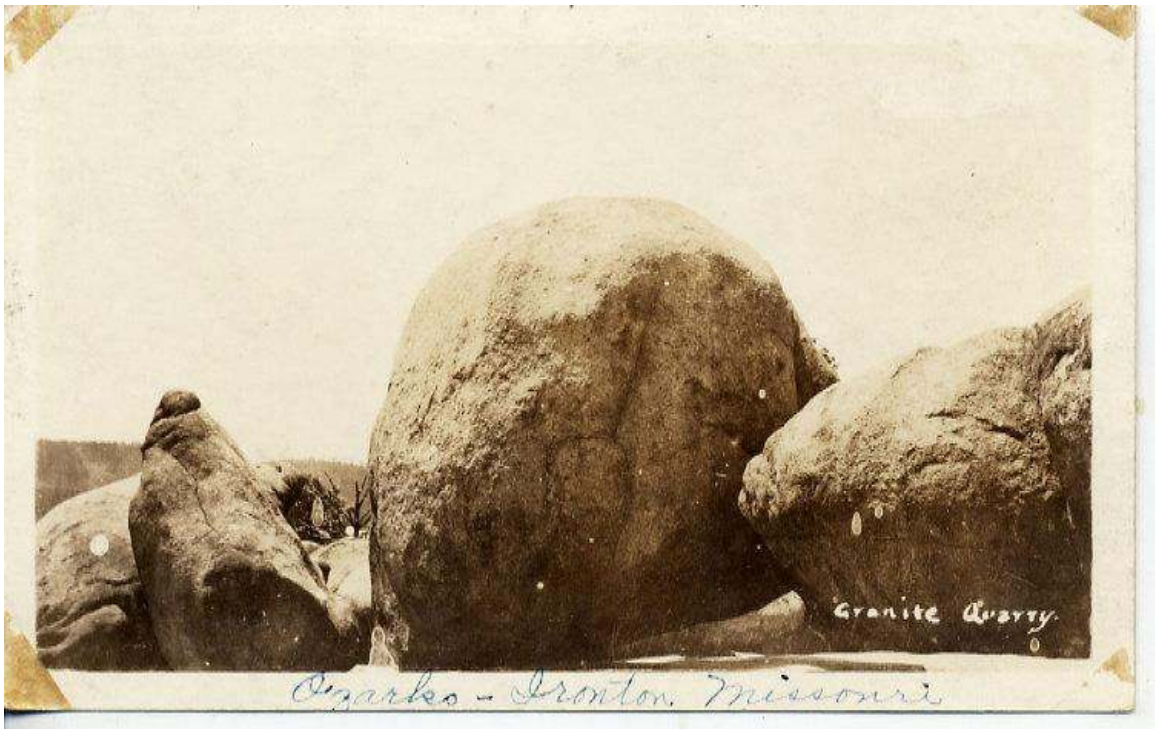
ELEPHANT ROCKS STATE PARK

TEACHER'S GUIDE



Elephant Rocks State Park
7406 Highway 21
Belleview, MO 63623

MISSOURI
STATE PARKS

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GOAL

This guide will acquaint you with Elephant Rocks State Park and the local geology, wildlife, plants and history.

OBJECTIVES

Teachers using this guide will discover why a visit to Elephant Rocks State Park can be not only a rewarding recreation trip but also an interesting place to study the unique geology of the area.

This guide will show how a visit to Elephant Rocks State Park supports the study of Earth Science.

After studying this teacher's guide, the instructor should be able to develop additional student instruction compliant with Show-Me Standards in the areas of:

a. communication arts,
b. fine arts,
c. sciences,
d. mathematics and
e. social studies
f. health/physical

A SHORT DESCRIPTION OF ELEPHANT ROCKS STATE PARK

Elephant Rocks State Park is located along Highway 21 four miles north of Pilot Knob, Mo. The park consists of 131 acres, seven of which are designated as a Missouri State Natural Area. The most prominent features of the park are the large, rounded, pink colored granite boulders, locally called "the Elephant Rocks."

The Elephant Rocks are on a tor (a small isolated rocky hill). Visitors to this geologic feature may view an exhibit on the history of the area and take a mile-long hike on the asphalt trail through the Elephant Rocks. There are picnic tables and grills beside the parking lot, with water fountains, bathrooms and a small playground area located nearby.

