

Underground River Landscapes

Some places have no surface rivers. If the region is a desert, this is understandable because there is no surface water; however there are humid regions where there are absolutely no rivers. Where did they go? In regions where the underlying bedrock is porous, the surface water seeps into the rock and flows underground. These underground rivers exhibit all the dynamics of surface running water; weathering occurs as the water dissolves soluble minerals in the rock, and valleys become caverns running underground. Deposition occurs as dissolved minerals precipitate out in columns, stalactites, and petrified waterfalls.

Underground caves are mysterious places, which can be fascinating to explore if you know what you are doing. Otherwise they can be very dangerous. **Spelunking** is the term used to describe cave exploration. Seldom a vocation but often a hobby, this pastime requires explorers to have many unusual qualities, including the agility of the rock climber, the courage of a miner, and the strength of an ox. In addition, they must not be afraid to squeeze through tiny spaces, come face to face with a bat, or walk submerged up to their neck in freezing cold water. Obviously, this is not everybody's idea of fun, but if you ever do decide to go spelunking, do it with a trained guide, go properly equipped, and never enter an underground cavern alone!

The first geologic study of caves occurred in the Karst Mountain region in Slovenia. Since this

was the first region studied, other regions with similar topography are called **karst** regions. Some of the features of karst topography include caverns, sinkholes or **dolines**, **stalactites**, and **stalagmites**. You may find it hard to believe, but about 15 per cent of the earth's land surface has karst topography. In order for caves to form, the area has to be tectonically stable and unaffected by glaciation for thousands of years. Regions in southern Europe, the United States, and southern China are well known for their caves, whereas Canada has few karst features because of its recent ice age.

If you look at a topographic map of a karst region, one odd thing you may notice is the absence of rivers. If there does happen to be a river, it may travel along the map for a distance, and then seem to disappear into thin air, only to re-emerge some distance away. Some valleys look just like river valleys, but there are no rivers in them. All over the map, you'll see strange little craters and sink holes pocking the surface. There is a logical explanation for all of these features.

Limestone with a calcium carbonate (CaCO_3) content of at least 80 per cent makes up the

underlying rock in karst regions. The rock is impermeable, so when it rains, water does not percolate through it. Instead, it seeps through cracks and joints in the limestone. Over time, more and more of the CaCO_3 in the limestone around the cracks and joints is dissolved, making the holes ever larger until caverns and caves are created beneath the surface. The water, which is constantly trying to find its base level, settles in underground lakes or pools. When one of these caves becomes too big, the ceiling collapses, creating the odd sinkholes and craters for which karst regions are famous. Running water underground creates dry valleys as the land subsides into caverns created underground.

Karst topography also has interesting depositional features. As water constantly trickles through cracks in the rock, it picks up calcium carbonate. When it drips from the roof of a cave, it leaves behind tiny traces of limestone. **Stalactites** are created from deposits of calcium carbonate that gradually build layer upon layer until massive icicle-like objects hang from the ceiling. On the floor of the cave, upside-down rock icicles called **stalagmites** form where the calcium-rich water drips onto the floor. When these two features join together, a **column** is

created. Other unusual formations, such as rock curtains and waterfalls frozen in stone, are also formed by this process. Karst topography provides a unique example of how water shapes the land in interesting and bizarre ways because of the underlying surface rock.

Karst landscapes

Karst landscapes are regions underlain with highly water soluble rock such as limestone and contain some unique landscape features. On the surface, dry valleys are evident and very little surface water is visible as streams disappear underground and flow through subsurface caves. Even water from heavy downpours infiltrates quickly into the ground, therefore erosion caused by runoff is minimized. Continued rainfall in wet season can fill the valleys with water, but most of the time, they are dry valleys.

Evolution of a Karst landscape

The evolution of a Karst landscape is a slow process. In the early stages, a dry surface is evident as streams disappear underground through a **sinkhole** (swallow hole). In this 'youth stage' the surface has numerous depressions but the roofs of the expanding caves underground have not yet begun to collapse. As water continues to dissolve the limestone, support for the overlying rock is minimized and collapse occurs. In this mature Karst stage, as cave ceilings crumble, several sinkholes may combine to create a very large depression referred to as a **uvala**. When the entire cave collapses, large gorge-like features called **poljes** take shape. In the final stages of Karst topography, all caves have collapsed with only small hills of rock fragments known as **hums** remaining.

Interior features of limestone caves

As surface waters disappear underground, limestone is dissolved and carried along in solution. Dripping water from the cave ceilings falls to the floor of the cave and here some of the limestone is deposited to create a growing mound of deposit called a **stalagmite**. A similar depositional feature begins to form on the roof of the cave at the point from where the water drips. These hanging icicle like deposits are known as **stalactites**. The speed at which stalactites and stalagmites form is very slow, taking years to add even a centimeter to the length. Over time, stalactites and stalagmites will join together to create **pillars**. As water flows along the cave floor, deposition also takes place on the streambed. These layered deposits are called **flowstones** and can extend along the entire length of the stream.

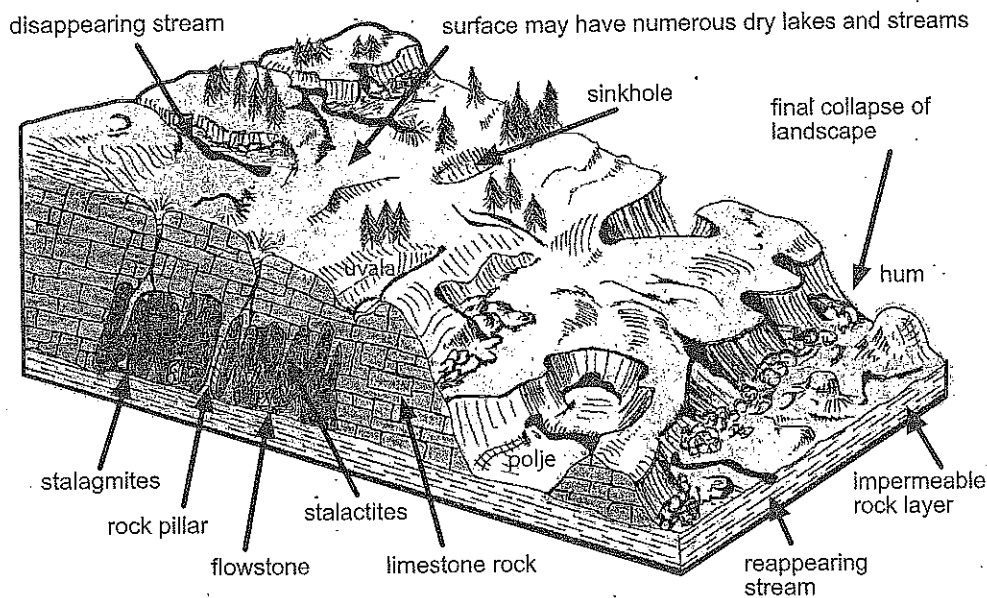


Figure 15.3 Features of Karst landscapes