Good day

I would like to introduce you to the concept of the proposed Tumbler Ridge Geopark. This proposal has significant potential implications for Tumbler Ridge and the Peace Region: economic diversification, community sustainability and job creation, in addition to taking the celebration of our remarkable heritage in the Tumbler Ridge area to new heights.

Attached is a two-page letter summarizing this initiative. A draft version of our Expression of Interest for the proposed Geopark can be viewed at the main page of the Tumbler Ridge Museum Foundation website (www.trmf.ca) or directly at www.trmf.ca/Tumbler-Ridge-Aspiring-Geopark.pdf.

I have taken the liberty of sending this message as a bcc to individuals and groups whom I think would be interested in this idea, and have mailed this information to those without email addresses. If you would choose not to receive further notifications like this regarding the proposed Geopark, please let me know and I will remove your details from the list. Please feel welcome to forward this message to others whom you think may be interested.

I would appreciate your feedback, comments and suggestions on the draft Expression of Interest and any other thoughts you may have pertaining to the proposed Tumbler Ridge Geopark.

Sincerely

Charles Helm
Chairperson, Tumbler Ridge Aspiring Geopark Steering Committee
helm.c.w@gmail.com
(250) 242 3984 (h)
(250) 242 4251 (w)
(250) 242 4076 (fax)
20 January 2013

I would like to take this opportunity to introduce you to a new initiative taking form in the Tumbler Ridge area of northeastern British Columbia. The Tumbler Ridge Museum Foundation, in conjunction with the community of Tumbler Ridge, Northern BC Tourism and the Wolverine Nordic & Mountain Society (WNMS, the local hiking and outdoor group) has formed a committee to propose a UNESCO Global Geopark, the Tumbler Ridge Geopark. If successful this would be the second UNESCO Global Geopark in North America. Currently there are 89 such Geoparks worldwide.

As defined by UNESCO on its website, “A Global Geopark is a unified area with geological heritage of international significance and where that heritage is being used to promote the sustainable development of the local communities who live there. The Global Geopark brand is a voluntary, quality label, and… not a legislative designation…” (http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/geoparks/some-questions-about-geoparks/what-is-a-global-geopark/)

There is clearly a potential opportunity for the creation of such a Geopark in the Tumbler Ridge area, given our rich fossil heritage, the research program of the Peace Region Palaeontology Research Centre with associated education and guided tour programs, the Museum exhibits in the Dinosaur Discovery Gallery and the Community Centre, the numerous geological features in the area (waterfalls, rock formations, alpine summits, caves, etc), and the extensive network of hiking trails to destinations of geological interest. In addition, much of the area’s industry is closely connected with fossil fuel and geological resource extraction (e.g. coal and natural gas). Our industries can therefore potentially play an important role as stakeholders in the development of the proposed Geopark. These attributes, together with the tourism theme of “Waterfalls and Dinosaurs”, allow us to claim that we are already functioning as a de facto Geopark.

The proposed Tumbler Ridge Geopark will also highlight the combination of biology and ecosystems, geography, archaeology, First Nations history, pioneer heritage and culture that characterize the area.

The boundaries of the proposed Tumbler Ridge Geopark extend from the Alberta border in the east to Mt Palsson in the west (maximum distance 119 kms), from Bulley Glacier Peak in the south to Skunk Falls in the north (maximum distance 105 kms). The surface area is 7822 square kilometres; elevation ranges from 663 to 2630 metres above sea level.
The Steering Committee comprises:

- Charles Helm (Chair)
- Darwin Wren (Mayor of Tumbler Ridge)
- Thomas Clark (Wolverine Nordic and Mountain Society)
- April Moi (Northern BC Tourism)
- Ray Proulx (Teck Corporation, representing industry)
- Larry White (Tumbler Ridge Museum Foundation)

Members representing tourism operators and educational facilities are to be added soon.

Scientific advisors include:

- Lisa Buckley & Richard McCrea (palaeontology)
- Kevin Sharman (geology)
- Sarah Waters (archaeology).

We plan to submit an Expression of Interest to the Canadian National Committee for Geoparks in March 2013, which will likely prompt a site visit by this committee in the summer of 2013. These are the first steps towards an application to the UNESCO Global Geopark Network later in the year. A draft version of our Expression of Interest can be viewed at the main page of the Tumbler Ridge Museum Foundation website [www.trmf.ca](http://www.trmf.ca), or directly at [www.trmf.ca/Tumbler-Ridge-Aspiring-Geopark.pdf](http://www.trmf.ca/Tumbler-Ridge-Aspiring-Geopark.pdf).

This proposal has significant potential implications for Tumbler Ridge and the Peace Region: economic diversification, community sustainability and job creation, in addition to taking the celebration of our remarkable heritage to new heights. I would appreciate your feedback, comments and suggestions on the draft Expression of Interest and any other thoughts you may have pertaining to the proposed Tumbler Ridge Geopark.

I look forward to conferring with you further in this endeavor and to discussing the proposed Tumbler Ridge Geopark concept and the opportunities it presents.

Sincerely,

Charles Helm
Chairperson, Tumbler Ridge Aspiring Geopark Steering Committee
helm.c.w@gmail.com
(250) 242 3984 (h)
(250) 242 4251 (w)
(250) 242 4076 (fax)
06 February 2014

Karen Goodings and Directors
Peace River Regional District

Dear Ms Goodings

I am looking forward to making a presentation to the PRRD on February 14th on behalf of the Steering Committee of the Tumbler Ridge Aspiring Geopark. During this presentation I hope the following proposal for funding for $250,000 can be considered. Such funding would increase the chances of success of our application for Global Geopark status.

The funding proposal has three components:

1) **Renovations to the Dinosaur Discovery Gallery:**

   This facility, with its exhibits, research programs, publications, guided tours and educational programs, has a critical role in the Geopark application.

<table>
<thead>
<tr>
<th>Renovation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Paint</td>
<td>$10,000</td>
</tr>
<tr>
<td>Museum Sign</td>
<td>$20,000</td>
</tr>
<tr>
<td>Exhibit Area</td>
<td>$50,000</td>
</tr>
<tr>
<td>Public Washrooms</td>
<td>$30,000</td>
</tr>
<tr>
<td>Public Access (Doors)</td>
<td>$20,000</td>
</tr>
<tr>
<td>Admission Area Upgrade</td>
<td>$20,000</td>
</tr>
<tr>
<td>Security Upgrade</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

   **Total:** $170,000

   Such funding will leverage $367,500 that has already been confirmed (NDIT $100,000; Cultural Spaces $267,500) for a total project budget of $537,500. The museum is in danger of losing these funds if they are not leveraged soon.

   The $367,500 covered by NDIT & Cultural Spaces would include construction of a new collections building for the Peace Region Palaeontology Research Centre,
exterior work shed, furnace upgrades, perimeter fencing, specimen cabinets, environmental monitoring systems, and heavy storage racks.

2) **Tumbler Ridge Aspiring Geopark Symposium (5th Peace Region Palaeontology Symposium):**

Since 2009 the Tumbler Ridge Museum has organized an annual symposium. The 2013 symposium is envisaged as being the most significant yet, focusing on all aspects of the proposed Geopark, and featuring expert presenters in their fields from across Canada. The object of the symposium is to educate the public about the proposed Geopark and to gain support for the formal application in the fall of 2013. Two days of talks are planned on the various aspects of the proposed Geopark, followed by three days of field trips to points of interest within the park’s boundaries. An important aspect of the field trips is to take representatives of the Canadian National Committee for Geoparks to these sites. This will require the use of a helicopter for two days. The resulting symposium volume will be the prototype for the planned Tumbler Ridge Geopark book.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel (air travel for presenters &amp; invited guests)</td>
<td>$10,000</td>
</tr>
<tr>
<td>Symposium Volume (prototype Geopark book)</td>
<td>$25,000</td>
</tr>
<tr>
<td>Symposium Venue (two days)</td>
<td>$5,000</td>
</tr>
<tr>
<td>Cultural Events</td>
<td>$5,000</td>
</tr>
<tr>
<td>Catering &amp; Banquet</td>
<td>$5,000</td>
</tr>
<tr>
<td>Helicopter Support</td>
<td>$20,000</td>
</tr>
<tr>
<td>Accommodations</td>
<td>$5,000</td>
</tr>
<tr>
<td></td>
<td><strong>$75,000</strong></td>
</tr>
</tbody>
</table>

3) **Travel expenses for Steering Committee member(s)**

One of the requirements in acquiring Geopark status is attendance at a Global Geopark international event: $5,000

**Total: $250,000**

Incidentally, the Wolverine Nordic and Mountain Society is using the $60,000 generated from Tumbler Ridge winning the BC Walking Challenge is 2011 to enhance the hiking trail system, including signage improvements.
As a Steering Committee, we are aware of the Economic Growth Solutions study commissioned by the PRRD in 2011 and the potential implications it had for funding the Tumbler Ridge Museum project.

We hope that if the PRRD is able to support this proposal, that providing funds to the Tumbler Ridge Museum Foundation as an economic development initiative in this manner would be consistent with the conclusions of that study, while giving our imminent application for Geopark status an increased chance of success.

Finally, if the PRRD could consider providing a letter of support for our application, that would be much appreciated.

Sincerely

Charles Helm
Chairperson
Tumbler Ridge Aspiring Geopark Steering Committee
TUMBLER RIDGE ASPIRING GEOPARK

TUMBLER RIDGE, BRITISH COLUMBIA, CANADA
EXPRESSION OF INTEREST
MARCH 2013
# TABLE OF CONTENTS

Introduction 3

Identification of the area  
1) Name of the proposed Geopark 5  
2) Surface area, physical and human geography characteristics 5  
3) Organization in charge and management structure 7  
4) Application contact person 9

Geological Heritage  
1) Location of the proposed Geopark 10  
2) General geological description 12  
3) Listing and description of geological sites 21  
4) Details on the interest of these sites 43

Geoconservation  
1) Current or potential pressure on the proposed Geopark 46  
2) Current status in terms of protection of geological sites 47  
3) Data on the management and maintenance of these sites 48  
4) Listing and description of non-geological sites 49

Economic activity and business plan  
1) Economic activity in the proposed Geopark 59  
2) Existing and planned facilities 60  
3) Analysis of tourism potential of the proposed Geopark 62  
4) Overview and policies for sustainable development 64  
5) Policies for community empowerment 66  
6) Policies for public and stakeholder awareness 66

Interest and arguments for joining the Global Geoparks Network 67

Awards 68

Symposia 68

Websites 69

Books 69

References, Outreach & Education, Media 70
INTRODUCTION

In submitting this expression of interest we are expressing our belief that in our region we are already functioning as a *de facto* Geopark.

We have wonderfully varied geology, topography, scenery and human history, catapulted to fame by the fantastic paleontological discoveries of the past decade. Government, industry, scientists, First Nations, volunteers and tourism organizations have been captivated by the potential this offers, and are keen to see it fulfilled.