On the trail there are informational plaques that fully describe what visitors encounter. These 23 markers are also written in Braille. Elephant Rocks State Park is the only Missouri state park that offers a Braille trail for visually handicapped visitors. The Braille markers are accompanied with tactile displays.

Recently, a new unpaved trail was opened at the park. This trail takes visitors to the remains of a steam-engine house built of granite blocks when the area was a busy granite quarry.

Around the trail there are many interesting things to see. There are the many pink boulders of granite 1.36 billion years old, and the distinctive landscape, foliage, and fauna for which the area is known. Look for carvings in the rocks left by the granite quarry workers long ago. The granite quarries, now filled with water, remain, as does extensive evidence of the work. The old engine house, built for a steam engine train, is nearby.

Elephant Rocks is an interesting place that has many things to see and learn.

THE SHOW-ME STANDARDS

Elephant Rocks State Park is a delightful place to visit. A visit can help students meet the Missouri Show-Me Standards. Here are some general suggestions.

There are four main goals presented by the Show-Me Standards and, overall, each of them emphasizes the ability to gather information, study information, analyze information and communicate conclusions.

Communication Arts and Fine Arts Standards

Elephant Rocks State Park is an interesting place to explore. It is a small but very different environment that is fun to describe. However, the simplicity of 'the rocks' belies their geologic uniqueness and complexity. Students may find describing, researching and presenting a report on Elephant Rocks State Park a challenging exercise. Research materials on the Elephant Rocks are sometimes very technical, hard to find, or lacking in detail. On the other hand, the Elephant Rocks are accessible, evocative and their setting can be inspirational. Assignments that stress **communication arts** and **fine arts** will be easy to devise and satisfying for the students to do.

Communication Arts Standard

#4 Formal writing

> Have a group of students read through a manual on the geology of the Elephant Rocks (See Specific Resources for Further Study section). They will need to have their vocabulary at hand. Using their own words have them write an essay on how the Elephant Rocks formed.

Fine Arts Standard

#1 Process and techniques for the production, exhibition or performance of a visual art

> Students can draw/photograph their favorite view or boulder or prepare multi-media presentations about the boulders.

Science Standard

First and foremost, Elephant Rocks State Park is a prime geologic site. The rocks were formed 1.36 billion years ago during the Precambrian geologic era. Almost nowhere else in North America is there an area that reveals so much of the earth's primary landform. Also, the environment of the Elephant Rocks is unusual in that there is such a variety of landform, flora, and fauna all around them. Geologists often come to the park to study and investigate the Precambrian strata and how it compares to other landforms nearby or to other Precambrian sites. Biologists come to study the plants and animals down to the smallest bacteria, lichen and mosses. A visit to Elephant Rocks State Park is an ideal introduction to an earth science, biology or environmental studies program.

For example:

#3 Characteristics and interactions of living organisms

Field surveys of trees, plants, wildlife and fishes.

4 Changes in ecosystems and interactions of organisms with their environments.

The Elephant Rocks are in a specific natural environment generally described as "igneous woodland." There are many examples of igneous woodland in the St. Francois Mountains in Iron and Reynolds counties. Have students study and identify the trees, soils, bushes, plants and animals and become familiar with this unusual natural environment. Perhaps they can visit similar igneous woodland areas such as the Hughes Mountain near Irondale, or the lovely Belleview Valley. Compare the Elephant Rocks and the Belleview Valley, two very different areas that exist side by side.

#5 Processes (such as plate movement, water cycle, air flow) and interactions of earth's biosphere, atmosphere, lithosphere and hydrosphere

For example, how does a tor develop? How critical is erosion to the development of the tor known as Elephant Rocks?

#7 Processes of scientific inquiry (such as formulating and testing hypotheses).
The Elephant Rocks are fine examples of granite, an igneous rock. Have students look at and study the granite and then compare and contrast their observations with other rocks in the area - rhyolite, dolomite, limestone, or what ever they can find to study.

Mathematics Standards

#2 Geometric and spatial sense involving measurement (including length, area, volume), trigonometry, and similarity and transformations of shapes

Example: Sign #18 reads, "Try to reach around the rock behind you. Can you guess its weight? It weighs 8,500 pounds, as much as a full-sized pickup truck or 10,264 cans of soda."

