



BERMUDA ZOOLOGICAL SOCIETY
"to inspire appreciation and care of island environments"

Eco File - Information document

Bermuda's Caves

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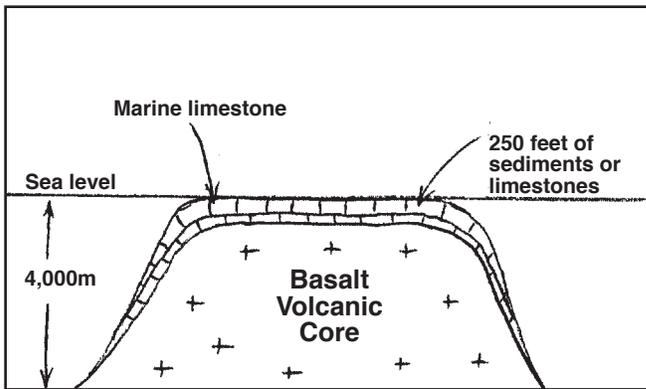
General

With their often unique flora, fauna and delicate speleothems, caves constitute one of the rarest and most fragile environments on Earth. Bermuda has one of the greatest concentrations of caves. Considering the thousands of years required to form the fragile and beautiful speleothems we all have an obligation to preserve them for future generations.

Unfortunately many caves have already been damaged or destroyed by the actions of man.

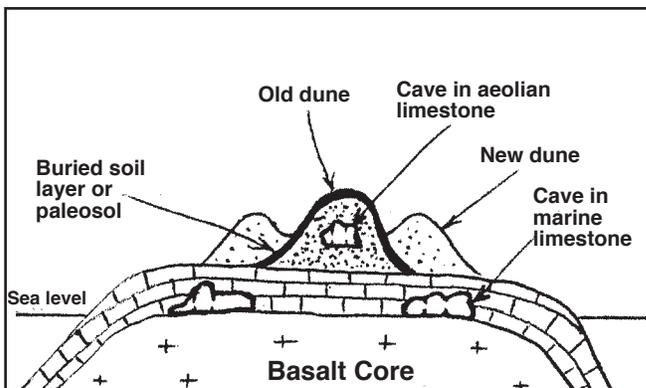
Formation of Caves

In order to appreciate caves fully, it is useful to understand how and why they are formed in Bermuda.



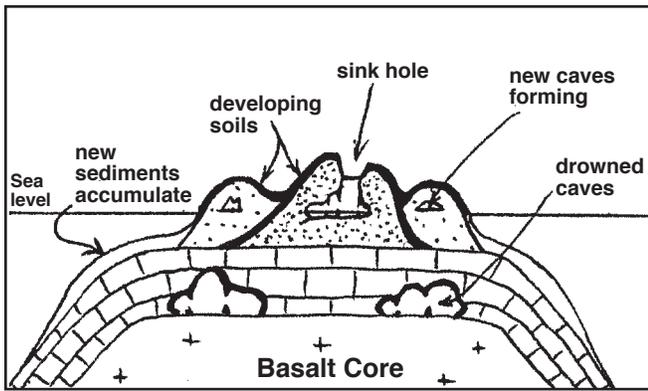
Bermuda has a volcanic basalt core, which is covered with a thin veneer of limestone. Volcanic rocks are buried 30 - 115 metres below limestones and are not exposed. The limestones are of two types (1) marine limestones and (2) aeolian (wind blown) limestones. Both types of limestone are made from sediments. Marine organisms extract calcium from sea water to make their body parts. After death these shells and skeletons are broken down by the action of waves to form sediment.

During the great ice age i.e., the past 1.5 million years the sea level rose and fell at least 5



Low sea level (cold, glacial periods)

As sea level began to fall, exposure of the platform enabled the marine sediments to be eroded and blown up into large dunes. They were cemented (hardened), to become aeolian limestones. New dunes formed to the seaward side of the old ones. Caves formed in both the marine limestone and in older aeolian limestone.

