



Core Drilling for Oil

Grade/Subject: 5th Science

Strand/Standard 5.1.1 Analyze and interpret data to describe patterns of Earth's features. Emphasize most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans while major mountain chains may be found inside continents or near their edges. Examples of data could include maps showing locations of mountains on continents and the ocean floor or the locations of volcanoes and earthquakes. (ESS2.B)

Lesson Performance Expectations: Student will be able to; recognize layers in the core samples and understand why core samples are taken. Students will identify the location of an oil deposit

Materials: Student groups of 3 - 4 students

- Map for each group or enlarge poster of the map. ([pdf file](#))
- Copy of the core sample cards [pdf](#) (It is suggested that you make multiple copies and laminate. Students may choose the same area.)
- Student worksheet
- Ruler in millimeters
- Digital device for videos

Time: 1 day, 45 - 60 minutes

Teacher Background Information:

- There are many reasons why scientists want to know what is beneath the earth's surface. Engineers must check the composition of the earth so they can design properly supported structures. Companies also want to identify and/or quantify a resource before they spend time and money drilling or mining for it. Mineral exploration is the process of drilling small-diameter holes in the ground to bring the cuttings (**core samples**) to the surface for analysis. These holes usually range from 5 inches to 6 3/4 inches in diameter depending on the depth required and what is being extracted. Taking **core samples** (core drilling) is a cost effective way to discover what is beneath the earth's surface without impacting the surrounding area.
- **Geologists** and engineers analyze the geological data found using these types of drilling methods. They use the analysis to make predictions about the earth's layers and the presence of certain **minerals** and fossil fuels that we use on a daily basis. The findings determine whether or not the land is rich in mineral deposits, thereby allowing companies to strategically mine for them. Core drilling is also used to locate fossil fuels. Natural resources inside Earth known as **fossil fuels** are converted into electricity, gasoline for transportation, and heat. Utah has many fossil fuels available to create these types of energy including coal, petroleum, natural gas, and several others. Currently, core drilling occurs in counties across Utah, including Uintah, Duchesne, Summit, Carbon, Emery, Grand, Wayne, Garfield, San Juan, and Kane.
- Carbon, Uintah, and Emery Counties have many wells and mining sites. Kennecott copper mine, located 28 miles southwest of Salt Lake City, is the largest mine in Utah and has been in production since 1906. Kennecott and other sites provide jobs and economic benefits to the counties in which they're located.

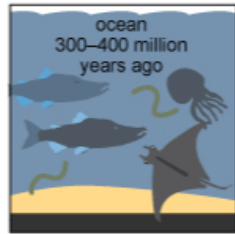
Student Background Knowledge: Students will need to know how sedimentary rock is created as sediments collect and are compacted over millions of years. They need instruction on the formation of oil in a "pool" in or between layers of sedimentary rock.

This video may be helpful: [Core Drilling with Play-doh](#) (4:71 min)

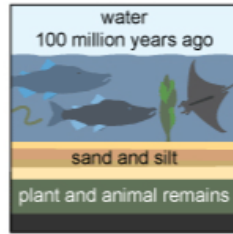
This picture may be helpful:

Petroleum and natural gas formation

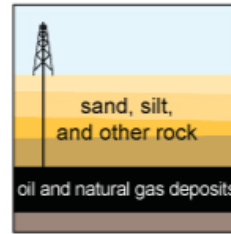
Tiny marine plants and animals died and were buried on the ocean floor. Over time, the marine plants and animals were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned the remains into oil and natural gas.



Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and natural gas deposits.



Source: Adapted from National Energy Education Development Project (public domain)

Teacher Step by Step: A 3-d lesson should insist students do the thinking. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

Before activity

1. Copy the student sheet for each group and enlarge the map to poster size.
2. Print cards in color and cut. There are more copies of the samples with less oil and fewer samples with more oil. As you tape the cards on the classroom map, write the letter and number of the coordinates on the back of each. If you want to print two sets of samples, put two in each location so more than one group can sample at that location.
3. The locations of the greatest oil are linked to lesser and lesser amounts in nearby cores.
4. Place the cards on the classroom map so students have access to picking up one at a time.

Start with the Phenomenon

1. Hand out the student sheet to each student. The pictures below are printed on the student sheet but you may also want to project them.

