

**37th Annual
Yellowknife Geoscience Forum
Abstracts of Talks and Posters
*November 17-19, 2009***



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In memory of Dr. Stephen Goff



This Abstract Volume is dedicated to Dr. Stephen Goff, our friend and colleague who passed away unexpectedly on Saturday, August 1, 2009. Steve was a District Geologist with the Northwest Territories Geoscience Office in Yellowknife.

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TECHNICAL PROGRAM

TUESDAY, NOVEMBER 17 (MORNING)

Theatre 1 – Exploration & Geoscience

Chairs: Edith Martel, Pattie Beales

08:40 Ketchum, J.W.F. and Cairns, S.R. - Northwest Territories Geoscience Office: Overview of Current Activities

09:00 Ham, L.J. and Costello, K.D. - Nunavut: Growing into the Next Decade

09:20 Adcock, S.W., Spirito, W.A., Chorlton, L. B., Paulen, R.C., McClenaghan, M.B., and Kerr, D.E.* - The Nunavut Indicator Mineral Compilation and the Canadian Database of Geochemical Surveys: A Strategy for Harmonized Management and Dissemination over the Internet

09:40 Webb, D.R., Pratico, V.V., and Regular, M. - Update on Tyhee Development Corp's Yellowknife Gold Project, NWT

* denotes speaker

10:00 Coffee (sponsored by Sub-Arctic Surveys Ltd.)

10:20 Kivi, K.R., Doyle, B.J., and Senn, M.J. - 2009 Exploration Update for the Providence Nickel Discovery, Slave Province, NT.

10:40 Manojlovic, P.M. - New Discoveries at the Wishbone Silver - Zinc and Back River Gold Projects

11:00 Lane, G. - The Role of Mineralogy in Exploration

11:20 Schleiss, W.A. and Burns, R.F. - Developing the World-Class Pine Point Property

11:40 Coffee (sponsored by NWT & Nunavut Chamber of Mines)

12:00 Mawdsley, B. - Working Effectively with the Mineral Analysis Laboratory

12:20 Kjarsgaard, B.A. and Wright, D. F. - Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park

12:40 Welcome

13:00 Lunch (sponsored by Boart Longyear Drilling Services, Nuna Group of Companies, and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick's School gymnasium

Theatre 2 – Regulatory Issues

Chairs: Andy Graw, Angie Norris

08:40 Hamre, K. - NWT Protected Areas Strategy: Status of Land Access and Protected Areas Decision Making

09:00 Wright-Bird, J. and Wiebe, H. - The Sahtu Land Use Plan: Challenges & Solutions

09:20 Beveridge, M. and Mills, C. - Draft NWT Water Stewardship Strategy

09:40 Holder, J., Seale, L., MacDonald, B.A., Fleck, S., Lakusta, T.*, Machtans, C., and Smith, R. - Seismic Exploration Guidance for the Protection of Land, Forest, and Wildlife in the Northwest Territories

10:00 Coffee (sponsored by Sub-Arctic Surveys Ltd.)

- 10:20 Slack, T.** - Exploration Agreements in the Akaitcho Region – The Yellowknives Dene Perspective
- 10:40 Kanigan, J.C.N.** - Updating the Northern Land Use Guidelines for the Northwest Territories and Nunavut
- 11:00 Racher, K.** - Clarity, Certainty and Consistency in Land and Water Board Processes: A Work in Progress
- 11:20 Traynor, S.** - Northern Regulatory Improvement Initiative: Update on Progress
- 11:40 Coffee** (sponsored by NWT & Nunavut Chamber of Mines)
- 12:00 Hoogeveen, D.** - Exploring the Debate over “Free-Entry” Mineral Staking (*student presentation*)
- 12:20 Hardin, M.J.** - The Duty to Consult and Accommodate: Current Judicial and Statutory Developments
- 12:40 Welcome** (Theatre 1)
- 13:00 Lunch** (sponsored by Boart Longyear Drilling Services, Nuna Group of Companies, and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick’s School gymnasium

TUESDAY, NOVEMBER 17 (AFTERNOON)

