**Geological History of Western Canada**

**Student Field Guide Projects**

Proof read, add more from Paul? And adjust before giving to students

**Project # 1 – Windmills – Why? (STOPS 1, 14, 15a/b)**

1. Alternative energy source, but is it really green?

2. Which REEs are used in windmills? Which minerals could these REEs come from?

3. Why should we care? Where are REEs currently mined? What are their prices, how much is stock piled, what is the forecasted supply?

4. What can we do? Talk to Jamie (and ???) about what Canadian mining companies are doing

5. Where are windmill farms in North America? In the world? How many and how much REE is used?

6. Use Google Earth to map windmill farms along the field trip route

(NOTE: Stop #1 is yours; but you can also talk about windmill farms first thing in the morning on day #2 in Pincher Creek; and comment at stops 14, 15a/b)

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #2 – Oldman River and tributaries (STOP 2, 3 and 15a)**

1. Use Google Earth to create a figure with the entire Oldman River watershed

2. Create a profile of the Oldman River

3. Measure the Oldman River bed widths

4. Complete a full description of the Oldman River

5. Collect specimen where possible for future analysis

NOTE: Stops 2 and 3 are half yours; along with a third opportunity for photographs in the viewpoint after the bridge when we turn into centre town Lethbridge; and stop 15a)

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #3 – St Mary’s River Formation (Stop 2)**

Contact the following people in order to obtain permission for visiting this outcrop:

Frank Shortt – 403-553-2234

John Schotten – 403-320-7827

Hanna Batan – 403-381-4358

What is the St Mary’s Formation and its age?

Where else does it outcrop?

Coordinate your group of students to complete a stratigraphic column, collect specimen and to take a structural measurement of the orientation of your outcrop

Why do you think that this outcrop is tilted? It is in the prairies, where most strata is flat-lying…is this primary or secondary?

NOTE: Stop 2 is half yours

**Project #4a – Glacial features East of Pincher Creek (i.e. Praries); Ammolite mine group (stop 3 and one furthest east)**

1. Use Google Earth and topographic maps to examine our route for glacial features. Is there anything that you can see along the route?

2. Plot the distribution of these glacial features on Google Earth figures. Are there any indications of ice flow directions?

3. What are the geological features that we can expect to see along this portion of the field trip?

3. Collect samples where appropriate. In your case you will want to collect two suites of samples, one at stop 3 and one as far east as the field trip gets to.

NOTE: Stop 3 is half yours (collect at least 30 pebbles from this outcrop; also collect a sample bag from the glacial lacustrine outcrop near the end of the exit from this parking lot). Compare and contrast these two suites of samples, is there any difference between the two? Why do you think this might be so?

4. Compare and contrast your pebbles with those of the alluvial fan and the other two glacier projects.

**Project 4b: Glaciation through Fold Belt (triangle zone to RMT; not including RMT) – Shell gas plant and Waterton group (stops 8, 29, 32)**

1. Use Google Earth and topographic maps to examine our route for glacial features. Is there anything that you can see along the route?

2. Plot the distribution of these glacial features on Google Earth figures. Are there any indications of ice flow directions?

3. What are the geological features that we can expect to see along this portion of the field trip?

4. Collect samples where appropriate. Collect at stops 8 and 29 (32 possible for future years). Compare and contrast these two groups of specimen. Are they similar or different?

5. Compare and contrast your pebbles with those of the alluvial fan and two other glacial people.

**Project 4c: Glaciation through Omineca Belt (RMT west; Stops 34, 39 40, 42, 44a/b, 48a, 54; this year Dutch Creek hoodoos 44a/b)**

1. Use Google Earth and topographic maps to examine our route for glacial features. Is there anything that you can see along the route?

2. Plot the distribution of these glacial features on Google Earth figures. Are there any indications of ice flow directions?

