SELF-GUIDED GEOLOGIC TOUR

Jackson Nature Park

Wilson County, TX

SAN ANTONIO RIVER AUTHORITY
Leaders in Watershed Solutions

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CONTENTS:

What You Will Need

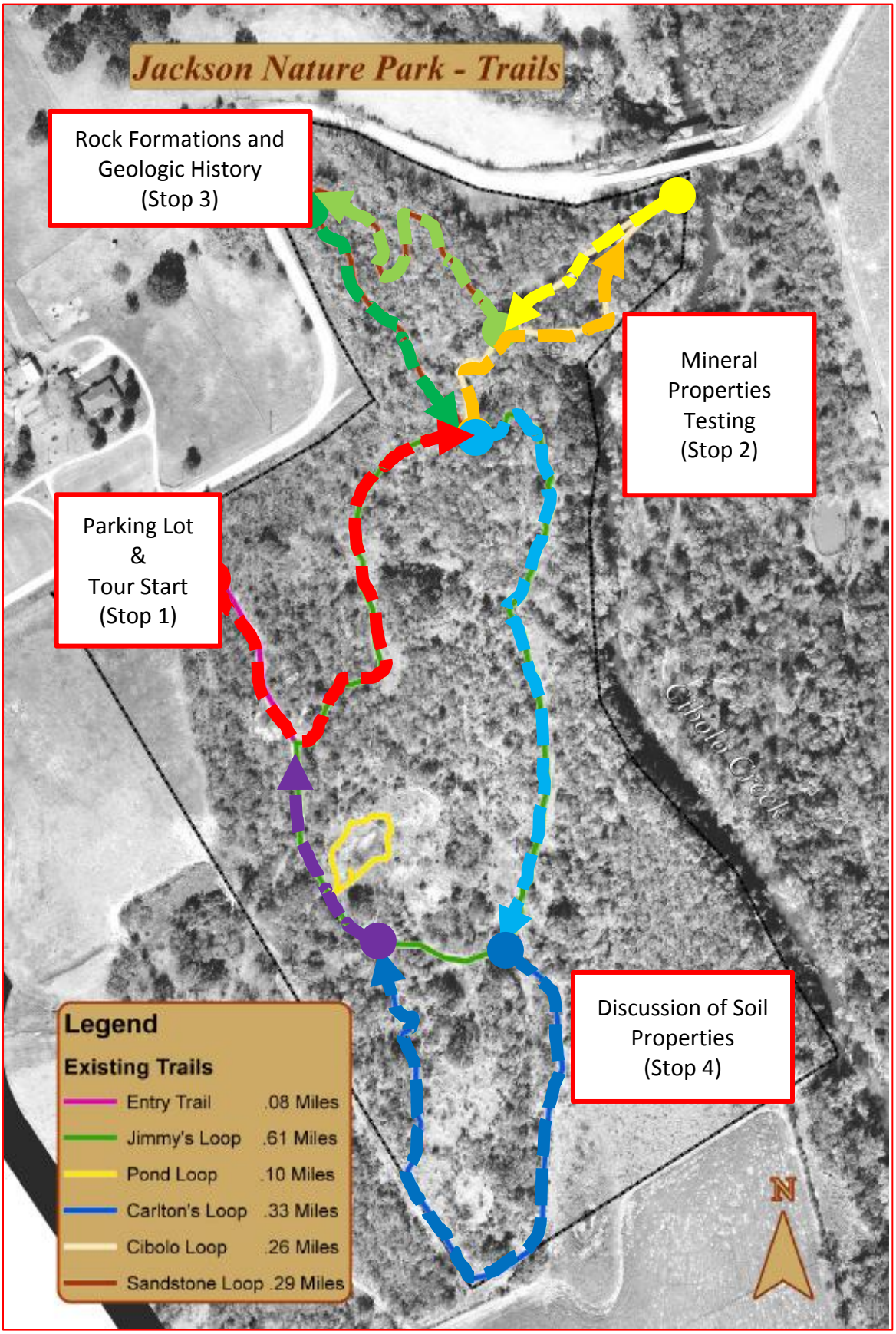
Hello, and welcome to Jackson Nature Park! During your visit, this guide will help you to gain a greater appreciation for the rock formations unique to this park, as well as an understanding of the general geology for this region.

