



THE
GEOLOGICAL
SOCIETY
OF AMERICA®

ROCKY MOUNTAIN Section Meeting

9–10 June 2017

Mount Royal University
Calgary, Alberta, Canada



Abstract

Program
Rocky Mountain Section
69th Annual Meeting of the Rocky Mountain Section, GSA
Calgary, Alberta, Canada
8–10 June 2017

*Welcome to the Heart of the Western Canadian Sedimentary Basin;
at the Gateway to the Canadian Rockies*



Local Program Committee

General Chair Katherine Boggs
Technical Program Chair Jenni Scott
Field Trip Chair Jean Hsieh
Student Volunteer Coordinator Susan Reid

GSA Rocky Mountain Section Officers for 2017–2018

Chair Amy Ellwein
Chair Elect Janet Dewey
Secretary/Treasurer Kevin Mahan

NOTICE

By registering for this meeting, you have acknowledged that you have read and will comply with the GSA Code of Conduct for Events (full code of conduct listed on page 17). If you need to report unacceptable behavior, please contact:

GSA Executive Director, Vicki McConnell, vmcconnell@geosociety.org

You may also stop by Registration or the GSA Bookstore Booth to have them directly contacted via phone.



Dedication to Grant Mossop

Dedication to Grant Mossop (1948 to 2005)

Passionate Geologist, Engaging Educator, Accomplished Cellist, and Family Man

Grant Mossop's passion for geoscience education impacted many. "For me, no thrill can compare to the teaching process, the passing along of what you've learned – to your children in the car as you pass the McConnell Thrust; to school kids in a classroom, enthralled at the wonders of the gypsum in the wallboard; to graduate students in a seminar, wrestling with complex stratigraphic reconstructions; to lay people in their seventies twiggling for the first time to how dramatic was the tectonic history of the Rockies" (quoted from materials for the 2002 Geological Association of Canada Presidential Address). Public outreach was so important to him, that he assisted in developing and was the narrator for several television programs and films on Earth Sciences in Western Canada.

Dr. Mossop was one of Canada's most widely recognized and respected sedimentary geologists. He authored over fifty scientific publications. But the Geological Atlas of the Western Canada Sedimentary Basin (1994) - the compilation of the nature and origin of the sedimentary rocks of Western Canada - was his most outstanding contribution to the fabric of Canadian Geoscience. This volume provides a framework for the exploration and development of the geological resources of Alberta, Saskatchewan, Manitoba and northeastern British Columbia.

Grant's impressive leadership skills resulted in his promotion to Head of the Alberta Geological Survey (1980 to 1984), and then Director of the Institute of Sedimentary and Petroleum Geology, the Calgary office of the Geological Survey of Canada (1991 to 2001). He was President of both the Geological Association of Canada (1986-1987) and the Canadian Geoscience Council (1989).

Grant Mossop was a native Calgarian, born to well-known Calgary musicians Cyril and Frieda Mossop. As a cellist, he toured with the National Youth Orchestra in 1965 and 1966 and was also a member of the Calgary Philharmonic Orchestra for eight years. He was one of the first Honours BSc Geology graduates of the University of Calgary in 1970, and then earned his MSc there one year later. His PhD was completed at Imperial College, University of London in 1973.

In addition to his scientific contributions, Grant's organizational skills led to extensive community involvement, including serving on the boards of museums, music societies, the Calgary Science Network, and the Senate and senior committees of the University of Calgary. When Grant died, in honour of his passion for education, his family and friends established an endowment fund at the University of Calgary which awards annually The Grant Mossop Graduate Scholarship in Geology.

Grant was a beloved husband, father, grandfather, brother, teacher, colleague, and friend. All who had the joy of knowing him will remember his energy, humour, brilliant mind, and infectious passion for life. He is gone too soon but will never be far away, his spirit nestled in the rugged grandeur and intimate beauty of the Canadian Rockies.



Grant Mossop with his original, very old, blue backpack standing in awe of "his" Rockies (photo courtesy of the Mossop family). His wife, Ruth, recalls that "at times the massive splendor or intimate beauty of the area would stop Grant, speechless, in his tracks." She says that of all the wonderful tributes that were paid to Grant when he died, perhaps the greatest came from his children: "His sheer enthusiasm for knowledge and clarity inspired all three of us to seek, in our own ways, deeper understanding of the workings of the world and of ourselves." (daughter Jennifer); "Dad's method of leadership was not one of command, but one of inspiration" (son David); "I now understand that Dad's reaction to the genius of a Gretzky goal, the beauty of a deeply expressed musical phrase, the sheer grandeur of a crisp mountain day or the immense pride so often felt for his family, revealed the depth of his gentle soul" (son Jonathan). All knew that tucked away in Grant's blue backpack for bone-weary, exhilarated hikers, was a traditional treat which dated back to his boyhood when he was encouraged by his father to hike these same trails and was rewarded at the middle and the end of the day ... with, yes, chocolate!

The 2017 GSA Rocky Mountain Section Meeting is dedicated to Grant Mossop's memory.



**Office of the President
Mount Royal University**
4825 Mount Royal Gate SW
Calgary, AB Canada T3E 6K6
Telephone: 403.440.6393
Email: ddocherty@mtroyal.ca

April 19, 2017

Dear Conference Participants:

On behalf of the campus community, we welcome you to Mount Royal University for the 69th annual meeting of the Rocky Mountain Section of the Geological Society of America.

As geoscience and geotechnical practitioners, secondary and collegiate-level educators and students you can expect an excellent time spent in the Western Canada Sedimentary Basin, which features a plentiful mix of rugged mountain ranges, lush foothills and grassy prairies.

Alberta also has experienced more major natural disasters than anywhere else in Canada. The keynote talks will see local emergency management people joined by Jeff Freymueller Director of EarthScope and Dave Eaton Director of Canadian Cordillera Array to describe experiences during the 2013 flood and 2016 wild fires.

In addition to a diverse set of technical sessions and field trips around the province, we look forward to having you enjoy exhibits and facilities on campus. Early in the week, you will tour Mount Royal's Cretaceous Seas exhibit and the Rockscape. The official opening will be held in the beautiful and acoustically amazing new Bella Concert Hall. You can also access our on campus recreation facilities, which are second to none in Calgary.

I would also like to express my gratitude. This annual meeting creates an excellent opportunity for the practitioners of tomorrow, both undergraduate and graduate students, to learn, to volunteer, to network and to be mentored. We very much appreciate the Geological Society of America's commitment to invest time and energy into this future generation.

In closing, I wish all of you a wonderful annual meeting, filled with opportunities to expand your knowledge in sessions, field trips and workshops and to catch up and collaborate with colleagues.

Sincerely,

David Docherty, PhD
President



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3rd April, 2017

Dear Meeting Delegates,

It is with great pleasure that I offer a warm welcome to all delegates of the 2017 *GSA Rocky Mountain Section Meeting*. On behalf of the Faculty of Science and Technology, Mount Royal University, we are proud to host your 69th annual meeting.

The *Section Meeting* will feature technical sessions and field trips, including keynote talks by Jeff Freymueller (Director of EarthScope) and Dave Eaton (Director of Canadian Cordillera Array); talks will also provide an opportunity to hear local perspectives on the 2016 wildfires in Fort McMurray, and the 2013 Alberta floods. These keynote presentations will be augmented by diverse technical sessions, including those with a focus on energy and carbon-capture in the Canadian Rocky Mountains, and cross-border evolution of the Rocky Mountain region. Complementary field trips will take full advantage of Calgary's location in the heart of the Western Canadian Sedimentary Basin. Delegates will be able to explore UNESCO World Heritage Sites, including Dinosaur Provincial Park, and the Burgess Shale Trilobite beds in Yoho National Park.

Mount Royal University has a proud history of collaborating with public, private, and community sectors, and the Faculty of Science and Technology aspires to strengthen linkages through events such as this *Section Meeting*. It is my personal hope that this meeting will offer an opportunity for all delegates – students, faculty, and professionals – to engage with each other, to network and interact, and to take some time to see and learn what the Faculty of Science and Technology, and the University as a whole, has to offer.

Calgary days in June are long, and the weather is more often than not beautiful. Out-of-town attendees will be treated to Calgary at its finest. Located in the foothills of the Canadian Rocky Mountains, I encourage travelers to spend a few extra days in Western Canada, and to benefit from the outstanding geological and geographical location of Calgary.

I look forward to seeing you in June.

All good wishes,



Jonathan Withey
Dean, Faculty of Science and Technology

General Information



LOCATION

The 69th Annual Meeting of GSA's Rocky Mountain Section will take place in the Roderick Mah Centre at Mount Royal University in Calgary, Alberta, Canada. Calgary is located in the heart of the Western Canadian Sedimentary Basin within sight of the Canadian Rockies. Our vibrant city is blessed with two of the largest urban parks in North America (Fish Creek Provincial Park and Nose Hill) in addition to the Weaselhead and Glenmore Reservoir, which are walking distance from campus.

Local attractions include Fort Calgary, the Glenbow Museum, Heritage Park, Calgary Zoo, TELUS Spark Science Centre, Canada Olympic Park, and the Military Museums. Family friendly events in June include: i) The National equestrian jumping tournament at Spruce Meadows June 7 to 11; ii) The Calgary Mayor's Environmental Expo 6–8 June; and iii) The Mountain Equipment Coop Paddlefest is 12 June on Chestermere Lake. The Royal Tyrrell Museum of Paleontology is 90 minutes away in nearby Drumheller. Canada Olympic Park has a zip line, downhill mountain bike trails, and a luge run open during the summer.

Calgary, originally called Fort Brisebois, was founded in 1875 by a troop of North West Mounted Police due to the presence of two clean rivers, forests of spruce and Douglas Fir (which can still be found in Fish Creek and Bowness Parks). Colonel James McLeod renamed our city Calgary after his home in the Scottish Highlands. Fescue grasslands to the northwest, rich grassy foothills to the west and the vast grass prairies to the east and southeast made Calgary a popular destination for pioneer ranchers once the railroad arrived in 1883. Calgary became known as the "Sandstone City" after the devastating fire of 1886 burnt much of the town to the ground. After the fire, the local Paskapoo Sandstone replaced wood as the most popular building material.

Oil was first discovered in Turner Valley, south of Calgary, in 1914. This first oil boom was one of the shortest ever, lasting May to August, abruptly halted by the outbreak of World War I. The discovery of the Leduc fields led to the next oil boom in 1947; resulting in Calgary becoming one of the fastest growing cities in Canada—from 100,000 in 1947 to 200,000 in 1955, 325,000 by 1965 to 1.4 million today.

Calgary hosted the winter Olympics in 1988. The Olympic Oval at the University of Calgary is known as the "Fastest ice in the world" because it has seen 261 long track and 30 short track records. Canada Olympic Park (at the western margin of Calgary) hosted ski jumping, luge and bobsled competitions. Cross-country skiing and biathlon competitions were held in nearby Canmore.

TRANSPORTATION

Calgary is crosscut by the Trans Canada and the Queen Elizabeth Highways (see map on page 13). The Trans Canada Highway (#1) runs from east to west through Calgary and the Queen Elizabeth Hwy #2 (Deerfoot in Calgary) runs from north to south through Calgary. Interstate 15 from Montana becomes highway #4 in Alberta. From Lethbridge, turn west on highway #3 to Fort MacLeod and then head north on highway #2.

Mount Royal University is north of the Glenmore Reservoir in the southwest quadrant of Calgary. See map on page 13. The Calgary International Airport is in the north-east quadrant of the city. From the airport take Airport Drive to Deerfoot and head south. Then take Glenmore Drive west to 37th Avenue. If you are staying at the Grey Eagles Resort, head south on 37th and follow the signs. If you are staying at the Mount Royal University Residences, head north on 37th, turn right on Richardson Way and turn right into campus. The residences will be on your right.

PARKING

There is free parking for guests at the Grey Eagles Resort. The resort will provide guests with a free shuttle to campus. It is an easy 20-minute walk to campus. There is also free parking for guests staying at the Mount Royal University Residences on campus.

EATING AND DRINKING

Delegates are provided with some refreshments and coffee breaks during the conference. There are also social events planned for Thursday and Friday evenings, which will end at local pubs/restaurants.

There are a number of restaurants within walking distance of Mount Royal University Campus; listed below. See map on page 14. Calgary has a wide variety of additional dining options within easy driving distance. Please explore these options online.

Sarcee Shopping Plaza (37th St., and 45th Ave.)