Pulling a core sample out of Earth



Analyzing the core samples



2. Discuss the Phenomenon with the students. Make sure they understand a hollow pipe is drilled into Earth and fills with the rock that it passes through and that scientists analyze the core samples. Have students list

questions they have about this process and share them.

3. Discuss with the students that taking core samples can give insight of what lies beneath Earth. Explain that an oil company uses this information to know where to drill.
4. Let each group decide which areas on the map they would like to get a core sample. Have them mark the coordinates on their map.
5. Students should get their first four samples and observe them. This will be largely guesswork. They may get the black layer that is oil or not.
6. Students will measure and color the different layers in millimeters and record them on their student sheet.
7. Once the students have completed their analysis of the first samples, they need to choose their next two samples based on the results of their first observations. If they need more data, then let them choose 2 more.
8. When the students feel they have identified the maximum amount of oil, they should check with the teacher to see if they are correct. (Probably B3 and B2) The team with the fewest core drills and finds the correct site has spent the least money.

[Oil and Gas Formation](#) (3:04 min)

Assessment of Student Learning.

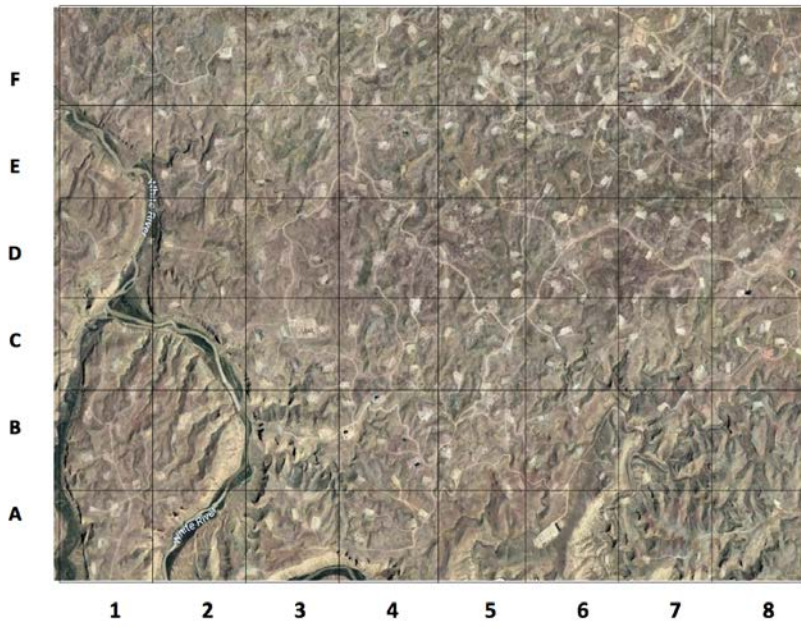
1. Why do oil companies use core samples? (*To locate rock layers containing oil*)
2. What else do you think core samples can provide information on? (*Earth History*)
3. How did you analyze the core sample? (*measured the thickness, recorded the color*)
4. Which core sample helped your group decide which would be the best place to drill for oil? *The one with oil*
Why? *If you didn't get any oil on any of them, you were out of luck.* Explain your evidence. *As soon as you found some oil, you could look around in that location.*

Standardized Test Preparation:

Core Drilling for Oil

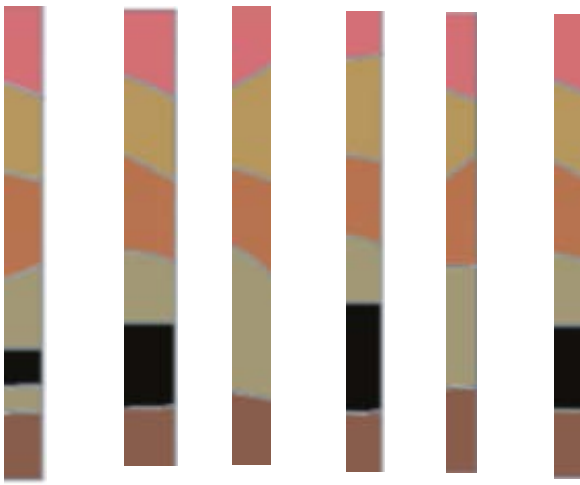
1. An oil company takes core samples in an area and analyses them. What are they looking for?
 - a. Evidence that sedimentary rocks are present.
 - b. Evidence that oil will be easy to find.
 - c. Evidence that ancient life once lived in this area.
 - d. Evidence that oil lies below the surface.*
2. Why do oil companies take core samples before drilling an oil well?
 - a. A core sample lets them know if an expensive oil drill should be built.
 - b. A core sample begins the drilling process by creating the hole.
 - c. A core sample can take the place of oil drilling machinery.
 - d. A core sample may have enough oil to make money on.

