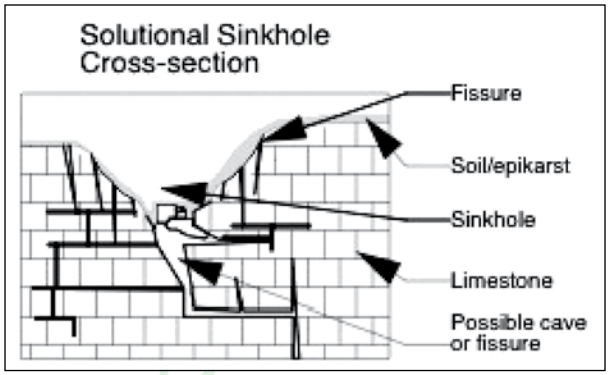
5 Sinkholes are Depressing



Beside the trail are two sinkholes – funnel-shaped depressions formed by collapse of subsurface openings or caves or by concentrated dissolution in particular locations, such as where a number of cracks intersect in the limestone.

Continuous slow erosion of the slopes usually blocks the drainage focus at the sinkhole base like gravel in an hourglass.

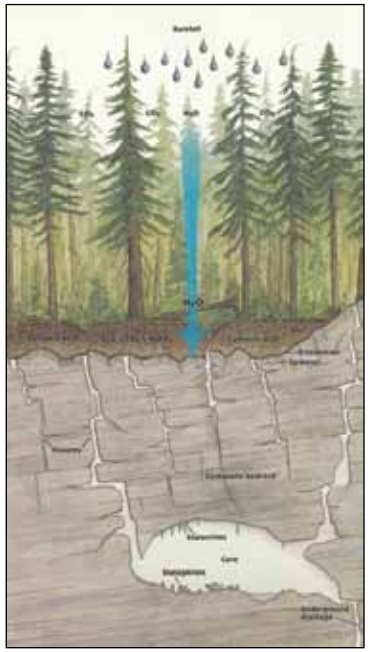
The larger sinkhole is >20m in diameter and 5m deep, the smaller is 5m in diameter and 2m deep, and both lie almost directly above the Siphon area of Riverbend Cave.

6 Swallets and Caves

You are standing above the entrance to Riverbend Cave, which is presently the lowest active sinking point or swallet for the surface stream that once flowed all the way down the gully that you crossed farther down the hillside.

Water now only flows into this entrance after heavy rains. The year-round stream sinks underground at a number of points upstream until the limestone gives way to insoluble igneous bedrock several hundred metres farther up the gully. Humanly impassable underground conduits from the streambed then feed into Riverbend Cave and into Andre's Annex, a small cave 50 m up the gully that once carried much of the stream flow and is linked hydrologically to Main Cave.

7 Epikarst – The "Outer Skin" of Karst



Just as our outer skin is called "epidermis", epikarst is the weathered surface layer of the karst bedrock. The organic soil and vegetation that partly or completely cover the rock generate carbon dioxide. This dissolves in the rainwater to form a mild carbonic acid that attacks the soluble limestone surface, forming the rounded shapes, slots and cavities you see on the outcrops in this area. Epikarst also includes a zone of solutional openings that lead down to connect with the subsurface. Water and soil can move down vertically to caves and conduits below and small animals can hide in the openings. Tree roots grow into the epikarst and downward to find water. Removing trees can disturb soil, which will wash down into the solutional openings making new growth on the surface more difficult.

Note the nearby "Cougar Cave", a short, dead-end pit with no zone of darkness. Can it technically be called a cave?

8 Beneath Our Feet

What we don't see is just as important as what we do see in uniquely three dimensional karst landscapes. Certain plants can only live on the karst and some subsurface creatures are specially adapted to living underground.

Understanding the connections between the surface and subsurface of these landscapes helps us to appreciate the sensitivity of karst systems.

HORNE LAKE CAVES PROVINCIAL PARK

Trail Guide

Trail to Main & Lower Cave

A well-developed trail with some stairs leads to the Main Cave entrance and a branch continues to Lower Cave. One-way walking time from the parking lot to Lower Cave is 15-20 minutes.

The Main Cave entrance is a narrow cleft in a mossy cliff, surrounded by lush ferns and other rain forest vegetation. Within the past 40 years, the small stream that flows at the inner end of the cave would back up and flow out of this entrance. More recently, this flow has opened new passages below the entrance - a dynamic example of how caves change and grow through water action in karst areas.