Sushi Hanami

Masala Bhavan South Indian Cuisine

Hadu nama Korean Cuisine

Weaselhead Bar and Grill

Liquor Depot

7-Eleven

Grey Eagle Resort & Casino (Tsuu T'ina First Nation Lands south of campus off 37th St.)

Little Chief Restaurant (in hotel)
Buffet (in casino)
Blaze Bar and Grill (in casino)
Stage Bar (snack foods; in casino)

Wild Rose Brewery (Currie Barracks northeast of campus)

Mount Royal University
Food Court (Wyckham Hall)
Starbucks (East Entrance)

Lincoln Park Centre (Richard Road south of campus)
Domino's Pizza (Take-out and Delivery)
Pita Pit
Spot On Kitchen and Bar
Lincoln Park Liquor (Beer and Liquor)
Tim Horton's
Calgary Drug Mart (drug store)

Small strip mall (Richardson Ave./46th Ave., and 37th St.)
Golden Leaf Chinese Food (Take-out and Delivery)
Hanni's Mediterranean Restaurant and Pizza

VENUE

The conference venue is located in Ross Glen Hall, at the Roderick Mah Centre on the southeast corner of Mount Royal University Campus. Catering, posters, and exhibits are in room EC1050.

WEATHER

Weather in Calgary can be unpredictable. June nighttime lows usually range from 6 to 10C (42 to 50F) with day time highs from 18 to 21C (64 to 70F). Expect sixteen hours of daylight during your visit. Please come prepared with rain gear.

Please be prepared for snow if you are attending one of the field trips to the mountains. Warm layers and rain gear are highly recommended during all months in the mountains.

REGISTRATION

Registration is required for anyone attending technical sessions, field trips, short courses, or exhibits. Check-in and on-site registration is in the East Entrance by the Pteranodon during the ice breaker on Thursday. Friday and Saturday registration is located in the Roderick Mah Centre.

Registration Hours

Thursday, 8 June	4–7 p.m. (East Entrance by the Pteranodon)
Friday, 9 June	7:30 a.m.–4:30 p.m. (Roderick Mah Centre)
Saturday, 10 June	7:30 a.m.–2 p.m. (Roderick Mah Centre)

Registration Fees

On-site registration fees are below.

	Standard Full Mtg.	One day
Professional Member	\$335	\$175
Professional Member 70+	\$175	\$90
Professional Nonmember	\$375	\$205
Early Career Professionals	\$175	\$95
Prof. Low Inc. Countries	\$152	\$77
Student Member	\$125	\$80
Student Nonmember	\$140	\$100
Student Low Inc. Countries	\$52	\$27
K–12 Professional	\$125	\$80
Guest or Spouse	\$55	n/a
Field Trip/Workshop Only	\$55	n/a

All fees are in US dollars. Fees for onsite registration will be collected in US dollars and credit cards only (no checks).

MEETING APP

To view abstracts, create a schedule, and see other information related to the meeting, go to <https://gsa.confex.com/gsa/2017RM/meetingapp.cgi>.

ACCOMMODATIONS

A block of rooms has been reserved at Grey Eagles Resort; 3777 Grey Eagle Drive, Calgary, Alberta, Canada. Reservations can be made by calling Grey Eagles Resort and Casino at +1-844-719-8777. Please mention that you are attending the GSA Rocky Mountain Section Meeting.

A block of rooms has been reserved at Mount Royal University residences (West Residence Front Desk for check-in; 200 Mount Royal Circle SW, Calgary, Alberta, Canada). Reservations can be made by calling Mount Royal University Residences at +1-866-264-7875 or local +1-403-440-6275. Please mention that you are attending the GSA Rocky Mountain Section Meeting.

SPECIAL EVENTS

Thursday, 8 June

Welcome Reception. 5–7 p.m., East Entrance by the Pteranodon. Enjoy light snacks and a complimentary beverage while connecting with your colleagues. Each participant received a coupon for one free beer, wine, or non-alcoholic beverage with their registration. Volunteers will provide you with tours of our Cretaceous Seas Exhibit and Rockscape. See map on page 14.

Official Opening and Evening Address. 7–8 p.m. Join us in the Bella Concert Hall for the Official Opening and Evening Address.

Social Event. 8–10 p.m. We will wrap-up the evening at the Wild Rose Brewery, located at Currie Barracks northeast of campus.

Friday, 9 June

Lunchtime Keynote Address. 12:20–1:20 p.m., EC1040. Victor Baker (University of Arizona, Past GSA President), “High Energy Mega-Floods and Icesheets.”

Poster Session Social. 4:35–6:30 p.m., EC1050 Posters. Each participant received a coupon for one free beer, wine, or non-alcoholic beverage with their registration.

Picnic and Hikes. 7–9 p.m. A picnic is provided in North Glenmore Park. Guided hikes will depart from North Glenmore Park into the Weaselhead Conservation Area. See map on page 15.

Saturday, 10 June

Lunchtime Keynote Address. 12:20–1:20 p.m., EC1040. Jeff Freymueller (University of Alaska – Fairbanks, Director of EarthScope), “EarthScope: Accomplishments, Legacy, and Future Opportunities.”

Poster Session Social, and Student Awards. 4:35–6:30, EC1050 Posters. Each participant received a coupon for one free beer, wine, or non-alcoholic beverage with their registration. Student Awards will be announced towards the end of this poster session.

BUSINESS MEETING

Rocky Mountain Business Meeting. Sat., 10 June, 2–4 p.m., EC1065.

TECHNICAL PROGRAM

Speaker Ready Room

The Speaker Ready Room is located in room EC1045, opposite the main presentation and poster rooms. Computers and assistance are available to view presentations. All presentations are to be displayed as PowerPoint presentations in technical rooms. We ask that oral presenters upload their presentation in the room that the presentation will be made the night prior to morning sessions and either the morning or lunch breaks for the afternoon sessions.

Speaker Ready Room Hours

Thursday, 8 June	5:30–7 p.m.
Friday, 9 June	8 a.m.–5:30 p.m.
Saturday, 10 June	8 a.m.–2 p.m.

Theme Session

T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array. David W. Eaton, eatond@ucalgary.ca; Katherine Boggs, kboggs@mtroyal.ca.

T2. Proterozoic Evolution of Western North America. Brian R. Pratt, brian.pratt@usask.ca.

T3. The Cambrian of Western Laurentia. Paul Johnston, pajohnston@mtroyal.ca; Robert B. MacNaughton, Robert.MacNaughton@Canada.ca.

T4. Cretaceous Stratigraphy of the North American Foreland. Dale A. Leckie, leckied@shaw.ca; Jennifer J. Scott, jescott@mtroyal.ca.

T5. Tertiary and Quaternary Landscapes. Robert R. Young, Robert.Young@ubc.ca.

T7. Geothermal Systems in the Thrust Belt and Adjacent Areas (Posters). Stephen E. Grasby, steve.grasby@canada.ca.

T8. Characterization of Fine-Grained Unconventional Plays. Per Kent Pederson, pkpederson@ucalgary.ca; Francois Marechal, francoismarechal@geo-libreinc.com.

T9. Revisiting Marginal Marine Environments through the Integration of Paleontology, Paleoecology, and Process Sedimentology. Murray Gingras, mgingras@ualberta.ca; Jennifer J. Scott, jescott@mtroyal.ca.

T10. Using the Rocky Mountains as a Natural Laboratory for Teaching the ‘What’ and the ‘How,’ of Geology. Glenn Dolphin, glenn.dolphin@ucalgary.ca.

Field Trips

For additional information, please contact the Field Trip Chair, Jean Hsieh, jhsieh@repsol.com.

Pre-Meeting

FT1. Hot and Cold Running Water in the Canadian Rockies. Thurs., 8 June. First pickup at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the Grey Eagles Resort. Cost \$100, includes coffee in the morning, a boxed lunch and water for the day. Fieldtrip leader: Steve Grasby, Natural Resources Canada, steve.grasby@canada.ca.

This trip examines several shallow to deep circulating spring systems in the Front Ranges of the Canadian Rockies, ending at the famous Banff Hot Springs. The focus is to examine controls on deep crustal circulation, climate change influence on local hydrogeology, and water/rock interactions that influence the spring chemistry. Microbial communities and endangered animals in the spring outlets will also be discussed.

FT3. Effects of Sedimentology and Facies on Structural Styles in the Canadian Rocky Mountain Fold and Thrust Belt. Wed–Thurs., 7–8 June. First pickup, 7 June, at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the Grey Eagles Resort. Cost: \$315, includes breakfast, lunch, water and snacks for the day and hotel accommodations overnight based on double occupancy. Trip does not include dinners for the evening of June 7. Fieldtrip leaders: Byron Veilleux, Repsol Oil & Gas Canada, Inc., bveilleux@repsol.com; Normand Begin, Repsol Oil & Gas Canada, Inc., nbegin@repsol.com.

Structural styles in the Rocky Mountain Fold and Thrust Belt are profoundly affected by the sedimentology of the stratigraphic units present within the Belt. This two day trip field trip will expose the attendees to various structural styles within the Foothills, Front ranges, Main Ranges and Western Main Ranges of the Rocky Mountain. We will be able to view how sedimentary facies changes and their associated mechanical stratigraphy influence fault terminations and result in profound variations to deformation styles. This field trip will discuss elements of the southern Cordillera

Lithoprobe transect, providing a reference for the future Canadian Cordillera Array.

FT4. Late Cretaceous Geology and Fossils of Dinosaur Provincial Park. Wed–Thurs., 7–8 June. First pickup at 7:30 a.m. on June 7, 2017 at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8:00 a.m. on June 7, 2017 in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the Grey Eagles Resort. Cost: \$210, includes lunch, water and snacks for the day and hotel accommodations overnight based on double occupancy. Trip does not include breakfast or dinners. Admission to the Royal Tyrrell Museum is included as well. Fieldtrip Leader: Don Henderson, Royal Tyrrell Museum, don.henderson@gov.ab.ca.

This two-day trip visits the exceptional exposures of Late Cretaceous sedimentary rocks in Dinosaur Provincial Park that record a variety of terrestrial, freshwater, and marine environments, and host impressive dinosaurs and other fossils that have been continually collected in the Park since 1910. Highlights will be guided tours to quarries in the Park and a behind the scenes tour of the collections and lab facilities at the Royal Tyrrell Museum of Palaeontology where many impressive fossils from the Park are housed and displayed.

FT11. New Looks at Old Paradigms—Semi-Radical Interpretations of Geomorphology and Cenozoic Rocks and Sediments in the Red Deer River Valley. Thur., 8 June. First pickup at 7 a.m. at the Mount Royal University residences. Departure from that location at 7:15 a.m. Second pickup at 7:30 a.m. in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 7:45 a.m. from the Grey Eagles Resort. Cost: \$150, includes lunch, water and snacks for the day as well as refreshments at the end of the day. Fieldtrip leaders: Milovan Fustic, University of Calgary, mfustic@ucalgary.ca; Kalina Malowany, University of Calgary, Gerald Osborn, University of Calgary, Osborn@ucalgary.ca.

This one-long-day trip examines (a) large- and small-scale valley geomorphology and (b) superbly exposed outcrops of both the Cretaceous Horseshoe Canyon Formation and Quaternary glacial-age sediments along the Red Deer River Valley near Drumheller. Although classical stratigraphic, sedimentologic, and geomorphological concepts will be discussed, the focus of the trip is on rather enigmatic, poorly documented features that contradict some commonly held beliefs. Emphasis will be on:

- *Horseshoe Canyon Point Bar Facies Models*
Contrary to popular belief, mudstone-clast breccias are NOT diagnostic of basal channel-lag deposits, and higher-energy cross-beds at the channel base are NOT the cleanest part of the channel fill, and may contain stratified mud.
- *Incised river valleys on the Alberta Plains*
Previous literature refers to post-glacial isostatic rebound as the reason all major plains rivers flow in valleys cut below the plains surface. The actual reason(s) may be more complicated.
- *Quaternary sedimentology*
The basic sediment types blanketing plains bedrock are till, recognized by unsorted texture, glacial lake

sediments, recognized by sorted, fine-grained texture, and alluvium, recognized by moderately sorted sand and gravel. We will examine outcrops of diamict radically more unsorted than till (silt to 5-m boulders), interpreted to be alluvium.

Toward the end of the day discussions will continue in the famous and historic Last Chance Saloon in Wayne (population 42) located in the heart of dramatic badlands. Late-evening return to Calgary.