3. What are the geological features that we can expect to see along this portion of the field trip?

4. Collect samples at stops . Compare and contrast these two groups of specimen. Are they similar or different?

5. Compare and contrast your pebbles with those of the alluvial fan and two other glacial people.

Multiple STOPS between #34 and Golden along RMT

Focus on gravel pits and excellent exposures where this student can actually map out sedimentary features in the outcrops

Best ones at first glance are (pick one):

**Project #5 – Ammolite mine (Stop 4; permission to collect samples)**

What is the significance of ammolite?

What is the economic importance of ammolite?

Outline the process of formation for ammolite (pressure, temperature and fluid conditions).

What stratigraphic units are present here?

Complete a stratigraphic section of the units in the mine

Collect and analyze some samples

**Project #6 – St Mary’s Reservoir (Stop 5; permission to collect samples)**

What is the importance of this location?

Describe what we should find here

Which stratigraphic units are located here

Complete a stratigraphic section

Photograph a grid (as much as possible)

Collect some samples

**Project #7 – Alluvial Fans – stops 6 (sample collection; get permission to collect samples) and 8 (photo)**

What is an alluvial fan? What is their importance?

Use Google Earth to locate at least 10 alluvial fans throughout the field trip route (include the one where Blakiston Creek empties into Waterton River and the ones at the base of Vimy Peak).

Print out a figure that shows these (3 copies) to share with the other two vans.

Collect at least 30 random samples from the alluvial fan at Blakiston Creek.

Analyze and provide a geological name for each of these samples

Compare and contrast your samples with those of the two glacial projects.

**Project #8 –Front Ranges Tectonics** - stops 6 (photo of Vimy Peak), 11a/b/c (photos of Vimy Peak and Mtn Crandell), 12 (photos of Mtn ranges), 22 (Crowsnest Mtn nappe), 25 (entrance into Front Ranges along crowsnest highway)

What marks divison between foothills and Front Ranges in southern Canadian Cordilleran?

Create a map with the approximate location of this feature throughout the field trip route. Print out 3 copies for the vans to use on the field trip.

Use Google Earth wherever possible to determine the orientation of the main features throughout the field trip route.

NOTE: the geological features that are associated with this feature

Take photos of this feature throughout the field trip and refine your map as much as possible.

Compare and contrast the Front Ranges between the Trans Canada and Crowsnest transects.

Part of your contribution includes 2 sample descriptions for glacier and alluvial fan projects

**Project #9 – Red Rock Canyon** – Stop 7 (all yours: get permission to collect samples)

What is the significance of this section?

Which units are present?

Are there any other rock types than the sedimentary rocks that dominate this area?

Create a topographic map using Google Earth, print out at least 10 copies for your group to use to map the contacts.

Create a geological map of Red Rock Canyon.

Measure an appropriate stratigraphic column

Collect some representative samples to analyze in the lab.

**Project #10 – Altyn Formation** – Stop 9 (permission to collect)

What is the Altyn Formation and its age?

Where does it outcrop?

Complete a stratigraphic section

Analyze the structures present. Are these primary or secondary?

Collect a representative suite of samples for analysis

**Project #11 – Waterton Formation** – Stop 10 (permission to collect)

What is the Waterton Formation and its age?

Create a map of Cameron Falls in Google Earth and print out at least 10 copies for your group to use

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #12 – Shell Waterton Gas Plant** (organize a tour of facility and reclamation of Plant #1)

Outline the history of this plant

What is processed at this plant? Where /how are the products shipped to?

Outline the chemistry of the processes at the plant.

Create a map of the plant with the relevant pipelines and train tracks

Using the dollar values at the end of September, 2011, estimate the value of the products (Canadian dollars) for a day, week, month and year.

Outline the reclamation process for Plant #1

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #13 – Triangle Zone and Foothills**

What is the significance of the triangle zone?

Reproduce a cross-section that outlines the main features of the triangle zone. Bring 3 copies of this figure for the 3 vans on the field trip

Create a map in Google Earth that depicts the approximate location of the triangle zone throughout the Canadian Cordillera. Print out 3 copies of a suitable scale map for the 3 vans for the field trip.

Use Google Earth to examine outcrops on either side of the field trip route. Measure dips wherever possible.

During the field trip, stop where appropriate to measure the orientation of the strata in order to refine your map of the triangle zone.

