

THE PENNSYLVANIA GEOLOGY GAME



www.ellenjmchenry.com

Purpose of game: To learn about various sites around PA that pertain to rocks and minerals (and water)

Target audience: Ages 10 to high school

Time need to set up: Allow at least 20 minutes to assemble board and cut out all cards

Time needed to play: This is flexible. You can use only a few task cards and play for about 20-30 minutes, or you can use more task cards and play for 60-90 minutes.

Number of players: 2 to 4 players (maybe up to 6, but for more than that, consider making a second game)

Materials needed: Copies of patterns pages with some printed onto card stock, scissors, glue stick and/or clear tape, a number cube (die), a few pennies or dimes (for closing roads), a piece of thin clear plastic, a few permanent markers to make a dot on the clear plastic

How to assemble the game:

1) Make copies of the pattern pages using a color printer, if possible.

-- If you don't have a color printer yourself and don't know anyone who does, you can always take the file on a memory stick (jump drive) to a copy shop such as Office Depot or Staples and they can print the pages for you. Highest priority for color would be the site cards, then the map pieces.

-- If you have heavy card stock paper available, use it for the site, mineral, and event cards. If you don't have card stock, the game can still be played with these printed onto regular paper.

-- Mineral cards and site cards: Make one set on card stock. (Blank on reverse side.)

-- Event cards: The page with the EVENT CARD labels is provided so that you can print this on the reverse side of your event cards, if you want to. If you are unable to do two-sided printing, just copy the text and leave the flip sides blank.

-- PA counties page: Make a copy for each player. These can be used to help locate the sites on the site cards.

-- Map pages can be printed on either card stock or regular paper. If you want the board to be durable for future use, use card stock and/or have the board laminated at a print shop.

2) Cut apart all the cards and put them into separate piles.

3) Assemble the map

There are two ways to assemble the map. You will notice that there are glue tabs along the sides of some of the pages. You can use these tabs to overlap the pages and use glue stick on the tabs. If you'd rather have clear tape along the creases so that when it gets folded the tape takes the brunt of the fold (instead of the paper itself folding) you can copy the pages onto card stock, cut off the glue tabs, put the pages next to each other with the edges "flush," then apply tape along the seams. Wide mailing tape works very well for this.

4) Make "tokens" for each player. You will need a sheet of clear plastic that is thin but reasonably stiff. A copier transparency would work, as would a piece of plastic from a "bubble wrapped" item you purchased at a store. Plastic food wrap is a little too thin. Cut a 1" x 1" square piece for each player and put a colored dot in the center, about 1/8" diameter using a permanent marker. Each player should have a unique color dot. This is a strange type of token (compared to those standard playing tokens like you use in Monopoly) but these flat clear token will work very well for this game.

NOTE ABOUT THE MAP:

This map is highly simplified and does not show many smaller rivers, state parks, etc. Please feel free to add any rivers, towns, roads or sites that you want to. There are blank site cards that you can use to add extra sites.

OPTIONAL: Cut some 30-mile measuring strips using the scale shown on the map. There are a few EVENT CARDS that require measuring distances.

Getting ready to play:

- 1) Put the EVENT cards on their designated space on the board. Put some ENERGY BOOST cards on their designated spot. (You don't have to put out all of the ENERGY cards. You can start with 10 or so. If you run out you can add more.)
- 2) Distribute site cards and mineral cards to the players. You have a lot of flexibility here. You can control the length and the complexity of the game by determining how many cards to give to each player. For a short game with younger students, use only 3 or 4 site cards and a few mineral cards. For older students, use more. Also you will want to think about whether you will be playing the game just once or several times. If you will be playing several times, you can give out fewer cards per game. If you can only play it once you may want to maximize the potential of the game and use most or all of the cards.

General guidelines for a not-too-long game with ages 10-13:

- 1 Cave card
- 1 Coal mine card
- 4 other site cards
- 1 limestone card
- 3 other mineral cards

It is up to you whether to distribute the cards at random or let the players choose sites that are of interest to them. If you let them choose, make sure they do not choose simply on the basis of location (choosing sites that are all in one place!).

BONUS FEATURE OF SITE CARDS: Many of these sites have videos that go with them. I have started a playlist called "PA Virtual Field Trips" on www.YouTube.com/TheBasementWorkshop.

Also, if you'd like to know more about mineral collecting in PA, go to Google and search using key words "John Betts mineral gallery Pennsylvania." The first listing will be for a fabulous virtual museum of mineral specimens collected right here in PA. You may want to add more mineral cards if you are especially interesting in rock and mineral collecting.

NOTES:

- LIMESTONE can be found just about anywhere in PA. Random sites had to be chosen for the sake of simplifying the game board. Effort was made to try to coordinate these sites with places where limestone is actually mined currently, but this cannot be guaranteed.
- The sites marked COAL represent places where there are active coal mines (as of 2014).
- There are thousands of GAS wells across western PA, so random sites had to be chosen. The main point is that gas is mainly located in western PA, in bituminous areas. Eastern PA has anthracite coal and a wider variety of minerals. (For more info on PA coal, check out the coal videos on the playlist mentioned above.)
- The mineral collection sites (except for the chert) are probably not the only areas where you can find these minerals. However, they do roughly correspond to exact locations, especially concerning the counties the minerals are found in. Effort was made to be approximately correct, if that makes sense. ;) In other words, you won't be learning anything wrong. All sites are valid, but you could legitimately add other sites in many cases. However, adding too many sites makes the game board look cluttered and confusing to the players.

