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CAVES OF THE FORT STANTON AREA, NEW MEXICO

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INTRODUCTION

There are a number of caves in the Fort Stanton area of New Mexico. These caves, some of which are well known, occur in the San Andres Limestone of Permian age. The caves are of interest because of the speliolithems (secondary mineral deposits formed in caves) they contain and because of their past usage by man. In this paper the development of the caves and their usage by man is discussed.

HISTORY OF THE DEVELOPMENT OF THE CAVES

The caves probably were formed shortly after the origin and development of the present surface drainage. Although it is commonly thought that caves generally are developed by waters in either the phreatic or the vadose zone, my studies indicate that the action of vadose water combined with some erosion by underground streams has formed the caves in the Fort Stanton area. This is suggested by the following facts:

1. The passageways, although somewhat affected by joint systems, appear to conform in general to the present surface drainage patterns.
2. One domal room of considerable magnitude in Fort Stanton Cave contains a characteristic heap of "breakdown" which is cemented at its base by the same type of clay fill that is found in all of the nearby caves. Attached to several pieces of this deposit of "breakdown" are fragments of speliolithems indicating that speliolithems formed on the ceilings prior to breakdown, and thus prior to the deposition of the cave fill. Many of the blocks of breakdown bear the marks of erosion, not solution. Some of these marks are covered by the clay fill, suggesting that prior to its deposition, the process actively removing the breakdown and therefore modifying the cave itself, was an underground stream.
3. Several curtains of speliolithems that developed under water before the clay fill was deposited are present in Fort Stanton Cave.
4. The walls of a number of the main passageways in Fort Stanton Cave exhibit two features of a passage modified by moving water. Several distinct water levels occur on the walls. Below each succeeding lower wall level more of the wall rock was removed than above that line creating typical inverted step walls. These features also pre-date the cave fill.
5. At two slight bends in the passageways, a terraced mound is superimposed on the bedrock, with the highest development of the mound at the inside of the passageway along the wall. The mounds slope down towards the outside of the bend of the passageway, just as a meander scar would develop.

The second step occurred when the passageways were filled with clay and gravel. The composition of the gravels indicates that at least one surface stream emptied into Fort Stanton Cave after the cave formed, as a significant number of the pebbles in the gravel are of igneous origin. Apparently these pebbles were derived from nearby igneous bodies. Some passages in the cave were filled completely with clay and gravel while others were only partially filled.

The third step was the partial excavation of the clay and gravel in the passages by streams originating on the land surface as suggested by the many igneous pebbles found in the stream beds. These pebbles have a greater degree of rounding than the pebbles in the clay and gravel fill.

The fourth, most recent, most interesting, and sometimes most destructive step in the history of the present caves, is the work of humans. The earliest record of human habitation is found in Feather Cave and the several shelter caves nearby.

Vandalism by modern man has been extensive in the caves of the Fort Stanton area. It is virtually impossible in exploring new passages in a cave to keep from breaking some speliolithems. However, the wholesale and systematic breakage of all speliolithems for monetary reasons is hardly in the same class. Because of the long time of development, and unreproducible conditions of speliolithems every broken one represents a loss for us and our descendants. Thus as one walks through the first one or two miles of Fort Stanton Cave, all that can be seen are bare walls with the remnants of broken speliolithems. This is what other "collectors" have left for you to see. The only parts of Fort Stanton Cave that still contain pretty speliolithems are the "new sections" at the back of the generally known cave. And even with the little publicity they have received, the new sections are being vandalized.

There is some evidence that Fort Stanton Cave was known and frequented by the Indians. In 1862, a company of the U.S. Cavalry chased a group of Indians into the mouth of Fort Stanton Cave. The troopers pitched camp outside and decided to starve the "redskins" out. A few days later, the same Indians were seen stealing the troopers' horses. These Indians knew of a second entrance, something which modern explorers have failed to locate.