Lower Cave has a resurgence entrance, formed as an underground stream emerges onto the surface. This stream originates far up the hillside and formed Riverbend Cave as it crossed from volcanic bedrock onto limestone and began to dissolve and erode its way along cracks in the soluble rock. Today, only a flooded, impassable passage about 20m long separates the Terminal Sump in Riverbend Cave from the stream rising at the upper end of Lower Cave.

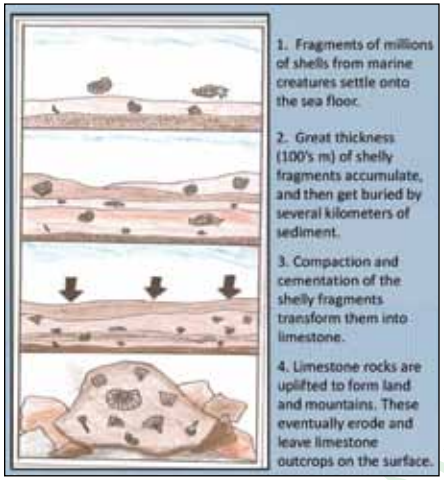
The Phil Whitfield Interpretive Trail Loop

[Named for a British Columbia caver involved with these caves since 1964 who designed and built the trail in 2011]

This self-guided interpretive trail switchbacks gently up the steep, forested hillside to the Riverbend Cave entrance, passing a number of karst surface features along the way. From the cave, a wider trail built in 1994 extends past other karst features and descends a long flight of stairs to reach a former logging road that originally connected Horne Lake with Port Alberni. This path continues down fairly steeply to close the loop at the Main/ Lower Cave Trail junction. One-way time from the parking lot to Riverbend Cave is 20-30 minutes.

The following texts are keyed to the numbered posts along the loop *(some text and diagrams supplied courtesy of* ***Vancouver Island University*** *Karst Geology students)*

1 Shellfish Under Pressure



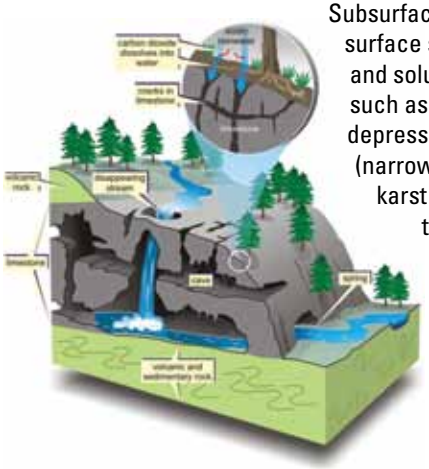
The limestone wall in front of you was formed from the compressed carbonate skeletons of marine creatures deposited on the floor of a shallow sea in this location 250 million years ago during the Permian period.

Carbon dioxide from decaying vegetation has dissolved in water to form a mild carbonic acid that flows over the surface and into the ground. The acidic water corrodes and grinds away the bedrock enlarging cracks and fissures deep within it. These soluble rock landscapes are known as karst. As you walk the park trails, watch for surface signs that hollow spaces have formed below the surface – caves!

2 A Streambed Without a Stream

Here, the trail crosses a dry gully that can be traced uphill all the way to the Riverbend Cave entrance. The stream that once flowed here has been "pirated" into underground conduits that follow the cracks and fissures in the limestone.

Today, the stream that formed Riverbend Cave only flows into the entrance seasonally, as newer underground conduits upstream continue to drain off the surface flow.



Subsurface drainage, no surface streams, dry gullies and solution features such as sinkholes (closed depressions) and grykes (narrow slots) are typical of karst landscapes. Look for these characteristics as you continue upward.

3 Not So Cosy Bedding

This outcrop shows how the calcium carbonate sediments that formed the limestone were laid down in layers or "bedding planes". Originally horizontal, they have been uplifted and tilted to their present position by plate tectonics. Water action splits and undermines these layers and blocks fall off.

Underground, this process also gradually enlarges the cave passages.

4 Gullies and Grykes

Once again, you are crossing the dry gully that once carried the Riverbend Cave stream. The slots or grykes on both sides of the trail were formed as the carbonic acid in the surface water slowly enlarged fissures in the calcium carbonate bedrock. Over time, the entire surface stream flow has shifted into the underground system of conduits and caves that now includes the Riverbend-Lower Cave system and Main Cave.

A cave is defined as "a naturally formed cavity that has a zone of darkness and can be entered by a human". Few grykes meet all of these criteria.

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