

## A Summer Activity during your stay in the Platinum Suites at the Grand Canadian



Figure 4. Entrance Sign at the intersection of Three Sisters Drive, Three Sisters Park Way and Peak Drive

### Magical hike to Canmore

Downtown Canmore is just a few minutes from the Grand Canadian Resort when driving by car. But there is a truly magical hike suitable for young and old from the resort to downtown Canmore. When it is wet and slippery the hike is somewhat challenging and quality hiking boots with good profile would be required. A skilled mountain biker can do the trip by bike, but the keyword is 'skilled'.

The hike leads you through shaded forest and warm river plain. Parts that are steeper have often stairs that go up by a maximum of 5m (30ft). There is a lot to see along the trail ranging from a numerous species of flowers to rocks with petrified wood. Whether coming from Canmore or from the resort direction, there are plenty of vistas and picturesque photo opportunities.

The trail is one of a myriad of trails that lead along the mountain slope up to Three Sisters Drive or down to the river plain. With many houses nearby, normal wildlife precautions should be more than adequate for safety. A map, marking the main trail is shown on the next page (Fig. 5).

Below is a route description or 'trail log' starting at Grand Canadian Resort' and ending on the intersection of Main Avenue and 8<sup>th</sup> Street in downtown Canmore. The hike would take an adult about 30 minutes to complete. When with smaller children the hike may last a fair bit longer depending on the number of flowers and playgrounds. From Canmore back to the Grand Canadian Resort, the trail is mostly uphill and a bit more demanding lasting at least 40minutes (unless you're an Olympian); with small children, arranging a pickup in downtown Canmore may make life a lot more pleasant – the trail is mostly in cell phone coverage. Also, we recommend a water bottle and suitable head covering (a Calgary Flames cap would be very fitting) on hot days. We wish you a very pleasant hike.

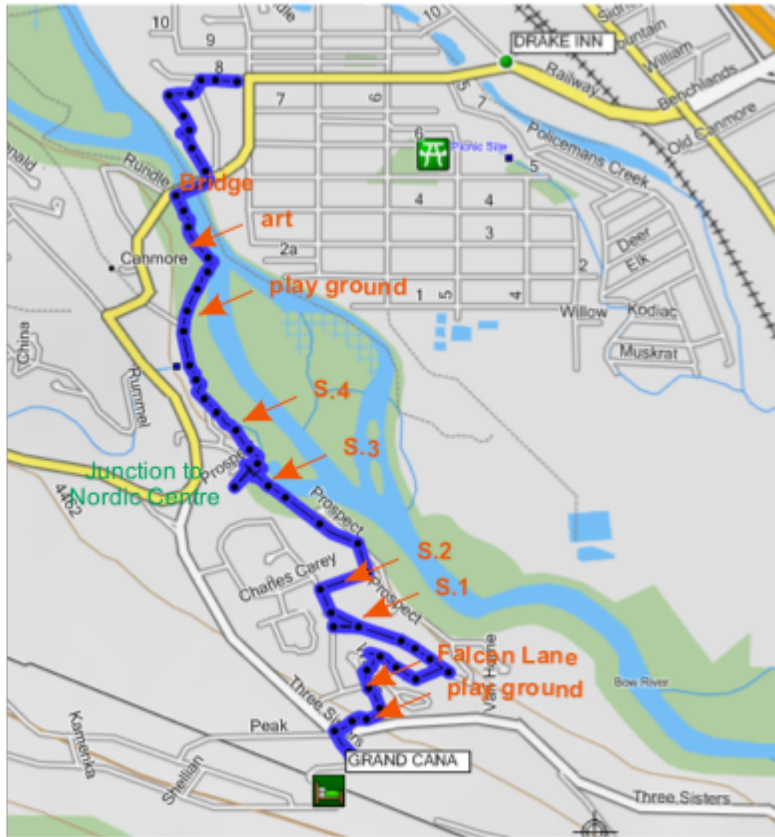


Figure 5. Map with route of Magic Trail and some of its many points of interest.

