

The Ni'iinlii Njik Caves, Northern Yukon



Notes on Geology and History

The Ni'iinlii Njik Caves, Northern Yukon

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Note: An asterisk (*) indicates an unofficial place name.

Front cover: Grande Caverne Glacée

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Place Names

K'aiiheenjik means willow river

Shih Ddhàa means Bear Mountain –
this is another name for Chii Ch'à'an Ddhàa

Chi'it'oo Choo Ddhàa – Big Nest Mountain

Ni'iinlii Njik – Fishing Branch River;
Sheenjik is another name for Ni'iinlii Njik.

Ch'oodèenjik – Porcupine River

Sriijaanjik Ch'à'an – Bluefish Caves

Ch'à'an means cave or den

Chii is rock/stone

Ddhah is mountain

Njik is river

K'aii is willow

Shih is grizzly bear

Ni'iinlii means spawning

Ch'it'oo means nest

Choo means big

Srijaa is grayling (bluefish)

Tsi tse han – researchers recorded this name from a Gwich'in elder in the 1980s but the meaning is uncertain. As a result, the name has not been transcribed into the modern Gwich'in spelling.

“[There are] a lot of sheep up there, a lot of wildlife, salmon spawn and they just gave it a name [official name] Ni'iinlii Njik [Fishing Branch] – [referring to] salmon spawning, that means replacing, it's a big high word I guess, and it's an area where everything gets replaced. So that's what it means, salmon go there to die, spawn and new life begins.”

— Stanley Njootli

Right: Ian Clark and Lance Nagwan at the mouth of Bear Cave, overlooking the Fishing Branch River.





Introduction to the Landscape

At 66° 30' north latitude, on the Arctic Circle, Ni'iinlii Njik* (the Fishing Branch River) nears its junction with the upper Porcupine River (Ch'oodèenjik). In this place is found a complex and fascinating landscape of limestone mountains, caves, sinkholes, and springs. The Ni'iinlii Njik region is a karst environment, shaped over millions of years by the action of water on the soft limestone bedrocks of the northern Ogilvie Mountains.

The two most prominent landforms of the Ni'iinlii Njik region are Chii Ch'à'an Ddhàa (Bear Cave Mountain) and Ch'it'oo Choo Ddhàa* (Big Nest Mountain—both are unofficial names) distinctive for the numerous caves and fissures that dot the mountain faces. At Chii Ch'à'an Ddhàa, where the Fishing Branch River nears the base of the mountain is a natural cold spring called Fish Hole, where the water remains unfrozen throughout the year. For millennia, both humans and bears have gathered at Fish Hole to take advantage of one of the latest salmon runs in North America. In winter, bears have long hibernated near Fish Hole, in the caves on Chii Ch'à'an Ddhàa. It is to these caves, especially Bear Cave (Chii Ch'à'an) at the summit, that long-ago hunters came in pursuit of bears, leaving traces of their passing in their turn.

Karst landscapes are formed by the dissolution of soluble rocks, such as limestone, by the action of water and are characterized by underground drainage systems with sinkholes and caves.



Left: Caves and fissures dot the slope of Chii Ch'à'an Ddhàa. Ian Clark photo

Top right: Chii Ch'à'an Ddhàa. Government of Yukon photo

Centre right: Ch'it'oo Choo Ddhàa. Base camp for 2008 investigations. Ilya Clark photo

Bottom right: Gully in Ch'it'oo Choo Ddhàa. Photo credit: Ilya Clark photo

Beringia

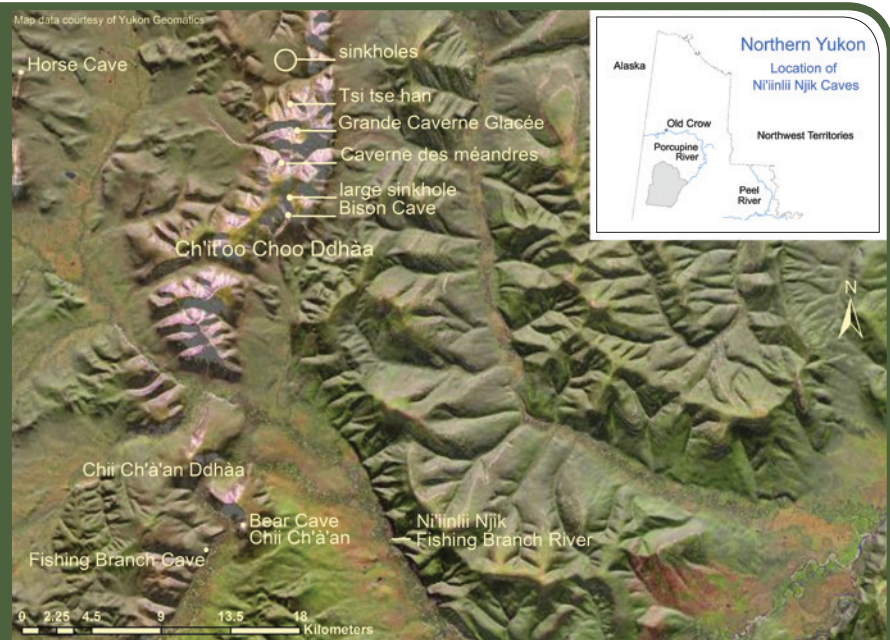
The last ice age (70,000 to 10,000 years ago) brought about a global reduction in sea levels by as much as 100 to 150 metres. While most of Canada was under massive ice sheets more than three kilometres thick, the region of Alaska and northern and central Yukon remained ice free. The low sea level exposed the Bering Sea floor, connecting the unglaciated regions of northeastern Asia and northwestern North America to form a single large landmass which is called Beringia.

Chii Ch'à'an and Ch'it'oo Choo mountains are within Eastern Beringia, the region of northwest North America which remained unglaciated during the last ice age. The cold, dry interiors of the caves of this region have in a number of instances preserved traces of the plant and animal life that once existed in ice age Beringia.

