

## The Madison Formation: A Virtual Field Trip

name: \_\_\_\_\_

A. Go to "The Madison Room" at <http://formontana.net/room.html> and then select (click on) **GATES OF THE MOUNTAINS**. Scroll down to read the explanation.

1. This photo, taken about 20 miles north of Helena, shows a place called the *Gates of the Mountains*. If you have taken the *Gates of the Mountains Boat Tour*, this is what you saw just before you entered the canyon. What is the specific name for the rock that makes up the cliffs shown in the photo? \_\_\_\_\_

2. What does the term "formation" mean to a geologist?

3. Why are geologists so interested in rock layers (formations)?

4. List three specific formations made of material (sand, silt, clay, etc.) deposited during the time when there were dinosaurs in Montana (from 250 to 65 million years ago).

5. Click on the link titled **GEOLOGIC TIME SCALE**. The material that makes up the Madison Formation (a.k.a. Madison limestone) was deposited during the Mississippian Period. When was this period?

6. Dinosaurs roamed Montana during the Mesozoic Era. When was this era, and what three periods did it include?

7. Throughout eastern Montana rock layers formed during the time of the dinosaurs and layers of Madison limestone are both present (and undisturbed). Which would be found above the other? (layers formed during the time of the dinosaurs, or the Madison limestone) Explain why.

8. Click on the word "Carboniferous". According to the text near the bottom of this web page, most of the rock found in Lower Carboniferous is limestone (including the Madison limestone) composed of the remains of crinoids. Click on "crinoids" to see some photos. Explain how these animals got their food.

9. Go back to the **GATES OF THE MOUNTAINS** page. Geographically, how widespread is the Madison formation, and how thick is it?

Tell what the environment in Montana was like when each of the following rock formations were being deposited as sediment:

10. Eagle formation:

11. Judith formation:

12. Madison formation:

13. Look at the map near the bottom of the *GATES OF THE MOUNTAINS* page. It shows where Montana was during the Mississippian Period. Today Montana is about 45 degrees north of the equator. Approximately what was the latitude of Montana 340 million years ago?

14. Was the surface of Montana on land, or beneath the ocean 340 million years ago?

15. What do marine organisms make with the calcium carbonate that they absorb from the water?

16. What eventually happens to these parts?

17. Seaweeds also "excrete" calcite. Use dictionary.com to find out find out what "excrete" means and then write out a definition **IN YOUR OWN WORDS**.

18. This excreted calcite then "precipitates" onto the sea floor. Explain what you think this sentence means. Do not use any resources. Think!

19. Click on the Hot Link titled "**More about the Madison Formation**". Read this page and look at the map. In what part of the state will you **NOT** find the Madison formation at or near the surface? Circle one.

a. the western third

b. the middle third

c. the eastern third

20. The Madison Limestone is exposed at the surface in parts of central and western Montana. Explain how plate tectonics and erosion combined to make this happen.

21. How do geologists know that Montana was above sea level for a time during the Mississippian Period?

22. The Madison limestone is present in eastern Montana. So, why doesn't the map show any blue areas in the eastern part of the state?

23. Why does limestone erode away so quickly in many parts of the world?

24. Why is Madison limestone one of the tougher types of rock found in Montana?

**B. Return to The Madison Room, and then select GIANT SPRINGS.**

25. Like the Gates of the Mountains, Giant Springs is also located on the Missouri River (near Great Falls). In this situation shown on the diagram, the Madison Formation is an aquifer. Why does the water stay in the limestone?

26. What is the source of the water that comes out at Giant Springs. (Where does it originate?)

27. Once the water enters the Madison formation, why does it flow toward Great Falls? (Look at the diagram at the top of the web page, and Think!)

28. How do scientists know that it takes the water about 2,900 years to get from the Little Belt Mountains to the Missouri River?

**C. Return to The Madison Room, and then select LITTLE ROCKIES.**

29. This photo of the Little Rockies was taken in north central Montana. Throughout most of central and eastern Montana the Madison limestone lies beneath younger rock layers. However, in the photo, the Madison Formation appears at the surface as white cliffs. Look at the cross-section diagram near the middle of the web page. Explain what caused the limestone to become tilted into the position shown in the photo.

30. What happened to the layers of Madison limestone that used to be above the igneous rock?

31. Find the Little Rockies on the colored map near the bottom of the web page. What does the blue represent? What type of rock is represented by the red color?

Blue:

Red:

**D. Return to The Madison Room, and then select SINKHOLES.**

32. The Belt "Meteor Crater" is not an impact crater. What is it?

33. The rock layer shown in the top photo is sandstone. What caused the layer of sandstone to collapse into the ground?

34. If you've ever been in the Lewis and Clark Caverns near Three Forks, you've been inside the Madison Formation. The Madison limestone can also be found just beneath the layer of sandstone that collapsed to form the Belt "Meteor Crater". Why is the Madison formation sometimes described as a "geological Swiss cheese"?

35. What is a "pishkun", and how do scientists know that this sinkhole was used as one?

36. Look at the photo at the bottom of the web page. What type of rock makes up the wall behind the person standing in the snow?

**E. Return to The Madison Room, and then select QUARRY.**

37. Here's that Madison limestone again! What is the difference between a mine and a quarry?

38. What is lost from the calcite molecules as the crushed limestone is heated?

39. Besides limestone, what other two ingredients are needed to make cement?

40. What ingredients are needed to make concrete?