#### Trail Log:

0m - Starting in the Grand Canadian Resort lobby. Upon exiting the building walk to the right across the parking lot past WorldMark to the intersection of Three Sisters Drive, Three Sisters Parkway and Peak Drive. Use the pedestrian crossing to the pathway on the other side of the Three Sisters Parkway. Follow the paved walking path to the right. Follow the gravel trail that splits off from the path towards the right (Fig. 6). If you and your children wish to be in downtown Canmore don't get tempted by the playgrounds.



Figure 6. Turn right on to small gravel path to playground.

300m - The gravel path leads you in a large semi-circle past a residential area. At the Falcon Lane, the path becomes residential road (Fig 7). After about 80m, a grassy area with a small gravel path splits off to the right (towards the river) – follow the path.



Figure 7. The hiking path ends on a residential road, right at the intersection with Falcon Lane. Cross Falcon Lane, and follow the public road for approximately 80 meters until you see a small path on your right through a grass field.

In summer you will see many flowers along the trail. Try to recognize some of the ones photographed below.





Figure 8. Wildflowers along the trail in late August.

Canmore is located in a geologically very interesting area. When you enter the Rockies using Highway Number One from Calgary, you must have noticed Mount Laurie also known as Mount Yamnuska. McConnell and Dawson two pioneer geologists from the 19<sup>th</sup> Century recognized here for the first time the concept of Thrust Faults (Fig. 9) The flat triangle of white rock are limestones and dolomites formed in shallow seas with reefs some 500 to 550 million years ago (Eldon Formation). Below in the mountain's scree slopes are shales and sandstones that are 'only' 60 – 150 million years ago (Belly River Formation). Those sandstones and shales were formed in coastal plains where all kinds of rivers flowed in a mediterranean type of climate. These are rocks are similar in character and age as those in the Badlands of Dinosaur Park in Drumheller.

So how can 500 million year old rock layers occur above much younger rocks? That is what McConnell and Dawson also wondered about. They realized that there was a large fault in between both rock formations right at the top of the scree slope and below the white cliffs (Fig. 9). The fault plane dips very little and is nearly flat. The McConnell Thrust is the first of six major thrust faults that form the front ranges of the Rocky Mountains.

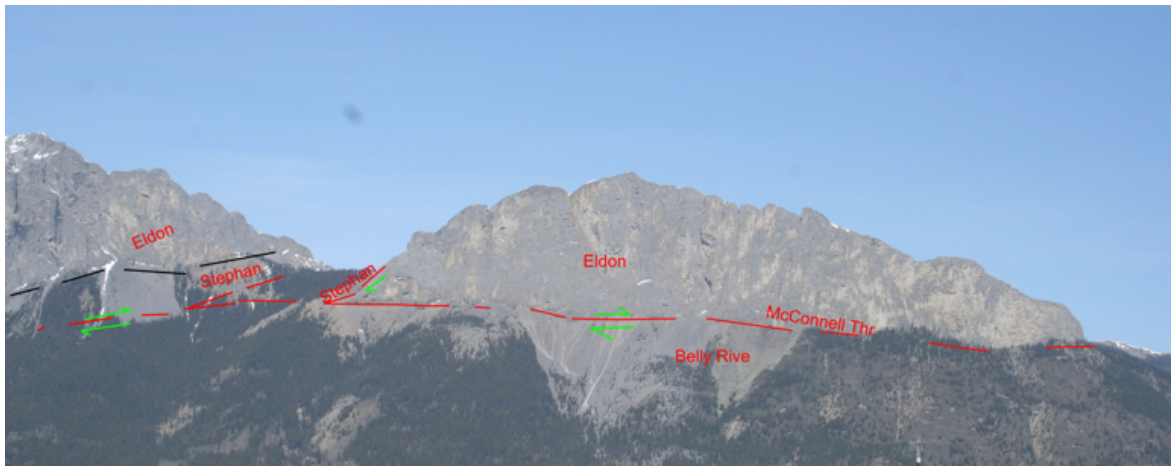


Figure 9. Mount Yamnuska with McConnell Thrust Fault.