In the following pages, we explore the geological processes that created the unique landscape of the Ní'iinlii Njik region and that continue to shape it today. We'll also look at the initial discoveries of traces of human and animal presence in the caves which provide us with glimpses of the environments and lifeways of ancient times as well as the more recent past.



Fishing Branch, as
seen from Chii
Ch'à'an Ddhàa



Top left: A small cave which provides shelter for the bear's winter hibernation.

Top right: Inside the cave, a grizzly bear den.

Left: Caves in the Ni'iinlii Njik region



Formation of the Landscape

The bedrock of Chii Ch'à'an Ddhàa and Ch'it'oo Choo Ddhàa is limestone, which has its origins in the skeletal remains of marine organisms such as coral and molluscs which lived in the warm, shallow seas of the middle Devonian period. During the late Cretaceous and early Tertiary periods (the Laramide orogeny, ca. 65 million years ago), movements in the earth's crust caused folding and faulting which in turn created north-to-south "anticline" structures that now define the mountains.

The limestone anticline was exposed by the erosion or stripping of overlying layers of sandstone and shale by ancient rivers and streams which were likely ancestral to the Upper Porcupine River. Fishing Branch River and the tributaries of Cody Creek are now entrenched in the limestone anticline, dividing the landscape into several distinct areas.

The numerous caves perched on the slopes of the limestone mountains and hills are surviving karst features. The caves developed at or close to ancient water tables as a result of river and stream action at a time when permafrost was absent from the area. While the caves are ancient and inactive, sinkholes and springs ("fluviokarsts") are active karst features which occur in the region's forested valleys at the level of current water tables. The persistence of karst activity in the perennially-frozen ground of a permafrost zone is very unusual. This may be a result of water continuing to flow in karstic conduits (fissures, cracks and channels in the bedrock), maintaining ice-free conditions in the surrounding bedrock.

Left: Cave openings on a cliff in Ch'it'oo Choo Ddhàa. These openings are important shelters for birds.

Devonian – a geologic period in Earth's history between about 420-358 million years ago (mya). Known as "The Age of Fish", seed-bearing plants appear by the end of Devonian.

The end of the Cretaceous, ca. 66 mya, saw the mass extinction of dinosaurs.

Orogeny – refers to forces and events leading to a large structural deformation of the Earth's lithosphere (crust and uppermost mantle) due to the interaction between tectonic plates.

"Laramide orogeny" was a period of mountain building in western North America, which started in the Late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago.

Anticline - anticline is a fold in the lithosphere that is convex and results in the oldest beds being at the core of the fold.

In its 15 kilometre long course along the foot of Chii Ch'á'an Ddhàa, the channel of Fishing Branch River descends some 60 metres in elevation, from 500-440 metres above sea level.

The Fishing Branch River displays karstic behaviour, with stream water periodically disappearing into the gravels of the stream bed, only to re-emerge downstream. The stream is fed near its headwaters by a series of springs located at an elevation of 450 metres above sea level, opposite the foot of Chii Ch'á'an Ddhàa, below the entrance to Bear Cave. The springs contribute to maintaining ice-free conditions on this portion of the Fishing Branch River, which is called Fish Hole.



Fishing Branch, opposite the foot of Bear Cave Mountain. The water flow comes mainly from springs. Nicholas Utting photo

Spring below the cliff at the foot of Bear Cave Mountain. Nicholas Utting photo

Only underground water is flowing in the bed of Fishing Branch River in July 1987, just a few kilometres upstream from Chii Ch'á'an Ddhàa



The Modern Landscape

Collapses, sinkholes and springs are common features of karst landscapes where water action accelerates the solution and collapse of the surface bedrock, exposing underground openings, caves, lakes or streams.

Collapses

The karst landscape continues to evolve in the Ní'íinlii Njik region, and there is every likelihood of discovering new caves. Collapse occurs as a result of ongoing water action in underground or interior openings within karst formations. Generally, the collapse dimensions are restricted to several cubic metres. The resultant opening is often filled with large blocks of limestone, ice or snow, which prevent exploration. Sometime around 1990, for instance, a collapse opened a 50 metre deep shaft, 100 metres downslope of Bear Cave. The shaft was first investigated and mapped in 1994. A very large room measuring 30 metres long, 20 metres high and 10 metres in width was explored, one of the largest in the region. However the shaft was full of ice a few years later and the room was inaccessible for further exploration.



Collapse on the slopes of Chii Ch'á'an Ddhàa



Sinkholes

In regions of continuous permafrost, the movement of groundwater outside of the active layer is generally prevented by ice. However, sinkhole formation in northern karst settings can occur where conditions are favourable. With sufficient flow, water heated by solar radiation in the summer can maintain a positive temperature over its course. Where fissures or openings in the bedrock are wide and the flow is vertical, water can circulate and contribute to erosion. This process can be seen to the north of Ch'i Ch'à'an Ddhàa where two small streams have disappeared into dolines. Each doline is approximately 20 metres deep and equally wide. On Ch'it'oo Choo Ddhàa, a sinkhole measuring 50 metres wide and 15 metres deep has been observed. A snow bank occupies the bottom of the sinkhole.

Far left: Large sinkhole near Ch'it'oo Choo Ddhàa

Left: Large sinkhole near Ch'it'oo Choo Ddhàa

Below: A snow bank occupies the bottom of the sinkhole

Bottom right: Sinkhole in the forest

Active layer – a layer of soil, rock or sediment which freezes and thaws annually.

Permafrost – soil, rock or sediment that remains frozen for more than two years in a row, lying beneath the active layer.

Doline - in limestone regions, a shallow, usually funnel-shaped depression of the ground surface formed by solution (the action of water dissolving the limestone).





Springs

Water enters mountain surfaces via the active layer which thaws annually. Water is also found at depth in the continuous permafrost zone. Regardless of its origins, water feeds the phreatic zones, which in turn supply the natural springs at valley bottom. The magnitude of flow in the series of springs at the foot of Chii Ch'á'an Ddhàa is sufficiently large as to prevent water from freezing despite the very low temperatures that can occur in this region.

