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CANADIAN QUATERNARY ASSOCIATION MEETINGS, 2001: PROGRAM AND ABSTRACTS

YUKON
Tourism
Heritage Branch
Sue Edelman, Minister
2001

CANADIAN QUATERNARY ASSOCIATION MEETINGS 2001
WHITEHORSE, YUKON
AUGUST 20 – 24
HIGH COUNTRY INN

HOST COMMITTEE

Jeff Hunston, Conference Chair
Bruce Barrett, Audiovisuals
Jeff Bond, Poster Session
Greg Hare, Transportation
Beth King, Registration
Bill LeBarge, International Delegates
Grant Lowey, Mid-Conference Field Trips
Chris Marion, Logistics
John Storer, Program

PROGRAM

Monday, August 20
Evening
6:30 – 9:30 PM: Opening reception, Yukon Beringia Interpretive Centre. Registration desk open.

Tuesday, August 21
Morning
7:45 AM: Registration desk opens, High Country Inn.
8:15 – 8:45 AM: Brief remarks by Conference Chair and Program Chair.
8:45 – 10:45 AM: Technical session:
Palaeolimnology, Palaeohydrology, Permafrost.
11:00 AM – Noon: Canadian Geomorphology Research Group; J. Ross Mackay Award presented to Scott Lamoureux, and prize lecture.

Noon – 1:00 PM: Lunch on your own. Meeting for outgoing CANQUA Council.

Afternoon
1:00 – 5:20 PM: Concurrent technical sessions:
Long Terrestrial Records of Plio-Pleistocene Climate Change (Part 1).
Economic Quaternary Geology.

Evening
7:00 – 9:30 PM: Yukon Science Institute public lecture, Yukon Beringia Interpretive Centre.
Speaker: Alan Cooper, Oxford University, "DNA Work on Ice Age Mammals."

Wednesday, August 22
Morning
7:00 – 8:30 AM: Yukon Field Camp Pancake Breakfast.

All Day
8:30 AM – 6:00 PM: Mid-conference field trips.

Evening
No events scheduled.

Thursday, August 23
Morning
8:00 AM – Noon: Concurrent technical sessions:
    Long Terrestrial Records of Plio-Pleistocene Climate Change (Part 2).
    Geomorphology; Holocene Palaeoecology (Part 1).

Noon – 1:00 PM: Lunch on your own.

Afternoon
1:00 – 3:40 PM: Technical session:
    Archaeology and Palaeontology.
1:00 – 3:40 PM: Posters may be set up in Room 2 during this time.
3:45 – 5:00 PM: CANQUA Annual Meeting.

Evening
6:00 – 10:00 PM: Conference banquet, High Country Inn.
    Speaker: Steve Porter, "Late Pleistocene Glaciation in the Pacific Northwest."

Friday, August 24
8:00 AM – Noon: Poster Session. Presenters to be with their posters.
11:00 AM – Noon: Meeting for incoming CANQUA Council.

Noon – 1:00 PM: Lunch on your own.

Afternoon
2:00 – 5:00 PM: Technical session:
    Holocene Palaeoecology (Part 2).

Evening
7:00 – 9:30 PM: Yukon Science Institute public lecture, Yukon Beringia Interpretive Centre.
    Speakers: Natalia Patyk-Kara, Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry (IGEM), Russian Academy of Sciences; and Irina Spasskaya, Institute of Geography, Russian Academy of Sciences: "Beringia and its Mineral Resources: Cenozoic History and Placer Deposits."

TECHNICAL SESSIONS AT A GLANCE

Tuesday, August 21

	Room 1	Room 2
8:15 AM	Opening remarks	
8:45 AM	**Palaeolimnology, Palaeohydrology, Permafrost**	
8:45 AM	Kershaw	
9:05 AM	Whiteman	
9:25 AM	Murton	
9:45 AM	Kokelj et al.	
10:05 AM	Abbott et al.	
10:25 AM	Côté and Burn	
11:00 AM	**CGRG Award**; Lamoureux	
12:00 Noon	**Lunch**	
1:00 PM	**Long Terrestrial Records (Part 1)**	**Economic Quaternary Geology**
1:00 PM	Huscroft et al.	Duk-Rodkin
1:20 PM	Westgate et al.	LeBarge
1:40 PM	Lian and Hicock	Bond et al.
2:00 PM	Berger	Patyk-Kara
2:20 PM	Froese et al.	Spasskaya
2:40 PM	Coffee	Break
3:20 PM	Barendregt	Morris
3:40 PM	Brookes	Levson et al.
4:00 PM	McMartin and Henderson	Hickin and Bobrowsky
4:20 PM	McQueen et al.	Bichler and Bobrowsky
4:40 PM	Paulen and DiLabio	Lowey
5:00 PM	Cooper et al.	Duk-Rodkin

Thursday, August 23

	Room 1	Room 2
8:00 AM	**Long Terrestrial Records (Part 2)**	**Geomorphology; Holocene Palaeoecology (Part 1)**
8:00 AM	Mate et al.	Bjornson et al.
8:20 AM	Schweger	Lewkowicz
8:40 AM	Blake	Lauriol et al.
9:00 AM	Ward et al.	Beierle
9:20 AM	Zazula	Teller
9:40 AM	Coffee	Break
10:20 AM	Elias	Reyes and Smith
10:40 AM	Blais-Stevens et al.	Beaney and Brennand
11:00 AM	Schweger	Johnsen and Brennand
11:20 AM	Storer	Bowman and Bobrowsky
11:40 AM	West and Donaldson	
12:00 Noon	**Lunch**	
1:00 PM	**Archaeology and Palaeontology**	
1:00 PM	Bell and Renouf	
1:20 PM	Laybolt	
1:40 PM	Whitney-Smith	
2:00 PM	Landry and Cwynar	
2:20 PM	Coffee	Break
2:40 PM	Matheus	
3:00 PM	Burns	
3:20 PM	Cinq-Mars and Lauriol	

Friday, August 24

	Room 1	Room 2
8:00 AM		**Poster Session**
12:00 Noon	**Lunch**	
2:00 PM	**Holocene Palaeoecology (Part 2)**	
2:00 PM	Sauchyn et al.	
2:20 PM	Cavin et al.	
2:40 PM	Vincent and Cwynar	
3:00 PM	Douglas et al.	
3:20 PM	Geertsema and Clague	
3:40 PM	Coffee	Break
4:00 PM	Kurek et al.	
4:20 PM	Chmura	
4:40 PM	Smol et al.	

TALKS AND POSTERS, BY SESSION

Tuesday, August 21

8:45 – 10:45 AM: PALAEOLIMNOLOGY, PALAEOHYDROLOGY, PERMAFROST.

8:45 G. Peter Kershaw. **PERMAFROST LANDFORMS AND CLIMATE CHANGE IN THE MACKENZIE MOUNTAINS, N.W.T.**

9:05 Colin Whiteman. **MELTOUT TILL OVERLYING LAURENTIDE BASAL ICE, MACKENZIE DELTA AREA, CANADA.**

9:25 Julian Murton. **BASAL ICE AND FROZEN DEFORMING BED OF THE LATE WISCONSINAN LAURENTIDE ICE SHEET, TUKTOYAKTUK COASTLANDS, NWT.**

9:45 Steven Kokelj, Scott Smith, and Chris Burn. **PHYSICAL AND CHEMICAL CHARACTERISTICS OF ACTIVE LAYER AND PERMAFROST SEDIMENTS, HERSCHEL ISLAND, WESTERN ARCTIC COAST, CANADA.**

10:05 Mark Abbott, Lesleigh Anderson, Maria Tsukernik, Bruce Finney, and Mary Edwards. **HOLOCENE PALEOHYDROLOGY AND GLACIAL HISTORY OF ALASKA AND THE YUKON TERRITORY FROM LAKE SEDIMENT STUDIES.**

10:25 M.M. Côté and C.R. Burn. **A GIS-BASED ANALYSIS OF THE ORIENTED LAKES ON EASTERN TUKTOYAKTUK PENINSULA, NORTHWEST TERRITORIES.**

11:00 AM – NOON: CANADIAN GEOMORPHOLOGY RESEARCH GROUP, J. ROSS MACKAY AWARD.

Scott Lamoureux. **LACUSTRINE SEDIMENTARY RECORDS OF LONG TERM GEOMORPHIC AND HYDROCLIMATIC CHANGE.**

1:00 – 5:00 PM: LONG TERRESTRIAL RECORDS OF PLIO-PLEISTOCENE CLIMATE CHANGE (PART 1).

1:00 Crystal A. Huscroft, Lionel E. Jackson, Jr., Rene W. Barendregt, and Mike Villeneuve. **CONSTRAINTS ON AGES OF PRE-MCCONNELL GLACIATIONS BASED ON NEW PALEOMAGNETIC INVESTIGATIONS AND AR-AR DATING OF BASALT IN WEST CENTRAL YUKON, CANADA.**

1:20 John Westgate, Shari Preece, Amanjit Sandhu, and Duane Froese. **TEPHRA POWER: PROVIDING A SECURE CHRONOLOGIC FRAMEWORK FOR LATE CENOZOIC GEOLOGIC/PALEOENVIRONMENTAL STUDIES IN EASTERN BERINGIA.**

1:40 Olav B. Lian and Stephen R. Hicock. **USING OPTICAL DATING TO PLACE LIMITS ON GLACIGENIC SEQUENCES: AN EXAMPLE FROM SOUTH-CENTRAL BRITISH COLUMBIA.**

2:00 Glenn W. Berger. **LUMINESCENCE DATING OF A POST-STAGE 5 LOESS-PALEOSOL SEQUENCE AT GOLD HILL, FAIRBANKS, ALASKA.**

2:20 Duane Froese, John Westgate, Shari Preece, and Amanjit Sandhu. **MID-PLIOCENE PERMAFROST AND THE FIRST CORDILLERAN ICE SHEET IN YUKON TERRITORY.**

2:40 – 3:20 Coffee break.

3:20 Rene W. Barendregt. **TIME CONSTRAINTS FOR THE EARLIEST RECORDS OF GLACIATION IN THE CANADIAN INTERIOR PLAINS AND AMERICAN MIDWEST.**

3:40 Ian A. Brookes. **DO YOU GET MY DRIFT?: GEORGE MERCER DAWSON'S CANADA.**

4:00 Isabelle McMartin and Penny Henderson. **RE-INTERPRETATION OF THE ICE-FLOW HISTORY WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.**

4:20 Kenneth McQueen, Osvaldo Gonzalez, and Ian Roach. **EL CAPITAN PALAEOVALLEY: IMPLICATIONS FOR UNDERSTANDING THE MIOCENE TO QUATERNARY LANDSCAPE HISTORY OF THE COBAR REGION, NSW, AUSTRALIA.**

4:40 Roger C. Paulen and Ron N.W. DiLabio.**DELIMITATION OF THE OWL CREEK BEDS, TIMMINS, NORTHEASTERN ONTARIO.**

5:00 Alan Cooper, Beth Shapiro, and Ian Barnes. **PERMAFROST BONE DNA. BEARS AND BISON DANCE THE TANGO.**

1:00 – 5:00 PM: ECONOMIC QUATERNARY GEOLOGY.

1:00 Alejandra Duk-Rodkin. **INTRODUCTORY REMARKS.**

1:20 William P. LeBarge. **MINING ECONOMICS AND GEOLOGY OF YUKON PLACER DEPOSITS.**

1:40 Jeffrey D. Bond, William P. LeBarge, and Leyla H. Weston. **PLACER DEPOSIT EXPLORATION IN GLACIATED TERRAIN: UNDERSTANDING CLIMATE IMPACTS ON DRAINAGES IN THE MAYO MINING DISTRICT, CENTRAL YUKON, CANADA.**

2:00 Natalia Patyk-Kara. **PRE-QUATERNARY AND QUATERNARY BURIED VALLEYS ALONG THE NORTH-EASTERN MARGIN OF ASIA AND PLACER DEPOSITS RELATED TO THEM.**

2:20 Irina Spasskaya. **PRE-QUATERNARY AND QUATERNARY DRAINAGE NET OF THE EASTERN URALS: RESTRUCTURING IN UPPER LINKS AND PLACERS' CONSERVATION.**

2:40 – 3:20 Coffee Break.

3:20 Tom Morris. **EVALUATING ONTARIO'S DIAMOND POTENTIAL THROUGH KIMBERLITE INDICATOR MINERALS DERIVED FROM MODERN ALLUVIUM SAMPLING PROGRAMS.**

3:40 Victor M. Levson, Travis Ferbey, David J. Mate, and Andrew J. Stumpf. **COMPLEX GLACIAL DYNAMICS AND MINERAL DISPERSAL IN THE CENTRAL CANADIAN CORDILLERA.**

4:00 Adrian S, Hickin and Peter T. Bobrowsky. **APPLICATION OF GROUND PENETRATING RADAR IN TROPICAL DIAMOND AND GOLD PLACER EXPLORATION, MAPLE CREEK, GUYANA.**

4:20 Ahren Bichler and Peter Bobrowsky. **AGGREGATE MINE RECLAMATION PRACTICES INTO THE 21ST CENTURY.**

4:40 Grant W. Lowey. **THE ROLE OF FORCING MECHANISMS, BASELEVEL CHANGE AND ACCOMMODATION SPACE IN THE FORMATION OF THE KLONDIKE GOLDFIELDS, YUKON, CANADA.**

5:00 A. Duk-Rodkin. **PREGLACIAL DRAINAGE AND DIAMOND PLACER POTENTIAL FROM THE INTERIOR PLAINS TO THE LABRADOR SEA.**

Thursday, August 23

8:00 AM – NOON: LONG TERRESTRIAL RECORDS OF PLIO-PLEISTOCENE CLIMATE CHANGE (PART 2).

8:00 David J. Mate, Victor M. Levson, and Richard Hebda. **INTERGLACIAL, GLACIAL AND HOLOCENE STRATIGRAPHY AND HISTORY OF THE OOTSA LAKE REGION, CENTRAL BRITISH COLUMBIA.**

8:20 Charles Schweger. **GLACIAL, INTERSTADIAL AND INTERGLACIAL ENVIRONMENTS OF THE YUKON – CONTRASTING THE EXTREMES.**

8:40 Weston Blake, Jr. **INTERSTADIAL ENVIRONMENTS AROUND NORTHERNMOST BAFFIN BAY.**

9:00 Brent Ward, Jon Driver, Erle Nelson, and Randy Enkin. **PORT ELIZA CAVE: EXAMPLE OF THE GLACIAL STRATIGRAPHIC POTENTIAL OF WAVE CUT, MARINE CAVES.**

9:20 Grant D. Zazula. **THE FULL-GLACIAL ENVIRONMENT OF THE BLUEFISH WATERSHED: PRELIMINARY MACROBOTANICAL ANALYSIS OF THE BLUEFISH EXPOSUES.**

9:40 – 10:20 Coffee Break.

10:20 Scott A. Elias. **PLIOCENE AND EARLY PLEISTOCENE SEASONAL TEMPERATURES IN THE NORTH AMERICAN ARCTIC, BASED ON MUTUAL CLIMATIC RANGE ANALYSIS OF FOSSIL BEETLE ASSEMBLAGES.**

10:40 A. Blais-Stevens, John J. Clague, Richard J. Hebda, Rolf W. Mathewes, and Brian D. Bornhold. **RECORD OF LARGE, LATE PLEISTOCENE OUTBURST FLOODS PRESERVED IN SAANICH INLET SEDIMENTS.**

11:00 Charles Schweger. **THE WARM PERIODS: YUKON'S INTERGLACIALS.**

11:20 John E. Storer. **THE VOLE *ALLOPHAIOMYS DECEITENSIS* FROM THE EARLY PLEISTOCENE OF FORT SELKIRK, YUKON TERRITORY, AND THE AGE OF THE CAPE DECEIT FAUNA, ALASKA.**

11:40 K.D. West and J.A. Donaldson **ERUPTIVE TIMING OF WHITE RIVER ASH DEPOSIT (YUKON, NORTHWEST TERRITORIES, AND ALASKA).**

8:00 AM – NOON: GEOMORPHOLOGY; HOLOCENE PALAEOECOLOGY (PART 1).

8:00 Jean Bjornson, Bernard Lauriol, and Denis Lacelle. **RETROGRESSIVE THAW SLUMPS: AN OPEN WINDOW INTO THE QUATERNARY OF THE RICHARDSON MOUNTAINS, NWT.**
8:20 Antoni G. Lewkowicz. **A QUANTITATIVE MODEL OF SLOPE HUMMOCK DEVELOPMENT, FOSHEIM PENINSULA, ELLESMERE ISLAND, NUNAVUT.**
8:40 Bernard Lauriol, Jean Bjornson, Jacques Cinq-Mars, Ian D. Clark, and Denis Lacelle. **GEOMORPHOLOGICAL RESPONSES TO CLIMATE CHANGE IN THE CANADIAN NORTH WEST DURING THE HOLOCENE: IMPORTANCE OF THEIR RECOGNITION.**
9:00 Brandon Beierle. **HOLOCENE CLIMATIC CHANGES IN THE CENTRAL YUKON TERRITORY, CANADA.**
9:20 James T. Teller. **LAKE AGGASIZ TRANSGRESSIONS AND FLOOD BURSTS: CONTROLS BY DIFFERENTIAL ISOSTATIC REBOUND AND THREE DIFFERENT OUTLETS.**
9:40 – 10:20 Coffee Break.
10:20 Alberto Reyes and Dan Smith. **TREE-RING DATES FOR NEOGLACIAL LAKE ALSEK, YUKON TERRITORY, CANADA.**
10:40 Claire Beaney and Tracy Brennand. **DRUMLINS OF THE CENTRAL INTERIOR PLATEAU, BRITISH COLUMBIA: SHAPE, SIZE AND DISTRIBUTION.**
11:00 Timothy F. Johnsen and Tracy A. Brennand. **GLACIAL LAKE DEADMAN, SOUTHERN INTERIOR OF BRITISH COLUMBIA: PALEOGEOGRAPHY AND PALEOENVIRONMENT.**
11:20 Charlotte Bowman and Peter Bobrowsky. **DETERMINATION OF HEAVY METAL CONCENTRATIONS AND ASSOCIATED HEALTH HAZARDS IN THE SOILS OF VICTORIA, BRITISH COLUMBIA.**

1:00 – 4:00 PM: ARCHAEOLOGY AND PALAEONTOLOGY.

1:00 Trevor Bell and Patricia Renouf. **PROSPECTING FOR SUBMERGED LANDSCAPES OF EARLY MARINE ARCHAIC INDIAN OCCUPATION, OFFSHORE NEWFOUNDLAND.**
1:20 A. Dawn Laybolt. **ENVIRONMENTAL RECONSTRUCTION THROUGH MICROMORPHOLOGICAL EXAMINATION OF LOWER MIDDEN SEDIMENTS AT MINK ISLAND (XMK-030) EMPLOYING THIN SECTIONS AND LATEX PEELS.**
1:40 Elin Whitney-Smith. **TUNDRA, TRUCKS AND EXTINCTIONS OR: ARE BISON THE PRAIRIE'S WAY OF MAKING MORE PRAIRIE?**

2:00 Mark Landry and Les C. Cwynar. **MINIMAL RESIDENCE HISTORY OF *DROSERA FILIFORMIS* FOR FIVE SHELBURNE COUNTY BOGS.**

2:20 – 2:40 Coffee Break.

2:40 Paul Matheus. **QUANDARIES IN PALEODIETARY STUDIES OF QUATERNARY MAMMALS: DO ISOTOPE DATA REALLY REFLECT DIETS, OR SOMETHING MORE SINISTER?**

3:00 James A. Burns. ***MAMMUTHUS* TIBIA FROM CANADIAN ARCTIC COAST, AND A REVIEW OF PLEISTOCENE FOSSILS ON CANADA'S NORTHERN SALT SHORES.**

3:20 Jacques Cinq-Mars and Bernard Lauriol. **GEOARCHAEOLOGICAL INVESTIGATIONS IN EASTERN BERINGIA: A CRITICAL REVIEW.**

Friday, August 24

8:00 AM – NOON: POSTER SESSION.