The Grand Canadian Resort is located below a very thick succession of limestones and dolomites as well. In fact in Grassi Lakes you can see some very thick reefal buildups. They were formed some 350 to 400 million years ago by organisms called Stromatoporoids. These coral-like animals have been dissolved from the rocks in many places leaving behind big vugs. One of the first major oil discoveries of Alberta, near Leduc in 1947, were from rocks similar to those at Grassi Lake (see also 'Hike to the Grassi Lakes'). In Leduc the oil was stored in vugs but also in much smaller pores in rock surrounding the vugs. Those smaller pores you can barely see with the naked eye; you can see them very well through a microscope.

The entire white cliff section above the Grand Canadian and which extends along the Rundle Range all the way to Banff were formed between 300million and 550 million years ago. Guess what, here in the valley and below the Grand Canadian Resort, just like below the cliffs of Mnt. Yamnuska, there are also rocks that are younger than the cliffs above. Along the Rundle Range, these younger rocks are formed some 150 to 200 million years ago during Jurassic times (remember the movie 'Jurassic Park'?).

During the Jurassic here in Western Canada we had extensive coal swamps and river plains. Along the hiking trail at stops 1, 2 and 3 you can see sandstone beds formed in the old river channels. But rather than that these beds lay flat, the forces of the earth have moved and folded them. For example, the sandstone layers 'outcropping' along the trail are turned nearly vertically. See if you and your kids can push them back in horizontal position and flatten them out.

While trying to push the rocks flat as they were 150 million years ago you may also notice that the sandstones are laminated (Fig. 10). These laminations are from sand ripples like you see sometimes on the bottom of lakes or rivers or along the beach. The ripples were formed by sand grains moving along the bottom of a river by the water currents. Isn't that incredible? Finding sand ripples that are over 150million years old? By the way, deposits formed in rivers and their floodplains are officially called 'fluvial deposits'.



Figure 10. Portion of a Jurassic sandstone formed in a river (fluvial sandstone) with laminations from sand ripples moving along the river floor (official term: 'medium scale trough cross bedding') - Stop 1, 950m from Platinum Suites of the Grand Canadian.



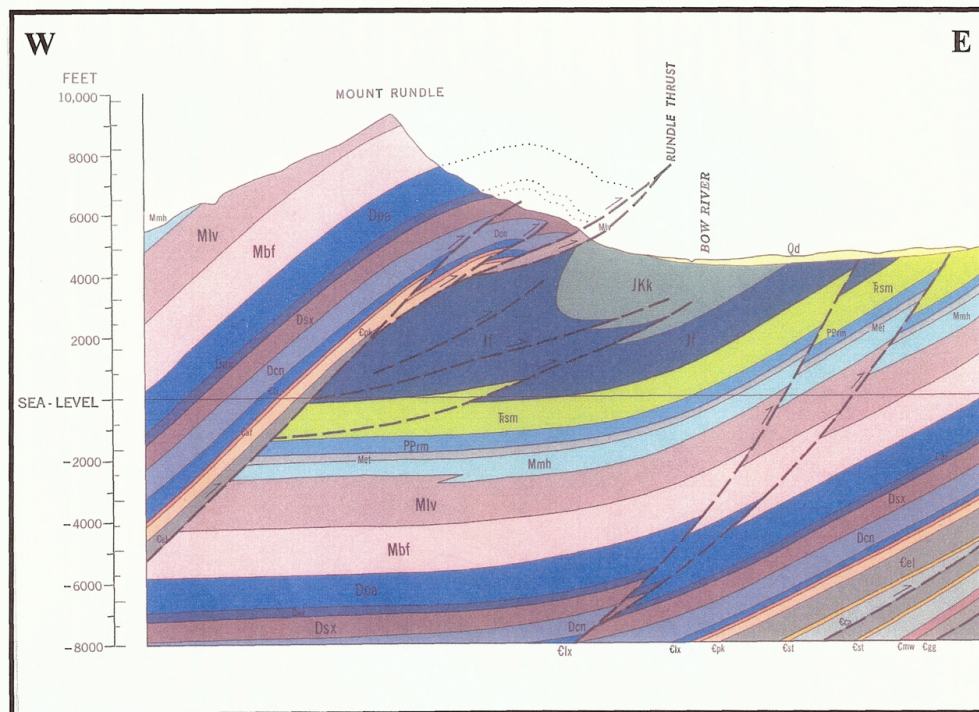
Figure 11. Driving from the Grand Canadian along Three Sisters drive to Downtown Canmore, at the turn-off to the Canmore Nordic Centre you can see Jurassic coal, shale and sandstone beds severely deformed below the Rundle Thrust Fault.