How to play:

- 1) The goal is to get across the state, having visited all your sites on the way across. The first player to visit all his sites and then get to the other side wins the game. (But we all win because we learned so much! :)
- 2) Players need to choose one of the highway signs as their starting point. It does not matter whether they choose to go west to east, or east to west. Players put their plastic "tokens" on their chosen starting point.
- 3) Players should take a few minutes to find all their site locations on the map so they know where they need to go. County locations are given in the site descriptions (on the site cards). Find the county on the county map and you'll have an approximate idea of where to look for the site on the large map. This is great practice for learning the counties.
- 4) Players move by rolling the die. They may use all of the "hops" on their roll, regardless of whether they stop at a destination. For example, if you roll a 5 and you are only 2 hops away from your destination, you may move 2 spaces, turn over your destination card, then continue on 3 more spaces. This is done in order to keep the game moving quickly. (The other option was to use a pair of dice, but a single die with bonus rolls seemed easier.)

5) Visiting a site: When players land on one of their sites, they turn that card over, indicating they've completed that task. The same for rock/mineral collecting-- just turn the card over after landing on the rock/mineral site.

6) "TO PASS OR NOT TO PASS?" YOU DECIDE...

The game was originally designed to have a "no passing" rule, in order to make it more challenging for older players. No passing means that players can't "hop" over each other's tokens. The players have to take alternate routes to avoid running into each other. However, if this rule complicates the game too much for your players, you can eliminate it.

7) ENERGY BOOST cards:

These are collected when a player lands on a COAL or GAS site. (GAS means "natural gas," of course, not liquid gasoline.) Coal and gas often occur in the same area.

Energy boost cards are kept in your hand for whenever you really need an extra roll. For example, if you roll a 2 and need some extra hops to get to a destination, use one of your boost cards and get a bonus roll. (To use the card, just return it to the pile and let it be recycled.)

NOTE: These coal sites represent areas that are still being actively mined for coal. The site cards that feature coal mines are old mines that are no longer operating and are just for tourism. Operating coal mines can't give tours.

8) EVENT cards:

When a player rolls a 1, an event card is drawn. (The player can still move his one space, then draw the card.) Often, the card will give instructions that involve all the players. (In this way, everyone is kept actively engaged in the game even during other players' turns.) Follow the instructions on the event card. A few cards have you blocking off a roadway for a short time. You can use pennies or dimes on the ends of the roadway, just like cones are used to mark real construction sites. You can determine exactly where to put the coin. It won't matter whether it is on an intersection or not--just choose how to want to do it. The main point is to keep the game lively and interesting. After an event card is used, put it on the bottom of the pile.

NOTE: If you are playing a short game and don't think you'll use all of the event cards, sort through them ahead of time and pick out the ones that are most appropriate for your group.

OPTION: Feel free to add your own event cards to the game. You may have some great ideas for twists and turn of fate that add drama to the game!

POP QUIZ CARDS: You will notice that some of the questions are multiple choice. If you are playing with 4 players, this means that if the first two players miss the question, the third player will only have one option left and will automatically get it right.

FOR SITUATIONS NOT COVERED IN THESE RULES:

If you come up with an unusual situation that is not covered here, just agree on a rule that suits everyone playing the game, and that will be your new rule. As long as everyone plays by the same rules, the game is fair.

EXTRA RESOURCES:

For information about non-fuel mineral resources in PA here is a booklet that could be used with ages 10 and up:

http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_014590.pdf

(This booklet has a lot of info about limestone. There are other uses for it besides the ones mentioned on the limestone mineral card. It's amazing how many things you can do with the chemicals in limestone! Lots of good info about all the other minerals, too.)

For a virtual online museum containing pictures of hundreds of collected mineral specimens from PA:

www.johnbetts-fineminerals.com/jhbnyc/mineralmuseum/gallery.php?st=501&init=&loc=Pennsylvania

For virtual field trips to some of the sites on the map:

www.YouTube.com/TheBasementWorkshop

LIST OF SITES

PETROGLYPHS

Sugar Grove petroglyphs (Greene)
Smith's Ferry petroglyphs (Beaver)
Indian Rocks petroglyphs (border of York and Lancaster)
Parkers Landing petroglyphs (Clarion)
Indian God Rock (Venango)

ROCKS

Dinosaur Rock (Lebanon)
Ticklish Rock (Sullivan)
Balanced Rock (huntingdon)
Jakes Rocks (Warren)
Devil's Den (Adams)
Rock Garden at World's End State Park (Sullivan)
Archrock Roadcut (Juniata)

MINES / COAL

Lackawanna Coal Mine (Lackawanna)
Seldom Seen Coal Mine (Cambria)
Pioneer Tunnel Coal Mine (Skuykill)
Number 9 Coal Mine (Skuykill)
Centralia underground mine fire (Columbia)

GLACIER FORMATIONS

Moraine State Park (Butler)
Boulder Field at Hickory Run State Park (Carbon)
Whaleback (Northumberland)
Shohola Stone (Pike)
West Liberty Esker (Butler)

CAVES

These are easily found by looking for the bat symbols.