Dermot Antoniades, Marianne S.V. Douglas, and John P. Smol. **RECENT ENVIRONMENTAL CHANGE INFERRED FROM DIATOM RECORDS AT ISACHSEN, ELLEF RINGNES ISLAND, CANADIAN HIGH ARCTIC.**

Rene W. Barendregt, Lydia A. Dredge, Erik Nielsen, Martin Roy, Kenneth L. Verosub, and Randy J. Enkin. **PALEOMAGNETISM OF QUATERNARY SEDIMENTS IN HUDSON BAY LOWLAND OF MANITOBA, CANADA.**

Bax R. Barton and Paul R. Kester. **SCHREGER ANGLE ANALYSIS OF THE KIRKLAND/LAKEVIEW ELEMENTARY SCHOOL TUSK: MAMMOTH OR MASTODON?**

Glenn W. Berger. **TEST OF TL AND IRSL DATING ACCURACY FOR LOESS OLDER THAN 200 KA.**

Nancy Bigelow, Mary E. Edwards, Scott A. Elias, and Thomas D. Hamilton. **LAST INTERGLACIAL VEGETATION IN NORTHWEST ALASKA: PRELIMINARY RESULTS FROM THE NOATAK RIVER.**

Randy W. Dirszowsky, William C. Mahaney, Kyle R. Hodder, Volli Kalm, and Max Bezada. **LITHOSTRATIGRAPHY OF THE MÉRIDA GLACIATION AND (PEDREGAL) INTERSTADE, MÉRIDA ANDES, NORTHWESTERN VENEZUELA.**

A. Duk-Rodkin. **PREGLACIAL DRAINAGE AND DIAMOND PLACER POTENTIAL FROM THE INTERIOR PLAINS TO THE LABRADOR SEA.**

Travis Ferbey and Victor M. Levson. **QUATERNARY GEOLOGY STUDIES IN THE HUCKLEBERRY MINE AREA, TAHTSA RANGES, WEST-CENTRAL BRITISH COLUMBIA.**

Pierre A, Friele, Duane Froese, Derald G. Smith, Aleksandar Miskovic, Lionel E. Jackson, Jr., and John C. Clague. **PARAGLACIAL SEDIMENT SUPPLY AND EOLIAN ACCUMULATION ALONG THE YUKON RIVER DURING THE PLEISTOCENE-HOLOCENE TRANSITION.**

Robert Gilbert and Scott Lamoureux. **SEDIMENTARY RECORD OF LAKES ACROSS THE NORTHERN COAST MOUNTAINS IN RESPONSE TO SPATIAL AND TEMPORAL CLIMATIC INFLUENCE.**

Markus Heinrichs and Sylvia Peglar. **HOLOCENE ENVIRONMENTAL HISTORY IN NORTHERN SWEDISH LAPLAND.**

Penny Henderson and Isabelle McMartin. **THE DEPOSITIONAL RECORD OF ICE-FLOW WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.**

Crystal A. Huscroft, Lionel E. Jackson, Jr., Rene W. Barendregt, and Mike Villeneuve. **CONSTRAINTS ON AGES OF PRE-MCCONNELL GLACIATIONS BASED ON NEW PALEOMAGNETIC INVESTIGATIONS AND AR-AR DATING OF BASALT IN WEST CENTRAL YUKON, CANADA.**

Crystal A. Huscroft, Brent C. Ward, Charles Tarnocai, and Lionel E. Jackson, Jr. **SOIL DEVELOPMENT AND THE AGE OF RIVER TERRACES ALONG THE YUKON RIVER, FORT SELKIRK TO WHITE RIVER, WEST-CENTRAL YUKON, CANADA.**

Joanne M. Livingston, D.G. Smith, D.G. Froese, G.J. Parkstrom, and M.K. Parker. **RECONSTRUCTING THE LATE HOLOCENE (LAST 3000 YEARS) ICE-JAM FLOOD HISTORY OF THE MIDDLE YUKON RIVER.**

Grant W. Lowey. **THE ROLE OF FORCING MECHANISMS, BASELEVEL CHANGE AND ACCOMMODATION SPACE IN THE FORMATION OF THE KLONDIKE GOLDFIELDS, YUKON, CANADA.**

Nicola MacIllfhinnein, Trevor Bell, and Joyce Macpherson. **A HOLOCENE POLLEN RECORD FROM THE GREY ISLANDS (NEWFOUNDLAND), LABRADOR SEA.**

Roderick A. McGinn. **THE ROLLING RIVER SECTION, RIDING MOUNTAIN, MANITOBA: A SEDIMENTARY SEQUENCE IN THE GLACIAL LAKE PROVEN BASIN.**

Kenneth McQueen and Craig Johnson. **PALAEOCHANNEL SEDIMENTS AND THEIR IMPLICATIONS FOR LANDSCAPE HISTORY AND GOLD EXPLORATION AT GIDJI, KALGOORLIE, WESTERN AUSTRALIA.**

Tom Morris. **EVALUATING ONTARIO'S DIAMOND POTENTIAL THROUGH KIMBERLITE INDICATOR MINERALS DERIVED FROM MODERN ALLUVIUM SAMPLING PROGRAMS.**

Z.K. Pfeiffer and S.A. Wolfe.**REGIONAL CLASSIFICATION OF SAND DUNES IN THE PRAIRIE PROVINCES, CANADA.**

Reinhard Pienitz, John P. Smol, William M. Last, Peter R. Leavitt, and Brian F. Cumming. **MULTI-PROXY HOLOCENE PALEOLIMNOLOGIC RECORD FROM A SALINE LAKE IN THE YUKON, CANADIAN SUBARCTIC.**

DeAnne S. Pinney and David M. Hopkins. **LATE PLEISTOCENE PALEOECOLOGY OF DALTON GULCH, TOFTY MINING DISTRICT, CENTRAL ALASKA.**

Sandra M. Rosenberg, Ian R. Walker, and Rolf W. Mathewes. **PALAEOECOLOGICAL ANALYSES OF SUBALPINE LAKES ON THE COAST AND IN THE INTERIOR WET BELT OF SOUTHERN BRITISH COLUMBIA.**

Paul Sanborn, Marten Geertsema, A.J. Timothy Jull, and Brad Hawkes. **SOIL EVIDENCE FOR HOLOCENE FIRES IN AN INLAND TEMPERATE RAINFOREST: EAST-CENTRAL BRITISH COLUMBIA.**

David Taylor, Martin Batterson, and David Liverman. **DEGLACIATION OF NEWFOUNDLAND AS REVEALED BY ICE-FLOW MAPPING.**

John Westgate, Shari Preece, Amanjit Sandhu, Duane Froese, and Charles Schweger. **AGE OF THE REID GLACIATION IN CENTRAL YUKON.**

Elin Whitney-Smith. **A SIMULATION ENVIRONMENT FOR PLEISTOCENE EXTINCTIONS: A TEACHING AND RESEARCH TOOL.**

Brent B. Wolfe, Thomas W.D. Edwards, Roland I. Hall, Tammy Karst, Andrew Paterson, Michael C. English, Barry Boots, William M. Last, Peter R. Leavitt, Suzanne McGowan, Barry G. Warner, and Sheila R. Vardy. **DETERMINING FLOOD AND CLIMATIC HISTORY OF THE PEACE-ATHABASCA DELTA USING A MULTIDISCIPLINARY PALEOLIMNOLOGICAL APPROACH.**

Stephen A. Wolfe, Jeff Ollerhead, David J. Huntley, and Olav B. Lian. **PRELIMINARY CHRONOLOGY OF SAND DUNE ACTIVITY IN THE PRAIRIE PROVINCES, CANADA.**

2:00 – 5:00 PM: HOLOCENE PALAEOECOLOGY (PART 2).

2:00 Dave Sauchyn, Chris Spence, and Bob Reid. **HIGH-RESOLUTION PROXY CLIMATE AND STREAM FLOW RECORDS FOR THE SOUTHWESTERN NORTHWEST TERRITORIES.**

2:20 Amanda Cavin, Garry McKenzie, and Lonnie Thompson. **BONA-CHURCHILL ICE CORE (2002): REFINING LATE HOLOCENE HISTORY OF WRANGELL-ST. ELIAS REGION.**

2:40 Jessie H. Vincent and Les C. Cwynar. **WERE TREES AND CLIMATE OUT OF EQUILIBRIUM IN SOUTHERN NOVA SCOTIA 11 000 YEARS AGO?**

3:00 Marianne Douglas, Neal Michelutti, and John Smol. **THE MERETTA LAKE (NUNAVUT) STORY: SEWAGE ADDITION HAS POTENTIAL FOR PALEOCLIMATE AND ARCHAEOLOGICAL APPLICATIONS.**

3:20 Marten Geertsema and John Clague. **FLOWSLIDES AND DROWNED, BURIED FORESTS AT HALDEN CREEK, NORTHEASTERN BRITISH COLUMBIA.**

3:40 – 4:00 Coffee Break.

4:00 Joshua Kurek, Les C. Cwynar, and Ray Spear. **HOLOCENE CLIMATE OSCILLATIONS IN THE WHITE MOUNTAINS OF EASTERN NORTH AMERICA.**

4:20 Gail L. Chmura. **CENTURY-SCALE SALT MARSH ACCRETION RATES IN EASTERN CANADA.**

4:40 John P. Smol, Bruce Finney, Irene Gregory-Eaves, Jon Sweetman, and Marianne Douglas. **TRACKING PAST ALASKAN SOCKEYE SALMON STOCKS USING LAKE SEDIMENT RECORDS: ASSESSING THE ROLE OF ANTHROPOGENIC AND NATURAL STRESSORS.**

ABSTRACTS, CANQUA 2001

Symbols: T = talk; P = poster; Tu = Tuesday; Th = Thursday; F = Friday.

Mark Abbott, Lesleigh Anderson, Maria Tsukernik, Bruce Finney, and Mary Edwards. **HOLOCENE PALEOHYDROLOGY AND GLACIAL HISTORY OF ALASKA AND THE YUKON TERRITORY FROM LAKE SEDIMENT STUDIES.** (T; Tu 10:05 AM)

Dermot Antoniades, Marianne S.V. Douglas, and John P. Smol. **RECENT ENVIRONMENTAL CHANGE INFERRED FROM DIATOM RECORDS AT ISACHSEN, ELLEF RINGNES ISLAND, CANADIAN HIGH ARCTIC.** (P)

Rene W. Barendregt. **TIME CONSTRAINTS FOR THE EARLIEST RECORDS OF GLACIATION IN THE CANADIAN INTERIOR PLAINS AND AMERICAN MIDWEST.** (T; Tu 3:20 PM)

Rene W. Barendregt, Lynda A. Dredge, Erik Nielsen, Martin Roy, Kenneth L. Verosub, and Randy J. Enkin. **PALEOMAGNETISM OF QUATERNARY SEDIMENTS IN HUDSON BAY LOWLAND OF MANITOBA, CANADA.** (P)

Bax R. Barton and Paul R. Kester. **SCHREGER ANGLE ANALYSIS OF THE KIRKLAND/LAKEVIEW ELEMENTARY SCHOOL TUSK: MAMMOTH OR MASTODON?** (P)

Claire Beaney and Tracy Brennand. **DRUMLINS OF THE CENTRAL INTERIOR PLATEAU, BRITISH COLUMBIA: SHAPE, SIZE AND DISTRIBUTION.** (T; Th 10:40 AM)

Brandon Beierle. **HOLOCENE CLIMATIC CHANGES IN THE CENTRAL YUKON TERRITORY, CANADA.** (T; Th 9:00 AM)

Trevor Bell and Priscilla Renouf. **PROSPECTING FOR SUBMERGED LANDSCAPES OF EARLY MARITIME ARCHAIC INDIAN OCCUPATION, OFFSHORE NEWFOUNDLAND.** (T; Th 1:00 PM)

Glenn W. Berger. **LUMINESCENCE DATING OF A POST-STAGE 5 LOESS-PALEOSOL SEQUENCE AT GOLD HILL, FAIRBANKS, ALASKA.** (T; Tu 2:00 PM)

Glenn W. Berger. **TEST OF TL AND IRSL DATING ACCURACY FOR LOESS OLDER THAN 200 KA.** (P)

Ahren Bichler and Peter Bobrowsky. **AGGREGATE MINE RECLAMATION PRACTICES INTO THE 21ST CENTURY.** (T; Tu 4:20 PM)

Nancy Bigelow, Mary E. Edwards, Scott A. Elias, and Thomas D. Hamilton. **LAST INTERGLACIAL VEGETATION IN NORTHWEST ALASKA: PRELIMINARY RESULTS FROM THE NOATAK RIVER.** (P)

Jean Bjornson, Bernard Lauriol, and Denis Lacelle. **RETROGRESSIVE THAW SLUMPS: AN OPEN WINDOW INTO THE QUATERNARY OF THE RICHARDSON MOUNTAINS, NWT.** (T; Th 8:00 AM)

A. Blais-Stevens, John J. Clague, Richard J. Hebda, Rolf W. Mathewes, and Brian D. Bornhold. **RECORD OF LARGE, LATE PLEISTOCENE OUTBURST FLOODS PRESERVED IN SAANICH INLET SEDIMENTS.** (T; Th 10:40 AM)

Weston Blake, Jr. **INTERSTADIAL ENVIRONMENTS AROUND NORTHERNMOST BAFFIN BAY.** (T; Th 8:40 AM)

Jeffrey D. Bond, William P. LeBarge, and Leyla H. Weston. **PLACER DEPOSIT EXPLORATION IN GLACIATED TERRAIN: UNDERSTANDING CLIMATE IMPACTS ON DRAINAGES IN THE MAYO MINING DISTRICT, CENTRAL YUKON, CANADA.** (T; Tu 1:40 PM)

Charlotte Bowman and Peter Bobrowsky. **DETERMINATION OF HEAVY METAL CONCENTRATIONS AND ASSOCIATED HEALTH HAZARDS IN THE SOILS OF VICTORIA, BRITISH COLUMBIA.** (T; Th 11:20 AM)

Ian A. Brookes. **DO YOU GET MY DRIFT?: GEORGE MERCER DAWSON'S CANADA.** (T; Tu 3:40 PM)

James A. Burns. ***MAMMUTHUS* TIBIA FROM CANADIAN ARCTIC COAST, AND A REVIEW OF PLEISTOCENE FOSSILS ON CANADA'S NORTHERN SALT SHORES.** (T; Th 3:00 PM)

Amanda Cavin, Garry McKenzie, and Lonnie Thompson. **BONA-CHURCHILL ICE CORE (2002): REFINING LATE HOLOCENE HISTORY OF WRANGELL-ST. ELIAS REGION.** (T; F 2:20 PM)

Gail L. Chmura. **CENTURY-SCALE SALT MARSH ACCRETION RATES IN EASTERN CANADA.** (T; F 4:20 PM)

Jacques Cinq-Mars and Bernard Lauriol. **GEOARCHAEOLOGICAL INVESTIGATIONS IN EASTERN BERINGIA: A CRITICAL REVIEW.** (T; Th 3:20 PM)

Alan Cooper, Beth Shapiro, and Ian Barnes. **PERMAFROST BONE DNA. BEARS AND BISON DANCE THE TANGO.** (T; Tu 5:00 PM)

M.M. Côté and C.R. Burn. **A GIS-BASED ANALYSIS OF THE ORIENTED LAKES ON EASTERN TUKTOYAKTUK PENINSULA, NORTHWEST TERRITORIES.** (T; Tu 10:25 AM)

Randy W. Dirszowski, William C. Mahaney, Kyle R. Hodder, Volli Kalm, and Max Bezada. **LITHOSTRATIGRAPHY OF THE MÉRIDA GLACIATION AND (PEDREGAL) INTERSTADE, MÉRIDA ANDES, NORTHWESTERN VENEZUELA.** (P)

Marianne Douglas, Neal Michelutti, and John Smol. **THE MERETTA LAKE (NUNAVUT) STORY: SEWAGE ADDITION HAS POTENTIAL FOR PALEOCLIMATE AND ARCHAEOLOGICAL APPLICATIONS.** (T; F 3:00 PM)

A. Duk-Rodkin. **PREGLACIAL DRAINAGE AND DIAMOND PLACER POTENTIAL FROM THE INTERIOR PLAINS TO THE LABRADOR SEA.** (T; Tu 5:00 PM + P)

Scott A. Elias. **PLIOCENE AND EARLY PLEISTOCENE SEASONAL TEMPERATURES IN THE NORTH AMERICAN ARCTIC, BASED ON MUTUAL CLIMATIC RANGE ANALYSIS OF FOSSIL BEETLE ASSEMBLAGES.** (T; Th 10:20 AM)

Travis Ferbey and Victor M. Levson. **QUATERNARY GEOLOGY STUDIES IN THE HUCKLEBERRY MINE AREA, TAHTSA RANGES, WEST-CENTRAL BRITISH COLUMBIA.** (P)

Pierre A, Friele, Duane Froese, Derald G. Smith, Aleksandar Miskovic, Lionel E. Jackson, Jr., and John J. Clague. **PARAGLACIAL SEDIMENT SUPPLY AND EOLIAN ACCUMULATION ALONG THE YUKON RIVER DURING THE PLEISTOCENE-HOLOCENE TRANSITION.** (P)

Duane Froese, John Westgate, Shari Preece, and Amanjit Sandhu. **MID-PLIOCENE PERMAFROST AND THE FIRST CORDILLERAN ICE SHEET IN YUKON TERRITORY. (**T; Tu 2:20 PM)

Marten Geertsema and John Clague. **FLOWSLIDES AND DROWNED, BURIED FORESTS AT HALDEN CREEK, NORTHEASTERN BRITISH COLUMBIA.** (T; F 3:20 PM)

Robert Gilbert and Scott Lamoureux. **SEDIMENTARY RECORD OF LAKES ACROSS THE NORTHERN COAST MOUNTAINS IN RESPONSE TO SPATIAL AND TEMPORAL CLIMATIC INFLUENCE.** (P)

Markus Heinrichs and Sylvia Peglar. **HOLOCENE ENVIRONMENTAL HISTORY IN NORTHERN SWEDISH LAPLAND.** (P)

Penny Henderson and Isabelle McMartin. **THE DEPOSITIONAL RECORD OF ICE-FLOW WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.** (P)

Adrian S. Hickin and Peter T. Bobrowsky. **APPLICATION OF GROUND PENETRATING RADAR IN TROPICAL DIAMOND AND GOLD PLACER EXPLORATION, MAPLE CREEK, GUYANA.** (T; Tu 4:00 PM)

Crystal A. Huscroft, Lionel E. Jackson, Jr., René W. Barendregt, and Mike Villeneuve. **CONSTRAINTS ON AGES OF PRE-MCCONNELL GLACIATIONS BASED ON NEW PALEOMAGNETIC INVESTIGATIONS AND AR-AR DATING OF BASALT IN WEST-CENTRAL YUKON, CANADA.** (T; Tu 1:00 PM + P)

Crystal A. Huscroft, Brent C. Ward, Charles Tarnocai, and Lionel E. Jackson, Jr. **SOIL DEVELOPMENT AND THE AGE OF RIVER TERRACES ALONG THE YUKON RIVER, FORT SELKIRK TO WHITE RIVER, WEST-CENTRAL YUKON, CANADA.** (P)

Timothy F. Johnsen and Tracy A. Brennand. **GLACIAL LAKE DEADMAN, SOUTHERN INTERIOR OF BRITISH COLUMBIA: PALEOGEOGRAPHY AND PALEOENVIRONMENT.** (T; Th 11:00 AM)

G. Peter Kershaw. **PERMAFROST LANDFORMS AND CLIMATE CHANGE IN THE MACKENZIE MOUNTAINS, N.W.T.** (T; Tu 8:45 AM)

Steven (S.V.) Kokelj, Scott (C.A.S.) Smith, and Chris (C.R.) Burn. **PHYSICAL AND CHEMICAL CHARACTERISTICS OF ACTIVE LAYER AND PERMAFROST SEDIMENTS, HERSCHEL ISLAND, WESTERN ARCTIC COAST, CANADA.** (T; Tu 9:45 AM)

Joshua Kurek, Les C. Cwynar, and Ray Spear. **HOLOCENE CLIMATE OSCILLATIONS IN THE WHITE MOUNTAINS OF EASTERN NORTH AMERICA.** (T; F 4:00 PM)

Scott Lamoureux. **LACUSTRINE SEDIMENTARY RECORDS OF LONG TERM GEOMORPHIC AND HYDROCLIMATIC CHANGE.** (T; J. ROSS MACKAY AWARD LECTURE; Tu 11:00 AM)

Mark Landry and Les C. Cwynar. **MINIMAL RESIDENCE HISTORY OF *DROSERA FILIFORMIS* FOR FIVE SHELBURNE COUNTY BOGS.** (T; Th 2:00 PM)

Bernard Lauriol, Jean Bjornson, Jacques Cinq-Mars, Ian D. Clark, and Denis Lacelle. **GEOMORPHOLOGICAL RESPONSES TO CLIMATE CHANGE IN THE CANADIAN NORTH WEST DURING THE HOLOCENE: IMPORTANCE OF THEIR RECOGNITION.** (T; Th 8:40 AM)

A. Dawn Laybolt. **ENVIRONMENTAL RECONSTRUCTION THROUGH MICROMORPHOLOGICAL EXAMINATION OF LOWER MIDDEN SEDIMENTS AT MINK ISLAND (XMK-030) EMPLOYING THIN SECTIONS AND LATEX PEELS.** (T; Th 1:20 PM)

William P. LeBarge. **MINING ECONOMICS AND GEOLOGY OF YUKON PLACER DEPOSITS.** (T; Tu 1:20 PM)

Victor M. Levson, Travis Ferbey, David J. Mate, and Andrew J. Stumpf. **COMPLEX GLACIAL DYNAMICS AND MINERAL DISPERSAL IN THE CENTRAL CANADIAN CORDILLERA.** (T; Tu 3:40 PM)

Antoni G. Lewkowicz. **A QUANTITATIVE MODEL OF SLOPE HUMMOCK DEVELOPMENT, FOSHEIM PENINSULA, ELLESMERE ISLAND, NUNAVUT.** (T; Th 8:20 AM)

Olav B. Lian and Stephen R. Hicock. **USING OPTICAL DATING TO PLACE AGE LIMITS ON GLACIGENIC SEQUENCES: AN EXAMPLE FROM SOUTH-CENTRAL BRITISH COLUMBIA.** (T; Tu 1:40 PM)

Joanne M. Livingston, D.G. Smith, D.G. Froese, G.J. Parkstrom, and M.K. Parker. **RECONSTRUCTING THE LATE HOLOCENE (LAST 3000 YEARS) ICE-JAM FLOOD HISTORY OF THE MIDDLE YUKON RIVER.** (P)

Grant W. Lowey. **THE ROLE OF FORCING MECHANISMS, BASELEVEL CHANGE AND ACCOMMODATION SPACE IN THE FORMATION OF THE KLONDIKE GOLDFIELDS, YUKON, CANADA.** (T; Tu 4:40 PM + P)

Nicola MacIllfhinnein, Trevor Bell, and Joyce Macpherson. **A HOLOCENE POLLEN RECORD FROM THE GREY ISLANDS (NEWFOUNDLAND), LABRADOR SEA.** (P)

David J. Mate, Victor M. Levson, and Richard Hebda. **INTERGLACIAL, GLACIAL AND HOLOCENE STRATIGRAPHY AND HISTORY OF THE OOTSA LAKE REGION, CENTRAL BRITISH COLUMBIA.** (T; Th 8:00 AM)

Paul Matheus. **QUANDARIES IN PALEODIETARY STUDIES OF QUATERNARY MAMMALS: DO ISOTOPE DATA REALLY REFLECT DIETS, OR SOMETHING MORE SINISTER?** (T; Th 2:40 PM)

Roderick A. McGinn. **THE ROLLING RIVER SECTION, RIDING MOUNTAIN, MANITOBA: A SEDIMENTARY SEQUENCE IN THE GLACIAL LAKE PROVEN BASIN.** (P)

Isabelle McMartin and Penny Henderson. **RE-INTERPRETATION OF THE ICE-FLOW HISTORY WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.** (T; Tu 4:00 PM)

Kenneth McQueen, Osvaldo Gonzalez, and Ian Roach. **EL CAPITAN PALAEOVALLEY: IMPLICATIONS FOR UNDERSTANDING THE MIOCENE TO QUATERNARY LANDSCAPE HISTORY OF THE COBAR REGION, NSW, AUSTRALIA.** (T; Tu 4:20 PM)

Kenneth McQueen and Craig Johnson. **PALAEOCHANNEL SEDIMENTS AND THEIR IMPLICATIONS FOR LANDSCAPE HISTORY AND GOLD EXPLORATION AT GIDJI, KALGOORLIE, WESTERN AUSTRALIA.** (P)

Tom Morris. **EVALUATING ONTARIO'S DIAMOND POTENTIAL THROUGH KIMBERLITE INDICATOR MINERALS DERIVED FROM MODERN ALLUVIUM SAMPLING PROGRAMS.** (T; Tu 3:20 PM + P)

Julian Murton. **BASAL ICE AND FROZEN DEFORMING BED OF THE LATE WISCONSINAN LAURENTIDE ICE SHEET, TUKTOYAKTUK COASTLANDS, NWT.** (T; Tu 9:25 AM)

Natalia Patyk-Kara. **PRE-QUATERNARY AND QUATERNARY BURIED VALLEYS ALONG THE NORTH-EASTERN MARGIN OF ASIA AND PLACER DEPOSITS RELATED TO THEM.** (T; Tu 2:00 PM)

Roger C. Paulen and Ron N.W. DiLabio. **DELIMITATION OF THE OWL CREEK BEDS, TIMMINS, NORTHEASTERN ONTARIO.** (T; Tu 4:40 PM)

Z.K. Pfeiffer and S.A. Wolfe. **REGIONAL CLASSIFICATION OF SAND DUNES IN THE PRAIRIE PROVINCES, CANADA.** (P)