You may also recognize coal layers interbedded with the fluvial sandstones and shales (Kootenay Formation). Those were formed in nearby forests and marshes. At stop 4 (1.9km from the Grand Canadian) you can see a large tree trunk that was washed into the river and that is now petrified wood (Fig. 19)

When driving from the Grand Canadian along Three Sisters Drive into Canmore, you can see some rock layers outcropping under some condominiums, right at the turn-off to Canmore's Nordic Centre and the Spray Lakes Road which leads to the Smith-Dorien (gravel) Highway.

Figure 11 shows that the Jurassic layers of the Kootenay Formation are in many places intensely folded. This probably happened when the 300 to 500 million year old Devonian and Cambrian limestones and dolomites that form the white cliffs above us, thrust over the sandstone and shale beds of the much younger Jurassic Kootenay Formation. The thrust fault plain, now some 20 to 30 million years old, along which the dolomite and limestones moved over the sandstones and shales of the Kootenay Formation is called the Rundle Thrust. Figure 12 shows a schematic cross section created by Canadian Geological Survey geologists Price and Mountjoy in 1964 across the Rundle Range near Banff. Here at the Grand Canadian a cross section across the Rundle Range would look very similar.





**Figure 12. Schematic Cross Section of the Rundle Range by Price and Mountjoy, 1964 – Geological Survey of Canada. Layers Epc to Mlv are 300-500million old layers thrust over Jurassic sandstones, coals and shales (Jf and Jkk) that lie in the core of the Mnt Allen Syncline. The Mnt Allen Syncline is a NNW-SSE trending narrow geological feature that runs from past Banff all the way to Mnt Allen in the Kananaskis and beyond.**

The layers above the thrust are labeled: Epc through Mlv and form the limestone and dolomite cliffs. The layers below the thrust are labeled Trsm (Triassic), Jf (Jurassic Fernie) and Jkk (Jurassic Kootenay). The schematic also shows that the Triassic and Jurassic beds below the fault are folded in a semi-cylindrical shape that is cut open at the top. Such a fold is called a syncline. The one below the thrust fold happens to be a very large syncline that can be traced from northeast of Banff all the way to the southwest past Mount Allen in the Kananaskis. It is known as the 'Mount Allen Syncline'. The centre of the syncline here at Canmore lies right below the Bow River (Fig. 12).

The following photos show the sandstones, shales and sometimes coal beds outcropping along the trail at stops 1, 2 and 4. These are the rocks of the Jurassic Kootenay Formation. The old coal mines, once the economic lifeblood of Canmore were until the 1970's mined to fuel the steam locomotives of the Canadian Pacific Railways. You may notice collapsed mineshafts along the Three River Parkway. All over town you may find relicts of Canmore's old mining industry including the Canmore Hotel.



Figure 13. Stop 1. After descending some wooden stairs, the trail crosses a residential street with Canada Post mailboxes and outcropping sandstones of the Kootenay Formation.

950m from the Platinum Suites of the Grand Canadian - Photo 11 shows sandstone at stop 1 that formed in a river channel some 150 to 200 million years ago. Sand moved along the bottom of the channel in the form of small dunes (Fig. 14), leaving behind dipping laminations, sometimes showing trough like geometries (Fig. 10).