The average density of granite is 2.75 g/cm3; with a range of 1.74 to 2.80. Calculate volume using a typical density for granite of 2.7 g/cm3. What is the volume of the rock? Answer: The boulder should be 1,427,976 cm3 which converts to 50 cubic feet or 1.9 cubic yards.

Social Studies Standard

A good portion of the modern history of the Elephant Rocks deals with the commercial mining or quarrying of the distinctive reddish granite. There was even a sizable village called Graniteville nearby. Have the students look at the quarrying evidence along the trail. Then, take a quick drive through the remains of Graniteville. What impact did quarrying have on the local environment at Elephant Rocks State Park? What difficulties did the geology and the environment present to those who developed the commercial activities there?

Settlers were late coming into the southeast part of the Ozarks. The area was only thinly populated at the time when other parts of Missouri had large numbers of people. Assignments stressing social studies, geography or social history in the Missouri Ozarks can be made after a visit to Elephant Rocks State Park and the Arcadia Valley. Students can see for themselves how formidable the environment is and how it might affect settlement patterns.

#4 Economic concepts (including productivity and the market system) and principles (including the laws of supply and demand)

When the pink granite became a popular product with dependable sales, large amounts of the heavy stone needed to be transported to those who bought it. Fortunately, there was a major railroad (the St. Louis, Iron Mountain & Southern Railroad) only a few miles east of the quarry. Have the students discuss how they would move large amounts of heavy stone from the quarry to the railroad.

Some students may enjoy writing a story about living near the Elephant Rocks. What would they do for a living? Could they make a lot of money? If they were starting a granite quarry near the Elephant Rocks, what would they need and what would they have to do to make the business successful?

It has been suggested that quarrying blocks was "the perfect Ozarks job" in the 1890s. A man could gross $6.30 a day cutting 70 blocks at nine cents per block. After paying the landowner a fee and a few other overhead incidentals, a person could clear $5. The average American subsistence income for the 1890s is estimated by the U.S. Bureau of Census at $530 dollars for a family of four. The average working class American family of four only earned $380. How many days work did the average Ozark block cutter have to work to make the average income of an American family of four? How long did it take to make above the subsistence level? What other jobs would a typical Ozark family have? At the pay rates for those jobs (found through historical research) how long would it take for a typical Ozarkian to reach subsistence level?

In the 1890s, workers hauled the granite to the main standard gauge railroad line on a short, narrow gauge railroad with a company steam engine. Later, into the 20th century, a small standard gauge railroad line developed around the Elephant Rocks. Why was it more economical to replace the narrow gauge with a standard gauge line instead of keeping the narrow gauge line in repairs? Why were local rail lines so important? After the beginning of the 20th century, gasoline trucks could haul granite also, but was it quicker, cheaper, and more environmentally friendly than a coal burning train? Today, what is cheaper and more environmentally friendly, trucks or trains?

John S. Brown, Ph.D., a retired geologist and former employee of St. Joe Lead Co., had the opportunity to purchase 131 acres of the Elephant Rocks with $100,000 of his own money. In 1966, he gave this property to the Missouri Department of Conservation and soon after it was transferred to the Missouri State Park Board to become a state park. Students can write an essay on what they would do if they had purchased Elephant Rocks and how their decision would impact the local economy.

#5 The major elements of geographical study and analysis (such as location, place, movement, regions) and their relationships to changes in society and environment

During a visit to Elephant Rocks State Park, take time to visit the engine house ruins. This is where the engines for the quarry's railroad were maintained. Was building a train track to the quarry a good idea? What negative and positive effects on the Elephant Rocks did this have?

#6 Relationships of the individuals and groups to institutions and cultural traditions

The quarry near the Elephant Rocks, run by the Sheahan family for many years, encouraged visitors and customers to recreate at the Elephant Rocks because it promoted their business. Was this a good idea? Did it affect the Elephant Rocks? How has the typical weekend picnic changed in the last 100 years?

#7 The use of tools of social science inquiry (such as surveys, statistics, maps, documents)

Have the students look at a Missouri state map. How far is Elephant Rocks from some of Missouri's larger cities? Have the students study a topographical map (Graniteville quad if possible). Can they describe the terrain around Elephant Rocks State Park? Can they explain why it was hard for early residents to live here? What currently influences or deters population growth?