The map below shows an area where 6 core samples have been taken.



The core samples are labeled below:

B3 B4 D6 B5 C8 B6



3. Based on the patterns seen in the core samples, how likely will it be to find oil in E8?
 - a. Very likely
 - b. Likely
 - c. Not likely
 - d. Very unlikely*

4. Based on the patterns seen in the core samples, where should drilling for oil be most successful?
 - a. Near B3
 - b. Near B4
 - c. Near B5*
 - d. Near B6

Extension of lesson and Career Connections:

Extension: Show students the location of oil wells in Utah and look for patterns. <https://datamining.ogm.utah.gov/>

Career exploration: Geologists, seismic survey crews, oil drillers,

Core Drilling for Oil

Name _____

Phenomenon:

Pulling a core sample out of Earth



Analyzing the core samples

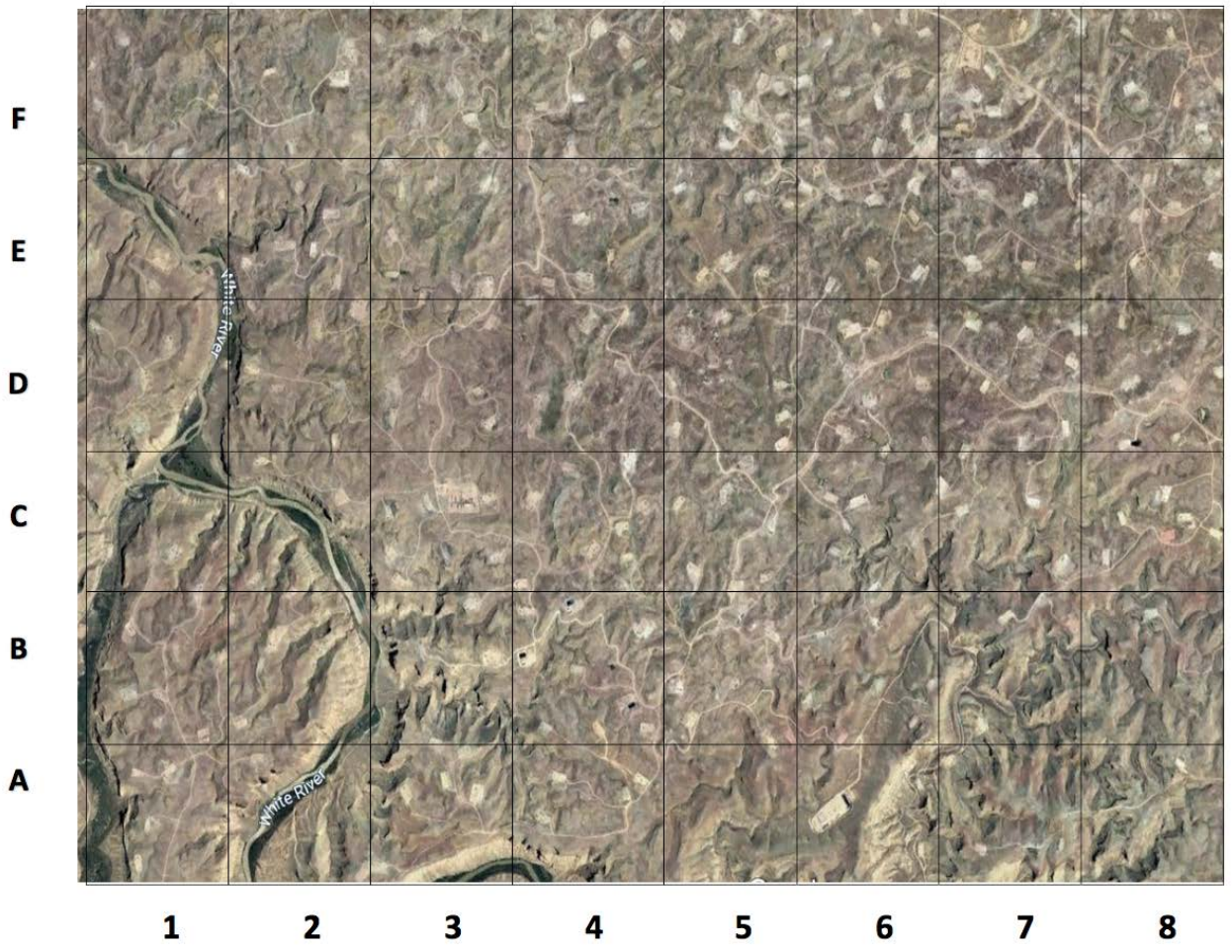


An oil company is looking at an area to drill for oil. Since setting up an oil drilling rig is expensive, the company is looking for evidence that oil is present before they place the next oil drilling rig. They decide to take core samples and analyze them like shown in the pictures above. What questions do you have about core sampling?

- 1.
- 2.
- 3.

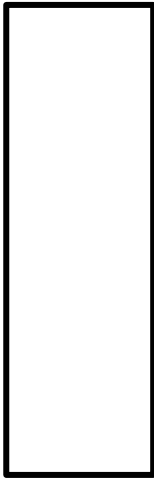
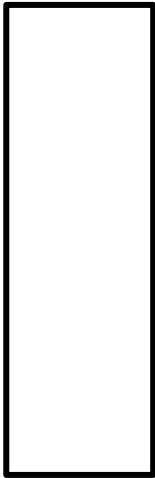


Directions

1. Use the map below to find oil. Where will you drill? Mark four places where your group would like to drill. Remember every time you do a core sample, it cost money. You will only have enough money to drill a few core samples. Make sure you mark off which sections you have chosen on the map.
2. Get the sample from the map in the front of the room and take it to your table.
