

## TOPIC 2 – GEOLOGY

### Topic Overview

Topic 2 highlights geologic formations in present-day North Dakota and the forces that created them. It includes graphics and information that will help you comprehend the magnitude of glaciations, erosion, and sedimentation on the landscape of North Dakota.

### Topic Objectives

- As a result of the study of Topic 2, you will be able to
  - Interpret a stratigraphic column.
  - Explain how coal, petroleum, and natural gas were formed.
  - Explore theories of Ice Age extinctions.
  - Expand awareness of the Williston Basin and its importance for the economy of North Dakota.

### ND Content Standards

- 8.1.1
- 8.1.2
- 8.5.1

### Common Core Standards

- RH 2
- RH 4
- RH 7
- WHST 1
- WHST 2
- WHST9

### Topic Activities

- Reading a Map
- Organizing Data 1
- Organizing Data 2
- Debate/Discussion



## Reading a Map

To access a photo/document/map, refer to the topic reading assignment or use the SEARCH feature to enter its name or number.

Study the map of the **Williston Basin** and complete the following:

1. Name the North Dakota counties (whole or part) included in the Williston Basin.
2. Explain how the Williston Basin formed.
3. Describe the significance of the Williston Basin to North Dakota and its economy. Be sure to include facts that support your answer.



# NORTH DAKOTA: PEOPLE LIVING ON THE LAND

## Unit 1 – Lesson 1 – Topic 2

### Organizing Data 1

To access a photo/document/map, refer to the topic reading assignment or use the SEARCH feature to enter its name or number.

Read about geologic formations, and study the North Dakota stratigraphic column **Image 1** and/or study the chart below. Place the following rock types under each appropriate Period and Epoch. Then, write a concluding statement.

ERA	PERIOD	EPOCH	DATES	AGE OF	NOTES
<b>CENOZOIC</b>	Quaternary	Holocene	0–2	Mammals	Humans
		Pleistocene			
	Tertiary	Pliocene	2–5		
		Miocene	5–24		
		Oligocene	24–37		
		Eocene	37–58		
Paleocene	58–65		Extinction of Dinosaurs		
<b>MESOZOIC</b>	Cretaceous		65–144	Reptiles	Flowering Plants
	Jurassic		144–208		First Birds and Mammals
	Triassic		208–248		First Dinosaurs
<b>PALEOZOIC</b>	Permian		248–286	Amphibians	End of Trilobites
	Carboniferous	Pennsylvanian	286–320		First Reptiles
		Mississippian	320–360		Large Primitive Trees
	Devonian		360–408	Fish	First Amphibians
	Silurian		408–438		First Land Plant Fossils
	Ordovician		438–505	Invertebrates	First Fish
Cambrian		505–540	First Shells		
<b>PRECAMBRIAN</b>			540–4,500		First Multi-celled Organisms
					First One-celled Organisms
					Approximate Age of Oldest Rocks



## Organizing Data 1 (continued)

Calcareous Shale  
Lignite  
Sandstone

Carbonate  
Mudstone  
Siltstone

Claystone/Shale  
Sand & Gravel  
Till

### MESOZOIC ERA

**CRETACEOUS PERIOD** (65-144 million years before today)

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### CENOZOIC ERA

**TERTIARY PERIOD** (2-65 million years before today)

**Paleocene Epoch** (58-65 million years before today)

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**Eocene Epoch** (37-58 million years before today)

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**Oligocene Epoch** (24-37 million years before today)

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**Miocene Epoch** (5-24 million years before today)

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**Pliocene Epoch** (2-5 million years before today)

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## Organizing Data 1 (continued)

**QUATERNARY PERIOD** (0-2 million years before today)

**Pleistocene Epoch** (0-2 million years before today)

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**Holocene Epoch** (0-2 million years before today)

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**Concluding statement:**



## Organizing Data 2

To access a photo/document/map, refer to the topic reading assignment or use the SEARCH feature to enter its name or number.

According to the Miriam-Webster online definition, a filmstrip is a strip of film bearing a sequence of images for projection as still pictures. The filmstrip was an effective educational tool used to give information to an audience before the electronic age came into being. It was first used in 1930, or less than 100 years ago.

Coal, petroleum, and natural gas were all created through a process of shallow seas covering and receding from an area several times over millions of years. From your reading and studying the cross sections for **Images 6 and 8 (How Coal Formed 2 and How Petroleum Formed)**, create a filmstrip sequencing the process in illustrations to show how lignite coal and petroleum were formed in North Dakota. Share your filmstrip with other class members.

The image shows two filmstrip templates. Each template consists of a black border with white sprocket holes on the top and bottom edges. The first filmstrip has a white box on the left containing the text "How Lignite Coal Was Formed" and four empty white rectangular frames to its right. The second filmstrip has a white box on the left containing the text "How Petroleum (Oil) Was Formed" and four empty white rectangular frames to its right.

## Debate/Discussion

At least three theories have been proposed to explain how Ice Age animals became extinct. From your reading, list reasons for the extinction based on each of the three theories mentioned. Then, compare your discussion points with those of a classmate. Together, come up with a concluding statement, and discuss whether or not some of the same concerns are relevant today.

### Theory One

### Theory Two

### Theory Three

**Concluding Statement:**