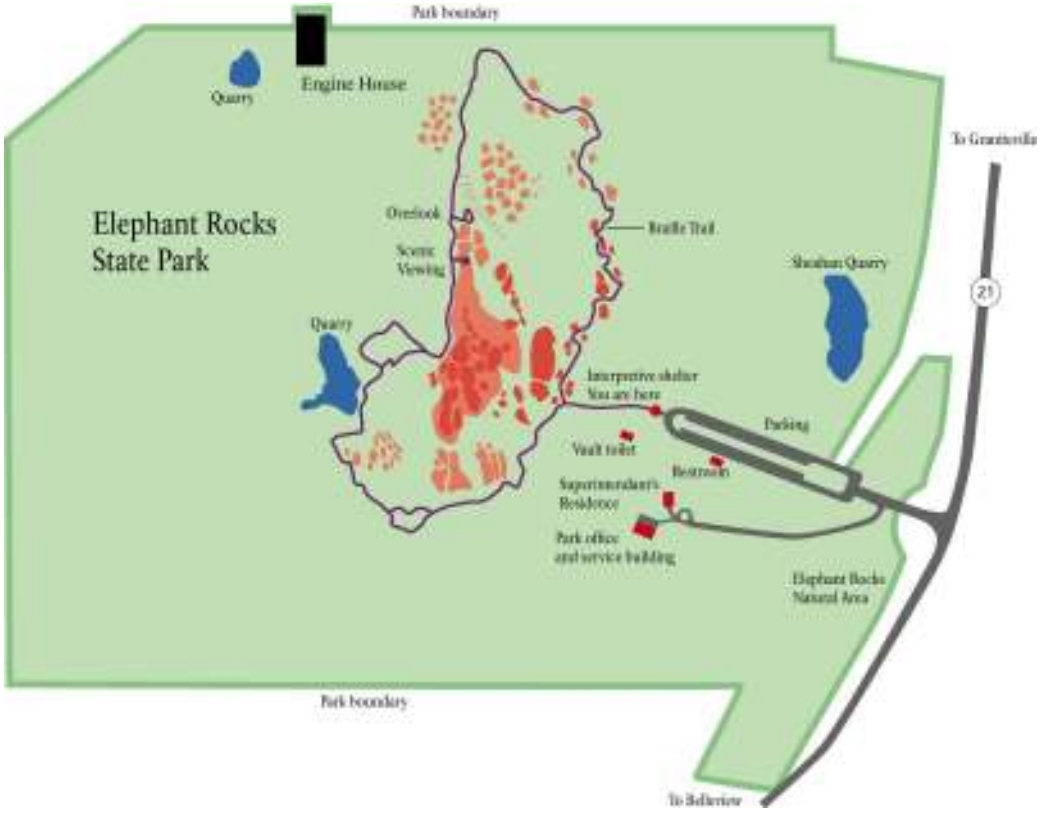
Health and Physical Education Standards

#4 Principles of movement and physical fitness

Have students practice bouldering (see vocabulary) on the Elephant Rocks. (Note: Bouldering is permitted at any time but a permit is needed for technical rock climbing in this park.)

#7 Responses to emergency situations

Students learning first aid can demonstrate proper splinting of a patient and proper carry techniques over the rugged terrain.



SPECIFIC RESOURCES FOR FURTHER STUDY

Elephant Rocks State Park is a place so frequently visited by the public that one would think there would be an extensive variety of source materials. However, it is difficult to find information that is comprehensive or information that is not technical and requires a degree in geology to understand.

Here are several source materials we often recommend to visitors.

"Geologic Wonders and Curiosities of Missouri" by Thomas Beveridge, Ph.D., Second edition revised by Jerry Vinyard, Missouri Department of Natural Resources, Division of Geology and Land Survey, Rolla, Mo. 1980. Paperback 391 pages, illustrated, maps, indexes

This book is truly one of the most interesting geology books. It is cleverly written, as well as simple to understand, with maps and diagrams and concise descriptions (many are firsthand accounts). Most of the geologic sites are described fully with directions on how to get to them. There is one full chapter on the area around the Elephant Rocks.