Left: Ephemeral spring. After a rain, water flow springs from the active layer on *Ch'it'oo Choo Ddhàa* plateau
Below: Perennial spring in the Fishing Branch valley bottom

Phreatic zone – term used in hydrology to refer to aquifers. In speleology, the study of caves, phreatic zone refers to the movement of water in cave passages.





The Ni'iinlii Njik Caves

The limestone formations of the Ni'iinlii Njik region are dotted with a multitude of caves and rock shelters. Most are small, shallow openings in the limestone but a number of larger caves have been identified. Caves are often ideal natural laboratories for research into past environments and human activity, particularly in the

northern Yukon which was part of ice age Eastern Beringia. Interior conditions make caves ideal environments for the preservation of organic remains, such as animal bones or plant remains, as well as tantalizing traces of human activity.

Charcoal and red staining on the ceiling of a small cave on Chii Ch'áan Ddhàa are signs of human activity

Left: Small, shallow openings in the limestone

Far left: View from the interior of the largest cave in Ch'it'oo Choo Ddhàa

Below: Organic remains (mainly animal bones) found inside a cave



Dagoo country and Van Tat Gwich'in country

“...from Bell River up towards Blackstone, right up to Fishing Branch [River] and Miner River and across to the head of Cody Creek, all this was Dagoo Country. That’s where they used to make their living... Crow River right up to Bell River, right across [to] the head of Bluefish [River], right down to the border around Rampart House, right up to the head of Caribou Bar and back this way: that’s Van Tat Gwich'in country... They covered the whole thing. So that’s how people used to keep their land. Every year they used a different place so this country has never been without people...”

— Alfred Charlie 1995 in VGFN 1995B:4

The country of the upper Porcupine River was traditionally an important resource area for Dagoo Gwich'in. Two villages, Johnson Village and Whitestone Village were located here, along with numerous camps. The limestone mountains were home to large sheep populations and the late salmon run in the Fishing Branch River drew both people and bears to Fish Hole in the late fall. When geologist William Ogilvie travelled through this country on an exploratory journey in 1888, he noted numerous old fish drying racks at the mouth of the river he named the Fishing Branch River. He was told that people had not hunted in this country for some years. The appearance of Hudson’s Bay Company trading posts on the Peel River (Fort McPherson) and at the mouth of the Porcupine River in the mid-19th century is almost certainly the reason people were not present at the time of Ogilvie’s visit.



Tor

Tors are large, free-standing rock outcrops at the crest of a ridge or mountain top, created by erosion.

Chii Ch'á'an Ddhàa Caves

Chii Ch'á'an Ddhàa measures five kilometres by four kilometres in area and rises to an altitude of 990 metres. The principal caves are found along the foot of the cliffs and in a few outlying tors. Twenty rock shelters plus Bear Cave itself have been discovered at elevations ranging between 800 and 950 metres above sea level. The progressive retreat of the limestone slopes has truncated many caves that were once much more extensive. Bear Cave itself preserves some substantial length: its 220 metres of mapped galleries consist of two entrances and three chambers, connected by narrower passages. It is nearly horizontal and 450 metres above the modern river valley.

Right: Aerial view of Chii Ch'á'an Ddhàa. Government of Yukon photo

Below: At the summit of Chii Ch'á'an Ddhàa. The cairn marks the Arctic Circle. Ian Clark photo





Speleothems and Caves

Characteristic of many of the caves in the Ni'iinlii Njik region is the presence of speleothems (stalagmites and flowstone) covering the walls and especially the floors of the chambers, attaining in places a maximum thicknesses of four metres. In some instances, these concretions have formed over silt and occasional gravel deposits, remnants of the ancient rivers and streams which originally created the caves. Speleothems form in warmer and more humid conditions than are present in the area today. Speleothems can be used as indicators of climatic changes, and in this region preserve a record of environmental and paleoecological conditions throughout much of the Tertiary and Quaternary Periods. Formation of speleothems largely ceased with the appearance of permafrost in the region prior to 1.25 million years ago.

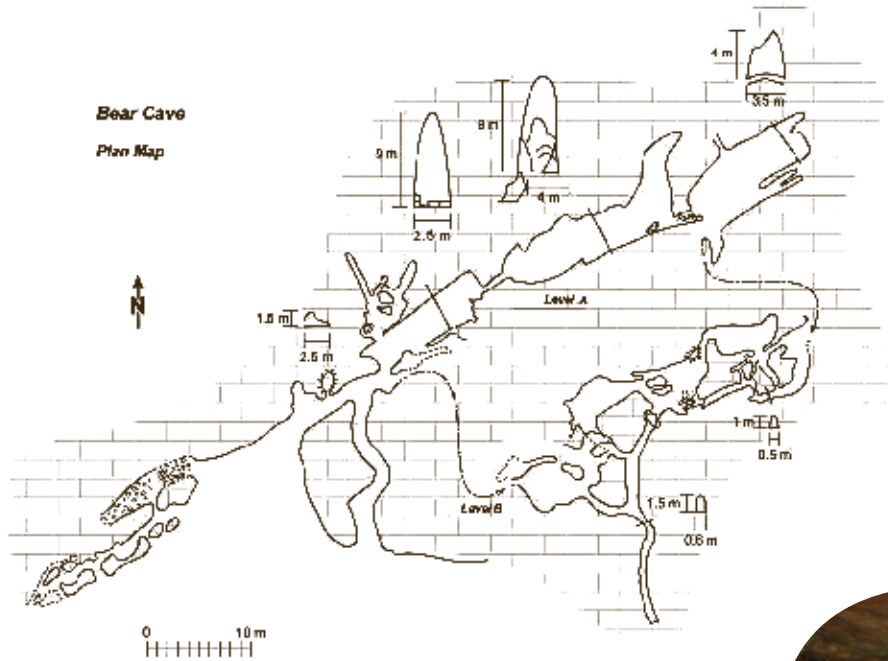
Bear Cave (Chii Ch'à'an)

Bear Cave is located near the summit of Chii Ch'à'an Ddhàa, directly above Fish Hole on the Fishing Branch River. Three main chambers have been mapped for the cave: the First Chamber, or Speleothem Cave, is accessible through both entrance passages and measures about 10 metres long, five metres wide and nine metres high. As implied in the name, "flowstone"—a type of "speleothem"—is common on the walls and ceiling of the chamber, and fragmented and blocky flowstone litters the floor. Thin, wet organic material occurs in pockets on the floor of the chamber with small wood pieces, the result of generations of porcupine residency.