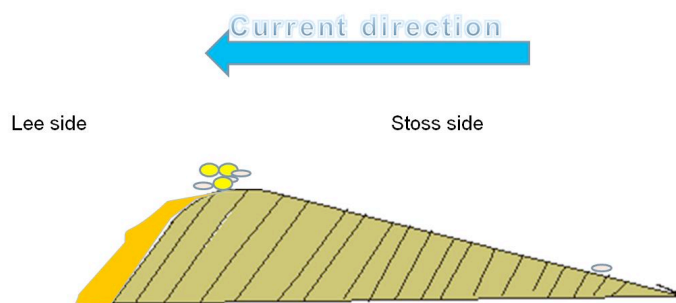


Figure 14. Sand grains are pushed by water flow to the top of the ripple, where with other grains builds up into an unstable pile that ultimately avalanches down the leeside and forms a foreset lamina.





Figure 15. Coming from the Grand Canadian Resort, you'll descend a set of wooden stairs. This photo was taken of the stairs coming from the opposite direction, from Downtown Canmore.

The hiking path continuous across the road on the right side of the outcrop. The path descends through the forest towards the river valley and ends on a T-intersection where you turn left towards downtown Canmore. Moving through the shadowy forest you'll descend a pair of wooden stairs (Fig. 15) after which you will see the Wall of Moss.



Figure 16. Stop – 2: The Wall of Moss

1.1 km from the Grand Canadian Resort. Stop 2 - The Wall of Moss is the second outcrop of steep dipping Jurassic Kootenay sandstones, here overgrown by mosses, making it quite picturesque (Fig. 16).

Continuing along the path, you will reach the main bike path along the river. Turn left toward downtown Canmore. But before continuing our magical hike through the 150 to 200 million year old coal swamps and river systems of the Kootenay Formation, explore today's Bow river along the path.

1300m from the Platinum Suites - Stop 3 is a recently abandoned channel of the Bow River and it is quite pretty (Figures 17 and 18).



Figure 17 – Stop 3. Across the bike path at the intersection between your hiking trail and the main path is this wooden fence with arrows pointing in opposing directions, go left. But before continuing look behind the fence and trees into the river valley.

The Bow River is generally classified as a ‘braided river’ system or a river system with multiple active and inactive channels. These rivers tend to be shallow with irregular water discharge and water levels (think snow melt in spring and drought in late summer). Braided rivers have often a ‘steep gradient’, i.e. the vertical topographic drop per kilometer (or mile). In the mountains, the waters of the Bow come from altitudes typically around 1500 to 2000m and the river is at 1000m above sea level near Calgary. Such a high gradient (1000m/100km or 10m/km) causes the river to form braided channels rather than the regular sinuous single channel systems of a ‘meandering’ river type.

A braided river has its multiple channels only during normal or low water discharge. However, at ‘bank full’ stage or maximum discharge, such a river tends to form one large straight channel with all gravel bars and smaller order channels below water. The water during bank full stage is flowing so fast, no swimmer would survive. On the water surface, you may observe ‘standing waves’ or wave crests that become so high, they break like on a surfing beach. The water energy is now high enough to transport boulders along the bottom that may be in excess of half a meter (two feet) in diameter. For you guys who love numbers, the water would have to flow at a rate in excess of 8m/sec or nearly 30km per hour (18 miles per hour). Did you ever stand in front of a 200 pound bicyclist coming at you at top speed? Well that is how the water would feel like (and the bicyclists would keep on coming).

Braided rivers tend to carry large boulders, gravel and sand. In the mountains, there are a lot of coarse materials to be transported and most is transported by braided rivers. The thrust faults were all formed under ground and fault blocks moved at a rate of 4mm or less per year, i.e. at the rate your finger nails grow. If you were a fifty year old Dinosaur during the late Cretaceous (some 60 million years ago) when a lot of this ‘mountain building’ was going on, one thrust block would have moved barely 20cm or less than a foot during Dino’s life. You think he would have noticed?



Figure 18. A channel branch of the Bow River that is in the process of being abandoned.

However, over millions of years, the thrust blocks stacked up and formed incredibly thick stacks of rocks below the surface, which floated on the liquid mantle of the earth like cork on water. So the thicker the rock build-up the higher the earth crust bulged up (try to do this by stacking blocks of Styrofoam in a bucket of water). But other than a smooth bulge there would not be much to see. It is the erosion that carves out the valleys and mountains; erosion by wind and water. However, over the last hundred thousand of years or so, it were the glaciers of various ice ages that sculpted the softer rocks of the Kootenay into deep broad U-shaped valleys leaving behind enormous amounts of glacial till made up of large boulders mixed randomly in a ground mass of sands and clays. It is these boulders, as well as the irregular discharge and high gradient, that make the Bow River around Canmore follow a braided pattern these days.