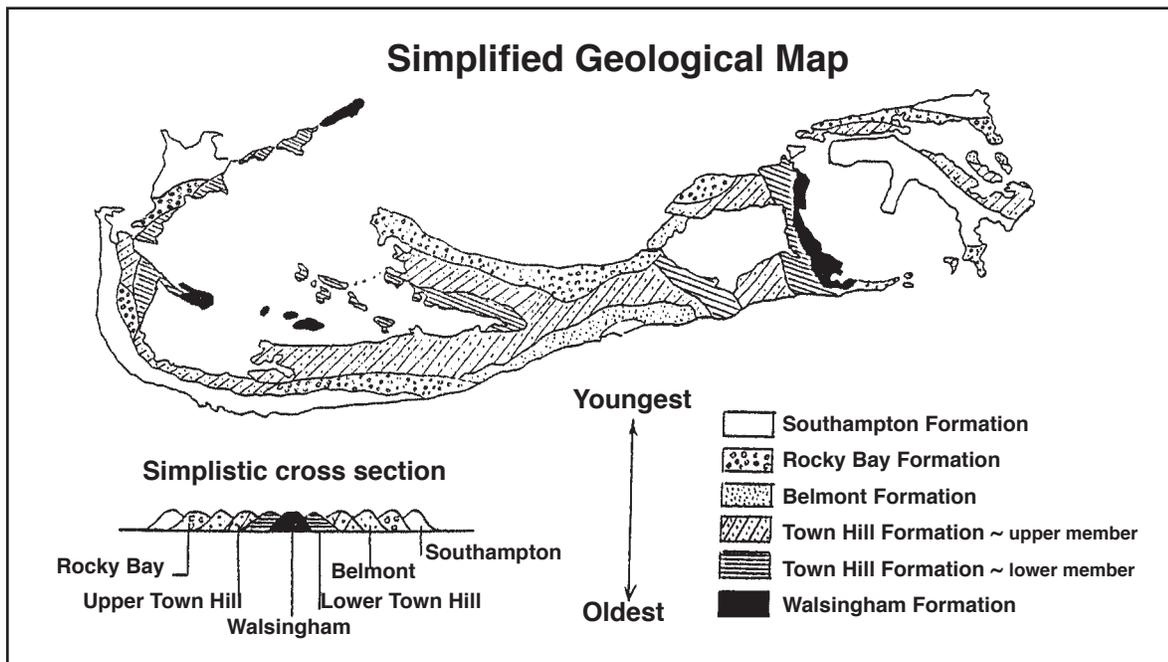


**High sea level
(warmer interglacial periods)**

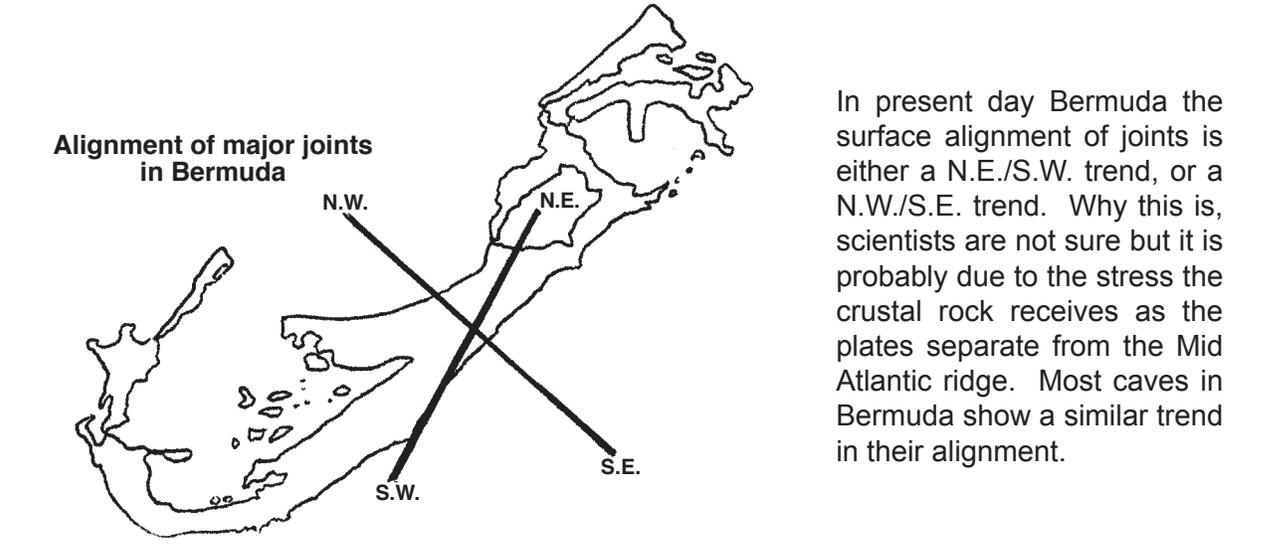
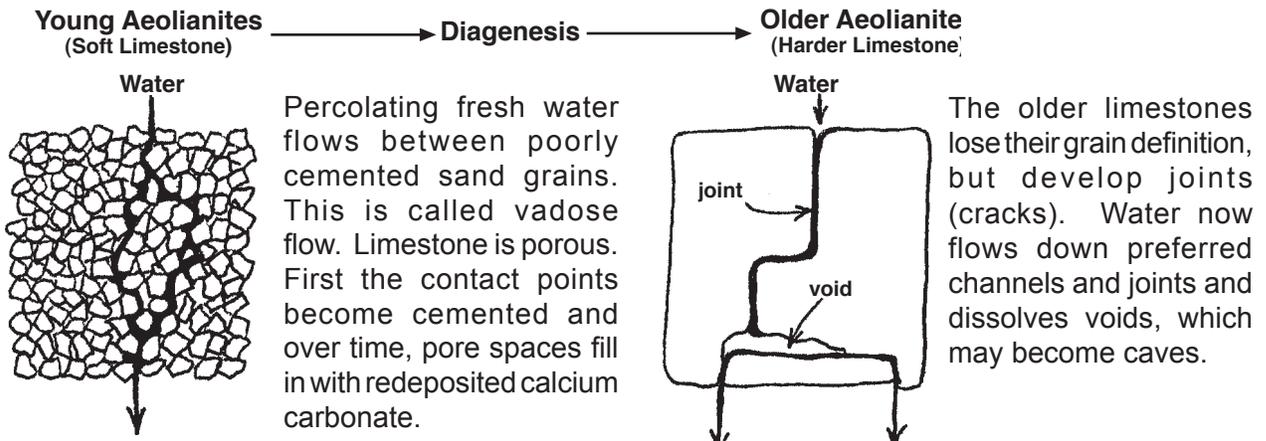
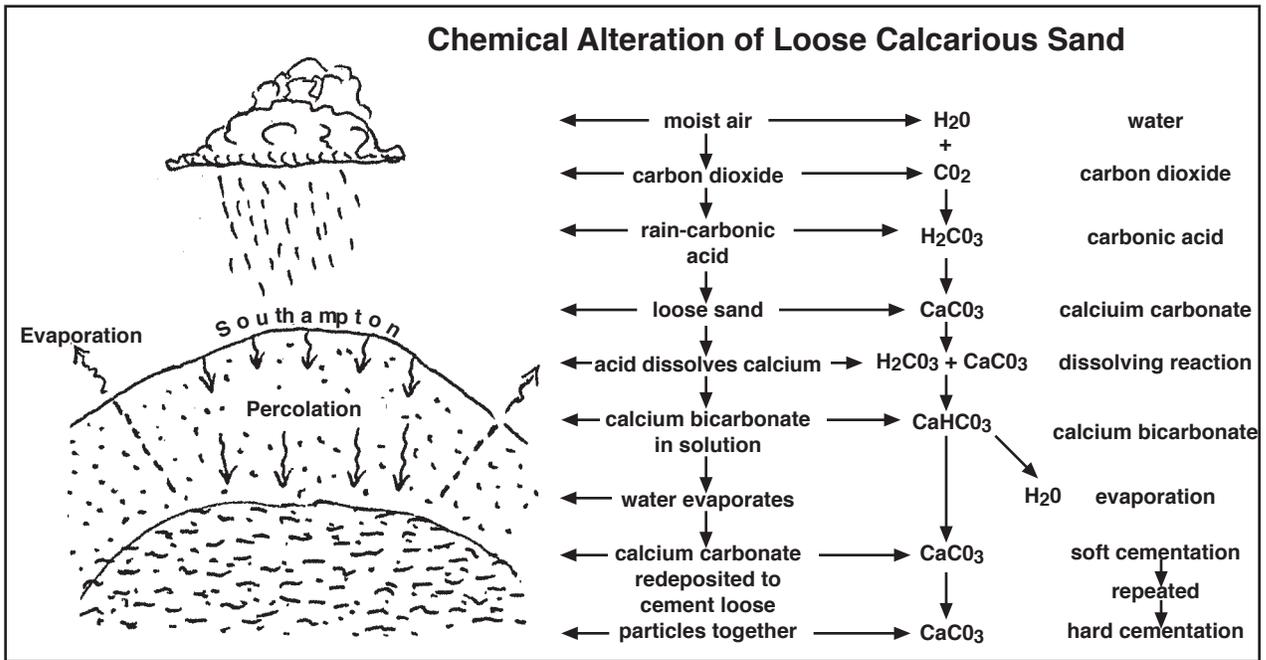
Most caves are now drowned or partially drowned by seawater. Some stalagmites on cave floors are now under water. Caves in older aeolian limestones may collapse forming dolines or sink holes.