To help you make the most of this trip, we recommend that you bring the following items with you to the park:

- This information packet
- A copper coin
- A nail
- A glass plate
- A magnifying lens
- A white unglazed porcelain tile
- A magnet
- A dropper bottle with vinegar
- A pencil or pen

We ask that you stay on marked trails and do not damage any natural resources to help preserve the park in its current condition. We hope that you enjoy this tour and your visit to Jackson Nature Park!

Map of Geologic Tour



Stop 1: Park Information

Jackson Nature Park is a 50-acre park located in the South Texas Brush Country ecological region of Texas. Prior to the arrival of Europeans in the mid-seventeenth century, the South Texas Brush Country was a landscape characterized by open grassland, sparsely dotted with thorny vegetation such as mesquite, acacia, prickly pear cactus and mimosa. While European settlement, and the subsequent overgrazing of the land by cattle, has led to increased density of thorny brush across the landscape, the South Texas Brush Country is still home to a greater diversity of animal life than any other ecological region of Texas (Smith and Campbell). Jackson Nature Park is a great place to explore the unique diversity of plants and animals of the brush country.

But wildlife is not the only resource that Jackson Nature Park has to offer: it is also rich in geologic resources. One of the reasons that Jackson Nature Park is so special, and the reason that you are here today, is that it is home to rock formations that are rare in this area. Another important geologic resource found in Jackson Nature Park, one common to most of Wilson County, is gravel. Some of the pits that you see around the park were created when gravel was mined here during the Great Depression.

In 1999, Mrs. Cloma Jackson donated this property for use as a natural area and a place for recreation. Today, the park is owned by Wilson County but maintained and operated by the San Antonio River Authority.

Before we begin our tour, here are a few safety reminders for travel in the park:

1. Please watch your step. Paths are uneven as a result of rocks and holes that have been created by animals (like armadillos and feral hogs).

2. Remember that this is a nature park, which means that there is plenty of wildlife around. There are venomous snakes that live on this property, and they enjoy this beautiful weather as much as we do. Please watch for them along the path and possibly among the rock formations. Do not try to pick up any snake, especially if you are not confident in your identification of the species.

3. Regardless of the temperature, make sure you stay hydrated during the tour, and take frequent rests if you require them.

Stop 2: Rock Properties

In order to better understand these rock formations, it is first helpful to know a little bit more about how to classify rocks and the minerals that constitute those rocks. The following will give you a crash course on rocks and minerals (From Marshak 2005).

The following are the definitions for rocks and minerals:

- A ***rock*** is a coherent, naturally occurring solid, consisting of glass or an aggregate of minerals. Rocks can be found on the earth's surface as either outcrops, which are bedrock exposed from the earth, or as broken chunks, like what you might find on the ground
    - Coherent means that the rock is held together. If these pieces became interlocked after freezing from a molten state into interlocking pieces, the rock is considered to be crystalline. If small bits of minerals and other rocks became cemented together over time, the rock is called clastic. Because a rock is coherent, a rock needs to be broken in order to be separated into pieces.
    - Naturally occurring means that the substance was not made by humans. For example, concrete and bricks are not rocks because they are created by humans.
    - Glass rocks form when melted parts of the earth's crust harden quickly, or if they contain a lot of silica. A number of events can cause rock to melt, but many times it is due to volcanic activity. An example of a glass rock is obsidian.

- A ***mineral*** is a homogeneous, naturally occurring, solid substance with a definable chemical composition and an internal structure characterized by an orderly arrangement of atoms in a crystalline structure.

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It is also important to be able to distinguish among the three types of rocks:

- ***Igneous rocks*** are formed by the freezing of molten rock, such as when a volcano erupts and the lava hardens.

- ***Sedimentary rocks*** are rocks that are built through the cementing of sediments, which are small pieces of bedrock that have been weathered and eroded away from their parent material, or by the precipitation of mineral crystals out of water solutions.

- ***Metamorphic rocks*** are formed when igneous or sedimentary rocks are exposed to extreme heat and pressure and change their composition.

The rock formations that you will see today are sedimentary rocks. Sedimentary rocks usually form a cover over the top of older igneous or metamorphic rocks, so a lot of the earth's crust is covered by sedimentary rocks. The fragments that you see within these rocks are minerals or other rocks that have been broken off of bedrock, and are called grains or clasts. Clasts can be classified based on their sizes. Boulders, cobbles and pebbles are considered to be "coarse-grained," sand is considered to be "medium-grained," and silt and mud are considered to be "fine-grained." Geologists also classify rocks based on how well the clasts are sorted by size. The clasts of the rock formations that you will see today are not very well sorted because there are clasts of different sizes mixed in and among each other.