To us, an application to become a UNESCO Geopark seems to be a logical, almost inevitable outcome of the work that has already been done.
We substantiate this claim that we are to all intents and purposes a *de facto* Geopark with evidence:

- our palaeontological museum with its Dinosaur Discovery Gallery, collections area, active research program in the Peace Region Palaeontology Research Centre, guided tours, educational camps and symposia;
- the network of hiking trails that lead to areas of geological and scenic splendour, and historic importance;
- a single modern community with attractive hospitality potential and a wealth of accessible geological attractions, but which is also situated close to a mountain wilderness that remains largely undisturbed, with further geological wonders that are accessible only to the adventurous;
- our Community Centre whose walls are filled with exhibits on our archaeological and more recent pioneer and mining history;
- the books that have already been written that celebrate these wonders, and the increasing enthusiasm of local artists and dramatists in portraying this history
- passionate volunteers who have forged working win-win relationships with government and industry and who, in collaboration with dedicated and disciplined scientists, drive this project forwards;
- the Tumbler Ridge community theme of “Waterfalls and Dinosaurs”.

![Image of books and flyers related to Tumbler Ridge and the Geopark project.](image-url)
A – IDENTIFICATION OF THE AREA

1. Name of the proposed Geopark

The name of the proposed Geopark is the Tumbler Ridge Geopark

2. Surface area, physical and human geography characteristics of the proposed Geopark

The proposed Geopark comprises a portion of the eastern slopes of the Hart Ranges of the northern Rocky Mountains of British Columbia.

High glaciated summits characterise the southern boundary, which is partially the divide between waters flowing northeast into the Murray and Wapiti Rivers, and waters flowing southwest into the Parsnip and Fraser Rivers.

The highest point is the summit of Bulley Glacier Peak, 2630 metres (8600 feet) above sea level. The lowest elevation, at the northern boundary where Salt Creek enters the Murray River, is 663 metres (2079 feet) above sea level. Elevation generally decreases from southwest to northeast.

Rivers cut valleys through the northwest-southeast trending front ranges of the mountains, then flow through the foothills. Numerous waterfalls grace these watercourses and their tributaries.

The geological formations likewise tend to lie in a northwest-southeast direction, with the oldest rocks typically being found in the southwest and progressively younger rocks occurring to the northeast. The age span encompassed is substantial – Cambrian to late Cretaceous. Outside of the mountainous areas, glacial till and Pleistocene deposits cover much of the bedrock, and in turn are mostly covered by various types of forest, mostly coniferous. In the lower-lying areas bedrock is therefore most commonly encountered in canyons.

The archaeological record demonstrates an abundance of prehistoric sites. The area appears to have been accessed extensively by mobile, small family based groups for seasonal forays and expeditions into the mountains for hunting and gathering purposes. The area is close to the postulated “Ice-free Corridor,” which would have allowed the population of the Americas once the Bering land-bridge had been crossed. One archaeological tool found near the western boundary of the area is the oldest in British Columbia.
While no First Nations communities or Indian Reserves are located within the proposed geopark boundaries, there are five distinct cultural First Nations peoples represented in the region: Beaver (Dunne-za), Saulteau, Sekani (Tse’Khene), Cree and Métis. The McLeod Lake Indian Band, Saulteau First Nations and West Moberly First Nations are Treaty 8 signatory First Nations communities comprised of these cultures with overlapping traditional territory in the proposed geopark area. The Kelly Lake Cree First Nation, Kelly Lake First Nation and Kelly Lake Métis Settlement Society, all located along Kelly Lake, are non-treaty First Nations communities with overlapping traditional territory in the proposed geopark area. All six of these communities have been approached by the Tumbler Ridge Aspiring Geopark Steering Committee regarding the proposed Geopark.

The European presence appears late in the record – an 1879 map indicates the entire proposed Geopark as “unexplored area.” The search for railway passes began in the early 1900s, followed by the first pioneer trappers and ranchers, whose numbers remained small.

In the 1950s natural gas deposits were identified, and in the 1970s sizeable metallurgical coal deposits were defined. This led to the formation, in the wilderness, of the community of Tumbler Ridge in the early 1980s and the development of two coal mines. Low coal prices led to the closure of the mines in 2000 and 2003, and the community faced extinction. A second generation of coal mines is now in operation, with more mines likely to open. Natural gas is extracted, and the prevailing southwesterly winds have led to the development of the first wind energy project.

Tumbler Ridge is the only community within the proposed Geopark, with an estimated population of 4000. The nearest communities are Chetwynd, 90 kilometres to the northwest, and Dawson Creek, a hundred kilometres to the northeast. At the time of Tumbler Ridge’s lowest ebb, in 2001, two local boys discovered dinosaur tracks in a creek-bed close to town.

This spurred the development of the Tumbler Ridge Museum Foundation and the associated Dinosaur Discovery Gallery with its educational and guided-tour components and the Peace Region Palaeontology Research Centre with its research program. Numerous subsequent palaeontological discoveries have occurred, some of global significance. Thanks to the work of the palaeontologists employed in this facility by the Tumbler Ridge Museum Foundation, and the support provided by volunteers, Tumbler Ridge has become the centre of excellence of vertebrate palaeontology in British Columbia. The local municipal council has recognised the importance of these initiatives and has provided annual support of $200 000 to the museum project since 2005.
Also in the early 2000s, the Wolverine Nordic and Mountain Society began developing a hiking trail network to numerous features of geological and aesthetic significance, thus further stimulating the development of tourism. Together with an influx of retirees, these initiatives helped the community survive when the mines shut down.

3. Organization in charge and management structure of the Tumbler Ridge Aspiring Geopark

Description:
The name of the organization is the

Steering Committee of the Tumbler Ridge Aspiring Geopark.

Steering Committee members:

Charles Helm (Chair)
Darwin Wren (Mayor, District of Tumbler Ridge)
Thomas Clark (Wolverine Nordic and Mountain Society)
April Moi (Northern BC Tourism)
Ray Proulx (Teck Corporation, representing industry)
Larry White (Tumbler Ridge Museum Foundation)

The local scientific advisors attend all Steering Committee meetings:

Lisa Buckley & Richard McCrea (palaeontology)
Kevin Sharman (geology)
Sarah Waters (archaeology).

Function:
The Steering Committee will liaise with and receive input from First Nations with current involvement and/or an historic presence in the area of the proposed Geopark. While developing the proposal and taking care of its logistical and administrative elements, the Steering Committee will receive input from and liaise with stakeholders, who are kept abreast of all developments and who are encouraged to attend meetings of the steering committee as needed.

These stakeholders include, but are not limited to:

Government of Canada, through the office of Member of Parliament, Bob Zimmer
Government of British Columbia through the office of Member of the Legislative Assembly, Blair Lekstrom
Peace River Regional District
North Peace Economic Development Council, South Peace Economic Development Council
BC Parks
Recreation Officer for the Peace Region (Rec Sites and Trails BC Program, Ministry of Forests, Lands and Natural Resource Operations)

British Columbia Paleontological Alliance

SciTech North

Community Futures BC

Industry representatives
Coal mines (Anglo American, Dehua, Teck Corporation, Walter Energy)
Natural Gas (CNRL, Talisman, Spectra etc.)
Wind Energy (Capital Power)
Forestry (West Fraser, Canfor etc.)

Educational institutions
University of Northern British Columbia
Tumbler Ridge Campus of the Northern Lights College
School District #59, Tumbler Ridge Secondary School, Tumbler Ridge Elementary School

Tumbler Ridge Public Library

Scientific Advisors
Geology (Kevin Sharman, James Haggart, Guy Plint), Palaeontology (Richard McCrea, Lisa Buckley, Phil Currie, George Pemberton), Archaeology (Sarah Waters)

Tourism operators
Jetboat operators
Hiking guide-outfitters
Helicopter outfitters (Ridge Rotors)
First Nations tours

Hospitality industry and restaurants
Bed and Breakfasts
Hotel operators
Restaurants

Representatives from specialized interest groups (ice climbing, rock climbing, canoeing, cross country skiing, mountain running, Emperor’s Challenge Mountain Run)

Community arts and cultural groups
Tumbler Ridge Community Arts Council
Local artists (Rita Henderson, Darcy Jackson, Joan Zimmer)

Community Seniors organizations

Local service organizations (Lions Club)

Local media (Tumbler Ridge News)

Advisors from previous successful UNESCO Geopark proposals (Stonehammer) or other United Nations projects (Robert Sandford, Mike Murtha).
Organigram:

The relation of the co-ordinating committee to the stakeholder groups and UNESCO representatives is portrayed in the following organigram.

4. Application contact person:

Dr Charles Helm, Tumbler Ridge Aspiring Geopark
+250 242 3984 (home)
+250 242 4251 (work)
+250 242 1101 (cell)
+250 242 4076 (fax)
helm.c.w@gmail.com
1. **Location of the proposed Geopark**

The most westerly point is Mt Palsson (121 degrees 47’30’’).

The most easterly point is the British Columbia-Alberta border (121 degrees 00 00’).

The maximum west-east dimension of the proposed Geopark is 119 kilometres.

The most northerly point is Skunk Falls (55 22’32’’).

The most southerly point is Bulley Glacier Peak (54 27’00’’).

The maximum north-south diameter is 105 kilometres.

The approximate area is 7 822 square kilometres.
Topographical map outlining the proposed Geopark; Tumbler Ridge is at upper centre. NTS maps 1: 250 000 93P and 93I.
2. General geological description of the proposed Geopark

For a regional geological overview, the story begins with the Cambrian to Ordovician age of rocks, 600 to 450 million years old. As a general rule, layers of accessible rocks are stacked up in order of oldest to youngest, from Cambrian to Late Cretaceous, with the oldest rocks far into the mountains and on their western flanks, and the youngest rocks north and east of Tumbler Ridge, extending to the Alberta border. There are exceptions to this rule where extensive folding and faulting has taken place, but usually it holds good.

The oldest (Cambrian) rocks in the western part of the Tumbler Ridge area thus display features such as worm burrows. Ordovician rocks harbour nautiloids. The area was then just to the west of the edge of the continent, and characterized by offshore seas on which reefs could accumulate.

Stromatoporoids accumulated in immense numbers and thickness during the ensuing Devonian Period (410 – 360 million years ago), when the area was in equatorial latitudes. These eventually allowed the formation of the enormous oil reserves that have provided a boon to the economy of Alberta, but not yet in British Columbia.

The first major strength in the fossil record of the proposed Geopark lies in rocks of the next Period, the Mississippian (360 to 290 million years ago). At this time, continents were joining together to create the great land masses of Laurentia and Gondwanaland, and the area by then had moved about twenty degrees north, and was part of a balmy, fairly shallow sea offshore from Laurentia, inhabited by a multitude of creatures. Clams, a variety of worms, brachiopods, bryozoans, crinoids, ammonoids, trilobites, and blastoids are found in these rocks. However, the most easily recognizable and numerous fossils in these limestone rocks are the corals, both solitary (rugose) and colonial (tabulate) forms. These fossils sometimes occur close to or in small limestone caves.
The next Period, the Permian, is hardly present in the Tumbler Ridge area on the surface, although deep underground it contains substantial natural gas reserves.

The next fossil strength is in marine rocks from the Triassic Period (250 – 210 million years ago). Those species that had survived the end-Permian extinction event had room in which to replicate and diversify. The super-continent Pangea, surrounded by a super-ocean, was just beginning to break up. In this ocean thrived the fishes and marine reptiles for which the Tumbler Ridge area has become renowned. Areas which were nearby and equivalent at the time are nowadays found in such diverse places as Madagascar, Greenland and Spitzbergen, Switzerland, Italy and Australia, and their fossil assemblages are quite similar.