3. Draw the layers you see. Oil will look like a black layer. You want to find the thickest layer of oil.
4. Use a ruler to measure the thickness of each layer and write it on the chart.



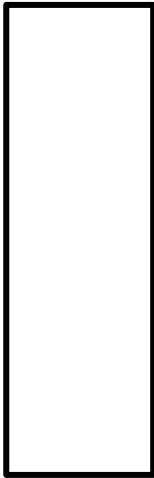
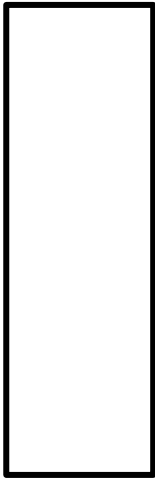


Analyze the Core Samples

Choose one area that you will want to take the core sample. Record the information below. Remember to answer the questions below.

Core Sample #1	Core Sample #2	Core Sample #3	Core Sample #4
Location:	Location:	Location:	Location:
Color in the sample 	Color in the sample 	Color in the sample 	Color in the sample 
Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.
Interpretation Is this a good place to drill for oil? Why or Why Not?	Interpretation Is this a good place to drill for oil? Why or Why Not?	Interpretation Is this a good place to drill for oil? Why or Why Not?	Interpretation Is this a good place to drill for oil? Why or Why Not?

Now that you have analyzed the 4 core samples, can your group determine where to place the oil drilling rig? If not, where should your group get the next two drilling samples?

Analyze Core Samples #5 and #6. Do you need to get more data? Where should your group get the next two drilling samples (#7 and #8)?

Core Sample #5	Core Sample #6	Core Sample #7	Core Sample #8
Location:	Location:	Location:	Location:
Color in the sample 	Color in the sample 	Color in the sample 	Color in the sample 
Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.	Measure in millimeters the length of each color. Record the length on the side.
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Now that you have analyzed the 8 core samples, can your group determine where to place the oil drilling rig?