Reinhard Peinitz, John P. Smol, William M. Last, Peter R. Leavitt, and Brian F. Cumming. **MULTI-PROXY HOLOCENE PALEOLIMNOLOGIC RECORD FROM A SALINE LAKE IN THE YUKON, CANADIAN SUBARCTIC.** (P)

DeAnne S. Pinney and David M. Hopkins. **LATE PLEISTOCENE PALEOECOLOGY OF DALTON GULCH, TOFTY MINING DISTRICT, CENTRAL ALASKA.** (P)

Alberto Reyes and Dan Smith. **TREE-RING DATES FOR NEOGLACIAL LAKE ALSEK, YUKON TERRITORY, CANADA.** (T; Th 10:20 AM)

Sandra M. Rosenberg, Ian R. Walker, and Rolf W. Mathewes. **PALAEOECOLOGICAL ANALYSES OF SUBALPINE LAKES ON THE COAST AND IN THE INTERIOR WET BELT OF SOUTHERN BRITISH COLUMBIA.** (P)

Paul Sanborn, Marten Geertsema, A.J. Timothy Jull, and Brad Hawkes. **SOIL EVIDENCE FOR HOLOCENE FIRES IN AN INLAND TEMPERATE RAINFOREST: EAST-CENTRAL BRITISH COLUMBIA.** (P)

Dave Sauchyn, Chris Spence, and Bob Reid. **HIGH-RESOLUTION PROXY CLIMATE AND STREAM FLOW RECORDS FOR THE SOUTHWESTERN NORTHWEST TERRITORIES.** (T; F 2:00 PM)

Charles Schweger. **GLACIAL, INTERSTADIAL AND INTERGLACIAL ENVIRONMENTS OF THE YUKON – CONTRASTING THE EXTREMES.** (T; Th 8:20 AM)

Charles Schweger. **THE WARM PERIODS: YUKON'S INTERGLACIALS.** (T; Th 11:00 AM)

John P. Smol, Bruce Finney, Irene Gregory-Eaves, Jon Sweetman, and Marianne Douglas. **TRACKING PAST ALASKAN SOCKEYE SALMON STOCKS USING LAKE SEDIMENT RECORDS: ASSESSING THE ROLE OF ANTHROPOGENIC AND NATURAL STRESSORS.** (T; F 4:40 PM)

Irina Spasskaya. **PRE-QUATERNARY AND QUATERNARY DRAINAGE NET OF THE EASTERN URALS: RESTRUCTURING IN UPPER LINKS AND PLACERS' CONSERVATION.** (T; Tu 2:20 PM)

John E. Storer. **THE VOLE *ALLOPHAIOMYS DECEITENSIS* FROM THE EARLY PLEISTOCENE OF FORT SELKIRK, YUKON TERRITORY, AND THE AGE OF THE CAPE DECEIT FAUNA, ALASKA.** (T; Th 11:20 AM)

David Taylor, Martin Batterson, and David Liverman. **DEGLACIATION OF NEWFOUNDLAND AS REVEALED BY ICE-FLOW MAPPING.** (P)

James T. Teller. **LAKE AGASSIZ TRANSGRESSIONS AND FLOOD BURSTS: CONTROLS BY DIFFERENTIAL ISOSTATIC REBOUND AND THREE DIFFERENT OUTLETS.** (T; Th 9:20 AM)

Jessie H. Vincent and Les C. Cwynar. **WERE TREES AND CLIMATE OUT OF EQUILIBRIUM IN SOUTHERN NOVA SCOTIA 11 000 YEARS AGO?** (T; F 2:40 PM)

Brent Ward, Jon Driver, Erle Nelson, and Randy Enkin. **PORT ELIZA CAVE: EXAMPLE OF THE GLACIAL STRATIGRAPHIC POTENTIAL OF WAVE CUT, MARINE CAVES.** (T; Th 9:00 AM)

K.D. West and J.A. Donaldson. **ERUPTIVE TIMING OF WHITE RIVER ASH DEPOSIT (YUKON, NORTHWEST TERRITORIES, AND ALASKA).** (T; Th 11:40 AM)

John Westgate, Shari Preece, Amanjit Sandhu, and Duane Froese. **TEPHRA POWER: PROVIDING A SECURE CHRONOLOGIC FRAMEWORK FOR LATE CENOZOIC GEOLOGIC/PALEOENVIRONMENTAL STUDIES IN EASTERN BERINGIA.** (T; Tu 1:20 PM)

John Westgate, Shari Preece, Amanjit Sandhu, Duane Froese, and Charles Schweger. **AGE OF THE REID GLACIATION IN CENTRAL YUKON.** (P)

Colin Whiteman. **MELTOUT TILL OVERLYING LAURENTIDE BASAL ICE, MACKENZIE DELTA AREA, CANADA.** (T; Tu 9:05 AM)

Elin Whitney-Smith. **A SIMULATION ENVIRONMENT FOR PLEISTOCENE EXTINCTIONS: A TEACHING AND RESEARCH TOOL.** (P)

Elin Whitney-Smith. **TUNDRA, TRUCKS AND EXTINCTIONS OR: ARE BISON THE PRAIRIE'S WAY OF MAKING MORE PRAIRIE?** (T; Th 1:40 PM)

Brent B. Wolfe, Thomas W.D. Edwards, Roland I. Hall, Tammy Karst, Andrew Paterson, Michael C. English, Barry Boots, William M. Last, Peter R. Leavitt, Suzanne McGowan, Barry G. Warner, and Sheila R. Vardy. **DETERMINING FLOOD AND CLIMATE HISTORY OF THE PEACE-ATHABASCA DELTA USING A MULTIDISCIPLINARY PALEOLIMNOLOGICAL APPROACH.** (P)

Stephen A. Wolfe, Jeff Ollerhead, David J. Huntley, and Olav B. Lian. **PRELIMINARY CHRONOLOGY OF SAND DUNE ACTIVITY IN THE PRAIRIE PROVINCES, CANADA.** (P)

Grant D. Zazula. **THE FULL-GLACIAL ENVIRONMENT OF THE BLUEFISH WATERSHED: PRELIMINARY MACROBOTANICAL ANALYSIS OF THE BLUEFISH EXPOSURE.** (T; Th 9:20 AM)

HOLOCENE PALEOHYDROLOGY AND GLACIAL HISTORY OF ALASKA AND THE YUKON TERRITORY FROM LAKE SEDIMENT STUDIES.

Mark Abbott, Lesleigh Anderson, and Maria Tsukernik, Department of Geosciences, University of Massachusetts, Amherst, MA 01003, USA; mabbott@geo.umass.edu, land@geo.umass.edu, mashats@student.umass.edu: Bruce Finney and Mary Edwards, Institute of Marine Science and Institute of Arctic Biology, University of Alaska, Fairbanks Alaska, AK 99775, USA; finney@ims.alaska.edu, mary.edwards@svt.ntnu.no.

The overall goal of my research in Alaska and the Yukon Territory is to document the regional pattern of precipitation-evaporation change from the late Pleistocene to present using multiproxy methods at a network of lakes. During the first phase of this project lakes situated in terrain that remained unglaciated during the Last Glacial Maximum were selected to obtain the long records of environmental change. This is possible because only the alpine regions in Alaska were glaciated during the last ice age. These lakes include Burial Lake in northwestern Alaska and a pair of lakes, Birch and Jan, in central Alaska. During the second phase of the project two classifications of lakes were targeted to obtain high-resolution Holocene climate records: (1) closed basin lakes – Meli, Tangled Up, Seven Mile, Jackfish, and Wrong and (2) glacial-fed lakes – Summit, Blue, Dumbbell, and Peanut. Seismic surveys and core transects from shallow to deep water were combined to identify transgression and regression sequences and collect sediments to document and date these features. Cores with continuous sedimentary records from the central basin were analyzed using an integrated methodology that combined sedimentary analyses of fine-scale sediment features, sediment magnetic characteristics, elemental and isotopic geochemistry, and palynology.

RECENT ENVIRONMENTAL CHANGE INFERRED FROM DIATOM RECORDS AT ISACHSEN, ELLEF RINGNES ISLAND, CANADIAN HIGH ARCTIC.

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Although the Canadian High Arctic is recognized as an important indicator of global environmental change, little or no historical climate information exists across this large region. Paleolimnological proxy records using bioindicators such as diatoms can potentially provide these missing data sets.

Isachsen (78° 47'N, 103°32'W) is located on the west coast of Ellef Ringnes Island in the Canadian Arctic Archipelago. It is subject to perhaps the most extreme climate in Canada, with annual averages of -19.1°C, and only 102 mm precipitation. Sediment cores were extracted from two shallow sites near Isachsen in July of 1996. Sites I-F and I-O (unofficial names) showed large differences in water chemistry (e.g., I-F: pH = 5.9, conductivity = 158µS; I-O: pH = 6.9, cond. = 17µS), which resulted largely from differences in local bedrock and topography. The diatom communities reflected these differences, showing little overlap between the two sites. However, recent stratigraphic changes occurred in both records. A stable diatom flora dominated by relatively few species existed throughout the lower portions of each core. Within a few centimeters of the sediment surface, both sites showed trends towards new dominant taxa and greater species diversity. This shift occurred at 2.5 cm depth in core I-O, and 4 cm in core I-F. A diatom calibration set for the Isachsen region is currently being constructed in an effort to determine and quantify the cause of these changes.

TIME CONSTRAINTS FOR THE EARLIEST RECORDS OF GLACIATION IN THE CANADIAN INTERIOR PLAINS AND AMERICAN MIDWEST.

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The earliest dateable evidence of Laurentide glaciation on the Canadian Prairies occurs in western Saskatchewan/eastern Alberta, and in the Hudson Bay Lowland of Manitoba. Absolute ages for the sedimentary record immediately predating the first arrival of ice (sections near Wellsch Valley, SK and Galt Island, AB), as well as the age of glacial lake sediments associated with the first glaciation (Wascana Creek Section, SK), are obtained from fission track ages on three tephras, which range from 0.7-0.4 Ma. These tephras and their enclosing sediments are normally magnetized, and based on their fission track ages, are assigned to the Brunhes Chron (<0.78 Ma). Fossil vertebrate assemblages contained within preglacial sediments immediately predating the arrival of the first ice at the Wellsch Valley, Galt Island and Medicine Hat sections indicate an early-middle Pleistocene fauna, and further strengthen a Brunhes age assignment for the first Laurentide glaciation of this region. Preglacial sediments at Wascana Creek and Wellsch Valley are reversely magnetized, and based on the late Blancan and Early Irvingtonian fossil assemblages at Wellsch Valley, can be assigned to the upper Matuyama Chron. At Medicine Hat and Galt Island, the preglacial sediments are normally magnetized, suggesting that preglacial sedimentation continued on into a portion of the Brunhes Chron in the valleys to the west of Swift Current. At least two major till sheets, referred to as the Labuma and Buffalo Lake tills, are present throughout large portions of southern Alberta and can be correlated to the Sutherland Group and Upper Floral Formation respectively, in Saskatchewan. Based on the 0.43 Ma tephra age and late Irvingtonian faunal assemblages of the underlying sediments, and a Sangamon age for overlying sediments, the Labuma till is Illinoian (most probably stage 6), and the Buffalo Lake till is Late Wisconsinan based on Chlorine 36 dates on the associated erratics and the radiocarbon ages on underlying wood and bone.

In Manitoba, the most extensive Quaternary record occurs in the Gillam area, where all sediments are normally magnetized. The lowermost (Sundance) till has a well-developed paleosol, and is overlain by the Amery till (most probably stage 6) which can be traced throughout the region. It is overlain by Nelson River sediments which yield amino acid ratios on *Hiatella arctica* shells that indicate a Sangamon age. The overlying tills are Wisconsinan in age.

Recent detailed paleomagnetic studies carried out at or near the “classic” sections of the American midwest and in the general vicinity of the Missouri River, in the states of Iowa, Nebraska, Missouri and Kansas indicate that the earliest glaciation(s) there occurred during the Matuyama Chron. Twelve sections reveal reversely magnetized lower tills and associated intertill beds, indicating that the so called “A” and “B” tills of the region predate the

Brunhes/Matuyama boundary (0.78 Ma). Tephra dates at the Afton, David City, and County Line sites corroborate a late Pliocene and early Pleistocene age for these tills.

Clearly, the extent and timing of the earliest Laurentide glaciations in the Interior Plains of Canada are different from those in the American midwest. Canadian sites reveal only normally magnetized sediments while in the US both normal and reversed sediments occur. The intriguing question is: Why?

PALEOMAGNETISM OF QUATERNARY SEDIMENTS IN HUDSON BAY LOWLAND OF MANITOBA, CANADA.

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Thick sequences of Quaternary sediments are exposed in the Hudson Bay Lowland along the banks of major river valleys. Both glacial and interglacial sediments are present. Four tills have been identified on the basis of provenance, lithologic composition, texture and colour, and from oldest to youngest are referred to as the Sundance, Amery, Long Spruce, and Sky Pilot till. Sundance till is a sandy granitic till of northwestern (Keewatin) provenance, while the others are calcareous and of eastern (Labrador) provenance.

Interglacial beds of Sangamon and pre-Sangamon age have been identified at a number of sites, and have been correlated on the basis of their stratigraphic position relative to the tills, and on paleoecological criteria.

Five sections in the lower Nelson/Hayes River area were selected for paleomagnetic study because they contain the most complete Quaternary stratigraphic record for this region. Collectively, the deposits represent a very considerable span of time, probably recording most if not all major glacial and interglacial events. Their record provides direct evidence for: glaciations of both eastern and western provenance, extensive suites of interglacial sediments, ice-free conditions over Hudson Bay, the raising and lowering of sea and land surfaces, and soil development. Since no absolute dating techniques could be applied to the older sediments, paleomagnetic measurements were made to determine whether reversely magnetized Matuyama Zone (2.6 - 0.78 Ma) sediments are present.

All units yielded normal magnetizations, indicating that the Quaternary record in the Hudson Bay Lowland can be assigned to the Brunhes Chron (<0.78 Ma) and is thus entirely of middle to late Pleistocene age. These results compare favorably with other sites within the Canadian Interior Plains and the adjacent US Great Plains, which reveal only normally magnetized glacial deposits. Collectively, the magnetostratigraphy of those sites and the sites described here from the Hudson Bay Lowland strongly suggest that continental glaciation occurred repeatedly in this region during the Brunhes Chron. The distribution and extent of ice in North America during glacial periods was apparently very different during the Matuyama from that during the Brunhes Chron. While ice was present in the Cordillera and in northeastern North America during the Matuyama Reversed Chron, it appears to have been largely absent from large areas of the Prairie Provinces of Canada and adjacent areas of the United States.

SCHREGER ANGLE ANALYSIS OF THE KIRKLAND/LAKEVIEW ELEMENTARY SCHOOL TUSK: MAMMOTH OR MASTODON?

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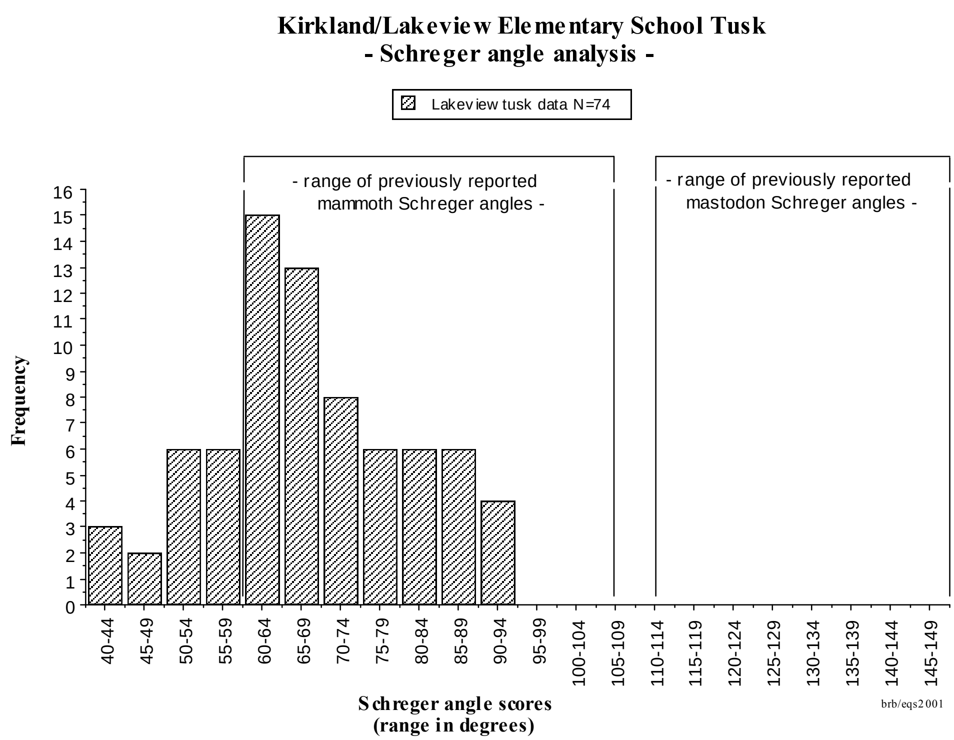
Recent methodological advances by researchers at the National Fish and Wildlife Forensics Laboratory and the University of Michigan reveal that tusks of mammoth and mastodon may be identified to the generic level based on the analysis of internal Schreger angles. Analysis of an isolated tusk, recovered from lacustrine clayey silt of the Olympia nonglacial interval at Lakeview Elementary School, Kirkland, Washington, revealed 74 measurable Schreger angles that ranged from 46° to 95° (mean = 76°). These values fall well within the previously reported range for *Mammuthus* sp., and suggest that the Kirkland/Lakeview tusk is from a mammoth (*Mammuthus* cf. *columbi*) and not from a mastodon, as previously reported in the press. Secondary data related to this tusk also support this diagnosis. The tusk dates to 16,540 ± 80 ^{14}C yr B.P. [CAMS-70709] (19,710 cal yr B.P.). Based on this analysis, the Kirkland/Lakeview mammoth tusk is the youngest dated evidence for mammoths from the Georgia-Puget lowlands.



DRUMLINS OF THE CENTRAL INTERIOR PLATEAU, BRITISH COLUMBIA: SHAPE, SIZE AND DISTRIBUTION.

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Drumlins are a common landform associated with continental glaciation although their mode of formation remains enigmatic. Previous research in the central Interior Plateau, British Columbia has identified a large drumlin field to the west of the Fraser River in the Quesnel region assumed to have formed during the last (Fraser) glaciation (circa 20kaBP). Drumlins have been used to infer ice flow directions in the Cordilleran Ice Sheet.

This paper presents the results of digital elevation model visualization, aerial photograph analysis and preliminary field work in the Quesnel region. A complex field of streamlined landforms, oriented approximately south to north, on the Fraser Plateau west of Quesnel is revealed. Morphologies include classic "inverted spoon" drumlins, spindle forms, crag and tail features and megaflutings. Drumlins exhibit a variety of sizes ranging from streamlined hills and bedrock knobs to smaller superimposed forms. Commonly these streamlined features are several hundred metres to kilometres in length. They occur in a variety of substrate materials and are arranged so that drumlins with similar morphologies are found in similar areas. Examples of these different observed drumlin types will be presented to highlight the inherent morphological variability within this drumlin field. Formative hypotheses for drumlin formation consistent with the morphology-distribution data will be discussed.

HOLOCENE CLIMATIC CHANGES IN THE CENTRAL YUKON TERRITORY, CANADA.

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Sediment cores from Chapman Lake, Yukon Territory were analysed to reconstruct paleoenvironmental changes over the past 13,000 years. High resolution organic carbon, macrofossil, grain size, and lithostratigraphic analyses provide evidence for climatic variability in central Yukon and suggest that Holocene climatic changes in this region were similar to those in other regions of North America. High organic carbon levels, as well as abundant charophyte oogonia in the macrofossil record characterized an early Holocene warm interval between 10,000 and 7500 BP. Organic carbon levels began to drop at ca. 7500 BP, declining steadily until ca. 4000 BP, when a major decline in organic carbon content occurred. Charophyte oogonia were replaced by bryophytes as the dominant macrofossil immediately prior to the 4000 BP event, with variable but generally lower organic carbon levels suggesting a cooler and more unstable climate than in the early Holocene. Preliminary evidence suggests conditions began to warm around 1550 BP, with increased organic carbon levels and the reappearance of oogonia in the fossil record. This period of increased productivity ended at 550 BP, with a sharp decline in organic carbon and the return of moss as the primary macrofossil constituent.

PROSPECTING FOR SUBMERGED LANDSCAPES OF EARLY MARITIME ARCHAIC INDIAN OCCUPATION, OFFSHORE NEWFOUNDLAND.

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One of the outstanding questions in Newfoundland archaeology concerns the apparent age discrepancy between earliest occupation of southern Labrador (~9000 BP) and insular Newfoundland (~5500 BP) by Maritime Archaic Indians (MAI). We have proposed that the spatial and temporal patterns of Holocene relative sea level (RSL) change may provide the key to resolving this question. The MAI were a marine-adapted culture, living and subsisting near the active shoreline. For most of the Island, RSL was tens of metres below present between 5000 and 9000 BP, and therefore the ancient shorelines which the MAI potentially occupied are now submerged in the shallow offshore. Until now, these offshore environments have not been the focus of archaeological investigation.

Our initial goals are simply to locate preferred landscapes of MAI occupation offshore and to evaluate their archaeological site potential. We have chosen to focus on features associated with freshwater sources, such as rivers and lakes, and coastal environments, such as estuaries, deltas and lagoons, for several reasons: (i) they supply a major subsistence need (water and food); (ii) they are a preferred landscape setting for the location of Archaic sites in the Northeast; (iii) they can be traced offshore from modern river systems and can be readily located on marine geophysical records; and (iv) they favour site burial and therefore have strong site preservation potential, even under conditions of shoreface erosion. Once suitable targets are identified, more detailed geophysical survey and coring will help delineate local landscape conditions which, on the basis of successful surveys elsewhere on the Island, have proved important in the preferential location of MAI sites.

LUMINESCENCE DATING OF A POST-STAGE 5 LOESS-PALEOSOL SEQUENCE AT GOLD HILL, FAIRBANKS, ALASKA.