At Stop 13 – measure the bedding orientation, collect representative samples and complete a quick stratigraphic column

At Stop 14 – Pincher Creek is located in the triangle zone. Is there anything at this location to indicate this? Would; you expect to see the apex of the triangle zone, why or why note?

At Stop 15 – what is the dip direction of these beds? Where is the triangle zone in relation to this stop?

Where is the triangle zone located in Turner valley and Jumping Pound on the Trans Canada?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #14 – Kootenay and Blairmore Formations**

What are the Kootenay and Blairmore Formations and their ages?

Create a map showing the surface outcrops of the Kootenay and Blairmore Formations

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #15 – Landslides (Stops 17, 72)**

What was Canada’s most destructive mass wasting event?

Use Google Earth to locate at least 10 mass wasting events along field trip route

Classify each of these events

What is up with Turtle Mtn today? What do you predict for a future event?

How can an event such as the Frank Slide occur? How can the 80 million tons of material move as far as it did during the Frank Slide? Describe this process.

Stop #17 is your main stop; there is also evidence of mass wasting at stop #15a. Is there anywhere else that we should stop at for your project?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #16 – Crowsnest River (Stop 18)**

1. Use Google Earth to create a figure with the entire Crowsnest River watershed

2. Create a profile of the Crowsnest River

3. Measure the Crowsnest River bed widths

4. Complete a full description of the Crowsnest River

5. Collect specimen where possible for future analysis

NOTE: Stops 18,

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #17 – Turtle Mountain Fault and Hosmer Nappe -** (Stop 18)

Combine this with project #26

What is the significance of these structure?

What type of structure are these? Use Google Earth to map and classify them.

Compare and contrast these features

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project 18 – Cadomin Conglomerate (stop 19)**

What is important about Cadomin conglomerate?

What is the Cadomin conglomerate and its age?

Where else does this unit outcrop? Create a figure with the extent of these outcrops

Use Google Earth to create 3 copies of maps for all three vans for field trip

Measure stratigraphic colum and collect samples at outcrop

**Project #19 – Crowsnest Volcanics (STOP 21)**

What is significant about this volcanic suite?

How extensive is this unit? Create a map with the extent of these outcrops

Complete stratigraphic column and collect samples for analysis

Does it make sense to do paleomagnetic studies with this unit? What does this indicate about the need to have a good well-rounded understanding of geological processes?

**Project #20 – Cardium Formation** – Stop 23

What is the Cardium Formation and its age?

What is the extent of the Cardium outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #21 – Devon Gas Plant (2012?); Stop 24**

Outline the history of this plant

What is processed at this plant? Where /how are the products shipped to?

Outline the chemistry of the processes at the plant.

Create a map of the plant with the relevant pipelines and train tracks

Using the dollar values at the end of September, 2011, estimate the value of the products (Canadian dollars) for a day, week, month and year.

Is there any reclamation underway at this plant? If so outline the processes being used.

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #22 - Palliser – Exshaw Formations (STOP 26)**

What are the Palliser and Exshaw Formations and their ages?

Both these units have economic significance. Outline these.

What is the extent of these units in outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #23 – Banff Formation and Structures (STOP 26)**

What is the Banff Formation and its age?

What is the extent of the Banff outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

What structures are located within the Banff Formation at this outcrop?

Measure and describe these structures

**Project #24: Etherington Formation (STOP 27)**

What is the Etherington Formation and its age?

What is the extent of the Etherington outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #25: Fernie Formation (STOP 28)**

What is the Fernie Formation and its age?

What is the extent of the Fernie outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

Project #26 – Hosmer Nappe Structure (STOPS 30, 31)

Combine with Project #17 (Turtle Mt Fault) – compare and contrast structures

**Project #27 – Rooseville and Eager Formations (STOPS 32 and 38)**

Tiny outcrop

Compare and contrast this argillite with Eager Formation (Stop #38)

What is the Rooseville and the Eager Formations and their ages?