Fossil Fish Lake, near Wapiti Lake, was the site of the initial Canadian discovery in 1947. Numerous collecting trips have been to the area since, which mostly comprises scree slopes in a number of cirques. There is excellent preservation of the specimens and a diverse fauna: over twenty genera of fishes and over a dozen genera of marine reptiles. Subsequently, further such sites have been discovered in the region, and many hundreds of specimens have been removed to the Peace Region Palaeontology Research Centre in Tumbler Ridge.

The fishes include sharks, ray-finned fishes and lobe-finned fishes like coelacanths. A new subfamily of coelacanths was recently described based on three of these specimens from the proposed Geopark area.

The ray-finned fishes are known as Ganoid fishes because of their scale pattern, and the mountain range in which Fossil Fish Lake lies is marked on the maps as the Ganoid Range. Outstanding fossil specimens from this locality ended up in research laboratories and great museums all over the world, with the exception of the Peace Region from which they had originated, until the formation of the Tumbler Ridge Museum Foundation, the establishment of a collections facility, and the subsequent exhibits in the Dinosaur Discovery Gallery in Tumbler Ridge.

*Rebellatrix* is a new genus of coelacanth based on these three specimens from the Tumble Ridge mountains (art: Michael Skrepnick).
A variety of Triassic fish and marine reptile specimens: bottom left is a neonatal reptile; thalattosaur jaws at bottom middle, crustacean at bottom right.

The marine reptiles are equally interesting and include ichthyosaurs, myxosaurs and thalattosaurs. In addition to the fishes and marine reptiles, these rocks also harbour ammonites, belemnites and crustaceans.

Deep underground, Triassic sediments also contain the natural gas deposits that have been so assiduously sought and developed in the past decade. The reserves (the amount proven by drilling) thus far identified in the Peace Region of British Columbia are enormous: 16.4 trillion cubic feet, or 115 million barrels. The resources (the potential amount present) are far higher. Towards the Alberta border reserves in Cretaceous rocks are being extracted, while in the mountains, improved technology has also allowed for drilling into the still deeper Permian beds (over four kilometers down), although this remains a more risky investment. The gas has become trapped as a result of thrust faulting, and it represents the organic remains of countless numbers of small organisms. As opposed to the Devonian reefs, these organisms were not reef builders, but rather were to be found on gently sloping floors of shallow seas, and formed platform carbonates, which slowly lithified.

During the Triassic and Jurassic periods, dinosaurs evolved, but the fossil record of these developments is absent from the Tumbler Ridge area. The next great strength in the regional fossil record is the Cretaceous Period. During this and the Jurassic Period, plate tectonics, with subduction of plates below the continental margin, were dominant factors in continental geology. Through this process, British Columbia more or less as we know it was steadily being glued onto the western shores of North America as chains of islands from the Pacific Ocean, known as ‘exotic terranes’, were added onto the west coast over millions of years.

Another effect of this process was equally dramatic, as rock strata thousands of meters thick were pushed up to the surface from the ancient sea-beds, and were buckled and contorted. This process steadily built up the Rocky Mountains. Their still reasonably orderly arrangement explains why the oldest rocks in the region are in the southwest, and why fossil shells and corals and other creatures are now found on the high mountain summits.
The third effect was crucial from a current economic perspective. The weight of all this rock caused the land east of the mountains to slowly sink. Swampy forest decaying in this area could slowly be buried and become peat, deprived of oxygen, then subjected to heat and pressure from accumulating overlying rock sediments. The process was akin to a giant slow-cooker, and the result was high-grade coal, suitable for use in the metallurgical industry, and the reason for the creation of Tumbler Ridge.

A situation had thus developed with new mountains to the west of present-day Tumbler Ridge, and a low-lying area to the east, filled with an alternately advancing and receding shallow sea forming the series of marine and terrestrial deposits that are characteristic of the Western Canadian Foreland Basin. This sea extended from the Arctic Ocean to the Gulf of Mexico, effectively dividing the continent into eastern and western parts. Sea levels rose and sank, and the Tumbler Ridge area would repeatedly alternate between shallow underwater habitat, coastal plain, and shoreline habitat. As the new mountains eroded, extensive estuaries would develop at the coast, then be swamped with the next rise in sea level. The data for these events and patterns is detailed, following the analysis of data from thousands of core samples from oil and gas wells throughout the region.

The fossil record has shown that dinosaurs found these terrestrial and coastal shoreline conditions attractive, and abundant evidence has accumulated for their presence. Within the Cretaceous rocks in the proposed Geopark area, there are nine terrestrial (non-marine) formations. Dinosaur footprints or bones have been described from every single one of these formations, spanning almost sixty million years. There are interesting changes to be found in the dinosaur fauna over this time period, using the evidence from tracks and bones.

One of the first reports of dinosaur tracks from Canada was from the Peace Canyon west of Hudson’s Hope in the 1920s (this is north of the proposed Geopark). Charles M. Sternberg visited the canyon in the 1930s and described many track specimens. Before the flooding of these sites due to the building of the Peace Canyon Dam and W.A.C. Bennett Dam, scientific expeditions from Alberta and Ontario were able to revisit them, and describe further specimens, including the oldest bird then known, and interesting evidence of dinosaur herding behaviour. They succeeded in salvaging some trackways, and making replicas of others.

Meanwhile, to the south of the proposed Geopark, on the banks of the Narraway River, a remarkable and remote, steeply dipping trackway site had been discovered, including an interesting change of dinosaur walking direction. When a National Geographic team was escorted to the site to film it in the early 1990s, and before it could be formally studied, it was found in shreds at the bottom of the cliff. Occasional dinosaur footprint finds were made in the Tumbler Ridge coal mines, but unfortunately these were the “bad old days” in which most would be destroyed rather than reported (one was relocated to the Britannia Bay Mining Museum).

So at the dawn of the millennium, the general perception was that the region’s dinosaur footprints were flooded or had disintegrated. Therefore, when two local children, Mark Turner and Daniel Helm, correctly identified a dinosaur trackway just below Tumbler Ridge on the banks of Flatbed Creek in 2000, this was significant, and the media interest which followed this story helped put Tumbler Ridge back on the map as more than just a dying coal-mining town.

The subsequent explosion of discoveries in many creeks and canyons, in the alpine, at industrial sites, and at coal mines has been well documented in the scientific literature and the popular media.
Many have been relocated to the Peace Region Palaeontology Research Centre.

The tracks of ankylosaurs (armoured dinosaurs) predominate. A remarkable ankylosaur footprint size range has been encountered, from baby to huge. Art by Michael Skrepnick.
Next in frequency are theropod tracks. Those close to Tumbler Ridge are small or medium sized, but those both from older rocks in the area, and from the youngest rocks, are significantly bigger.

Tyrannosaurid prints and trackways are of particular interest.

Ornithopod prints are also found, including skin impressions, as are crocodilian, turtle, avian and invertebrate tracks.
The first reported dinosaur bone in British Columbia was found beside the boys’ ankylosaur trackway in 2001.

In 2002 the first accumulation of dinosaur bones in British Columbia was discovered. While not articulated, these included dinosaur bones from a number of groups including theropods, ornithopods and ankylosaurs. In addition to dinosaur bones and teeth this locality produced crocodilian armour, turtle shell and bones, fish including a freshwater ray, a variety of invertebrates, and an abundance of plant material. Over two hundred bones were removed from this site during the first three years of excavation. These bones were much older than the well-known Alberta material (93 million years as opposed to 65-74 million years) and thus were the oldest known dinosaur skeletal material in western Canada. Being from the Turonian Age, they provide a valuable window on vertebrate fossils, which are globally rare from this time period.
Subsequent prospecting in younger rocks, at 75-73 million years old just slightly older than the Alberta dinosaurs, has yielded further sites. Several hundred bones have been removed from these localities, including one articulated hadrosaur specimen surrounded by scores of shed juvenile tyrannosaur teeth. Teeth of the sickle-clawed dromaeosaurs and troodontids as well as hadrosaur jaws, fish scales, and champsosaur vertebrae have also been documented and recovered. At the hadrosaur excavation site there is evidence in the form of microtektites of a significant extraterrestrial event (currently undergoing research).

Also in these Cretaceous rocks is the final fossil strength of the Tumbler Ridge area: evidence of abundant plant life and invertebrate life. In the latter category are lobsters, oysters, inoceramids and starfish impressions.
As for the plants, a great transformation took place during the early part of the Late Cretaceous Period (Cenomanian), from a landscape initially dominated by redwoods, ferns, cycads, seed ferns, horsetails and ginkgo, to one dominated by angiosperms (flowering plants). These are all well represented in local rocks. This change took place around 97-95 million years ago, the age of some of the rocks around Tumbler Ridge.

The youngest bedrock in the area is about 73 million years old. Overlying it there is just the overlying Quaternary material associated with the Ice Ages and glaciation. For the intervening 70 million years, either there was no deposition of sediments, or else what was deposited has been eroded away.

Much of the last two million years of regional history has been dominated by ice, erosive for the most part, hence there is little record except for the last Wisconsin glaciation period. There were two great Pleistocene Ice Sheets: the Laurentian, which spread south and west from the polar regions, and the Cordilleran, which spread eastwards from the Rocky Mountains. Much of the present topography and geomorphology is the product of these glaciers and their subsequent melting. This includes moraines, terraces, the remnants of old lakeshores, and the glacial till that makes local gardens difficult to dig.

Small sand dunes on the Murray Canyon Overlook trail speak of accumulations of windblown sand off the glaciers. In places there are deep, parallel glacial striations on bedrock far away from the mountains.
As the glaciers melted they left an ice-free corridor between them, and a massive lake was impounded against the retreating Laurentide Ice Sheet. Known as Glacial Lake Peace, its arms extended well up what is now the Murray River valley, submerging what is now the Tumbler Ridge town-site. The Ice-free Corridor provided a possible avenue for the peopling of the continent from the northwest. An 11 000 year old bison skull has been discovered within the proposed Geopark in a gravel pit. Isostatic rebound has subsequently caused at least one river to change its course.

One question that is sometimes asked is why the Rockies to the southeast (Banff and Jasper) and to the northwest (Muskwa Kechika) are higher than those in the Tumbler Ridge area. Those areas tend to have more massive quartzite and limestone strata underlying the other rocks. These are more resistant to erosion, and have a tendency to form great cliffs. The Tumbler Ridge rocks in general are finer grained and are more prone to erosion. This provides a significant benefit for hikers and lovers of mountain scenery. The High Rockies invite admiration from the valley bottoms, and summit ascents by the technically expert extreme adventurer. By contrast the Tumbler Ridge mountains are accessible in their entirety, and can be enjoyed with relative ease from their ridge-tops and summits, arguably a more complete and fulfilling experience.

Current landforms range from glaciated high summits through a variety of mountainous topography to plateaux and deep valleys, with a number of types of lakes and a preponderance of magnificent waterfalls. Below the treeline much of the region is forested, with rocks exposed in canyon and waterfall settings.

3. Listing and description of geological sites within the proposed Geopark

Most of the accessible sites are to be found in a north-south band through the centre of the area. The far western and far eastern portions have fewer sites, but respectively represent the main catchment areas of the fossil fish / marine reptiles and dinosaur bones and tracks.

