

Iowa's Tectonic Future

** Created by Kyle N. Hoffman, Geology, Linn-Mar High School, Marion Iowa. 2009*

Teachers' Notes

Objectives:

- Students will demonstrate knowledge of the rock cycle
- Students will demonstrate knowledge of plate movements
- Students will demonstrate understanding of the connection between plate tectonics and rock formation

Standards:

Science as Inquiry

1. Identifies questions and concepts that guide scientific investigations
2. Designs and conducts scientific investigations
4. Formulates and revises scientific explanations and models using logic and evidence
5. Recognizes and analyzes alternative explanations and models
6. Communicates and defends a scientific argument

Earth and Space

1. Understands and applies knowledge of energy in the earth system
2. Understands and applies knowledge of Geochemical cycles

Physical Science

3. Understands and applies knowledge of chemical reactions
4. Understands and applies knowledge of motions and forces
5. Understands and applies knowledge of interactions of energy and matter

Essential Questions:

1. What are the connections between plate tectonics and rock formation?
2. What geologic processes have to occur to change Iowa's geology?

Engage:

They will need to take out their field journals. Put them into groups of four and have them open to the Devonian Fossil Gorge section. Using a copy of the Stratigraphic Column of Iowa (<http://www.igsb.uiowa.edu/gsbpubs/pdf/EM-40.pdf>), from the Iowa DNR Geologic Survey, they will be creating their own stratigraphic column for the two locations we have visited, the Devonian Fossil Gorge and the Palisades-Kepler State Park bluffs. They will be using their notes from these spots (earlier class trips) to create their stratigraphic column. They will need to be ready to share their columns with the class and should be ready to explain their reasoning for choosing the geologic layers they did.

Explore/Elaborate:

The students will be creating a geological forecast for Iowa for 1 million years from now. They will need to use the following questions and ideas to create their forecast.

- What plate movements have happened around the country?
- Thoroughly describe all possible events that they think could happen.
 - o Make sure to connect all events with the plate movements they mentioned
- Name which plates moved to where
 - o Which major geologic events are associated with each plate
 - o Think in terms of; volcanic activity, earthquakes, glacial movement, sea-level changes, mountain formation and erosion and plate movement
- Create an image of how you see the new country would look
 - o Label all areas of change
 - o Explain what changes occurred

Next, localize this assignment.

- How would all these changes affect Iowa?
- What are the geologic changes?
 - o Ex. mineral deposits, new rock formations (both newly on top and changes from existing layers)
- What could Iowa now start to mine for?
- Describe how each change formed
 - o Think of geologic processes (plate tectonics, volcanic activity, glacial affects, erosion affects)
- Create a new stratigraphic column for the same two places from earlier, plus a new one for the area around our school.
 - o Devonian Fossil Gorge
 - o Palisades-Kepler State Park
 - o Linn-Mar Campus

Extension:

- Make a realistic prediction of Iowa's geology after another million years.
- Illustrate Iowa's new landscape. Excluding city growth, what would the Corridor Area (Iowa City to Cedar Falls/Waterloo) look like? What would the agricultural landscape be like, along with river systems and general topography?

Hints:

- Students' predictions will be defined by their understanding of tectonics that takes place in and around the North America Plate.
- Also, their descriptions of tectonic activity in Iowa will also be defined by their understanding of tectonics in general.
- There may be very different answers and one way to check for accuracy is to have the students search from tectonic projections in the computer lab.

Evaluation:

	5	3	2	1
United States Model – 1 MY from Present	Realistic prediction. All requirements are met. Detailed illustration.	Realistic prediction. All requirements are met. Illustration not detailed.	Realistic prediction. 1-2 requirements are not met. Illustration not detailed.	Non-realistic prediction. Over 3 requirements not met and illustration not detailed.
United States Model – 1 MY from Present – Description of Events	Thorough description of all events mentioned. All requirements met.	Thorough description of all events mentioned. 1-2 requirements missing.	1-3 events not described and 1-2 requirements missing.	Over 4 events not describe and over 3 requirements missing.
Iowa's Geology – 1 MY from Present	Well thought out and realistic results in relation to United States Model. All requirements met.	Well thought out and realistic results in relation to United States Model. 1-2 requirements missing.	Not well thought out and non-realistic results in relation to the United States Model. 1-2 requirements missing.	Not well thought out and non-realistic results in relation to the United States Model. Over 3 requirements missing.
Iowa's Geology – 1 MY from Present – Description	Descriptions of Iowa's geology changes are realistic and thorough. All requirements met.	Descriptions of Iowa's geology changes are realistic and thorough. 1-2 requirements missing.	Descriptions of Iowa's geology change are non-realistic and not thorough. 1-2 requirements missing.	Descriptions of Iowa's geology change are non-realistic and not thorough. Over 3 requirements missing.
Stratigraphic Columns	All columns are complete. Each layer is appropriately named.	All columns are complete. 1-3 layers not labeled appropriately.	1-2 columns are not complete. 1-3 layers not labeled appropriately.	2-3 columns are not complete. Over 4 layers are not labeled appropriately.

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Propose:

You will be forecasting Iowa's geology 1 million years from now. Iowa is now known for its agriculture and pork processes, but will that hold true a million years in the future? You will be figuring out what is going to happen around the country due to plate movements. What new geologic features will be appearing and how different will the country's landscape look? What affect will this have in Iowa, an area known for little plate movement?

Essential Questions:

1. What are the connections between plate tectonics and rock formation?
2. What geologic processes have to occur to change Iowa's geologically?

Exploration:

You will be making several predictions using plate movements and their consequences. To begin:

- Using what you now know about plate movements in and around the United States, you need to create a trajectory model of where those plates will be 1 million years from today.
 - o Make an illustrated model of the new United States (do not label yet)
- In your composition notebook, make a list of all the events that have happened due to the plate movement you have mentioned.
 - o Include: mountain formation and deformation, city movement, new fault lines, desertification, new river systems, etc.
 - o Also include (if applicable): sea-level changes, glacial formation and movement
- Add all your changes to your model and make sure to label all changes.
- In your composition notebook, describe all your events in relation to the plate movement
 - o Name the actual plate that caused the event

Next, you will localize your new country. Think of how all these changes will affect Iowa geology and Iowa's landscape. You will need to focus on what will happen to the geologic layers beneath Iowa along with possible new layers on top. Answer the following statements:

- How will the plate movement geologically change Iowa?
- Describe which layers would change and how.
 - o Think about mineral deposited, rock layers changes (metamorphism), rock deposition, change in river systems, glacial formation and movement
- Describe what geologic process had to occur for each change you have mentioned.
 - o Ex: magma chamber formation developing beneath Iowa, causing metamorphism in the lower rock layers
 - You will need to be more descriptive though
- What could we start to mine now in Iowa?
- Create a new stratigraphic column for the same two places from earlier, plus a new one for the area around our school.
 - o Devonian Fossil Gorge
 - o Palisades-Kepler State Park
 - o Linn-Mar Campus

- Label each layer with the appropriate rock type.

Extension:

- Predict Iowa's landscape for this time.
 - o Illustrate Iowa's new landscape.
 - o Excluding city growth, what would the Corridor Area (Iowa City to Cedar Falls/Waterloo) look like?
 - o What would the agricultural landscape look like, along with river systems and general topography?

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