Post- Meeting Trips

FT5. Biota, Brines, Sandstones and Mines: Geology of the Early-Mid Cambrian of the Canadian Southern Rocky Mountains. Sun–Mon., 11–12 June. First pickup, 11 June, at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagle Resort. TRIP DEPARTS promptly at 8:15 a.m. from the Grey Eagle Resort. Cost: \$375, includes breakfast, lunch, water and snacks for the day and hotel accommodations overnight, based on double occupancy. Trip does not include dinner on the first night, but will include a pizza dinner en route back to Calgary on 12 June. Fieldtrip leaders: Paul Johnston, Mount Royal University, pajohnston@mtroyal.ca; Chris Collom, MacCallum Geological Consulting, Calgary, cjcollom@shaw.ca; Patricio Desjardins, Patricio.desjardins@gmail.com.

This two-day trip provides an overview of Cambrian stratigraphy from Exshaw, Alberta to Field, B.C. and culminates with a hike to examine the unusual geology of the famed Trilobite Beds of the Burgess Shale in Yoho National Park. Thanks to permission from Parks Canada, the hike will include areas normally inaccessible to visitors to the site. This is a rigorous hike (Elevation gain: 795 m [2610 feet]; 8 km [5 miles] round trip; steep trail and 30 degree mountain slope; 7.5 hours total, 5 hrs. hiking); not recommended for persons with significant health challenges.

FT6. Carbon Capture and Storage: A Trip to Visit Past and Recent Changing Environments in Alberta's Plains and Shell's World-Leading Quest CCS Project. Sun–Tues., 11–13 June. First pickup, 11 June, at 8 a.m., at the Mount Royal University residences. Second pickup at 8:15 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:30 a.m. from the Grey Eagles. Cost: \$475, includes admissions to Tyrrell Museum and Dinosaur Provincial Park. Lunch, water and snacks during the day and hotel accommodations overnight based on double occupancy. A light breakfast is provided at each of the two hotels. Trip cost does not include dinners, which are not arranged. Fieldtrip leaders: Kirk Osadetz, CMC Research Institutes, Inc., kirk.osadetz@cmcghg.com; Luc Rock, Shell, luc.rock@shell.com, and Alwynne Beaudoin, Royal Alberta Museum, alwynne.beaudoin@gov.ab.ca.

This three-day post-meeting trip departs Calgary to visit the Upper Cretaceous succession and world-renowned Royal Tyrrell Museum of Paleontology in Drumheller prior to staying overnight in Edmonton (Day 1). We will visit Shell's Quest project, the world's first commercial CO₂ capture and storage project associated with oil sand operations. Quest

captures CO₂ at Shell's Scottford Refinery and sends it, by pipeline, to geological storage in basal Cambrian clastic rocks near Radway. From Radway we proceed to Hanna (Day 2) from which we visit the Sheerness mine-mouth coal-fired power Plant, Dinosaur Provincial Park – a UNESCO World Heritage Site, and CMC Research Institutes' Field Research Station (FRS), near Brooks. The FRS is a facility where CO₂ injected from above simulates a leak from below. While the detection and monitoring technologies used at the FRS are primarily for addressing regulatory, environmental and safety risks of CCS geological storage they are also applicable to containment and conformance issues related to groundwater protection, in situ bitumen projects, and induced hydraulic fracturing and produced water disposal related to unconventional petroleum production. The trip travels through open prairies and across incised badland river valleys eroded into the Upper Cretaceous Interior Seaway cyclothemic succession during differential Paleogene and younger epeirogenic uplift in a landscape modified by Laurentide glacial and post-glacial processes. The landscape, its municipalities and its agricultural industries are vulnerable to a changing climate, but they are also the site of globally leading efforts to manage industrial, and understand natural, CO₂ and CH₄ emissions. Industrial Health and Safety requirements require that participants bring steel-toed safety footwear. Other personal protective equipment will be supplied.

FT7. Geology of the Waterton-Glacier National Parks Area. Sun–Tues., 11–13 June. First pickup, 11 June, at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. Trip DEPARTS promptly at 8:15 a.m. from the Grey Eagles. Cost: \$330, includes lunch, water and snacks for the day and hotel accommodations overnight based on double occupancy. Fieldtrip leader: Brian Pratt, University of Saskatchewan, brian.pratt@usask.ca.

This three-day trip will examine the Mesoproterozoic belt stratigraphy and structural geology through Waterton and Glacier National Parks in Alberta and Montana (respectively). Outcrops of the Altyn, Apekunny, and Grinnell formations will be viewed as well as the related structures. A possible itinerary could be: Day 1: Drive from Calgary across border and hike to Apikuni Falls. Day 2: Outcrops on Going-to-the-Sun Road including Apekunny Formation at Dead Horse Point, Sunrift Gorge and Sun Point (Apekunny and Grinnell formations), below Logan Pass for Helena Formation and St. Mary Visitor's Center walls. Day 3: Drive to Waterton Lakes National Park to see Waterton Formation in townsite and Red Rock Canyon (Grinnell Formation). Return to Calgary. Note: Participants must be prepared with passports and required visas.

FT8. Evidence for Catastrophic Subglacial Processes across Alberta, and a refined Deglacial Chronology in the Zone of the Purported Ice-Free Corridor. Sun–Mon., 11–12 June. First pickup, 11 June, at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the

Grey Eagles. Cost: \$260, includes water and snacks for the day. Lunches may be more conveniently obtained at planned stops. Hotel accommodations overnight are included, and based on double occupancy. Trip does not include dinners. Admission to the Royal Tyrrell Museum is included as well. Fieldtrip leader: Robert Young, University of British Columbia, Okanagan Campus, robert.young@ubc.ca.

This two-day trip will look at some newer radiocarbon dates in the western Alberta, the zone of a purported Ice-Free Corridor that was used as migration route for the first Americans. It will look at dated Quaternary vertebrate fossil sites that give a glacial history of the region, which will indicate when the area was and was not available for migration. The second major theme will relate to a series of glacial landforms, including hummocks, eskers, and tunnel valleys. The features, taken individually and as an integrated landscape indicate catastrophic subglacial processes occurred. The catastrophic nature of this landscape will become apparent, and is recognizable in part because of similarities with those found in the Channeled Scablands, yet can be considered an order of magnitude larger.

FT9. Montney Analogue Field Trip: The Sulphur Mountain Formation around Canmore and Kananaskis. Sun., 11 June. First pickup at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the Grey Eagles. Cost: \$100, includes coffee in the morning, a boxed lunch and water for the day. Fieldtrip leader: Jon Noad, Sedimental Services, jonnoad@hotmail.com.

The Canadian Rockies are famous for their outstanding scenery, and also for their oil and gas production. Most of our knowledge regarding the highly productive Triassic Montney Formation has been garnered in the subsurface, but there are excellent age equivalent outcrops, such as the Sulphur Mountain Formation, which can provide valuable data and discussion points. Facies range from upper shoreface sandstones, through lower shoreface HCS sandstones and coarse siltstones, to finely laminated lower shoreface sandstone and offshore siltstone beds, as well as turbidites. All of these depositional settings can be explored in the Sulphur Mountain Formation in the field. This one-day field trip will visit a series of outcrops in Canmore and Kananaskis that demonstrate the character and variety of this stratigraphic interval.

FT10. Canadian Rocky Mountain Fold and Thrust Belt for Geoscience Educators. Sun., 11 June. First pickup at 7:30 a.m., at the Mount Royal University residences. Departure from that location at 7:45 a.m. Second pickup at 8 a.m., in front of the Grey Eagles Resort. TRIP DEPARTS promptly AT 8:15 a.m. from the Grey Eagles. Cost: \$85, includes coffee in the morning, a boxed lunch and water for the day. Fieldtrip leaders: Glenn Dolpin, University of Calgary, glenn.dolpin@uncalgary.ca; Katherine Boggs, Mount Royal University, kboggs@mtroyal.ca.

This one-day field trip is open to students, K–12 teachers and Geoscience Educators. The Canadian Rockies form a world famous geological backyard to Calgary. We will explore the spectacular vistas, geological structures and geomorpho-

logical features from Calgary to Field along the Trans-Canada Highway. The historical development of our understanding of the tectonics that formed the Rocky Mountain Fold and Thrust Belt will be outlined from McConnell's original field work in the 1880s, through the acceptance of plate tectonics to the Lithoprobe transects. In conjunction with the companion session, the "what" and "how" of teaching geology will be discussed throughout this field trip.

Workshops

Pre-Meeting

W1. Clastic Sedimentology Workshop—Applications and Examples from the Energy Industry (Students, K–12 Teachers, and Geoscience Educators). *Co-sponsored by Repsol Oil & Gas Canada, Inc.* Thur., 8 June. This workshop will be at the Core Shed in northwest Calgary. Participants will be picked up from in front of the Grey Eagles Hotel at 8 a.m., and in front of the Residences registration at 8:10 a.m. Mark Radomski, Repsol Oil & Gas Canada, Inc., mradomski@repsol.com.

This one-day workshop provides an applied overview of the use and importance of sedimentology in the energy industry. This session covers a broad range of clastic depositional settings in both lecture and core display/exercise format with emphasis placed on the applied use of sedimentology and stratigraphy in the spatial reconstruction of reservoirs in the subsurface. Examples and case studies will include examples from Western Canada, South-east Asia, and South America.

W2. Digital Field Methods for Sed/Strat and Structural Geology: Use of Tablet-Based Apps for Mapping and Measurements in Undergraduate Courses. 1–5 p.m., Thur., 8 June. Roderick Mah Center, Ross Glen Hall, EC1065. Lawrence Malinconico, Lafayette College, malincol@lafayette.edu.

This half-day workshop explores the use of tablet applications for digital field mapping. We will demo and test some of the different applications listed: (1) Compasses: GeoCompass 2, Lambert, Field Compass; (2) Vertical measurements: Theodolite; (3) Mapping Programs: Clino, GeoFieldBook; and (4) Stratigraphic programs: Stratlogger. Several iPads will be available; however, participants are encouraged to bring their own iPads with apps installed. Additionally, participants are encouraged to share their favorite geologic field apps with the group. This workshop will explore one component of "how" geologists work towards solving problems "in the field."

W4. Using Virtual Field Experiences (VFEs) to Enhance Learning in Undergraduate Geology Courses. 8 a.m.–1 p.m., Thur., 8 June, Roderick Mah Center, Ross Glen Hall, EC1065. Glenn Dolphin, University of Calgary, glenn.dolphin@ucalgary.ca; Jon Cooper, University of Calgary, jonathan.cooper@ucalgary.ca; Alexander Dutchak, University of Calgary, alexander.dutchak@ucalgary.ca; Brandon Karchewski, University of Calgary, brandon.karchewski@ucalgary.ca.

Growing student numbers, diminishing resources, and accessibility issues have made geology field trips ever more challenging to incorporate into instruction. A strategy for

ameliorating the growing deficiency of field experiences for students is the development and use of virtual field experiences (VFEs). With the ever-advancing digital technologies such as GigaPan photos, three-dimensional photo stitching, Google Earth, drone created fly-bys and virtual landscapes, etc., students can have access to the field virtually and develop some understandings of geology as well as developing an approach to fieldwork. In this workshop we will give participants experience with some of our newly developed VFEs, in an inquiry setting, asking "Why does this place look the way it does?" and then we will describe some of the techniques used to collect, curate data from the field and finally, how to put it together into a VFE format.

Post-Meeting

W3. Planning for the future of the Canadian Cordillera Array and EarthsCAN. Sun., 11 June, 8:30 a.m.–4:30 p.m., Roderick Mah Center, Ross Glen Hall, EC1065. Dave Eaton, University of Calgary, eatond@ucalgary.ca; Jeff Freymueller, University of Alaska Fairbanks, jfreymueller@alaska.edu; Rick Aster, Colorado State University, rick.aster@colostate.edu; Katherine Boggs, Mount Royal University, kboggs@mtroyal.ca; Julie Elliott, Purdue University, julieelliott@purdue.edu; Roy Hyndman, Natural Resources Canada, Roy.Hyndman@canada.ca; Lucinda Leonard, University of Victoria, lleonard@uvic.ca; Kristin Morell, University of Victoria, kmorell@uvic.ca; Mike Schmidt, University of Calgary, michael.schmidt@ucalgary.ca; Derek Schutt, Colorado State University, derek.schutt@colostate.edu.

