



LOAN COPY ONLY

# EVIDENCE OF ANCIENT SEAS IN OHIO

by

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TEACHER GUIDE

OEAGLS-Oceanic  
Education  
Activities  
for  
Great  
Lakes  
Schools

**TEACHER GUIDE**  
**OEAGLS INVESTIGATION #10**

Completed 1979  
Revised  
September 1985

This instructional activity was prepared with the support of the National Oceanic and Atmospheric Administration and The Ohio State University College of Education and School of Natural Resources. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the authors, and do not necessarily reflect the view of NOAA or the University.

Figures 1-6 are from Noble, Allen G. and Korsok, Albert J., Ohio-An American Heartland, Bulletin 65, Ohio Division of Geological Survey, Columbus, Ohio, 1975.

## TEACHER GUIDE EVIDENCE OF ANCIENT SEAS IN OHIO

### OVERVIEW

In this investigation, students study the sedimentary rocks commonly found in Ohio. These rocks are then related to the geologic history of the state and to the types of environments that must have existed when they were formed. The presence of many mineral resources, especially oil and gas, under Lake Erie is mentioned and students are asked to discuss problems with exploiting those resources. Students also learn how some of Ohio's rock and mineral resources are used.

**OBJECTIVES:** When students have completed this investigation they will be able to

1. Describe the environments in which each of the following sediments would be deposited: clay, silt, mud, shale, sand and sandstone; limestone and dolostone; salt and gypsum; coal, oil, natural gas.
2. Explain the relationship between the geological history of Ohio and its mineral wealth.
3. Explain why some areas of Ohio do not have as much mineral wealth as other areas.
4. Explain how some of the rocks and minerals found in Ohio are used.

### PREREQUISITE STUDENT BACKGROUND

Students should have experience in identifying sedimentary rocks and the common minerals. They should be familiar with the geologic time scale.

**MATERIALS:** Each lab group should have

1. A set of rocks including shale, sandstone, limestone, dolostone, salt, gypsum and coal. Be certain that the samples you use exhibit the characteristics given in the student guide. These are the rocks that outcrop at the surface in Ohio and therefore can be collected by the teacher. The Ohio Geological Survey, Fountain Square, Columbus, Ohio will provide a set of single specimens of Ohio rocks on request. They can be purchased, if necessary, from Ward's Scientific, Rochester, New York.
2. A small jar filled with water and sediment. The sediment should be of mixed sand and clay.
3. A binocular microscope with watch glass, tongs and saturated salt solution.
4. A heat source—a candle, alcohol lamp or bunsen burner.

Keywords shale, sandstone, limestone, dolostone, oil, gas, coal, salt, gypsum, fragmental rock, organic rock, chemical rock

### SUGGESTED APPROACH

The investigation can be used in either an individualized format with each student having access to the necessary laboratory materials, or in a group laboratory with pre-lab and post-lab discussions. The information in the student guide should be presented during the pre-lab or post-lab discussion.

If used in an individualized format, each pair of students should have the set of rocks available since these are the most heavily used materials. One or two jars with sediment, and 4 or 5 set-ups with microscopes and salt solutions should be available at stations placed around the classroom.

The investigation could be preceded by the film Rocks That Form on the Surface, available from Encyclopedia Britannica Educational Corporation. The film describes sedimentary rocks, where they come from, what they are composed of, and how they are formed. It is 16 minutes long.

You might want to use this investigation as an introduction to a unit on Ohio's energy supply. There is a great deal of concern about full exploitation of natural gas in Ohio. Ohio's coal has a large amount of sulfur in it which adds to pollution. Therefore, there is a problem in its use. The two methods now being used to reduce sulfur in coal are stack scrubbers and fluidized-bed boilers. Both use limestone to remove the sulfur.



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by Susan Leach and Victor J. Mayer  
The Ohio Sea Grant Education Program

### INTRODUCTION

Did you know that you may be living on a sea bottom? Or that Ohio is a major producer of rocks and minerals? In 1982 Ohio was seventh among all states in the amount of coal mined and fourth in the amount of salt. Most of these sediments as well as sandstone, limestone, dolostone, shale, clay, oil, and natural gas, which are also obtained here, indicate that Ohio has in the past been covered by shallow seas.

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### ACTIVITY A: HOW WERE OHIO'S ROCKS FORMED?

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In this activity students examine and describe the common sedimentary rocks found in Ohio.

**MATERIALS:** Jar with sediment and water, samples of rock; microscope, pyrex watch glass, salt solution, heat source, and worksheet.

#### PROCEDURE

All of the rock types common to Ohio are sedimentary in origin. One type is made of pieces (fragments) of rock that were broken or worn from larger chunks. Clay, sand and gravel are examples of sediments that are fragments of rock. The fragments are then cemented together to form rocks such as shale and sandstone. These are called fragmental rocks.

Other types of sedimentary rocks form from plants and animals which died and fell to the bottom of lakes, swamps and oceans. Their hard parts are cemented into rocks such as limestone and dolomite. These types of rocks are called organic rocks. The soft parts of the plants or animals form coal, oil, and natural gas.

The third type of sedimentary rock forms from the evaporation of water. Minerals that are dissolved in the water precipitate to form rocks such as salt and gypsum. These are called chemical rocks.

In this activity you will learn how the three types of sedimentary rocks form.

1. Shake the jar filled with sediment and water. Allow the sediment to settle. Use the blank on your worksheet to describe the sediment.



#### WORKSHEET RESPONSES:

- T1. Students should note that the fragments of rock in the jar settle out according to size. The sand settles first in a layer on the bottom, and the clay settles last forming a layer on top.

You should have seen that different sizes of sediments settled at different places. This happens to sediments carried by streams and rivers as they enter a lake or ocean. The large heavy pieces settle out first, close to shore. The smaller pieces are carried by slow currents out into deeper water.

Shale is made up of clay, silt, and mud. Such very fine sediments are the last to settle out of streams and currents. Therefore, they will be carried out furthest in a lake or ocean. Sediments making up shale are so fine that they cannot be seen, even under a microscope. Shale is usually dark colored and made up of very thin layers.

2. Pick out the sample of shale from your rock tray. Write down a description of the sample.

Sandstone is made up of pieces of sand. The pieces are large enough so that you are able to see them. If you have walked along a beach you may recall seeing sand. It is usually found deposited along the edges of lakes and oceans.

3. Identify the sample of sandstone from your rock tray. Describe its characteristics.

T 2.3 The description that students write of the types of rocks should be similar to those in the student guide but in their own words.

Limestone and dolostone are formed of the chemicals calcium carbonate and magnesium carbonate. These chemicals are found in shells and skeletons of many animals and plants. The hard parts of these plants and animals accumulate at the bottom of the lake or sea as sediments. When this sediment is buried it will change into rock. Sometimes you can find fossils in these rocks. Often, however, the plant and animal remains have been so broken and ground up that pieces cannot be identified.

Any carbonate will react chemically with hydrochloric acid. This will cause a fizzing to occur.

4. Identify the samples of limestone and dolostone from your rock tray. Describe the two rocks.

T 4 Note that no distinction is made in the activity between limestone and dolostone. You may wish to provide some dilute hydrochloric acid. A drop on limestone will fizz rapidly, whereas on dolostone it will fizz very slowly at first. This is the easiest way to distinguish one from the other.