Where are the oldest limestones?

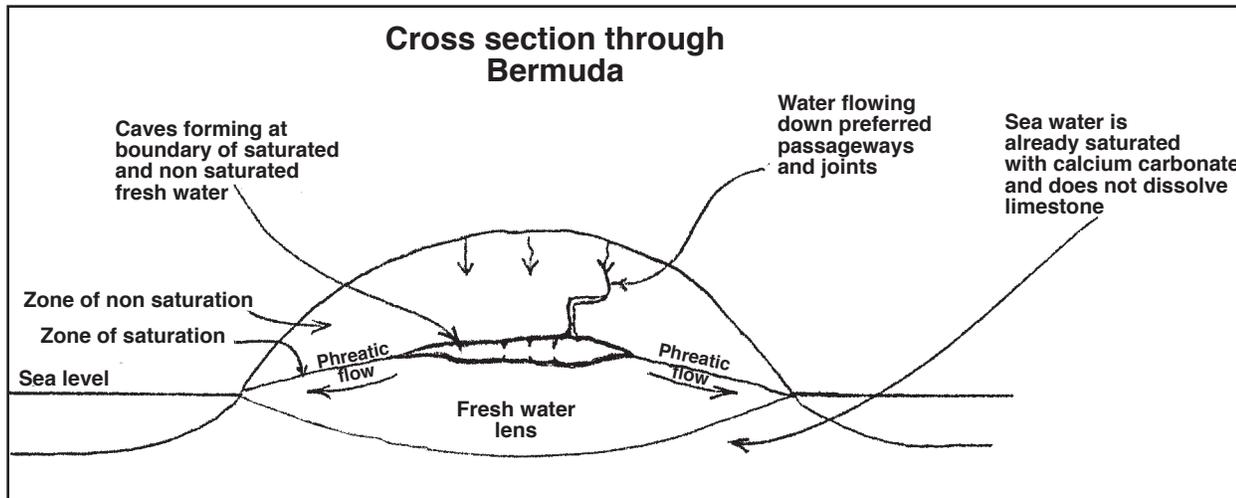
Bermuda has one of the greatest concentrations of caves in the world. The area at the eastern end of Harrington Sound is one of the most important. Here the oldest limestone, Walsingham, in which caves are found, is exposed at the surface.



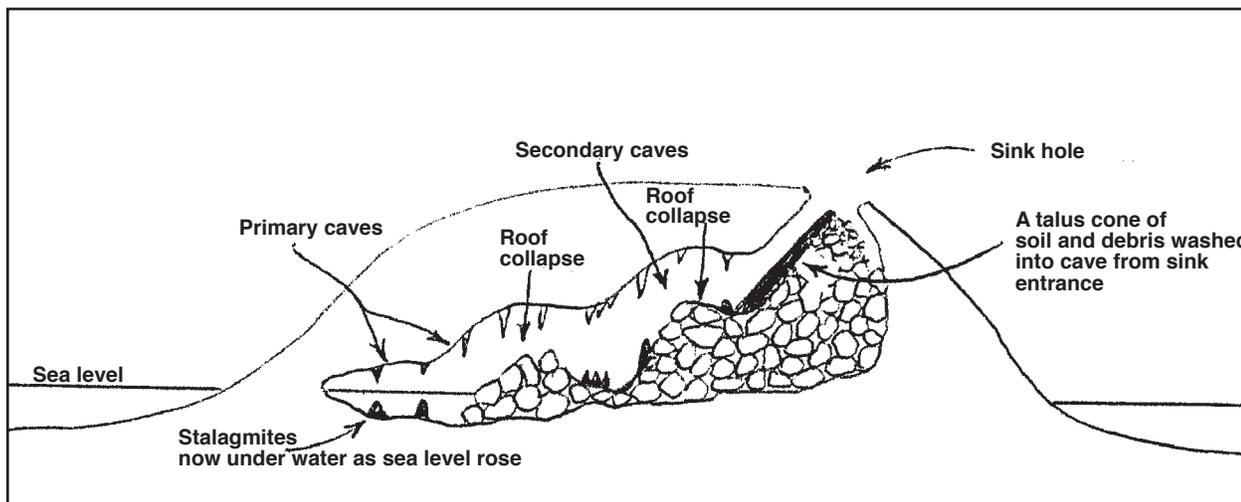
Over time Bermuda's aeolian limestone changes from dunes of loose sand into hard limestone. This is called diagenesis and takes place chemically.