"Volcanic Rocks of the St. Francois Mountains" by Art Hebrank, Missouri Department of Natural Resources, Division of State Parks, Missouri Mines State Historic Site, Park Hills, Mo., no date, Photocopied pamphlet, 8 pages, illustrated, diagrams, maps.

Art Hebrank is the resident expert on the St. Francois Mountains. He has written a guide of the Elephant Rocks area that is technical enough to suit geology students but it is not so obscure that it discourages general public use.

"The Quarrying Industry of Missouri" by Buckley & Buehler, Missouri Bureau of Geology and Mines, Jefferson City, MO 1904

This is a turn of the 20th century technical manual that considers the whole state of Missouri. The part that will be of interest to students will be the section on the local granite quarries, and the short section describing in technical detail Missouri's Precambrian geologic history.

Inquire at Fort Davidson State Historic Site Visitor Center or call 573-546-3454 for photocopies of these selections.

“Mountains of Antiquity: St Francois Mountains” by Missouri Department of Natural Resources, Jefferson City, Mo. 2001, DVD format 22 minutes 30 seconds.

This is a very fine introductory tour of Elephant Rock State Park and the other surrounding state parks. It includes Johnson’s Shut-Ins State Park, Taum Sauk Mountain State Park and other sites. It is available for sale and each DVD has open captions for the hearing impaired.

VOCABULARY

Here are some unfamiliar words and their definitions. Knowing these words will help make a visit to Elephant Rocks State Park more interesting.

Bouldering - Bouldering is a type of climbing undertaken without a rope and is normally limited to the height the climber ascends the route so that any fall will not risk significant injury. This variation of climbing can be practiced on large boulders, at the base of larger rock faces or climbing routes, in indoor climbing centers, or even on manmade structures.

Ferrous - This is a geologic descriptive term for any natural substance that has relatively high iron content. Much of the soil and rock in and around the Elephant Rocks contain the element iron (Fe).

Glade - This is a descriptive term for a land area covered with a good deal of rock and only a little soil. In the southeast Ozarks, there are many hilltops that are referred to as glades. Glades have their own distinctive plants and animal communities.

Granite - Granite is an igneous rock formed when magma cools slowly underground and grows large crystals of minerals. The Elephant Rocks are all granite that is tinted pinkish by the content of iron in its magma.

Gruss - This unusual term is not often found in any dictionaries except in geology literature and it means "weathered rock." In the Elephant Rocks area, much of the exposed rocks are gruss.

Igneous - This is another geologic term that defines rocks and landforms that are formed by volcanic activity or cooling of magma underground (granite). A good portion of the southeast Missouri Ozarks was created by igneous activity while most of the other areas in the Ozarks were formed by layers of clay, sand and calcium deposits lay on top of one another through the geologic ages. Therefore, most of the Ozarks are described as "sedimentary." (See St. Francois Mountains)

Lichens - Lichen are small plant life of the fungus variety. At Elephant Rocks State Park, the gray and brown growths on the rocks and trees are lichen. At the park, there are many kinds of lichen, some of them uncommon.

Magma - This is a geologic term defining the hot molten rock that is part of vigorous volcanic activity.

"Missouri Red" - This term refers to the trade name of the granite product quarried near Elephant Rocks State Park. The Elephant Rocks were never quarried and used for a salable product. The rocks crumble too easily because they have been weathered and eroded. "Missouri Red" was cut out of the granite formation underground.

Precambrian - This is a geologic term that describes the earliest of geologic eras. The Elephant Rocks and the St. Francois Mountains are among North America's most ancient landforms. They were formed in the Precambrian time era from 1.5 to 1.1 billion years ago.

Porphory - This is a geologic term that defines a kind of igneous rock that was formed when molten magma flowed from its volcanic source and began to cool. As the magma cooled, some crystals were larger than the rest and are visible in the rocks. The hills around Elephant Rocks as well as Pilot Knob Mountain, Buford Mountain and Taum Sauk Mountain are all chiefly composed of igneous porphyry.

Quarry - When granite or marble or any other kind of stone is mined or extracted from the ground, the workplace is called a quarry. At Elephant Rocks State Park, there are two deep abandoned quarries. Nearby, there are several old quarries and at least one still being used.