Salt and gypsum form from sea water when it evaporates. This can happen when a sea is cut off from the ocean. If the area is hot and dry, then the water will evaporate and deposits of salt and gypsum will be left. Salt can be identified by its taste. Gypsum is very soft. You can scratch it with your fingernail.

5. Place a drop of salt solution in the glass. Then place it on the stage of the microscope and examine it. Describe what you see.

T 5 Try this out before you do it with your students. It may be that the tap water will have contaminants that would mask the precipitation and growth of salt crystals. If so, you may need to use distilled water.

6. Using a pair of tongs, heat the watch glass until all the water has evaporated. After the glass has cooled, place it under the microscope. Describe what you see.

T 6 Warn the students not to touch the watch glass with their fingers after heating it. They must use a set of tongs to hold the watch glass over the flame and to insert it under the microscope. The salt crystals should appear to be perfect cubes. You may want to have some table salt for the students to look at under the microscope.

7. Identify the samples of salt and gypsum from your rock tray. Describe each.

T 7 Their descriptions should be similar to those in the student guide.

Geologists have not been able to actually see how coal, oil, and natural gas form. They believe, however, that these minerals form from partially decayed plant or animal bodies under high pressure and high temperature. Coal formed from plant matter that accumulated in large swamps. Often leaves and stems are found in coal. Coal is black and relatively light weight.

8. Identify the sample of coal from the rock tray. Describe it.

T 8 The coal is black and relatively light weight (low density). Students may discover vegetative remains in their samples. You might want to discuss the types of coal. Most coal in Ohio is bituminous. Other types are lignite which is very low grade and anthracite. Anthracite has undergone a certain amount of metamorphism and will be shiny black and quite hard.

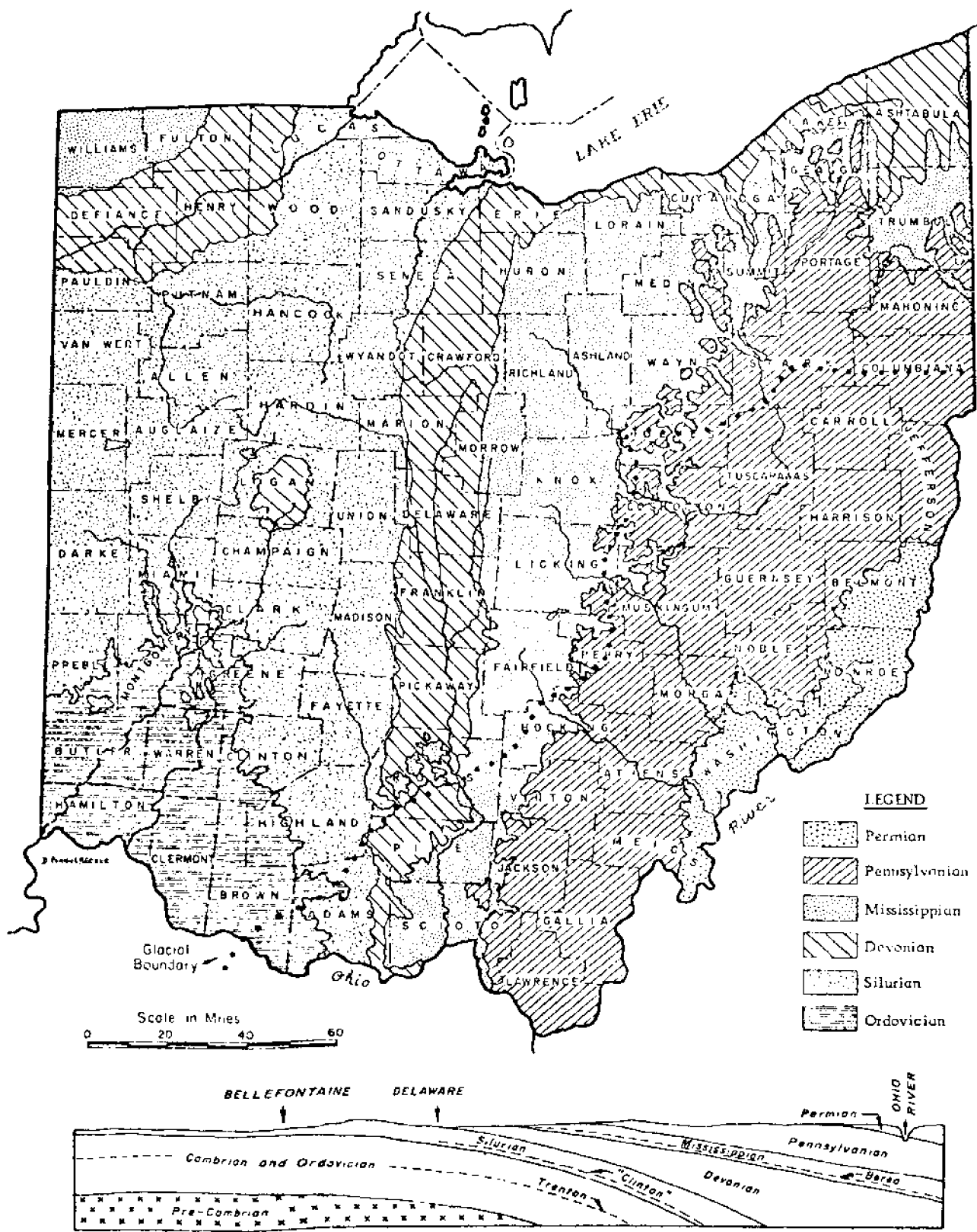


Figure 1. GEOLOGIC MAP OF OHIO

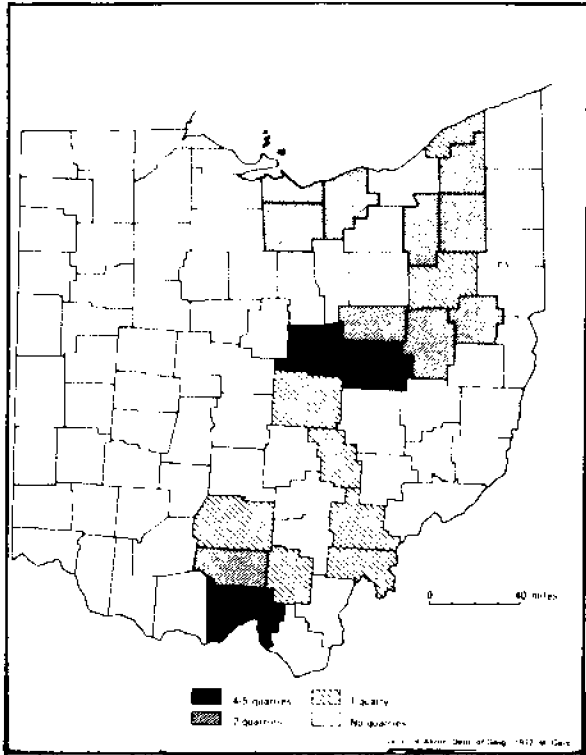


Figure 2. Active sandstone quarries (Ohio Division of Mines, 1970); no counties reported three active quarries.