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The uppermost ~12 m at the Gold Hill Trench-1 site consists of massive loess with four recognizable interbedded organic-silt horizons beneath the surface soil (0.8 m thick), at mean depths of 3 m, 7.9 m (10 cm thick), 9.95 m (3-5 cm) and 11 m (~1 m). The prominent (30 cm thick, brown) paleosol at 3 m is strikingly visible at other Gold Hill exposures. Here I present thermoluminescence (TL) and infrared-stimulated luminescence (IRSL) age estimates. TL yields stratigraphically self-consistent results, with an age of ~30 ka (three samples) for the buried soil at 3 m. This is similar to ^{14}C ages for a major organic-rich horizons at sites elsewhere in Alaska, for the same soil in the road-cut east of the Russian Trench at Gold Hill, and for extensive thawing of permafrost in the Fairbanks area . Other TL results are: 45±3 (1Φ) ka at 5.8 m in massive loess; 48±6 ka ~7.8 m (15 cm above the 7.9 m ―soil‖), implying not only rapid loess deposition in the interval 45-50 ka, but also development of a ―soil” at ~50 ka; 71±9 ka at ~9.8 m

(~20 cm above the 9.95 m ―soil‖), implying a ―soil” development episode at ~75 ka; and 78±9 ka in the middle (~11.2 m) of the underlying 1-m-thick organic silt, implying that the development of this “soil” (OIS 5a?) ceased at ~80 ka. There are evident, specific regional and continental (e.g., Sierra Nevada, California) comparisons to this TL chronology. IRSL ages agree with TL ages only at 7.8 m (49±4 ka) and 9.8 m (70±8 ka). IRSL ages (three samples) for the prominent soil at 3 m are ~50% older than the TL ages, whereas IRSL ages at 11.2 m are ~40% younger than the TL ages. These discrepancies and the lack of stratigraphic self-consistency of the IRSL ages imply that the IRSL results are controlled adversely by presently undetermined factors, probably variable mineralogical effects.

TEST OF TL AND IRSL DATING ACCURACY FOR LOESS OLDER THAN 200 KA.

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The controversy about the upper age limit of thermoluminescence (TL) dating of unheated sediments continues since the Berger-Pillans-Palmer publication in 1992 demonstrating that TL ages for loess up to 800 ka could be attained. Independent TL kinetics studies of feldspars (providing the main TL signal in loess) suggested ages exceeding 1 Ma could be attained. Analogous kinetics studies of infrared-stimulated-luminescence (IRSL) since then have also suggested long lived IRSL signals in feldspars. On the other hand, studies of museum specimens of feldspars suggested a near ubiquitous signal instability (anomalous fading), and others have observed apparent upper age limits of 200-400 ka for IRSL dating..

I have re-analyzed several of my original samples of known-age loess, and collected more from Alaska, attempting to improve the precision of the original TL results, as well as to test the upper age limit of IRSL dating. Loess samples from 75±5 ka to 475±25 ka are reported here, but results from additional, older samples will be available at the time of the conference. Present results indicate: (1) TL age accuracy for loess up to at least 500 ka is obtainable; (2) my present methods of IRSL dating yield sample-dependent age underestimation for samples older than ~100 ka; (3) replication of analyses suggest that independent age assignments for one sample from New Zealand may be too young; and (4) replicate TL analyses on sample BIR91-6 closely underlying Old Crow tephra at Birch Hill, Fairbanks, give an improved-precision TL age estimate of 147±12 ka (1Φ) for this widespread tephra.

AGGREGATE MINE RECLAMATION PRACTICES INTO THE 21^{ST} CENTURY.

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The aggregate industry has grown considerably globally and especially so within North America during the 20^{th} century. Communities are tied to sand and gravel operations in two ways: need for raw material and financially. However, the general public often perceives this relationship differently. Increased noise, dust, traffic and in particular, the creation of derelict land, generate a negative impression in public opinion. To remedy this situation, archaic regulations, poor mining practices and a lack of community involvement are factors that must be addressed. Mining companies must be held responsible for the reclamation of abandoned pits according to governing regulations. Regulations must be updated to suit the environmental consciousness of the community. The community should be educated on the importance of the aggregate industry. With all this in mind, it is timely to review reclamation practices for the 21st century. There are three basic types of reclamation practices that can be discerned: passive rehabilitation, naturalization and urbanization. Each has its own individual strengths and weaknesses. Normally, a reclaimed pit represents a mixture of these three components, its success judged on how well the derelict land is integrated back into the community and the surrounding environment. A review of such mining activities is presented and discussed.

LAST INTERGLACIAL VEGETATION IN NORTHWEST ALASKA: PRELIMINARY RESULTS FROM THE NOATAK RIVER.

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We examined bluff exposures along the Noatak River to determine environmental changes during the last interglaciation and their relationship to the Old Crow tephra (OCt), a widespread marker horizon in eastern Beringia. We present here preliminary results from two bluffs located beyond tree-line in the shrub tundra. The OCt has been identified at Nk-26; at Nk-37 the OCt has not yet been found, but several superimposed peats are thought to date to the last interglaciation. At Nk-26, samples collected directly above the OCt contain only a few herb and forb macrofossils, suggesting a tundra vegetation, which is consistent with the pollen and insect fossil analyses at the same section. At Nk-37, the lowest peat contains abundant wood and spruce needle fragments, while the upper peats contain seeds from shrubby taxa and few spruce needle fragments, suggesting the retreat of the forest and expansion of shrub tundra. Pollen and insect fossil analyses of the peats confirm the macrofossil reconstruction. Although the relationship between the peat layers at Nk-37 and the OCt is still unknown, it seems likely, based on the results from Nk-26, that the deposition of the OCt did not occur during the warmest part of the last interglaciation.

RETROGRESSIVE THAW SLUMPS: AN OPEN WINDOW INTO THE QUATERNARY OF THE RICHARDSON MOUNTAINS, NWT.

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Retrogressive thaw slumps open a window into the Quaternary of Willow River, NWT. In many places throughout the valley they expose two units, a clayey till (~10m) underlying a diamicton (~5m). These units are the result of Pleistocene glaciation and the events that followed during the

Holocene. Located in the Richardson Mountains 30 km west of Aklavik, the valley was partially invaded by a glacial tongue of the Laurentide ice sheet. Progressing against topography, the tongue blocked the drainage and formed a glacial lake. The glaciolacustrine sediments were overridden by progressing ice and reworked into a clayey till rich in organics. Since the retreat, two elements have profoundly modified the landscape: (1) Ongoing incision of Willow River to 300 m during the Holocene; (2) Periods of retrogressive thaw slump activity. Five ^{14}C dates were obtained from the Willow River cut which established a regional chronology. Ten ^{14}C dates were obtained from the slump sites in the overlying diamicton which indicate periods of important thermokarst activity around 9.5 ka BP and a modern reactivation. Units similar to the Willow River units have been observed elsewhere in polycyclic retrogressive thaw slumps which helps us to understand the genesis of the overlying diamicton. It is interpreted as being an infilled fossil thaw slump, which is exposed by an active slump. Judging by the extensive distribution of the two units and by the many slump scars, we can infer that the retrogressive thaw slumps have been, and still are, a dominant geomorphological agent in Willow River landscape.

RECORD OF LARGE, LATE PLEISTOCENE OUTBURST FLOODS PRESERVED IN SAANICH INLET SEDIMENTS.

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Two anomalous silty clay beds are present in ODP cores collected from Saanich Inlet, on Vancouver Island, British Columbia. The beds, which date to about 10,500 ^{14}C yr BP (11,000 calendar years BP), contain Tertiary pollen derived from sedimentary rocks found only in the Fraser Lowland, on the mainland of British Columbia and Washington just east of the Strait of Georgia. Abundant illite-muscovite in the sediments supports a S-type pluton provenance in the Fraser Lowland.

These evidences indicate that the clay beds are probably the distal deposits of huge floods that swept across the Fraser Lowland at the end of the Pleistocene. Muddy overflow plumes from these floods crossed the Strait of Georgia and entered Saanich Inlet, where the sediment settled from suspension and blanketed diatom-rich muds that had accumulated on the fiord floor. The likely source of the floods is ice-dammed lakes in the Fraser and Thompson valleys, which are known to have disappeared at about the time the floods occurred.

INTERSTADIAL ENVIRONMENTS AROUND NORTHERNMOST BAFFIN BAY.

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Fieldwork around northernmost Baffin Bay has revealed the widespread occurrence of an older generation of marine deposits beneath Holocene sediments and raised beaches. These sediments are separated from those of Holocene age by till-like or nonfossiliferous units. Three sites studied and dated in detail are: Cape Storm, southern Ellesmere Island; Coburg Island at the entrance to Jones Sound; and Saunders Island, Greenland – subarctic *Mytilus edulis* occurs at the last two localities.

Another site is beside Glacier 7A-45, a westward-flowing outlet glacier from Ellesmere's Prince of Wales Icefield. Datable terrestrial materials occur in sub-till sediments. If this inland site became ice-free in mid-Wisconsinan time, the adjacent Baffin Bay coasts must have become deglacierized also.

The age ranges for pre-Holocene deposits are: Cape Storm, 20 000 and 50 000 ^{14}C years; Coburg Island, 25 000 to 46 000 ^{14}C years; Saunders Island, 38 000 to 46 000 ^{14}C years; and Glacier 7A-45, 20 000 to 43 000 ^{14}C years. The results on wood, sedges and mosses from the inland site support the finite ages on marine mollusc shells, marine algae, whale bone, bird bones, and other constituents from the coastal deposits. All are assigned to the Cape Storm Nonglacial Interval.

PLACER DEPOSIT EXPLORATION IN GLACIATED TERRAIN: UNDERSTANDING CLIMATE IMPACTS ON DRAINAGES IN THE MAYO MINING DISTRICT, CENTRAL YUKON, CANADA.

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Understanding drainage responses to past climate change can supplement placer gold exploration in glaciated terrain. In the Mayo mining district of central Yukon placer-bearing drainages have undergone multiple periods of glaciation, periglaciation and interglaciation.

Placers that have been incorporated into glacial till or buried under thick meltout drift generally require a phase of fluvial reconcentration to reform economic grades. Late glacial outwash and post-glacial fluvial down-cutting often provide the necessary erosion, but only if adequate base-level changes occur in trunk streams. During glacial advances proglacial outwash may breach drainage divides. The result is a vigorous reworking of placers in the upper reaches of the drainage. This can also occur in a deglacial setting with differential retreat of ice from a drainage. Under periglacial climates sedimentation will increase into a drainage. Also the movement of sediment through the drainage will increase as a result of higher precipitation rates. The development of large periglacial fans during the late Wisconsinan McConnell advance is apparent in streams that remained unglaciated. Periglacial fans may host reconcentrated placers and/or effectively bury placers in trunk streams. A similar setting occurs under paraglacial conditions associated with recently deglaciated areas. During interglacial climates, streams undergo a period of incision and reconcentration in response to base-level disequilibrium following the glaciation. Placer concentration will continue at varying rates throughout an interglacial. During the Holocene the earliest stages of warming appear to have been the most active downcutting and placer reconcentration phases.

Excessive overburden depths and low-grade concentrations often hinder the economics of glaciated placer deposits. The importance of base level changes in reducing overburden depths and reconcentrating placers into higher-grade deposits cannot be overemphasized.
Placer deposits in glaciated terrain may be less predictable than those in unglaciated terrain but the opportunity for high grade pockets and low grade/high tonnage deposits is good.

DETERMINATION OF HEAVY METALCONCENTRATIONS AND ASSOCIATED HEALTH HAZARDS IN THE SOILS OF VICTORIA, BRITISH COLUMBIA.

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During the past decade there has been an increasing number of reported incidents involving trace elements (e.g., arsenic, lead, cadmium and mercury) and their adverse effects on human health. The impact of these and other geogenic contaminants on human health and the environment has been recorded around the world (e.g., Canada, USA and Bangladesh). This study involves an investigation of the relationship between geology, geochemistry and health in the city of Victoria, Canada.

To date, 294 soil samples have been taken from 17 census tracts within the municipality of Victoria. At all sites,samples were collected at a depth of 5 cm below surface, and at selected sites deeper, C-horizon samples were obtained to establish background element concentrations. Additional background data were obtained from local bedrock and till samples. Additional surface samples were also collected specifically from playgrounds within the census tracts sampled.

All samples collected thus far have been evaluated by ICP-MS for 35 trace elements at two size fractions: 80 microns and 2 millimeters. Loss on ignition analysis has been determined for the 2mm fraction. The ICP-MS results indicate that a number of the samples are well above the Canadian Environmental Quality Guidelines for Soils for lead, copper, zinc, and arsenic. Detailed interpretation of the data awaits the completion of sample collection, health data compilation and further analysis. However, preliminary interpretation of the results indicates that dangerous levels of various trace elements occur in the urban environment and do pose a threat to the health of the general populace.

DO YOU GET MY DRIFT?: GEORGE MERCER DAWSON'S CANADA.

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G. M. Dawson's late 19th Century glacial reconstructions in the Canadian Cordillera and Interior Plains are reviewed in light of the contemporary intellectual climate. Two questions are raised, which, curiously, escaped Dawson, as well as contemporary objectors, even modern appraisals.

Question One asks why icebergs drifted *westward* across the "Glacial Sea" from the "great confluent glacier" on the "Laurentian Axis" to the foot of the Rockies, *against* a W-E atmospheric circulation that Dawson invoked to grow the Cordilleran Glacier?

Question Two asks how icebergs collected debris from the sea-floor, which they were supposed to deposit "down-drift." This is a general query as well as applying to Dawson's Cordilleran "boulder-clay" and, west of the Coteau, to his Cretaceous-rich drift, derived from Cretaceous bedrock. Bergs could not have deposited this latter drift, neither could floe-ice, since Laurentian erratics at the surface, "dropped from icebergs," would have been buried by floe-ice drift during marine regression.

Dawson's grand schemes for the Cordillera and the Plains appeared late in the day, and raised little comment. They were immediately overtaken by rapidly widening (though much delayed) acceptance of the Glacier Theory. R.A. Bell, for instance, championed Canadian glaciation in the same year as Dawson's Cordilleran synthesis (1890), while Chamberlin (1894) applied Dawson's term "Laurentide" to the now-familiar sub-continental ice-sheet, sweeping Dawson aside.

MAMMUTHUS TIBIA FROM CANADIAN ARCTIC COAST, AND A REVIEW OF PLEISTOCENE FOSSILS ON CANADA'S NORTHERN SALT SHORES.

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In July, 2000, Spencer Trennert found a mammoth tibia on Nicholson Peninsula, N.W.T.— to the southeast but still in the lee of the Tuktoyaktuk Peninsula, on the Arctic coast of western Canada. He found it lying on the gravelly beach and surmised that it had eroded from the 18-24 m-high cliffs of cobbles and sands farther back yet from the shore. His sister, Brendalynn Trennert, brought it to the Provincial Museum of Alberta for identification.

The immature right tibia is from a 12-16 year old, judging by the missing, unfused distal epiphysis. It was compared with some smaller-than-–standard" mammoths from Russia and judged to have potential for growth to a –standard" size; it was young but not a dwarf. A conventional ^{14}C date on collagen from dense cortical bone yielded a result of almost 34,000 yBP (del ^{13}C-corrected).

A review of late Pleistocene fossil finds from along the coast revealed that this is one of the oldest dated Pleistocene fossils in the region. Recoveries from the coast are uncommon relative

to the hordes of bones found along major watercourses like the Old Crow and Porcupine rivers in the Yukon.

BONA-CHURCHILL ICE CORE (2002): REFINING LATE HOLOCENE HISTORY OF WRANGELL-ST. ELIAS REGION.

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Surface temperatures in southeastern Alaska and parts of Canada rose as much as 2°C in the last 30 years, more than twice the global average of 0.6°C. Have rates of past warming been similar, or is this an unprecedented phenomenon? What is the relative importance of temperature and precipitation on glacial fluctuations here? These and other questions will be explored following ice core retrieval from the col between Mt. Bona and Mt. Churchill (61° 23'N, 141° 43'W; 4420 m asl), located in the Wrangell Mountains of southeastern Alaska, scheduled for Spring 2002. A study of the glacial geology, including mapping and dating of surrounding end moraines, will provide information on how the glaciers have responded to climate events recorded in the ice cores. This research will emphasize dating of the late glacial maximum and Younger-Dryas and Neoglacial events, particularly the ―Little Ice Age" moraines. A review of recent paleoclimate research presented here, including results from dendrochronology, palynology, paleolimnology and other glacial studies, will establish a regional picture. The volcanic history, tree ring temperature reconstructions, and historical variability in southern Alaskan vegetation will be summarized. Bona-Churchill regional climate and environmental studies are necessary to gain further insight into this complex system.

CENTURY-SCALE SALT MARSH ACCRETION RATES IN EASTERN CANADA.

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Salt marshes, which occur at a narrow elevation range spanning mean high water, are assumed to maintain elevation in pace with sea level changes. Tide gauges records from eastern Canada reflect rates of sea level rise that vary from a low of 21.2 cm per century at Escuminac, New Brunswick to more than twice that (47.5 cm per century) at Yarmouth, Nova Scotia. If rates of salt marsh accretion are driven by rates of relative sea level rise, then marsh accretion rates should show similar geographic variation.

This study compares marsh accretion rates in the vicinity of five tide gauges which represent a range of rates of sea level rise in eastern Canada: Escuminac, Rustico (PEI), Halifax, Yarmouth, and Eastport (Maine). In each region three marshes were cored, targeting sites of national and international significance such as the Ramsar sites Malpeque Bay (PEI) and Tabusintac River Estuary (NB) as well as PEI and Kouchibouguac National Parks (NB). In each marsh coring locations were selected from high marsh, vegetated by *Spartina patens*, thus controlling for elevation and flooding frequency. Accretion rates are determined by examination of the pattern of unsupported lead-210 with depth, providing a rate averaged over ~100 yr.

GEOARCHAEOLOGICAL INVESTIGATIONS IN EASTERN BERINGIA: A CRITICAL REVIEW.

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Making use of a very inclusive definition of "geoarchaeology," this paper will present an overview of about thirty years of interdisciplinary work carried out in the northern Yukon interior and neighbouring areas. Particular attention will be given to the fact that much of what has been achieved, in terms of our present understanding of Late Pleistocene and early Holocene eastern Beringian palaeoecology, palaeontology and geochronology, results from research efforts that were, early on, intimately linked with (if not triggered by) important archaeological and (palaeo)anthropological questions having to do with the "Initial Peopling of the New World" issue.

PERMAFROST BONE DNA. BEARS AND BISON DANCE THE TANGO.

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Studies of mitochondrial DNA from permafrost bison and bear bones reveal a dynamic pattern of localised population extinctions and replacements in late Pleistocene (LP) eastern Beringia. Paleoecological barriers can be observed between LP lower 48 states and eastern Beringian populations and even between Interior Alaska and the Yukon Territory. Surprisingly, bison genetic diversity in LP Siberia appears to be a subset of that in Alaska – indicating the possibility of a recent dispersal westwards across the Bering landbridge.

The timing of periods of ecological change, as detected by genetic and radiocarbon data, does not appear to correlate directly with known climatic or environmental events raising the question of what driving factors were responsible. For example, a key transition appears to lie between 21 and 20 Kyr – slightly before the peak of the Last Glacial Maximum.

A GIS-BASED ANALYSIS OF THE ORIENTED LAKES ON EASTERN TUKTOYAKTUK PENINSULA, NORTHWEST TERRITORIES.

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The orientation, size and shape of 600 lakes on Tuktoyaktuk Peninsula were obtained from 1:250,000 digital NTS sheets 107C, D and E by ArcView GIS. These lakes are outside the glacial limits in a tundra plain with <15 m relief. The lakes range from1800 to 20 ha, and are of mean orientation N06°E, with standard deviation 38°. 145 former lake basins are identified on the maps, and smaller lakes are inset in 130 of these. The mean orientations of the former lake basins and inset lakes are not significantly different at the 0.01 level. The orientation of the lakes

has been attributed to cross winds establishing currents which preferentially erode the ends of the lakes. Wind data from Tuktoyaktuk and Nicholson for 1970-95 indicate a consistent wind regime within the region. A wind-driven model of lake morphology provides an orientation of N15°E for all winds, and N13°E for winds above 20 km/h. The coincidence of the modeled orientation and the lake statistics supports the efficacy of wind-induced orientation. The similarity in orientation of existing lakes and former lake basins suggests that these processes have been effective for at least several centuries.

LITHOSTRATIGRAPHY OF THE MÉRIDA GLACIATION AND (PEDREGAL) INTERSTADE, MÉRIDA ANDES, NORTHWESTERN VENEZUELA.

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At Pedregal more than 40 m of sediment are exposed within a fan complex formed between lateral moraines of the adjacent Mucuchache and La Caballo valleys. Early and late Mérida (Wisconsinan) glaciations are represented by till and proglacial fluvial and lacustrine sediments. A middle Wisconsinan interstadial event, here termed the Pedregal Interstade, began following early Mérida glaciation at ca. 60 ka BP. During this period, a lake developed in the basin due to movement of the Mesa de Caballo along the Boconó fault and blockage of local drainage. Cyclic lacustrine deposition is related in part to variable delta/shoreline progradation as the lake deepened in general. A number of shallow lake phases lasting from a few hundred to at most 2000 years were marked by peat accumulation and in some cases incipient Spodosol development. Final lake drainage occurred due to movement of the Boconó Fault and breach of moraines forming the Mesa de Caballo; however, earlier lake level fluctuations probably resulted from climate change. Radiocarbon dating of the peats suggests they are related to warmer periods and may correlate with small ―interstadials” or ―D-O events” detected in the oxygen isotope record of Greenland ice cores and North Atlantic marine sediments.

THE MERETTA LAKE (NUNAVUT) STORY: SEWAGE ADDITION HAS POTENTIAL FOR PALEOCLIMATE AND ARCHAEOLOGICAL APPLICATIONS.

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Meretta Lake, Cornwallis Island, Nunavut (72°41.75'N, 94°59.58'W) was one of the High Arctic sites studied during the International Biological Programme (1968-72). For close to 30 years (beginning in 1949) it received sewage effluent from a nearby transportation base. Initially,

loadings of nutrients to the lake were high. Because sewage effluent is high in algal nutrients such as phosphorus and nitrogen, Meretta Lake was heavily impacted with algal blooms and became highly eutrophied, especially by high latitude standards. We conducted a paleolimnological analysis of the sediments (early 1800s to 1993) and traced the nutrient impact on the lake using diatoms, a group of siliceous microfossils and ^{210}Pb dating. The diatoms recorded the initial impact of nutrient additions and our limnological analyses (1992-1999) showed that the amounts of nutrients were declining steadily. The application of these findings are applied to a site (72°08.66N, 94°01.50W) on Somerset Island. –Savelle Lake” is of archaeological interest because it was the site of a large encampment of Thule people (ca. 80 –houses”). These marine hunters accumulated many whale carcasses on the lake. Many nutrients from these carcasses would have entered the lake. We are using diatoms to track the impact and duration of their occupation of the site.

PREGLACIAL DRAINAGE AND DIAMOND PLACER POTENTIAL FROM THE INTERIOR PLAINS TO THE LABRADOR SEA.

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An eastern flowing paleo-drainage system drained the Interior Plains and exited through Hudson Strait into the Labrador Sea. The drainage is reconstructed using paleo-topography, provenance of sediments, and recycled pollen found in offshore wells in the Labrador Sea. It was probably active from early Tertiary until the Late Pleistocene, when Laurentide ice retreat established the current north-flowing Mackenzie River system. Late Cretaceous to early Tertiary (Eocene) kimberlite pipes bearing diamonds are common in the N.W.T. A comparison of drainage and geologic setting of the N.W.T. kimberlites with those of the Orange River in South Africa, suggests some striking similarities. Some of the N.W.T. pipes have been extensively eroded (>60 %) suggesting that diamond placer deposits likely occur in the region and potential placers are suspected along the depositional sector of the paleo-drainage. Considering nearly 62 million years of fluvial erosion with an estimated volume of ~3x10 km^2 sediments in the offshore, placer potential is highest to the east and southeast of the N.W.T., possibly as far as Hudson Bay and the Labrador Sea.

