# Karst Aquifers: Valley and Ridge, Piedmont, and Blue Ridge Aquifers

ACTIVE

By **Water Resources Mission Area**

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The carbonate aquifers of the Appalachian Valley and Ridge Province, formed during Appalachian mountain building, have highly variable karst aquifer characteristics. The Valley and Ridge, Piedmont, and Blue Ridge Aquifers demonstrate karst features such as caves, sinkholes, sinking streams, and conduits.

The carbonate aquifers of the Appalachian Valley and Ridge Province are formed within a thick Paleozoic sequence of layered carbonate and siliciclastic rocks that were highly folded and faulted during Appalachian mountain building. Fluid flow thus has been through complex geologic structures, resulting in highly variable karst aquifer characteristics with a wide range of groundwater residence times, geochemical characteristics, and aquifer compartmentalization. Cave geometries likewise are variable, ranging from small, isolated caves of limited extent to some of the longest and deepest caves known in the United States.

The Great Valley aquifer is the primary carbonate aquifer in the Valley and Ridge Province, formed within a sequence of Cambrian and Ordovician rocks over 10,000 feet (3,048 meters) thick. This aquifer is an important water resource for numerous cities and towns along the Interstate 81 corridor from Tennessee to Pennsylvania.

The northern extent of the Great Valley in Virginia, West Virginia, and Maryland has been particularly well studied, especially within the drainage basin of the Shenandoah River. Larger springs typical of the Shenandoah Valley karst aquifer are 4th and 5th magnitude (10-500 gal/min; 0.6 to 28 L/sec) artesian springs, most with relatively muted discharge variability. Geologic structure strongly influences spring locations, discharge and geochemistry. Spring discharge accounts for more than 85% of stream flow in the Shenandoah River basin. As a result, surface-water quantity and quality is highly dependent on groundwater use and management. Circulation of groundwater through conduits exceeds depths of 2000 feet (610 meters) as evidenced by a small number of high-yield deep wells. Most wells are finished less than 300 feet (100 meters) below land surface and may yield between 1-150 gal/min (0.063-9.45 L/s). While the majority of springs have ambient water temperatures, many mildly thermal springs have been identified.

The Shenandoah Valley karst hosts a number of unique endemic species. Of note is the Madison Cave Isopod (*Antrolana lira*), a crustacean of originally marine ancestry found only caves containing fresh groundwater in the Shenandoah Valley region.

## Sinkholes

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Flourescent tracer is injected into a sinkhole as part of intensive investigations of the hydrogeology, water quality, and groundwater flow of the karst aquifer in the Hopewell Run Watershed, northern Shenandoah Valley, near Leetown, West Virginia. (Credit: Mark Kozar, USGS.)

## Featured Studies and Datasets

Aquifer-scale studies and the datasets they produce are a key component to understanding how karst aquifers behave, and the quality of water within them.

- Assessment of the Northern Shenandoah Valley karst aquifer — Hydrogeologic assessment and simulation of groundwater flow

## Additional Information

The following websites are additional sources of information about this aquifer:

- Great Valley Water-Resources Science Forum
- Sinkholes in Pennsylvania (Pennsylvia Geological Survey)
- Photo Gallery for Clarke County, Virginia

## Contacts

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