Theatre 1 – Exploration & Geoscience

Chairs: John Ketchum, Don James

- 12:30-19:00 Trade Show** – Weledeh and St. Patrick’s School gymnasium – Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)
- 14:50 Falck, H. and Day, S.** - New Stream Sediment Survey Results from the Arctic Red and Mountain Rivers, Mackenzie Mountains, NTS 106 A and B
- 15:10 Martel E., Fischer B., and Falck, H.** - Selwyn-Mackenzie Shale Basins Project: Is another Red Dog Hiding in the Misty Creek Embayment?
- 15:30 Dunning, J.K.** - Selwyn Project: Poised for Developing High-Grade Zinc & Lead
- 15:50 Kirkham, G., Baker, F., and Falck, H.** - The Cantung Mine: Using 3D Modeling for Exploration Targeting and Resource/Reserve Calculations
- 16:10 Burns, R.F.** - Sedimentary Copper, Lead and Zinc in the NWT
- 16:30-19:00 Reception** (sponsored by Diavik Diamond Mine (a Rio Tinto/Harry Winston joint venture), First Air – The Airline of the North, Trinity Helicopters Ltd., and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick’s School gymnasium – please don’t drink and drive. Complimentary rides home are provided by St. Patrick’s SADD. Pick-up is in the Weledeh parking lot.
- 19:00 Charles Camsell Talk: Dr. Jean-Bernard Caron** (sponsored by NAPEG, and Yellowknife 2007) – Prince of Wales Heritage Centre
- 19:00 EBA Reception** in support of NWT Mining Heritage Society – Top Knight (4910 49 St)

Theatre 2 – Mining Practices & Northern Infrastructure

Chairs: Val Gordon, Fraser Fairman

12:30-19:00 Trade Show – Weledeh and St. Patrick's School gymnasium – Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)

14:50 Reichard, P. - Collapsible Fuel Tanks – Economic and Environmental Benefits for Arctic Operations

15:10 Hunter, R., Zaluski, G., and Willy, S. - Uranium in the Thelon Basin – A Future for Responsible Mineral Development in Canada's North?

15:30 Rarog, M. and Bourke, R. - Evolving Standards for Northern Field Worker Safety

15:50 Campeau, C. - An Alternative for Lack of Marine Infrastructure: Ocean Group's Floating Wharves

16:30-19:00 Reception (sponsored by Diavik Diamond Mine (a Rio Tinto/Harry Winston joint venture), First Air – The Airline of the North, Trinity Helicopters Ltd., and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick's School gymnasium – please don't drink and drive. Complimentary rides home are provided by St. Patrick's SADD. Pick-up is in the Weledeh parking lot.

19:00 Charles Camsell Talk: Dr. Jean-Bernard Caron (sponsored by NAPEG, and Yellowknife 2007) – Prince of Wales Heritage Centre

19:00 EBA Reception in support of NWT Mining Heritage Society – Top Knight (4910 49 St)

Theatre 3 – Energy in Canada's North Session

Chair: Adrienne Jones

12:30- 19:00 Trade Show – Weledeh and St. Patrick's School gymnasium – Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)

14:50 MacNaughton, R.B., Fallas, K.M., Gal, L.P., Hadlari, T., and Sommers, M. - Geo-Mapping for Energy and Minerals (GEM): 2009 GSC-NTGO Field Studies in the Mackenzie Corridor

15:10 Price, P.R. and Enachescu, M.E. - The Maunoir Oil Discovery – A Cambrian Clastic Oil Discovery within the Sahtu Settlement Region of the Central Mackenzie Valley, NWT

15:30 Issler, D.R., Chen, Z., Hu, K., and Lane, L.S. - Geo-Mapping for Energy and Minerals (GEM): Studies of the Beaufort-Mackenzie Basin Thermal Regime

15:50 Drummond, K.J. - Tarsiut-Amauligak Fault Zone, Beaufort Sea, Ultimate Oil and Gas Resources

16:10 Blasco, S.M., Bennett, R., MacKillop, K., Youngblut, S.E., Brucker, S.T., and Blasco K.A. - Seabed Geohazard Constraints to Deep Water Exploration Drilling in the Canadian Beaufort Sea

16:30-19:00 Reception (sponsored by Diavik Diamond Mine (a Rio Tinto/Harry Winston joint venture), First Air – The Airline of the North, Trinity Helicopters Ltd., and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick's School gymnasium – please don't drink and drive. Complimentary rides home are provided by St. Patrick's SADD. Pick-up is in the Weledeh parking lot.

