

Carbonate Rock Formation

Limestone, dolomite (or dolostone), and marble are often collectively referred to as carbonate rocks because the main mineral is calcite. The chemical name of calcite is calcium carbonate.

Limestone, dolomite, sandstone and shale are sedimentary rocks (there are also other sedimentary rocks) that are often found together in a “rock group”.

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Sedimentary rocks are formed from small pieces of other things that pile up together and then get compacted into a rock.

Sandstone for example is formed when granite rock erodes releasing small grains of quartz (sand). When the sand piles up and gets compacted sandstone is formed.

Limestone is formed when sea shells (snails, clams, etc.) are dissolved chemically and then deposited (piled up) and compacted.

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Sedimentary rocks **OFTEN** but not always have fossils in them.

If there are fossils the identification of the rock and the age of the rock is easier to determine.

The only natural process that we know of to produce limestone and shale occur in water (ocean) environments.

Sandstone can be produced in a desert and wind environment but is more commonly produced in a water environment.

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The “stuff” settling out of water at any one time depends on two factors:

1. The speed of the water motion
2. The size (mass) of the particles.

The faster the water moves, the bigger the particles it can carry.

When a river is flowing it is often carrying a mixture of mud, sand and other small particles.

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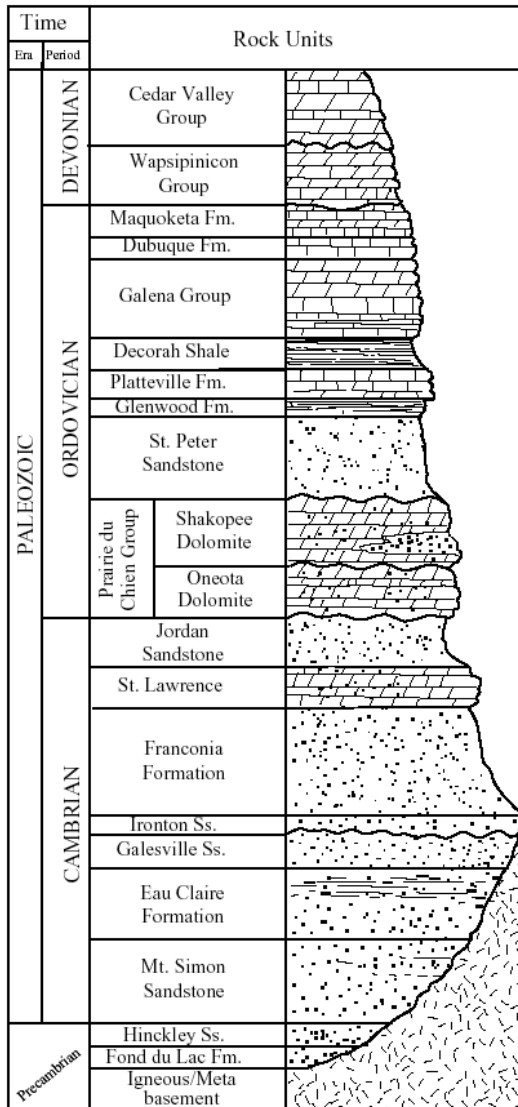
When the river flows into a large lake or ocean the biggest particles will settle out first and the smallest last.

This means that sand piles up near the shore where it can settle out first.

Mud will pile up a little further out into the ocean because it settles out more slowly.

Calcite (the main mineral in limestone) will pile up further out into the ocean, in clear water areas where shelled animals can live.

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The diagram at the left shows the general layering of the sedimentary rocks in southeastern Minnesota. Notice the combined pattern of limestone, sandstone and shale. Pay attention to the symbols used to represent each type of rock. The oldest rock is at the bottom because it was put there first, the youngest rock is at the top.

Why are there different layers?
 What happened to cause each of the layers?
 You have this diagram in the *Caves in Minnesota* publication from the Minnesota Geological Survey

Figure 2. Generalized Paleozoic rock column for southeastern Minnesota.

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Sedimentary rocks are put in place in nearly horizontal layers with the oldest at the bottom.

Sandstone is formed near sea shores

Mudstone and shale is formed further out to sea

Limestone is formed even further out to sea

What does the evidence of variable layers on the bedrock tell us about this area?

Notice that Hutchinson is very near the border of the limestone bedrock on the maps from the Minnesota Geological Survey.

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Ancient tropical seas from the Minnesota Geological Survey describes the process of the sedimentary rock formation in southeastern Minnesota during Cambrian and Ordovician times.

Study the diagrams carefully.

Note how the different sea levels left behind different types of rocks.

Again, notice the location of Hutchinson in comparison to the types of bedrock.

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The time scale for this rock formation along with other rocks in Minnesota is outlined in *Precambrian Geology* from the Minnesota Geological Survey

We will be considering geologic time in much more detail in a later unit so you will not be responsible for knowing this time scale now but it is a good introduction that will be reinforced each unit through the end of the trimester.

How Do We Know?

A reasonable question. Where is the evidence for all of this.

First, the evidence is complicated and obscure. In most places it is not in places where we can see it.

The evidence has increased greatly in the last few years with the combination with gps, Geographic Information Systems (GIS) databases and drill core or water well records

Evidence

Every well or core sample drilled in Minnesota must be logged and stored. As this information is analyzed the “picture” of the bedrock in Minnesota has become more clear.

In 2008 additional evidence was collected in McLeod county as the Minnesota Geological Survey did additional drilling, sampling and collecting to learn more about our bedrock as well as our glacial drift.

Evidence

As more evidence is collected we have more pieces that fill in the details of the story of Minnesota and the earth.

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- <http://www.pca.state.mn.us/water/groundwater/karst.html>