PLIOCENE AND EARLY PLEISTOCENE SEASONAL TEMPERATURES IN THE NORTH AMERICAN ARCTIC, BASED ON MUTUAL CLIMATIC RANGE ANALYSIS OF FOSSIL BEETLE ASSEMBLAGES.

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Late Tertiary and early Quaternary fossil beds in the high arctic have yielded well-preserved plant macrofossils and insects, documenting the existence of coniferous forests. Nearly all of the beetle specimens in these fossil assemblages represent extant species. I applied the Mutual Climatic Range method of paleotemperature analysis to fossil beetle assemblages from eleven sites, estimating mean summer (TMAX) and winter (TMIN) temperatures. Arctic TMIN values during the Pliocene were substantially warmer than they are today. The MCR estimates support the paleobotanical scenario, that Arctic Pliocene climates were far less continental. Several Pliocene-age assemblages yielded TMAX estimates 9-10ºC warmer than modern values at the sites. This is the same degree of warming required to allow coniferous forests to grow in the high arctic. By 3 myr, a cooling trend is marked in the paleobotanical and fossil beetle evidence from Alaska. All assemblages dating between 5.7 and 2 myr yielded calibrated TMAX values between 12.4 and 13.8ºC, regardless of location. Thus the insect fossil data supports the theory that there was far less latitudinal gradation in temperatures during the late Pliocene than there is today. The MCR reconstructions suggest regional climatic cooling (especially winter temperatures) began by at least 2 myr.

QUATERNARY GEOLOGY STUDIES IN THE HUCKLEBERRY MINE AREA, TAHTSA RANGES, WEST-CENTRAL BRITISH COLUMBIA.

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Detailed stratigraphic, sedimentologic, and geochemical studies were conducted in the area of Huckleberry Mine, a producing porphyry copper-molybdenum open pit mine in west-central BC. Complimentary glacial history and ice flow studies were conducted across five 1:50:000 NTS map sheets (93 E/10, 11, 14, 15, 16). Ice flow data indicate that glaciers in the early and late Fraser Glaciation, flowed easterly through the Huckleberry Mine area into the Nechako Plateau from high elevation areas in the Coast Mountains. However, west to southwest ice flow dominated in the region during the glacial maximum. The source of ice for this event was an ice dome east of the study area in central British Columbia.

The dominant Quaternary unit found in the study area is a massive, matrix-supported diamict, up to 12 metres thick, interpreted as a basal till. It typically is clay-rich, overconsolidated, well jointed and fissile. Clasts are sub-angular to sub-rounded, commonly striated and often mineralized. Pyrite and chalcopyrite grains locally occur within the matrix. The till overlies glacially abraded bedrock, proximal glaciolacustrine sediments (laminated, stony silt and clay with interbedded sand and diamict lenses) or, less commonly, glaciofluvial gravels. Glacial units are typically capped, on steep valley slopes, by colluvial deposits and, in valley bottom settings, by thick peats. Nonglacial sediments under till in nearby areas have yielded radiocarbon dates in the 25-40 ka range and the till of the Huckleberry Mine area is therefore interpreted as being Late Wisconsinan in age.

Geochemical analyses of basal tills, collected from surface exposures and Becker Hammer drill holes in the mine area, show significant variance in elemental concentrations, both laterally and vertically. Dispersal patterns are complex but copper concentrations in basal till (median: 226 ppm; maximum: 8924 ppm) generally decrease with increasing distance from known mineralization, as expected. However, although there are indications of both early and late easterly transport, a net westward dispersal is clearly observed in both surface and drill hole samples, even though the last ice-flow event was towards the east.

PARAGLACIAL SEDIMENT SUPPLY AND EOLIAN ACCUMULATION ALONG THE YUKON RIVER DURING THE PLEISTOCENE-HOLOCENE TRANSITION.

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Stratigraphic investigation of sediments exposed along the middle Yukon River indicate rapid accumulation of eolian sediments during the Pleistocene-Holocene transition. Radiocarbon ages from overbank sediments indicate that the Yukon River was at its present channel elevation by at least 10 000 ^{14}C years BP (10 ka), and subsequent floodplain aggradation was dominated by eolian accumulation. Localized blankets of fine sandy silt, 9-14 m thick, and eolian dunes have been identified along the Yukon River between the White River confluence and Steven's Village, Alaska. Bedding is primarily horizontal planar to wavy. Interbeds of laterally extensive, organic-rich silt occur throughout. At White River confluence, the silts rest on channel gravel at river level, with radiocarbon ages indicating 12 m of eolian sedimentation between 9.5 and 9 ka. Twenty kilometers upstream of Fort Yukon, radiocarbon ages from the base of a large sand sheet/dune complex indicate accumulation began after 10.3 ka. Downstream, near Beaver, radiocarbon ages from the overbank/eolian contact range between 11.5 and 10.1 ka, and near Steven's Village, they record aggradation between 9.8 and 9.3 ka, and prior to 7.5 ka. In each case, the surface soil associated with the eolian sediments is a weakly developed Brunisol, 30-40 cm thick, similar to the zonal soil of the region, suggesting little eolian sedimentation has occurred along the Yukon River floodplain since the early Holocene.

Eolian activity occurred through the McConnell glaciation. The onset of deglaciation in the central Yukon and St. Elias Mountains began shortly after 13.5 ka, with the main retreat phase extending from 12.5-11.5 ka. Since glaciers were near their present extent before 10 ka, we discount the role of large-scale katabatic winds as the primary cause of eolian accumulations along the Yukon River floodplain in the early Holocene. Regional vegetation records indicate the development of forest by 8.5 ka in the interior of Yukon and Alaska with the transition to modern climate after 8 ka. Our data suggest that the paraglacial sediment flux to the Yukon River persisted through the early Holocene, contributing sediment for eolian accumulation along the floodplain. Further, the onset of significant accumulation correlates with the wane of meltwater discharge. The cessation of eolian accumulation is attributed to a decrease in paraglacial sediment flux and to the arrival of boreal vegetation, both contributing to a stabilization of the Yukon River floodplain by the early to mid Holocene.

MID-PLIOCENE PERMAFROST AND THE FIRST CORDILLERAN ICE SHEET IN YUKON TERRITORY.

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Arctic regions are especially sensitive to changes in climate. At no time has this been more apparent than during the intense climate shifts of the late Pliocene that led to the onset of extensive northern hemisphere glaciation. Fluvial deposits of the Klondike goldfields, central Yukon, are of particular interest since these sediments immediately precede and follow the onset of glaciation in the Pliocene. Stratigraphic and sedimentologic investigations of these deposits, coupled with fission track ages and paleomagnetic data, provide a basis for assessing Pliocene environmental change in eastern Beringia.

The first ice-wedge casts known in North America occur in the upper White Channel gravel. At the Dago Hill site, a fission track age on the Dago Hill tephra indicates aggradation began by 3.18 Ma and slightly earlier evidence of permafrost is found in the reversely magnetized sediments at Jackson Hill. An ice-wedge cast at the Jackson Hill site suggests discontinuous permafrost, with a mean annual temperature no warmer than present (MAT –5.1º C), existed by the Mammoth sub-chron (3.22-3.33 Ma). At the Quartz Creek site, an ice-wedge cast infill includes the Quartz Creek tephra which has an ^{40}Ar-^{39}Ar age on hornblende of 2.6± 0.24 Ma, which agrees with the minimum age of the L-shaped spectrum of 2.71 Ma- the step least likely to contain extraneous argon. A weighted mean isothermal plateau fission track age on this tephra of 2.97± 0.3 Ma is consistent with a normal polarity (Gauss >2.6 Ma).

The first evidence of glaciation in Yukon is recorded by the Klondike gravel, an extensive glaciofluvial outwash derived from the first Cordilleran ice sheet advance in the region. The lower portion of the Klondike gravel interbeds with the White Channel in the Klondike valley and is also magnetically normal, indicating an equivalent magnetostratigraphic unit. Based on the close association of the Klondike gravel with the first evidence of permafrost in the upper White Channel gravel and Quartz Creek tephra (2.6±0.24 Ma) we think the first glaciation also occurred within the Gauss chron (>2.6 Ma), suggesting large ice volumes in the northern Cordillera at the onset of northern hemisphere glaciation.

FLOWSLIDES AND DROWNED, BURIED FORESTS AT HALDEN CREEK, NORTHEASTERN BRITISH COLUMBIA.

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Halden Creek has been frequently impounded by flowslides. The landslides are recorded in sedimentary exposures in two ways. 1. Trees died in the resultant temporary lakes and were subsequently partially buried by alluvium. The buried portions of the trees were preserved. Bank erosion exhumed these ancient drowned forests. 2. In some cases multiple organic layers are recorded in landslide debris scarps. Using radiocarbon dates of trees and organic layers, we attempt to reconstruct flowslide history at Halden Creek.

SEDIMENTARY RECORD OF LAKES ACROSS THE NORTHERN COAST MOUNTAINS IN RESPONSE TO SPATIAL AND TEMPORAL CLIMATIC INFLUENCE.

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With the growing recognition of short-term fluctuations in climate driven by decadal oceanic oscillations, it is increasingly important to use long-term proxy data to assess changes beyond the instrumental record and to understand the response of the hydrologic, glacial and geomorphic systems to past and future climate forcing, including human-induced global warming. In this preliminary study of lakes across the Coast Mountains in Northern British Columbia, Yukon and southeastern Alaska, we set the stage for in-depth study of drainage basin and lacustrine processes, and application of lacustrine records to assessment of environmental change in the region. We have measured limnological data and collected surface sediment cores from Atlin Lake (including Torres Channel, Williston Bay and Llewellyn Inlet), Bennett Lake, and Chilkoot Lake. These three sites represent a transect from continental to maritime climate influence, with varying impact of glacial and hydrologic inputs.

Our sampling was carried out in late July-early August 1999 during a period of high temperatures. All three lakes are thermally stratified and exhibit evidence of sediment transport via interflows and underflows. Subbottom sounding indicated varying sediment fills, but sites with high sediment influx (Chilkoot, Williston Bay, Llewellyn Inlet) showed evidence for substantial accumulation. Sediments from all sites were laminated and thin section analysis suggests that Chilkoot and the proximal sites in Atlin Lake are varved. These catchments derive most of their incoming sediment from glacial meltwater. In contrast, Bennett Lake showed decreased suspended sediment in the water column and faintly laminated sediments in the south arm, likely due to upstream sediment traps.

In addition to these preliminary results, we plan to carry out detailed subbottom acoustic surveys, sediment coring, and lacustrine process studies to identify the nature of the environmental signal contained in the sediments.

HOLOCENE ENVIRONMENTAL HISTORY IN NORTHERN SWEDISH LAPLAND.

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Sub-arctic regions are considered ecologically sensitive to climate change, therefore attention has focused on establishing past records of environmental response to climate change in order to better predict, and thus possibly to adapt to, future climate change. We present a 9000 calibrated

year, multi-proxy paleoecological record from a site typical of the coniferous sub-arctic region in northern Scandinavia.

Basal pollen changes indicate the transition from open, juniper-birch scrub to alder-birch-pine parkland. Subsequent zones indicate a cooling trend with decreasing importance of pine, birch and alder and increased abundance of spruce until present day, demonstrating that the sub-arctic terrestrial ecosystems are sensitive to climate changes.

Early Holocene chironomid assemblages represent relatively warm environmental conditions. Subsequent communities reflect trophic changes and increasingly complex habitats, including an expanding littoral community. A late-Holocene increase in *Sergentia* may be associated with an increase in acidity, however the presence of cold stenotherms (e.g., *Heterotrissocladius*) indicates cooling occurred. Recent changes in community composition reflect human disturbance on the landscape, with associated changes in allochthonous organic deposition resulting from fertilisation and forest clearing. This small aquatic ecosystem likely reflects ontogenic processes more than climate trends. However, the combined effects of future climate and land use changes will likely have a significant influence on the composition and abundance of aquatic and terrestrial organisms within this region.

THE DEPOSITIONAL RECORD OF ICE-FLOW WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.

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The configuation of the Keewatin Sector of the Laurentide Ice Sheet during the last glaciation has been reconstructed by integrating both the erosional and depositional record, with some success. In the Kivalliq region of Nunavut, glacial deposits have been used to infer the ice-flow history in several ways:

1) Dispersal trains – glacial transport directions have been determined from the distribution of distinctive indicators in till. A dispersal train of sediment, derived from a unique redbed sequence, extends over 300 km southeasterly from the bedrock source parallel to the main ice-flow direction in the region. Smaller, well-defined, geochemical dispersal trains, associated with unique or contrasting bedrock lithologies or mineralization, have also been defined in till in the Meliadane trend (NTS 55J, K, N) and MacQuoid Lake area (NTS 55M) through recent till sampling projects. These dispersal trains are present in the surface (presumably, the youngest) till and, consequently, the pattern represents a composite of the ice-flow history for that area.
2) Glacial stratigraphy –till sections exposed on the Kazan River contain at least three till units, distinguished on the basis of composional variation, colour, and till fabric. The lack of regional stratigraphic control and absolute chronological indicators is a constraint on a regional interpretation.

APPLICATION OF GROUND PENETRATING RADAR IN TROPICAL DIAMOND AND GOLD PLACER EXPLORATION, MAPLE CREEK, GUYANA.

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Maple Creek, a tributary of the Potaro River in northeastern Guyana, is part of an historic alluvial diamond and gold mining district. This study consists of three objectives focused on a buried, placer rich, paleo-channel:

- evaluate ground penetrating radar (GPR) as a viable tool in tropical placer exploration;
- correlate local stratigraphy to GPR data and identify potential host horizons;
- assess the economic significance of the channel fill sediments for placer diamonds and gold.

A total of 44 km of survey line was completed at the property. The GPR performed very well and proved effective in imaging the bedrock sediment interface, thereby confirming the structure of the buried incised channel. Depth of penetration may be >40 m, but verification of this depth awaits confirmation of velocity analysis. Exceptional GPR data also revealed architectural elements of the channel fill sediments, isolating three separate lithofacies. An extensive trenching program consisting of more than 30 profiles provided excellent stratigraphic control for the upper four metres of the channel fill and complements other, new and historic workings, which also provided subsurface profiles that extended to bedrock. Five test pits within the channel fill confirmed the economic (both diamonds and gold) significance of the sediments.

CONSTRAINTS ON AGES OF PRE-MCCONNELL GLACIATIONS BASED ON NEW PALEOMAGNETIC INVESTIGATIONS AND AR-AR DATING OF BASALT IN WEST CENTRAL YUKON, CANADA.

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New paleomagnetic investigations and application of Ar-Ar dating of the Selkirk Volcanics have further constrained the ages of the Reid and some pre-Reid glaciations in Central Yukon. A basalt flow near Fort Selkirk is overlain by outwash deposited during Reid Glaciation. The basalt has a preliminary Ar-Ar age of 311±30 ka. This age is consistent with the normal magnetization of the flow and its termination below the level of the contemporary Yukon River flood plain. Taken with the ca.190 ka Sheep Creek Tephra, which overlies Reid drift elsewhere, Reid Glaciation occurred during isotope stage 8. Thirty km west of Fort Selkirk, outwash from the youngest pre-Reid glaciation known in that area overlies a reversely magnetized basalt flow. The basalt has a preliminary Ar-Ar age of 1.47±0.05 Ma, a maximum age for the outwash. Immediately north of Fort Selkirk, the maximum age of till and outwash deposited during an older pre-Reid glaciation is constrained by an Ar-Ar age 1.83±0.3 Ma on underlying reversely magnetized basalt and an Ar-Ar age of 1.37±0.03 Ma on an overlying reversely magnetized basalt. These ages are in agreement with some fission track ages determined on the Fort Selkirk Tephra which also occurs between the basalt flows. The age on the upper flow also indicates a maximum age for the most recent incursion of pre-Reid glacial ice at that location. Fifty km northwest of Fort Selkirk, a normally magnetized basalt flow has a preliminary Ar-Ar age of 2.69±0.04 Ma. It predates drift from the oldest and most extensive regional glaciation of central Yukon. This age is consistent with previous work in the Klondike area which suggests initiation of regional glaciation near the end of the Gauss Chron.

SOIL DEVELOPMENT AND THE AGE OF RIVER TERRACES ALONG THE YUKON RIVER, FORT SELKIRK TO WHITE RIVER, WEST-CENTRAL YUKON, CANADA.

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The age and genesis of high level terraces along the Yukon River have been poorly understood with reference to the interaction among fluvial processes, glaciation, and crustal movements in west-central Yukon. Between Fort Selkirk and its confluence with the White River, soil development and sedimentology were examined and compared to terrace height with the aim of constructing a history of aggradation and incision.

Terraces were grouped into discrete categories according to the degree of soil development on their upper surfaces compared to an established soil chronostratigraphic sequence. The soils developed on the highest terraces, which range from 190 to 250 m, have preserved morphological features representative of the Wounded Moose paleosol (Early Pleistocene). Terraces between 80 and 110 m also have soil development comparable to that of a Wounded Moose paleosol, yet are distinctly less developed than those soils found on the uppermost terraces. Soil development representative of the Diversion Creek paleosol (Middle Pleistocene) commonly occurs on terraces between 50 and 14 m above modern river levels. Soil development as well as clay mineralogy and extractable Al and Fe were used as primary tools in the correlation of terrace soils with type Wounded Moose and Diversion Creek paleosols.

GLACIAL LAKE DEADMAN, SOUTHERN INTERIOR OF BRITISH COLUMBIA: PALEOGEOGRAPHY AND PALEOENVIRONMENT.

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Glacial Lake Deadman was the last (ca. 9000 aBP) in a series of large ice-dammed lakes that flooded the southern interior valleys of British Columbia during the decay of the Cordilleran Ice Sheet. Thick sediments from this lake dominate the valley-fill and are important records of the

deglacial style of the Cordilleran Ice Sheet, yet they have not been studied in detail. The past extents, or paleogeography, of the lake have been refined by integrating DGPS, GIS, DEM and GPR data. This is the first study to use these combined technologies for paleogeographic reconstruction in the Cordillera.

Detailed sedimentological work revealed that: lake sediments were mostly derived from tributary sources rather than an ice-tongue, deposition of clay was very rare, subaqueous fan deposition was abruptly followed by silt deposition at tributary inputs, sediments were subject to large-scale subaqueous failure, sediments were deposited in a higher energy environment than most modern glacial lakes, and the lake was short-lived. The final drainage of Glacial Lake Deadman may be the source of an outburst flood that terminated in the marine environment of the Georgia Basin (ca. 300 km to the southwest).

PERMAFROST LANDFORMS AND CLIMATE CHANGE IN THE MACKENZIE MOUNTAINS, N.W.T.

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An area centred on Macmillan Pass has been the subject of detailed field studies since the 1970s and analysis of areal photos from 1943 to 1981 to determine the extent and status of prominent permafrost landforms such as palsas and peat plateaux. Virtually all features that have been found between 20 km east of Macmillan Pass and 45 km to the west into Caribou Pass have lost areal extent. Smaller landforms have degraded entirely while larger features have lost area at a rate of 1% per annum. Most landforms exhibit indications of degradation (e.g. surface depressions, dissection or peripheral decay) and some of these same features also have evidence of aggradation (e.g. wetland sedges, side-slopes merging with the peatland).

Six palsa wetlands have been instrumented with automated microclimate stations since 1990. Over the past decade, mean annual air temperatures ranged from -4.5 (1991) to -9.2°C (1996) while mean annual palsa core temperatures varied from -3.4 (1993) to -0.1°C (1998). Temperature trends at the two sites with the most complete record confirm as much as a 1.6°C decrease in air temperature over the decade while their permafrost core temperatures increased by 0.7°C. Palsa temperature characteristics are considerably affected by snowpack and summer precipitation since they affect heat exchange between the landform and the atmosphere.

PHYSICAL AND CHEMICAL CHARACTERISTICS OF ACTIVE LAYER AND PERMAFROST SEDIMENTS, HERSCHEL ISLAND, WESTERN ARCTIC COAST, CANADA.

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Physical and chemical characteristics of the active layer and near-surface permafrost were investigated at five sites on Herschel Island, Yukon Territory. Soil soluble cations, moisture content and organic content profiles at undisturbed sites indicated a thaw unconformity between 50 to 80 cm below the base of the present active layer. Paleoactive layer depth, estimated to be between 90 to 100 cm, is less than at comparable sites in the Mackenzie Delta area. The difference may be due to the proximity of Herschel Island to the Beaufort Sea coastline during the early Holocene. Soluble cations in permafrost and in the active layer at recently-disturbed sites were two orders of magnitude higher than in the active layer at undisturbed sites. Na^+ was the dominant cation in undisturbed permafrost, recently disturbed active layers, and surface runoff derived from disturbed areas. The degradation of permafrost following terrain disturbance can result in surface salinization, a condition detrimental to vegetation growth. However, leaching of soluble salts from disturbed areas appears to proceed over time. These processes yield a range of soil conditions that contribute to the floristic diversity of Herschel Island.

HOLOCENE CLIMATE OSCILLATIONS IN THE WHITE MOUNTAINS OF EASTERN NORTH AMERICA.

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Evidence of millennial-scale climate oscillations has been found in marine cores and ice cores taken from the North Atlantic, but whether or not these oscillations punctuate the Holocene climate of eastern North America remains to be determined. High elevation ponds located at ecotonal boundaries provide the most likely sites to register brief, small-magnitude climate fluctuations. Two ponds in the White Mountains have yielded complete Holocene records of climatic change. A high-resolution loss-on-ignition analysis from Speck Pond (1050m) and Lake of the Clouds (1500m) will be used to infer Holocene climate. A spectral analysis will be conducted for each site to determine the dominant climate frequencies. A paleotemperature analysis using chironomids will also be completed for the most significant climate oscillation found at each site. Preliminary data from Speck Pond suggest a rhythmic Holocene climate.

LACUSTRINE SEDIMENTARY RECORDS OF LONG TERM GEOMORPHIC AND HYDROCLIMATIC CHANGE.

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A central theme in geomorphic research has been to understand the processes and rates of change on the Earth's surface. During the last century, considerable progress has been made documenting geomorphic systems and lacustrine sedimentary records have provided valuable long term records to extend our perspective of geomorphic change during the Holocene and beyond. Interest in the past twenty years regarding anthropogenic climate change and the characteristics of natural climate variability has also made use of sedimentary records to obtain a similar long perspective. For both of these research areas, annually laminated (varved) sediments are particularly useful because they provide long records with high temporal resolution. Once believed to be limited to proglacial and meromictic lakes, varved sedimentary records are now available from a range of environmental conditions.