19:00 Charles Camsell Talk: Dr. Jean-Bernard Caron (sponsored by NAPEG, and Yellowknife 2007) – Prince of Wales Heritage Centre

19:00 EBA Reception in support of NWT Mining Heritage Society – Top Knight (4910 49 St)

TUESDAY, NOVEMBER 17 (EVENING)

Charles Camsell Talk

Tuesday November 17, 2009; 7 pm

Prince of Wales Northern Heritage Centre (PWNHC)

Sponsored by NAPEG and Yellowknife 2007, open to the public (free)

Dr. Jean-Bernard Caron, Royal Ontario Museum

Treasures of the Burgess Shale; A paleontological windfall revisited

Speaker Biography

A profound curiosity about fossils during his childhood led Jean-Bernard Caron to collect and curate his own personal fossil collection in his native France. By the age of 10, he knew he wanted to become a professional palaeontologist. As a teenager, he often joined various professional field crews across Europe for summer field expeditions collecting fossils, and the experience gained as a volunteer field assistant led to an invitation from Desmond Collins, then Curator of Invertebrate Palaeontology at the Royal Ontario Museum (ROM), to join his field crew at the famous Burgess Shale fossil deposit in British Columbia. This was his first visit to Canada, and he returned to the Burgess Shale as a ROM volunteer for the following two summer field seasons.

His Master's thesis dealt with *Banffia constricta*, one of the most bizarre animals known from the Burgess Shale. By the end of his Ph.D. project, Jean-Bernard had examined about half the Burgess Shale specimens (more than 70,000 fossils) stored at the ROM, which houses what can now be considered the world's largest collection of its kind. He joined the ROM as Associate Curator of Invertebrate Paleontology in early 2006, thus finally fulfilling his long-standing childhood dream.

At present, his main responsibilities are to curate and interpret fossils from the very large ROM Burgess Shale collection. This represents a real Pandora's Box for science, with many new organisms still to be described. He also studies fossils from other deposits, particularly in China, where there are sites of similar age and quality of preservation. These Burgess Shale-type deposits yield spectacularly preserved soft-bodied organisms. Because of their great age (about half a billion years old), they are of crucial importance for the study of the origins of animal groups during the Cambrian evolutionary bloom.

WEDNESDAY, NOVEMBER 18 (MORNING)

Theatre 1 – Exploration & Geoscience

Chairs: Don James, Edith Martel

- 09:00** **Armstrong, J.P.** – An update on the Hammer and Aviat Projects, Nunavut
- 09:20** **Corrigan, D., Nadeau, L., Brouillette, P., Tremblay, T., Boutin, M., Wodicka, N., Houlé, M., Spratt, J., Erdmann, S., Clark, D., Partin, C., Day, S., and Kuiper, Y.** - The GEM-Minerals Program on Melville Peninsula: Project Summary and Preliminary Report
- 09:40** **Kienlen, B.** - Unexplored Potential of the Amaruk Project
- 10:00** **Coffee** (sponsored by De Beers Canada Inc.)
- 10:20** **Tremblay, T., Paulen, R., and Corrigan, D.** - Quaternary Geology Studies in Northern Melville Peninsula, Nunavut
- 10:40** **Duke, N., MacLeod, M., and Iannelli, T.** - Bedrock Geology and Mineral Resources of IOL PI-17, North-Central Baffin Island
- 11:00** **Young, M., Sanborn-Barrie, M., Dyke, A., James, D., Lynds, T., Craven, J., and Coyle, M.** - The Cumberland Peninsula GEM Project: Overview of 2009 Field Results and Insights into Exploration Potential
- 11:20** **Turner, E.C. and Long, D.G.F.** - Rift-Related Shale Lithostratigraphy, Chemostratigraphy and Metal Prospectivity, Mesoproterozoic Borden Basin, Nu
- 11:40** **Coffee** (sponsored by NWT & Nunavut Chamber of Mines)
- 12:00** **Long, D.G.F. and Turner, E.C.** - Tectonic, Sedimentary and Metallogenic Re-Evaluation of Basal Strata in the Mesoproterozoic Bylot Basins (NU): Are Unconformity-Type Uranium Concentrations a Realistic Expectation?
- 12:20** **Bédard J., Rainbird, R.H., Dewing, K., Hadlari, T., Harris, J., Ootes, L., and Sharpe, D.** - Victoria Island GEM Project: Base and Precious Metal Potential of Minto Inlier and Surrounding Region, N.W.T. and Nunavut
- 12:40** **Harris, J.** - Nuclear North of 60° – Total Energy Supply for Remote Human Habitations
- 13:00** **Lunch** (sponsored by NWT & Nunavut Chamber of Mines) – Capitol Theatre
- 13:00** **NWT & Nunavut Chamber of Mines AGM** (ticket is required) – Yellowknife Inn, Copper Room