In the spirit of the collaboration that was central to coordinating the Lithoprobe transects, during this workshop we will be planning out the initial phases of the Canadian Cordillera Array. This workshop is intended to expand on the presentations from session T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array. Are you curious? Would you like to be involved? Do you have suggestions for innovative sensors or applications for an array of telemetered observatories? If so, please come to this workshop.

W5. Virtual Geological Tours—3-dimensional Geological Modeling of Outcrops utilizing Unmanned Aerial Vehicles. Sun., 11 June, 8:30 a.m.–12:30 p.m., Roderick Mah Center, Ross Glen Hall, EC1075. Rudy Strobl (Executive Director, EnerFox Enterprises); Milovan Fustic (Adjunct Professor, University of Calgary); Rob Davies (Director of Field Operations, Automated Aeronautics).

This half-day course provides an introduction to the application of 4k video and 3-dimensional models created with the use of Unmanned Aerial Vehicles (UAV's). UAV's appropriately equipped with specialized cameras provide low cost, reliable, timely, comprehensive images and data for all outcrops regardless of size or dimension. Images and data obtained from UAV's are particularly effective for studying exposures, which are steep, inaccessible and remote.

Scientific applications are presented using high-resolution video and 3-d models of the Lower Cretaceous McMurray Formation oil sands. These exposures represent large-scale tidally influenced fluvial point bar successions. Previous studies were challenged by nearly vertical exposures 70m high

and 1.6 km long limiting our ability to measure geological features or accurately map the associated stratigraphy. Detailed sedimentology, statistics on bed lengths, measurements of geological features and reservoir characterization over the length of the outcrop are now possible with the complementary UAV images and data.

Teaching applications with examples of shoreface, tidal delta, and distributary mouth bar successions of the Upper Cretaceous Castlegate and Blackhawk Formations (Eastern Utah Book Cliffs) will also be highlighted. Comprehensive sedimentological studies and nearly ideal visualization are now possible with the 3-dimensional models created.

The course includes practical tips and tools, how to use UAV's safely, and an introduction to appropriate software and processing of these data and images. A brief summary of aviation protocol and licensing requirements for operating UAV's will also be addressed.

Virtual geological tours and 3-dimensional modeling are now possible with current technology. Join this course to learn more about this rapidly growing scientific research and teaching tool.

EXHIBITS

Exhibits are located in room EC1050, and are open from 9 a.m. to 6:30 p.m., both Friday and Saturday 9–10 June.

OPPORTUNITIES FOR STUDENTS

Mentor Programs

Co-sponsored by the GSA Foundation. The Mentor Programs and the Career Workshops are located in B108 (down the B-wing from the East Entrance and the Pteranodon). For more information on the mentor programs, go to www.geosociety.org/mentors/ or contact Jennifer Nocerino, jnocerino@geosociety.org.

Geoscience Career Workshop Part 1: 9–10 a.m., Friday, 9 June, Career Planning and Informational Interviewing. Your job-hunting process should begin with career planning, not when you apply for jobs. This workshop helps you begin this process and introduces you to informational interviewing. This section is highly recommended for freshman, sophomores, and juniors. The earlier you start your career planning, the better.

Geoscience Career Workshop Part 2: 10–11 a.m., Friday, 9 June, Geoscience Career Exploration. What do geologists in various sectors earn? What do they do? What are the pros and cons to working in academia, government, and industry? Workshop presenters and professionals in the field address these issues.

Geoscience Career Workshop Part 3: 9–10 a.m., Saturday, 10 June, Cover Letters, Resumes and CVs. How do you prepare a cover letter? Does your resume need a good edit? Whether you are currently on the job market or not, learn how to prepare the best resume possible. You will review numerous resumes helping you to learn important resume do's and don'ts.

Roy J. Shlemon Mentor Program in Applied Geoscience. Friday, 9 June, noon–1:30 p.m. Students have the opportunity

to discuss career prospects and challenges with professional geoscientists from multiple disciplines over a FREE lunch. Learn more about this program at <http://www.geosociety.org/mentors/>.

John Mann Mentors in Applied Hydrogeology Program. Saturday, 10 June, noon–1:30 p.m. Students interested in applied hydrogeology or hydrology as a career will have the opportunity to network with professionals in these fields over a FREE lunch. Learn more at <http://www.geosociety.org/mentors/>.

VOLUNTEER

The Rocky Mountain Section offers free meeting registration to student volunteers in return for two shifts of ~4 to 5 hours of work during the meeting. If you are a student interested in volunteering, please contact the Student Volunteer Coordinators, Susan Reid, sjreid1@mtroyal.ca.

Student Volunteer Room EC1075. Students will meet with the Volunteer Coordinator before the meeting begins in the room EC1075 for their assignments and training, where needed. Students can leave personal items in room EC1045 while they are working.

Outstanding Student Presentation Program. This year, Rocky Mountain Section GSA will award cash prizes and plaques to the best graduate and undergraduate posters and oral presentations. Judging of student oral and poster presentations take place throughout the meeting, and award winners' names will be announced at the awards reception on Saturday afternoon, during the poster session in EC1050.

SPOUSE & GUEST ACTIVITIES

Local attractions in Calgary include Fort Calgary, the Glenbow Museum, Heritage Park, Calgary Zoo, TELUS Spark Science Centre, Canada Olympic Park, and the Military Museums. The Military Museums is across Crowchild from Mount Royal Campus. Family friendly events in June include: i) The National equestrian jumping tournament at Spruce Meadows, 7–11 June; ii) The Calgary Mayor's Environmental Expo, 6–8 June; and iii) The Mountain Equipment Coop Paddlefest is June 12 on Chestermere Lake. The Royal Tyrrell Museum of Paleontology is 90 minutes away in nearby Drumheller. Canada Olympic Park has a zip line, downhill mountain bike trails and a luge run open during the summer.

EXTERNAL GROUP EMERGENCY RESPONSE INFORMATION

While visiting and using Mount Royal University (MRU) facilities, we want to ensure that your group has a basic understanding of the Emergency Response Procedures that MRU has planned for.

Emergency Evacuation Procedures

In the event of an alarm please evacuate the building as soon as possible and exit to a parking lot away from the building. Each parking lot is equipped with a Muster Point sign, please wait there until further direction is provided by Security Services or an Emergency Warden.

REPORTING EMERGENCIES OR INCIDENTS

In the event of an Emergency please, please call 9-1-1 or report to the nearest MRU employee. The following outlets are also available to assist or call 9-1-1 in an emergency:

- **ETS Reception** (during operational hours): 403-440-8890 *Please Dial 9 first if calling from a regular internal phone*)
- **Emergency Security Services** (24 hours): 403-440-5900 *(Please Dial 9 first if calling from a regular internal phone)*

If calling 9-1-1 directly, please contact Security Services immediately following the 9-1-1 call at 403-440-5900. It is essential that Security Services is aware of any and all incidents on Campus to help support Emergency Services' arrival at the exact location of the Emergency.

In the event of **minor injuries** or **suspicious or unusual activity** (i.e. interruption to your event, loitering, suspicious activity, etc.), please contact the nearest ETS team member

within the office in the Roderick Mah Centre for Continuous Learning or at 403-440-8890 (available during operational hours) or contact Security Services directly for assistance at 403-440-6897 (their non-emergency line). Accidents or injuries must be reported to the ETS office and Security Services, upon which a campus incident report form will be completed.

The Emergency help phones located around Campus offer a direct line of communication to Security Services and can be used in the event of an Emergency. Please familiarize yourself with the locations of these resources.

MRU SAFEWALK

If you or any member of your group does not feel safe walking alone, MRU offers a "Safe Walk" program – the group will escort you to your vehicle. Safe Walk is arranged by calling Security Services directly or by using any Emergency Phone on Campus.

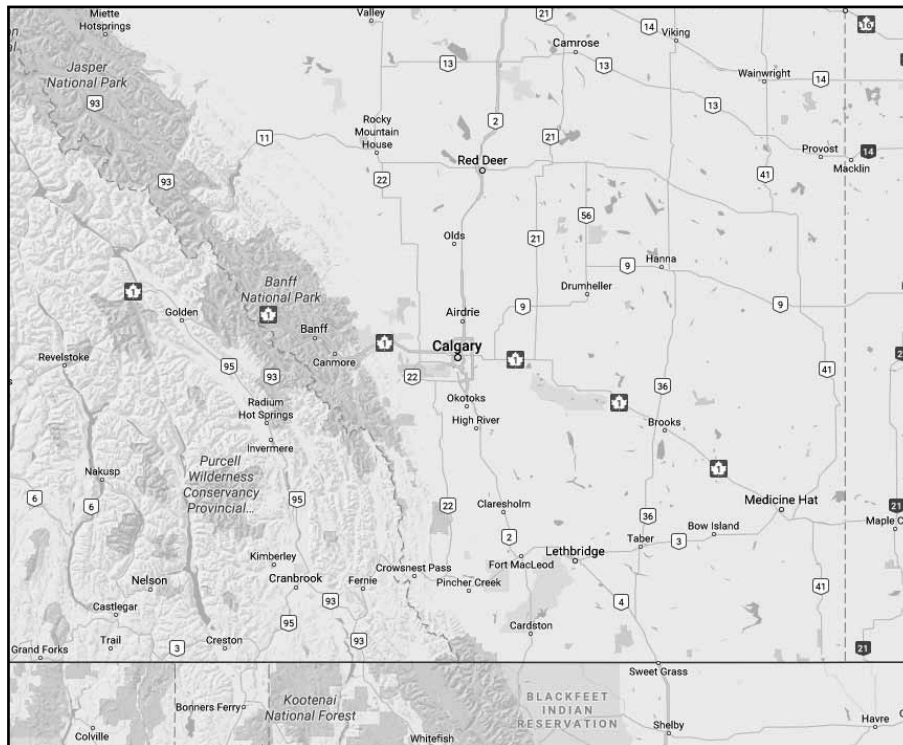


Figure 1: Regional setting for Calgary. The Trans-Canada highway cuts east-west through Calgary and Highway 2 cuts north-south through Calgary. The airport is in the northeast, while Mount Royal University campus is in the southwest.



Figure 2: Mount Royal University Lincoln Park Campus (surrounded by Mt Royal Circle, west of Richard Rd) with Grey Eagle Resort.



Figure 3: Mount Royal University Lincoln Park Campus with Grey Eagle Resort, Residence Check-in, East Entrance (Welcome Reception) and restaurants within walking distance of campus (modified after Google Earth).

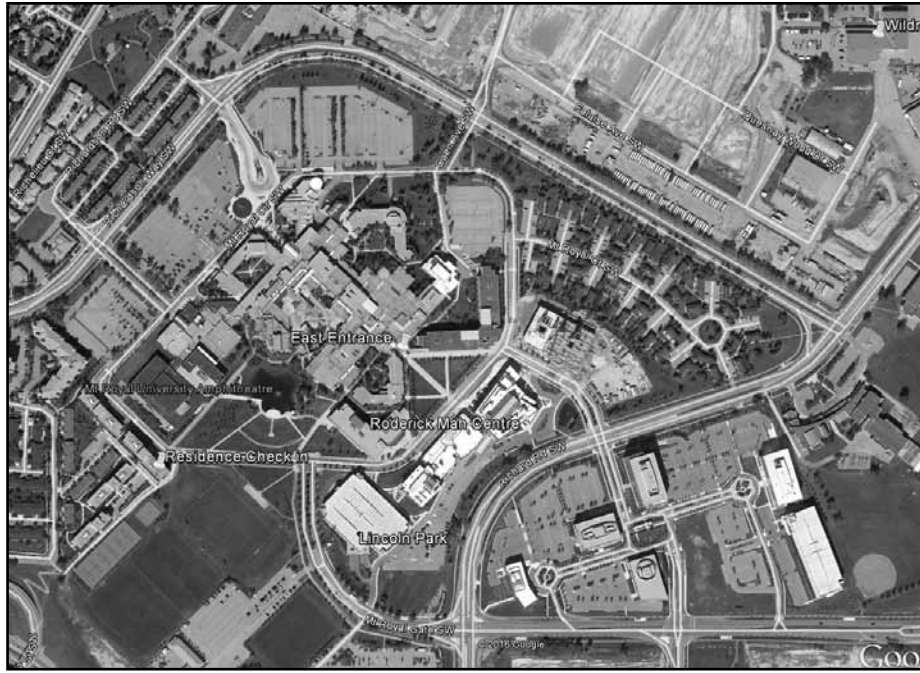


Figure 4: A close up view of Mount Royal University Lincoln Park Campus. The Roderick Mah Centre is where registration, talks and posters are located on 9–10 June. The East Entrance is where the Welcome Reception is located on 8 June. The Bella Conservatory is located about the “centre” in the Roderick Mah label (modified from Google Earth).