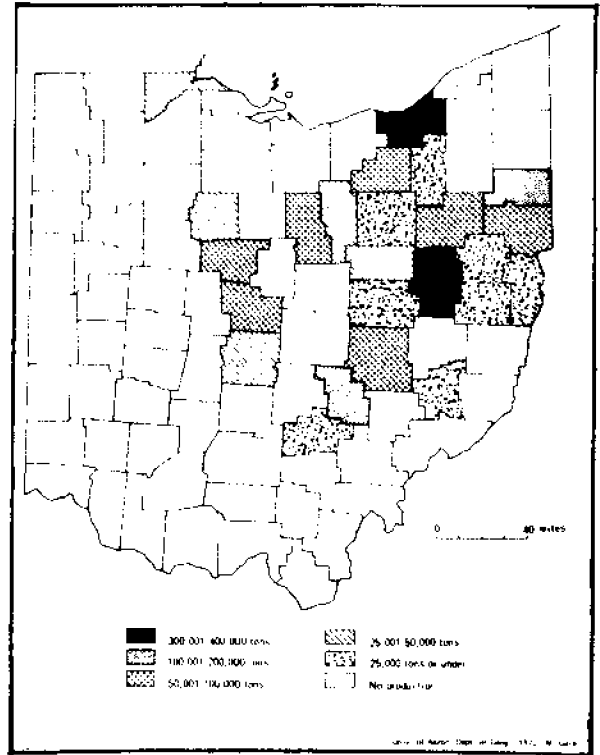


Figure 3. Shale production in 1969 (Ohio Division of Mines, 1970); no counties reported between 200,001 and 300,000 tons.

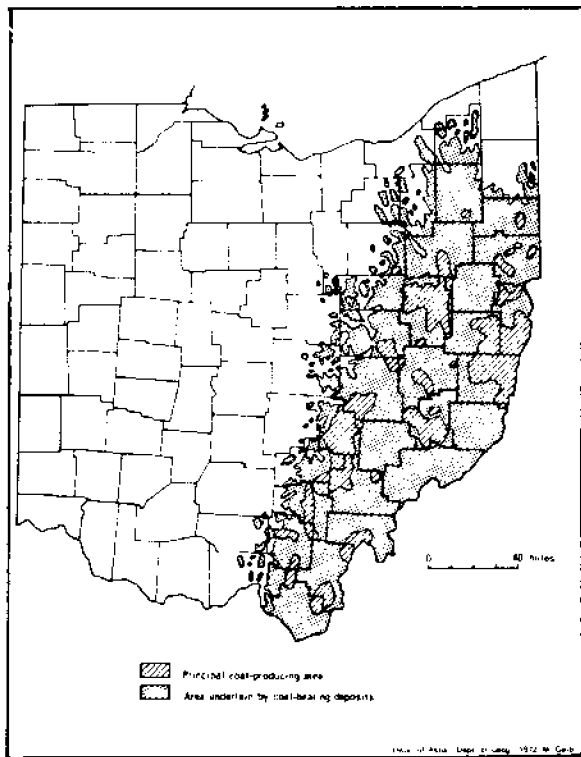


Figure 4. Coal deposits in Ohio (Brant and DeLong, 1960).

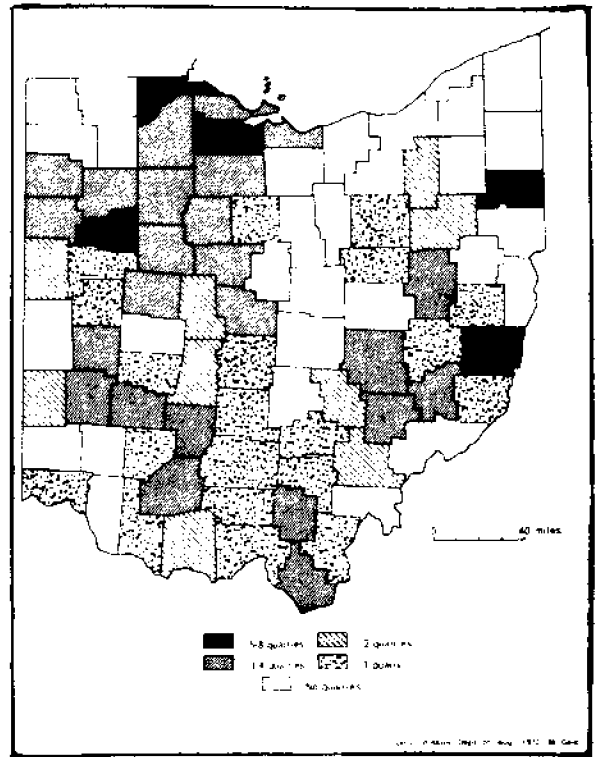


Figure 5. Active limestone quarries in Ohio in 1969 (Ohio Division of Mines, 1970).

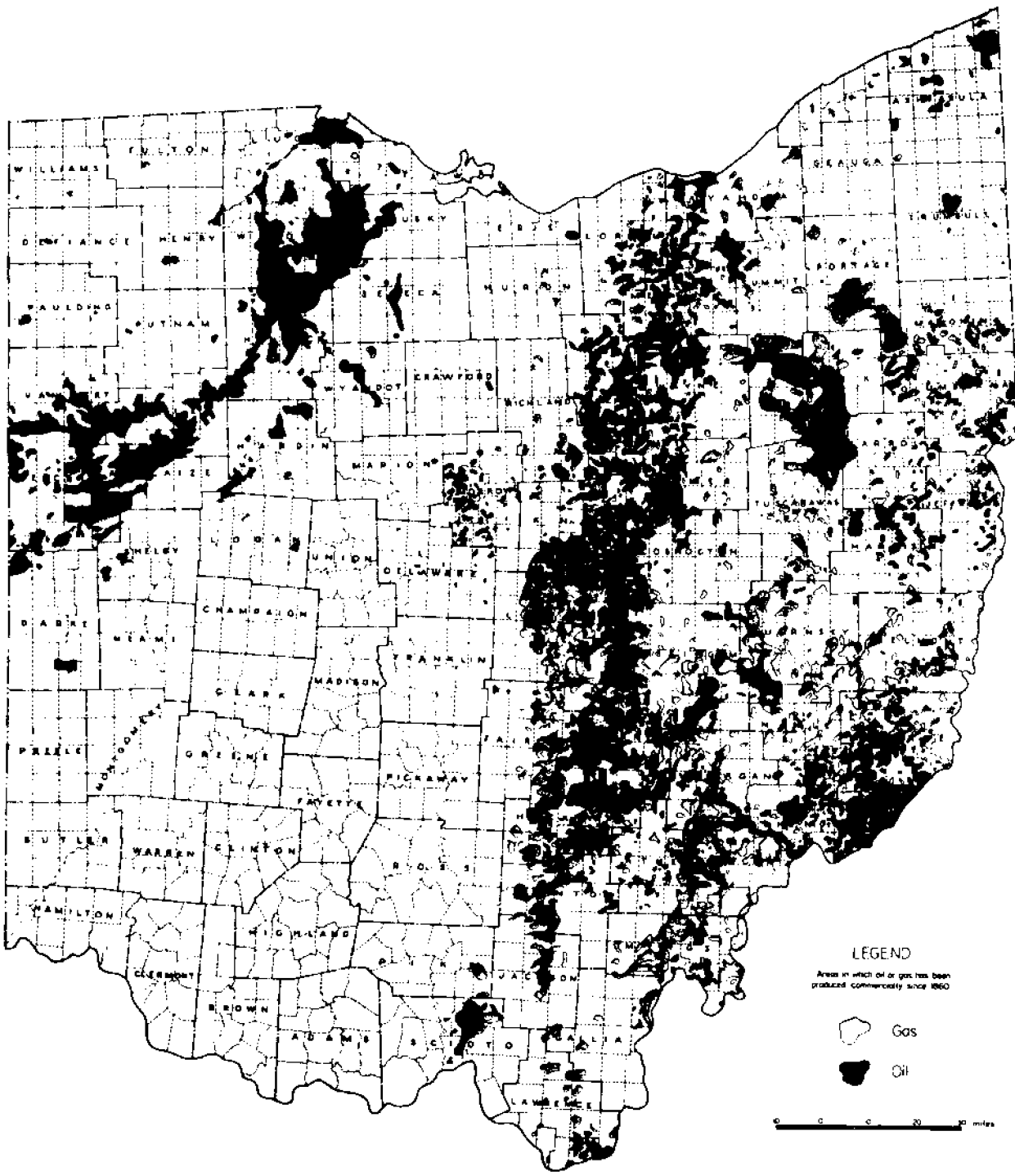


Figure 6. Oil and gas fields in Ohio (Ohio Division of Geological Survey).