Well, from tropical seas to ice ages we wander... You can see glacial till on many places in Canmore and also on the Grassi Lake trails (see the next hike). Back to the braided Bow River and stop 3. During low and normal water, the river comprises gravel bars and adjacent channels (figure 19). The bars form the river bottom during bank full and boulders, gravel and sand move across them. When the water level falls, and thus the energy level of the water flow, first the coarsest boulders and then somewhat finer gravel and sand, and finally even the silts and clays drop out of the water, accumulating on the bars. Over time the bars build up higher and higher, until plants grow on top. Finally, during the highest floods, water only flows across slowly and only sands and clays are baffled and deposited between the roots and branches of the bar vegetation. Adjacent channels may also fill up with sediments and there comes a time when they fill up enough that it is easier for water to flow elsewhere. The channel is, slowly or abruptly, abandoned. At stop 3 we have an example of a bar overgrown by vegetation and an adjacent channel that is slowly abandoned.



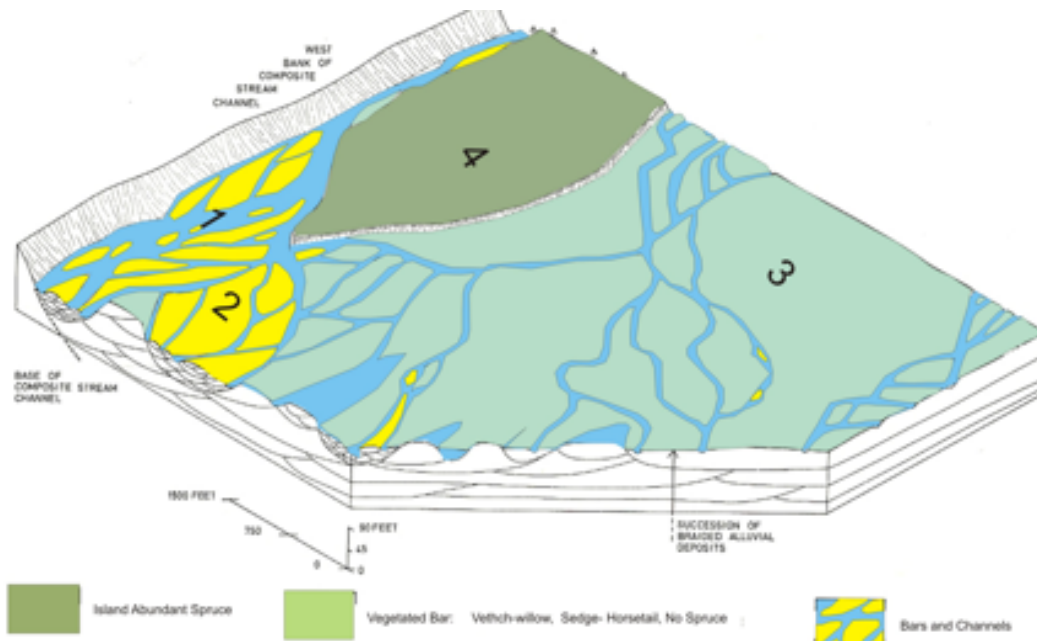


Figure 19. Schematic of a braided river system according to Williams and Rust in 1969.

1.9km from the Platinum Suites at the Grand Canadian Resort, Stop 4 is located along the bike path into downtown and it shows some beautiful plant prints and tree trunks embedded in the river deposits of the Jurassic Kootenay Formation (Fig. 20a, b).





Figure 20a – Stop 4. Fossilized wood in Kootenay channel deposits. -Close-up in figure 20B.