Sites are divided into five categories:

A) Accessible
B) Potentially accessible in future
C) Difficult access
D) Restricted
E) Roadside viewpoints

Accessible destinations

Cabin Pool – Flatbed Creek: public-accessible dinosaur footprint sites on Flatbed Creek; 2 km hiking trail, moderate; guided tours.
Flatbed Pools including Overhanging Rock Pool, Top Pool: pools and rock formations on Flatbed Creek, 4 km hiking trail, moderate; self-guiding brochure.

Flatbed Falls: small waterfall and deep pool on Flatbed Creek, close to town in Flatbed Falls Regional Park, 500m hiking trail – moderate; self-guiding brochure.

Flatbed Canyon: stratigraphy and canyon features (and old meander side-trip), close to Tumbler Ridge, best seen in winter via cross country skiing, 7 kms return to Flatbed Falls or 10 km return to Top Pool, or 10 km one-way downstream “bridge-to-bridge” - easy.
Flatbed Mini-Falls / Linking Trail: 3 kms hiking trail geological sites on Flatbed Creek, suitable for future interpretive trail / guided tours close to town.

Tumbler Point: point above Murray River close to Tumbler Ridge with geomorphology and views; 3.5 kms hiking trail on outskirts of town, self-guiding brochure.

The Bald Spot: steep, grassy, open area on ridge immediately above Tumbler Ridge; steep trail leads to good views of town and part of proposed Geopark area.

Wolverine River: public-accessible dinosaur footprint site on Wolverine River; 500m hiking trail, moderate; guided lantern tours. The tracks at this site are shallow, making them difficult to appreciate in harsh sunlight. They come alive with the angled lantern-light, revealing exquisite detail of skin impressions.

Lost Haven Cabin and surrounding trails: 6 km of cross country skiing, hiking, cycling trails including riverine areas, geomorphology; easy to moderate; self-guiding brochure.

Quality Canyon and Falls: deep canyon on Quality Creek with waterfall and pool at its head, with interesting geological features, close to Tumbler Ridge, 4 km circular hiking trail, rope section installed to facilitate canyon access – moderate; self-guiding brochure.
Quality Falls: small waterfall in intimate canyon on Quality Creek close to Tumbler Ridge, 1.25 km hiking trail, moderately strenuous; self-guiding brochure, interpretive geological signs.

Bearhole Lake Provincial Park: large protected area of wetlands and forest on JKiskatinaw Plateau.

Murray Canyon Overlook: viewsites onto Murray River canyon and surrounding landscapes illustrating geomorphology, in particular Quaternary features; interpretive trail with self-guiding brochure, 3 kms one way, 6 kms return – easy.

Tepee Falls: waterfall on Tepee Creek, cliff scenery, 3 km hiking trail (6 kms return) – easy, optional challenging route to base of falls with interesting rock features and a dinosaur trackway; self-guiding brochure.
Mt Puggins: old fire-tower just north of proposed Geopark boundary provides views of northern part of proposed Geopark; rough road provides access.

**Quantum Falls:** high waterfall and deep canyon on unnamed creek, 1 km route after boat access on Murray River – moderate.

**Quillon Falls:** double waterfall amid giant boulders on unnamed creek, 500m route after boat access on Murray River – moderate.

Bergeron Cliffs: cliff band on flanks of Mt Bergeron north of Tumbler Ridge; 4 km hiking trail (8km return) along cliff-top; moderate; Interesting geology, self-guiding brochure.

Bergeron Falls including Bergeron Canyon, Hidden Valley, Scalpel Ridge: highest accessible waterfall in region with interesting nearby geological features; simple rock scrambling through canyon required to reach base of falls, 12 km circular hiking trail – strenuous; self-guiding brochure.
**Bullmoose Marshes**: wetland area with roadside access; 1 km hiking trail - easy, part is disabled-accessible on boardwalk; self-guiding brochure and bird list.

**Gwillim Lake**: large lake in provincial park, roadside access and campground; School District camp and cabins on opposite shore; 1 km Lakeshore Trail, easy.

**Mt Reesor** including Caribou Highway: alpine summit; unusual rock and landform formations; 5 kms of hiking routes (10 kms return) – strenuous. Access through coal mine required.

**Mt Spieker**: large flat-topped mountain with interesting cliffs and rocks; 6 kms of hiking routes, moderate. Access through coal mine required.
Albright Ridge: alpine area with ridge-walking, lakes, small caves, summits, snowfields; 10 km circular route strenuous. Trail brochure.

Cowmoose Mountain: alpine summit and plateau, 10 km hiking route, strenuous; self-guiding brochure.

Holzworth Meadows including Theropod Peak and other unnamed peaks: alpine meadows and a variety of summit options; 5 kms of hiking trails and routes, strenuous; self-guiding brochure.

Pinnacle Peak: alpine summit with impressive rock strata; 4 km hiking route (8 kms return), strenuous; self-guiding brochure.
**Windfall Lake**: extensive alpine area and summits and karst areas above Windfall Lake; 5 km hiking trail to lake (10 kms return) - moderate, thereafter numerous route options and circular return route - strenuous.

**Tunnel Mountain**: trailless alpine trip from Windfall Lake to rock tunnel and summit – route-finding skills required.

**Hole-in-the-Wall**: resurgence spring at foot of cliff, a small provincial park in Sukunka River – close to roadside but lengthy road access on radio-controlled road.

**Barbour Falls**: waterfall on Barbour Creek, 1 km trail – easy; self-guiding brochure.

**Nesbitts Knee Falls**: on Waterfall Creek, 1 km hiking trail; moderate, with self-guiding brochure.
**Tentfire Canyon:** wilderness canyon with falls, icefalls; no trail – challenging.

**Greg Duke Lakes:** short trail built by Ministry of Forests to small lakes; 1 km, easy.

**The Stone Corral karst area** in Monkman Provincial Park: two small caves, water and cliff features, fossils, trace fossil site known as The Mural, 4 km circular interpretive hiking trail – strenuous.

**Canary Falls and Lake Joan:** small waterfall and lake and springs in Monkman Provincial Park, 1 km hiking trail – moderate.

**Kinuseo Falls:** major waterfall on Murray River in Monkman Provincial Park, 65 kms by road from Tumbler Ridge, followed by 300m walk suitable for disabled access. Trails to viewpoints and a steep route to base of falls. Interesting rock folding. Campground nearby.
The Cascades:

a unique series of ten consecutive waterfalls on Monkman Creek, reached via a 20 km hiking trail (40 kms return) in Monkman Provincial Park – moderate to strenuous. Backcountry campsites. Seven of these waterfalls are accessible by hiking trail:
**Hell’s Half Acre**: site of old rock-slide off Mt Watts, 21 kms along hiking trail to Monkman Lake.

**Monkman Lake**: large lake in Monkman Provincial Park surrounded by mountains, accessed by 24 km hiking trail (48 kms return) – moderate.

**Monkman Tarns**: subalpine area with lakes in Monkman Provincial Park, 12 kms hiking route beyond Monkman Lake – strenuous.

**Babcock Falls**: waterfall and deep pool on Babcock Creek, 1 km hiking trail – easy; steeper route to base of falls; self-guiding brochure. Cliffs depicting high-energy environment with petrified logs.
The Boulder Gardens:
An area of unsurpassed beauty and unique rock formations; moderate 4 km circular hiking route, self-guiding trail brochure, popular with rock climbers and boulderers
The Titanic:
newly developed route to
spectacular geological formations
and scenery including pinnacles,
meadows and cliffs. 1 km route,
moderate.
Mt Kostuik: alpine summit with interesting summit rocks; 5 km hiking route, strenuous.

The Terminator: alpine summit; 3 km hiking route, strenuous.

Flatbed East: short hike and 2 km canoe trip past cliffs, old river valley, easy.

Mt Clifford: small mountain with summit at treeline; 5 km hiking route (10 kms return), moderate.

Stony Lake: medium sized lake with forestry campsite; Monkman Pass Memorial Trail with self-guiding brochure nearby; roadside access.

Kruger’s Flats: low-elevation open meadow, Monkman Pass Memorial Trail and historic cabins; 4 km hiking or cycling trail (8 kms return); easy.

Long Lake: small, long lake with stony bottom, 300m hiking trail, easy.

Thunder Mountain: old fire-tower provides views of southern part of proposed Geopark; rough road provides access.
**Wapiti Falls:** smaller waterfall on Wapiti River, 7 km hiking trail – easy.

**Wapiti Lake:** large lake in mountains, in Wapiti Lake Provincial Park; 21 km hiking trail (42 kms return), moderate.

**Onion Lake:** subalpine lake, 12 kms beyond Wapiti Lake – strenuous.

**Bootski Lake:** alpine tarn amongst impressive mountains; 4 km hiking route (8 kms return) – strenuous.

**Red Deer Falls:** high waterfall on Red Deer Creek; 10 km trail for hiking or mountain biking – moderate.

**Belcourt Falls:** a remote double waterfall on Belcourt Creek, 3 km hiking trail – easy.
Potentially accessible destinations

**Skunk Falls:** spectacular destination; trail access is challenging but may improve in future, easier access from Murray River is possible.

**Salt Falls** and **Salt Canyon:** spectacular hiking and canyon-crawling; no formal trail access but access from Murray River is possible.

**Lower Babcock Falls:** two successive falls on Babcock Creek, easiest access in winter through cross country skiing – 8 kms return.

**Bullmoose Falls:** cross country skiing – 18 kms return.

**Cotton Candy Canyon:** tight canyon accessible from Murray River.

**Bullmoose Mountain:** potentially accessible via old exploration roads, large mountain-goat population with natural trails made by goats.
**CNRL site:**
dinosaur trackways, may become an accessible site for guided tours once gas drilling operations are completed.

**Peace River Coal Mine:** potential for mine tours, foot-walls with abundant dinosaur footprints.

**Quintette Coal Mine:** potential for mine tours

**Flatbed-Kinuseo isostatic rebound:** canoeing along floor of old river valley
Difficult access – for the intrepid adventurer

Bulley Glacier

Monkman Glacier

Bulley Glacier Falls

Courtipat Falls

Unnamed Cascades

Wolverine Falls

Upper Tunnel Falls

Lower Tunnel Falls

Upper and Lower Blue Lakes, Paxton Lake, Lupin Lake
Hook Lake

Imperial Canyon

Imperial Spring

Red Deer Canyon

Unnamed and unexplored canyons off Murray River

Belcourt Canyon

Wapiti Canyon
Bulley Glacier Peak

The Fang

Mt Bulley, Mt Barton, Paxton Peak, Castle Mountain

The Shark’s Fin
Mt Crum

Mt Palsson

The Sunken Lakes

Pyramid Peak

Mt Becker, Little Mt Becker

Caving areas: Windfall Lake area, Albright Ridge area, Hunca Munca Cave
Wapiti-Puskwaskau junction

Restricted destinations

The Big Spring (resurgence spring, private property)

Access to parts of Boulder Gardens / Babcock Mountain / Titanic Trail will be restricted during coal mining operations.

Cretaceous dinosaur bones and / or tracks, cycads, angiosperms, redwood, gingko, seed ferns; Triassic fish, marine reptiles, ammonites, belemnites, crustaceans

Some areas contain fossil sites that we are not able to disclose in a publicly accessible document, for protection from the threats of vandalism and theft. Many of the products are to be found in the Peace Region Palaeontology Research Centre collections and the Dinosaur Discovery Gallery exhibits. We will be happy to share details on these localities with the Canadian National Committee for Geoparks and the Global Geoparks Network.