The Second Chamber or Ice Cave is reached through a short narrow passage and measures 20 metres long by eight metres wide and more than 10 metres in height. Clear pillars of ice rise from the floor of the chamber, and ice crystals coat the ceilings and walls, and in places are so thick as to form drapes.

The Last or Third Chamber is now accessible only through a passage off the First Chamber. When Alaskan naturalist Otto Geist visited the cave in 1953, he reached this room through a passage from the Ice Cave, which was blocked by ice in 1997.

The Third Chamber measures about 15 metres long, seven metres wide and about five metres high. This is a cold cave, without appreciable ice formation. Spectacular and unusual large flowstones and popcorns occur on the walls and ceiling of the chamber, and blocky speleothem fragments are common on the floor.



Many speleothems have undergone extensive shattering, likely as the result of earth tremors and earthquakes, and to a lesser degree, frost action.



Top right: Ice formation inside Bear Cave
Right: Ice plug blocking entry to Third Chamber from First Chamber. Ilya Clark photo





Left: Bear Cave entrance.
Government of Yukon photo



Centre left: First Chamber and a large broken flowstone on the left



Bottom left: In situ flowstone at 3 m above the floor in First Chamber

Bottom right: Lance Nagwan entering the Second Chamber



Dagoo explored the bear caves

“ This land, this Chii Ch’a’an ..., long ago when the Dagoo ran out of food, they searched all over. When they could hunt no more on the land they knew there was lots of meat here. They fished here and there was a shih who also came for the fish. They saw its tracks and followed it and they were able to find this cave. They went into the cave. ... They couldn’t see so at nighttime they crawled in and felt their way around. They say that a shih doesn’t attack in its own den. I wonder who, one of them felt around and felt the shih ear. He asked for a gun. They gave him a gun and he held up its ears and below that he shot. They tied a rope around its neck and pulled it out.

They cut it up and went back home with it.

The next day, they had a feast with the shih and the following day, they came back here. Down at the river, they cut wood and brought it all up [on the mountain].

They made wood shavings and fire sticks and walked inside the cave with them. They found another one, another shih and killed it. They pulled it out. They lived off it. While they were there, they became curious and went back inside the cave. They lighted the wood shavings — it must have lighted very little.

The story goes that there was everything in there. There was a table, chair, they felt around for all that was in there. What Dick [Nukon] said before, one man felt around alongside the wall, and felt something like fifty-pound flour sacks piled along there. This is all the story. Back a ways, there was a back room too, they said. They walked all around inside. Right now, today, it’s really dangerous [cave-ins]. “

— Alfred Charlie at Chii Ch’a’an, 29 July 2000



Otto Geist provided the first written description of Bear Cave. Geist visited the cave between August 25 and 27, 1953, accompanied by John Nukon, Peter Lord, and Alfred and Donald Frost, all Gwich'in men from Old Crow, Yukon. Geist was guided to the location by John Nukon, who had visited the cave as a boy 53 years prior.

According to John Nukon, Tetlit Gwich'in from Fort McPherson had discovered the cave in 1900 during a grizzly bear hunt. The hunters had followed bear tracks up the mountain through the snow, and found the tracks ended at the cave. The following is from Geist's recounting of the event that John Nukon described to him:

"Food was scarce, and the hunters knew that if they once entered the cave, the bear would be theirs. But to go into an unknown cave not only was difficult, but as they crawled through the portal, they found the interior to be pitch dark. To get light into the cave, they had to gather wood from the timberline, carry it uphill first, then down into the cave. First, firebrands had to be whittled for lighting the cave. By now the hunters had penetrated into the cave far enough to find not one grizzly bear, but two, both curled up and sleeping. The animals had no doubt started to hibernate. Both grizzlies were killed, and the carcasses were pulled up the slanting spruce saplings which also had been carried up to the cave from the timber below."



Top Right: Passage inside Bear Cave.
Government of Yukon photo

Centre right: Bernard Lauriol holding one of
the torches abandoned by Otto Geist's party
inside Bear Cave in 1953. Luc Carrier photo

Bottom right: Wood left behind
in a passage in Bear Cave

Left: Jacques Cinq-Mars with Charlie
Peter Charlie and Donald Frost at one
of the entrances to Bear Cave, 1997.

Ice in Caves

The ice in Bear Cave and in other caves in the region is a consequence of permafrost and its distribution is related to a “topoclimatic zonation” inside the caves. In general, near the entrance (Zone 1) both air and ground temperature are above 0°C and relative humidity is around 80%. Further inside the cave (Zone 2), relative humidity is near 100%, temperature near the floor is below 0°C and above 0°C at the ceiling. In this zone the ice is abundant. At the deepest points in the cave (Zone 3), the air temperature is around -2°C and humidity 65% or less. The walls are dry. The low water vapour in Zone 3 is explained by the fact that the atmosphere loses an important part of its humidity in Zone 2 as the air flow travels from outside and condenses on the walls. This dynamic air circulation occurs only in summer since snow tends to block the entrances in winter.



John Nukon's story provides the explanation for the presence of cut spruce and poplar trees concentrated in the passage between the Speleothem Cave and the Ice Chamber (Second Chamber), and in the passage to the Third Chamber. The cut trees, according to Geist's recounting of the tale, were used as "ladders" to access the chambers of the cave at different levels, and to assist in pulling the bear carcasses up from lower levels of the cave.