When the rock contains clasts that are larger, it is called a conglomerate. When rock contains clasts that are medium to coarse, they are called sandstone. We would probably refer to the formation at Jackson Nature Park as a sandy conglomerate. The grains in this rock are held together by a natural-forming cement created when minerals are dissolved into water, the water with minerals fills the pore spaces in between other pieces of rock, and then the mineral precipitates from the water and harden.

The clasts within sedimentary rocks can be made up of varying minerals. In order to identify what minerals make up each of these clasts, geologists make observations about those minerals and conduct tests to look at the mineral's properties. The most important properties include: hardness, color, luster, streak, magnetism and ability to dissolve in acid.

Today, you will be conducting tests on some of the minerals found within pieces from the rock formations. We ask that you search for three pieces of rock on the ground that you could use for your tests. **PLEASE DO NOT DAMAGE THE ROCK FORMATIONS BY DOING THESE TESTS ON ROCKS THAT ARE STILL PART OF THE FORMATION. PLEASE FIND PIECES OF ROCK THAT HAVE BEEN WEATHERED ON THE GROUND AND ARE PART OF THE SOIL.** Then, you can make your observations for each of the three clasts that you study in the "Rock Properties Chart." In order to study these clasts, you will be provided with a rock test kit that includes:

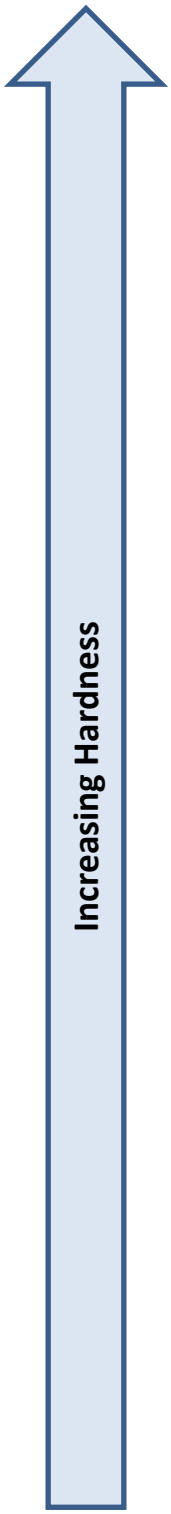
- A copper coin
- A nail
- A glass plate
- A magnifying lens
- A white unglazed porcelain tile
- A magnet
- A dropper bottle

Once you know all of your minerals' properties, you will need to use rock books or the internet to identify the mineral**. PLEASE DO NOT REMOVE ANY ROCKS FROM THE PARK.**

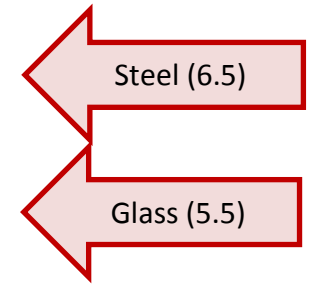
Rock Properties Chart

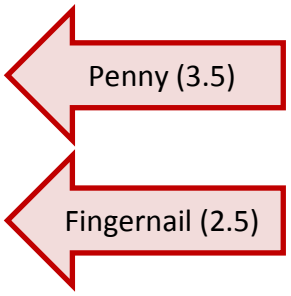
Property	Clast 1	Clast 2	Clast 3
HARDNESS: how much a mineral resists scratching and where it falls on the Mohs Hardness Scale			
COLOR: how a mineral is colored			
LUSTER: how a mineral shines			
STREAK: the color of powder of a mineral when run across a porcelain tile			
MAGNETISM: whether a mineral is attracted to a magnet			
CHEMICAL TEST: how a mineral reacts to acid			

Mohs Hardness Scale



Example Mineral	Scale
10	Diamond
9	Corundum
8	Topaz
7	Quartz
6	Feldspar
5	Apatite
4	Flourite
3	Calcite
2	Gypsum
1	Talc





Stop 3: Geologic Formations

Studying rocks can be exciting: they provide a historical record of the Earth's geologic events and give insight into interactions among components of the Earth's systems. By studying layers of rocks, geologists are able to piece together the geologic history of this region of Texas.