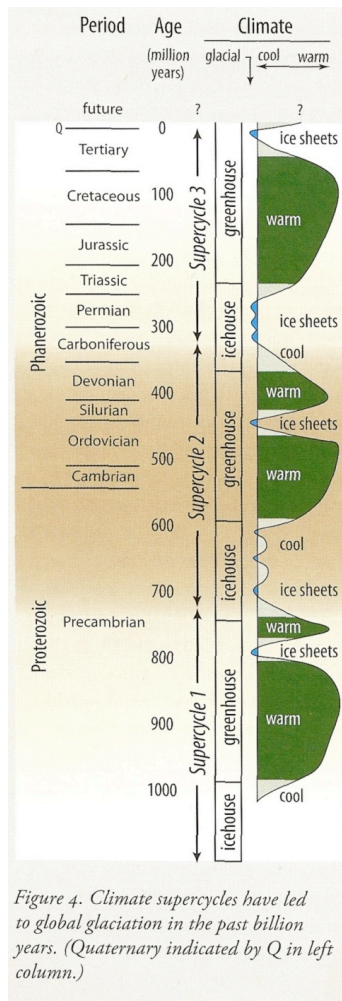


Figure 21. Climate change over geological time (from 'Climate change and Landscape – Rutter, Coppold and Rokosh. Published by: The Burgess Shale Geoscience Foundation in 2006)

We're now 2.2km from the Grand Canadian Resort, time for the kids to enjoy a playground on the river plain, while you can sit on a bench contemplating life and... how this world of us was formed. You may have started to wonder about Canmore rocks formed in climates that range from tropical reef settings to humid Mediterranean forest to glaciations. Climates change over time, they always have and they always will. During ice ages, water is bound in enormous ice sheets and sea level is low. Image, ten thousand years ago, just a few millennia prior to the building of pyramids, man could walk across the North Sea from Amsterdam to London. Ah, a lot cheaper than flying, no wonder prices go up! During warm periods, ice melts and sea level rises, since the last ice age, sea level has risen nearly 150m. Figure 20 represents the change of climate over geological time. You see, it is all a matter of perspective.

After the kids have nearly reached exhaustion, it is time to move on to the last leg of our hike. Follow the bike path to downtown, and see one of the more striking works of art displayed in Canmore. The 23 feet high structure is named "Chinook" after the warm winds that cross the mountains into the prairies during the winter. Chinook is the work of Canadian artist Bigoudi and it was unveiled in October 2006. The sculpture was the winner of the Canmore Art Trust in 2005. The sculpture depicts ribbons blowing in the Chinook wind. "For me Canmore is three elements: the Rock, the Water and the Wind. All offering movement. All powerful gifts of



nature. We benefit from these elements every day each in our own personal way by choosing to live in Canmore”, says Bigoudi.

“There are multiple elements in my project that relate to these principles: the base of the sculpture is inspired by trees in the wind, the ribbon is white to express purity, the shape relates to the movement of wind or water... and this all comes from a simple shape originally created by 10 fingers playing with paper...”

For more info, visit: <http://www.bigoudi.ca/>



Figure 22. Chinook Sculpture by Bigoudi.

In the distance, you can see the bridge where Rundle Drive crosses the Bow. Follow the trail towards the bridge. At the other side of the bridge the trail resumes and you descend from the road level onto the bike path on the east side (downtown side) of the Bow and go under the bridge walking past another sculpture (irreverently referred to by the writer as ‘rustique’ or even more mundane ‘Rust Bucket’. Maybe you can discover the real name and meaning of this work.

Following the bike path along the river, some 300m from the bridge, you can turn right onto a gravel path that leads first to River Road and next to Main Street or 8th Street in downtown Canmore.

This is the end of our magical hike in downtown Canmore (Fig 23). We hope you enjoyed the hike .We’re now 3.1km from the Platinum Suites of the Grand Canadian Resort. Oh, and when you walk near the Drake Inn, don’t forget to have a ‘tete-a-tete’ with one of Canmore’s more famous citizens (Fig. 24)



Figure 23. Looking from 8<sup>th</sup> Avenue towards Highway 1 along Main Street.



Figure 24. Having a 'tete-a-tete' with one of Canmore's more famous citizens. "Ceanmore", also known locally as 'Big Head' was created by Alan Henderson and inaugurated on September 24, 2008.