Oil and gas are thought to form in mud deposited at the bottom of oceans and seas. Later, they move from the shales formed from these muds into sandstones and limestones where they are held until found by a geologist or driller.

The rocks and minerals found in Ohio were deposited in layers one on top of the other. Some of these layers were eroded. Some were tilted and broken. Some of the history of Ohio kept in those rocks was destroyed. What is left, however, tells geologists about the events that occurred in Ohio long before man and even the dinosaurs lived.

## ACTIVITY B: WHAT DO ROCKS TELL ABOUT OHIO'S HISTORY?

**MATERIALS:** worksheet

**PROCEDURE:** Use Figures 1 through 6 to answer the questions. Figure 1 is a geologic map of Ohio. It shows the age of rock found at the surface in the state.

1. Find the county you live in on the map in Figure 1. What is the age of surface rock in your county?

**WORKSHEET RESPONSES:** The answers to questions 1-4 will depend upon the county of residence of the student.

1. Figure 1 is used to answer this question. In Franklin County for example, most of the surface rock is Devonian.

2. Find your county on Figure 2-6. What rocks or minerals are found in your county?

T2. Answers will vary. In Franklin County shale and limestone are produced.

3. Find out what the uses are of the rocks and/or minerals mined in your county.

T3. Again, answers will vary. For Franklin County, shale is used for making bricks and limestone is used for building stone, cement, aggregate, and a source of lime.

4. What was the environment in your county when its rocks were formed?

T4. To answer this question students will have to refer to the information in Activity A. Both the shale and limestone, for example, form in either lakes or seas. This would be the appropriate response of the students. In reality, fossils of marine animals have been found in both the Ohio Shale and the Columbus Limestone found in Franklin County. Therefore, seas once covered that area. Actually, all of the rocks in Ohio that are older than Mississippian were deposited in a marine environment.

5. Where would you go in the state to find ancient swampy areas?

T5. Since coal formed in swamps, you would need to go to the eastern part of the state where the coal mines are found, as indicated in Figure 4.

6. Where is most shale mined?

T6. Most shale seems to be mined in the northeastern part of the state.

7. What was the environment of that area when the sediments were being deposited?

T7. This shale was deposited either in lakes or seas.

Shale is used to make house bricks, sewer tiles and pottery. Can you think of any buildings in Ohio that have used a form of shale in their construction?

8. Refer to Figure 1. Where are the oldest surface rocks found?

T8. Figure 1 indicates that the oldest rocks are found in the southwestern part of the state.

Salt is found in two types of deposits. Rock salt is found in strata like other sedimentary rocks. Natural brines are mixtures of water and salt that fill open spaces in sedimentary rocks.

About 1/4 of Ohio has rock salt under it. It is found east of a line from Lorain (on Lake Erie) to Marietta (on the Ohio River). The Morton Salt Company mine at Fairport actually gets its salt from a mine in the rocks below Lake Erie. Its major use is for salting roads during the winter to rid them of snow and ice.

9. Fairport is located in Lake County. What age of rock is at the surface at the salt mine?

T9. The mine is located on the shore. Figure 1 indicates that the surface rock is Devonian.

10. Salt is found in Silurian rocks. At the Fairport mine, where would they be found?

T 10 By referring to the cross section, students should infer that Silurian rock would be found below the mine under the Devonian and that it would come to the surface somewhere under the lake

Natural brine is found under about half of the state. It is found east of a line from Lorain to Portsmouth (on the Ohio River). These natural brines are sea water that was trapped as sediments were deposited and changed into rock. They are "fossil sea water." During early times in Ohio, these brines were used as a source of salt. Now they are important sources of a variety of chemicals used in industry.

Gypsum is also found in Silurian rocks. There is a mine near Port Clinton in Ottawa county. Here the gypsum is refined and made into wallboard for use in building houses and other structures.

11. Natural gas and oil are thought to occur below Lake Erie. Under what part of Lake Erie would you be likely to find oil and gas? Refer to Figure 6.

T 1 The area north of Cuyahoga County would seem to be the most likely spot for gas since gas fields trend north-south through the county and, therefore, also go out under Lake Erie to the north. For a similar reason, the western basin of Lake Erie would seem to be the most likely place for oil

12. Why do you think very little has been done to explore gas and oil under Lake Erie? What types of problems would be encountered?

T 12 Students might suggest problems of floating rigs in the lake and the expense of drilling from such platforms. Possible pollution problems may also be suggested. There has been a moratorium on oil and gas drilling in the U.S. waters of Lake Erie because of the danger of pollution

13. Where in Lake Erie would you go to find limestone and dolostone? Refer to Figure 5.

T 13 From the geologic maps, students should surmise that the islands off Sandusky are composed of limestone and dolostone

14. Coal is found in rocks of Pennsylvania age in Ohio. Do you think it might ever be mined from under Lake Erie? Explain. Refer to Figure 1

T 14 No students should realize from Figure 1 that Pennsylvanian rock does not underlie the lake

Coal, natural gas and oil are used as sources of energy to heat our homes, fuel our cars, operate our television sets, build radios and manufacture the wide variety of other products we use every day.

Ohio has had many mineral resources. They, in part, are the reason that industry has been so important in the economy of the state. These resources, however, are nonrenewable. Although the processes that formed them are still going on in the world's oceans and seas, they are so slow that they do not result in new oil, gas or coal for use by our civilization. In just a few decades, we have used most of the oil and gas that took millions of years to form. We must, therefore, look to other types of renewable or inexhaustible energy to support our industry. One source is the sun. Oil and gas are actually sources of solar energy that was captured by plants and animals and then preserved by geological processes. We need to learn how to use solar energy and other renewable energy forms so we will have enough for the future.

15. From what you have learned about Ohio's rocks, what seems to be the most common type of environment that existed during the time when they were deposited?

T 15 This is a critical question. Help students summarize what has been learned about geologic history in Ohio. They should realize that through most of its history it was covered by sea water

## REVIEW QUESTIONS

1. List the types of minerals that have been found in Ohio.
2. Describe how the three types of sedimentary rocks found in Ohio (fragmentary, organic and chemical) are formed.
3. How is coal formed? Oil and gas?
4. List the types of minerals that are found along or under Lake Erie.
5. Where in the world today would you expect to find sediments forming that will become limestone? Coal? Sandstone?
6. How did the environment in Ohio change from the time when the oldest rocks were formed?
7. What are ways in which each of the following is used?
  - a. salt
  - b. gypsum
  - c. coal

### ACTIVITY C: (supplement)

**MATERIALS:** Figure 1 and 4 colored pencils.

A. Fill in the third column of the table by selecting one of the colored pencils and placing the name of its color in the blank for each county. Use the same color for each county that has exactly the same rock types. For example, Hamilton and Franklin counties should be the same color since they both have shale and limestone at the surface. You should end up with only four different colors for the six counties.