Rhyolite - This is a geologic term that defines a kind of igneous rock formed when molten magma flows above ground and cools relatively quickly. The result is a hard smooth rock with crystals so small that they cannot be seen without a microscope (because crystallization requires slow cooling). There are many varieties of rhyolite in the area around Elephant Rocks State Park. Rhyolite ranging in color from rosy red to dark blue, purple, orange and black can be found when exploring the St. Francois Mountains. In nearby Arcadia Valley, both Shepherd Mountain and Pilot Knob Mountain are

formed nearly completely by rhyolite of a deep reddish color. Rhyolite with some scattered larger crystals is called rhyolite porphyry.

St. Francois Mountains - In southeast Missouri, one part of the Ozark Plateau formed much differently than the rest of the area. Early in its geologic history (1.5 billion years ago) the eastern tip of the plateau experienced violent volcanic activity. Geologists think the area became a huge volcanic mountain range the size of the modern day Cascade Range in Washington state. The volcanic activity continued over millions of years. When the volcanoes became dormant, they wore away and were covered over by sediments laid down by ancient tropical seas that once covered the Ozarks. At the time the modern Rocky Mountains were formed, the Ozark Plateau also rose again and slow erosion has formed the area ever since. Today, this erosion has revealed the ancient remains of the volcanic activity and is known as the St. Francois Mountains. It covers parts of St. Francois, Iron, Madison, and Reynolds counties in southeast Missouri. This part of the Ozarks is known for its fine scenery, unique geologic sites, clear beautiful streams and rivers, its "shut-ins" and acres of oak and pine forests.

Shut-Ins - This is a local term found in the St Francois Mountains used to describe a river or a stream that flows between two hills. The stream or river becomes confined to a narrow canyon that can be deep or shallow, but always rocky. There are several well-known shut-ins that are spectacular: Johnson's Shut-Ins in Johnson's Shut-Ins State Park; Ironton Shut-Ins on Highway 72 west of Lake Killarney; the St Francis River Shut-Ins in Madison County along Highway E; and the Millstream Gardens Conservation Area in Madison County.

Silica - Silica is an element that makes up the mineral quartz. Quartz is a shiny mineral widely found in the granite at Elephant Rocks State Park, and in the rhyolite at Pilot Knob Mountain and other places. Silica can be identified by its sugary sparkle when the sun shines on it.

Tor - The specific technical name for a rocky hilltop is tor, an old Gaelic word. Elephant Rocks State Park is located on a tor – a rocky hilltop. The term is used in technical literature to distinctly describe the hills with rock tops from those with tops covered by soil and plants. In the St. Francois Mountains, there are both kinds.

VISITING ELEPHANT ROCKS STATE PARK

Before Your Visit

Have each student locate Elephant Rocks State Park on a Missouri highway map. They might also locate other points of interest nearby like Fort Davidson State Historic Site, Taum Sauk Mountain State Park and Johnson's Shut-Ins State Park.

Divide the class into two or more groups. Verbally, give a short description of the Elephant Rocks. Have each group write a short essay on how such "rocks" might have been formed. These should be saved to compare and contrast to what they learn during their visit to Elephant Rocks.

As an activity during Earth Science class or a short geology section, review the geologic eras, and use the vocabulary words in this guide to familiarize the class with the unique geology of the area around Elephant Rocks State Park. (See page 12).

During Your Visit

Have the students take notes on what they see at Elephant Rocks State Park. Did they see any animals? What were they? What carvings in the rock did they see? If they brought cameras, have students take pictures of interesting plants, lichen, carvings and rocks. Have students look at plants near the trail. Can they identify any of them? Have everyone jot down what they see for later discussion.

After Your Visit

Each student should give a short report on what they saw at Elephant Rocks State Park. If possible, have them share their photos.

INFORMATION FOR YOUR VISIT

Elephant Rocks State Park
7406 Hwy 21, Belleview, MO 63623
Coordinates: N37°39.045' W90°41.415'

Mailing Address:
c/o Fort Davidson State Historic Site
P.O. Box 509
Pilot Knob, MO. 63663

Phone: 573-546-3454 **Fax:** 573-546-2713

E-Mail: fort.davidson.state.historic.site@dnr.mo.gov

State Parks Web Site: mostateparks.com/elephantrock.htm

HOURS

Summer (April-October)
Every Day 8 a.m-8 p.m.