Radiocarbon dating of the wood by University of Ottawa researchers reveal the logs date between 8,000 and 8,850 radiocarbon years before present. These dates indicate bear hunting activity not only in historic times, but in ancient times as well. Researchers also found items left from Geist's 1953 visit to Bear Cave, including a whittled wooden torch, John Nukon's 'shiner' lamp (a clean gallon can with a candle for light), and forgotten film rolls beneath 10 centimetres of ice in the Second Chamber of the cave.

Far left: Ice stalagmites in the Second Chamber

Top left: Ice and concretions in the Second Chamber

Centre left: Hoar frost on the ceiling and a broken stalagmite on the floor in the Third Chamber. The stalagmite lies on a 4 metre thick flowstone.

Bottom left: Popcorn formations on the wall in the Third Chamber

Far right: Ian Clark sampling wood for radiocarbon dating



Massive ice blockage in caves

The presence of warmer air in the interior of caves, near the ceiling, results in melting of the hoarfrost. Water droplets falling onto the cave walls form ice curtains, and on contact with the cave floor, ice stalagmites. This phenomenon occurs a few meters from the entrance if the cave has a diameter less than 1 m. If the diameter is around 2-3 m they are at 30-35 m from the entrance and if the diameter is around 4-5 m, the ice formations are located at 100 m from the entrance. The formation of massive ice blockages correlates closely with climatic change. Radiocarbon dating of wood and small animal carcasses encased in ice blockages indicate these features formed in the colder and wetter conditions that have prevailed in the past 2,000 – 3,000 years.



Ch'it'oo Choo Ddhàa Caves

Ch'it'oo Choo Ddhàa measures approximately 20 kilometres north to south and about five kilometres east to west. It rises to an altitude of 1219 metres which is 500 to 600 metres above the surrounding lowlands. Large and small sinkholes and short horizontal caves are common at various levels in the gully walls of the mountain. A large and rather spectacular sinkhole is southeast of Tsi tse han cave, which indicates ongoing karstic activity in the region. Tsi tse han cave is one of the most interesting caves ever discovered in Ch'it'oo Choo Ddhàa.

Tsi tse han Cave

Tsi tse han cave is located near the northern end of Ch'it'oo Choo Ddhàa at an elevation of 750 metres above sea level, and is one of the few large caves of the formation with a mapped horizontal extent of 50 metres. The main chamber of Tsi tse han is a room about 18 metres long, six metres wide and about two to three metres high. Two corridors are present at the rear of the main chamber: a short passage which is obstructed by ice, and a longer passage, about 10 metres long by one metre wide, which ends in a small chamber, measuring about 10 metres long by six metres wide and about two metres high. Access to the second chamber was blocked by ice in 1997. Beyond the second chamber is a narrowing in the rock which appears to lead further on to other openings. The walls of the second chamber are well decorated with speleothem deposits (principally flowstone), although less massive than those in Bear Cave. A layer

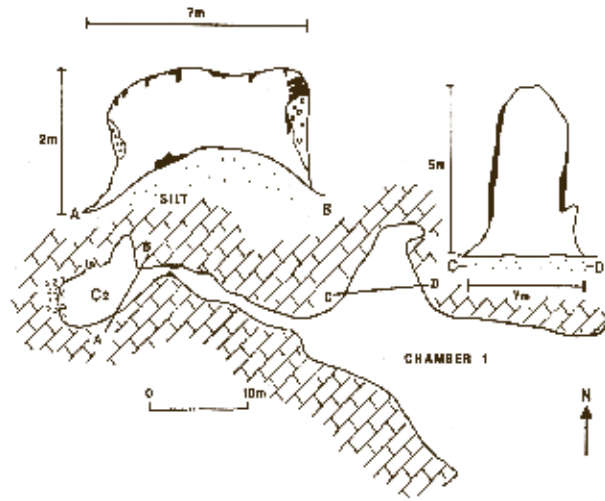


Top right: A snow patch marks the location of Tsi tse han cave.

Centre right: Entrance to Tsi tse han cave

Bottom right: University of Ottawa researchers sampling sediments and recording temperature/humidity inside Tsi tse han cave. Government of Yukon photo

Left: Lance Nagwan with the shiner lamp left behind in Bear Cave by his great-grandfather John Nukon



of wet, muddy silt covers the floor of the main chamber. The rear chamber floor is under a layer of clay, with numerous cracks due to the arid conditions within the interior of the cave.

There is evidence of hunters sheltering in the cave on at least one occasion in the past: limestone blocks were used to construct a low dry stone wall approximately 30 to 50 centimetres high across the mouth of the corridor. Five spruce trees were cached behind the wall. The trees were unburned, but may have been stored as firewood. Wood from one of the spruce trees was radiocarbon dated to about 700 years before present. Human presence is also evident in a streak of red paint 10 centimetres long at the entrance of the cave's rear chamber, at the end of the corridor. Analysis of a sample of the paint indicates it was made from organic material, possibly the local lichen. Lichens are responsible for the appearance at times of extensive staining on exposed limestone.



Above: Map of Tsi tse han cave interior
 Top left: Spruce trees behind dry stone wall.
 Sawn portion of one tree removed for radiocarbon dating. Government of Yukon photo
 Left: A small streak of red paint

In the second room, the floor is covered by silts. There are six large pebbles lying on the floor to form a circle. Is the origin of the circle natural, or is it human-made? It is difficult to answer; however, a torch found near the entrance suggests that people once visited the darker places in the cave. The torch consisted of a stick of spruce wood 90 centimetres long that served as a support for flammable material. The torch was not dated but did show signs of being carved by an iron tool indicating that it is no older than the mid-19th century.

Also recovered at Tsi tse han cave were porcupine fecal remains dating to 4270 years ago, and two caribou femurs in the outer room, which may indicate carnivore use of the cave.