B. Using the color scheme you just devised, color in each of the six counties using the appropriate color for each, on Figure 1.

C. Using the appropriate pencil, color in all the areas of Ohio that are the same age as the rocks in the 6 selected counties in Table 1, so that rocks of the same age will be the same color.

D. Describe Ohio's environment and how it changed from Ordovician time to Permian time.

## REVIEW QUESTIONS:

1. Although most of the following are not technically minerals they are usually regarded as part of the state's mineral resources: limestone, sandstone, shale, coal, oil, natural gas, rock salt, and gypsum.

2. Fragmentary rocks are formed from the cementing of fragments of pre-existing rocks. Organic rocks are formed from the remains of plants and animals that die and fall to the bottom of lakes, swamps and oceans.

3. Coal is formed from plant matter that accumulated in ancient swamps. Oil and gas are formed in mud deposited at the bottom of oceans and seas. Later they migrate into sandstones and limestones.

4. Rock salt, gypsum, sandstone, shale, limestone, oil and gas are found along or under Lake Erie.

5. Limestone is likely to be forming in shallow tropical waters, such as around Florida, the West Indies, Australia and other places where reefs are forming. Coal is being formed in places where there are extensive swamps, such as in Eastern Florida, the Gulf Coast, Central America and southeast Asia. Coal can also result from peat deposits in temperate and even arctic climates. Sandstone is being formed wherever sand is being deposited, such as deserts, stream beds, beaches and in near-shore shallow water of lakes and oceans in any climate.

6. This will be a difficult question for students to answer. You may have them do Activity C (in this guide) first. It could be done orally by the teacher if there is a time constraint. From Ordovician time through Devonian time Ohio was covered by oceans that may have varied in depth. Beginning in Mississippian time, the ocean was much shallower and Ohio was still under water. It was close to a dry continent however, resulting in the deposition of sandstone. In Pennsylvanian and Permian time much of Ohio was still under this shallow sea. Eastern and southeastern Ohio had become part of a swampy coastline where coal was deposited associated with some sandstone and limestone.

7. Salt is used to clear ice and snow from roads, gypsum for wallboard and coal as a source of energy. All have other uses as well.

## EVALUATION ITEMS:

1. Salt and gypsum deposits may form from sea water as it
  1. settles
  2. cools
  3. heats up
  - \*4. evaporates.
2. Clay, silt, and mud that are deposited far from the shore of lakes and oceans may eventually form
  - \*1. shale
  2. coal
  3. sandstone.
  4. limestone
3. A rock that is formed from plant matter that accumulated in large swamps is called
  1. limestone
  2. shale
  3. sandstone
  - \*4. coal.
4. A mineral that is mined from beneath Lake Erie is
  1. limestone.
  2. coal.
  - \*3. rock salt.
  4. shale.
5. Which of the following is an important source of energy found below Lake Erie?
  1. uranium
  2. salt
  3. coal
  4. limestone
  - \*5. oil and gas
6. Which type of environment occurred in your area when its rocks were formed?
  1. shallow seas
  2. swamps
  3. river flood plains
  4. hot and dry with evaporating sea
7. In what part of the state would the oldest rocks be found at the surface?
  1. Northeast
  2. Southeast
  3. Northwest
  - \*4. Southwest
  5. Central
8. What is the age of the rock below your area?
  1. Permian or Pennsylvanian
  2. Mississippian
  3. Devonian
  4. Silurian
  5. Ordovician
9. Sea water trapped in rocks is
  1. salt.
  2. ground water
  3. oil
  - \*4. natural brine.
10. Which of the following is used to make wallboard?
  1. shale
  2. salt
  - \*3. gypsum
  4. oil
11. A major use of limestone is in
  - \*1. making cement
  2. making brick
  3. melting road ice
  4. making glass

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OEAGLS (pronounced "eagles") are designed to provide middle school students with a greater awareness of the Great Lakes and oceans, and a greater understanding the impact that these bodies of water have on people's lives.

Other OEAGLS topics are available from the Ohio Sea Grant Education Program, 29 W. Woodruff Avenue, Columbus, OH 43210. Topics in print include:

The Effect of Lake Erie on Ohio's Temperature (EP-1)  
The Effect of Lake Erie on Climate (EP-2)  
Ancient Shores of Lake Erie (EP-3)  
How to Protect a River (EP-4)  
Lake Erie and Changing Lake Levels (EP-5)  
Erosion Along Lake Erie (EP-6)  
Coastal Processes and Erosion (EP-7)  
Pollution in Lake Erie: An Introduction (EP-8)  
Yellow Perch in Lake Erie (EP-9)  
Evidence of Ancient Seas in Ohio (EP-10)  
To Harvest a Walleye (EP-11)  
Oil Spill! (EP-12)  
Shipping on the Great Lakes (EP-13)  
Geography of the Great Lakes (EP-14)  
Ohio Canals (EP-15)  
The Estuary: A Special Place (EP-16)  
The Great Lakes Triangle (EP-17)  
Knowing the Ropes (EP-18)  
Getting to Know Your Local Fish (EP-19)  
Shipping: The World Connection (EP-20)  
We Have Met the Enemy (EP-21)  
It's Everyone's Sea: Or Is It? (EP-22)  
PCBs in Fish: A Problem? (EP-23)



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### ACTIVITY A: HOW WERE OHIO'S ROCKS FORMED?

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#### PROCEDURE

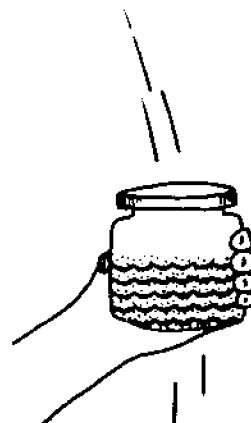
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In this activity you will learn how the three types of sedimentary rocks form.

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Shale is made up of clay, silt, and mud. Such very fine sediments are the last to settle out of streams and currents. Therefore, they will be carried out furthest in a lake or ocean. Sediments making up shale are so fine that they cannot be seen, even under a microscope. Shale is usually dark colored and made up of very thin layers.

2. Pick out the sample of shale from your rock tray. Write down a description of the sample.

Sandstone is made up of pieces of sand. The pieces are large enough so that you are able to see them. If you have walked along a beach you may recall seeing sand. It is usually found deposited along the edges of lakes and oceans.

3. Identify the sample of sandstone from your rock tray. Describe its characteristics.

Limestone and dolostone are formed of the chemicals calcium carbonate and magnesium carbonate. These chemicals are found in shells and skeletons of many animals and plants. The hard parts of these plants and animals accumulate at the bottom of the lake or sea as sediments. When this sediment is buried it will change into rock. Sometimes you can find fossils in these rocks. Often, however, the plant and animal remains have been so broken and ground up that pieces cannot be identified.

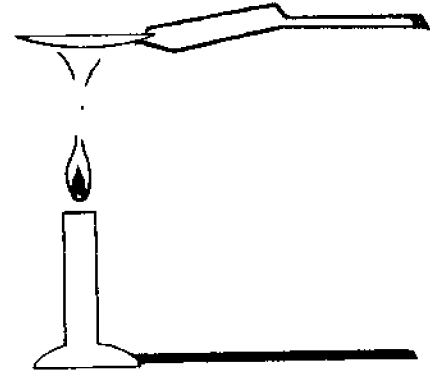
Any carbonate will react chemically with hydrochloric acid. This will cause a fizzing to occur.