Figure 5: The picnic will be held in North Glenmore Park which is south of Mount Royal Campus. This is an easy 40-45 minute walk from campus. There will be shuttles to and from campus, Grey Eagles Hotel and the picnic location. There will also be guided hikes into the Weaselhead from the picnic location (these are not extreme hikes, however there is a steep set of stairs that descend into the Weaselhead)

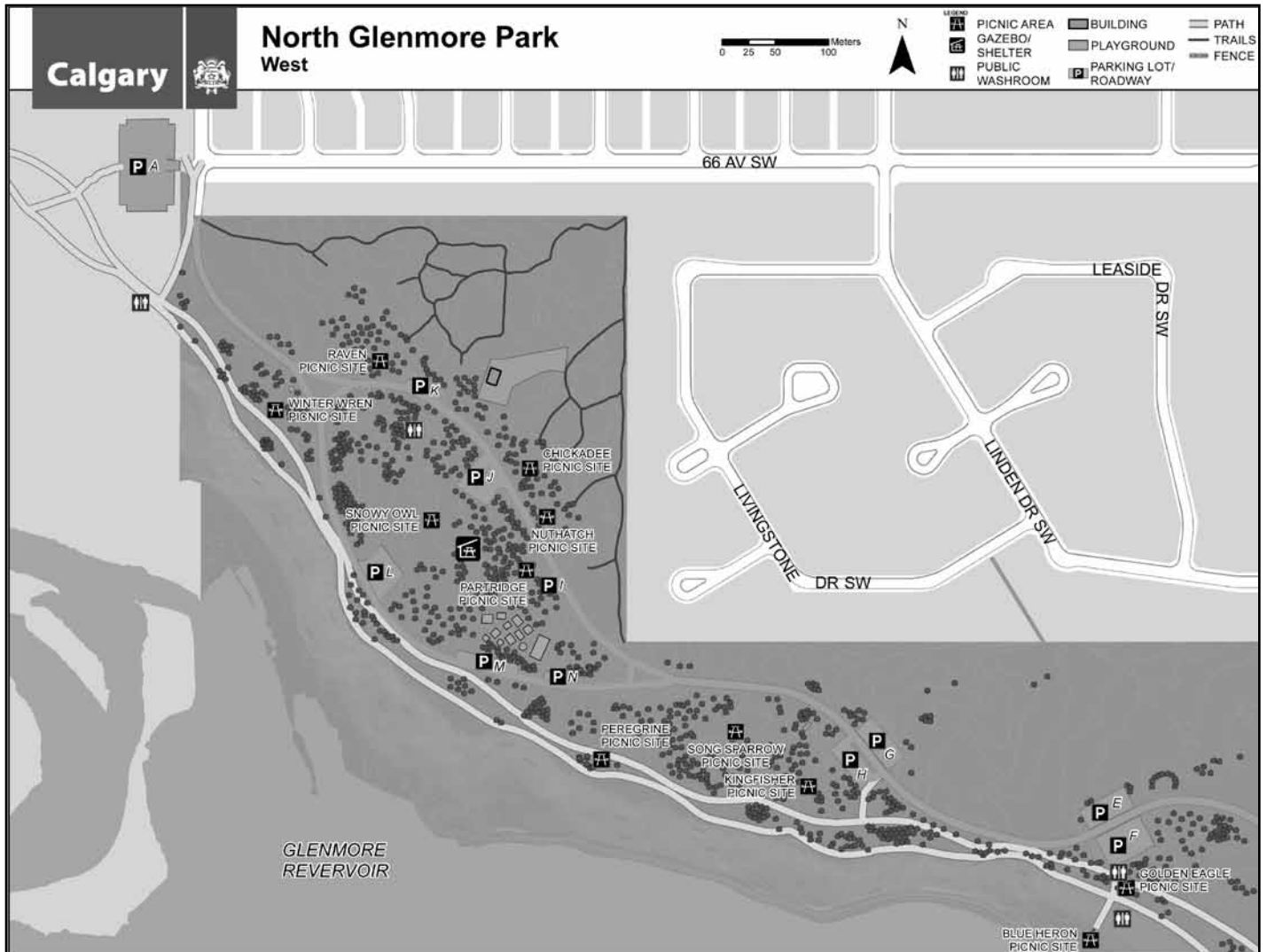


Figure 6: We have Snowy Owl and Partridge Picnic Sites reserved for our group. There is a covered structure and washrooms at this location; however please bring weather appropriate layers with you (courtesy of the City of Calgary).

CODE OF CONDUCT AT GSA EVENTS

Approved by GSA Council on 25 September 2016

GSA is a premier, international scientific society whose goals and mission are to advance geoscience research and discovery, to provide service to society and to promote stewardship of Earth, within and beyond the geosciences profession. In fulfilling its goals and mission, and in keeping with its Diversity Position Statement, GSA meetings foster the exchange of scientific ideas, through open and respectful dialogues at oral and poster sessions, field trips, short courses, mentorships and other GSA-supported programs. GSA promotes, provides, expects and endorses a professional and respectful atmosphere and values a diversity of views and opinions.

All registrants, guests, volunteers, exhibitors, GSA staff, service providers, and others in attendance are expected to abide by this GSA Events Code of Conduct, which outlines specific expectations for participants at GSA-supported events and is in addition to the provisions of the GSA Code of Conduct.

Expected Behavior

All registrants, guests, volunteers, exhibitors, GSA staff, service providers, and others in attendance are to:

- Be treated with respect and consideration.
- Be considerate, collegial, and collaborative.
- Communicate openly, with civil attitudes, critiquing ideas rather than individuals.
- Avoid personal attacks directed toward other registrants, guests, volunteers, exhibitors, GSA staff, service providers, and others in attendance.
- Obey the rules and policies of the meeting venue, hotels, GSA contracted facility, or any other venue where your meeting badge and GSA affiliation is likely to be displayed.
- Alert meeting security personnel, GSA staff, or GSA leadership if you notice someone in distress, or perceive a potentially dangerous situation, or witness a dangerous situation.

Procedures to be followed in an emergency situation:

- Evaluate the situation and if appropriate call 911 or activate a local fire alarm.
- Do not endanger yourself. Follow the directions of building security, law enforcement, fire department, military personnel, or GSA staff.
- Initiate first aid if appropriate, so trained and necessary.
- Be as observant as possible in order to communicate to emergency staff.

Unacceptable Behavior includes but is not limited to:

- Harassment, intimidation, or discrimination.

- Physical or verbal abuse of any registrant, guest, volunteer, exhibitor, GSA staff, service provider, or other attendee.
- Disruption of presentations at oral or poster sessions, in the exhibit hall, on field trips, or at other events organized by GSA at the meeting venue, hotels, or other GSA-contracted facilities.
- Audio and video recording, or taking images of an individual's oral presentation without the presenters' permission, is expressly forbidden. Images of posters taken without permission are not allowed. Images of posters may be taken with the explicit consent of the presenter, and images may be acquired only in the presence of the presenter.

Examples of unacceptable behavior include but are not limited to:

- Verbal comments related to gender, sexual orientation, disability, physical appearance, body size, race, religion, national origin or any other identified characteristic outlined in the GSA Diversity Position Statement.
- Inappropriate use of nudity and/or sexual images in public spaces or in presentations.
- Intentional, uninvited physical contact of any form.
- Threats (implied or real) of, physical, professional or financial harm.
- Stalking registrants, guests, volunteers, exhibitors, GSA staff, service providers, or others in attendance.

Consequences of Unacceptable Behavior

- Anyone requested to stop unacceptable behavior is expected to immediately cease and desist.
- GSA staff, leadership, security, or law enforcement personnel shall take action(s) deemed necessary and appropriate. Actions may include immediate removal from the meeting or field trip without warning or refund.
- GSA reserves the right to prohibit attendance at any future GSA meeting or other GSA-sponsored event.

Reporting Unacceptable Behavior

If you are the subject of unacceptable behavior or have witnessed any such behavior, please immediately notify a GSA staff member on-site (see page 2 for contact information) or GSA member with a designated leadership position (i.e. GSA President, GSA Councilor, GSA Section Officer, GSA field trip leader).

Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety, or a criminal act is expected to contact 911. Those witnessing a potential criminal act should also take actions necessary to maintain their own personal safety.

Schedule of Events

EVENT	TIME	LOCATION
WEDNESDAY, 7 JUNE		
FT3. Effects of Sedimentology and Facies on Structural Styles in the Canadian Rocky Mountain Fold and Thrust Belt: 7–8 June (Field Trip)	7:30 a.m.–11:55 p.m.	Mount Royal University, Residences
FT4. Late Cretaceous Geology and Fossils of Dinosaur Provincial Park: 7–8 June (Field Trip)	7:30 a.m.–11:55 p.m.	Mount Royal University, Residences
THURSDAY, 8 JUNE		
FT11. New Looks at Old Paradigms—Semi-Radical Interpretations of Geomorphology and Cenozoic Rocks and Sediments in the Red Deer River Valley: 8 June (Field Trip)	7 a.m.–7:30 p.m.	Mount Royal University, Residences
FT1. Hot and Cold Running Water in the Canadian Rockies: 8 June (Field Trip)	7:30 a.m.–5 p.m.	Mount Royal University, Residences
W1. Clastic Sedimentology Workshop—Applications and Examples from the Energy Industry (Students, K–12 Teachers, and Geoscience Educators) (Workshop)		Core Shed in northwest Calgary
W4. Using Virtual Field Experiences (VFEs) to Enhance Learning in Undergraduate Geology Courses (Workshop)	8 a.m.–1 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1065
Registration	4–7 p.m.	Mount Royal University, East Entrance by the Pteranodon
Welcome Reception	5–7 p.m.	Mount Royal University, East Entrance by the Pteranodon
Exhibits Set-up	5–7 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Speaker Ready Room	5:30–7 p.m.	Mount Royal University, Roderick Mah Centre, EC1045
Official Opening and Evening Address	7–8 p.m.	Mount Royal University, Bella Concert Hall
Social Event	8–10 p.m.	Wild Rose Brewery, located at Currie Barracks northeast of campus
W2. Digital Field Methods for Sed/Strat and Structural Geology: Use of Tablet-Based Apps for Mapping and Measurements in Undergraduate Courses (Workshop)	1–5 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1065
FRIDAY, 9 JUNE		
Registration	7:30 a.m.–4:30 p.m.	Mount Royal University, Roderick Mah Centre
Speaker Ready Room	8 a.m.–5:30 p.m.	Mount Royal University, Roderick Mah Centre, EC1045
Exhibits Open	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Geoscience Career Workshop Part 1: Career Planning and Informational Interviewing (Workshop)	9–10 a.m.	Mount Royal University, B108 (down the B-wing from the East Entrance and the Pteranodon)
Geoscience Career Workshop Part 2: Geoscience Career Exploration (Workshop)	10–11 a.m.	Mount Royal University, B108 (down the B-wing from the East Entrance and the Pteranodon)

EVENT	TIME	LOCATION
Morning Oral Technical Sessions		
T2. Proterozoic Evolution of Western North America	9 a.m.–12:10 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
T9. Revisiting Marginal Marine Environments through the Integration of Paleontology, Paleoecology, and Process Sedimentology	9 a.m.–12:10 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1060
Morning Poster Sessions		
Earth and Planetary Science (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Paleontology and Paleoecology (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T2. Proterozoic Evolution of Western North America (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T3. The Cambrian of Western Laurentia (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T7. Geothermal Systems in the Thrust Belt and Adjacent Areas (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T8. Characterization of Fine-Grained Unconventional Plays (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon	noon–1:30 p.m.	Mount Royal University, B108 (down the B-wing from the East Entrance and the Pteranodon)
Lunchtime Keynote Address	12:20–1:20 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
Poster Session Social	4:35–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Picnic and Hikes	7–9 p.m.	North Glenmore Park
Afternoon Oral Technical Sessions		
Luncheon Talk: Victor R. Baker, <i>High-Energy Megafloods and Ice Sheets</i>	12:20–1:20 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
T3. The Cambrian of Western Laurentia I	1:30–4:40 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
T8. Characterization of Fine-Grained Unconventional Plays	1:30–4:40 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1060
T10. Using the Rocky Mountains as a Natural Laboratory for Teaching the ‘What’ and the ‘How’ of Geology	1:30–4:40 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1065
SATURDAY, 10 JUNE		
Registration	7:30 a.m.–2 p.m.	Mount Royal University, Roderick Mah Centre
Speaker Ready Room	8 a.m.–2 p.m.	Mount Royal University, Roderick Mah Centre Ross Glen Hall, EC1045
Exhibits Open	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Geoscience Career Workshop Part 3: Cover Letters, Resumes and CVs (Workshop)	9–10 am	Mount Royal University, B108 (down the B-wing from the East Entrance and the Pteranodon)