What is the extent of these units in outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #28 – Rocky Mountain Trench**

Create a Google Earth map outlining the extent of the RMT and one showing the extent of the RMT along the field trip route

What is the significance of this physiogeographic feature? Does it have true geologic significance?

What is Jubilee Mountain? What is the significance of this feature for the RMT?

Tectonically what is the RMT part of?

STOP #35 – S end of RMT on field trip

STOP #43 – view down RMT ~ half way?

STOP #46b – Jubilee Mtn

STOP on TCH just east of Golden – north end of RMT

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #29 – Gateway Formation (STOP 33)**

What is the Gateway Formation and its age?

What is the extent of the Gateway outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #30 – Borsato and Southesk Formations (STOPs 35 and 36)**

What are the Borsato and Southesk Formations and their ages?

What is the extent of the these units in outcrop? Create a map with this.

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #31 – Kootenay River (STOPS 35, 36, along 39, 40**

1. Use Google Earth to create a figure with the entire Kootenay River watershed

2. Create a profile of the Kootenay River

3. Measure the Kootenay River bed widths

4. Complete a full description of the Kootenay River

5. Collect specimen where possible for future analysis

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #32 – Burnais Formation Gypsum and Gypsum quarry (STOP 37)**

What is the Burnais Formation and its age?

What is the extent of the Burnais outcrop? Create a map with this.

Organize a tour of the Gypsum quarry

What uses are there for gypsum? What is the current value of gypsum on the world markets? What is the yearly output of gypsum from this quarry?

Describe a stratigraphic column

Collect structural data

Collect a representative suite of samples to analyze

**Project #33 – Columbia River (STOPS 40, 41, 43, 44, 46a**

1. Use Google Earth to create a figure with the entire Columbia River watershed

2. Create a profile of the Columbia River

3. Measure the Columbia River bed widths

4. Complete a full description of the Columbia River

5. Collect specimen where possible for future analysis

Are there any other opportunities to examine your river that I missed?

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**Project #34 – Windermere Supergroup (STOP 41b)**

What is the Windermere Supergroup and its age?

What is the extent of the Windermere outcrop? Create a map with this.

What are the regional correlations between the Windermere outcrops?

Describe a stratigraphic column, where does this fit in the regional Windermere correlations?

Collect structural data

Collect a representative suite of samples to analyze

**Project #35 – Red Wall Fault (STOP 45a)**

What unit is present here, what is the lithology and its age?

What is the extent of this unit? Create a map with this.

Measure and describe the structure.

Describe a stratigraphic column

Collect a representative suite of samples to analyze both in the fault and far enough from the fault to not be stained red.

**Project #36 – McKay Formation (Stops 47, G, H, 49, J)**

What is the McKay Formation and its age?

What is the extent of the McKay Formation? Create a map with this.

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #37 – Kicking Horse River (STOPS 48a, b)**

1. Use Google Earth to create a figure with the entire Kicking Horse River watershed

2. Create a profile of the Kicking Horse River

3. Measure the Kicking Horse River bed widths

4. Complete a full description of the Kicking Horse River

5. Collect specimen where possible for future analysis

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #38 – Purcell Thrust (STOPS Ga, 50)**

What is the Purcell Thrust? What is its significance?

What is the extent of the Purcell Thrust? Create a map with this.

What lithological units are located at this stop? And their ages?

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #39 – Tectonic Model of Rockies (STOP 49a/b)**

Describe this tectonic model? What is its significance?

What lithological units are located at this stop? And their ages?

Describe and measure a stratigraphic column at this location. Or is this possible?

Collect structural data

Collect a representative suite of samples to analyze

**Project #40 – Donald Formation (STOP K)**

What is the Donald Formation and its age?

What is the extent of the Donald Formation? Create a map with this.

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #41 – Horsethief Creek Group (STOPS L; R&M STOP 2-2; 71a/b)**

What is the Horsethief Creek Group and its age?

What is the extent of the Horsethief Creek Group? Create a map with this.

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #42 – Isogradic surfaces (STOP 70)**

What is an isograd? And an isogradic surface?

What should we care about isograds?

