A Geologic History of the Arkansas Ozarks

and Geological Features.

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The Ozarks are not limited to just Arkansas, but a good chunk of it is. Three of the four plateaus, the Boston Mts., the Salem, and Springfield, extend into the northern part of Arkansas; giving it a natural beauty and interesting geological features that aren't in any other part of Arkansas, if not the nation. A way to learn more about these plateaus, one by one, is to learn more about the relative aging of the areas and the geologic features that make each plateau unique.

Throughout the Paleozoic era the continents came together, forming the super continent Pangea. As separate continents collided into each other, mountains were formed. An example of this is when the North American plate hit the European plate and formed the Appalachians that we're familiar with today. Likewise, supercontinent "Gondwana", which was a collaboration of South America, Africa, Antarctica, and various other, forced the dome of Arkansas to be uplifted. This dome is what we know now as the Ozarks. Because of this force, limestone and related calcareous rocks like dolostone, which is formed from the mineral dolomite, were made common. Along with other rocks such as sandstone and chert. In the Pennsylvanian Era, the North American plate collided with it's southern neighbor, the South American plate. This formed the Ouachita Mts. and bumped up the Ozark plateaus into their present location. Through the years, erosion cut and formed these three plateaus into what they are today.

More detailed geologic history of the Ozarks would go something like this. During the Precambrian times, around 1400 million years ago, Silicic volcanic eruptions centered around the St. Francis Mountains in Missouri. Shortly thereafter, from the Precambrian era to the end of the Cambrian period, Weathering and erosion occurred. Then came the Ordovician period where shale deposited itself on the continental shelf with sandstone. This happened until the Mississippian period, where slightly deeper and marine carbonate, aka shale, deposited itself on
the outer continental shelf. Then in the Pennsylvanian period, when the two American plates collided, the uplift of the land to the north and east caused coastal sedimentation of sand and mud. From then on Weathering and erosion dominated and man showed up in the area.

The Boston Mountains actually sit on top of a plateau and it is the youngest of the three plateaus. Over the millions of years of erosion by seawater and later by rivers, all of the Ozark plateaus were raised a significant amount over its surrounding areas. The Boston Mts., however, are the highest of the plateaus. It's the highest at 2,500 feet because rivers have cut into the plateau, slowly eroding it, making it have valleys that are anywhere from 500 to 1500 feet deep. Of the three plateaus, the Boston Mts., are also the youngest of the group. They're topped with Pennsylvanian sandstone and shale, which the other two lack from this era. Devils Den is a national park, in the Boston Mts., where you can get a good idea of the principle of superposition. Since the strata of the area is, for the most part, undisturbed, then someone can look at the rocks overlapping each other. All over the park there's Late Mississippian period sandstone, shale, and limestone, so someone could get their filling of it! In fact, Devils Den has the largest sandstone cave in the nation. The principle of super position says that if any strata is undisturbed then the oldest is at the bottom and the youngest on top. If you take that knowledge and apply it to the fact that the boston mountains have been undisturbed for a good amount of time, then when you see the sandstone and shale on top of the dolostone and boone formation; You'll know that you're at the youngest part of the Ozark plateaus.

The second youngest, or second oldest, is the Springfield plateau. It's not nearly as high or rigid as it's younger sibling, the Boston Mts. Also, it's significantly lower than the Boston Mts. with its elevation being around 1800 feet above sea level. Instead of the Pennsylvanian period sandstones and shale, there is instead Mississippian fossiliferous limestone and chert. This
formation of rocks is also known as the Boone formation and extends through these 14 counties: Baxter, Benton, Boone, Carroll, Independence, Izard, Lawrence, Madison, Marion, Newton, Searcy, Sharp, Stone, and Washington. Although this type of rock is found in more than the Springfield plateau, it's the plateaus "top rock". The fossiliferous limestone is mixed in with chert and contains tons of fossils from the Paleozoic era, like crinoids and trilobites. This dates back to the Mississippian era which was 320-360 million years ago and the state was still covered by sea. Since this is limestone, it is easily weathered chemically. This changes the landscape to that of the Boston Mts. It has rolling hills on top, but below there is caves, sinkholes, disappearing and reappearing streams. This type of rock makes for good Karst topography as well.

The oldest of the three, dating back to the Ordovician era, is the Salem plateau. There's an abrupt drop in elevation between the Springfield and Salem plateau; Giving the area a deceptive mountainous look, dropping from 1800, to close to sea level, then to 1500 feet, although it's practically nothing compared to the Boston Mts. The Ordovician carbonate rock, known as dolostone, is what it's topped with. While dolostone doesn't erode by acidic means as easily as limestone; It does indeed erode. This area frequents more natural springs than caves and sinkholes. In the state of Arkansas, the Salem plateau is home to the largest natural spring, the Mammoth Spring. While it's certainly not the only one, but it's the definitely the biggest.

Karst topography features land that consists of chemical weathering or rocks that dissolve slowly, such as limestone and dolostone. These rocks, from what we've covered, are in abundant supply through the Ozarks and make it a landscape that Karst topography is king. How this happens is by acidic groundwater coming from rainwater. The rainwater becomes acidic by adhering itself to carbon dioxide in the atmosphere. In doing so, it creates carbonic acid and then passes through the soil and moves through the pores of the high permiable rock. If the rock type
isn't susceptible to the acidic groundwater, it still erodes over time. While it works its way through, it's dissolving calcite. Calcite is the main mineral in limestone, marble and an important one in dolostone. When the rocks dissolve it in turn creates caves, springs, disappearing streams, dry valleys, and sinkholes. Caves and springs are fairly well understood to most people, however, disappearing streams and dry valleys may not be. Sometimes, one will see a stream that seems to "disappear" into some bedrock. This, however, isn't really the case. Instead, the stream has actually gone into the bedrock through pore spaces and comes out somewhere else, out from the bedrock. Dry valleys are valleys with streams, except these streams don't have water in them all year round, if any. It's a very common feature in areas underlain with carbonate rock types. Another feature that may or may not be well known is a sinkhole. At a glance, they have bowl to funnel circular shape and depressed; Depressed as into the ground, not sad. They weren't always that way and in fact some were underground caves with water. They collapse onto themselves over time if the water solution enter the rock and expand them. This is more of a gentle lowering over time and forms a depression. Another type of sinkholes is the solution subsidence sinkhole. This is formed when carbonate rock is topped by insoluble rock. The underlain rock, for example limestone, will dissolve and leave the top rock to subside where its predecessor was. Collapse sinkholes are mainly the leftovers of a cave collapsing into its own chamber.

The age of the Ozark plateau begins with the Ordovician period and with most of its features set by the end of the Pennsylvanian period. The sandstone and shale dominated Boston Mts, the Limestone and cherty Springfield and the dolostone Salem plateaus make up the Ozark plateau. Their interesting features are what make this area so unique. Whether it's going to Devils Den to test your knowledge on the superposition principle, checking out what different creatures used to live here by way of the fossiliferous limestone, or checking out the largest spring in
Arkansas. Take your pick, because the Ozark plateau has enough variation of geologic features to make anyone interested in geology. Next time you come across an area with a sudden depression and rock pointed downward; You may know enough to say that's part of what the Karst topography is.
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