EVENT	TIME	LOCATION
Morning Oral Technical Sessions		
T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array	9 a.m.–12:10 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1060
T4. Cretaceous Stratigraphy of the North American Foreland	9 a.m.–12:10 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
Morning Poster Sessions		
T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T4. Cretaceous Stratigraphy of the North American Foreland (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
T5. Tertiary and Quaternary Landscapes (Posters)	9 a.m.–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
John Mann Mentors in Applied Hydrogeology Program Luncheon	noon–1:30 p.m.	Mount Royal University, B108 (down the B-wing from the East Entrance and the Pteranodon)
Lunchtime Keynote Address	12:20–1:20 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
Poster Session Social, and Student Awards	4:35–6:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
Afternoon Oral Technical Sessions		
Luncheon Talk: Jeffrey T. Freymueller, <i>Earthscope: Accomplishments, Legacy, and Future Opportunities</i>	12:20–1:20 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
T3. The Cambrian of Western Laurentia II	1:30–4:40 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1060
T5. Tertiary and Quaternary Landscapes	1:30–4:40 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1040
Rocky Mountain Business Meeting	2–4 p.m.	Mount Royal University, Ross Glen Hall, EC 1065
Exhibits Tear down	6–7:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1050
SUNDAY, 11 JUNE		
FT6. Carbon Capture and Storage: A Trip to Visit Past and Recent Changing Environments in Alberta's Plains and Shell's World-Leading Quest CCS Project: 11–13 June	8 a.m.–11:55 p.m.	Mount Royal University, Residences
FT10. Canadian Rocky Mountain Fold and Thrust Belt for Geoscience Educators: 11 June (Field Trip)	7:30 a.m.–6:30 p.m.	Mount Royal University, Residences
FT9. Montney Analogue Field Trip: The Sulphur Mountain Formation around Canmore and Kananaskis: 11 June (Field Trip)	7:30 a.m.–6:30 p.m.	Mount Royal University, Residences
FT5. Biota, Brines, Sandstones and Mines: Geology of the Early-Mid Cambrian of the Canadian Southern Rocky Mountains: 11–12 June (Field Trip)	7:30 a.m.–11:55 p.m.	Mount Royal University, Residences
FT7. Geology of the Waterton-Glacier National Parks Area: 11–13 June (Field Trip)	7:30 a.m.–11:55 p.m.	Mount Royal University, Residences
FT8. Evidence for Catastrophic Subglacial Processes across Alberta, and a refined Deglacial Chronology in the Zone of the Purported Ice-Free Corridor: 11–12 June (Field Trip)	7:30 a.m.–11:55 p.m.	Mount Royal University, Residences
W5. Virtual Geological Tours—3-dimensional Geological Modeling of Outcrops utilizing Unmanned Aerial Vehicles (Workshop)	8:30 a.m.–12:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1075
W3. Planning for the future of the Canadian Cordillera Array and EarthsCAN (Workshop)	8:30 a.m.–4:30 p.m.	Mount Royal University, Roderick Mah Centre, Ross Glen Hall, EC1065

Technical Sessions

Meeting policy prohibits the use of cameras or sound-recording equipment at technical sessions and poster sessions.



A no-smoking policy has been established by the Program Committee and will be followed in all meeting rooms for technical sessions.

NOTICE

In the interest of public information, the Geological Society of America provides a forum for the presentation of diverse opinions and positions. The opinions (views) expressed by speakers and exhibitors at these sessions are their own and do not necessarily represent the views or policies of the Geological Society of America.



NOTE INDEX SYSTEM

Numbers (2-4, 15-4) indicate session and order of presentation within that session.

* denotes speaker

FRIDAY, 9 JUNE 2017

MORNING ORAL TECHNICAL SESSIONS

SESSION NO. 1

T2. Proterozoic Evolution of Western North America

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

Brian R. Pratt, Presiding

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| | 9:00 AM | INTRODUCTORY REMARKS |
| 1-1 | 9:05 AM | Thorkelson, Derek*; Verbaas, Jacob; Medig, Kirsti P.R.; Furlanetto, Francesca: PROTEROZOIC WILSON CYCLICITY AND ITS APPLICATION TO LAURENTIA-AUSTRALIA INTERACTIONS |
| 1-2 | 9:30 AM | Pratt, Brian R.*; Long, Darrel G.F.: SEDIMENTATION AND DEFORMATION OF THE GEORGE FORMATION, A PALEOPROTEROZOIC CARBONATE PLATFORM IN THE MUSKWA ASSEMBLAGE OF NORTHEASTERN BRITISH COLUMBIA |
| 1-3 | 9:50 AM | Dembrowski, Tracy*; Gonzales, David A.: AN INVESTIGATION OF THE AGE AND PETROLOGY OF THE TRIMBLE GRANITE, NEEDLE MOUNTAINS, SOUTHWESTERN COLORADO |
| 1-4 | 10:10 AM | Rule, Roy*; Pratt, Brian R.: HORODYSKIA: NOT A FOSSIL BUT DUE TO SEDIMENT-MICROBIAL INTERACTIONS IN THE APPEKUNNY FORMATION (BELT SUPERGROUP, CA. 1.46 GA, WESTERN NORTH AMERICA) |
| | 10:30 AM | BREAK |
| 1-5 | 10:45 AM | Rainbird, Robert*; Ielpi, Alessandro: SIMILARITIES AND PALEOGEOGRAPHY OF PROTEROZOIC TERRESTRIAL SANDSTONE DEPOSITS ON THE CANADIAN SHIELD: PRODUCTS OF SUPERCONTINENT ASSEMBLY |
| 1-6 | 11:10 AM | Pratt, Brian R.*; Ponce, Juan Jose: SEDIMENTARY DYNAMICS OF THE GRINNELL FORMATION (BELT SUPERGROUP, CA 1.45 GA), WESTERN NORTH AMERICA: NOT ARID PLAYAS CROSSED BY CREEKS BUT |

SUBAQUEOUS MUDS ROCKED BY EARTHQUAKES AND SWEEP BY TSUNAMIS

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|-----|----------|--|
| 1-7 | 11:30 AM | Constenius, Kurt N.*; McGimsey, Robert G.; Valencia, Victor; Ibanez-Mejia, Mauricio; Domanik, Kenneth J.: PEPERITE IN THE PURCELL LAVA AND A REVISED AGE OF THE UPPER PROTEROZOIC BELT-PURCELL SUPERGROUP |
| 1-8 | 11:50 AM | Madronich, Lauren I.*; Guest, B.; Matthews, William A.: CONSTRAINING RODINIAN RIFT-RELATED MAGMATISM FROM ZIRCON U-PB AGES AND TRACE ELEMENT COMPOSITIONS |

SESSION NO. 2

T9. Revisiting Marginal Marine Environments through the Integration of Paleontology, Paleocology, and Process Sedimentology

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1060

Murray Gingras and Jennifer J. Scott, Presiding

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|-----|----------|---|
| | 9:00 AM | INTRODUCTORY REMARKS |
| 2-1 | 9:05 AM | Holbrook, John*: FLUVIO-LACUSTRINE VS. FLUVIO-MARINE AND THE RARITY OF THE CLASSIC DELTA IN THE MODERN LAKE |
| 2-2 | 9:30 AM | Birgenheier, Lauren P.*; Gall, Ryan D.; Rosencrans, Ellen M.; Vanden Berg, Michael D.: CLIMATIC CONTROL ON FLUVIAL-DELTAIC SYSTEMS OF THE LACUSTRINE GREEN RIVER FORMATION, UINTA BASIN, UTAH |
| 2-3 | 9:50 AM | Scott, Jennifer J.*; Porter, Richard J.: TRACE FOSSILS IN THE DELTAIC TULLIG CYCLOTHEM, CARBONIFEROUS, COUNTY CLARE, IRELAND |
| 2-4 | 10:10 AM | Noad, Jon*: CONTRASTING TIDAL DEPOSITS IN THE NEOGENE OF EASTERN BORNEO |
| | 10:30 AM | BREAK |
| 2-5 | 10:45 AM | Buatois, Luis A.*; Mangano, Maria Gabriela; Díez-Canseco, Davinia; Solorzano, Euridice; Rodriguez, Williams: ICHOLOGIC DELINEATION OF THE FLUVIAL-TIDAL TRANSITION AND ITS SIGNIFICANCE FOR FACIES MODELLING OF MARGINAL-MARINE ENVIRONMENTS |

- 2-6** 11:10 AM Botterill, Scott E.*; Timmer, Eric R.; Gingras, Murray K.: **APPLICATION OF THE PROCESS ICNNOLOGICAL FRAMEWORK TO ANCIENT DATASETS: AN EXAMPLE FROM THE LOWER CRETACEOUS BLUESKY AND MCMURRAY FORMATIONS, ALBERTA, CANADA**
- 2-7** 11:30 AM Campbell, S. Gordon*; Dolby, Graham; McNeil, David H.; Gingras, Murray: **CALIBRATING THE MICROPALaeONTOLOGY OF THE BLUESKY FORMATION WITH SEDIMENTOLOGICAL AND ICNNOLOGICAL SIGNATURES**
- 2-8** 11:50 AM Ditzler, Eric; Timmer, Eric R.; Ranger, Michael J.; Gingras, Murray K.*: **ICNNOLOGICAL DISTRIBUTIONS ON A BRACKISH-WATER POINTBAR**

POSTER TECHNICAL SESSIONS

SESSION NO. 3

Earth and Planetary Science (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 3-1** 1 Lea, James*; Boggs, Katherine: **NSOMEKA PLANITIA, HENIE QUADRANT, VENUS**
- 3-2** 2 Martinez-Sacristan, Hernando*: **EVIDENCES OF DIASTROPHISM AND UNCONFORMITY BETWEEN JURASSIC AND CRETACEOUS FLAT CONTINENTAL AND MARINE LAYERS IN COLOMBIA: FAR FROM RHETORIC, CLOSER TO REALITY**

SESSION NO. 4

Paleontology and Paleoecology (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 4-1** 3 Hood, Seana C.*; Ritterbush, Kathleen A.: **PALEOECOLOGY OF SILICEOUS SPONGES IN COASTAL MARINE SETTINGS ALONG WESTERN PANGAEA USING DEPOSITIONAL MODELS FROM PERMIAN CHERTS OF NORTHWESTERN UTAH**
- 4-2** 4 Richmond, Dean R.; Lukens, Mitchell W.; Celestino, Serena M.*: **UPPER JURASSIC MORRISON FORMATION CLAMS ON THE HALF SHELL, CENTRAL MONTANA**

SESSION NO. 5

T2. Proterozoic Evolution of Western North America (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 5-1** 5 Rule, Roy*; Pratt, Brian R.: **SEISMITES, STORMS AND SEDIMENTS: SEDIMENTARY DEFORMATION AND MISS OF THE LOWER BELT CARBONATES (WATERTON AND ALTYN FORMATIONS, BELT SUPERGROUP, CA. 1.47 GA, WESTERN NORTH AMERICA)**
- 5-2** 6 Chumley, Adam S.*; Baird, Graham B.; Kelly, Nigel M.; Mahan, Kevin H.; Zaggale, Richard H.; Allaz, Julien M.: **GEOCHEMISTRY OF THE BIG THOMPSON CANYON PALEOPROTEROZOIC GRANITOID, NORTHERN COLORADO FRONT RANGE: IMPLICATIONS FOR TECTONIC ACTIVITY AND CRUSTAL GROWTH AT ~1.7 GA**
- 5-3** 7 Parker, Stuart D.*; Winston, Don: **REVISED INTERPRETATIONS OF DETRITAL ZIRCON POPULATIONS IN THE MESOPROTEROZOIC BELT AND PURCELL SUPERGROUPS OF MONTANA, IDAHO AND BRITISH COLUMBIA**

