Sinkholes

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a while until the underground spaces just get too big. If there is not enough support for the land above the spaces then a sudden collapse of the land surface can occur. These collapses can be small, as this picture shows, or they can be huge and can occur where a house or road is on top.

The most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. The picture to the left shows a sinkhole that quickly opened up in Florida, apparently eating a swimming pool, some roadway, and buildings.

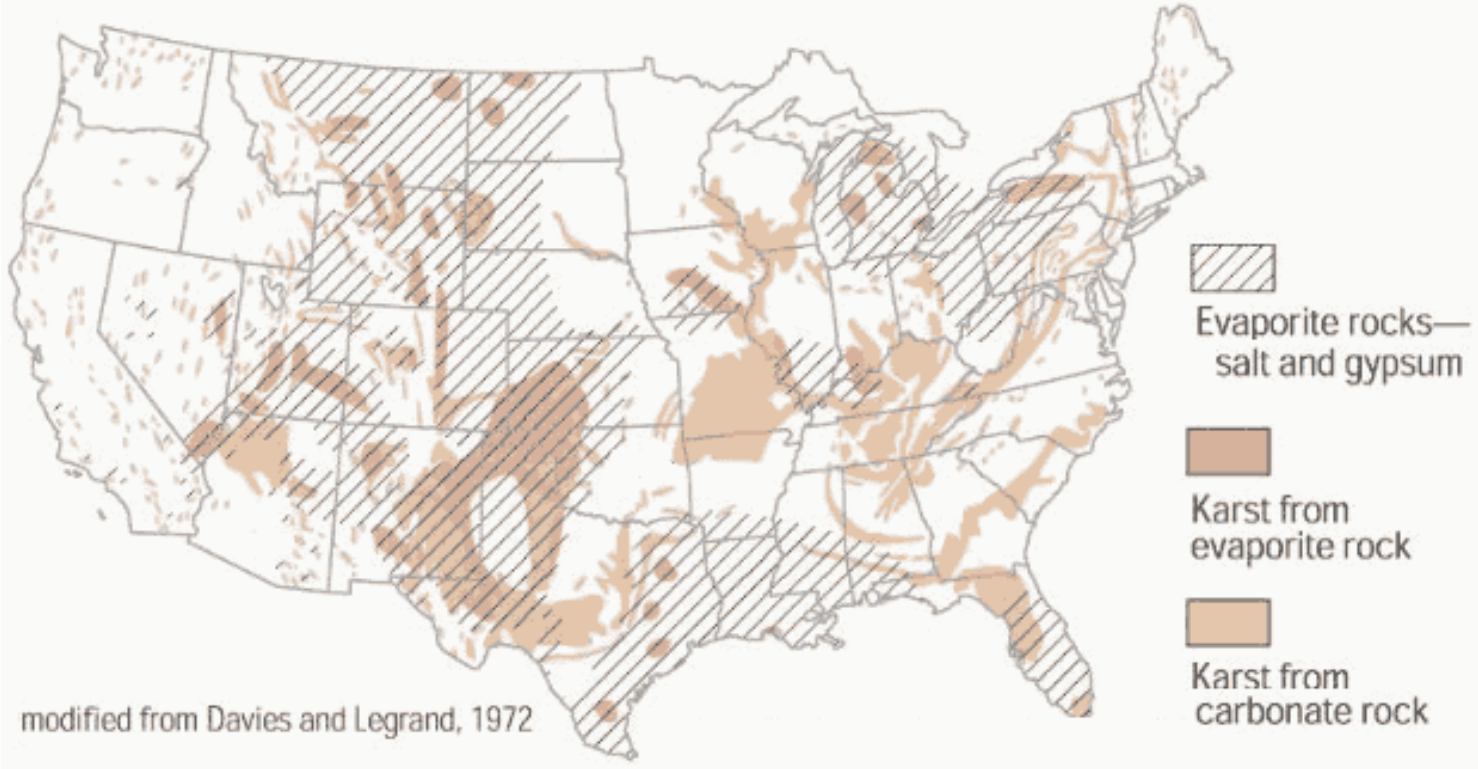
What is a Sinkhole?

A sinkhole is an area of ground that has no natural external surface drainage--when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface. Sinkholes can vary from a few feet to hundreds of acres and from less than 1 to more than 100 feet deep. Some are shaped like shallow bowls or saucers whereas others have vertical walls; some hold water and form natural ponds. Typically, sinkholes form so slowly that little change is seen in one's life- time, but they can form suddenly when a collapse occurs. Such a collapse can have a dramatic effect if it occurs in an urban setting.