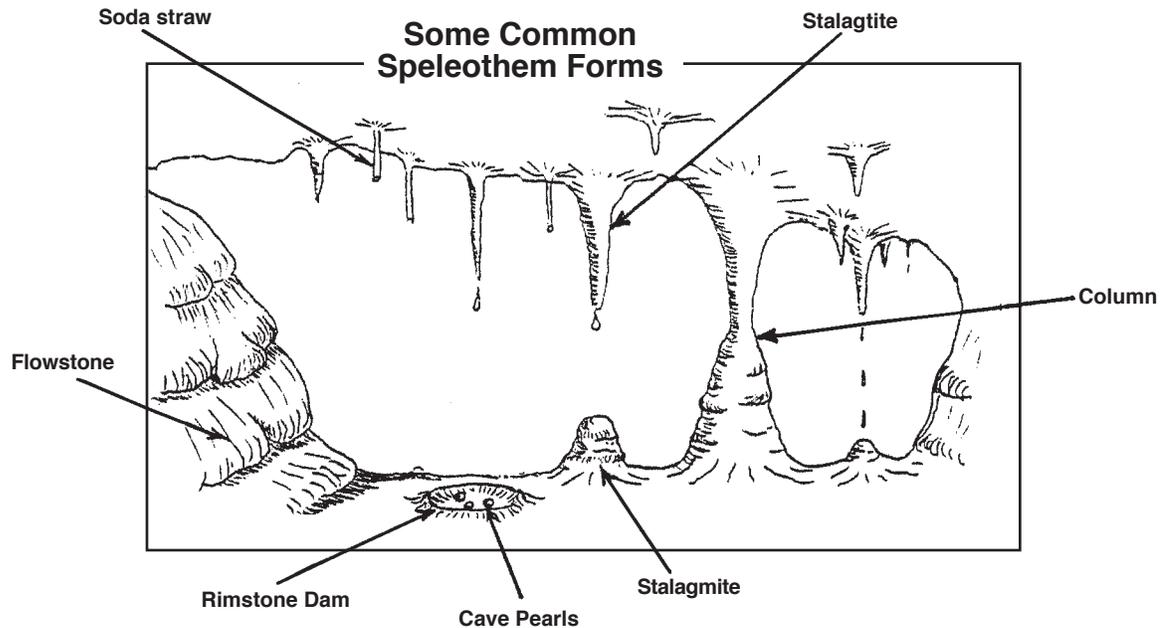
Water seeping downwards will stop when it reaches an impermeable layer. In the aeolianites this will be the level saturated with salt water, and fresh water will rise and fill in the pores and joints above the salt water, to form a fresh water 'lens'. Caves form along the boundary of the saturated and non-saturated layer of fresh water. Fresh water continually flows outward (towards the shore), a movement called phreatic flow. The horizontal nature of many caves suggests this method of formation by phreatic water dissolving limestones.



Many caves in Bermuda have mounds of rubble in their chambers from roof collapse. In this way caves 'migrate' towards the surface, where eventually a sink hole may result. It is useful to think of caves as dynamic entities rather than just holes in the ground. Some parts of caves may become more active from percolating and dripping water while other parts may become dormant. They are always changing in subtle ways.