Lincoln Caverns
Indian Caverns
Crystal Caverns
Penn's Cave
Laurel Caverns
Woodward Cave
Coral Cave

FOSSIL SITES

Ambridge, ferns (Beaver)
Swatara Gap (Lebanon and Skuykill)
Dinosaur tracks (Montgomery)
Centerfield Coral Reef (Monroe)

WATER RELATED

Potholes at Conewago Falls (Dauphin)
Bushkill Falls (Pike)
Ohiopyle Falls (Fayette)
Archblad Pothole (Lackawanna)
Frankfort Mineral Springs (Beaver)
Slippery Rock Gorge / McConnells Mill (Lawrence)
Boiling Springs (Cumberland)

SCENIC VIEWS

PA Grand Canyon (Tioga)
Mt. Davis (Somerset)
Mt. Nittany (Centre)
Presque Isle (Erie)
Cherry Springs Vista (Potter)

Note: I originally had the Johnstown Flood Museum also listed as a site. When typing up the cards, this seemed like an extra that would not fit nicely on the pages. I left it on the large map, but took it off the list of places. If you would like to add this site card, just use one of the extra blank cards and make a card for it.

LIST OF ROCKS and MINERALS and where to look for them:

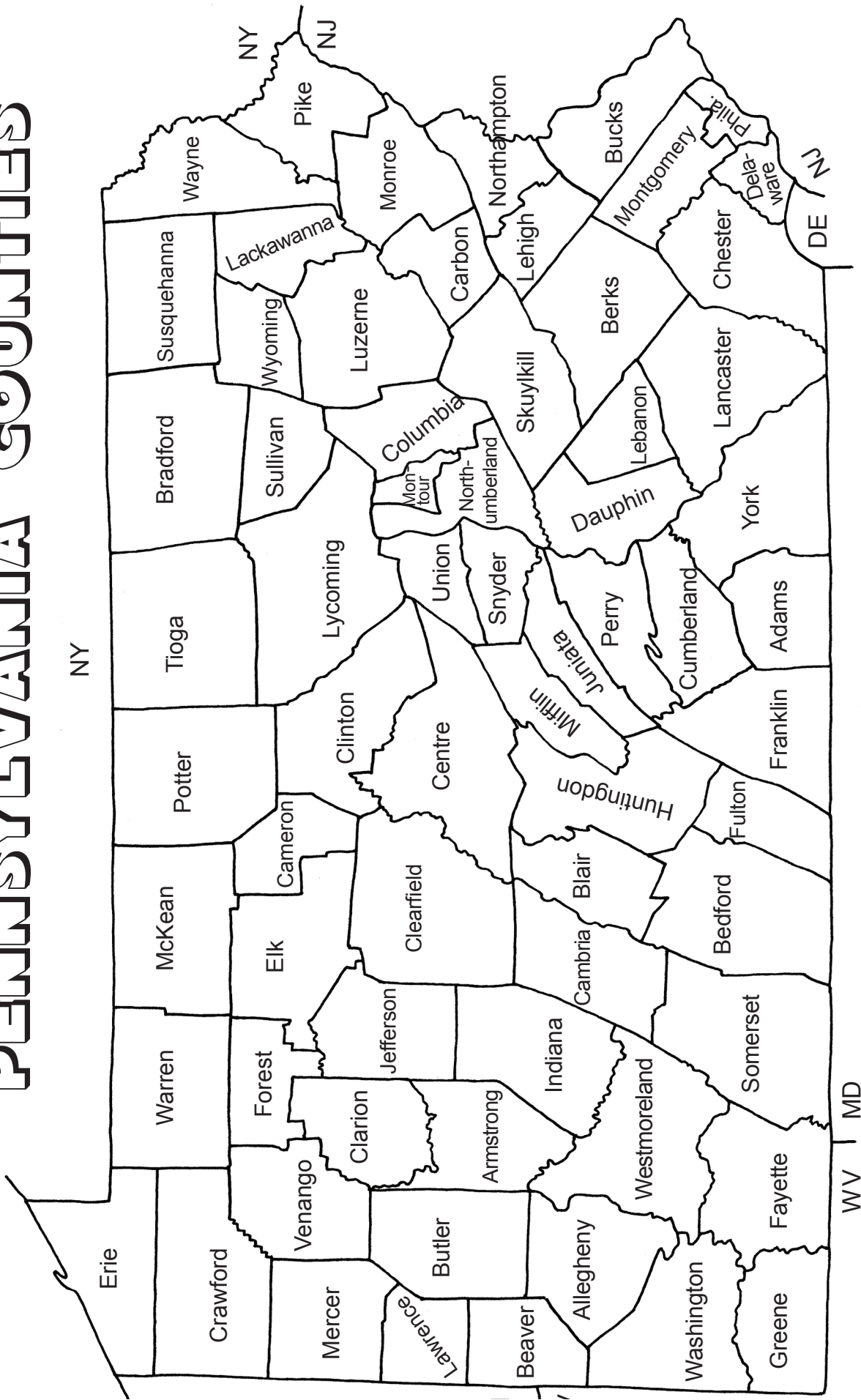
Aggregate (Erie, Crawford, Warren)
Amethyst (Delaware, Chester)
Beryl (Delaware, Chester)
Calcite (York, Lancaster, Delaware)
Copper (York, Lancaster, Montgomery)
Diabase (Chester)
Feldspar (Delaware, Chester)
Garnet (Delaware, Chester)
Gneiss (Delaware) (*pronounced: "nice"*)
Gold (Lancaster, York)
Graphite (Bucks, Lehigh)

Gravel (Pike, Tioga)
Iron (Centre, Huntingdon,
Lead (Blair, Lancaster, Montgomery)
Limestone (all over PA)
Magnetite (Chester, Berks, Lebanon, Philadelphia)
Malachite (Lebanon, Berks, Chester)
Nickel (Lancaster)
Oölitic chert (Centre) (*pronounced: "oh-oh-lit-ik"*)
Pyrite (Centre, Chester, Lebanon, Lancaster, Luzerne,
Berks, Montgomery)
Rutile (Chester)
Salt (Bradford, Crawford, Indiana)
Shale (many places in PA but in this game the sites
are Pike, Susquehanna, Potter)
Silver (Lancaster, York)

NOTE: This list is to show trends, not always exact locations (although in the case of oölitic chert, it is found in only this one tiny place in the state). For example, there could be a salt deposit somewhere other than the three counties listed, but by and large these three counties are a fairly accurate representation of where salt is found.