SESSION NO. 6

T3. The Cambrian of Western Laurentia (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 6-1** 8 Virmani, Nancy*; Johnston, Paul A.: **A MIDDLE CAMBRIAN SMALL SHELLY FAUNA FROM CARBONATE MEMBERS OF THE BURGESS SHALE FORMATION, BRITISH COLUMBIA**
- 6-2** 9 Witvoet, Leela*; Pelletier, Anique; Targett, Kate: **LIFE'S A DRAG - A CAMBRIAN GIANT HOLDS FAST**
- 6-3** 10 Rippenhagen, Abbey Hope*; Fornwald, Connor: **HITTING THE SLOPES: THE KEY TO TRILOBITE TAPHONOMY**

SESSION NO. 7

T7. Geothermal Systems in the Thrust Belt and Adjacent Areas (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 7-1** 11 Beach, Chelsea A.*: **GEO THERMAL ENERGY PRODUCTION AND POTENTIAL; COMPARE AND CONTRAST THE TECTONIC SETTING OF NEW ZEALAND, ICELAND AND CANADA**
- 7-2** 12 Stange, Courtney*; Boggs, Katherine: **ENCASING NATURE: A CLASSIFICATION OF HYDROTHERMAL DEPOSITS IN FAIRMONT HOT SPRINGS, BRITISH COLUMBIA**
- 7-3** 13 Fornwald, Connor*; Boggs, Katherine: **THE REDWALL FAULT: A PLUMBING SYSTEM FOR THERMAL SPRINGS IN SOUTHEASTERN BRITISH COLUMBIA**
- 7-4** 14 Allred, Kent*: **GEO THERMAL ENERGY POTENTIAL: COMPARE AND CONTRAST CANADA, ICELAND, AND USA. FROM POLICY TO GEOLOGY**

SESSION NO. 8

T8. Characterization of Fine-Grained Unconventional Plays (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth

- 8-1** 15 Jafri, Noor H.*: **CHARACTERIZATION OF SEDIMENTARY BEDFORMS OF COLORADO GROUP MUDSTONES**
- 8-2** 16 Worms, Katherine*; Birgenheier, Lauren P.: **X-RAY FLOURESCENCE AND OPTICAL PHOTOGRAPH ANALYSIS TO EVALUATE THE PALEOREDOX CONDITIONS, PALEOPRODUCTIVITY AND DEPOSITIONAL ENVIRONMENT OF AN EOCENE LAKE SYSTEM: MAHOGANY ZONE, GREEN RIVER FORMATION, EASTERN UINTA BASIN, UTAH**
- 8-3** 17 Ritterbush, Kathleen A.*; Hood, Seana C.; Wistort, Zackery P.: **INVESTIGATING CHERTS OF UTAH AT THE LEADING EDGE OF THE PERMIAN SPICULITE BELT**

LUNCHTIME KEYNOTE ADDRESS

SESSION NO. 9

Luncheon Talk: Victor R. Baker, High-Energy Megafloods and Ice Sheets

12:20 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

Rob R. Young, Presiding

- 9-1** 12:20 PM Baker, Victor R.*: **HIGH-ENERGY MEGAFLOODS AND ICE SHEETS**

AFTERNOON ORAL TECHNICAL SESSIONS

SESSION NO. 10

T3. The Cambrian of Western Laurentia I

1:30 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

Paul Johnston and Robert B. MacNaughton, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 10-1 1:35 PM Desjardins, Patricio R.*; Buatois, Luis A.; Mangano, Maria Gabriela; Pratt, Brian R.: **SEDIMENTOLOGY, ICHNOLOGY AND SEQUENCE STRATIGRAPHY OF THE LOWER CAMBRIAN GOG GROUP, SOUTHERN ROCKY MOUNTAINS, CANADA**
- 10-2 2:00 PM Labaj, Marcelina*; Pratt, Brian R.: **SEDIMENTARY FACIES ARCHITECTURE, DEPOSITIONAL MODEL AND SEQUENCE STRATIGRAPHY OF A NEARSHORE, MIXED CARBONATE-SILICICLASTIC SYSTEM OF MIDDLE/UPPER CAMBRIAN OF SOUTHEASTERN ARIZONA**
- 10-3 2:20 PM Smith, Adam E.*; Heizler, Matthew T.; McLemore, Virginia T.; Maher, Kierran C.: **⁴⁰AR/³⁹AR GEOCHRONOLOGY AND GEOCHEMISTRY OF REE-RICH EPISYENITES IN THE CABALLO MOUNTAINS, SOUTHERN NEW MEXICO: POTENTIAL RELATIONSHIP TO HYDROTHERMAL FLUIDS DERIVED FROM CAMBRIAN-ORDOVICIAN ALKALINE MAGMATISM**
- 10-4 2:40 PM Richards, Barry Charles*: **LEAD-ZINC-SILVER ORE DEPOSITS HOSTED BY CAMBRIAN CARBONATES IN THE SOUTHERN KOOTENAY ARC, SOUTHEAST BRITISH COLUMBIA**
- 3:00 PM **BREAK**
- 10-5 3:15 PM MacNaughton, Robert B.*; Fallas, Karen M.; Moynihan, David P.: **UPLIFT OF REDSTONE ARCH (MACKENZIE MOUNTAINS, NWT) DURING DEPOSITION OF CAMBRIAN SERIES 2: LOCAL EXPRESSION OF A REGIONAL TECTONIC EVENT?**
- 10-6 3:40 PM Dilliard, Kelly A.*; Pope, Michael C.; Coniglio, Mario: **SEQUENCE STRATIGRAPHY OF THE UPPER SEKWU FORMATION: IMPLICATIONS FOR THE EARLY CAMBRIAN OF WESTERN LAURENTIA**
- 10-7 4:00 PM Herbers, David*; Gingras, Murray: **MIXED DELTAIC, SHOREFACE, AND TIDAL EMBAYMENT SEDIMENTATION ALONG A STORM-INFLUENCED SHORELINE; OUTCROPS OF THE MOUNT CLARK FM WITHIN THE MACKENZIE MOUNTAINS, NWT**
- 10-8 4:20 PM Sommers, Matthew*; Gingras, Murray K.; MacNaughton, Robert B.; Fallas, Karen M.: **SUBSURFACE ANALYSIS AND CORRELATION OF CAMBRIAN FORMATIONS BENEATH THE COLVILLE HILLS, NORTHERN MAINLAND NORTHWEST TERRITORIES**

SESSION NO. 11

T8. Characterization of Fine-Grained Unconventional Plays

1:30 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1060

Per Kent Pederson and Francois Marechal, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 11-1 1:35 PM Egenhoff, Sven O.*; Borcovsky, Damien; Fishman, Neil: **UPPER BAKKEN MEMBER SHALE FACIES ARCHITECTURE, NORTH DAKOTA, USA – A TALE OF RADIOLARIANS AND CLAY CLASTS**
- 11-2 2:00 PM Marechal, Francois*; Cheema, Amjed; Strom, Raymond: **DOES A GOOD OUTCROP JUST STAND OUT? – IDENTIFICATION AND ANALYSIS OF A POTENTIALLY REPRESENTATIVE BASIN CENTRED JURASSIC OIL BEARING SHALE OUTCROP**

- 11-3 2:20 PM Wistort, Zackery P.*: **IDENTIFICATION OF SILICIFIED TRACE FOSSILS IN THE PERMIAN OF NORTHWESTERN UTAH**
- 11-4 2:40 PM Haines, Forest E.*: **MARKER BEDS AND STRATIGRAPHIC MEMBERS OF THE LOWER MISSISSIPPIAN STRATOTYPE IN THE NORTH CENTRAL SECTION ARE TRACEABLE TO THE ROCKY MOUNTAINS FROM ARIZONA TO ALBERTA**
- 3:00 PM **BREAK**
- 11-5 3:15 PM Pedersen, Per K.*: **BEDFORMS TO STRATAL ARCHITECTURE AND PLAY FAIRWAYS OF MARINE MUDDY DEPOSITIONAL SYSTEMS**
- 11-6 3:40 PM Paz, Maximiliano*; Ponce, Juan Jose; Buatois, Luis A.; Mángano, Gabriela; Carmona, Noelia B.; Desjardins, Patricio: **SEISMIC SCALE BOTTOMSET FACIES OF A MIXED CARBONATE-SILICICLASTIC RAMP: THE JURASSIC-CRETACEOUS VACA MUERTA FORMATION IN THE PICÚN LEUFÚ AREA, NEUQUÉN BASIN, ARGENTINA**
- 11-7 4:00 PM Egenhoff, Sven O.*: **SHALES ARE LARGELY EVENT DEPOSITS! EVIDENCE FROM THE BJÖRKÅSHOLMEN FORMATION, SWEDEN; THE WOODFORD SHALE, OKLAHOMA; AND THE UPPER BAKKEN SHALE, NORTH DAKOTA**
- 11-8 4:20 PM Stonge, Andy*: **SEISMIC CHARACTERIZATION OF FINE-GRAINED UPPER CRETACEOUS RESERVOIRS WITHIN THE GREAT PLAINS POLYGONAL FAULT SYSTEM**

SESSION NO. 12

T10. Using the Rocky Mountains as a Natural Laboratory for Teaching the 'What' and the 'How' of Geology

1:30 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1065

Glenn Dolphin, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 12-1 1:35 PM Cooper, Jonathan*; Dolphin, Glenn; Dutchak, Alex R.; Karchewski, Brandon: **DEVELOPING VIRTUAL FIELD EXPERIENCES (VFES) FOR TEACHING GEOSCIENCE CONCEPTS AND PROCESSES**
- 12-2 2:00 PM Malinconico, Lawrence L.*; Sunderlin, David: **INTEGRATION AND PEDAGOGICAL EFFICACY OF DIGITAL FIELD METHODOLOGIES IN A FULL-YEAR SED/STRAT AND STRUCTURE COURSE**
- 12-3 2:20 PM Richards, Bill D.*: **USING ROCKY MOUNTAIN REGION'S GEOLOGICAL DIVERSITY AS VIRTUAL LEARNING OPPORTUNITIES**
- 12-4 2:40 PM Leckie, Dale A.*: **USING THE ROCKY MOUNTAINS TO PROMOTE GEOTOURISM – AN EXAMPLE: PASSING THROUGH TIME: A GEOLOGICAL TOUR THROUGH BANFF, YOHO AND JASPER NATIONAL PARKS**
- 3:00 PM **BREAK**
- 12-5 3:15 PM Dolphin, Glenn*: **FROM "ROCKS FOR JOCKS" TO "JOCKS TALKING ABOUT ROCKS": RE-CONCEPTUALIZING THE DESIGN AND SCOPE OF THE TRADITIONAL, LARGE LECTURE, INTRODUCTORY GEOLOGY COURSE FOR NON-SCIENCE MAJORS**
- 12-6 3:40 PM Nieto-Obregon, Jorge*; Méndez-Orduña, David; Silva Romo, Gilberto; Mendoza-Rosales, Claudia Cristina; Arcos Hernández, José Luis; Campos Madrigal, Emiliano: **DIDACTIC APPROACH TO REGIONALIZATION OF THE FAULT PLANE (AS A FUNCTION OF THE PITCH ANGLE OF STRIATION LINEATION), USING TRIDIMENSIONAL MODELS AND TRIGONOMETRIC ANALYSIS TO DETERMINE THE SENSE OF SLIP**
- 4:00 PM **DISCUSSION**