Find a nice place among the rock formations to sit and observe, while you read about how these formations were created.

In order to understand how the rocks at Jackson Nature Park were created, it is important to first look at the big picture of how the earth was moved and formed in the South Texas region - truly a fascinating story. If you are not used to learning about geology, it can sometimes be challenging to read geologic papers. So rather than describe the geologic history of this region in words, we have created a pictorial description of these events, found on the sheet labeled "Geologic History Chart." All information shown in this chart was obtained from a paper called "Geologic History as it Relates to Modern Vegetation Patterns of South Central Texas" written by Bill Ward, member of the Native Plant Society of Texas Symposium. It may also help you to refer to the "Geologic Time Scale" (Geological Society of America).

Once you know the big geologic picture, you are ready to learn more about these formations specifically. The San Antonio River Authority was very lucky to learn from the expertise of a local geologist and member of the South Texas Geological Society, Dr. Thomas Ewing. Earlier this year, Dr. Ewing published an article specifically about the formations at Jackson Nature Park in the South Texas Geological Society Bulletin.

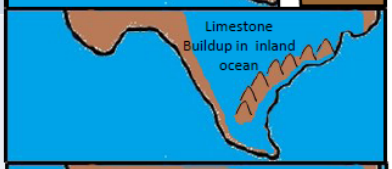
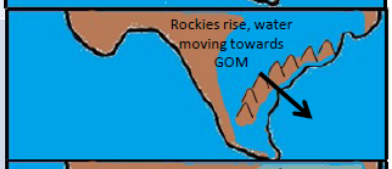
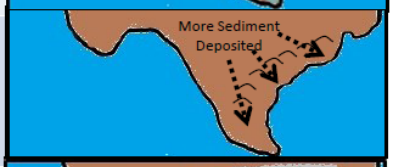
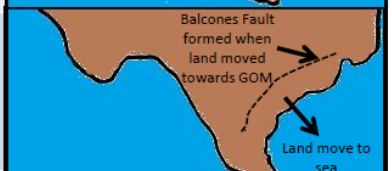
Here is a summary of some of the major findings described by Dr. Ewing in his paper:

- The rocks exposed at Jackson Nature Park were formed during the Middle Eocene Epoch (45-48 million years ago) and is referred to as the Queens City Formation
- The Queens City Formation is largely composed of sand that was deposited when this area was once the coast of the Gulf of Mexico
- Before now, even regional reports did not find any component of the Queens City Formation to contain rock grains larger than a medium sand
- But what you see at Jackson Nature Park is that the exposed rocks consist of two layers that are made up of larger pieces of rock up to 2" in diameter (called a conglomerates)
- The large rock pieces found in the conglomerates seem to be made of different materials, including limestone and older pieces of sandstone. The author suggests that they may be from the Paleozoic (up to 540 million years ago), and it is possible that they may have been transported here from Central or North Texas, and perhaps even as far as the Rocky Mountains. More analyses are required to determine more precisely their origin and age
- In order for these larger pieces to be transported here, it would have required moving water with a lot of energy. This suggests that there likely was a major stream channel that came through this area, transporting and then depositing these larger pieces of rock in the surrounding areas
- These rock formations are only seen because a newer stream (Cibolo Creek) happens to cross and cut through where this old stream channel used to be located and where it left behind these large chunks of rock

If you would like to read Dr. Ewing's article, go to the following link:
http://www.stgs.org/Feature%20Article.pdf