Iron is found in other places, but in smaller quantities. Gravel might be found in counties adjacent to those listed. Also, this is not a complete list. You might want to add other minerals such as zinc (Montgomery, Lehigh, Cumberland), mica (Berks, Chester), talc (Lancaster), asbestos (Chester, Delaware, Lancaster, Northampton) or uranium (Carbon) or others you may know about.

PENNSYLVANIA COUNTIES



The first counties to be established were Philadelphia, Chester and Bucks, in 1682. The last was Lackawanna in 1878. The Native Peoples of Pennsylvania were the Lenape (Delawares), The Susquehannocks, the Shawnee and the Seneca. The names of 12 counties (and many other place names) come from the languages of these native peoples.

EVENT

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SINKHOLE

PA is basically a limestone state. Groundwater can erode the underground limestone fairly easily, causing empty areas that can suddenly collapse, forming depressions called sinkholes. A sinkhole just opened up (not really--only in our game) along 322 between Brookville and Philipsburg. Anyone on this section of road right now will need to move forward or backup until they are clear of this area. This section of road will remain closed until someone rolls a 6. (Tip: Use pennies to block off this section.)

SIRENS

The person holding this car just got stopped for speeding. To slow you down a bit, you must pick up an extra mineral card.

HELICOPTER

This card is only for the person who picked it up.

Give yourself a helicopter ride to any location or road dot inside a State Park or State Forest. (If you don't want to use this card, you may trade it to another player for one of their energy boost cards. They may use this card on their next turn instead of rolling the die.

HELICOPTER

This card is only for the person who picked it up.

Give yourself a helicopter ride to any exit on Interstate 80. If you don't want to use this card, you may trade it to another player for one of their energy boost cards. They may use the helicopter on their next turn instead of rolling the die.

ROAD WORK

Close the Turnpike from Monroeville to Bedford. (If you are on this section of road right now, move enough spaces so that you are no longer on it.) As soon as someone rolls a 6 you can open the road again. (Use pennies at either end of the road to remind everyone it is closed.)

ROAD WORK

Close 476 from Scranton to Allentown. (If you are on this section of road right now, move enough spaces so that you are no longer on it.) As soon as someone rolls a 6 you can open the road again. (Use pennies at either end of the road to remind everyone it is closed.)

EARTHQUAKE

The most severe earthquake PA has ever had was 5.2 on the Richter scale. That's enough to rattle windows, but not enough to cause major damage.

If your token is within 30 miles of one of the epicenter symbols, move 3 spaces in any direction that is away from the quake.

EARTHQUAKE

There have been over 100 quakes in PA since 1724. Often the tremors are felt in neighboring states. (The most recent quake felt by Pennsylvanians (in 2011) originated in Virginia, not PA.)

If your token is within 10 miles of an earthquake symbol, move 5 spaces in any direction that is away from the quake.

FLOODING

Flash flooding is often a problem in PA. Unfortunately, flooding has closed Route 8. If you are on it now, move enough spaces to get to safety. As soon as someone rolls a 6 the road will be safe for travel again. (Use pennies on the road as a reminder it is closed.)

<p>If any player has ever visited the PA Grand Canyon or hiked any part of the Appalachian Trail (in real life) he or she may move 2 extra spaces right now.</p>	<p>The Appalachian Trail goes along the Appalachian Mountains from Georgia to Maine. Part of the trail goes through PA.</p> <p>If you are south of the dotted Trail line, you may move your token to any mineral site south of the Trail.</p> <p>(If you have already turned over all your mineral cards, you may move your token 4 spaces.)</p>	<p>If you, the person holding this card, have ever actually been to any of the caves on this map (in real life), you may move your token to any of the caves on the map. (Hint: Even if you have already turned over your cave card, look to see if there is a cave close to where your other destinations are.) You may pass and not use this card if you'd rather stay where you are right now.</p>
<p>Roads that go east to west have even numbers. If you are on an east/west road, you may go 2 space east or west.</p> <p>(If the road you are on is not marked, you can't use this card even if the road looks like it is running east to west. The road has to be numbered.)</p>	<p>Ground Hog Day (February 2) is a big event in PA! The official Ground Hog Day town is Punxsutawney. In their sunrise ceremony, if the ground hog sees his shadow this means there will be six more weeks of winter. This is one day you hope will be cloudy!</p> <p>Anyone within 50 miles of Punxsutawny gets to move 3 extra spaces right now.</p>	<p>If you, the person holding this card, have ever actually been to any of the tourist coal mines on this map (in real life), you may move your token to any of the four coal mine spaces. (Hint: Even if you have already turned over your mine card, look to see if there is a mine close to where your other destinations are.) You may pass and not use this card if you'd rather stay where you are right now.</p>
<p>Traffic on the turnpike is very heavy right now. The signs are flashing, "Be prepared for delays." If you are on the turnpike, you will only be allowed to move 1 space on your next move (but without drawing an event card). You won't have to roll the die; you already know you will be moving 1. Sorry, but these things to happen when you travel!</p>	<p>If the place where you are right now (where you are sitting, playing this game) is within 30 miles of a PA border, all players may go to one of their destinations instantly (like a science fiction transporter!).</p>	<p>The dotted line represents the southern edge (approximately) of a huge ancient glacier. This glacier covered the top of North America! Many geological features in this area were affected by the melting glacier. (It created potholes and eskers.)</p> <p>Anyone who is north of the dotted glacier line may move up to 3 spaces in any direction. Go ahead and move right now.</p>