Assessment

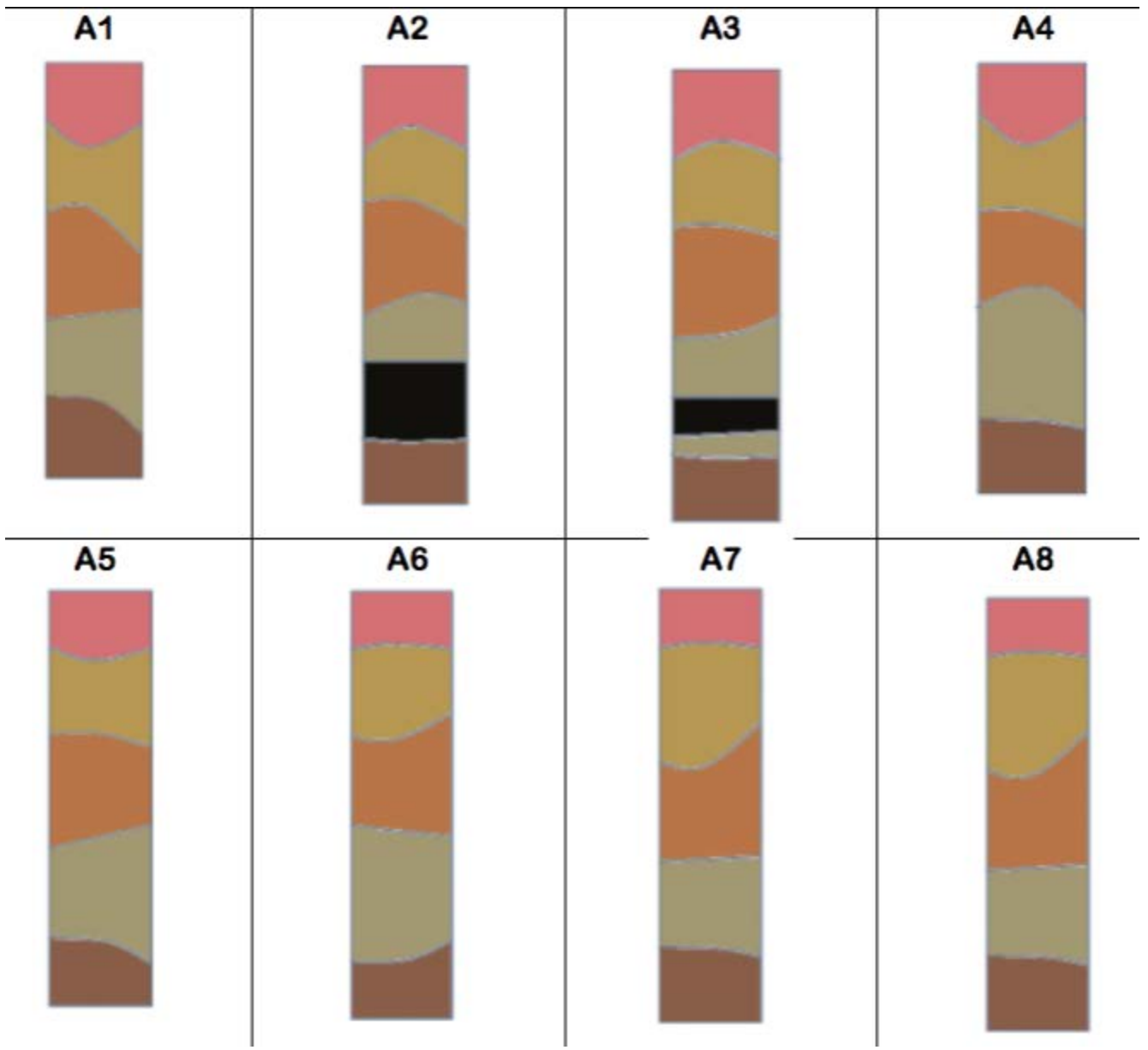
1. Why do Oil companies use core samples?
2. What else do you think core samples can provide information about?
3. How did you analyze the core sample?
4. Which core sample helped your group decide which would be the best place to drill for oil? Why? Explain your evidence.

Support Materials

Core Drilling for Oil

Map of Ouray, Utah

Core Samples



B1



B2



B3



B4



B5



B6



B7



B8



C1



C2



C3



C4



C5



C6



C7



C8



D1



D2



D3



D4



D5



D6



D7



D8



E1



E2



E3



E4



E5



E6



E7



E8



F1



F2



F3



F4



F5



F6



F7



F8