Bison Cave

Bison Cave, located near the southern end of Ch'it'oo Choo Ddhàa, is a small shelter about five metres long and one and a half metres wide, and about two metres high. The flat floor is



Right: Bernard Lauriol evaluating the potential of Bison Cave for future palaeontological research.

A bison tibia lies in the foreground.

L. Carrier photo

Top: Bernard Lauriol at the entry to Bison Cave



comprised of about 10 centimetres of loess (wind-blown silt) with blocks of limestone rubble. The cave is of interest principally for its palaeontological remains. Very well-preserved bison and horse bones were recovered on the floor inside Bison Cave. Bone identifications and dates are as follows:

Specimen	Element	Date
Horse (<i>Equus cf. lambei</i>)	cervical (5th? vertebra)	
Horse (<i>Equus cf. lambei</i>)	right tibia (subadult, lacking both epiphyses)	
Bison (<i>Bison priscus</i>)	right humerus (carnivore gnawing at proximal end)	12,960 BP
Bison (<i>Bison priscus</i>)	right humerus (proximal end missing due to carnivore gnawing)	13,135 BP
Bison (<i>Bison priscus</i>)	left tibia	
Bison (<i>Bison priscus</i>)	left astragalus (ankle bone)	
Bison (<i>Bison priscus</i>)	left metatarsal (canon bone)	13,040 BP

Grande Caverne Glacée

Grande Caverne Glacée, one of the larger caves in Ch’it’oo Choo Ddhàa, also contains well-preserved organic remains. A spruce wood fragment embedded in ice was recovered here, and dates to 7350 BP. The carcass of a mouse that dates to more than 100 years old was also found in the cave.

Left: Ice stalagmite measuring 1.5 m in height



Meander Cave

Meander Cave is notable for the evidence of animal habitation. Mummified mouse remains and bear fecal remains were recovered inside Meander Cave, below the ice plug which blocks the end of a passage littered by broken concretions. The fecal remains were dated from 37,000 to 38,000 years old. Pollen and plant remains within the sample revealed a diet composed primarily of juniper. This plant is abundant in the valleys, at the base of the south facing slopes. What is intriguing, however, is that modern bears do not feed on juniper, as it is toxic to them. Therefore, the fecal remains are thought to belong to the extinct short-faced bear (*Arctodus simus*), which disappeared from Beringia at the end of the ice age.

Left, from top to bottom:

Meander cave entry

Ice plug (undetermined thickness) blocking cave access at 45 m from the entrance

Lance Nagwan sampling the ice plug

Carcass of a small rodent lying on the ice floor in front of the ice plug. Ilya Clark photos

Right: Researcher Caroline Duchesne in front of the ice plug in Meander Cave





Far left: View from interior of Meander Cave; left: Lance Nagwan stands at the entry to Meander Cave

Opposite page, clockwise from top left: The 25 m long and 0.3 m high passage below the ice plug in Meander Cave

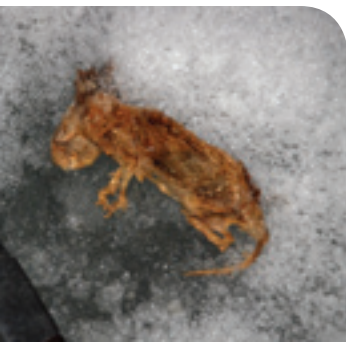
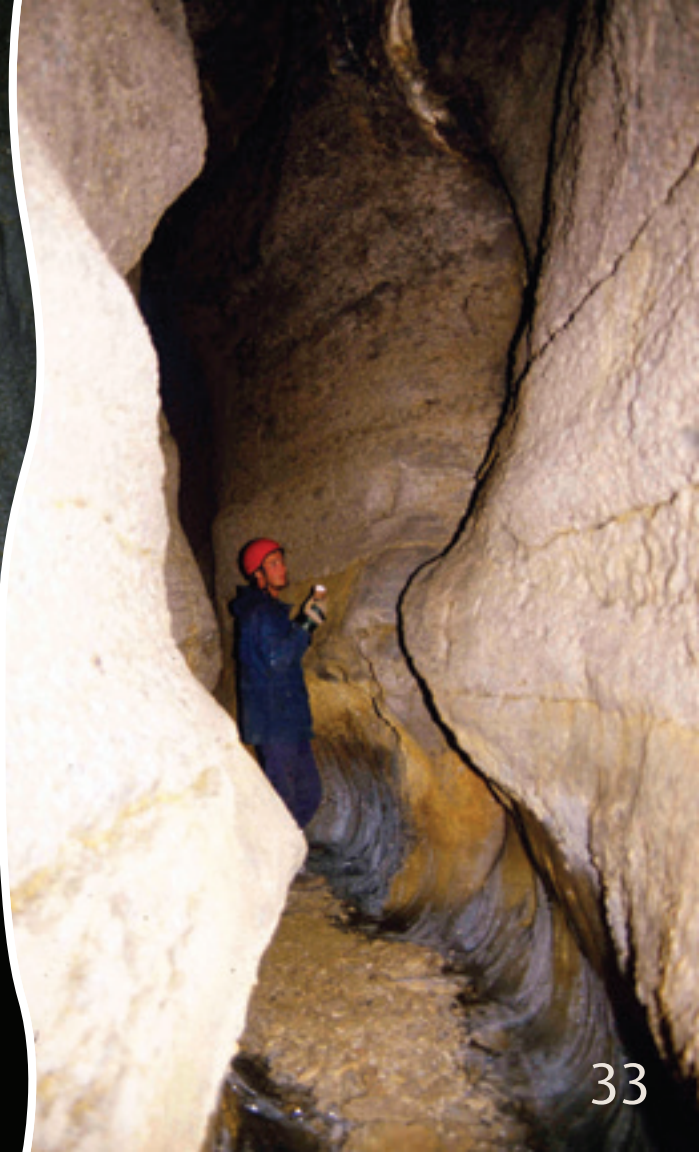
Peter Charlie assisting in mapping of Meander Cave