<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What radioactive gas is commonly found in the ground all over PA, but in especially great quantities in eastern PA in the areas where anthracite coal is found?</p> <p>a) methane b) xenon *c) radon</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What is the PA state tree? (the eastern hemlock)</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What is the PA state bird? (the ruffed grouse)</p>
<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>How many National Forests does PA have? (1: Allegheny National Forest)</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>Who carved PA's petroglyphs? a) Iroquois *b) Algonquins c) Sioux</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What is the PA state fossil? (the trilobite)</p>
<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What radioactive element can be found in some PA rocks? *a) uranium b) plutonium c) thorium</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What PA rock formation played a role in a Civil War battle? (Devil's Den) Gettysburg</p>	<p>POP QUIZ!</p> <p>Ask this question to the person on your right. If they guess correctly, they may move 4 extra spaces. If they don't get it right, ask the next person. If they miss, keep going around the circle. If no one gets it right, the questioner (you) may take the extra 4 moves. But give the right answer before you do!</p> <p>What is the most abundant type of rock in PA? (limestone)</p>

	<p>If you are holding a site card for a water feature, you may move 2 extra spaces right now.</p> <p>(Water features would include waterfalls, Boiling Springs, Frankfort Mineral Springs, and Presque Isle beach.)</p>	<p>If are holding a card for a rock formation that involved glaciers, you may go there immediately.</p> <p>(This would include West Liberty Esker, Shohola Stone, Archbald Pothole, Jakes Rocks, Boulder Field and Whaleback Anticline.)</p>
	<p>Anyone who has all their cards turned over, or has only one card left, must take another site card.</p>	<p><i>These instructions are only for the person who picked up this card.</i></p> <p>Trade one of your cards for another player's card. (Hint: You might want to choose a card for a location you happen to be close to at the moment.)</p>
	<p><i>These instructions are only for the person who picked up this card.</i></p> <p>You are traveling with a seismographer (a person who studies earthquakes). Move your token to a road dot that is close to any of the earthquake epicenter symbols, so that the scientist can do some research there.</p>	<p><i>These instructions are only for the person who picked up this card.</i></p> <p>Trade one of your cards for another player's card. (Hint: You might want to choose a card for a location you happen to be close to at the moment.)</p>



TICKLISH ROCK

No one set this boulder on its pedestal. This is an example of "differential weathering" where different types of rock have eroded at different rates, creating fascinating natural sculptures. Ticklish Rock is made of sandstone. The tiny pedestal is only 18 by 30 inches. It is located in Sullivan County.



INDIAN GOD ROCK

Located in Venango County, the petroglyphs on this 22-ft wide sandstone boulder were probably carved about 1000 years ago. When Europeans came to the area, the native "Indians" made it clear to them that this was a sacred place, so the Europeans began calling it "Indian god" rock. As with all PA petroglyphs, the writing in the rock has experienced a lot of erosion and is becoming difficult to see.



BALANCED ROCK

This boulder is perched on the edge of a cliff, looking as though it might fall at any moment. Most likely, this rock survived erosion better than the surrounding rock, which has been weathered away. It has been this way for thousands of years, so it's not likely to fall any time soon. Balanced Rock is in Huntington County.



"LITTLE INDIAN ROCK"

This petroglyph is on the edge of the Susquehanna River, on the border between York and Lancaster counties. It is thought that the Algonquin peoples made the carvings. There is a similar boulder near by called Big Indian Rock.



SUGAR GROVE PETROGLYPHS

These designs were probably carved by the Monongahelan people. The 23-foot boulder is made of sandstone. There are 48 designs which include human figures, animal tracks, birds and bird tracks, and abstract designs. It is located in Greene Co.



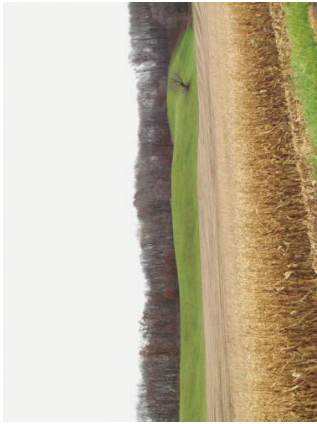
PARKERS LANDING PETROGLYPHS

Several boulders on the edge of the Allegheny River near the town of Parker (Clarion Co.) have ancient petroglyphs carved on them. This design is called the "antlered panther." Its significance in Native American culture is unknown.