Mississippian invertebrates (corals, trilobites, crinoids, brachiopods)

Pinnacle Peak
Albright Ridge
Windfall Lake area

Roadside viewpoints

Albert’s Point: views from highway pullout of Mt Bergeron, Bergeron Cliffs, Murray River valley, suitable for interpretive signage.
Heritage Highway summit – views from highway pullout of distant mountains plus nearby wind power project, suitable for interpretive signage.
Hourglass Road - Glacial striations, suitable for interpretive signage.
Theropod Peak (rock folding)
Mt Hermann: driveable subalpine summit with good mountain views, but rough access road.
Mt Babcock: driveable past Boulder Gardens trailhead to lookout point with good mountain views.
Bullmoose Marshes Wetland Interpretive Area
Gwillim Lake viewpoint
4. Details on the interest of these sites in terms of their international, national, regional or local value

The Peace Region Palaeontology Research Centre is steadily growing into an international centre of excellence for vertebrate palaeontology research. This is the only museum in British Columbia dedicated to vertebrate palaeontology and is well known nationally and internationally. The museum facility is just under 2500 square metres and includes a nearly 600 square metre public interpretive "Dinosaur Discovery Gallery". This gallery currently displays one large, main gallery exhibit interpreting dinosaur tracks and their makers from the mid-Cretaceous (~100mya). The main exhibit is supported by four large specimen display cases containing original specimens of dinosaur and bird tracks as well as contemporaneous fossil plant specimens from the region. Four backlit displays and two LCD displays provide additional information pertaining to geology and palaeogeography of this time period, as well as information on dinosaur and bird tracks and the difference between flowering and non-flowering plants. A wheelchair accessible 20 person capacity theatre allows visitors to explore several hours of local, national and international documentaries and television.
While all the palaeontological finds are of local and regional importance, many are of national importance and some are of international importance. Examples of the latter include the only known example of tyrannosaurid trackways, the unique features associated with the excavation of British Columbia’s first articulated dinosaur (many shed juvenile tyrannosaur teeth suggesting herd scavenging behaviour), dinosaur trackways of Turonian age, one of the largest collections of Triassic fish and marine reptiles, the only three known examples of a new subfamily of coelacanth, etc. The importance of these features is evidenced in the attention international researchers pay to them.

The Peace Region Palaeontology Research Centre, being the centre of excellence in vertebrate palaeontology in British Columbia, includes in its collections specimens from the wider region and from other parts of the province.
These include data from the internationally significant Kakwa dinosaur footprint site (right), and a replica of the only three sauropod trackways in Canada (left). In time these will be on display.

The biggest marine reptiles in the world are to be found north of the proposed Geopark, and plans call for these to be excavated and removed to Tumbler Ridge, where they will be exhibited. Such exhibits, although not from within the proposed Geopark boundaries, will add to the international reputation and importance of the exhibits within the Dinosaur Discovery Gallery.

The occurrence within the proposed Geopark of Cambrian to Cretaceous rocks and fossils allows such geological stories to be told in a museum setting in an attractive community in the foothills wilderness of northwestern Canada, right in the area in which the rocks and fossils occur. This is at least a nationally significant educational phenomenon.

Aesthetically, some of the waterfalls (Kinuseo, The Cascades) are of national or international significance. The remainder are of regional or provincial significance when considered alone, but together, considering the accessibility that has been developed for them, they are of national significance at least.

Aside of their fossil content, the mountainous, wilderness nature of much of the proposed Geopark makes it aesthetically spectacular. The fact that most summits can be attained without technical gear is regarded as an advantage – these are mountains to get on top of, to enjoy from the summits, not just the valleys. This, too, is of national importance.

The Boulder Gardens and Titanic form a special site within the proposed Geopark, with an unusual geological history that is at least nationally or continentally significant.

Almost all the rocks are of sedimentary origin, and some of them are fortuitously exposed close to Tumbler Ridge in canyons. These sites are eminently suitable for educational geological field tours in addition to the already popular dinosaur footprint tours.
C - GEOCONSERVATION

1. Current or potential pressure on the proposed Geopark

In theory, potential pressures include
- coal mining
- natural gas development
- wind energy projects
- road construction
- forestry
- climate change effects.

Fortunately, even in combination, these do not pose significant threats to the proposed Geopark. Both the Tumbler Ridge Museum Foundation and the Wolverine Nordic and Mountain Society have established an enviable and exemplary track record of co-operation with industry.

Coal: The coal mines exist in a northwest-southeast trending belt in the front ranges. To date these have not been close to critically important geological features, with the one exception of the Boulder Gardens and Titanic (described below). Some attractive alpine areas and summits do become inaccessible during mine development, but typically become accessible again at the end of the lifespan of the mine. Many palaeontological discoveries have emanated from the mines and have enriched the knowledge of the area as a result. Old mining exploration roads now form the routes of some of the area's hiking trails.

The Boulder Gardens and Titanic are in an area that is geologically unusual (translational movement on a soft layer of kaolinite which has caused a rift valley at the summit of Mt Babcock and vast, impressive rock exposures where parts of the mountain slipped off the edge). Exquisite hiking opportunities abound, along with outstanding rock climbing. A hiking trail has been developed through the Boulder Gardens, and a route more recently established to the Titanic. The planned Teck coal mine approaches this area closely. Co-operation between the Wolverine Nordic and Mountain Society and Teck Ltd is underway to ensure that the critically important parts of the Boulder Gardens are not affected. The parts of the area that fall within the safety blast zone may need to be temporarily closed during mine development and operation, and reopened to the public afterwards. This represents a typical example of constructive co-operation with industry.

Natural gas: There haven't been any cases of natural gas exploration or sites affecting geologically significant sites. Typically, such sites are in forested areas and tend to uncover areas of bedrock exposure. Again, this has been fortuitous: dinosaur bones and tracksites have been the fortunate result, and many of the companies have gone to enormous lengths to bring specimens to the museum, with resulting major in-kind donations. One site in particular may be suitable for guided tours once the well-site has been shut down. Oil and gas pipelines do cross the area, and have the potential to spill (this hasn't happened to date in the area, although it has in other areas of Canada).

Wind energy: A number of wind energy projects have been proposed. To date, only one has been built. Some of these have been proposed on previously pristine mountain ranges, sometimes in the areas that are the catchment area for the fossil fishes and marine reptiles. Objections have been lodged to such developments. Instead, there has been active support for proposals that are close to existing infrastructure and are on already disturbed land. The project that has commenced is of this kind. The Tumbler Ridge Museum Foundation has entered into the first agreement of its kind in British Columbia with the company concerned (Capital Power).
according to which any palaeontological discoveries will be reported to the Peace Region Palaeontology Research Centre palaeontologists. Powerlines do affect some visual quality objectives, but this is regarded as a small price to pay for the development of clean energy.

Roads: There are no major road developments planned, other than to the new coal mines. Old unused roads typically get deactivated. A number of road cuttings have yielded fossil discoveries.

Forestry: By its nature, forestry blocks occur in forested areas, and in the proposed Geopark do not occur in any geologically significant areas, although visual quality objectives may be affected by cutblocks in the mountain areas. The karst areas in the proposed Geopark area are not threatened by forestry practices. Timber harvesting may affect some of the hiking trails to geological destinations such as waterfalls. Typically in such situations the Wolverine Nordic and Mountain Society has worked with the logging companies to minimize any damage (an example is the trail to Quality Canyon – the cutblock was shifted so as to preserve the trail). The discovery of the Stone Corral area in 1999 led to the boundary of Monkman Provincial Park being redrawn so as to incorporate it – Canfor had been scheduled to log part of this area but magnanimously agreed to cancel these plans so that the area could be protected.

Climate change: If current global warming trends continue, glaciers will continue to shrink. The current Mountain Pine Beetle epidemic can be viewed as an effect of global warming. The Murray Canyon Overlook trail to an interesting geological destination (geomorphology) is an example of a hiking trail that passes through beetle-infested pine forest, which now needs to be logged. The Wolverine Nordic and Mountain Society works with the logging company to minimize any effects, and to promote rapid recovery. Pine beetle infestation does not damage any geological sites or destinations directly, but does affect some of the trails which pass through pine forest to reach them, and involves increased work in maintaining them. Increased risk of fires with a combination of more dead trees and warmer conditions poses a potential problem, one that is shared with many communities in northern Canada.

Air and water quality are of a relatively high standard in the area. Use of all-terrain vehicles above tree-line is not permitted on some mountains (violations occur but are not frequent). Littering and vandalism at some destinations does occur but is generally a manageable problem.

Waterfalls are typically protected from development and pressure by being in remote canyons. Palaeontological sites are not adequately protected in British Columbia, and there have been instances of vandalism; this is something the palaeontologists in Tumbler Ridge have had an active role in addressing (as described in next section).

In summary, then, while pressures on geological sites may exist in the proposed Geopark area, they are minimal. The one exception is the Boulder Gardens, and that potential area of contention has been addressed through consultation and co-operation with industry.

2. Current status in terms of protection of geological sites within the proposed Geopark

Parts of the proposed Geopark are protected within existing provincial parks, such as Monkman Provincial Park, Wapiti Lake Provincial Park, Gwillim Lake Provincial Park and Bearhole Lake Provincial Park.

The remaining sites are almost all on crown land or within the municipal boundary of the District of Tumbler Ridge. There is the potential for some of these to become regional parks (for
example Bullmoose Marshes). It is not inconceivable that sites within the Tumbler Ridge Municipal Boundary receive some protective status in future, although there are no specific plans in this regard. Two sites only are wholly or partially on private land (John Terry ranch and The Big Spring). The “accessible” sites are generally protected by their remoteness and relative inaccessibility (for example the waterfalls in canyons) and are not in need of more formal protection. In addition, all the hiking trails and their associated destinations are registered through Front Counter BC with the Recreation Sites and Trails BC Program, Ministry of Forests, Lands and Natural Resource Operations. The trails then show up on the relevant maps so that they are apparent to any proposed industrial development projects, which typically are able to avoid them after consultation.

Adequate protection of palaeontological sites has been a vexing issue, as the province of British Columbia has lagged behind other Canadian and North American jurisdictions in adequately recognizing and protecting this heritage. Even in neighbouring Alberta, with some of the strictest laws in the world, vandalism of palaeontological sites continues. The provincial government has been implementing a Fossil Management Framework in an attempt to address this. Input was received from a variety of sources, with the Tumbler Ridge Museum Foundation and the palaeontologists of the Peace Region Resource Centre at the forefront of this process. This is a work in progress, and the anticipated results may not occur for years. In the meantime, the necessary the only ways to deal with such issues at a local level have been:

1) Liaising actively with industry
2) Not divulging the specific localities of many discoveries. This has been balanced with the need for education and tourism by opening two sites to public access close to Tumbler Ridge. Vandalism has occurred at both sites, but this has not been insurmountable.

3. Data on the management and maintenance of these sites

A) Accessible: Such sites typically have had hiking trails constructed to them. Examples include the public-accessible dinosaur footprint sites (Cabin Pool and Wolverine River), many waterfalls and alpine summits and alpine lakes, cliffs, viewsites, a wetland area, historic sites etc. Those that are within the provincial parks are managed by BC Parks, with volunteer assistance; those that are on crown land are typically maintained by volunteers of the Wolverine Nordic and Mountain Society; a few trails close to Tumbler Ridge are maintained by staff of the District of Tumbler Ridge. Such management includes the provision of highway signage, brochure boxes, trail maintenance (annual clearing of deadfall), removal of garbage and, in the case of heavily used areas, provision of outhouses.