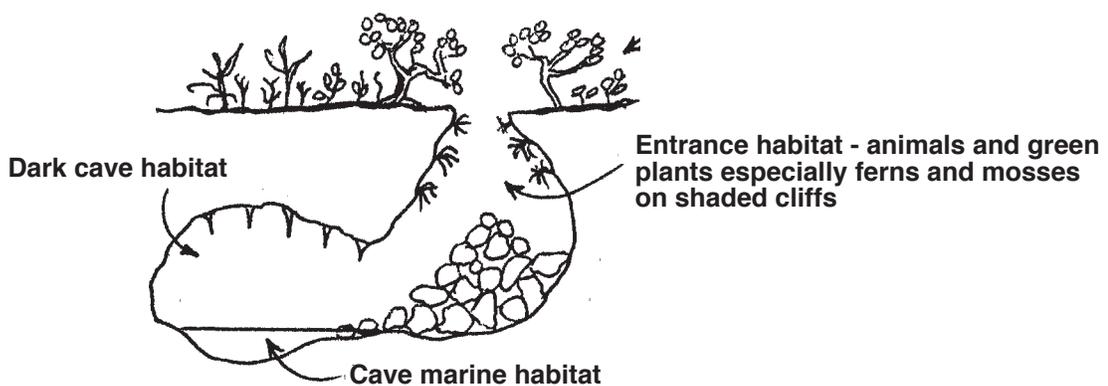


After solution, a secondary phase is the decoration of caves with a variety of calcite (re-deposited crystalline calcium carbonate) forms. These are called speleothems, and take thousands of years to form.



Cave Ecology

The entrances to caves, especially sink holes, and caves themselves provide unique habitats, where conditions of light, temperature, water salinity and air currents are relatively stable. Many rare species of plant and animals are found in caves or close to the entrances. Cave animals are adapted to dark conditions i.e. are blind and lack pigmentation. Such animals are called troglobites and carry out their life cycle in caves, while troglaphiles may be found in suitable habitats outside caves.



Economic, Social & Scientific Importance of Caves

Caves are important tourist attractions. Each year, 200,000+ tourists visit the Crystal Caves, Leamington Caves, Prospero's Cave and Devils Hole spending \$2.5 million. Over 30 Bermudians are directly employed in these businesses. Cave related attractions make a significant contribution to the islands economy.

Recreational cave exploring, whether organised by groups or not, differs from other sports in that it is intentionally little publicized. This ensures misuse or abuse of caves by individuals, who are not fully aware of the conservation and safety problems involved, will not cause irreparable damage. If you do explore caves take sensible precautions - inform someone on the surface of your whereabouts, take extra lights, food and water.

Remember and take heed of the cave explorer's motto:

Take nothing but pictures.
Kill nothing but time.
Leave nothing but footprints.

Your participation in preserving caves is important.

Important scientific studies involving both geology and palaeontology (study of fossils) are still continuing. Studies, involving marine and terrestrial life forms have recently described over 60 new, previously undiscovered endemic life forms.

Controversy still exists about the exact formation of caves. Continued study will produce better understanding and wider appreciation of their worth.

Destruction of Bermuda's Caves

Caves are destroyed by the actions of man. There are four threats;

1. filling and quarrying
2. water pollution
3. dumping and littering
4. vandalism

List of Some Destroyed Caves

Wilson's Cave; Govt. quarry - Bulldozed shut
Penistons Cave; Govt. quarry - filled
Wilkinson Quarry Cave; quarrying
Kindley Field Cave ; Excavated and later destroyed
Tuckers Island Caves; filled,U.S.Naval Annex
North Bastion; Dockyard construction
Cave island; Airport construction
Two Caves; Westgate Prison construction

Numerous other caves have been filled or destroyed during construction of hotels, golf courses and private residences.

Calcite	A mineral composed of calcium carbonate, precipitated by drip-water in the caves. Most of the formations in the cave are made of calcite.
Breakdown starts	Chunks of rock that break off from walls and ceilings when the cave to fall apart. This takes a long time.
Dome	A scooped out ceiling in a room. It looks something like the inside of a bowl.
Phreatic Passage	Passages formed by water dissolving limestone. This happens under water and is happening today under many of our lakes and rivers.
Vadose Passage	Passages cut through limestone by running water. This usually happens in open air.

References:

Bermuda Biological Station Paper No. 814
National Speleological Society, Cave Avenue, Huntsville, Alabama 35810, U.S.A.