A mummified mouse collected in the passage below the ice plug

A mummified mouse recovered partially embedded in the ice plug in Meander Cave

Far right: Passage inside Meander Cave







Left: Aerial view of Fishing Branch cave
Below: Adze-cut logs at the mouth of Fishing Branch cave
Government of Yukon photo



Fishing Branch Cave

About three kilometres southwest of Chii Ch'áan Ddhàa on the Fishing Branch River is a small cave situated at the base of a limestone outcrop. A notable feature of the site is the presence of approximately 25 stone adze-cut logs at the mouth of the cave. The interior of the cave is about 10 metres in length, about one metre wide and one metre in height. The cave floor is comprised of wet organics, principally porcupine feces and small wood pieces. Some of the wood was dark in colour but, due to the state of preservation of the wood, it could not be determined if this was a result of organic staining or a result of burning. No other traces of human activity were noted inside the cave. It is likely the cave was used as a meat or fish cache at one time. Dendrochronological estimates suggest that the wood dates from the early to mid-eighteenth century.

Notes on Various Discoveries in the Caves of the Ni'iinlii Njik Region

Additional faunal material from cave sites in the Ni'iinlii Njik region includes a mammoth bone recovered on the surface inside a cave in Ch'it'oo Choo Ddhàa, and a Dall's sheep skeleton 20 metres inside Caverne de la Chèvre.

Bird and small mammal remains have been recovered as well in caves in the Ch'it'oo Choo Ddhàa and Chii Ch'à'an Ddhàa. On a limestone formation some 15 kilometres west of Ch'it'oo Choo, a single horse bone was recovered in a small excavation at the mouth of a small cave.

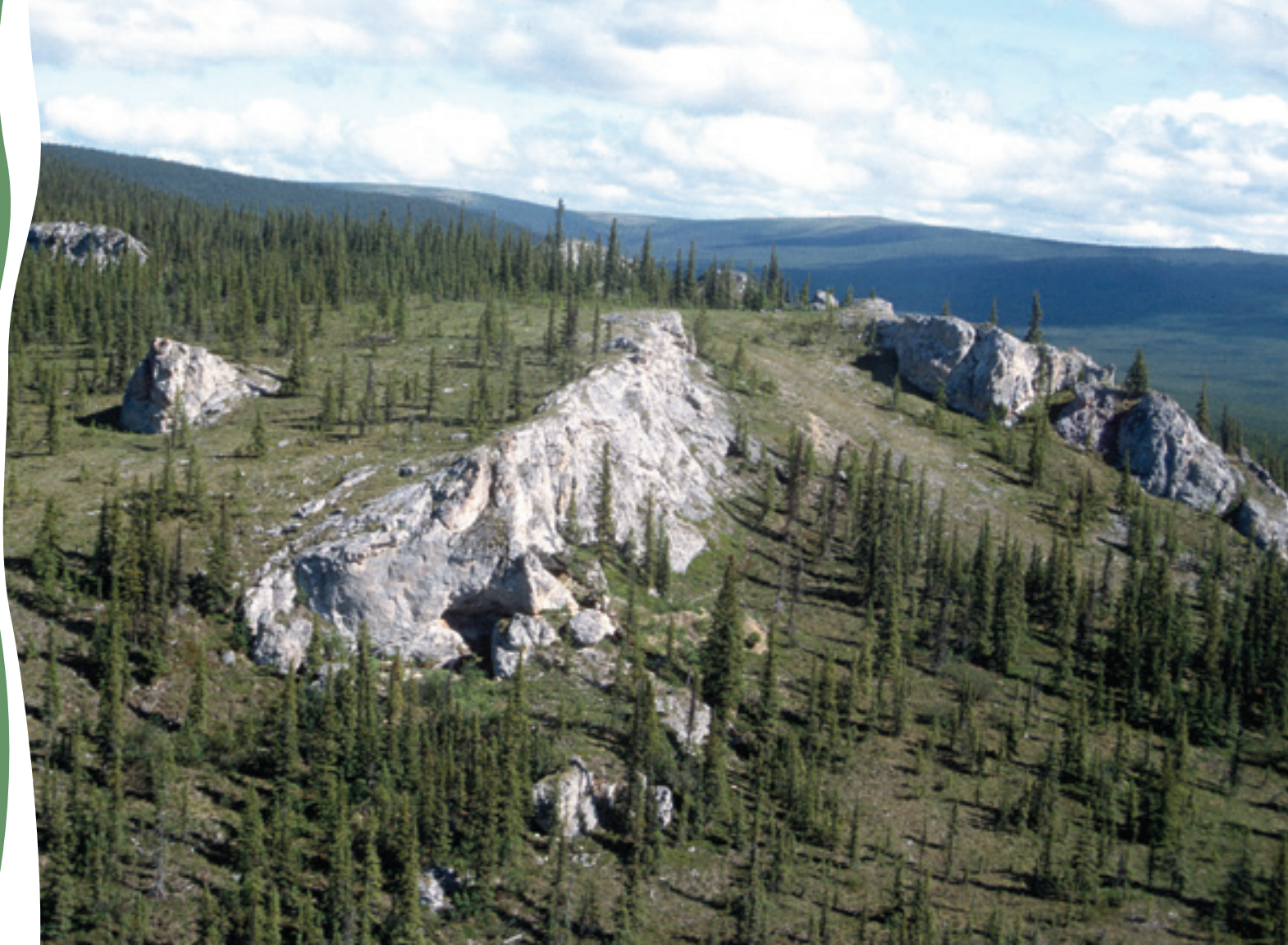
Dated specimens recovered from caves in Ch'it'oo Choo Ddhàa include:

Specimen	Location	Date
<i>Marmota</i> sp. carcass	Grande Caverne Glacée	70+/-50 BP
<i>Erethizon</i> faecal remains	Tsi tse han cave	4270 +/-70 BP
<i>Picea</i> sp.	Grande Caverne Glacée	7350+/-70 BP
? <i>Arctodus</i> faecal remains	Meander Cave	37,940+/-460 BP
<i>Rangifer</i> sp. bone fragment	Incredible Cave	2130+/-40 BP
<i>Rangifer</i> sp. bone fragment	Incredible Cave	2920+/-40 BP

Dendrochronology – dating technique based on counting of annual growth rings in trees.