4. Identify the samples of limestone and dolostone from your rock tray. Describe the two rocks.

Salt and gypsum form from sea water when it evaporates. This can happen when a sea is cut off from the ocean. If the area is hot and dry, then the water will evaporate and deposits of salt and gypsum will be left. Salt can be identified by its taste. Gypsum is very soft. You can scratch it with your fingernail.

5. Place a drop of salt solution in the glass. Then place it on the stage of the microscope and examine it. Describe what you see.

6. Using a pair of tongs, heat the watch glass until all the water has evaporated. After the glass has cooled, place it under the microscope. Describe what you see.



7. Identify the samples of salt and gypsum from your rock tray. Describe each.

Geologists have not been able to actually see how coal, oil, and natural gas form. They believe, however, that these minerals form from partially decayed plant or animal bodies under high pressure and high temperature. Coal formed from plant matter that accumulated in large swamps. Often leaves and stems are found in coal. Coal is black and relatively light weight.

8. Identify the sample of coal from the rock tray. Describe it.

Oil and gas are thought to form in mud deposited at the bottom of oceans and seas. Later, they move from the shales formed from these muds into sandstones and limestones where they are held until found by a geologist or driller.

The rocks and minerals found in Ohio were deposited in layers one on top of the other. Some of these layers were eroded. Some were tilted and broken. Some of the history of Ohio kept in those rocks was destroyed. What is left, however, tells geologists about the events that occurred in Ohio long before man and even the dinosaurs lived.

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## ACTIVITY B: WHAT DO ROCKS TELL ABOUT OHIO'S HISTORY?

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**MATERIALS:** worksheet

**PROCEDURE:** Use Figures 1 through 6 to answer the questions. Figure 1 is a geologic map of Ohio. It shows the age of rock found at the surface in the state.

1. Find the county you live in on the map in Figure 1. What is the age of surface rock in your county?
2. Find your county on Figure 2-6. What rocks or minerals are found in your county?
3. Find out what the uses are of the rocks and/or minerals mined in your county.
4. What was the environment in your county when its rocks were formed?
5. Where would you go in the state to find ancient swampy areas?
6. Where is most shale mined?
7. What was the environment of that area when the sediments were being deposited?

Shale is used to make house bricks, sewer tiles and pottery. Can you think of any buildings in Ohio that have used a form of shale in their construction?

8. Refer to Figure 1. Where are the oldest surface rocks found?

Salt is found in two types of deposits. Rock salt is found in strata like other sedimentary rocks. Natural brines are mixtures of water and salt that fill open spaces in sedimentary rocks.

About 1/4 of Ohio has rock salt under it. It is found east of a line from Lorain (on Lake Erie) to Marietta (on the Ohio River). The Morton Salt Company mine at Fairport actually gets its salt from a mine in the rocks below Lake Erie. Its major use is for salting roads during the winter to rid them of snow and ice.



Natural brine is found under about half of the state. It is found east of a line from Lorain to Portsmouth (on the Ohio River). These natural brines are sea water that was trapped as sediments were deposited and changed into rock. They are "fossil sea water." During early times in Ohio, these brines were used as a source of salt. Now they are important sources of a variety of chemicals used in industry.

9. Fairport is located in Lake County. What age of rock is at the surface at the salt mine?
10. Salt is found in Silurian rocks. At the Fairport mine, where would they be found?

Gypsum is also found in Silurian rocks. There is a mine near Port Clinton in Ottawa county. Here the gypsum is refined and made into wallboard for use in building houses and other structures.

11. Natural gas and oil are thought to occur below Lake Erie. Under what part of Lake Erie would you be likely to find oil and gas? Refer to Figure 6.
12. Why do you think very little has been done to explore gas and oil under Lake Erie? What types of problems would be encountered?