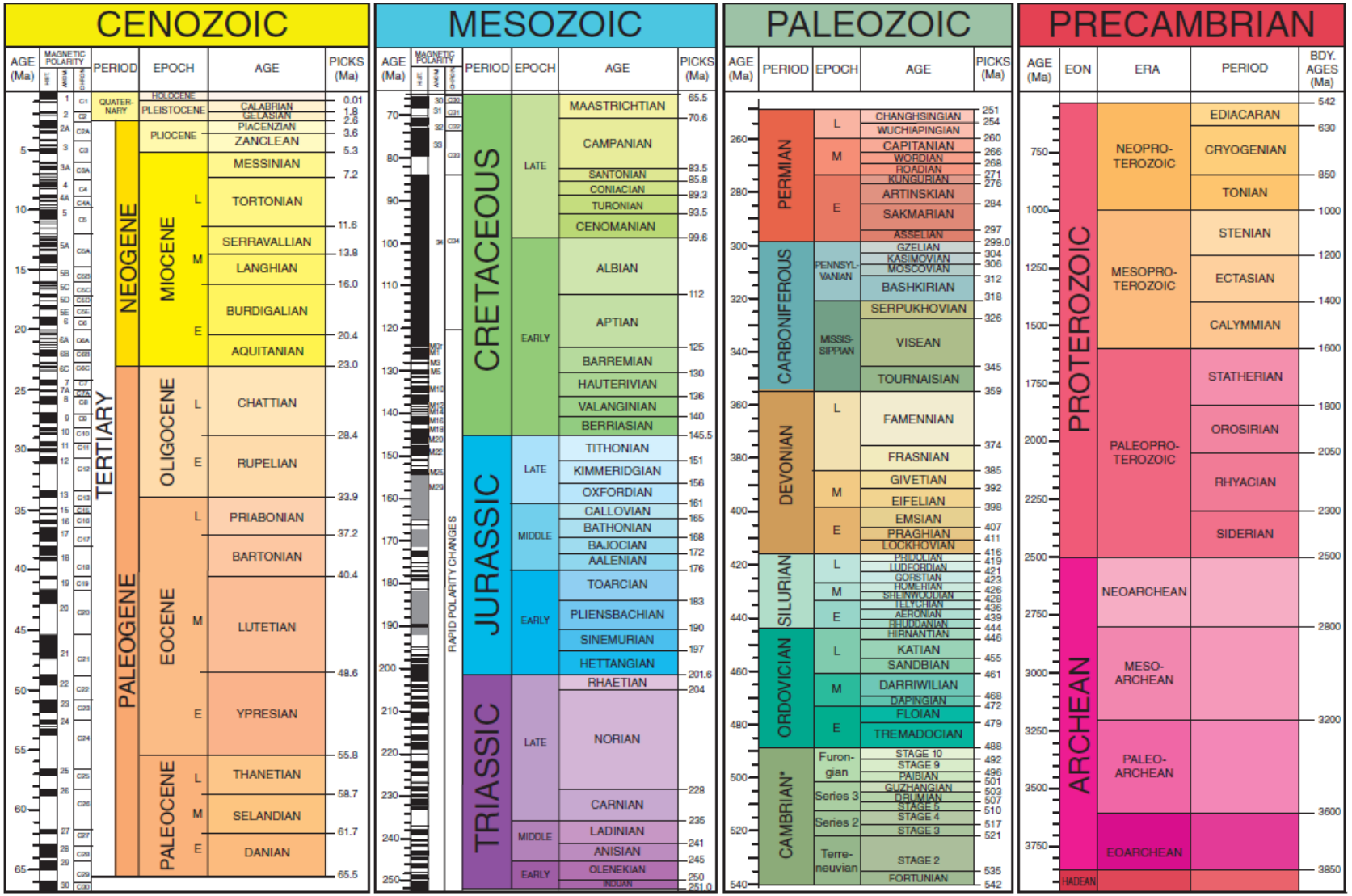
Geologic History Chart

Based "Geologic History as it Relates to Modern Vegetation Patterns of South Central Texas" by Bill Ward

MYA	Period	Epoch	What Happened?	Picture
320-300	Carboniferous	Pennsylvanian	Formation of the Ouachita Mountains in south central Texas	
300-162	Permian –Jurassic	Early Permian - Middle Jurassic	Ouachita Mountains worn down by erosion and begin to sink into ocean as Atlantic Ocean and Gulf of Mexico start to form	
162-146	Jurassic	Late Jurassic	Hot climate and small opening to GOM = salt buildup in GOM, then opening led to build up of limestone and dolostone	
146-100	Cretaceous	Early Cretaceous	Ouachita Mountains continued to sink into GOM. The ocean moved so far inland it covered most of Texas, leaving hundreds of feet of marine limestone.	
100-67	Cretaceous	Late Cretaceous	Rocky Mountains form, and eroded material from mountains flows down to coastal plain. The sea retreats	
67-41	Paleogene	Paleocene – Middle Eocene	South Central Texas is a muddy sea and land continued to rise because of lifting of Rocky Mountains	
41-34	Paleogene	Late Eocene	More sediment eroded from mainland causing land to be built up and GOM to retreat	
34-23	Paleogene	Oligocene	Streams and winds brought volcanic ash and debris from western US	
23-2.5	Neogene	Miocene – Pliocene	Edges of South Central Texas began to sink towards the GOM. Sedimentary layers began to slide downward or flex on older faults, forming the Balcones fault.	
2.5-today	Quaternary	Pleistocene - Holocene	On Edwards Plateau, increased erosion down to limestone. Sinking and sliding land exposing other layers: older to younger from west to east.	

