

# GEOLOGY

## Cypress Hills Interprovincial Park



Rising more than 600 meters above the surrounding prairies, the Cypress Hills are a striking geological anomaly on the flat plains. Unlike the Rocky Mountains, these hills do not owe their existence to the faulting and folding of a geological uplift. Read this fact sheet to discover the unique geological history of the Cypress Hills.



### For More Information

If you would like to know more about the geology of the Cypress Hills, please contact the Visitor Centre.

**403-893-3833 ext. 5**

**<https://albertaparks.ca/parks/south/cypress-hills-pp/>**

### A High Plateau

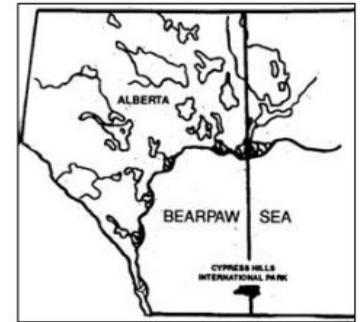
The highest point in mainland Canada between Labrador and the Rocky Mountains, the Cypress Hills form a high plateau surrounded by a rolling upland. Climbing sharply from the north, the Cypress Hills reach their highest elevation (1466m) at Head of the Mountain, before gradually dropping back to the plains in the south. Formed by millions of years of sedimentary *deposition*<sup>1</sup>, followed by millions of years of erosion, the Cypress Hills are known as an *erosional plateau*<sup>2</sup>. Today, the Cypress Hills expose a unique cross-section of geological history found nowhere else in western Canada.

era	period	epoch	age	formation	
CENOZOIC	Quaternary	Pleistocene	0.1	Glacial	loess, till 0 -30 m
	Tertiary	Miocene	11	Cypress Hills	conglomerate 38 m
		Oligocene Eocene	50		
MESOZOIC	Upper Cretaceous	Palaeocene	55	Ravenscrag	sandstone, siltstone, coal, shale 70 m
			65		
			65	Frenchman	sandstone, shale 75 m
	Maastrichtian		66	Battle	shale 10 m
				Whitemud	sandstone, clay shale 8 m
			68	Eastend	sandstone, shale coal 125 m
	Campanian	>68	Bearpaw	shale 250m	

approximate age in millions of years

### A Layer Cake

The geological story of the Cypress Hills begins during the *Cretaceous* Period more than 70 million years ago, when most of southern Alberta was covered by the warm, shallow Bearpaw Sea. Large rivers from the west carried clay and silt which settled onto the sea floor. These sediments were compressed into a dark grey flaky *shale*, now called the *Bearpaw* Formation, which forms the base of the Cypress Hills.



The Cypress Hills resemble a giant layer cake, composed of many layers of *sedimentary rocks*. Each layer, called a *formation*, formed at different times under different conditions. The youngest formations are found higher in the hills.

Sedimentary rocks are made from sediments which have been deposited by water, and then compressed and cemented into rock. The grain size of the rock indicates the environment in which the sediments were deposited. For instance, gravels are only deposited by fast moving streams, while fine clays are deposited in still water. Most formations are predominantly a single rock type, with thin *interbedded* layers of other rock types.

## The Ice Age

As the climate cooled during the *Pleistocene* Epoch, huge continental ice sheets crept south. Glaciers flowed around the Cypress Hills but never completely engulfed it. The top 100 meters of the plateau was left an island, called a *nunatak*, above the surrounding ice. The surrounding land and the lower portions of the hills were sculpted and eroded by the ice sheets. As the ice sheet finally began to melt about 15,000 years ago, large amounts of *till* - a mixture of silt, sand, and gravel - was dumped into the plains and the flanks of the hills. High winds swept across the bleak landscape; blanketing the top of the unglaciated plateau with thick deposits of silt called loess. Meltwater coursed between the plateau and the retreating ice, carving out the valleys which now dissect many parts of the Cypress Hills.



## The Changing Hills

By 10,000 years ago, the ice age was over. The last of the major geological processes playing a part in the formation of the Cypress Hills had ended, but even to this day, the hills continue to change. Erosion from streams and sudden thunderstorms deepens the coulees and ravines, while slumping and landslides wear away at the edges of the Cypress Hills.

### Fossils

Throughout the geological history of the Cypress Hills, living creatures have flourished in the area. Some are now preserved as fossils. Marine mollusk ammonites and baculites occur in the Bearpaw Formation, while *Triceratops* and other fossils from the age of dinosaurs are occasionally found in the Frenchman Formation. The eastern portion of the Cypress Hills Formation contains abundant fossils of many strange and extinct mammals, including titanotheres, camels and saber-toothed cats. A reminder that collecting fossils and rocks in a Provincial Park is **prohibited**.

### Coal, Clay and Cobbles

Many of the formations of the Cypress Hills contain resources of economic importance. Although of poor commercial quality, the coal seams of the Eastend Formation were mined for local use in the early part of the century. The Whitemud Formation is the most important source of ceramic clay in Western Canada, supporting the local pottery, pipe, brick, and clay industries for many years. The large cobbles of the Cypress Hills Formation were once used for grinding phosphate in the manufacture of fertilizer. Gravel deposits were also mined for construction purposes. Mining, no longer permitted in the park, once played an important role in the development of the area.

## Streams, Swamps and Sediment

By about 68 million years ago, the Bearpaw Sea had retreated to the east. The area became a forested, semi-tropical coastal region where deltas, rivers and swamps deposited mud and sand on top of the Bearpaw shale. Light grey and brown sandstones and interbedded dark grey shale originated in brackish fresh water, while thin coal layers formed from decayed vegetation in swamps. These rocks make up the thick Eastend Formation. As the sea receded, the thin Whitemud Formation, consisting of a fine, white clay with some interbedded sandstone and shale, was formed in still, fresh waters.

For a relatively short time, a brackish semi-marine environment returned, leaving behind the purple-grey shale of the thin Battle Formation. Active volcanoes far to the west also deposited layers of ash across the area at this time. The *Kneehills Tuff*, a 20cm ash layer found in the Battle Formation, has been dated at 66 million years old. Later, deposition stopped in the area and some erosion took place, creating an *unconformity* in the geological record. Subsequently, large meandering rivers returned to the area, laying down sediments which formed the grey and brown sandstones and thin interbedded shale of the Frenchman formation.



About 65 million years ago, the dinosaurs became extinct, marking the end of the Cretaceous Period and the beginning of the Tertiary Period. During the Palaeocene Epoch, rivers and swamps continued to deposit sediments in the area, forming the sandstone, siltstone, coal and shale of the Ravenscrag Formation. Beginning about 55 million years ago, major mountain building to the west formed the Rocky Mountains. Large rivers eroded the new mountains and deposited gravel and cobbles across the western plains, which a semiarid environment had turned into a broad savanna. The uplift of the Sweetgrass Hills, around 50 million years ago, caused other rivers to carry the cobbles and gravel across the Cypress Hills area during the late Eocene, early Oligocene, and Miocene Epochs. The gravel and cobbles formed a conglomerate rock, called the Cypress Hills Formation - now the uppermost sedimentary layer which caps the Cypress Hills.

### Divide and Erode

Over time, geological processes slightly elevated the Cypress Hills region. The sedimentary layers remained nearly horizontal, but the area became a drainage divide. For millions of years, large rivers originating in the mountains were forced to flow around this divide, lowering the surrounding land and isolating the Cypress Hills as a high plateau. Resistant to erosion, the hard conglomerate cap protected the softer rocks of the underlying formations, ensuring that the area remained a flat-topped upland. Even before the Ice Age, the Cypress Hills had essentially developed their present form.