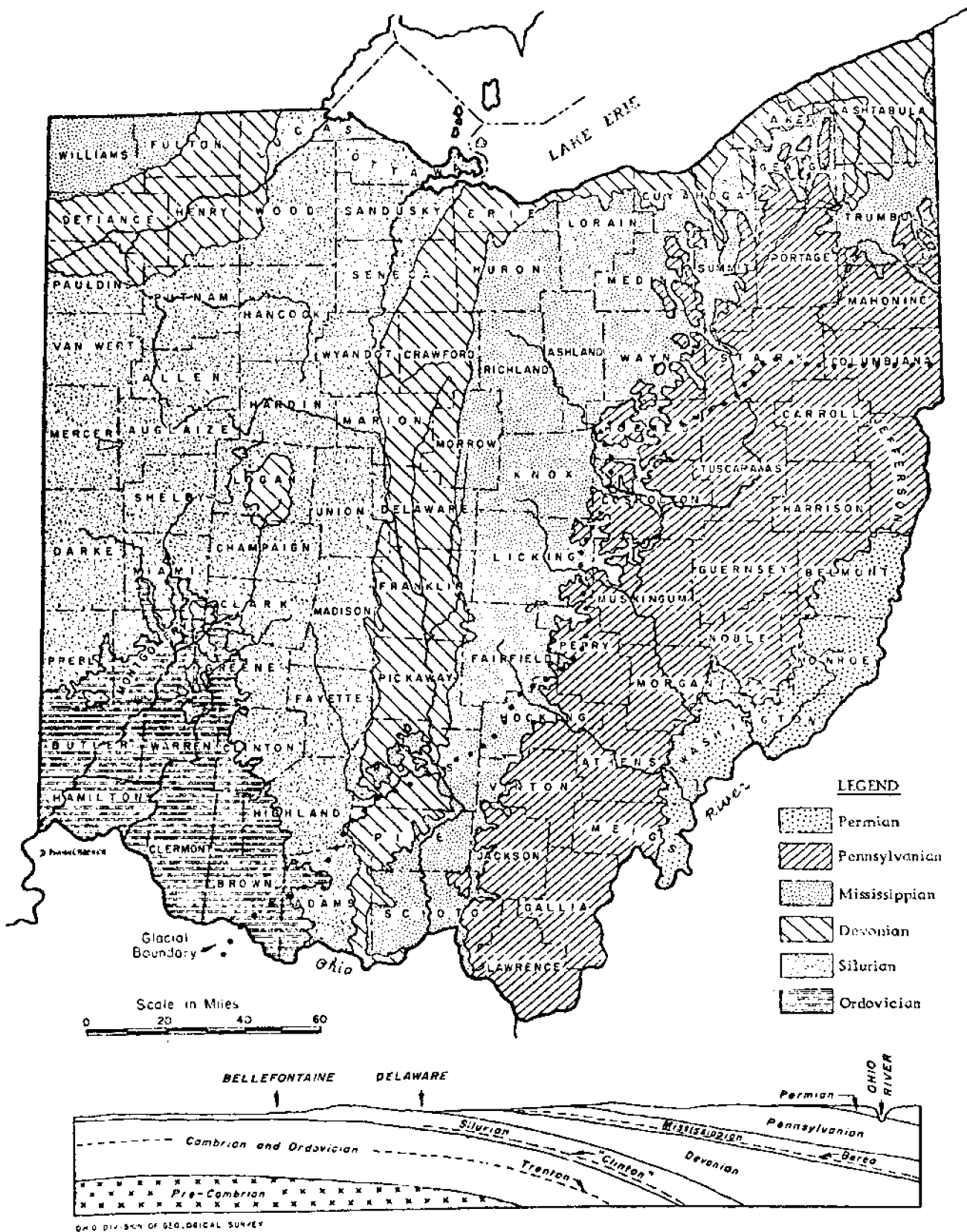


Figure 1. GEOLOGIC MAP OF OHIO

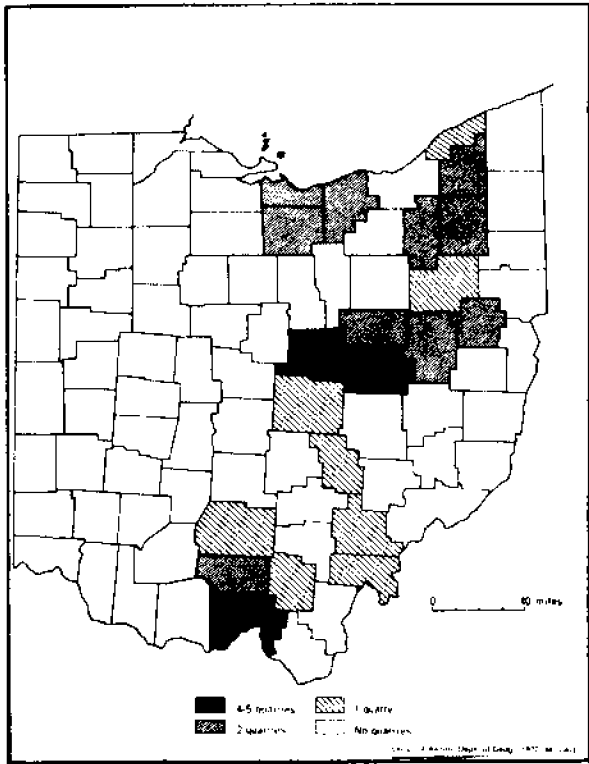


Figure 2. Active sandstone quarries (Ohio Division of Mines, 1970); no counties reported three active quarries.

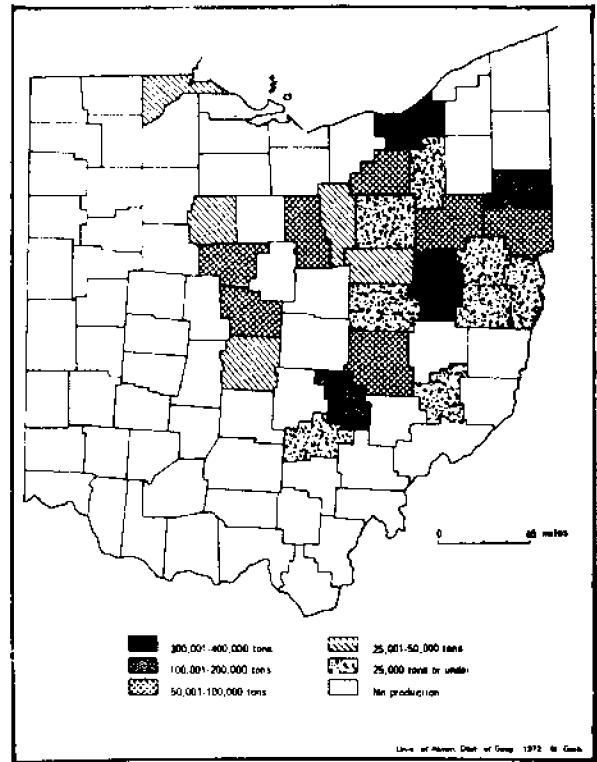


Figure 3. Shale production in 1969 (Ohio Division of Mines, 1970); no counties reported between 200,001 and 300,000 tons.

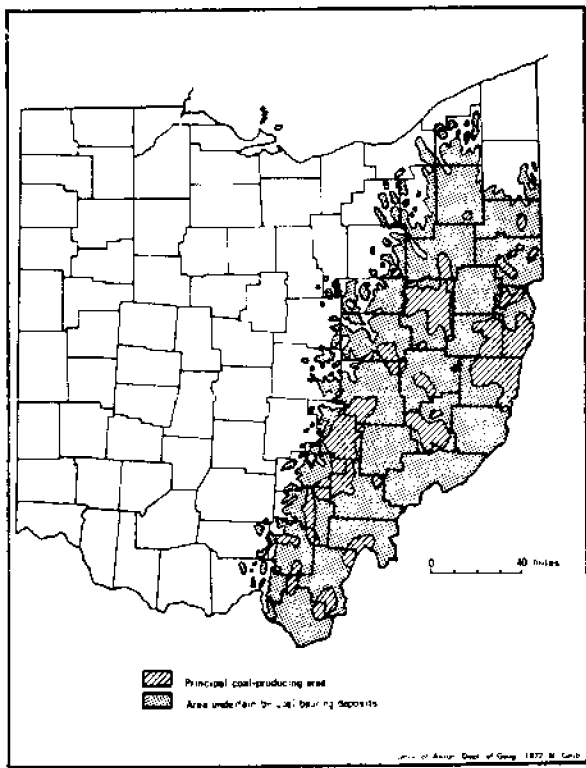


Figure 4. Coal deposits in Ohio (Brant and DeLong, 1960).

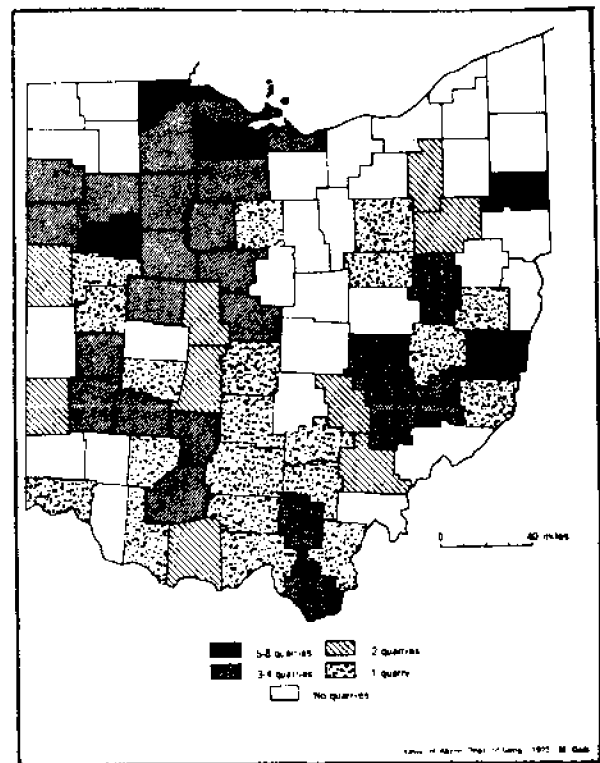


Figure 5. Active limestone quarries in Ohio in 1969 (Ohio Division of Mines, 1970).