Right: Luc Carrier holding mammoth bone discovered in a cave on Ch'it'oo Choo Ddhàa.



Cave studies and the record of past climate, animals and human history

The best known examples of past environments and human history preserved in caves are the Bluefish Caves (Sriijàanjik Ch'á'an), located on the Bluefish River about 50 kilometres south of the community of Old Crow. These are small, shallow rock shelters where the deposition of wind blown silts during last glacial period was instrumental in the preservation of an important record of faunal and floral remains, all dating between about 13,000 and 25,000 years ago. Ice age vertebrates from Bluefish Caves comprise 35 mammal species and 23 bird species, as well as fish and a single amphibian. Traces of some of the earliest human presence known in North America, dating back



Left: Aerial view of Bluefish Cave.
R. Gotthardt photo

Right: Excavations of bone bed lying outside of the mouth of Bluefish Cave 1. R. Gotthardt photo

13,000 and possibly as old as 25,000 years have also been recovered from the caves.

Where similar conditions can be found, other caves might be discovered that contain equally rare but important traces of past environments, animals

and human populations. For the time being, however, the caves of northern Yukon and the Ni'iinlii Njik region specifically, safely shelter the record of the past in their frozen sediments and in the frozen chambers deep within their interiors.



The Story of K'aiiheenjik (Willow Man) at Chii Ch'á'an Ddhàa

K'aiiheenjik was a man who lived with his people, the Van Tat Gwich'in, in the region of Crow Flats. K'aiiheenjik was known amongst his people to be a "superman" and a great hunter. K'aiiheenjik was of enormous strength and stature.

In the legend, K'aiiheenjik made war on the people who killed his brother. After K'aiiheenjik killed many people, the remaining Van Tat Gwich'in banded together to find K'aiiheenjik and kill him. A scouting party passing through the mountains spotted a number of mountain sheep drinking water from a stream. Suddenly an enormous man stepped out of the bushes and killed a sheep with a single blow of his club. When they saw him pick up the sheep's body and carry it away under one arm, they knew that it must be K'aiiheenjik. A war party was formed to ambush K'aiiheenjik. K'aiiheenjik killed dozens of the warriors with his club before he fled, his enormous body full of arrows. K'aiiheenjik came to a high bluff which he climbed. After he had reached the summit, he looked down at his pursuers. Before his pursuers' eyes, K'aiiheenjik defiantly broke off the arrow shafts which still protruded from his body and built a small fire with them. K'aiiheenjik sat down to rest beside his fire. After a while, as the people below watched, K'aiiheenjik slumped over and collapsed.

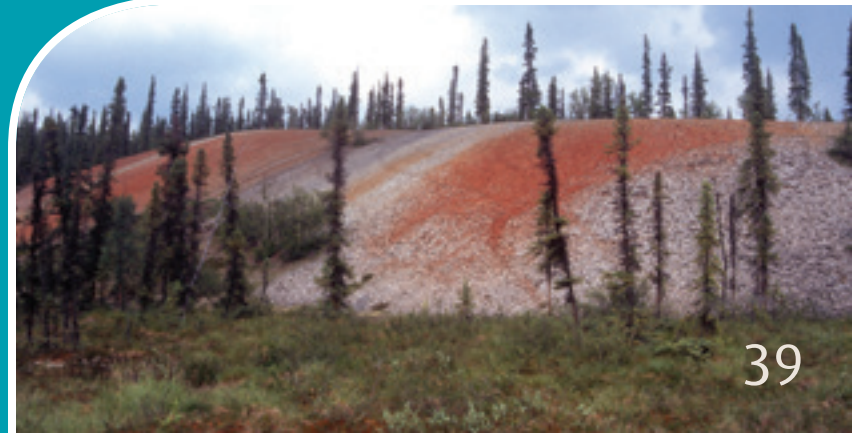
Bear Cave near the summit
of Chii Ch'á'an Ddhàa.
Government of Yukon photo

Everyone thought that he had finally died from his arrow wounds. Two brave young men climbed up to check. When they reached the summit, K'aiiheenjik sprang up and grabbed the young warriors under each arm and jumped backwards off the cliff. On the way down the cliff face, a sharp rock ripped open K'aiiheenjik's belly. When he reached the bottom of the cliff his pursuers, who had waited below, rushed towards him. As they approached, K'aiiheenjik reached down with his hand and disemboweled himself, and with his last dying strength, heaved his guts into the river as a gesture of disdain. Thereupon he died before his pursuers could reach him. Those blood stains on the face of the cliff and at the bottom remain there even today in the form of streaks of red rock and to this day the river does not freeze over in that place where he threw his entrails.

That is the story of how the red stained rocks and never freezing area of the river came to be at a bluff called "K'aiiheenjik Bluff".



Right and far right: Ochre Hill: A hill stained with red ochre lies south of Bear Cave Mountain and would have been a distinctive landmark for travellers in the past. Government of Yukon photo





University of Ottawa
researcher entering
Tsi tse han. Government
of Yukon photo



University of Ottawa
researchers camped
on Ch'it'oo Choo Ddhàa,
2008. Ilya Clark photo

Right: View from top of Bear Cave Mountain/Chi Ch'á'an Ddhàa down to the Fishing Branch River/Ní'inlii Njik.
Government of Yukon photo





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Top left: Ilya Clark photo

Bottom left: Ian Clark in Bear Cave, Second Chamber

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Left: Caverne de la Chèvre. Ilya Clark photo

Right: Caverne de la Chèvre

Back cover: Interior passages of Caverne de la Chèvre