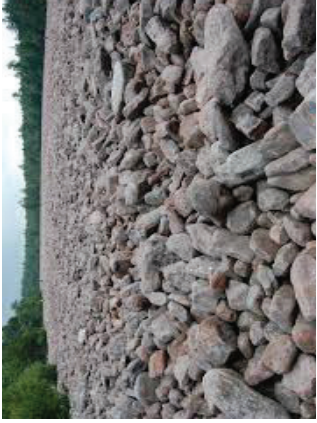
SMITHS FERRY PETROGLYPHS

These Monongahelan petroglyphs are very close to the Ohio border (Beaver Co.). It was a popular tourist attraction in the early part of the 20th century. Now all the petroglyphs are under water, due to the construction of a dam. Plaster casts of the designs were made by the Carnegie Museum before the dam was opened.



WEST LIBERTY ESKER

An esker is a long ridge of gravel left behind by a retreating glacier. This ridge of sand and gravel is all that remains of a temporary stream created by melting ice. This 3-mile long esker is located in Butler County. Nearby is Moraine State Park, another site formed by ancient glaciers.



BOULDER FIELD HICKORY RUN STATE PARK

Hickory Run State Park (in Carbon Co.) is located at the edge of the area of North America that was once covered by glaciers. It is believed that this field of boulders was left by a retreating glacier. Boulder Field covers over 16 acres.



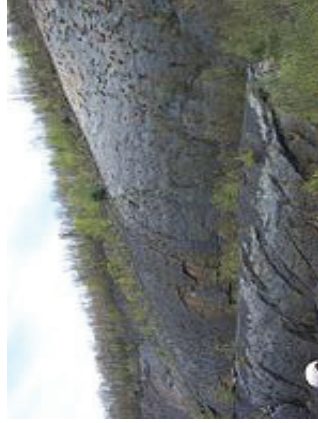
JAKES ROCKS

Like the Shohola Stone, these rocks are believed to have been left behind by glaciers. The Allegheny plateau's valleys were probably carved out by melting glacial streams. This rock formation is very close to a scenic overlook where you can look out over the Allegheny Reservoir near the Kinzua Dam in Warren County.



ARCHBALD POTHOLE

This 38-ft deep hole was discovered by accident in the late 1800s. At that time it was full of sand and gravel and had to be cleaned out. Geologists believe it was created by water erosion at the end of the Ice Age. The hole cuts through layers of sandstone, shale and coal. It is possible that the pothole was at the bottom of a waterfall that spilled off the top of a glacier. The pothole is located in Lackawanna Co.



WHALEBACK ANTICLINE BEAR VALLEY STRIP MINE

This 7-acre site in Northumberland County is one of the best folded rock structures in the U.S. You can see three kinds of faults, as well as folds, joints, cleavage and lineations. Plant fossils (found in shale) and layers of coal are common in this area. The anticline (folded mound) shown here looks like the back of a whale.



SHOHOLA STONE

This boulder was left by a glacier. Even though it might look like it was cut, this is its natural shape. The Lenape (Delaware) tribe called the boulder "Peace Stone" ("shohola" means peace) and believed it to be the center of the Universe. This stone is located in Pike County.



ROCK GARDEN AT WORLD'S END STATE PARK

This geological feature is part of an area of PA called the Endless Mountains region of Sullivan County. Geologists believe that they are not really "true" mountains that got pushed up, but are remnants of extreme erosion, where harder rocks were left as mountains and softer rocks eroded into valleys. Fossil hunters report finding petrified lungfish burrows in this area.



DEVIL'S DEN at Gettysburg

According to legend, the name of this rock feature came from an 8-ft black snake that lived here prior to the Civil War. During the Civil War, this was the site of an important battle. The rocks are part of an igneous intrusion into ancient sediments. Devil's Den is located in the Gettysburg National Military Park in Adams County.



SLIPPERY ROCK GORGE McConnells Mill State Park

This rocky gorge in Lawrence County is a very popular hiking area. The gorge gets its name from Slippery Rock Creek, which runs through an area of the state known for its oil reserves. Most likely, oil came to the surface and covered some of the rocks along the creek making them oily and slippery. The hiking trails go through many interesting rocky crevasses.



CHERRY SPRINGS VISTA Cherry Springs State Park

Located in Potter County, Cherry Springs Vista sits on top of the Allegheny Plateau at an elevation of 2,300 feet above sea level. Its remote location makes it ideal for observation of the night sky. Many amateur astronomers come here with their telescopes. The park got its name from its abundance of black cherry trees.



DRAKE'S OIL WELL

This site in Venango County is the first place in North America where a commercial oil well was built. The well goes down 70 feet into a layer of sandstone that has a reservoir of oil in it. Drake installed a pump that pumped out about 20 barrels of oil a day. At that time all you could do with the oil was burn it in a lamp or use it as medicine (yes, they really did drink it!).



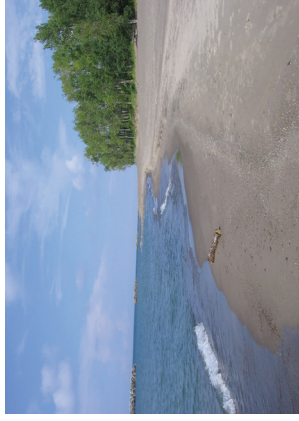
MT. DAVIS the highest point in PA

The top of this mountain is 4314 feet above sea level, the highest elevation in PA. Mt. Davis is in Somerset County and is part of a 30-mile ridge. It was named after John Nelson Davis, a naturalist and surveyor (and Civil War veteran) who studied the plants and animals of this area.