SPELIOTHEMS

One of the most intriguing features of caves are the speliolithems they contain. After once having created the long winding passageways and the high vaulted rooms, Mother Nature is not satisfied until she has decorated these chambers with sparkling crystal needles and pendants formed of calcium carbonate or calcium sulfate. Speliolithems may be divided into two major

groups: 1) those formed in air filled chambers; and 2) those formed in water filled chambers. Speliothems formed in an air filled chamber occur either as pendants hanging from the ceiling or walls (stalactites or helictites), or rising from the floors (stalagmites), or as a covering on the wall or floor known as flowstone.

The most impressive speliothems are the massive stalactites suspended from the ceiling, and their floor based counterparts, stalagmites. Stalactites will form only if the evaporation rate in the cave is higher than the amount of water present otherwise, stalagmites will develop. Stalagmites form because the water, not being able to deposit all of its dissolved salts on the ceiling, falls to the floor and deposits the remaining dissolved salts as evaporation occurs.

Though evaporation is not the only variable which determines the rate of deposition of speliothems it is easy to see that all stalagmites and stalactites do not necessarily form in the same length of time. The differences become even more apparent when the caves of arid New Mexico are compared to the caves in southwestern Virginia, where there is heavy annual rainfall. The speliothems in the New Mexico caves are quite often "dead" and dry, whereas the speliothems in the caves of southwestern Virginia are generally wet and "alive." In several caves, samples have been taken of huge speliothems and accompanying water and it has been determined how much volume is being added to the speliothems in that area at present. At one tested commercial cave in Maryland, the proprietor proudly proclaims that as it takes 100,000 years to deposit one cubic inch of speliothem material and as the volume of that particular speliothem is 700 cubic inches, the formation is approximately 700 million years old. The cave is formed in Upper Ordovician limestone indicating that, this speliothem and at least part of the cave would have been formed about 200 million years before the surrounding rocks were deposited if the rate of deposition had been constant.

Actually, deposition rates of CaCO_3 varies considerably, from the quoted rate of 1 cubic inch per 100,000 years, to as much as 4 cubic inches per year, as has been observed by the author in the Washington, D. C. area.

The shape of speliothems is the basis for their common names. Pillars are stalactites and stalagmites that have grown together into massive columns. "Broom sticks" are very slender pillars, about 2 to 4 inches in diameter. "Soda straws" are very slender stalactites, which look like long straws suspended from the ceiling. Quite often a sloping ceiling will have "curtains" developed on it. "Curtains," "drapes," or "bacon rind," as they may be called, are formed when water, instead of dropping from the ceiling, runs down an inclined surface, depositing CaCO_3 as it goes. These speliothems are quite often banded parallel to their edge, leading to the name "bacon rind."

Helictites are a type of pendant formation that do not respond in the normal way to gravity as they may grow in any direction and usually change directions. Helictites are composed of CaCO_3 and/or $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. The name helictite generally is applied to any clump of stalactites or stalagmites that do not hang straight down

from the ceiling or point straight up from the floor. Gypsum flowers are a type of helictite.

The most commonly encountered type of flowstone is the frozen waterfall. Frozen waterfalls are composed of overlapping sheets of CaCO_3 that were deposited on a wall or inclined floor.

There are several other types of speliothems which can be deposited in an air filled chamber, but they are not known to occur in the caves of the Fort Stanton area and therefore are not discussed here.

The second major group of speliothems, those formed in water filled chambers, are quite varied and include such features as calcite rafts, lily pads, and rimstone pools. They are usually associated with a noticeable water level mark below which all surfaces are covered with individual crystals that are larger than those formed in air filled chambers. A stalactite covered with these crystals is generally larger at its base than at its apex and has the appearance of a club hanging from the ceiling. These speliothems are known as "war clubs," and passages containing an abundance of them are often called war club rooms.

One of the most striking features of speliothems is their color. In most caves, they stand out as stark white forms, against a drab brown or gray background. However other colors occur in one of the caves in the Fort Stanton area.