As researchers have focused on the information contained in varved sediments, valuable insights regarding the close interaction of geomorphic and hydroclimatic systems have become apparent. The challenges involved in isolating these different environmental signals from the sedimentary record continue to provide valuable information on the nature of change in the earth system and complement ongoing efforts to understand how geomorphic processes at a variety of time scales operate.

MINIMAL RESIDENCE HISTORY OF *DROSERA FILIFORMIS* FOR FIVE SHELBURNE COUNTY BOGS.

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A paleobotanical study focusing on the Thread-leaved Sundew, *Drosera filiformis,* is being conducted. *D. filiformis,* classified by the Committee On the Status of Endangered Wildlife In Canada (C.O.S.E.W.I.C.) as endangered, is known in Canada from only five raised bogs in Shelburne County, Nova Scotia, and has a disjunct distribution in the northeastern United States. The object of this study is to determine the minimal residence time of *D. filiformis* in the five bogs of Shelburne County. This is the first time that the residence history of an endangered species will be determined and is possible because the seeds of *D. filiformis*: 1) can be readily distinguished from other sundew species and 2) preserve well in peat bogs. This paleobotanical study will consist of macrofossil and pollen analysis of peat cores extracted from Shelburne County bogs. Preliminary data from a 367cm peat core demonstrates the presence of *D. filiformis* seeds at a depth of 218cm, which likely represents mid-Holocene time. Dates are pending.

GEOMORPHOLOGICAL RESPONSES TO CLIMATE CHANGE IN THE CANADIAN NORTH WEST DURING THE HOLOCENE: IMPORTANCE OF THEIR RECOGNITION.

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In the Northern Yukon and in the Richardson Mountains, N.W.T, distinct periods of geomorphological response to climate change during the Holocene can be distinguished. Photo-interpretation, field observations and ^{14}C dating enable the identification of three periods and suggest the beginning of a fourth. The first period, from 11 to 8 ka BP, is characterized by a very hot and dry climate conducive to aeolian deposition observed in the Northern Yukon, and to retrogressive thaw slump activity, observed in the Richardson Mountains. During the second period, 8 to 5 ka BP, the climate was warm and humid. During this period the Holocene terraces of the Porcupine and the Old Crow rivers were established. Finally, from 5 ka BP up to recent time, the cool and dry climate has favored a reactivation of valley erosion, aeolian deposition, and an increase in solifluction activity and cave icing. Recent geomorphological activity suggests a transition to a fourth period. The warming of the climate, which has been ongoing for the last 20 years, leads to the exposure and melting of massive ice bodies as observed in the Richardson Mountains and probably to the melting of cave ice in the Northern Yukon. The hot paleoclimate at 11 to 8 ka BP is the perhaps the most relevant analogue of climate warming observed today in the northwestern Arctic.

RÉPONSES GÉOMORPHOLOGIQUES AUX CHANGEMENTS CLIMATIQUES DANS LE NORD-OUEST CANADIEN PENDANT L'HOLOCÈNE: INTÉRÊT DE LEUR CONNAISSANCE POUR LE FUTURE.

De grandes périodes de réponses géomorphologiques aux changements climatiques sont survenues pendant l'Holocène dans le nord du Yukon et dans les monts Richardson T.N.O. La photo-interprétation, des observations sur le terrain et des datations au 14C permettent d'en distinguer trois et de suggérer le début d'une quatrième. Une première période de 11,000 à 8000 BP, se caractérise par un climat chaud et sec, favorable à l'édification de dépôts éoliens et à des glissements rétrogressifs provoqués par la fonte de glace massive. Une seconde, de 8000 à 5000 BP, est associée à un climat chaud et humide. L'édification des terrasses holocènes des rivières Old Crow et Porcupine date de cette période. Finalement, de 5000 BP jusqu'à tout récemment, le climat frais et sec a permis une reprise d'érosion dans les vallées, la formation de dépôts éoliens, un accroissement de la solifluxion sur les versants et un englacement des cavernes. Une transition vers une quatrième période se dessine. Le réchauffement climatique en cours depuis une vingtaine d'années est surtout favorable à la fonte de glace massive telle qu'observée dans les monts Richardson et probablement à la fonte de la glace de caverne dans le nord du Yukon.

Si on compare le réchauffement récent à ce qui s'est déroulé pendant l'Holocène, l'époque qui offre le plus d'analogies est celle entre 11,000 et 8000 BP.

ENVIRONMENTAL RECONSTRUCTION THROUGH MICROMORPHOLOGICAL EXAMINATION OF LOWER MIDDEN SEDIMENTS AT MINK ISLAND (XMK-030) EMPLOYING THIN-SECTIONS AND LATEX PEELS.

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Mink Island (XMK-030) is located off the coast of Katmai National Park on the Alaska Peninsula. The site contains excellent stratigraphy dating between 300 B.P. and 7,000 B.P. This well-preserved cultural and geological stratigraphy has allowed the exploration of local environmental conditions over time and the processes of site formation in the early period of occupation (7-5000 BP), and additionally, to address the cause(s) of an apparent occupational hiatus at the site between 5,000 and 2,200 B.P.

To examine these processes, evidence was collected using two procedures, thin-sections and latex peels. Both methods preserved strata intact as well as associated sediments. Once collected, sediments and strata from both samples were microscopically examined to distinguish and identify both cultural and natural formation processes. The micromorphology of sediment grains, their orientation, sorting and composition were determined and used to indicate erosional and depositional processes that contributed to the internal structure of the midden. Evaluation of microscopic observations allowed the identification of wetting and drying, compaction, volcanic deposits and human distortion of sediments.

MINING ECONOMICS AND GEOLOGY OF YUKON PLACER DEPOSITS.

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The physical characteristics of Yukon placer deposits are defined by their geology, physiography and sedimentology. These features are a reflection of their weathering, depositional and post-depositional history, and have a direct influence on the economic viability of each placer deposit.

Yukon placer deposits can be divided into two main types: glaciated and unglaciated. Glaciated placer deposits are found in central and southern Yukon and lie within the limits of one or more of the approximately eight Pleistocene glaciations (pre-Reid (multiple), Reid and McConnell), which blanketed Yukon between 2.58 Ma and 29.6 Ka. Unglaciated placer deposits lie in west central and northern Yukon outside of the limits of any Cordilleran glaciations and range in age from Tertiary to Holocene.

There are several factors that affect the economics of Yukon placer mining. These include: mineral value and size, grade, volume, continuity, thickness of overburden, permafrost presence, accessibility and regulatory environment. These characteristics can be discussed within the context of the geology and physiographic settings of placer deposits in both glaciated and unglaciated terrains.

Examples of placer deposits in glaciated terrain include pre-Reid glacial till and Holocene stream alluvium on Nansen Creek, Reid glaciofluvial gravel on Duncan Creek, pre-McConnell interglacial and modern creek gravel on Livingstone Creek and modern stream alluvium on Gladstone Creek. Unglaciated placers include Tertiary gravel terraces (e.g. White Channel Gravel on Hunker and Bonanza creeks), Holocene stream alluvium on Eldorado Creek, low gravel terraces on Sixtymile River, and modern gulch alluvium on Kenyon and Swamp creeks. The characteristics each creek will be compared in order to contrast the various economic factors affecting modern placer mining in Yukon.

COMPLEX GLACIAL DYNAMICS AND MINERAL DISPERSAL IN THE CENTRAL CANADIAN CORDILLERA.

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Ice divides within the Cordilleran ice sheet in central British Columbia have been shown in recent years to be much more dynamic than previously thought. At the last glacial maximum a major ice divide developed in the low-lying Interior Plateau region and ice flowed away from this divide across adjoining high mountain ranges. In some areas, the present distribution and orientation of streamlined landforms such as drumlins, crag-and-tail ridges and roche-moutonnée, does not indicate the dominant ice flow direction at the glacial maximum. Implications of these shifts on glacial dispersal and drift prospecting in the central interior of British Columbia are dramatic. Results from recent studies at mineral properties in the region will be discussed.

During the Late Wisconsinan glaciation, ice in the Cordillera initially moved into the Interior Plateau from ice centres located in the Coast Mountains. Many workers have suggested that a similar ice-flow pattern continued throughout the last glaciation and that during deglaciation ice retreated back to Coast Mountain ice centres. However, ice-flow indicators observed during field studies in the region show that ice at the last glacial maximum flowed outward from the interior and was not constrained by major topographic barriers such as the Babine Range and Hazelton Mountains. In east-draining valleys with wide passes to the Pacific Ocean, upslope westerly ice-flow continued to the end of the last glaciation or until regional ice stagnation occurred. Late glacial eastward ice-flow was restricted mainly to confined valleys with high mountain catchments and to adjoining areas in the interior, suggesting that a late westward migration of the interior ice divide occurred locally. However, evidence for westward flow is preserved at many unprotected low elevation sites, indicating minimal erosion during later eastward flows. These observations suggest that, in addition to traditional air photo studies, detailed ground observations are required to determine the ice flow history and dominant dispersal directions of mineralized materials in the central Canadian Cordillera.

A QUANTITATIVE MODEL OF SLOPE HUMMOCK DEVELOPMENT, FOSHEIM PENINSULA, ELLESMERE ISLAND, NUNAVUT.

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Slope hummocks are composed of stratified silty sands and occur on slopes of 10-25° sheltered from prevailing winter winds. On convexo-concave slopes, these hummocks increase in size on the upper segment but become smaller downslope of the location of maximum late-winter snow depth. On convex slopes, hummock heights increase steadily or attain a stable size. Excavated sections show that hummocks develop through repetitive deposition and stabilization of niveo-aeolian sediment and internal deformation is limited to rolling, stretching and compression. Measurements of slope movement demonstrate that hummocks travel downslope as units moving over a deformable basal layer. In the basal concavity of a slope, hummocks may be buried and/or stretched.

An empirical model has been developed which predicts steady-state hummock heights within a field. The model calculates the position of the hummock on the slope and then adds or subtracts an increment of height. Refinements include the effect of soil moisture on movement rates, and of changes in movement on hummock size through acceleration (stretching) and deceleration (compression). The model can be tuned to represent hummock heights and movement rates at two sites using reasonable inputs of parameters such as slope moisture content, frequency of deposition and snow density. A transit time of about 3000 years is produced for a hummock to move 40 m from the top to the base of a slope, suggesting there has been enough time since Holocene emergence for equilibrium conditions to develop.

USING OPTICAL DATING TO PLACE AGE LIMITS ON GLACIGENIC SEQUENCES: AN EXAMPLE FROM SOUTH-CENTRAL BRITISH COLUMBIA.

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Many of the deeply incised river valleys in the Canadian Cordillera are filled with unconsolidated sediments that are, in places, several hundred metres thick. Lithostratigraphic studies of some of these fills have shown that they consist of sediments that probably represent several Quaternary (?) glaciations, yet absolute chronological control has been elusive. Optical dating is now an established method of determining the time elapsed since feldspar or quartz grains were last exposed to sufficient sunlight. Although depositional environments favourable to providing absolute optical ages are generally lacking in these glacigenic sequences, calculated optical ages can often be used as maximum age limits which, together with independent knowledge of when glaciations occurred locally and globally, can be used to place limits on when deposition took place. We will illustrate this by discussing optical dating of a widespread glaciolacustrine unit in the Fraser River valley, near Clinton, south-central British Columbia.

RECONSTRUCTING THE LATE HOLOCENE (LAST 3000 YEARS) ICE-JAM FLOOD HISTORY OF THE MIDDLE YUKON RIVER.

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A major problem facing hydrologists is the inability to extend the flood history of a river beyond the historic record (~100 years). By augmenting the historic hydrometric record with a pre-historic flood record from sedimentary evidence (flood couplets) preserved in overbank deposits, it is possible to obtain a more accurate flood frequency from which to assess large flood recurrence intervals.

Along northern interior continental rivers, the formation of ice-jams and their associated flooding is a common phenomenon. Analyses of extreme stage values at Dawson City, YT, for the last century indicates all overbank events have been ice-jam related. Summer storms and spring freshet events have no oral or historic overbank record. This study presents a new methodology for the recognition and quantification of frequency of ice-jam flood events along the middle Yukon River between Dawson City, YT and Circle, AK. This method is based on the assumption that identifiable sand-silt couplets separated by organic layers represent large magnitude-duration, low frequency ice-jam floods. Sequences of up to 100 flood beds have been recorded in organic deposits at numerous sites along the Yukon River dating back to at least 3000 years B.P. These flood beds can be directly aged (tephra and ^{14}C dating) and frequencies over time determined. The possibility exists to examine the influence of known climate change cycles (e.g., Little Ice Age, Medieval Warm Period) on late Holocene ice-jam flood frequency.

THE ROLE OF FORCING MECHANISMS, BASELEVEL CHANGE AND ACCOMMODATION SPACE IN THE FORMATION OF THE KLONDIKE GOLDFIELDS, YUKON, CANADA.

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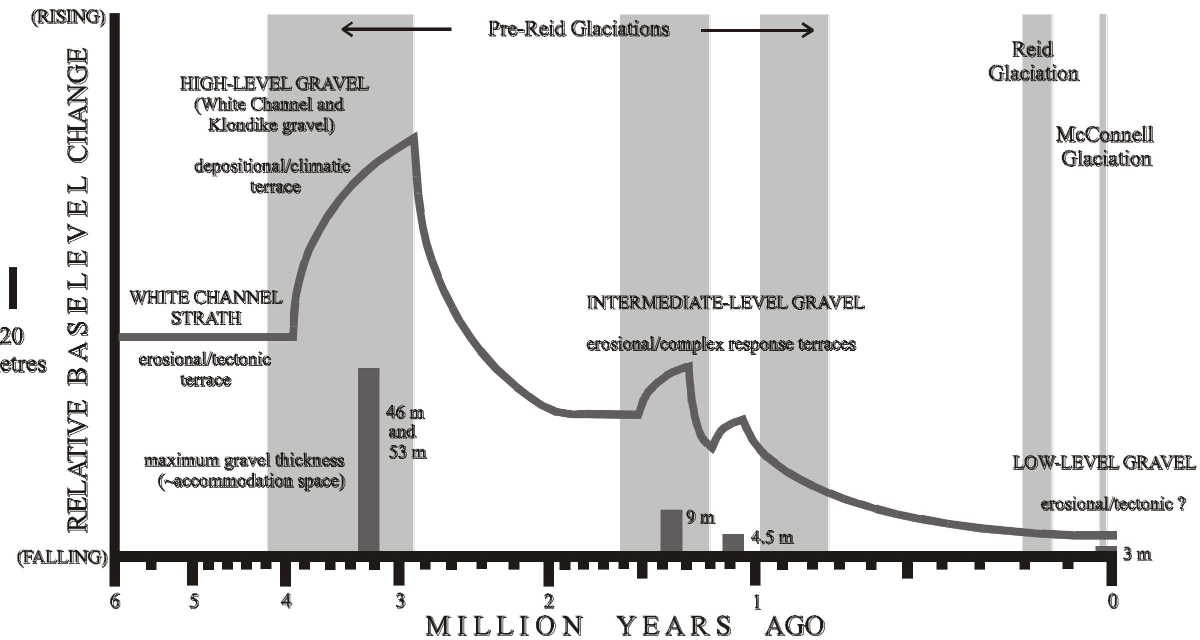
The Klondike goldfields are located in the unglaciated part of west-central Yukon, Canada. Since their discovery over 100 years ago, they have produced an estimated 311 mt of gold, primarily from bench and creek placers that are fluvial in origin and range from Pliocene to Holocene in age. The placer deposits are classified as "high-level," "intermediate-level" and "low-level" gravel. The high-level White Channel Gravel (Pliocene), presently the most important gold-bearing unit, is up to 46 m thick and rests unconformably on the White Channel strath. It is interbedded with and overlain by up to 53 m of the glaciofluvial Kondike Gravel (Pliocene). The strath is interpreted as an erosional "tectonic" terrace that formed during isostatic uplift and under conditions of dynamic equilibrium. The White Channel Gravel and Klondike Gravel are interpreted as a depositional "climatic" terrace that formed during a reversal in the tectonically induced downcutting, which is attributed to the initial and most extensive of the pre-Reid glaciations. The intermediate-level gravel (Pleistocene), the least important economically, is up to 9 m thick. It is interpreted as minor erosional "complex response" terraces that formed during static equilibrium when there were pauses in valley-floor degradation, which are attributed to the

subsequent and less extensive pre-Reid glaciations. The low-level gravel (Pleistocene-Holocene), historically the most important gold-bearing unit, is up to 3 m thick. It formed also during valley-floor degradation and may represent a return to dynamic equilibrium conditions. Hence, the dominant forcing mechanisms controlling the formation of the placer deposits were isostatically compensated exhumation and climatic change related to the repeated glaciation of the Yukon. In addition, the lowering of baselevel from high-level, to intermediate-level and finally to low-level gravel was accompanied by a decrease in accommodation space (as indicated by a decrease in gravel thickness), which resulted in an increase in the concentration of the placer gold.



A HOLOCENE POLLEN RECORD FROM THE GREY ISLANDS (NEWFOUNDLAND), LABRADOR SEA.

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An 800 cm core from a lake (104 m; 50°46.08’N, 55°31’W) on the Grey Islands, situated in the Labrador Sea 20 km east of Newfoundland’s Northern Peninsula, provides a nearly complete Holocene pollen sequence with a distinct maritime influence. By 9.8 ka (705 cm), the site had emerged from the postglacial Daly Sea and a herb-shrub tundra was established. Tundra persisted until 7.8 ka when spruce and fir invaded to form boreal forest. Fire at 7.3 ka resulted in a brief resurgence of herbs and shrubs, primarily alder, followed by forest re-establishment by 6.8 ka. Paludification led to an increase in *Sphagnum* and greatly decreased pollen influx after 3 ka, followed by an increase in shrubs and herbs at the expense of trees after 1 ka. Today the Grey Islands are dominated by tuckamore (dwarf shrub barrens) with patchy areas of black spruce forest and sphagnum bog.

Timing of initial forest development at the expense of shrub tundra (7.8 ka) coincides with other sites on the Northern Peninsula, though as much as 1 ka later than the rest of the island and slightly earlier than in southeastern Labrador. Increasing tree birch between 7 and 4.5 ka is indicative of higher summer temperatures and a longer growing season, while also signaling the weakening of a cold ocean influence which, in pollen and dinoflagellate cyst records from the Labrador sea, is dated about 7 ka. A major forest fire in the record falls within the 8 to 6.5 ka period of increased fire frequency on the Northern Peninsula. Water temperature in the Labrador Sea reached a maximum around 6 ka, coincident with the start of the hypsithermal period on the Grey Islands. After 2.5 ka the Labrador Sea re-exerted a cold bottom water influence and the Grey Islands experienced paludification and forest demise.

INTERGLACIAL, GLACIAL AND HOLOCENE STRATIGRAPHY AND HISTORY OF THE OOTSA LAKE REGION, CENTRAL BRITISH COLUMBIA.

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Unusually well exposed late Pleistocene and Holocene stratigraphic sections occur within the study area along the shores of Ootsa Lake (Nechako Reservoir) and the Cheslatta River spillway. Quaternary sediments are mostly products of Late Wisconsinan glaciation. However, evidence for pre-Late Wisconsinan sedimentation has been found at several sites, including till of an older glaciation and organic-bearing, blue-grey, lacustrine sediments of probable Middle Wisconsinan age. Stratigraphic correlation of Middle Wisconsinan lake sediments suggests that an extensive lake system occurred in the region during the Olympia Nonglacial Interval.

Glaciofluvial and glaciolacustrine sediments deposited in front of the ice margin were overridden during glacial advance and are best preserved in large valleys. Advance-phase glaciolacustrine sediments are significant, as slope failures are spatially associated with areas where they are preserved. The distribution of these sediments indicates that advance-phase glacial lakes occurred up to approximately 855 m asl, at least several metres above modern reservoir level. Till is the most common Pleistocene surficial sediment, covering approximately 80% of the area; large areas of exposed bedrock are rare. Striae, streamlined landforms and till geochemistry provide evidence that ice flow direction during the last glacial maximum was to the northeast. Crag-and-tails, flutings and drumlinoid ridges are the dominant landforms and reflect an erosional landscape modified partly by subglacial meltwater floods.

Excellent exposures of the entire Holocene sequence, including thick lacustrine sediments, delta deposits and peat bogs, are present in the area due to incision by the Cheslatta River spillway. A radiocarbon date on wood, in a basal peat 320 cm deep overlying marl at the Skins Lake bog, of 9540±70 years BP (Beta 146669) indicates the timing of peat bog establishment and provides a minimum date for deglaciation. A second radiocarbon date of 7940±80 years BP (Beta 146672) was obtained on wood underlying a thick delta sequence and indicates that the delta prograded over peats in that area after that time.

QUANDARIES IN PALEODIETARY STUDIES OF QUATERNARY MAMMALS: DO ISOTOPE DATA REALLY REFLECT DIETS, OR SOMETHING MORE SINISTER?

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With increasing frequency, carbon and nitrogen isotopes ($\delta^{13}C$ and $\delta^{15}N$) are being used to study paleodiets of Quaternary mammals. However, paleodietary studies can be biased in over-emphasizing assumed inter-specific isotopic differences among food items, especially differences among plant species consumed by herbivores. Studies on modern plants show that $\delta^{13}C$ and $\delta^{15}N$ can vary significantly within a given plant species or growth form (e.g., shrub, forb) – differences which are caused by variations in microhabitats, regional climates, and even microclimates. Variations in these parameters affect processes such as soil nitrogen cycling (influencing which forms of nitrogen are available for uptake) and water stress in plants (influencing stomatal conductance, which in turn affects carbon uptake). In turn, these processes have strong influences on isotope fractionation and can vary on small spatial scales, on the order of a few meters, and they vary temporally with changes in climate or vegetative succession. Paleoecological studies are not adequately incorporating these non-dietary processes into interpretations of isotopic signatures derived from fossil animal tissues. While this contention would seem to diminish the value of isotopes in paleodietary studies, this cloud does have a silver lining – stable isotopes may actually provide more direct information about paleoecosystems (e.g., nitrogen cycling, water stress) than information that is extracted about ecosystems inferentially through reconstructions of animal diets.

To illustrate these ideas, I present and discuss isotope data for 13 species of herbivores and carnivores from the late Quaternary of Beringia.

THE ROLLING RIVER SECTION, RIDING MOUNTAIN, MANITOBA: A SEDIMENTARY SEQUENCE IN THE GLACIAL LAKE PROVEN BASIN.

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The Glacial Lake Proven basin covers an area of approximately 340 km^2 on the Riding Mountain Uplands in Manitoba. At least three phases in the history of the glacial lake have been identified based on depositional units, different outlets and associated lake levels. Near the southern margin of the basin, the Rolling River has incised into the Early Glacial Lake Proven sediments and exposed a 15 m section of the supraglacial lacustrine deposits.