Winter (November-March)
Every Day 8 a.m. – 5 p.m.

No reservations are needed for a group. There is no admission fee.

Parking
Parking is ample and can accommodate your school bus. There is no parking fee.

Accessibility

Elephant Rocks State Park has a mile-long, asphalt paved trail. Generally, it is accessible to people with disabilities. There are benches along the way for those who might want to rest. Furthermore, Elephant Rocks State Park has the only Braille Trail in the Missouri state park system.

Each informative marker has a Braille translation and some have examples that can be touched and handled. The short trail to the Engine House is not paved and may not be easy to access.

Restrooms

Elephant Rocks State Park has seasonal modern restrooms, water fountains and a pit latrine. All are accessible.

Day Trips, Lunches

If your group plans to visit the park for several hours, a picnic lunch might be desirable. Both Elephant Rocks State Park and nearby Fort Davidson State Historic Site have picnic facilities (accessible tables, water, restrooms and barbecue grills).

Fort Davidson State Historic Site also has one large and three small picnic shelters. The large one can be reserved for a fee. Otherwise it is available on a first-come first-served basis. All four have electric outlets.

Other options are restaurants in Pilot Knob. The area has McDonalds and Sonic for fast food and several other options for more formal group meals.

Elephant Rocks State Park Teacher's Guide

This teacher's guide was prepared by Brick Autry, interpretive resource technician at Fort Davidson State Historic Site. The guide was made possible by proceeds from the parks-and-soils sales tax, which supports Missouri state parks and historic sites.

Directions to Elephant Rocks State Park

From St. Louis

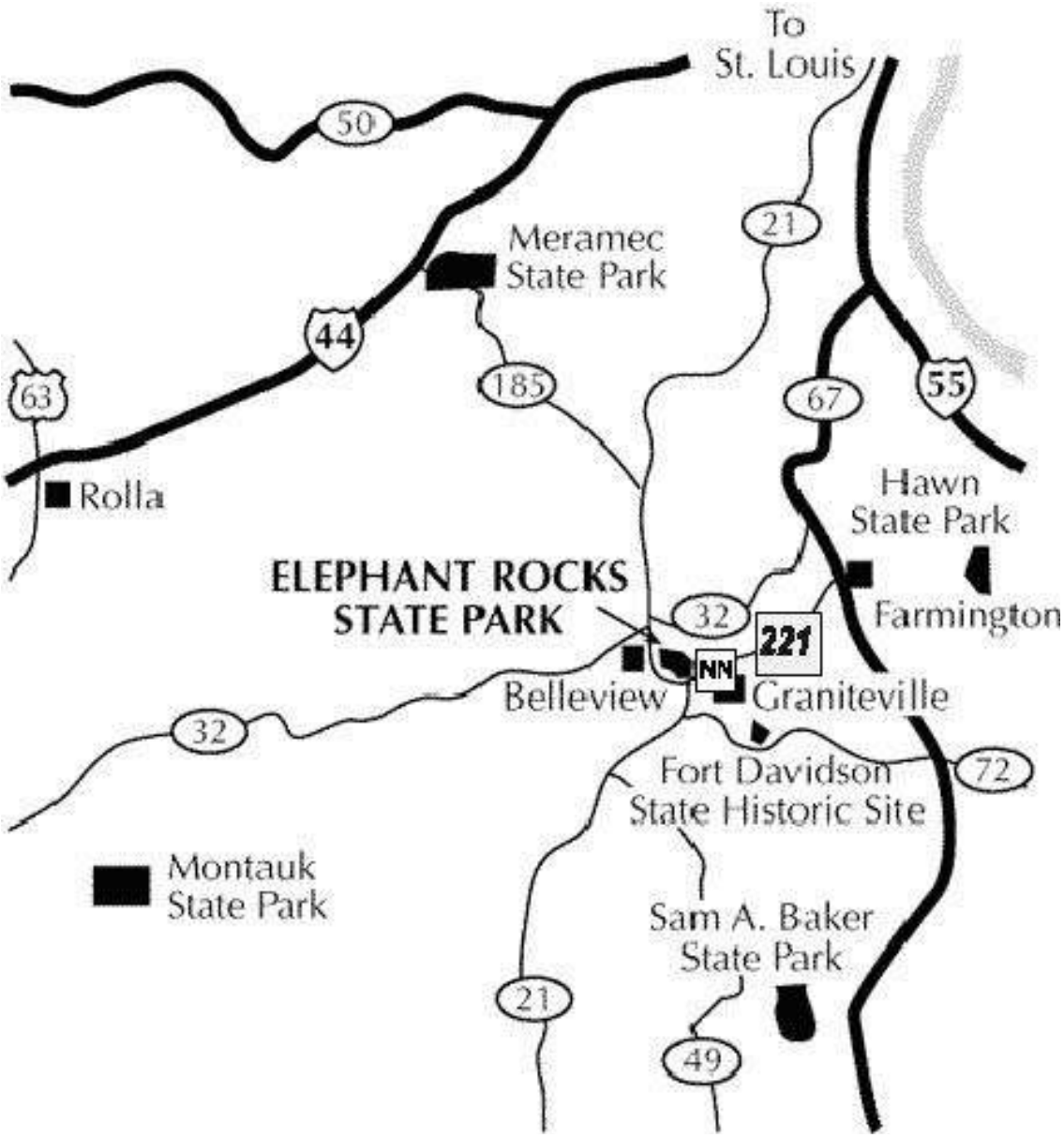
Take I-55 south out of St. Louis to U.S. Hwy. 67. Turn right (Exit 174) onto southbound U.S. Hwy. 67 and drive past Bonne Terre, Park Hills, Leadington and into Farmington. On the south side of Farmington is the State Road 221 overpass. Exit onto 221. Travel on Route 221 for 9 miles. When you reach the intersection of 221 and Route NN, go straight onto NN. Travel 8 miles to a flashing stoplight at a three-way stop. Turn right onto northbound Hwy. 21 and travel two miles. The park entrance is on right side of road. The trip is about one and one half hours long.