MT. NITTANY

This mountain in Centre County is a focal point for many aspects of local culture. From the scenic overlook, you can see the entire campus of Penn State University, whose mascot is the Nittany Lion. According to legend, Nittany was the name of a local "Indian" princess. The top of the mountain ridge is made of sandstone with patches of quartzite at higher elevations. Under the sandstone is a layer of shale, followed by more sandstone, then limestone.



PRESQUE ISLE

In French, Presque Isle means "almost an island" (a peninsula). Presque Isle is the main geological feature of Erie County. The peninsula has many beaches and picnic sites along both sides. The waves of Lake Erie are constantly eroding the beaches. In the mid-1800s, water covered the lower part of the peninsula and turned it into an island. In the 1950s, a concrete seawall was built to slow down the process of erosion.



PA GRAND CANYON

The correct name for this land feature is Pine Creek Gorge, though most people in the state call it the PA Grand Canyon. The Native Americans used the gorge much as we use our modern highways. In the 1800s the gorge had most of its trees chopped down by loggers. It is located in Tioga Co.



SCULPTURED ROCKS at Conewago Falls

These rocks are located in the Susquehanna River right below Three Mile Island near Harrisburg. They are a type of igneous rock called diabase. Most of PA is sedimentary; igneous formations are rare. In this part of the river, an ancient lava flow cut through the sediments. Moving water, possibly from melting glaciers, then eroded the diabase forming these fantastic shapes.



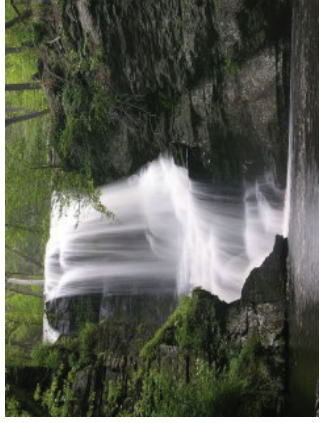
OHIOPYLE FALLS

Ohiopyle Falls is one of a series of falls on the Youghiogheny River in Fayette Co. This scenic area was made even more famous when architect Frank Lloyd Wright built a house out over one of the falls. (The house is called Fallingwater.) The word "Ohiopyle" is a Lenape (native) word meaning "it turns very white," referring to the churning water at the bottom of the falls.



CENTRALIA MINE FIRE

Centralia, in Columbia County, is in the anthracite coal region of PA. During the 1940s and 50s, the town began using an old strip mine as a garbage landfill. In May of 1962 the town decided to get rid of the landfill by burning the garbage. Unfortunately, the fire spread to the coal seam running underneath the dump, and began burning underground. This fire has been burning underground ever since. The town had to be abandoned.



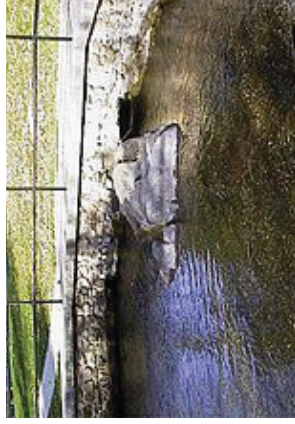
BUSHKILL FALLS

Bushkill Falls, in Pike County, is a series of eight waterfalls, the tallest of which is 100 feet. The falls are located in the Pocono Mountains region of the state. The falls are inside a private park that charges an admission fee. The water from the falls flows into the Delaware River, then into the Delaware Bay, then into the Atlantic Ocean.



RICKETTS GLEN

This state park reaches into three counties: Columbia, Luzerne and Sullivan. It also goes across two physiographic areas: the Allegheny Plateau and the Ridge and Valley area. The plateau is much higher, so creeks flowing down to the Ridge and Valley create waterfalls. Kitchen Creek drops about 1000 feet in just over two miles!



THE BUBBLE at Boiling Springs

The water at Boiling Springs (Cumberland Co.) isn't really boiling—it's fresh, cool groundwater, bubbling up from an underground aquifer. The ground water comes up at this place because of an igneous (diabase) intrusion. Boiling Springs just happens to be located at approximately the halfway point on the Appalachian Trail, so it has been a popular place for hikers to stop and refresh themselves.



FRANKFORT MINERAL SPRINGS

During the 1800s, this natural spring was the focal point of a health resort. The water coming out of the spring is rich in minerals essential to human health. People really did feel better after drinking this water! The resort was destroyed by a fire in 1930 and never rebuilt. This site is now part of Raccoon State Park in Beaver County.



VISIT A CAVE

Tour one of these caves:

Lost River Caverns
or
Lincoln Caverns



VISIT A CAVE

Tour one of these caves:

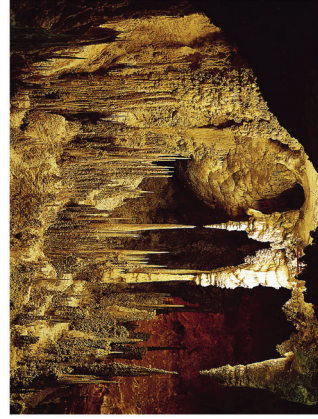
Crystal Cave,
Woodward Cave
or
Penn's Cave



VISIT A CAVE

Tour one of these caves:

Laurel Caverns
or
Coral Caverns



VISIT A CAVE

Tour one of these caves:

Indian Caverns
or
Indian Echo Caverns



FOSSILIZED FERNS in Ambridge, PA

Fossilized ferns can be found in many places in PA. Anywhere you have shale, there is a possibility of finding ferns. This site northwest of Pittsburgh is a place that fossil collecting clubs go to because of the abundance of the ferns.