A supraglacial melting-ice facies (Zelena Formation; an ablation till) is exposed at the base of the sequence. Depositional evidence suggests that there was a rich sediment supply into Early Glacial Lake Proven depositing a supraglacial lacustrine complex that conveys an impression of alternating layers of sands. These deposits are overlain by a thick sequence of supraglacial lacustrine bottomsets consisting of sand and silt rythmites. In the upper part of the section, the deposits depict the characteristics of a supraglacial lake-margin deposit. There is some regular lamination of the finer sand and silt, evidence of coarse incalcations and material supplied by mass movements or wash off, and numerous dropstones.

RE-INTERPRETATION OF THE ICE-FLOW HISTORY WITHIN THE KEEWATIN SECTOR OF THE LAURENTIDE ICE SHEET.

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Recent systematic mapping of ice-flow indicators on bedrock in the Kivalliq Region of Nunavut (NTS 55J, K, L, M, N, O and 65I, P) has provided new evidence for major shifts in ice-flow within the Keewatin Sector of the Laurentide Ice Sheet (LIS). The record of successive glacial flow, as indicated by cross-striations and other evidence of multiple ice flows, is particularly well preserved under the area of the Keewatin Ice Divide (KID), which is defined as the zone occupied by the last remnants of the LIS west of Hudson Bay. The relative chronology determined from these data indicate that the ice flow record is more complex than previously reported and challenges the view that the KID was a static, long-lived feature of the LIS in central Keewatin. Evidence is presented for at least four glacial flows of regional significance prior to the final decay of the KID. This suggests that the dispersal centre in Keewatin was a highly mobile feature with major southeastward and northwestward shifts at least up to 200 km on either side of its final axis. To date, this work represents the most comprehensive and detailed study of its kind within the Keewatin Sector of the Laurentide Ice Sheet.

EL CAPITAN PALAEOVALLEY: IMPLICATIONS FOR UNDERSTANDING THE MIOCENE TO QUATERNARY LANDSCAPE HISTORY OF THE COBAR REGION, NSW, AUSTRALIA.

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El Capitan lies 50 km northeast of Cobar in the sub-arid zone of eastern Australia. This region has preserved elements of a landscape history extending back to the late Mesozoic and involving humid and arid weathering, erosion/deposition and significant lowering of relief. In such ancient landscapes it is commonly difficult to establish the effects or significance of more recent surface processes and events. Fortunately at El Capitan a small province of leucitite lavas was erupted during the late Tertiary, providing a readily datable time marker for the more recent landscape history.

Radiometric dating of El Capitan lavas indicates they erupted in the Mid Miocene (14.87±0.15 Ma). The distribution of remnant flow outcrops shows that the lavas were extruded into a shallow NNW-trending valley. The partly connected basaltic outcrops now stand up to 30 m above the surrounding land surface. This could suggest 30 m of surface lowering in the past 15 Ma, assuming the lavas infilled and were enclosed by the older valley. However, there is evidence for flow inflation and the depth of the palaeovalley was probably much less than the thickness of the flows. A more realistic estimate of post-Miocene erosion is provided by a thin

flow extruded from the Wilga Tank vent and now topographically inverted. Its base is 17 m above the general land surface suggesting stripping rates of ca. 1 m per million years.

A deep weathering profile, similar to those common throughout the region and characterised by a ferruginous mottled zone and underlying bleached saprolite, is preserved beneath a dissected flow. Other sub-basaltic deposits include baked soils; silcretes; and quartz-rich gravels-grits. By contrast, weathering profiles on the basalt are thin and lack significant ferruginisation. They also contain quartz (35-50%) and grain size analysis indicates that this is an aeolian component. Previous workers suggest that aeolian dust is common in many soils of the region and that this reflects high winds during periods of major glaciation, including in the Pleistocene. Quartz is absent in the leucitites and so its presence in the basaltic soils confirms a dust flux to the post-Miocene landscape.

PALAEOCHANNEL SEDIMENTS AND THEIR IMPLICATIONS FOR LANDSCAPE HISTORY AND GOLD EXPLORATION AT GIDJI, KALGOORLIE, WESTERN AUSTRALIA.

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Buried palaeochannels occur over the Archean Yilgarn Craton of Western Australia and represent remnants of an extensive palaeodrainage network developed through the Cainozoic. In areas of greenstone-hosted gold mineralisation, palaeochannels may contain economic placer gold deposits and concentrations of supergene gold that extend into the underlying weathered bedrock. The presence of palaeochannels can also complicate exploration for gold, as thick (>15m) palaeochannel clays effectively mask bedrock geochemical anomalies.

A major palaeochannel at Gidji, 13 km north of Kalgoorlie, contains sand- and clay-rich facies composed of low-crystallinity kaolinite, quartz and minor smectite. These sediments can be distinguished from underlying, *in situ* saprolite by their mineralogy and chemistry (particularly K/Al and Mg/Al ratios, low REE contents; and low K/Rb ratios). Ferruginous pisoliths and mega-mottles occur in parts of the clay-rich facies. The palaeochannel sediments were deposited during the Mid-Late Eocene and were derived from a mature and deeply weathered pre-Eocene landsurface. Their stratigraphy indicates a change from dominantly fluvial to fluvio-lacustrine conditions, possibly caused by a major rise in base level in one of two Mid-Late Eocene marine transgressions. The palaeochannel sediments are overlain by alluvial/colluvial sands and gravels. Overlap of playa lakes and older quartz-rich and younger gypsum-bearing dune sands indicates a change to progressively more arid conditions during the Late Tertiary and Quaternary.

The Gidji palaeochannel contains bedrock and placer/supergene gold anomalies that can be differentiated using a multi element approach. Primary gold mineralisation shows associated As, Sb and W, pathfinders which are lacking with the placer/supergene gold anomalies. However, As is also concentrated in ferruginous lag and pisoliths in the palaeochannel sediments, resulting in false or displaced anomalies.

EVALUATING ONTARIO'S DIAMOND POTENTIAL THROUGH KIMBERLITE INDICATOR MINERALS DERIVED FROM MODERN ALLUVIUM SAMPLING PROGRAMS.

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Following the discovery of diamonds in the Wawa area in 1992, the Ontario Geological Survey (OGS) has developed methods to evaluate a region's diamond potential through overburden sampling and kimberlite indicator mineral (KIM) geochemistry. Kimberlite is the host rock type most commonly associated with diamond exploration.

Sampling of modern alluvium provides a fast, relatively inexpensive method by which to obtain a heavy mineral signature for individual drainage basins. A quick and simple method for stream sediment sampling has been developed that allows almost anyone, with limited training and experience, to sample correctly and consistently.

KIMs routinely evaluated at the OGS include: a) Cr-pyrope garnets; b) eclogitic garnets; c) megacrystic garnets; d) chromites; e) Mg-ilmenites; f) Cr-diopsides; and g) olivine.
The use of KIM geochemistry is not well defined for all KIMs. As such, the OGS has developed better methods to interpret Cr-diopside and olivine geochemistry. Additional work on chromite and Mg-ilmenite chemistry is planned.

Since 1993, the OGS has undertaken several modern alluvium sampling programs throughout Ontario. These programs have led to the discovery of diamond-bearing rock in the Wawa area, and exceptional kimberlite exploration targets within the Kapuskasing Structural Zone, Trans Superior Structural Zone, Winisk Fault System (Stull Lake/Attawapiskat) and the Lake Timiskaming Fault System.

BASAL ICE AND FROZEN DEFORMING BED OF THE LATE WISCONSINAN LAURENTIDE ICE SHEET, TUKTOYAKTUK COASTLANDS, NWT.

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Twenty-one luminescence age estimates from pre-glacial aeolian dune sand of the Kittigazuit Formation near Cliff Point indicate that the last Laurentide glaciation of Liverpool Bay, and by implication the Tuktoyaktuk Coastlands, occurred during the late Wisconsinan.

Buried remnants of the Laurentide Ice Sheet occur as massive ice and icy sediments in the Eskimo Lakes Fingerlands and Summer Island area. The basal-ice interpretation is inferred from: (1) Ice-sediment facies and groupings closely resemble those from contemporary basal ice but differ from intrasedimental massive ice. (2) The massive ice contains abundant glacigenic diamicton. (3) The upper contact of the ice formed by thaw or erosion, consistent with downward ablation or erosion of the ice, but inconsistent with downward freezing during permafrost aggradation. (4) Melt-out till formed by downward thaw of the massive ice commonly overlies it.

Subglacial deformation beneath the Laurentide Ice Sheet is indicated where deformation till overlies sequences containing glaciotectonic structures indicative of high shear strains. Deformation of at least partially-frozen ground is indicated where pre-deformation ground ice (folded massive ice, ice clasts, rafts of massive ice) is preserved. But fully-frozen conditions are unlikely because of (1) freezing-point depression in clay-rich sediments and (2) growth of post-deformation segregated ice.

PRE-QUATERNARY AND QUATERNARY BURIED VALLEYS ALONG THE NORTH-EASTERN MARGIN OF ASIA AND PLACER DEPOSITS RELATED TO THEM.

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Evolution of the late Cenozoic drainage at the north-eastern margin of Asia is closely related to destructive processes due to the opening of the Arctic Ocean basin, on the one hand, and to the tectonic "crowding" and uplift along the active continental margin of the NW Pacific sector, on the other hand. These events promoted formation of branched drainage networks of different ages; many of these valleys are found buried and submerged.

Four general stages can be distinguished in the Cenozoic drainage evolution: late Paleocene-Eocene, Oligocene, Miocene, and Pliocene-Quaternary; valley incision and considerable drainage restructuring occurred at the beginning of the each cycle, while the second part of each stage was marked by transgression, aggradation and valley filling. There are two types of different-aged valley space relations: intra-valley setting and inter-valley setting.

The first type of setting appears as buried channels occurring within recent valleys and/or close to them within common structural depressions. It is typical of most placer-bearing mountain and piedmont areas of the Kolyma, Chukotka and Koryakia regions. Buried Miocene, late-Pliocene, early Pleistocene and middle Pleistocene valleys in these areas contain many large and rich Au, PGE, Sn and W placers overlain by alluvial, lacustrine, glacial and glacio-fluvial deposits.

On the shelf and within inter-mountain depressions, evolution of valleys produced the second setting, where entire drainage systems were interrupted and diverged. Buried fluvial channels in ancient Beringia are of Eocene, Miocene, late Pliocene, early Pleistocene and middle- and late Pleistocene age. Such inter-valley drainage restructuring could be the most important factor for fine- and small-gold placer formation and for diamond occurrences (single finds).

DELIMITATION OF THE OWL CREEK BEDS, TIMMINS, NORTHEASTERN ONTARIO.

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The name Owl Creek beds refers informally to organic-bearing nonglacial and proglacial lacustrine sediments in the Timmins area. They underlie Matheson Till and consist of overconsolidated laminated sediments containing fine-grained organic detritus and small wood fragments. At a few sites, a paleosol is preserved at the base of the unit. The upper part of the Owl Creek beds is proglacial in origin, consisting of laminated organic-rich silt that was deposited in front of advancing Laurentide ice. At many sites, the top of the unit has been truncated by the ice that deposited the Matheson Till. Owl Creek beds comprise a formation equivalent to the Missinaibi Formation and are likely correlative in age (Sangamon). They represent an accumulation of sediment and organic material deposited in a large shallow lake during the Sangamon and earliest Wisconsin.

These nonglacial beds have been intersected in 186 boreholes in the Timmins area, in 24 boreholes east of Timmins, and were briefly exposed at the Owl Creek open pit gold mine. They range in thickness from 0.1 to 27.7 m, with a mean thickness of 7.4 m. Geographic information systems (GIS) were utilized to reconstruct the preglacial paleo-topography and construct an isopach map of the organic-bearing beds. These reveal a broad shallow lacustrine body with deeper portions in the centre and along its eastern margin. The beds are bound against the rising bedrock to the south, east and west. They thin northward, but the total extent of the beds to the north and northeast is unknown due to poor distribution of exploration boreholes beyond the margins of the Abitibi Greenstone Belt.

REGIONAL CLASSIFICATION OF SAND DUNES IN THE PRAIRIE PROVINCES, CANADA.

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The modern morphologies of more than 120 dune fields in Alberta, Saskatchewan and Manitoba reflect the changing geologic and climatic conditions since deglaciation. This study outlines a sequence of dune development using aerial photography to classify each dune field in terms of orientation, morphology, and level of activity. Average orientations (within narrow-range classes) are determined for each dune field. Chronologic sequences are interpreted for dune fields with multiple orientations and morphologies.

At least three regions are defined, based upon dune fields with similar attributes, reflecting the spatial and temporal variations in sediment supply (amount and grain size of source material), sediment availability (through moisture and vegetation) and wind regime (direction and intensity). A southern region, predominantly consisting of re-worked, inactive to partially active parabolic dunes, is interpreted to reflect dune re-activation due to episodic droughts in the Holocene. A northern region, predominantly consisting of inactive dunes, is sub-divided into northwest-trending dunes depicting off-ice katabatic winds, and southeast-trending dunes depicting circulation patterns associated with Pacific westerlies.

MULTI-PROXY HOLOCENE PALEOLIMNOLOGIC RECORD FROM A SALINE LAKE IN THE YUKON, CANADIAN SUBARCTIC.

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Multi-proxy paleolimnological analyses were conducted on a sedimentary sequence from a saline lake in the central Yukon to infer patterns of Holocene climatic change, using sediment mineralogy and biostratigraphy (diatoms, pigments). Sediment mineralogy and fossil pigments at the base of the core indicated a moderately deep lake dominated by clastic influx, probably in a basin fed by glacial meltwater. The early Holocene history (ca. 11,000-8100 ^{14}C yr BP) was characterized by a relatively deep, mesosaline lake, with diatom-inferred salinities approximating 20 g L^{-1}. Relatively fresh (2-15 g L^{-1}) and eutrophic conditions prevailed during the mid-Holocene (ca. 8000-2000 yr BP), with four periods of alternating fresh and saline conditions, but overall indicative of more humid conditions than today. The recent history of the lake was marked by a trend towards drier conditions and the development of hypersaline Mg-SO_4 brines during the past 2000 years. The various indicators reveal a complex history of frequent and rapid shifts in paleosalinity and lake paleoproductivity during the Holocene, and the effects of the Younger Dryas and Little Ice Age episodes may be recorded in the proxy data. The paleoclimatic interpretation emerging from this site provides evidence for more dynamic climatic change during the mid- and late Holocene than recorded so far by palynological studies.

LATE PLEISTOCENE PALEOECOLOGY OF DALTON GULCH, TOFTY MINING DISTRICT, CENTRAL ALASKA.

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The Tofty (Hot Springs) mining district is located in the western part of the Yukon-Tanana upland, central Alaska, between the Yukon and Tanana rivers, and is approximately 10 km northwest of the town of Manley Hot Springs. A 1997 placer mine cut at Dalton Gulch in the Tofty district exposed 15-20m of unconsolidated deposits containing ice lenses, interstitial ice, and syngenetic ice wedges. Up to six stratigraphic units were recognized in the wall of the pit. The sediments contained a rich and varied late Pleistocene vertebrate fauna that was firmly dated to 33,260 ± 670 yr BP, a time of general climatic amelioration in Beringia commonly known as the Boutellier interval. In addition to a large-mammal fauna consisting of mammoth, bison, and caribou, the assemblage included rodents identified as arctic ground squirrel and collared

lemming. Both large- and small-mammal faunas are typical of late-glacial faunas of interior Alaska, but this site is exceptional in its abundance of well-preserved, *in situ* remains.

TREE-RING DATES FOR NEOGLACIAL LAKE ALSEK, YUKON TERRITORY, CANADA.

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Lake Alsek in southwestern Yukon Territory formed several times during the Neoglacial when Lowell Glacier advanced across the Alsek Valley and blocked southerly drainage of the Alsek River. During major phases of Lake Alsek, large mats of floating driftwood and woody detritus were deposited at several locations in Alsek Valley and were left stranded when lake waters receded. Dendrochronological techniques were used to crossdate white spruce (*Picea glauca*) driftwood samples from the Lake Alsek basin using a white spruce tree-ring width chronology collected at nearby Telluride Creek. Six successfully crossdated driftwood samples provide new constraining dates for three recent phases of Lake Alsek. The last major lake phase ended sometime between 1857 and 1891 and was preceded by a ponding event that ended between 1788 and 1832. An earlier, more extensive lake phase ended sometime after 1611. These results suggest that Lowell Glacier reached its maximum Little Ice Age position at least 200 years earlier than several other large valley glaciers in the northeastern St. Elias Mountains.

PALAEOECOLOGICAL ANALYSES OF SUBALPINE LAKES ON THE COAST AND IN THE INTERIOR WET BELT OF SOUTHERN BRITISH COLUMBIA.

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To investigate postglacial environmental changes in both the coastal and interior wet belts in southern BC we analyzed fossil chironomids from two subalpine lake cores, Frozen Lake in the Fraser River Valley, and Eagle Lake in Mount Revelstoke National Park. We used a temperature-inference model developed from modern chironomid assemblages to reconstruct Holocene climatic regimes at each lake. Midge stratigraphy and postglacial temperature reconstructions for each lake will be combined with pollen analyses at Eagle Lake to evaluate British Columbia’s climatic history and vegetation development since deglaciation. An emphasis will be placed on the timing of Western Hemlock (*Tsuga heterophylla*) and Mountain Hemlock (*Tsuga mertensiana*) migration into the Columbia Mountains region of southeastern B.C.

SOIL EVIDENCE FOR HOLOCENE FIRES IN AN INLAND TEMPERATE RAINFOREST: EAST-CENTRAL BRITISH COLUMBIA.

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Natural disturbance processes in the wet, cold Interior Cedar-Hemlock biogeoclimatic zone of east-central British Columbia are assumed to be dominated by rare, but severe, stand-destroying wildfires. Reconstruction of forest disturbance history is hampered by incomplete ring sequences in the predominant old-growth western redcedar (*Thuja plicata*) trees and a lack of palynological studies in the region. Preliminary studies in the upper Fraser River watershed have revealed a rich record of charred organic materials in soil horizons buried in alluvial fans, and beneath landslides and other colluvial deposits. Such datable materials are particularly abundant in deposits associated with reworking of deeply dissected, silty glaciolacustrine terraces in the lower Morkill River valley, 130 km east of Prince George. Excavations have exposed complex buried soil profiles, some with up to 22 distinct charcoal-containing layers, with AMS radiocarbon ages ranging up to 6000 BP. Fieldwork during 2001 is contributing additional sites, and the intent is to build up a radiocarbon chronology of fire-related sedimentation events that may elucidate climate-driven changes to forest disturbance processes during the Holocene. Parallel examination of present-day post-fire erosion and sedimentation processes is also being conducted at nearby sites where severe wildfires affected similar forest types and landforms.

HIGH-RESOLUTION PROXY CLIMATE AND STREAM FLOW RECORDS FOR THE SOUTHWESTERN NORTHWEST TERRITORIES.

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In the southwestern Northwest Territories, there are only about 60 years of continuous instrumental weather data from just a few locations. Records of this length are a poor basis for the detection of climate change and are very unlikely to capture the climatic and hydrologic extremes that characterize the region. A collaborative study was initiated to build a network of tree-ring chronologies and reconstruct annual precipitation, temperature and stream flow. During 1999, tree ring chronologies were established immediately north and east of Yellowknife. During 2000, the project was extended to the southwestern NWT along the MacKenzie and Liard Highways and to Nahanni National Park. This work has resulted in a network of ten tree-ring chronologies based on the sampling of *Pinus banksiana* (jack pine), *Picea glauca* (white spruce), and *Pinus contorta* (lodgepole pine). Most chronologies are currently 150-200 years in

length, but several range from 250 to 350 years. There are significant correlations of standardized ring-width data with annual and monthly precipitation, and mean annual and summer discharge for various rivers. The length and climate sensitivity of these preliminary chronologies indicates the potential for relatively long proxy climate and streamflow records from the southwestern NWT.

GLACIAL, INTERSTADIAL AND INTERGLACIAL ENVIRONMENTS OF THE YUKON – CONTRASTING THE EXTREMES.

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Glacial and interglacial environments were extremely different, interstadials intermediate. Glacial environments, known from organic poor deposits and lake sediments, exhibit pollen assemblages dominated by herbaceous taxa (i.e. Chenopodiaceae, Brassicaceae, Caryophyllaceae, *Polemonium*) including grass, sedge and *Artemisia*. Combined, the latter three can reach 60-70% of the pollen record when annual pollen influx may measure <100 grains/cm^2/yr. Macrofossils from Bluefish River (Grant Zazula, U of Alberta) include many of the above including abundant *Artemisia*. Sparse, xeric adapted, tundra vegetation dominated. Interglacial environments are known from organic alluvium, peats and soils indicating a significant increase in biological production. Spruce dominates with up to 90% as pollen and as logs, cones and needles. Closed canopy spruce forest with fir extended well beyond present limits giving evidence for a mesic climate as warm or warmer than today's. Interstadial environments, known from organic rich alluvial deposits, are intermediate between glacials and interglacials. Pollen assemblages indicate birch shrub tundra and open spruce woodland vegetation. Much of the 100 ka glacial-interglacial cycle can be characterized as interstadial. Unfortunately the stratigraphic record of fossil vertebrates is not established well enough to determine if mammalian biomass differed between glacials, interstadials and interglacials.

THE WARM PERIODS: YUKON'S INTERGLACIALS.

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Why all this interest in glacials? Interglacials are much more unusual. Tuned Marine Isotope Stage records indicate that interglacial environments are the exception, perhaps accounting for only 10% of the time over the last million years. A Holocene-centric perspective greatly influences our understanding of the Quaternary. For example, the culturally biased concept of refugia should be applied to the present biogeography not to the biogeography of the more common interstadials and glacials. Eight Yukon interglacials have now been recognized and dated by tephrochronology, TL and palaeomagnetics providing the most complete record of interglacials in North America. Yukon interglacials are characterized by closed canopy *Picea-Abies* forests with up to 90% spruce pollen, common spruce macrofossils and sphagnum. Plant and insect range extensions indicate warmer than present climates. Compared to the Holocene, notable are the reduced presence of *Alder* and general absence of *Pinus* while *Abies* was more abundant and widespread. This makes the Holocene, our basis for comparisons, a unique interglacial. Lack of permafrost in the past and influence of anthropogenic fire during the Holocene may account for the differences. Dense spruce forests no doubt provided poor conditions for Pleistocene megafauna which may not have been able to survive Yukon interglacials!

TRACKING PAST ALASKAN SOCKEYE SALMON STOCKS USING LAKE SEDIMENT RECORDS: ASSESSING THE ROLE OF ANTHROPOGENIC AND NATURAL STRESSORS.

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Past fish stocks have often been difficult to infer using paleolimnological records, although a variety of indirect techniques have been proposed (e.g., morphological changes in the carapaces of invertebrate fossils, invertebrate species assemblage changes sensitive to predation, and occasionally fish fossils). We believe that a combination of isotope, diatom, and invertebrate paleolimnological techniques can be used to track past Pacific sockeye salmon populations in nursery lake sediment profiles. These approaches determine changes in the returns of adult spawners by looking at nutrient indicators: the diatom and N isotope signature preserved in the sediment cores. In addition, we have been able to look at secondary trophic interactions by studying zooplankton microfossils preserved in the sediments as well. Our study of five Alaskan sockeye nursery lakes and two control systems over the past ca. 300 years illustrated the importance of climatic forcing on salmon populations, as well as the influence of commercial harvesting. We have now extended the time series for three study lakes over the past 2000 years and demonstrate even more striking and sustained variation.