Geologic Timescale

Published by the Geological Society of America



*International ages have not been fully established. These are current names as reported by the International Commission on Stratigraphy.

Walker, J.D., and Geissman, J.W., compilers, 2009, Geologic Time Scale: Geological Society of America, doi: 10.1130/2009.CTS004R2C.

Sources for nomenclature and ages are primarily from Gradstein, F., Ogg, J., Smith, A., et al., 2004, A Geologic Time Scale 2004: Cambridge University Press, 589 p. Modifications to the Triassic after: Furin, S., Preto, N., Rigo, M., Roghi, G., Gianolla, P., Crowley, J.L., and Bowring, S.A., 2006, High-precision U-Pb zircon age from the Triassic of Italy: Implications for the Triassic time scale and the Carnian origin of calcareous nannoplankton and dinosaurs: Geology, v. 34, p. 1009–1012, doi: 10.1130/G22967A.1; and Kent, D.V., and Olsen, P.E., 2008, Early Jurassic magnetostratigraphy and paleolatitudes from the Hartford continental rift basin (eastern North America): Testing for polarity bias and abrupt polar wander in association with the central Atlantic magmatic province: Journal of Geophysical Research, v. 113, B06105, doi: 10.1029/2007JB005407.

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Stop 4: Soil Properties and Land Use

As you wander around the rest of Jimmy's Loop and Carton's Loop, you can stop somewhere shady to read about soil properties and land use.

The geologic events of the past affect the geologic resources that are readily available to humans today. When a sedimentary rock (or any type of rock) becomes weathered by rain or ice, it can eventually be broken down into the smaller pieces of which it is comprised. These pieces now form one component of soil.

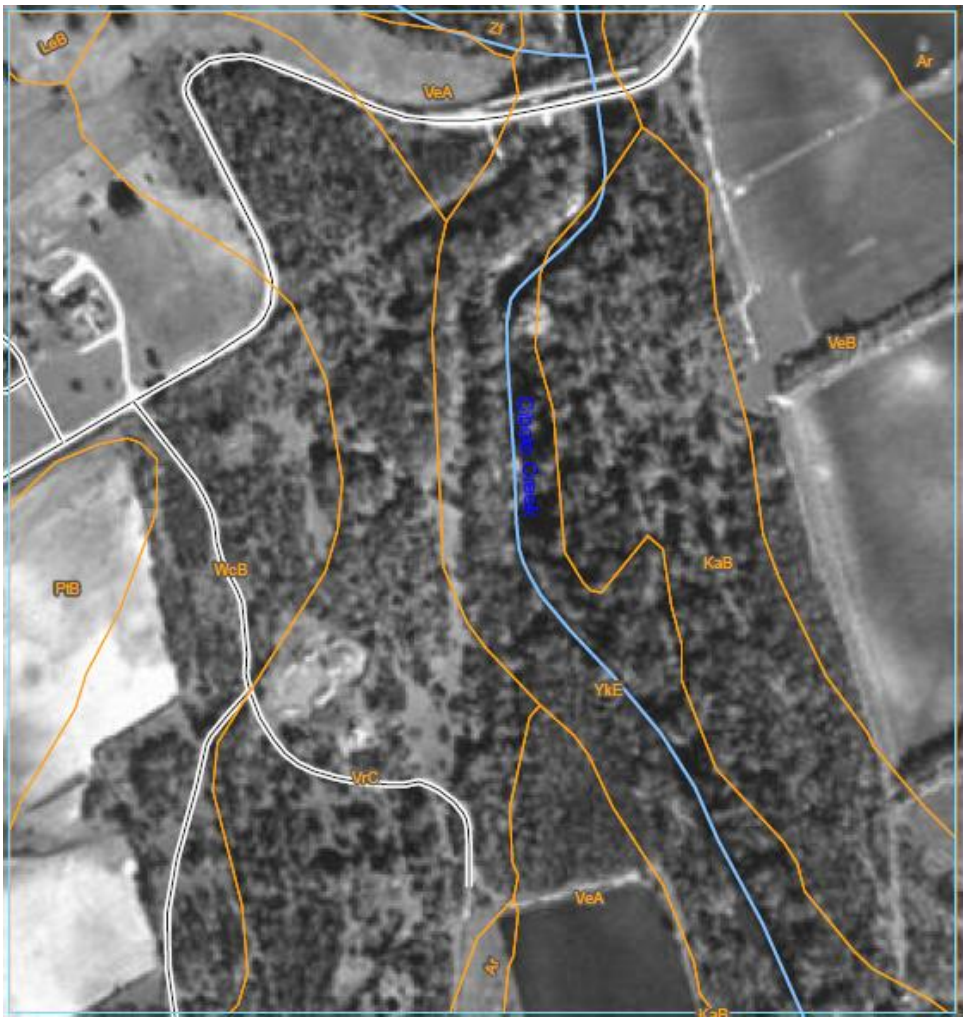
To classify the soil, scientists look at the steepness, length and shape of the slopes; the general pattern of how water moves off of the land; the kinds of crops and native plants that can be found growing on a particular type of soil; and the kinds of bedrock. They also look at the color, texture, size and shape of soil aggregates, the kind and amount of rock fragments, distribution of plant roots, reaction, and other identifying features. Then soil scientists use a taxonomic class system to classify soils systematically. You can find lots of information about soils at the Natural Resources Conservation Service (NRCS) Website – they have the coolest tool that lets you create a soil report for just about anywhere in the country. You can look at the "Jackson Nature Park Soil Map" (NRCS) to learn more about the soils found in Jackson Nature Park.