SWATARA GAP FOSSIL SITE

This site was a very popular collection area for many years. Recent road construction resulted in tons of rock being taken to the nearby State Park where people could safely sift through the rocks. Word got around fast, and now there are very few fossils left. However, this site is still worth mentioning because some of the best trilobites ever found in PA were found at this site (Lebanon and Skuykill Counties.)



DINOSUAR TRACKS

Montgomery County has some unique fossils. This shows a track made by an Atreipus dinosaur. Tracks and bones from Phytosaurs have also been found, as well as tracks from various smaller unidentifiable reptiles.



CENTERFIELD CORAL REEF

Fossilized coral reef, that is! There is a roadcut on Rt. 191 below Stroudsburg (Monroe County) that reportedly has many marine fossils, especially horn corals. It is almost as if there was a coral reef at that site long ago.



TOUR A COAL MINE

Visit a coal mine that is open for tourists. (Mines that are still in operation can't legally give tours.)

Seldom Seen Coal Mine

Cambria County



TOUR A COAL MINE

Visit a coal mine that is open for tourists. (Mines that are still in operation can't legally give tours.)

“Number 9”

Skuykill County



TOUR A COAL MINE

Visit a coal mine that is open for tourists. (Mines that are still in operation can't legally give tours.)

Lackawanna Coal Mine

Lackawanna County



TOUR A COAL MINE

Visit a coal mine that is open for tourists. (Mines that are still in operation can't legally give tours.)

Pioneer Tunnel Coal Mine

top edge of Skuykill County

ENERGY BOOST	ENERGY BOOST	ENERGY BOOST	ENERGY BOOST
ENERGY BOOST	ENERGY BOOST	ENERGY BOOST	ENERGY BOOST
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COPY THIS PAGE ONTO COLORED PAPER IF POSSIBLE.



Limestone is used for building construction, for gravel, and for making concrete.

LIMESTONE



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LIMESTONE



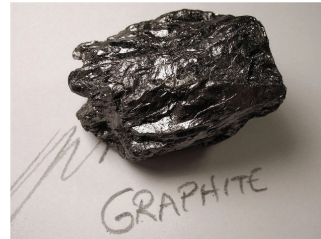
Iron is extracted from rocks such as **hematite** (eastern PA). Iron was used to make steel.

IRON



Iron is extracted from rocks such as **limonite** (central PA). Iron was used to make steel.

IRON



Graphite is made of carbon and is sort of an ultra-hard type of coal. It is used in pencils and can also be used as a lubricant.

GRAPHITE



Pyrite is known as "fools gold" and has little commercial value. It is made of iron and sulfur.

PYRITE



Salt is an important nutrient our bodies need. It is also used to melt winter ice on PA roads.

SALT



Aggregate is used to make roads. It is mostly limestone with sand mixed into it.

AGGREGATE (sand and gravel)



Gravel is used to make roads and for landscaping. It is made of crushed limestone.

GRAVEL



Amethyst is a type of quartz, SiO_2 . The color comes from small amounts of iron and from radiation during formation.

AMETHYST



PA was never a huge source of gold. However, tiny gold flakes can still be found in streams in Lancaster and York counties.

GOLD



Silver is usually found as ore (in rocks) which must be heated to extract the silver. Galena can contain silver as well as lead.

SILVER



Lead in PA is found in the mineral **galena** (PbS). Galena was mined during the 1700s (to make musket shot) at Ft. Roberdeau near Altoona.

LEAD



Beryl is a mineral made of the elements beryllium, aluminum and silicon. Pure beryl is clear. Colored beryl has trace elements.

BERYL



Garnet is a type of gemstone made of silicon (like quartz).

GARNET



Nickel is almost always found embedded in rock (ore), often in rock that also contains iron.

NICKEL



Shale is one of PA's most abundant rocks. It is made of ancient mud that turned to rock.

SHALE



Calcite is made of calcium, carbon and oxygen. It is a major component of limestone, and of stalactites that form in caves.

CALCITE



Malachite is highly prized by rock collectors. The green color comes from the mineral copper.

MALACHITE



Magnetite has a high iron content, making it magnetic. Magnetite used to be called lodestone.

MAGNETITE



Rutile contains titanium. It does not have commercial value but is prized by mineral collectors.

RUTILE



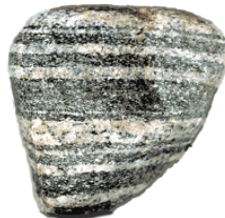
Copper is one of the most useful metals on the planet. It's usually found in ore (in rocks) and must be melted out of the rock.

COPPER



Feldspar is one of the mineral building blocks of igneous rocks like granite. Tiny fragments of feldspar can be seen in sand.

FELDSPAR



Gneiss is classified as a metamorphic rock. It is thought that gneiss started out as granite.

GNEISS



The tiny dots in oölitic chert might look like eggs ("oö" is Greek for "egg") but they were formed by chemistry, not biology. This rock is found in only a few places in the world. Lucky PA!

OÖLITIC CHERT



Diabase is an igneous rock believed to have formed from cooling lava. It is mined for use in construction. The miners of Chester County called it "black granite."

DIABASE

NOTE: This is NOT a complete list of all the minerals found in PA. If you would like to see a very nice virtual museum of PA minerals, do an Internet search with key words: "John Betts mineral gallery Pennsylvania." (This site has mineral specimens for collectors. It does not include things like limestone, coal and shale.)