PRE-QUATERNARY AND QUATERNARY DRAINAGE NET OF THE EASTERN URALS: RESTRUCTURING IN UPPER LINKS AND PLACERS' CONSERVATION.

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The region east of the southern Ural Mountains (Transuralian peneplain) is one of a few areas in the world where commercial placers of rock crystal (piezo-optical quartz) are found. The placers are restricted to small valleys (known under the local name "log"); they are upper links of an ancient (Miocene) drainage net which dissected the older – Mesozoic – peneplain. Neotectonic movements (mostly of block type) resulted in linear erosion of clayey weathering crust. The clay was removed, while fragments of crystal-bearing veins were deposited in stream channels, usually a few kilometers from the primary source. During the late Miocene - Pliocene, under

conditions of tectonic stability and rather high position of regional base level, a broad fluvial terrace developed in major valleys of the Ural and Tobol rivers. The upper links of drainage net ("logs") stopped functioning and became filled with loose slope deposits, and the piezo-quartz placers were buried under a thick (up to 15-20 m) layer of red clays.

Quaternary reactivation of linear erosion resulted in a fresh dissection of formerly planed interfluves. It is only occasionally, however, that newly formed valleys of small streams inherit former "logs." An analysis of buried erosional landform positions, and their order and rate of movement relative to major river valleys and block structures, gives an insight into regularities of placer occurrences and conservation.

THE VOLE *ALLOPHAIOMYS DECEITENSIS* FROM THE EARLY PLEISTOCENE OF FORT SELKIRK, YUKON TERRITORY, AND THE AGE OF THE CAPE DECEIT FAUNA, ALASKA.

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The vole *Allophaiomys deceitensis* dominates the mammal fauna from the "Fossil" locality at Fort Selkirk, Yukon Territory. The Fort Selkirk assemblage has a probable age between 1.5 and 1.8 million years BP, based on dates recently published by others: an Ar/Ar date of 1.37±0.03 Ma on an overlying basalt; a weighted mean corrected fission track age of 1.48±0.11 Ma on the Fort Selkirk Tephra beneath the basalt and immediately above sediments yielding an equivalent fauna at nearby "Cave;" and an Ar/Ar date of 1.83±0.3 Ma on a nearby basalt underlying the fossiliferous beds. Detailed comparison with the type sample of *Allophaiomys deceitensis* from Cape Deceit, western Alaska, demonstrates that the Cape Deceit *Allophaiomys* has slightly less positively differentiated enamel on the principal triangles of the first lower molar (Basic Triangle Quotient 97.8 for Cape Deceit, 91.4 for Fort Selkirk); and that the Cape Deceit sample contains lower frequencies of "complex" variants in the occlusal patterns of the first lower molar and third upper molar. These results indicate that the Cape Deceit fauna is slightly older than the Fort Selkirk assemblage. Because sediments preserving the Cape Deceit fauna show a normally oriented paleomagnetic signature, it is likely that the Cape Deceit Formation correlates with the Olduvai subchron (Matuyama chron), currently estimated at 1.95 to 1.77 Ma. Cape Deceit is therefore probably a latest Pliocene fauna.

DEGLACIATION OF NEWFOUNDLAND AS REVEALED BY ICE-FLOW MAPPING.

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The glaciation and Late Wisconsinan deglaciation of the Island of Newfoundland, Canada is known to be complex. A comparatively thin glacial sediment cover, combined with the widespread occurrence of bedrock suitable for the preservation of striations has allowed an extensive ice-flow mapping programme over the last 15 years. New data was combined with published records to develop a database containing over 10,000 records of ice-flow indicators.

The distribution of data is by no means uniform, but allows a re-examination of existing ideas of the glacial history of the Island. Preliminary interpretation suggests that the ice flow evidence is best explained by a more extensive ice cover at the glacial maximum than previously suggested, with confluence of Newfoundland and Laurentide ice in the Gulf of St Lawrence, and ice from the Northern Peninsula merging with ice from central Newfoundland over Notre Dame Bay. As deglaciation progressed a pattern emerged of distinct ice caps in central Newfoundland, the Northern Peninsula and Avalon Peninsula, that became more complex as deglaciation progressed and these ice caps fragmented further. The pattern described is combined with the radiocarbon record to provide a chronology of deglaciation.

LAKE AGASSIZ TRANSGRESSIONS AND FLOOD BURSTS: CONTROLS BY DIFFERENTIAL ISOSTATIC REBOUND AND THREE DIFFERENT OUTLETS.

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Differential isostatic rebound of proglacial lake basins around the Laurentide Ice Sheet led to transgressing and deepening waters south of the isobase that extended through the lake's overflow outlet. During the early stage of Lake Agassiz (Lockhart Phase; ca. 11.7-10.9 ka), when the outlet was at the southern end of the basin, the lake margin *regressed* through time; lake levels did not remain fixed, so the only beaches that formed were related to storms. Any abrupt drops in lake level did *not* leave distinct beaches.

Following this early phase of the lake, most beaches formed by *transgression*, as overflow shifted into the central (the ~~e~~eastern outlets;" ca. 10.9-10.1 ka and 9.4-8.0 ka) and northern (the Clearwater-Mackenzie outlet; ca. 10.1-9.4 ka) parts of the basin. Whenever lake level was drawn down as a result of outlet erosion or deglaciation of a lower overflow route, differential rebound forced the lake's margin to transgress upslope (southward), either until a new lower outlet was deglaciated or until transgressing waters reached the previous outlet. The resulting beaches typically grew in size as they transgressed upslope, so larger beaches relate to longer transgressive periods. Today these isochronous shoreline features outline the extent of the lake at the end of each transgression. These beaches can be used to date episodes of catastrophic outflow from Lake Agassiz and the related abrupt changes in lake area and volume, because they immediately followed the transgressive maximum.

WERE TREES AND CLIMATE OUT OF EQUILIBRIUM IN SOUTHERN NOVA SCOTIA 11 000 YEARS AGO?

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Pollen evidence indicates that spruce was limited to the central third of Nova Scotia prior to the start of the Younger Dryas (10 800 yr BP). The absence of spruce in southern Nova Scotia is puzzling as the modern temperature regime of Nova Scotia cools with increasing latitude. One possible explanation is that spruce entered central Nova Scotia via the Chignecto isthmus and had not had enough time to reach the south coast before the onset of the Younger Dryas. This explanation conflicts with the dynamic equilibrium hypothesis of plant migration which states that plants migrate in equilibrium with climate. To test the equilibrium hypothesis a network of 30 sites will be cored throughout Nova Scotia and analyzed for pollen and chironomids at a single time-slice prior to the Younger Dryas and just after the Killarney Oscillation (11 200 yr BP). The pollen data will be used to reconstruct the distribution of vegetation and the chironomid data will be used to reconstruct the late-glacial thermal regime. Taken together, the two sets of data will allow us to determine if spruce had filled its available habitat or if a migration lag existed. Preliminary data suggest that southern Nova Scotia was sufficiently warm to support spruce, thus spruce was not in equilibrium with climate in southern Nova Scotia.

PORT ELIZA CAVE: EXAMPLE OF THE GLACIAL STRATIGRAPHIC POTENTIAL OF WAVE CUT, MARINE CAVES.

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The Port Eliza cave is a wave cut, marine cave located on the west coast of Vancouver Island. It is approximately 60 m long and lies at 95 m asl, well above the Late Wisconsinan marine limit. A 2 m excavation near the back of the cave revealed a silty sand diamicton at the base that has the appearance of a till but contains abundant bones. This assemblage consists of well preserved specimens of amphibians, fish, birds and mammals. Mammals are represented mainly by the limb bones and teeth of voles, likely *Microtus townsendii*, Townsend's vole. Laminated clay makes up the rest of the sequence. A crust of speleothems with stalagmites up to 25 cm across covers portions of this sedimentary package. The lower diamicton is thought to represent debris flows from a glacier that incorporated bones on the floor of the cave. The laminated clays were deposited subglacially in standing water when a warm-based glacier covered the cave entrance. The speleothems were deposited after deglaciation.

Nineteen oriented samples were taken for paleomagnetic study from the laminated clay. Fluctuations in declinations suggest secular variation spanning a few hundreds to a few thousands of years. Preliminary radiocarbon ages of two of the vole mandibles are 18,010±100 (41.1 mg, CAMS-74624) and 16,340±60 (43.3 mg, CAMS-74625) and a piece of charcoal from just below the stalagmite is 9,540±40 (4.0 mg, CAMS-74626). These results will be placed into a regional context and the utility of stratigraphic studies in marine caves will be discussed.

ERUPTIVE TIMING OF THE WHITE RIVER ASH DEPOSIT (YUKON, NORTHWEST TERRITORIES, AND ALASKA).

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Of numerous unconsolidated tephra beds in the Yukon, Northwest Territories and south-central Alaska, the White River Ash is the largest and most distinct. This air-fall deposit of Holocene tephra has an estimated bulk volume of 25-50 km^3 and covers an area of more than 540,000 km^2. The ash is a bilobate product of two distinct eruptive events of Mount Churchill, ca.1887 years B.P. (northern-lobe ash) and 1147 years B.P. (eastern-lobe ash).

Recent stratigraphic evidence from several distal deposits of the White River Ash has revealed that the eastern-lobe eruption occurred during the late fall or early winter. Laterally continuous layers of frozen air-fall ash preserved between spring deposits of fluvial sand and gravel support this conclusion. Such accurate knowledge of eruption timing is of particular significance when assessing the cultural impact of volcanic activity on the region's Athapaskan peoples.

Currently, work is being done to develop a geochemical fingerprint to differentiate between the two lobes of ash. Other ongoing studies have indicated that the repose period between eruptions of Mount Churchill (approximately 740 years) is similar to that of several other pyroclastic volcanoes that have erupted unexpectedly after long periods of repose. This indicates a potential of further eruptive activity from Mount Churchill.

TEPHRA POWER: PROVIDING A SECURE CHRONOLOGIC FRAMEWORK FOR LATE CENOZOIC GEOLOGIC/PALEOENVIRONMENTAL STUDIES IN EASTERN BERINGIA.

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Tephra beds possess many of the attributes of index fossils, and like them, facilitate accurate correlation of strata over long distances, which, in some cases, are on a continental scale. They can be used to establish relative stratigraphic sequences, as with fossils, but also temporally calibrated sequences, because they can be dated by several radioisotopic methods. Characterization and dating are best done by grain-specific methods with high spatial resolution because tephra beds – especially distal occurrences – are typically contaminated, rendering bulk analyses suspect. The essential toolkit of a tephrochronologist, therefore, includes an electron microprobe for major-element analyses, a laser ablation inductively-coupled plasma mass spectrometer for trace-element analyses, and $^{40}Ar/^{39}Ar$ (feldspar) or fission-track (glass, zircon) systems for dating, preferably augmented by paleomagnetic data.

Widespread, silicic tephra beds across eastern Beringia come from volcanoes in the eastern Aleutian arc – Alaska Peninsula (AAAP) region or the Wrangell volcanic field (WVF). Glass morphology, mineral content, and geochemistry of each tephra bed clearly reveal its provenance. For example, tephra beds from AAAP have few crystals, mainly bubble-wall glass shards, abundant pyroxene, and rare-earth-element (REE) profiles with a well developed Eu anomaly. In contrast, tephra beds from WVF have many crystals, the glass is mainly in the form of highly inflated pumice, hornblende is abundant, and REE profiles are steep with a weakly developed Eu anomaly.

Detailed late Cenozoic tephrostratigraphic records are available for two areas where gold mining activities have produced many exposures of late Cenozoic sediments: Fairbanks, central Alaska and the Klondike region of Yukon. Nineteen distinctive distal tephra beds have been recognized in the Gold Hill Loess at Fairbanks. They include, in order of increasing age (Ma): VT (0.13±0.03), HH, Old Crow (0.14±0.01), Sheep Creek (0.19±0.02), PH, HP (0.61±0.05), Ester Ash (0.81±0.07), SP (0.87±0.06), AT, WP (1.03±0.10), Mosquito Gulch (1.45±0.14), and PA (2.02±0.14). Underlined beds come from the WVF. They reveal a fragmentary loess record with numerous unconformities and show that loess deposition in central Alaska began in the late Pliocene.

Twenty distinctive tephra beds have been identified in the Klondike area, although many samples remain to be studied. They include: White River Ash (1-2 ka), Dawson (c. 20 ka), VT, Old Crow, Dominion Creek (0.17±0.02), Sheep Creek, Midnight Dome (1.09±0.18), Flat Creek (1.23±0.18) Mosquito Gulch, Paradise Hill (1.54±0.13), Quartz Creek (2.97±0.24), and Dago Hill (3.18±0.41). They show that the gold-bearing Upper White Channel gravel is of late Pliocene age, as is the earliest permafrost and first extensive Cordilleran glaciation. As well, they provide a chronology for at least five separate interglacials, and indicate that prominent glaciers existed in the Ogilvie Mountains at 1.5 Ma.

Surprisingly, only four tephra beds are common to these two areas: VT, OC, SC, and MG. Fortunately, several sites with thick loess and multiple tephra beds occur along the Yukon River in and near the Yukon-Charley National Preserve, Alaska, and, given their intermediate position, they may well provide additional linkages between the Fairbanks and Klondike tephrostratigraphical records. Work on these new sites is in progress.

The outcome will be a late Cenozoic time-stratigraphic framework applicable to much of eastern Beringia, facilitating connections of Ice-Age records, and improving the temporal calibration of climate/environmental change in this region during the last three million years.

AGE OF THE REID GLACIATION IN CENTRAL YUKON.

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Tephra beds and their paleoenvironmental setting at Ash Bend on the Stewart River help to constrain the age of the Reid Glaciation in central Yukon. Sheep Creek tephra (UT1052) occurs in sediments which fill a channel cut into the Reid glacial drift. It separates organic-rich silt with spruce logs, abundant spruce pollen, and remains of bison, mammoth, and moose (boreal forest) from overlying silts with less spruce pollen (transitional), which, in turn, are overlain by silts and sands with sparse, poorly-preserved pollen of Cyperaceae, Poaceae and *Artemisia* (tundra).

Sheep Creek tephra has a TL age of 190 ± 20 ka, in agreement with (1) a glass-DCFT age of 174 ± 20 ka for Dominion Creek tephra (UT1456), which occurs 30 cm above Sheep Creek tephra in the Klondike goldfields, and (2) a weighted mean glass-ITPFT age on Old Crow tephra of 140 ± 10 ka, situated 3 m above Sheep Creek tephra at Eva Creek, Fairbanks, Alaska. The TL age of Sheep Creek tephra puts it at the boundary between MIS 6 and MIS 7, exactly the paleoenviromental setting recorded at Ash Bend. In other words, the dense boreal forest environment belongs to interglacial MIS 7 and the succeeding tundra conditions to MIS 6.

These constraints strongly suggest an MIS 8 age for the Reid Glaciation. This is consistent with non-deposition of speleothems in caves of the Mackenzie Mountains between 210-280 ka, and a major peak in the rate of terrigeneous sediment input to the Gulf of Alaska at 250 ka. At present, there is no tightly constrained maximum age for the Reid Glaciation.

MELTOUT TILL OVERLYING LAURENTIDE BASAL ICE, MACKENZIE DELTA AREA, CANADA.

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Recently "ground ice" in the Mackenzie Delta, north-west Canada has been reinterpreted as buried glacier ice of the Laurentide Ice Sheet. Clast macro-fabric analysis in massive, deformed ice, icy sediments, meltout diamicton and the Toker Point Till in the Eskimo Lakes area and around Mason Bay, Richards Island, supports the glacier ice hypothesis. Fabrics conform to ice movement directions inferred from the distribution of erratics, striations on bedrock, streamlined landforms and ice-marginal features and are very similar to those of Lawson's classic Matanuska Glacier study.

It has been suggested that preservation potential of meltout till, in particular supraglacial meltout till, is poor, especially where "shear instability" and "hydraulic instability" are high, and that thick, extensive, massive tills are unlikely to form from either subglacial or supraglacial debris meltout. The present study suggests that some meltout till, though perhaps not thick sheets, can be deposited and preserved in areas with low ice gradients, high hydraulic conductivity, limited involution activity, burial beneath other sediments and subsequent permafrost aggradation, typical of the Mackenzie Delta area.

A SIMULATION ENVIRONMENT FOR PLEISTOCENE EXTINCTIONS: A TEACHING AND RESEARCH TOOL.

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The search for the causes of the Pleistocene Extinctions is handicapped by simplistic conceptual models. An adequate model would allow precision in quantities and timing (how much overhunting? when?), exhibit internal dynamics (if predators reduce prey populations, how does this affect predators in turn?), and support comparison of competing hypotheses.

This poster session presents a system dynamics model developed to specify and compare a new hypothesis – Second Order Predation – with the overkill hypothesis. The model provides a quantitative description of the interrelationships between plant stocks (high and low quality grass, big and small trees), herbivore stocks (browsers, mixed-feeders and ruminant and non-ruminant grazers), carnivores, and *Homo sapiens.* Different assumptions regarding *H. sapiens* in-migration, predator or prey hunting, and other factors can be simulated. For certain reasonable starting values, results are consistent with Second Order Predation: killing of carnivores leads to herbivore overpopulation, then habitat destruction, and ultimately to differential extinction of herbivores.

With a zero predator kill rate, extinctions occur only if *Homo sapiens* food requirements and in-migration are set to improbably high values.

Participants will learn to run the model, interpret results, and change inputs to reflect other assumptions. The simulation software is available on CD or from http://quaternary.net/extinct2000.

TUNDRA, TRUCKS AND EXTINCTIONS OR: ARE BISON THE PRAIRIE'S WAY OF MAKING MORE PRAIRIE?

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Classically, we have assumed that environment shapes animal evolution. However, allowing for the impact of animal on environment creates the basis for a new understanding of the Pleistocene. The Second-Order Predation Hypothesis holds that a herbivore population boom, caused *by Homo sapiens* predator hunting, led to over-use of vegetation, and, finally, to environmental exhaustion and the extinction of herbivores.

The author's system dynamics model specifies this hypothesis through a quantitative description of the interrelationships between four plant stocks; high and low quality grass, big and small trees; four herbivore stocks; browsers, mixed-feeders and ruminant and non-ruminant grazers; carnivores, and *Homo sapiens*.

Model simulations show how a herbivore boom may have wiped out trees and in turn caused “plaid” Pleistocene environments to give way to “striped” Holocene environments. Bison, having become smaller and obligate grazers, then maintained the prairie.

Although not covered by the model, thinking about the impact of fauna on environment suggests that Pleistocene megaherbivores may have maintained well-drained soils by breaking up the permafrost, just as military trucks in the Arctic during WWII did. The absence of megaherbivores allowed permafrost and tundra to form creating environmental change.

The model is available on CD or from http://quaternary.net/extinct2000/.

DETERMINING FLOOD AND CLIMATE HISTORY OF THE PEACE-ATHABASCA DELTA USING A MULTIDISCIPLINARY PALEOLIMNOLOGICAL APPROACH.

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The Peace-Athabasca Delta (PAD) spans 3900 km^2 and is one of the world’s largest freshwater boreal deltas. Numerous perched basins and surrounding wetlands provide a rich habitat for wildlife including large muskrat, bison and duck populations. The nutrient and water balances of these basins, and resulting ecological conditions, are highly dependent on periodic flooding which occurs almost exclusively during high backwater events caused by spring ice-jams on the Peace and Athabasca Rivers. In the absence of periodic flooding, water levels decline and isolated basins can dry up completely resulting in loss of marsh environment.

Reduced spring flooding due to flow regulation on the Peace River and climate change represent competing hypotheses to explain dry conditions that have characterized the PAD during much of the past 30 years. Rigorous scientific assessment of these hypotheses, however, has been hampered by the lack of hydrological and ecological records of the PAD beyond the brief historical period. In order to evaluate the role of climate variability in regulating flood regimes and ecosystem health of the PAD, we are conducting a multidisciplinary study aimed at producing high-resolution paleolimnological records covering the past 1000 years. Results from this project will contribute to more effective management of water and ecological resources in the PAD.

PRELIMINARY CHRONOLOGY OF SAND DUNE ACTIVITY IN THE PRAIRIE PROVINCES, CANADA.

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A chronology of sand dune activity in the prairie provinces is being established using radiocarbon and optical ages. Radiocarbon ages from paleosols date stability, whereas those from organic material within underlying sediments provide maximum limiting ages of dune deposits. Optical ages from stratigraphic sections provide depositional chronologies, whereas those from shallow-depth samples from the heads of stabilized dunes provide the time of most recent activity. More than 90 radiocarbon ages from published sources have been mapped (Manitoba - 50, Saskatchewan - 39, Alberta - 2), and 75 optical ages have been determined (Manitoba - 12 , Saskatchewan - 57, Alberta - 6).

Dunes in the southern prairies have been repeatedly active during the late Holocene. In the driest portions of the prairies, most of the dunes have been active in the last 200 years as a result of drought in the late 1700s, and the others show evidence of activity in the last millennium. Ages in the southern boreal region indicate that dunes have been reactivated in the Holocene, possibly due to fire or a northward shift of ecozones in association with drought. Chronologies for northern regions are presently being prepared.

THE FULL-GLACIAL ENVIRONMENT OF THE BLUEFISH WATERSHED: PRELIMINARY MACROBOTANICAL ANALYSIS OF THE BLUEFISH EXPOSURE.

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Investigations at the Bluefish Exposure (site HH-75-24, 140^{o} 21.5’ W long., 67^{o}23’ N lat.) have yielded information on the full-glacial environment in the Bluefish watershed, northern Yukon. As the Late Wisconsinan Laurentide ice rearranged the local drainage, water inundated the Old Crow and Bluefish Basins, and sediments were deposited in a shallow-water, near-shore deltaic environment as the Bluefish River drained into the proglacial Bluefish Lake. At the Bluefish Exposure, in the Upper Bluefish unit, organic detritus deposited within cross-bedded sands and silts were derived from, and therefore, at some level representative of the local vegetation. This AMS C^{14} macrobotanical assemblage is dominated by Poaceae sp. florets and seeds, Brassicaceae cf. *Draba* sp., various taxa of *Carex* sp., various taxa of Caryophyllaceae (cf. *Arenaria* sp., cf. *Cerastium* sp. and cf. *Silene* sp.), *Papaver* cf. Radicatum type, *Potentilla* sp., and *Artemisia* sp. flowers. These macrobotanical data support full-glacial pollen data from the Bluefish Exposure, interpreted as a nearly treeless or shrubless steppe-tundra vegetation during a period of extreme cold and aridity. Dated *Artemisia* sp. confirms its presence in the local vegetation of the Bluefish watershed and likely at other sites in eastern Beringia where it is present in full-glacial pollen assemblages.

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