The properties of the soil types found in a particular area can significantly affect not only the native vegetation, but also what types of agriculture can be successfully implemented. If you look at the soil map for this area, you will notice that all of the soil types are "well-drained," beneficial when you are trying to grow crops. The sediments that were carried to this area during the uplift of the Rocky Mountains now form the basis for the soils in the South Texas area. So understanding the geologic history of a region can help you to better understand its modern day uses.

Farming practices beginning with the European immigrants played a significant role in the economy of South Texas. During the late 1800s, Polish and German immigrants introduced Old World farming practices and planted a variety of crops, such as corn, melons, potatoes, cucumbers and pumpkins in Wilson County. In the early 1900s, cotton farming became an increasingly important part of the economy in this region, along with corn, sugar cane, and tobacco. After WWI, the prices for commodities went down and farmers were forced to diversify their crops by adding peanuts, watermelon, flax, peas, and sugar cane.

As of 1977, a soil survey report for Wilson County indicated that about half of the area of the county is farmed (NRCS). Today the main crops are peanuts, grain sorghums, corn, watermelons, flax, black-eyed peas, and vegetables. Also, some cotton is still grown. The soil is also important for growing forage for cattle-raising. Most people in the county earn their living because of the soil, and thus are affected by the geology around them (NRCS 1977).

Jackson Nature Park Soil Map
Map Created by the Natural Resources Conservation Service



There are six main soil types that were found by soil scientists to exist at Jackson Nature Park and its immediate surroundings.

- Ar = Buchel Clay: This is a soil type that is occasionally flooded. Its parent material is calcareous (has calcium carbonate, usually from limestones) clayey (very small particles of rock) alluvium (unconsolidated rock particles). It is in a moderate drainage class and has clay in all horizons up to 75 inches. There is very little of this soil type within the park, but there is a lot of this type immediately adjacent to the park where crops are being grown.
- KaB = Atco loam (0-3% slopes): This soil type is made up of the erosion remnants on stream terraces and its parent material is calcareous loamy alluvium. This soil class is well drained and is not frequently flooded.
- VeA = Venus Clay loam (0-1% slope): This soil type is found on stream terraces, and its parent material is loamy alluvium of quaternary age. This soil is well drained and is not frequently flooded
- YkE = Yahola-Ustifluvents: This type of soil is found in the floodplains, and is comprised of loamy alluvium parent material from the Holocene age. The soil is well drained and is frequently flooded
- VrC =Vernia Gravelly Loam (1-8% slope): This soil type is a part of stream terraces, and its parent material is sandy and gravelly alluvium. This type of soil is well drained and is not flooded.
- WcB = Wilco Loamy Fine Sand (0-3% slopes): This soil type is the residue from weathered sandstone and shale of the Eocene age. It is well drained, and it is not prone to flooding.

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