Find evidence for this isograd

Describe the lithological units at this stop.

Take relevant structural measurements.

Collect a representative suite of samples to analyze

**Project #43 – Selkirk Fan Structure (Two of STOPS 65, 66, 67, 68, 69)**

What is the Selkirk Fan Structure? What is its significance?

What is the extent of the Selkirk Fan Structure? Create a map with this.

What lithological units are located at these stops? And their ages?

Describe the lithologies at this location

Collect structural data, is there anything that indicates the presence of this fan structure?

Collect a representative suite of samples to analyze

**Project #44 – Illicilliwaet River (STOP 63a)**

1. Use Google Earth to create a figure with the entire Illicilliwaet River watershed

2. Create a profile of the Illicilliwaet River

3. Measure the Illicilliwaet bed widths

4. Complete a full description of the Illicilliwaet River

5. Collect specimen where possible for future analysis

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #45 – Clachnacudainn Complex (STOPS 64, 63)**

What is the Clachnacudainn complex? What is its significance?

What is the extent of the Clachnacudainn Complex? Create a map with this.

What lithological units are located at this stop? And their ages?

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #46 – Revelstoke Dam and Columbia River Fault (STOP 51)**

What is the Columbia River Fault? What is its significance?

What is the extent of the Columbia River Fault? Create a map with this.

What lithological units are located at this stop? And their ages?

Describe and measure a stratigraphic column at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #47 – Monashee Complex Cover Gneiss (STOPS E, D, C, B**

What is the Monashee complex? What is its significance?

What is the extent of the Monashee Complex Cover Gneiss? Create a map with this.

What lithological units are located at this stop? And their ages?

Describe the lithological units at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #48 – Three Valley Gap Assemblage (STOP 52)**

What is the three valley gap assemblage? What is its significance?

Describe the lithologies present at this outcrop

Take all relevant structural measurements

Collect a representative suite of samples for analysis

**Project #49 – Gneisses at boundary between Monashee Mountains and Columbia Mountains (STOPS A, B, 53b, 55, 56a/b/c/d)**

Is there any tectonic significance to this boundary?

Describe the lithologies

Take structural measurements

Collect a representative suite of samples for analysis

**Project #50 - Craigellachie Monument (STOP 53a)**

Outline the historical significance of this location

Which province is missing? What is this province’s representative rock?

What rock would you propose to represent Alberta?

Do the representative rocks for the other provinces and territories make sense?

DO NOT collect any specimen here (DO take photographs). Instead you will be responsible for outlining the geological setting (with relevant details) for four of the provinces/territories.

**Project #51 – Eagle River (STOPS 54, 56e, 57, 60??)**

1. Use Google Earth to create a figure with the entire Eagle River watershed

2. Create a profile of the Eagle River

3. Measure the Eagle River bed widths Eagle River

5. Collect specimen where possible for future analysis

Are there any other opportunities to examine your river that I missed?

Part of your contribution includes 2 sample descriptions for alluvial fan and glacier projects

**Project #52 - Okanagan-Eagle River extensional detachment fault (STOPs 56e/f, 57, 58)**

What is the Okanagan-Eagle extensional detachment fault? What is its significance?

What is the extent of the Okanagan-Eagle extensional detachment fault? Create a map with this.

What lithological units are located at this stop? And their ages?

Describe the lithological units at this location

Collect structural data

Collect a representative suite of samples to analyze

**Project #53 – Sicamous Formation (STOP 58)**

What is the significance of the Sicamous Formation? And its age?

What is the extent of this formation? Create a map outlining this extent

Describe the lithologies present

Collect appropriate structural measurements

Collect a representative suite of samples for analysis

**Project #54 – Okanagan Lake (STOPS 59, 60…more???)**

1. Use Google Earth to create a figure with the entire Okanagan Lake

2. Create a profile of Okanagan Lake

3. Create a map in Google Earth that depicts the land use patterns around Okanagan Lake

4. Collect specimen where possible for future analysis

Are there any other opportunities to examine your lake that I missed?

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Project #55 – Foreland Belt Tectonics – Trans Canada