THE CAVES

The caves in the Fort Stanton area can be divided into two groups on the basis of size. One group includes caves which are deep enough for a man to get out of sight of the sun. The two best known caves of this type, although there are others, are Fort Stanton Cave and Feather Cave. The second group includes the shallow shelter caves which generally occur at the base of steep bluffs.

Fort Stanton Cave is located on the south side of Highway 380 about midway between Lincoln and Capitán, New Mexico. The entrance is a steep-sided sinkhole. The rubble in the sinkhole has effectively divided the original cave into separate caves. The main cave has several miles of known passageways. The first 1 to 2 miles are devoid of speliothems. In the "new section," all of the different types of speliothems mentioned earlier are present.

Two rare types of selenite crystals are found in Fort Stanton Cave. One is a selenite twin crystal form that occurs in the Crystal Passage. These crystals look like long flat needles with a decidedly concave prism face (Hills, 1895). In 1939 mention of these crystals appeared in another article (Wheeler, 1939) in which a collecting expedition to Fort Stanton Cave was reported. The practice of collecting these crystals to sell has gone on for some time. So much so, that today there are more crystals, the majority of them broken, around the entrance of the cave and for sale in local souvenir shops, than there are in the cave.

The second rare type of selenite crystal has not been described in the literature, and is known from only one other cave (Crystal Cave, Indiana), besides Fort Stanton Cave. These crystals occur individually as 1½-inch long needles, terminated on both ends by a 6-sided

pyramid. The needles have 6 equal sides and are 1/40 inch wide.

Some of the speleothems in Fort Stanton Cave are unusual because of their color. One seldom observed color in speleothems is bluish black. Flowstone of this color occurs in Fort Stanton Cave and looks like velvet. This flowstone has been analysed and found to have a high manganese content. Other flowstone in the cave is carmel colored; the impurity causing this particular color is unknown.

It has been reported that in the early 1900's it was necessary to use a boat to visit the middle part of the known Fort Stanton Cave. At that time the Federal Government had the first mile of the cave surveyed in order to determine if the water in it flowed toward the nearby Government Springs. The findings indicated that this was the case and the water level in the caves was 37 feet higher than the spring. The spring still flows intermittently although all of the known passages in Fort Stanton Cave are dry today, except after an especially rainy season. It is thought that this recent drying of the cave may be a reflection of a regional lowering of the water table. Two of the known passageways of Fort Stanton Cave end in breakdown within several hundred feet of Government Spring. On several occasions running water has been heard through this breakdown, suggesting that there are passageways containing water behind and below it.

Feather Cave is across the highway from Fort Stanton Cave. It has a shallow sinkhole entrance. From the entrance, a rubble covered slope leads down to a fairly flat room approximately 200 feet long and 50 feet wide. The floor is quite dissected and the trenches of the archaeologists are still visible. The most striking feature of Feather Cave is the utterly black appearance of the walls and ceilings. This color was caused by soot from countless cooking fires kindled by the early inhabitants of the cave.

Feather Cave has been partially excavated by University of New Mexico archaeology students. In the literature published by this group, the cave was given a new name, Dan's Cave, in honor of one of the researchers. Prior to that time, the people in the area knew this cave as Feather Cave, or Outlaw Cave. The cave was studied for an entire summer by a group of University of New Mexico students, and was subsequently visited by many hundreds of people. However in spite of this careful study of a room barely 200 feet long and 50 feet wide, a new room was discovered a few months ago behind the breakdown at the end of the cave. This new room contained many well preserved Indian artifacts which will be described in the near future.

There are several small shelter caves in the bluffs across the highway from Fort Stanton Cave and near Feather Cave (fig. 1). Some of these caves contain speleothem development. Shards of pottery and faded pictographs have been found in some of these caves. At least one of the shelter caves is the home of cave swallows, a bird of somewhat restricted range in New Mexico.