B) Potentially accessible in future: These currently fall into category C but have the potential to be developed and managed as category A sites in future.

C) Difficult access: such sites deep in the wilderness will remain accessible only to the dedicated and hardy. They may involve multiday trips through trackless terrain. It is important that many sites remain in this condition to preserve the true wilderness experience for those who seek it. Such adventurers typically leave no trace of their presence, and such sites do not require active management and maintenance.

D) Restricted: requiring secrecy because of inadequate protection legislation - this refers to palaeontological sites. These are maintained in a data base that is not public-accessible. Management of these sites sometimes involves camouflaging them. They are not envisaged as public-accessible field sites, but instead are interpreted through the exhibits in the Dinosaur Discovery Gallery and the programs of the Tumbler Ridge Museum Foundation and Peace Region Palaeontology Research Centre.

E) Roadside viewpoints: not requiring protection
4. Listing and description of non-geological sites and how they are integrated into the proposed Geopark

Archaeological / prehistoric features

In British Columbia, archaeological sites may be protected under the Heritage Conservation Act (the Act). Sites pre-dating 1846 (the assertion of British sovereignty in the territory of British Columbia), whether recorded or otherwise, are automatically protected under the Act, and may not be altered or disturbed without a permit issued under the Act. In some circumstances, sites post-dating 1846 are also protected by the Act from disturbance.

![Image](image1.png)  
![Image](image2.png)

Nearly three hundred protected archaeological sites have been identified in the proposed Geopark area. These typically involve the discovery of a few stone artifacts, consisting of flakes produced during tool manufacture or the tools themselves, which are generally accessioned into the North Peace Museum in Fort St. John, BC, or left in situ. These sites typically do not lend themselves to tourist visits based on the low numbers of artifacts resulting from the short term use of the majority of the sites.

Instead, the fascinating story of the aboriginal presence in the area dating back over 10,000 years is best told through exhibits and education. Currently such an exhibit is housed in the Community Centre in Tumbler Ridge. It was installed by the Tumbler Ridge Museum Foundation in collaboration with local archaeologists and First Nations with an historic presence in the area.

There is potential for the installation of interpretive displays in areas with a high concentration of archaeological sites in areas that are visited by tourists. Examples include the Kinuseo Falls – Stone Corral area, Gwillim Lake, Stony Lake, and a suitable site close to Tumbler Ridge.
A large wall painting depicting a prehistoric First Nations scene from the mountains graces the Community Centre – it was created by a local First Nations artist, Rita Henderson, who is interested in creating further works of this nature for public exhibition and education.

A stone artifact was recently discovered on the Murray Canyon Overlook trail, a poignant reminder that some of the trails we hike on today have been in use for centuries or millennia.

**Historical features**

Culturally modified trees (CMTs) are also of First Nations origin but of historic age. CMTs are sensitive to disturbance and are not suitable for public access. Their story is best told through museum exhibits as currently housed in the Tumbler Ridge Community Centre.

The Flatbed tree carving is a unique feature, being the only one of its kind known in northeastern British Columbia. It has an unfortunate history of being cut down and then stored in a basement for decades, but has found a secure home in the museum exhibits in the Tumbler Ridge Community Centre, where it is sensitively displayed.
The exploits and photographs of the first European explorers in the region to document and photograph their findings (Fay, Gray) are interpreted in the Tumbler Ridge Museum Foundation’s exhibits in the Tumbler Ridge Community Centre.
A separate exhibit reproduces and interprets the first maps of the area now within the proposed Geopark.

The first permanent residents in the area were trappers. Interpretive museum exhibits celebrate their historic presence and their contributions (Don and Catherine Peck, Kate Edwards, Bill Warn, John Terry).

The Monkman Pass Highway, an initiative of the late 1930s, is one of the most significant in the area’s history.

Parts of the old route have been re-identified and can be hiked (Kruger’s Flats, Stony Lake). Corduroy and an old bridge and cabin remains are identifiable.

An interpretive driving tour and hiking route roughly follow the highway the pioneers built through the mountains.
Museum exhibits celebrate this heritage in the Tumbler Ridge Community Centre, along with one on Alex Monkman and another on Euphemia McNaught, pioneer artist of the Peace Region, depicting all her paintings from sites within the proposed Geopark and its surrounding area.

Kruger’s Flats is also a hiking destination, the site of an historic ranch and mink farm. Stony Lake was the first tourist destination in the region in 1937. Remains of the old site can be visited, and a museum exhibit in the Community Centre focuses on this aspect of regional history.
John Terry’s ranch remains privately owned, and is a potential future tourist destination. A database has been kept of a number of old trappers’ cabins in the proposed Geopark. In some cases the contents have been removed or donated to the museum by descendants. Some of these are on display.

Exhibits in the community centre celebrate the coal mining history of Tumbler Ridge, and the development of the town of Tumbler Ridge out of the wilderness. Coal mine tours were offered in the 1980s and 1990s, and there is interest in redeveloping these tours.

The coal leaves the community via a railway line that tunnels through the Rocky Mountains (one such tunnel is within the proposed Geopark). A railway caboose has been placed beside the Visitor Centre in Tumbler Ridge, and the surrounding area beautified with a garden and benches. The caboose houses the museum’s Railway Exhibit, which tells the intriguing story of this unique railway and the geological challenges faced during its construction.
Canoeing and kayaking opportunities

Murray River, Flatbed East, Flatbed Creek, Wolverine River, Wapiti River: in addition to flat water canoeing and fishing opportunities on many of the lakes in the area, canoeing or kayaking are possible on these waterways.

Cross country skiing opportunities

Lost Haven and Wolverine Trails (trackset and groomed), Flatbed Creek through canyon to falls and Overhanging Rock. Other options include Perry Creek to falls, Bullmoose Creek to falls, Barbour Canyon to falls, Babcock Creek to Lower Babcock Falls.
Winters in Tumbler Ridge are long. Healthy outdoor exercise is feasible through cross country skiing. A feature of the area is skiing up canyons to waterfalls. The route up Flatbed Canyon past Flatbed Falls to the Overhanging Rock is a favourite, and permits an appreciate of geology even in winter, with the potential of becoming a tourist attraction within the Geopark.

**Ice climbing opportunities**

Babcock Falls, Nesbitt’s Knee Falls, Perry Falls, Bullmoose Mine Falls, Tepee Falls, etc.

The proposed Geopark contains numerous areas suitable for ice climbing, with many ice-falls as yet unclimbed. There is potential for the development of ice-climbing tourism.
Rock-climbing and bouldering opportunities

While there are many areas with potential, the Boulder Gardens and Titanic areas are uniquely suitable, and are becoming famous in rock-climbing circles. Many new routes are currently being cleaned and established. This activity obviously is closely associated with an appreciation of geology.

Mountain running

The alpine mountain ridges lend themselves to mountain-running (members of the Canadian national team have trained on them).

The Emperor’s Challenge Mountain Run is organized by the Wolverine Nordic and Mountain Society and is run each August. It has become the largest off-road running event in British Columbia, with a field capped at 800. It passes through interesting geological scenery on Mt Babcock.
The proposed Geopark provides an opportunity for the viewing of some of North America’s large mammals. Grizzly and Black Bear, Mountain Goat, Caribou, Moose and Elk are all found in their appropriate habitats.

Ornithologically the area is interesting: over 230 species have been identified, of which over a hundred are known to breed. A bird checklist has been produced and updated, in collaboration with the Biodiversity Centre for Wildlife Studies. One of the compelling features, related in turn to geology and climate, is the “east meets west’ phenomenon. Ancestral populations were separated during Ice Ages into eastern and western forms; now that the ice has receded, the proposed Geopark area is one of the best studied places where these populations have regained their territory and now meet one another. In some cases they are now separate species, in other cases subspecies. In some cases such distinctions are blurry, and even the birds get confused. In one particular case the research done in Tumbler Ridge led to the splitting of one species (Winter Wren) into two (Winter Wren and Pacific Wren). This story is told in a museum exhibit. The Bullmoose Marshes are a wetland area that has been developed for hiking and birdwatching. Improved boardwalks were constructed in 2012.

The area is also crossed by the migration path of the Golden Eagle along the eastern flanks of the Rockies. For seven months of the year these birds migrate, with peaks in March and October – an estimated 6000 birds are involved. The preferred routes and ridges in the proposed Geopark have not been well studied yet.

The open slopes of the Murray Canyon Overlook trail are visited by many butterflies. Collections have been made and rare species identified. A museum exhibit in the Community Centre interprets these findings and displays regional butterflies.
Stargazing and aurora-watching opportunities

The latitude of the proposed Geopark means that in mid-summer the skies are seldom completely dark. However, between mid-August and late April there are substantial blocks of true darkness which is ideal for astronomy. There are easily accessible high-altitude areas near Tumbler Ridge that offer skies free of light pollution. These conditions make the area a worthy destination for amateur astronomers. The latitude also allows for frequent aurora borealis displays.

D – ECONOMIC ACTIVITY & BUSINESS PLAN

1. Economic activity in the proposed Geopark

Tumbler Ridge is the infrastructure hub of the proposed Geopark.

Increased tourist visits will benefit the hotel and retail industries, and will act as an economic stimulus and provide economic diversification to a community that has experienced the boom-bust cyclical nature of the mining and natural gas industries.

Increased visits and thus revenues (admission, educational activities, guided tours) will support the non-profit Tumbler Ridge Museum Foundation in its efforts to maintain the Peace Region Palaeontology Research Centre and Dinosaur Discovery Gallery.

Tourism operators (for example jet-boat tours, guide-outfitting) will experience increased activity.

A Geopark will raise the profile of the work being done in Tumbler Ridge, including the scientific research, and may stimulate increased interest from provincial and federal governments and educational institutions.

A Geopark may act as an attractant to retirees and seniors to move back to Tumbler Ridge.

Many of the activities do not require formal guiding, but are maintained by volunteers, for example most of the hiking trail system. This involves a sizeable volunteer or in-kind economic contribution.
2. Existing and planned facilities for the proposed Geopark

Geo-education and geo-tourism

The Dinosaur Discovery Gallery and the Museum Foundation’s exhibits in the Community Centre currently cater to geo-education and geotourism. So do the programs offered by the Peace Region Palaeontology Research Centre: dinosaur footprint tours to two sites close to town, and educational Dino Camps for kids.

The many accessible sites in the area are typically reached by hiking trails which have self-guiding brochures. Most of these brochures already include geological information (they were developed by a local geologist volunteer).

The Museum Foundation & Peace Region Palaeontology Research Centre have hosted an annual palaeontology symposium since 2009. There are plans to make this of broader geological and scientific interest in future.

Planned additions include:

Further exhibits in the Dinosaur Discovery to reflect the ongoing discoveries and achievements of the research program of the Peace Region Palaeontology Research Centre and other scientists with active research in the proposed Geopark area.

Expansion of existing programs to cater to a wider range, including camps for seniors. Current tours and camps occur in summer only; four season camps and tours are possible. There are further sites of geological and palaeontological interest close to town (Flatbed Falls, Mini Falls, Quality Falls) that are suitable for geological tours, and in winter Flatbed Canyon is accessible on cross country skis.