From Jefferson City

Take U.S. Hwy. 50 east out of Jefferson City to U.S. Hwy. 63. Turn right onto U.S. Hwy. 63 south and travel to Vichy. At the junction of U.S. Hwy. 63 and Hwy. 68, turn left onto Hwy. 68. Stay on Hwy. 68 through St. James. South of St. James at the junction of Hwy. 68 and Hwy. 8, stay to the left. You will be on Hwy. 8. Travel on Hwy. 8 to Potosi. As you leave Potosi, turn right onto Hwy. 21 south. About five miles south of Belleview on Hwy. 21 is Elephant Rocks State Park on the left side of the road. The trip is about two and one half hours long.

From Springfield/Joplin

Take I-44 out of Springfield toward St. Louis. Exit at St. James Overpass (Exit 195) and turn right onto Hwy. 68. Stay on Hwy. 68 through St. James. South of St. James at the junction of Hwy. 68 and Hwy. 8, stay to the left. You will be on Hwy. 8. Travel on Hwy. 8 to Potosi. As you leave Potosi, turn right onto Hwy. 21 south. About five miles south of Belleview on Hwy. 21 is Elephant Rocks State Park on the left side of the road. The trip is at least four hours long.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OTHER NEARBY GEOLOGIC SITES OF INTEREST

Johnson's Shut-Ins State Park

In addition to the shut-ins, the park offers a window into the area's geology, exposed by the 2005 breach of the Taum Sauk Upper Reservoir. The park features a popular swimming spot, a new nature interpretive center, picnic areas and campgrounds. Go to mostateparks.com/jshutins.htm for more information about this park.

Missouri Mines State Historic Site

Missouri Mines State Historic Site is truly one of the more unique sites in Missouri. The museum is housed in the main building of the old St. Joe Lead Co. at Park Hills, Mo. Video and specially designed equipment from the mining era can be viewed. The museum also features one of the more extensive rock and mineral collections in the nation. Go to mostateparks.com/momines.htm for more information.

Other State Parks and Historic Sites within a Half-Hour Drive

Fort Davidson State Historic Site
Taum Sauk Mountain State Park
St. Joe State Park

Other State Parks and Historic Sites within a One Hour Drive

Dillard Mill State Historic Site
Hawn State Park
St. Francois State Park
Washington State Park
Sam A. Baker State Park

Missouri Department of Natural Resources
Division of State Parks
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Jefferson City, MO 65102
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