Almost every trip made to the Fort Stanton area in the last two years has resulted in new discoveries, either in additional passages to known caves, or in the

discovery of new caves. All have been partially excavated, although some have not been fully opened. All of the newly discovered caves, as far as they have been explored to date, are above the level of Fort Stanton Cave, and like Fort Stanton Cave show the same alignment to the surface drainage.

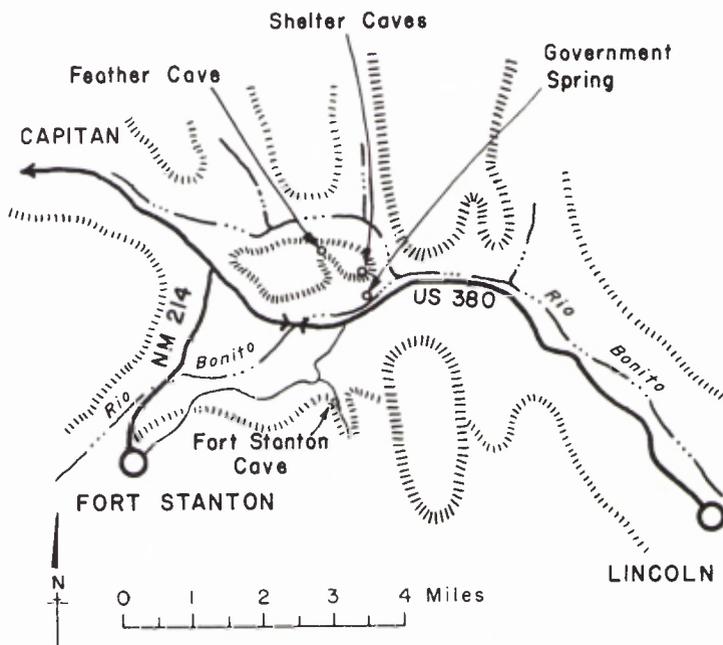


Figure 1. — Sketch map of the Fort Stanton Cave area, New Mexico.

A sketch map (fig. 1) indicates the general location of some of the caves discussed here. There are many known caves in the area covered by figure 1 in addition to these marked. The locations of these caves are purposely not shown because several would be quite dangerous for a novice; several are merely tunnels dug into the clay and gravel fill blocking the cave entrances; and at least two of the unmarked caves have not been fully explored and it is not advisable for a novice to attempt to explore them. The two caves that are marked on the sketch map are quite interesting, safe, and contain several miles of mapped passageways.

SUGGESTIONS TO SPELUNKERS

Caving can be fun as well as informative and interesting. There are many cavers that visit caves to gather data to enable them to better understand the caves and the flora and fauna they contain. These people are called "speleologists." Those people that visit caves for fun and enjoyment are called "spelunkers." To them belongs the thrill of finding a room with no signs of human passage, a room never seen by man before. As a matter of fact, the parent body of organized caving in this country; the National Speleological Society, started as just such a group, a hiking group that had courage and curiosity enough to poke their heads into holes in the ground.

There are laws protecting the caves of the Fort Stanton area, because it is on Federal land. However, owing to excessive vandalism, it is quite possible that in the near future a locked gate may be placed at the entrance to protect the cave from people. As a prospective visitor to the wonders of subterranean worlds, you may forestall such measures by being cognizant of and following the simple conservation practice of removing nothing from a cave but pictures, and leaving nothing behind but foot prints.

If you do plan to visit some of the caves in this area, there are a few simple precautions to follow:

1. Have alternate sources of light. Matches may become wet, just as batteries run down. So have both matches and flashlights, as well as spares.
2. Quite often a hard hat is necessary to protect yourself from low ceilings.
3. An accident in a cave may be quite serious, so tell some reliable friends where you are going, and never go alone.

4. All accidents in caves that have been reported were due to the carelessness of the individuals involved. Caves hold no hidden pit falls or traps, only beauty and different forms of life than those seen on top of the ground.
5. In order to preserve the beauty for others that will follow, remember—Take only pictures, and leave only foot prints.

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