SATURDAY, 10 JUNE 2017

MORNING ORAL TECHNICAL SESSIONS

SESSION NO. 13

T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1060

David W. Eaton and Katherine Boggs, Presiding

9:00 AM **INTRODUCTORY REMARKS**

- 13-1** 9:05 AM Allam, Amir*; Lin, Fan-Chi; Tape, Carl: **DEEP ROOTS AND SHALLOW DAMAGE STRUCTURE OF THE DENALI FAULT ZONE FROM TOMOGRAPHIC AND LARGE-N SMALL-APERTURE ARRAY SEISMIC IMAGING**
- 13-2** 9:30 AM Schutt, Derek L.*; Lowry, Anthony R.; Buehler, Janine S.: **MOHO TEMPERATURE AND COMPOSITIONAL CONTROLS ON LITHOSPHERIC BENDING STRENGTH IN THE WESTERN UNITED STATES**
- 13-3** 9:50 AM Ferguson, Grant*: **FACTORS CONTROLLING THERMAL SPRINGS IN THE CANADIAN CORDILLERA**
- 13-4** 10:10 AM DiCaprio, Lydia*; Eaton, David W.: **IMPLICATIONS OF AN ABRUPT CRATON EDGE: CONDITIONS FOR EXTRUSION OF THE CRATONIC LITHOSPHERE**
- 10:30 AM **BREAK**
- 13-5** 10:45 AM Currie, Claire A.*; Wang, Huilin; Hyndman, Roy D.; Chen, Yunfeng; Gu, Yu Jeffrey: **RELATIONSHIP BETWEEN LITHOSPHERE TEMPERATURES AND MOHO GEOMETRY IN SOUTHWESTERN CANADA**
- 13-6** 11:10 AM Chen, Yunfeng*; Gu, Yu Jeffrey; Hung, Shu-Huei: **CRUST AND UPPER MANTLE STRUCTURES SURROUNDING THE ROCKY MOUNTAIN FORELAND BASIN IN SOUTHWESTERN CANADA**
- 13-7** 11:30 AM Jones, Peter*: **THE LEWIS THRUST: WHOSE FAULT IS IT, ANYWAY?**
- 13-8** 11:50 AM Parker, Stuart D.*: **MORE THAN ONE WAY TO SHEAR: ACCOMMODATING VARIABLE EXTENSION IN THE NORTHERN BASIN AND RANGE AND EASTERN SNAKE RIVER PLAIN**

SESSION NO. 14

T4. Cretaceous Stratigraphy of the North American Foreland

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

Dale A. Leckie and Jennifer J. Scott, Presiding

9:00 AM **INTRODUCTORY REMARKS**

- 14-1** 9:05 AM Birgenheier, Lauren P.*; McCauley, Andrew; DeReuil, Aubry A.; Horton, Brendan: **WHAT TO DO WITH A SEA OF MUD: THE MANCOS SHALE REVISITED**
- 14-2** 9:30 AM Schultz, Sarah K.*; MacEachern, James A.: **SEQUENCE STRATIGRAPHY OF FALLING-STAGE AND LOWSTAND DEPOSITS OF THE LOWER CRETACEOUS (ALBIAN) VIKING FORMATION, JOARCAM FIELD, CENTRAL ALBERTA**
- 14-3** 9:50 AM Daniels, Benjamin G.*; Hubbard, Stephen M.; Matthews, William A.; Quinn, Garrett M.; Guest, Bernard; Leckie, Dale A.; Hadlari, Thomas: **SEDIMENT PROVENANCE AND DISPERSAL DURING FORELAND BASIN UPLIFT: LOWER CRETACEOUS MANNVILLE GROUP, ALBERTA BASIN, CANADA**

- 14-4** 10:10 AM Super, Samantha C.*; Hubbard, Stephen M.; Matthews, William A.; Brar, Ranjot S.; Coutts, Daniel S.; Horner, Sean C.; Venieri, Marco; Guest, Bernard: **DETRITAL ZIRCON GEOCHRONOLOGY OF UPPER CRETACEOUS AND PALEOGENE STRATA, ALBERTA BASIN, CANADA: IMPLICATIONS FOR PROVENANCE AND TECTONIC EVOLUTION**
- 10:30 AM **BREAK**
- 14-5** 10:45 AM Fanti, Federico*: **BASINWARD: REGRESSIVE DEPOSITIONAL ARCHITECTURE IN THE OLDMAN AND WAPITI FORMATIONS (CAMPANIAN, WESTERN INTERIOR SEAWAY)**
- 14-6** 11:10 AM Eberth, David A.*; Ramezani, Jahandar; Roberts, Eric M.; Rogers, Raymond R.; Braman, Dennis R.; Evans, David C.: **BIOSTRATIGRAPHIC IMPORTANCE OF THE NEW CA-TIMS U-PB GEOCHRONOLOGY FOR THE BELLY RIVER GROUP AT DINOSAUR PROVINCIAL PARK (CAMPANIAN, ALBERTA, CANADA)**
- 14-7** 11:30 AM Genecov, Michael Joseph*: **MIDDLE THOMPSON CREEK ISOLATED SAND BODY: A TIDE-DOMINATED DELTA'S IMPLICATIONS ON THE STRATIGRAPHY OF THE PICEANCE BASIN'S EASTERN EDGE**
- 14-8** 11:50 AM Gilbert, Meagan*; Buatois, Luis A.; Renaut, Robin W.: **STRATIGRAPHY AND SEDIMENTOLOGY OF THE DINOSAUR PARK- BEARPAW FORMATION TRANSITION (CAMPANIAN) IN THE CYPRESS HILLS REGION, SOUTHWESTERN SASKATCHEWAN, CANADA**

POSTER TECHNICAL SESSIONS

SESSION NO. 15

T1. From Earthscope to EarthsCAN and the Canadian Cordillera Array (Posters)

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth #

- 15-1** 18 Ellsworth, G. Graham*; Bartholomew, Mervin J.: **THE BRITTLE DEFORMATION SEQUENCE AT DEAD INDIAN HILL AND THE HEART MOUNTAIN DETACHMENT**
- 15-2** 19 Fox, Kevin*; Gonzales, David A.: **A PETROLOGIC AND GEOCHEMICAL INVESTIGATION OF MINERALIZATION AT THE YELLOW JACKET MINE, OURAY COUNTY, COLORADO**
- 15-3** 20 Hess, Terra Lee*; Carter, Michael; Sundell, Kent: **THE SEARCH FOR DIAMONDS IN THE LARAMIE MOUNTAINS OF THE WYOMING ARCHEAN PROVINCE, USA**
- 15-4** 21 Droboth, Jason Curtis*: **QUAKE CATCHER NETWORK IN CALGARY: TESTING THE LIMITS OF VOLUNTEER HOSTED SEISMIC NETWORKS**
- 15-5** 22 Callis, Samuel J.*; Stearns, Michael A.: **RECONCILING EMPLACEMENT OF THE LITTLE COTTONWOOD STOCK WITH PROTRACTED FLUID FLOW IN THE ALTA STOCK, WASATCH MOUNTAINS, UTAH, USA**
- 15-6** 23 Pritchard, Chad; Huddleston, Keylin A.*: **COMPARISON OF TWO CRETACEOUS AGE GRANITES ALONG THE SPOKANE RIVER USING ESTIMATED AGE, MINERAL COMPOSITION, AND APPLICABLE GEOTHERMOBAROMETRY**
- 15-7** 24 Witvoet, Leela*; Boggs, Katherine: **POSSIBLE EDUCATIONAL APPLICATIONS FOR THE FUTURE CCARRAY**

SESSION NO. 16**T4. Cretaceous Stratigraphy of the North American Foreland (Posters)**

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

Booth #	
16-1	25 Withdrawn
16-2	26 Scott, Jennifer J.*; Aslam, Rida; Wyenberg-Henzler, Taia: STRATIGRAPHY AND ICHNOLOGY OF COASTAL PLAIN HETEROLITHIC AND MUDSTONE FACIES OF THE CAMPANIAN DINOSAUR PARK TO BEARPAW TRANSGRESSION, SOUTHERN ALBERTA

SESSION NO. 17**T5. Tertiary and Quaternary Landscapes (Posters)**

9:00 AM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1050

Authors will be present from 4:45 to 6:30 PM

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17-1	27 Wheeler, Aspen R.*: ABUNDANCE AND COMPOSITION OF PRECIPITATION FEATURES ON WEST ANTARCTIC SUBGLACIAL TILL GRAINS
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**LUNCHTIME
KEYNOTE ADDRESS****SESSION NO. 18****Luncheon Talk: Jeffrey T. Freymueller**, Earthscope: Accomplishments, Legacy, and Future Opportunities

12:20 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

David W. Eaton and Katherine Boggs, Presiding

18-1	12:20 PM	Freymueller, Jeffrey T.*: EARTHSCOPE: ACCOMPLISHMENTS, LEGACY, AND FUTURE OPPORTUNITIES
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**AFTERNOON
ORAL TECHNICAL SESSIONS****SESSION NO. 19****T3. The Cambrian of Western Laurentia II**

1:30 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1060

Paul Johnston and Robert B. MacNaughton, Presiding

	1:30 PM	INTRODUCTORY REMARKS
19-1	1:35 PM	Mangano, Maria Gabriela*: INTERPLAY OF ECOLOGIC, TAPHONOMIC AND EVOLUTIONARY CONTROLS ON ICHNOFAUNAS FROM BURGESS SHALE-TYPE DEPOSITS
19-2	2:00 PM	Morgan, Chad A.*; Henderson, Charles M.; Pratt, Brian R.: THE FIRST GIANT PALEODICTYON: A NEW ICHNOSPECIES FROM THE MID-CAMBRIAN OF ALBERTA
19-3	2:20 PM	Collom, Christopher J.*: ORIGIN AND PALEOENVIRONMENT OF THE CAMBRIAN NATALCO EMBAYMENT OF THE CATHEDRAL ESCARPMENT, BRITISH COLUMBIA, CANADA
19-4	2:40 PM	Kimmel, V. Allen*: GEOLOGY OF THE MOUNT STEPHEN TRILOBITE BEDS AND ADJACENT STRATA FIELD B.C., YOHU NATIONAL PARK - NEW INSIGHTS ON A 130 YEAR OLD DISCOVERY
	3:00 PM	BREAK
19-5	3:15 PM	Johnston, Paul A.*; Johnston, Kimberley J.; Keith, Stanley B.: SYNGENETIC, DEEP-SOURCED, CLINOCHLORE MUD DIAPYRS IN THE MIDDLE CAMBRIAN BURGESS SHALE
19-6	3:40 PM	Richards, Barry Charles*: PB-ZN-AG OREBODIES IN CAMBRIAN CARBONATES DEPOSITED ON THE WESTERN CRATONIC PLATFORM AND IN THE ADJACENT WHITE RIVER TROUGH, SOUTHEASTERN BRITISH COLUMBIA
19-7	4:00 PM	Keith, Stanley B.*; Johnston, Kimberley J.; Johnston, Paul A.: TALC PROTRUSIONS AT TALC LAKE, BRITISH COLUMBIA: A MAJOR COMPONENT OF THE GIANT, CAMBRIAN-AGE, HYDROTHERMAL, HYDROCARBON-DOLOMITE-BASE METAL-MUD VOLCANO SYSTEM ON THE KICKING HORSE RIM
	4:20 PM	DISCUSSION

SESSION NO. 20**T5. Tertiary and Quaternary Landscapes**

1:30 PM, Mount Royal University, Roderick Mah Centre, Ross Glen Hall EC1040

Robert R. Young, Presiding

	1:30 PM	INTRODUCTORY REMARKS
20-1	1:35 PM	Leckie, Dale A.*; Leier, Andrew: CENOZOIC FLUVIAL DRAINAGE PATTERNS OF SOUTHERN CANADA AND NORTHERN UNITED STATES – THE DETRITAL ZIRCON RECORD

20-2	2:00 PM	Patrick, A. Kacy*; Burrell, Sara A.; Currano, Ellen D.: THE EARLY EOCENE SAN JUAN BASIN FLORA: AN INVESTIGATION INTO THE EARLY CENOZOIC HISTORY OF THE MOUNTAIN WEST	20-5	3:15 PM	Young, Robert R.*: SUBGLACIAL MEGAFLOODING ON THE ALBERTA PLAIN, WITH ANALOGIES TO THE CHanneled SCABLANDS
20-3	2:20 PM	Orcutt, John D.*; Caledo, Jonathan J.M.; Richards, Bill D.: FIRST OCCURENCE OF A MAMMAL FROM THE MID-MIOCENE CLARKIA FOSSIL BEDS	20-6	3:40 PM	Thapa, Prasamsa*: CONTROLS ON ROCKFALL-TALUS PROCESS-RESPONSE SYSTEMS, KANANASKIS, CANADIAN ROCKIES
20-4	2:40 PM	Hartman, Gregory*; Slomka, Jessica: REGIONAL NEOGENE-QUATERNARY STRATIGRAPHY OF THE PEACE RIVER LOWLAND, NORTHWESTERN ALBERTA	20-7	4:00 PM	Costa, Ozeas S.*: CHANGING PRECIPITATION PATTERNS IN THE U.S. MIDWEST: CAUSES AND CONSEQUENCES
	3:00 PM	BREAK	20-8	4:20 PM	Mahan, Shannon A.*: LUMINESCENCE GEOCHRONOLOGY: PROGRESS, PRODUCTS, AND PREDICTIONS

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