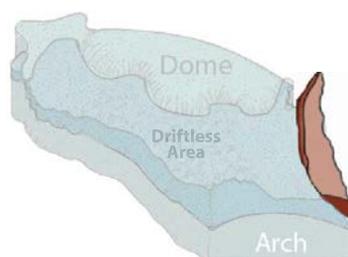
1. Crystalline bedrock



2. Sandstone and dolomite



3. Eastern dolomite

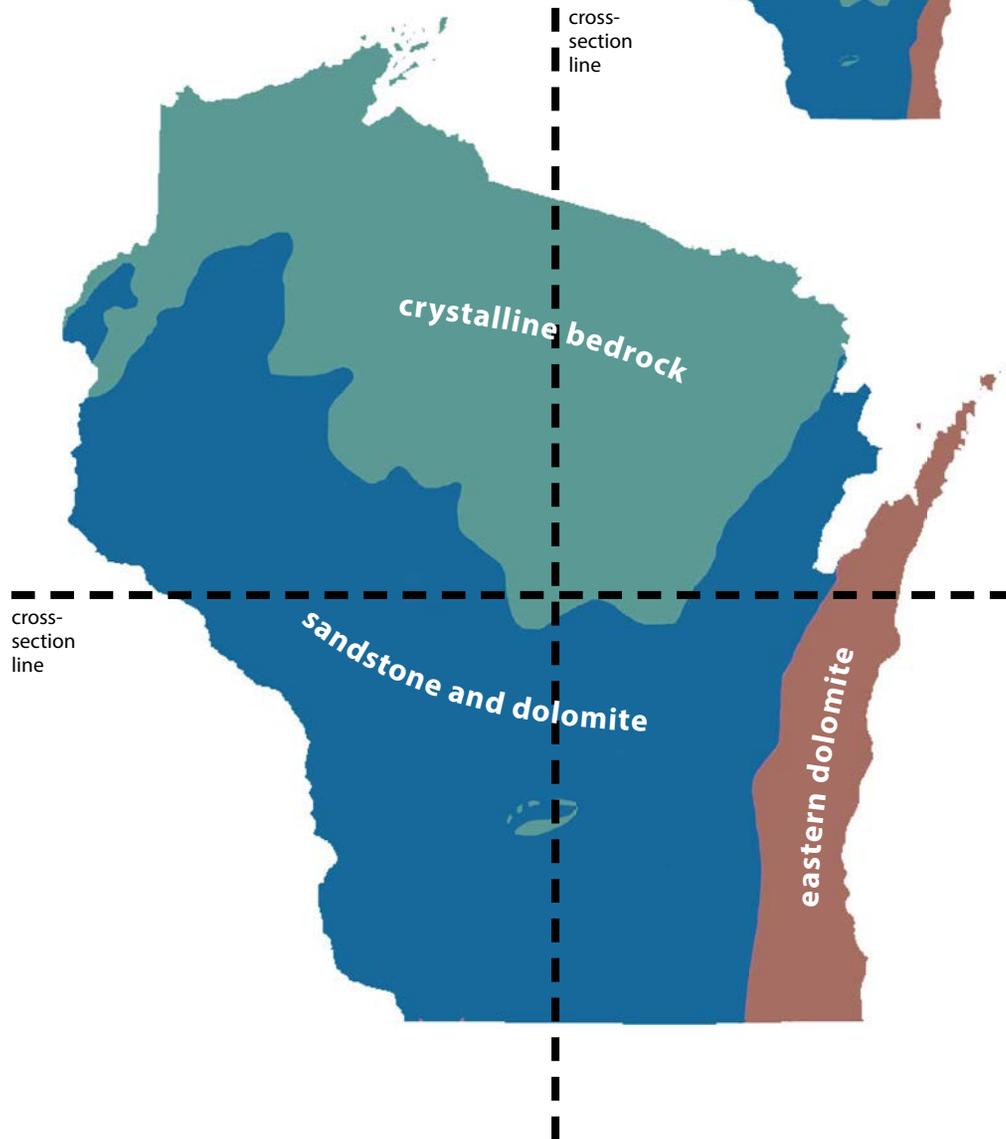
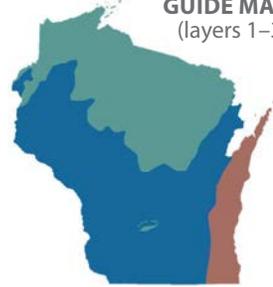


4. Sand and gravel



Wisconsin's aquifers

GUIDE MAP
(layers 1-3)



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Adapted from *Groundwater: Wisconsin's Buried Treasure* (Wisconsin Department of Natural Resources, 2006).

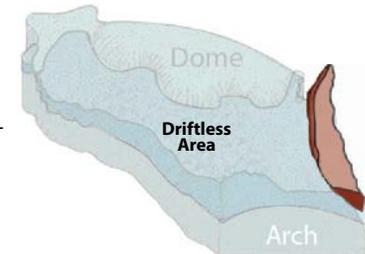
4 Sand and gravel

Cover entire state except for the Driftless Area in the southwest. In the Driftless Area, make a network of narrow bands for river valleys.



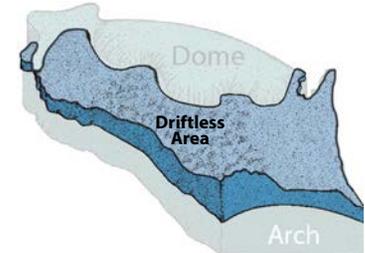
3 Eastern dolomite

Form a thin wedge along the eastern part of state, from the tip of Door County to the Wisconsin-Illinois border. Include a ridge (the Niagara Escarpment) on the western edge.



2 Sandstone and dolomite

Make this layer thickest in the southwest (Driftless Area) and thinner to the north. It does not cover the dome. For more realism, add hills and valleys to the Driftless Area.



1 Crystalline bedrock

Cover entire state with this layer. Make a slightly mounded ridge down the center for the arch and a raised area (the dome) over the northern third.