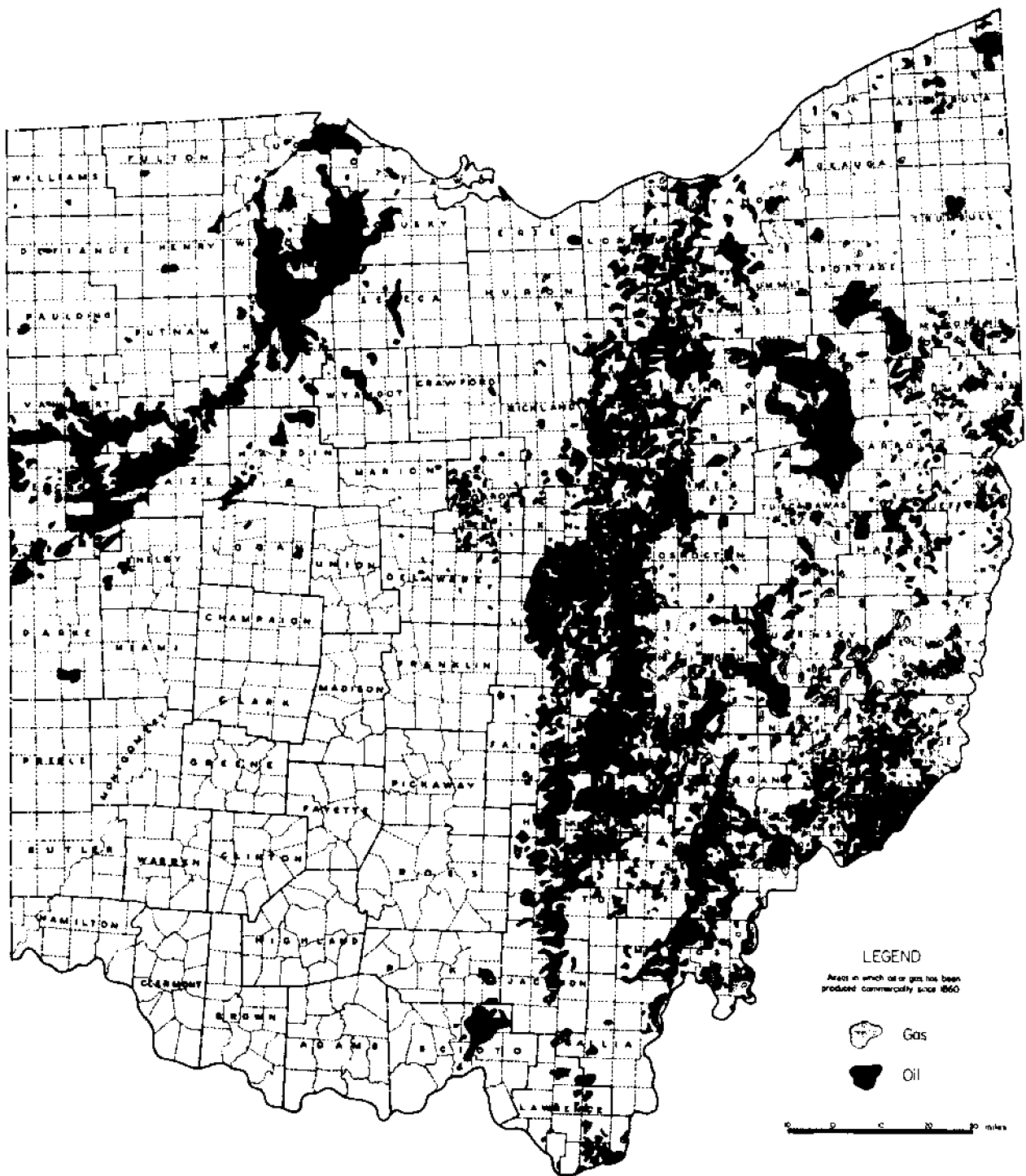


Figure 6. Oil and gas fields in Ohio (Ohio Division of Geological Survey).

13. Where in Lake Erie would you go to find limestone and dolostone? Refer to Figure 5.

14. Coal is found in rocks of Pennsylvania age in Ohio. Do you think it might ever be mined from under Lake Erie? Explain. Refer to Figure 1.

Coal, natural gas and oil are used as sources of energy to heat our homes, fuel our cars, operate our television sets, build radios and manufacture the wide variety of other products we use every day.

Ohio has had many mineral resources. They, in part, are the reason that industry has been so important in the economy of the state. These resources, however, are nonrenewable. Although the processes that formed them are still going on in the world's oceans and seas, they are so slow that they do not result in new oil, gas or coal for use by our civilization. In just a few decades, we have used most of the oil and gas that took millions of years to form. We must, therefore, look to other types of renewable or inexhaustible energy to support our industry. One source is the sun. Oil and gas are actually sources of solar energy that was captured by plants and animals and then preserved by geological processes. We need to learn how to use solar energy and other renewable energy forms so we will have enough for the future.

15. From what you have learned about Ohio's rocks, what seems to be the most common type of environment that existed during the time when they were deposited?

## REVIEW QUESTIONS

1. List the types of minerals that have been found in Ohio

2. Describe how the three types of sedimentary rocks found in Ohio (fragmentary, organic and chemical) are formed.

3. How is coal formed? Oil and gas?

4. List the types of minerals that are found along or under Lake Erie.

5. Where in the world today would you expect to find sediments forming that will become limestone? Coal? Sandstone?

6. How did the environment in Ohio change from the time when the oldest rocks were formed?

7. What are ways in which each of the following is used?

a. salt

b. gypsum

c. coal

Name \_\_\_\_\_

**WORKSHEET  
EVIDENCE OF ANCIENT SEAS IN OHIO**

**ACTIVITY A: HOW WERE OHIO'S ROCKS FORMED?**

Describe the following:

1. sediment after it settled \_\_\_\_\_  
\_\_\_\_\_
2. shale \_\_\_\_\_  
\_\_\_\_\_
3. sandstone \_\_\_\_\_  
\_\_\_\_\_
4. limestone \_\_\_\_\_  
\_\_\_\_\_
- dolostone \_\_\_\_\_  
\_\_\_\_\_
5. salt solution \_\_\_\_\_  
\_\_\_\_\_
6. what is left of the salt solution when it has evaporated \_\_\_\_\_  
\_\_\_\_\_
7. salt \_\_\_\_\_  
\_\_\_\_\_
- gypsum \_\_\_\_\_  
\_\_\_\_\_
8. coal \_\_\_\_\_  
\_\_\_\_\_

## ACTIVITY B: HOW ARE OHIO'S ROCKS AND MINERALS USED?

1. What is the age of surface rock in your county? \_\_\_\_\_  
\_\_\_\_\_
2. What rocks or minerals are obtained in your county? \_\_\_\_\_  
\_\_\_\_\_
3. How are your county's rocks used? \_\_\_\_\_  
\_\_\_\_\_
4. What was the environment when your county's rocks were formed? \_\_\_\_\_  
\_\_\_\_\_
5. Where would you go in Ohio to find ancient swampy area locations? \_\_\_\_\_  
\_\_\_\_\_
6. Where is most shale mined? \_\_\_\_\_
7. What was the environment for the area when sediments were being deposited? \_\_\_\_\_  
\_\_\_\_\_
8. Where are the oldest surface rocks found? \_\_\_\_\_
9. What is the age of the rock at surface at the Fairport salt mines? \_\_\_\_\_
10. Where is Silurian rock found at Fairport? \_\_\_\_\_
11. What area of Lake Erie is most likely to have oil and gas? \_\_\_\_\_
12. Why do you think little gas and oil exploration has been done under Lake Erie? What types of problems would be encountered? \_\_\_\_\_  
\_\_\_\_\_
13. Where are limestone and dolostone found under Lake Erie? \_\_\_\_\_
14. Do you think coal will ever be mined from under Lake Erie? Explain. \_\_\_\_\_  
\_\_\_\_\_



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