The trail brochures will be revised, so as to provide additional emphasis on geology.

Local artists are working on producing murals of geological destinations and placing them prominently in town; this will enable a walking tour of Tumbler Ridge that raises awareness of geological heritage.

River boat tour operators can be given training to enable them to add geological education on tourist excursions up the Murray River (to Kinuseo Falls) and downstream through the Murray Canyon and to numerous tributaries with waterfalls.
First Nations representatives have expressed an interest in tours that interpret traditional use of plants and the landscape.

Helicopter tours for visitors to less accessible sites of special interest are envisaged.

Tourist tours of the regional coal mines may be resumed – these may feature dinosaur tracks too.

Existing guidebooks will need to be updated, and appropriate literature, websites and social media sites developed, along with a coffee-table book on the Geopark.

**Tourist information**

The Tumbler Ridge Visitor Information Centre and Dinosaur Discovery Gallery provide comprehensive visitor information services. Self-guiding brochures are also available at trailheads. Current websites include:

- [www.trmf.ca](http://www.trmf.ca)
- [www.pris.bc.ca/wnms](http://www.pris.bc.ca/wnms)
- [www.dtr.ca](http://www.dtr.ca)

Northern BC Tourism and Tourism BC have an interest in the proposed Geopark. Tourist information is already available at their sites (websites, Visitor Information Centres) and this can be expected to increase.

**Education sites**

Dinosaur Discovery Gallery within the Peace Region Palaeontology Research Centre: This twenty-three hundred square metre facility houses palaeontological exhibits, a gift shop, education room and small theatre, and the research and collections components. A renovation project is underway that will enhance it.

Tumbler Ridge Community Centre: The walls of this centre in downtown Tumbler Ridge are adorned with over thirty exhibits featuring diverse aspects of the natural and human history of the region. It also houses the municipal library, and recreational facilities like swimming pool, gym and squash courts.
Lost Haven Cabin: This shelter serves as a warm-up hut on the cross country ski trail system near Tumbler Ridge. It can form an attractive venue for outdoor classes, and has trail access down to the banks of the Murray River.

Flatbed Falls interpretive shelter: This covered structure was built in the 1980s with industry funding. It has a number of benches and is suitable for use as an outdoor classroom.

Gwillim Lake Camp (School District #59): This lakeside facility has a central cooking and relaxation area, surrounded by cabins in the forest; it is available for use by school groups and can be rented out to other groups for retreats.

Conference Centre - Trend Mountain Hotel: One of Tumbler Ridge’s hotels boasts a fully equipped conference centre.

Accommodation

Three hotels; more are planned. Current room capacity: 204.

Bed & Breakfasts.

One RV Park in Tumbler Ridge; 54 sites with capacity for overflow camping.

Lions Campground just outside Tumbler Ridge; 40 sites.

Provincial Park campgrounds (Monkman and Gwillim Lake); 71 sites.

Ten Forestry Recreation campsites in the region offer basic camping.

Trails

There are maintained hiking trails to a diversity of sites as described above; the majority self-guiding brochures. The website of the Wolverine Nordic and Mountain Society, www.pris.bc.ca/wnms has photo galleries and downloadable brochures.

3. Analysis of geotourism potential of the proposed Geopark

As with any proposal, the Tumbler Ridge proposed Geopark has its strengths and weaknesses. In this case, depending on one’s perspective, what may be perceived as weaknesses can also be seen as strengths.

One weakness is the long Canadian winter, with a resulting relatively short summer tourist season. This can be countered by offering museum education programs and camps throughout the year, and by creating winter field trips such as Flatbed Canyon (stratigraphy lesson and dinosaur footprints). Development of products suitable for the spring and fall tourist seasons is likewise desirable.

Another potential weakness is the distance from large cities, and thus the relative remoteness. This does make it more challenging to attract very large numbers of visitors, but the converse is that the wilderness geological experience offered here is less crowded and more pristine.
Likewise, Tumbler Ridge is not on a through-road – there is therefore minimal chance of attracting chance visitors who happen to stop and be intrigued. Conversely, the concept of a destination-area that is not bothered by the din and presence of highway traffic passing through is enviable and attractive.

The possibility of the railway line being opened to tourism cannot be excluded. This would form another remarkable attraction.

Across the border in the neighbouring province of Alberta, a palaeontological museum is being developed based on a Pachyrhinosaur bonebed. Fortunately, the “product” there is very different from ours. This will be a complementary feature that will help attract visitors to the area and will likely increase interest in the Tumbler Ridge area.

The geological destinations in the proposed Geopark, are almost without exception in spectacular wilderness settings. However, driving the hundred kilometres into the community from Dawson Creek, Chetwynd or Grande Prairie, the scenery is pleasant but not overwhelmingly attractive. Very few of the sites can be reached by road. Some visitors will therefore have to be content with the Dinosaur Discovery Gallery, the museum exhibits and programs, helicopter or riverboat tours, and a handful of driveable sites like Kinuseo Falls. This would be in contrast to, for example, the higher ranges of the Canadian Rockies further to the south where there are innumerable geology lessons to be learned from within the comfortable confines of one’s vehicle as it meanders along the valley bottom and visits roadside pullouts.

The flip side of this is that the proposed Geopark area is a hiker’s paradise, and that most of the destination sites are reached via reasonably short trails. More than a month would be needed in the area to properly visit them all. This will be a “healthy-lifestyle” Geopark in which getting out onto the trails and indulging in healthy activities such as hiking and cross country skiing will yield optimal enjoyment. Combined with time spent in the Dinosaur Discovery Gallery, enjoying the programs and other exhibits and partaking in tours, a truly great and unique experience may result.

Another potential weakness has been the relative lack of funding that has thus far been available to the museum project, despite substantial support from municipal government and other programs. This reflects the fact that the project has been driven by a handful of passionate volunteers and a couple of dedicated scientists, who have tried to raise funds in any way possible. Marketing initiatives have thus far been minimal, and reputation spreads largely by word of mouth.

The Dinosaur Discovery Gallery exhibits and Community Centre exhibits have been developed at a fraction of the cost usually associated with such endeavours. Other projects of similar or lesser importance may have been fortunate to have enjoyed significant provincial support from the outset. The Tumbler Ridge Museum Foundation project in fact began when, after the discovery of the first accumulation of dinosaur bones, it was realized that there was no facility and no scientists within the province that were qualified to do it justice. What has been achieved so far in these circumstances can be regarded as near-miraculous.

Conversely, this weakness can also be perceived as a strength – in the long term, well-organized grassroots projects driven by local passion and enthusiasm have a success rate that top-down projects struggle to match (many of which ultimately fail due to lack of direction and commitment or which wither due to the financial burdens of top-heavy management structures).

The relatively small size of the community at the heart of the proposed Geopark can be perceived as a weakness, as it may be challenging to provide the type and amount of
infrastructure that a larger community could provide. The converse opinion is that an attractive, remote community in an inspiring foothills setting and with an inspiring design has much to recommend it, and that the social support and volunteer networks that spring up in small communities may be stronger and more effective than their urban counterparts.

A number of studies (all attached) have analyzed the tourism potential of the Tumbler Ridge museum project:

Lions Gate
AldrichPears
Economic Growth Solutions.

4. Overview and policies for the sustainable development of:
   - Geo-tourism and Economy

The proposed GeoPark is geographically situated within the north-east area of British Columbia’s Northern BC Tourism Region. The Northern Region encompasses 61.9% of the province’s total land area and stretches from the Queen Charlotte Islands in the west to McBride in the east, and north to the Yukon and Alaska borders. As such, the bulk of tourism research relates to the province and Northern BC Tourism Region. Fortunately, the 2008 South Peace Value of Tourism Study is specific to the area in which the GeoPark would be located.

In 2010, BC’s tourism industry generated $13.4 billion and the Northern Region contributed $1.3 billion to the overall picture. Results from the 2008 South Peace Value of Tourism Study show that visitor spending contributes $91,500 annually to the local area. The study also indicates that 227,800 visitors travelled through the region between January 1, 2008 and December 31, 2008.

The introduction of a GeoPark will not only attract new visitation but entice visitors to extend their length of stays. Across the province, there are an estimated 17,943 tourism-related businesses that employ about 260,000 workers, or 10.8 per cent of British Columbia’s total labour force of 2.4 million people. An estimated 8,500 tourism industry workers are employed in the Northern Region.

Within the Northern Region, the BC resident currently makes up the largest share of visitor volume and expenditures, followed by Alberta.

Other current visitor markets include:
- rest of Canada
- USA
- Germany
- United Kingdom
- Netherlands
- Australia.

This summary of current visitation does not take into account potential developments in global tourism trends, coupled with the increasing connection between the Tumbler Ridge economy and Chinese economic interests. Given the interest in China in Geoparks, a Geopark in western North America may be a sought-after commodity.
The outcomes from the 2008 Tumbler Ridge Community Tourism Plan identify key visitor types as the Free Independent Traveler and those visitors who travel in small groups. Key activities include outdoor recreation, sightseeing and visiting attractions such as Kinuseo Falls and the palaeontological exhibits and field sites.

These findings are also highlighted in Tourism BC’s 2012 In-Market Research Report for Northern BC which indicates visitors are most likely to participate in sightseeing, visiting parks (provincial or national), nature appreciation, wildlife viewing, hiking and visiting rural communities. This Report also points out that visitors to destinations in Northern BC participated in a far greater range of activities while on their trip than originally planned.

Based on the research, Geopark status would appeal to visitors traveling in the Northern Region. Moreover, such status would support the goals of the Tumbler Ridge Community Tourism Plan, which are:
- to grow the tourism industry strategically as a way of diversifying the local economy, expanding the tax base, increasing jobs and income available to residents while recognizing community values
- to enhance destination development and appeal for visitors through the strategic use of regional provincial, national and private infrastructure investments.

Providing services for visitors to the Geopark will generate new employment opportunities for residents and contribute to the social fabric of the community. In summary, Geopark status will lead to increased tourist visits and thus stimulate the local and regional economy. This is a process that has already begun, since the tourism product was developed in Tumbler Ridge in the early 2000s, and the Waterfalls and Dinosaurs theme was subsequently adopted.

Visitation numbers to the Dinosaur Discovery Gallery are increasing, and in 2012 were 3890 (adult admission fee was $8, with reduced rates for members, seniors, children). Geopark status will continue and accelerate this trend, but is unlikely to overwhelm the capacity of the community given the relative remoteness of the area from major urban centres.

The studies mentioned in this section are attached. The three studies thus far done on the Tumbler Ridge museum project are also attached, and include detailed economic information.

- **Geo-education and Geo-heritage**

Planned initiatives to foster Geo-education and to promote an appreciation of Geo-heritage include:

- Continue to maintain the Dinosaur Discovery Gallery and Community Centre exhibits, and increase promotion and marketing.

- Continuation of the Museum Foundation’s popular Dino Camps for children.

- Reinstitution of northern wilderness camps, to include specific topics such as Boulder Gardens and geology.

- Continuation of annual scientific symposium, focusing on palaeontological and geological themes.

- Expansion of educational camps to include four-season camps, seniors’ camps, etc.
- Continuation of existing Dinosaur Trackway tours (daytime and lantern).

- Introduction of new guided tours – possibilities include coal mine tours (which may include dinosaur footprint localities within the mines), wind energy project tours, train trips.