Photo courtesy of Doug Gouzie, 2006

Areas prone to collapse sinkholes

The map below shows areas of the United States where certain rock types that are susceptible to dissolution in water occur. In these areas the formation of underground cavities can form and catastrophic sinkholes can happen. These rock types are evaporites (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite). Evaporite rocks underlie about 35 to 40 percent of the United States, though in many areas they are buried at great depths.

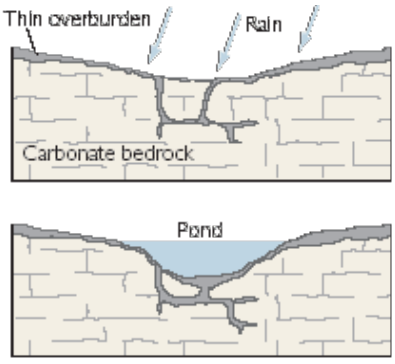


Types of sinkholes

Since Florida is prone to sinkholes, it is a good place to use to discuss some different types of sinkholes and the geologic and hydrologic processes that form them. The processes of dissolution, where surface rock that are soluble to weak acids, are dissolved, and suffosion, where cavities form below the land surface, are responsible for virtually all sinkholes in Florida.

Dissolution sinkholes

Diagram of a sinkhole caused by dissolution of subsurface rock, generally limestone. Dissolution of the limestone or dolomite is most intensive where the water first contacts he rock surface. Aggressive dissolution also occurs where flow is focussed in preexisting openings in the rock, such as along joints, ractures, and bedding planes, and in the zone of water-table fluctuation where ground water is in contact with the atmosphere.

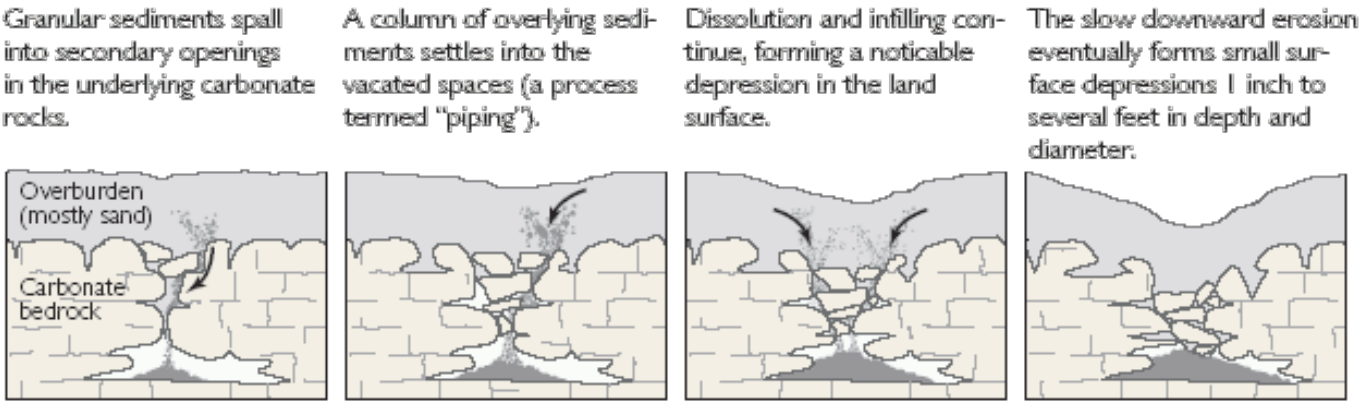


Rainfall and surface water percolate through joints in the limestone. Dissolved carbonate rock is carried away from the surface and a small depression gradually forms.

On exposed carbonate surfaces, a depression may focus surface drainage, accelerating the dissolution process. Debris carried into the developing sinkhole may plug the outflow, ponding water and creating wetlands.

Cover-subsidence sinkholes

Cover-subsidence sinkholes (the following diagram) tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods.



Sinkholes can be human-induced

Tom Scott

New sinkholes have been correlated to land-use practices, especially from ground-water pumping and from construction and development practices. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by ground-water fluid pressure. The water below ground is actually helping to keep the surface soil in place. Ground-water pumping for urban water supply and for irrigation can produce new sinkholes In sinkhole-prone areas. If pumping results in a lowering of ground-water levels, then underground structural failure, and thus, sinkholes, can occur.

Sources and more information

- Sinkholes, USGS Fact Sheet 2007-3060 (http://pubs.usgs.gov/fs/2007/3060/)
- Land Subsidence in the United States, U.S. Geological Survey Circular 1182 (http://water.usgs.gov/pubs/circ/circ1182/)
- Land Subsidence in the United States, USGS Fact Sheet-165-00 (http://water.usgs.gov/ogw/pubs/fs00165/)
- Carbonate-rock aquifers, Aquifer Basics (http://capp.water.usgs.gov/aquiferBasics/carbrock.html)