- Brochure development for specific self-guided geology road tours, including the three highway routes into Tumbler Ridge, and the unpaved roads to the Boulder Gardens, Mount Hermann, Albright Ridge, Windfall Lake, etc.

- Brochure development (self-guiding geological brochure) interpreting the winter cross country ski trip up Flatbed Canyon.

- Upgrade the Wolverine Nordic and Mountain Society’s trail brochures to feature even more information on geology.

- Expansion of the TRMF, WNMS, District of Tumbler Ridge and regional tourism websites to place an added emphasis on geology.

- Continue working with local artists who are depicting the local geological heritage through murals and smaller works of art. This includes providing advice that is geologically, palaeontologically and archaeologically correct in the hope that the resulting products are scientifically accurate.

- Continue working with local Arts Council regarding drama productions that describe and celebrate regional history.

- Produce a coffee-table book highlighting the features of the proposed Geopark.

5. Policies for, and examples of, community empowerment (involvement and consultation) in the proposed Geopark

Municipal government is part of the steering committee. The proposal is volunteer-driven and is a grassroots initiative. The list of stakeholders is long and includes a broad cross-section from the community. Presentations and updates will be provided to stakeholders and other community groups, with opportunities to provide input.

6. Policies for, and examples of, public and stakeholder awareness in the proposed Geopark.

The list of stakeholders is long and includes a broad cross section of the Tumbler Ridge community. Reports will be made back to the public (through, for example, the local newspaper) and stakeholders (through email and opportunities to meet with steering committee).

A list of such letters, emails, reports, news releases is being kept.
E – INTEREST & ARGUMENTS FOR JOINING THE GLOBAL GEOPARKS NETWORK

Ever since we became aware of the Geopark concept and the Global Geopark Network, we have believed such a designation and recognition would be a perfect fit for what we have been working towards for the past decade. The efforts we have subsequently made to include all levels of government, industry, First Nations and local stakeholders in the Geopark concept have without exception yielded enthusiasm and excitement.

A single delightful community in a large, easily definable area of remarkable natural wonder; an ongoing palaeontological research program that has received the support of local government and industry; a passionately involved volunteer base that has already gone to great lengths to celebrate this science, geological heritage and beauty; a burgeoning museum facility that already collects, prepares, interprets and informs, and caters to visitors; an unequalled network of hiking trails to select geological destinations; the opportunities for healthy lifestyle promotion that come with all these activities – together these already make Tumbler Ridge a unique destination, and ours a unique product.

We believe that through our Waterfalls and Dinosaurs community theme, our focus on natural wonders and palaeontological heritage, our development of a museum and gallery exhibits, educational programs, symposia, guided tours and our network of hiking trails to sites of geological and aesthetic significance, Tumbler Ridge is already functioning as a de facto Geopark.

Joining the GGN will formalize this interest and activity. Being part of a greater organization dedicated to the same goals will support the community in its endeavours, raise its profile, and act as an economic diversification stimulus, while enhancing community pride and “sense of place.” We hope that by having our representatives attend Global Geopark Network meetings and initiatives, we will learn and be able to bring this knowledge back to our area to enhance our programs and our product. Conversely, we hope that what we have to offer will interest the GGN, and lead to a legacy of mutual benefits.
AWARDS

The work of the Tumbler Ridge Museum Foundation, Peace Region Palaeontology Research Centre and Wolverine Nordic and Mountain Society has been recognized at many levels:

Tumbler Ridge palaeontologists Richard McCrea and Lisa Buckley received the Sci-Tech North Technology Leadership Award in 2008 and 2010.

Lisa Buckley received the University of Alberta Graduate Student Association “Community Involvement Award” in recognition of scientific outreach activities in the Peace Region in 2012.

Lisa Buckley received the Best Palaeobiology/Palaeoecology Presentation award for “A novel avian ichnotaxon from the Early Cretaceous (Albian) Boulder Creek Formation of northeast British Columbia: multivariate analysis and modern avian osteology as interpretive tools in vertebrate palaeoichnology.” Dinosaur Track Symposium, 2011, Obernkirchen, Lower Saxony, Germany.

Richard McCrea received the Museums in Motion Award of Merit from the British Columbia Museums Association in 2011 in recognition of his work as Curator of Palaeontology for the Tumbler Ridge Museum Foundation.

Charles Helm received the Rene Savenye Award for contributions to British Columbia paleontology in 2011.

Charles Helm received the Walter Smith Visionary Award for innovation in tourism from Tourism Prince Rupert / Northern BC Tourism in 2009.

Charles Helm received a Community Futures Award from the United Nations International Year of Fresh Water in 2003.

Charles Helm received the Queen’s Golden jubilee Medal in 2002. Charles Helm and Rose Colledge received the Queen’s Diamond Jubilee Medal in 2012.

The Wolverine Nordic and Mountain Society has received awards at provincial (British Columbia Parks and Recreation Association) and regional (Peace River Regional District) level as a model non-profit volunteer organization

SYMPOSIA


WEBSITES

www.trmf.ca, website of the Tumbler Ridge Museum Foundation, includes information on educational activities, trackway tours, exhibits, etc. The main page has links to the Waterfalls brochure and Dinosaurs brochure.

www.pris.bc.ca/wnms, website of the Wolverine Nordic and Mountain Society, with photo galleries and trail brochures

www.tumblerridge.ca, website of the District of Tumbler Ridge

www.prprc.com, website of the Peace Region Palaeontology Research Centre

www.canadatracks.com

http://prrd.bc.ca/services/development/planning/index.php, the Economic Growth Solutions study

BOOKS

Helm, Charles; Beyond rock and coal – the history of the Tumbler Ridge area, MCA Publishing, 2000, 118 pages.


Helm, Charles; Daniel’s Dinosaurs, Maple Tree Press, 2004, 32 pages..


Helm, Charles & Murtha, Mike; The Forgotten Explorer – Samuel Prescott Fay’s 1914 expedition to the Northern Rockies, Rocky Mountain Books, 2009.
REFERENCES, OUTREACH & EDUCATION, MEDIA


SCIENTIFIC PAPERS

Buckley, L.G. and R.T. McCrea 2005. New dinosaur and other terrestrial vertebrate skeletal discoveries from the Kaskapau (middle Turonian) and Wapiti (late Campanian-early Maastrichtian) formations of northeastern British Columbia. Jasper Science Writers Conference.


McCrea, R.T. 2011. Observed changes in vertebrate ichnofaunas from the uppermost Jurassic/lowest Cretaceous (Tithonian/Berriasian) to Lower Cretaceous (Albian) of western Canada. Dinosaur Track Symposium, Obernkirchen, Germany.


SELECTED SEMINARS, TALKS & DELEGATIONS

The discovery and documentation of a new dinosaur track site from the Upper Cretaceous (lower Maastrichtian) of northeast British Columbia, Canada. Qijiang International dinosaur tracks symposium, Chongqing Municipality, November 30, 2012.


Observed changes in vertebrate ichnofaunas from the uppermost Jurassic/lowest Cretaceous (Tithonian/Berriasian) to Lower Cretaceous (Albian) of western Canada. Dinosaur Track Symposium, Obernkirchen, Germany, April 15, 2011.


PRPRC 2010 Field Results (British Columbia’s first complete dinosaur). Delegation at the Peace River Regional District Meeting, Dawson Creek, British Columbia, November 3, 2010.


PRPRC 2008 Field Results (British Columbia’s first complete dinosaur). Delegation at the Peace River Regional District Meeting, Dawson Creek, British Columbia, November 26, 2009.


A significant dinosaur track site discovery in the Peace Region: implications for conservation and Tourism. To North and South Peace Economic Development Commissions, Dawson Creek, British Columbia.
Paleocene vertebrate trackways from Alberta, October 23, 2007. Cenozoic Track Meeting, New Mexico Museum of Natural History and Sciences, Albuquerque, New Mexico.


'Vertebrate tracks of western Canada'. November 15, 2006, Victoria Palaeontological Society, University of Victoria, Victoria, British Columbia.


FIELD TRIPS, WORKSHOPS & SYMPOSIA ORGANIZATION


Palaeontological field trip to fossil track sites near Tumbler Ridge, Canadian Palaeontological Conference/British Columbia Palaeontological Association Conference, 2005.

Alberta Palaeontological Society field trip to Tumbler Ridge area track sites, 2004

200 Years of Vertebrate Paleoichnology Symposium, Sixty-Second Annual Meeting of the Society Of Vertebrate Paleontology, Norman Oklahoma, October 9, 2002.

PALAEOONTOLOGICAL RESOURCE CONSERVATION ACTIVITIES


Member of B.C. Parks Palaeontological Advisory Committee – Palaeontological Resources of Kakwa Provincial Park, British Columbia. March 29, 2005 – present.


Contributors for designation of protective status for two track sites in the Getting Formation of British Columbia (application in review).

Contributors to an application for Non-Staking Reserves for six fossil vertebrate localities in B.C.’s Peace Region 2003 - 2005.

Richard McCrea was palaeontological advisor and advocate for the Grande Cache track site’s designation as an Alberta Provincial Historic Resource, which was formalized in the spring of 2006.


Interview for CJDC TV (Dawson Creek), Federal funding for PRPRC renovations, January 27, 2012.


Interview, for The Canadian Press, ‘B.C. moves toward some protection of fossil sites’, by Dirk Meissner, October 6, 2010.


Richard McCrea and Lisa Buckley, Tumbler Ridge Elementary School Science Fair judge (K – 7), May 9, 2008.

CBC Radio ‘Daybreak North’ (Chris Walker), Interview on museum move, April 14, 2008.


CBC Radio interview ‘All Points West’ Victoria program (Jo-Ann Roberts Host) November 15, 2006


CBC Radio Daybreak Program Prince George (Kevin Sylvester host) - interview on new dinosaur footprint finds in NEMI Trend Mine near Tumbler Ridge, B.C., June 22, 2006.

The Beaver: Canada’s History Magazine article ‘Walking with dinosaurs’, by Ann Chandler (June-July, 2006: 36-37)


CBC Radio Canada Raphaelle Derome - juvenile ankylosaur trackslab, July 29, 2005

CBC Radio - B.C. Almanac - Jennifer Chen - juvenile ankylosaur trackslab recovery July 27, 2005


Dinosaur display and presentations for the Northern Regional Science Fair at North Peace Secondary School, Fort St John, British Columbia, April 13, 2005.

CBC Radio (Kelowna) interview on dinosaur track discovery in southeastern British Columbia, Daybreak South Program hosted by Marion Barschel, February, 24, 2005


Knowledge Network Program "The Leading Edge" on Tumbler Ridge dinosaur tracks and excavations, January, 2005.

Presentation for the Children’s Summer Reading Club Program at the Tumbler Ridge Public Library, June 26, 2004.


Living Landscapes: Peace River Northern Rockies public event (two day school program for 250 Grade 6 students; Fossil Road Show & presentation on Tumbler Ridge dinosaur excavation, May 27 - 29, Northern Lights College, Ft. St. John, British Columbia.


Discovery Channel Program “Daily Planet” on Tumbler Ridge Dinosaur Tracks, Premiered in Canada, September 8, 2003 (soon to air in U.S.).


CBC radio interview, CBC Radio Prince George, March 12, 2002.

Newspaper interview, 'Dinosaur footprints taking big step into Exploration Place', by Bernice Trick For The Prince George Citizen, January 30, 2002.