Theatre 2 – Climate Change

Chairs: Steve Kokelj, Carl Ozyer

- 09:00** **Kokelj, S.V., Thompson, M., Thienpont, J., Lantz, T.C., Pisaric, M., Smol, J., Blais, J., and Zajdlik, B.** - Climate Warming, Permafrost Degradation and Impacts to Aquatic Environments, Western Arctic, NWT, Canada.
- 09:20** **Palmer, M.J., Kokelj, S.V., and Burn, C.R.** - Permafrost Conditions across the Treeline: A Case Study from the Mackenzie Delta Area
- 09:40** **Nesbitt, L. and Ripley, S.** - The Impacts of Climate Change on Water and Wastewater Systems: Assessment and Monitoring in the NWT
- 10:00** **Coffee** (sponsored by De Beers Canada Inc.)

- 10:20 Seto, J.T.C.** - Considering Climate Change in Northern Development
- 10:40 Cousineau, G.S.** - Climate Change Adaptation and Northern Transportation
- 11:00 Kokelj, S.V., Riseborough, D., Coutts, R., and Kanigan, J.C.N.*** - Permafrost and Terrain Conditions at Northern Drilling-Mud Sumps: Impacts of Vegetation and Climate Change and the Management Implications
- 11:20 Holubec, I., Auld, H., Fernandez, S. and Wang, B.** - Climate (Temperature) and Ground Temperature Dynamic Normals for Northern Canada
- 11:40 Coffee** (sponsored by NWT & Nunavut Chamber of Mines)
- 12:00 Kokelj, S.V., Lantz, T.C., Pisaric, M.F.J., Solomon, S., and Morse, P.** - Large Scale Impacts of a Storm Surge in the Outer Mackenzie Delta, N.W.T.
- 12:20 Whalen, D., Solomon, S., Forbes, D., Manson G., Plewes, M.** - The Changing River Morphology of the Mackenzie Delta
- 12:40 Simons, B., De La Mare, C., Stevens, C., Panayi, D.** - Climate Change and Wildlife in Canada's North
- 13:00 Lunch** (sponsored by NWT & Nunavut Chamber of Mines) – Capitol Theatre
- 13:00 NWT & Nunavut Chamber of Mines AGM** (ticket is required) – Yellowknife Inn, Copper Room

Theatre 3 – Outreach

Chairs: Diane Baldwin, Fritz Griffith

- 10:00 Coffee** (sponsored by De Beers Canada Inc.)
- 10:20 Enge, A.** - Creating Partnerships through Training
- 10:40 Chouinard, R.** - Investigating Community Mine Education Strategies: A Case Study with the Tlicho Community, NWT, Canada (*student presentation*)
- 11:00 Matthews, S.** - Tundra Science Camp at the Tundra Ecosystem Research Station, NWT
- 11:20 Griffith, F.** - Community Mapping Program: Geoscience Outreach with a Hands-on Approach
- 11:40 Coffee** (sponsored by NWT & Nunavut Chamber of Mines)
- 12:00 Ham, L.** - Geoscience Outreach: Rock and Mineral Kits across Nunavut
- 12:20 Daniel, S.** - Experiential Science
- 13:00 Lunch** (sponsored by NWT & Nunavut Chamber of Mines) – Capitol Theatre
- 13:00 NWT & Nunavut Chamber of Mines AGM** (ticket is required) – Yellowknife Inn, Copper Room

WEDNESDAY, NOVEMBER 18 (AFTERNOON)

Theatre 1 – Keynote Address

14:00-14:50 Keynote Presentation (open to delegates)

Dr. Dan Marshall, Simon Fraser University - The Mountain River Emerald Occurrence, Northwest Territories: A New Environment for Emerald Formation in the Continuum of Gem-Beryl and Emerald Deposits Worldwide

Dr. Marshall is The Howard Street Robinson Lecturer chosen by the Mineral Deposits Division and the Precambrian Division of the GAC[®]. It is funded by the Robinson Fund of the GAC[®] that was established in 1977, following the bequest to GAC[®] from the estate of Howard Street Robinson, a founding member of GAC[®]. The bequest was "for furtherance of scientific study of Precambrian Geology and Metal Mining."

Dr. Marshall's lecture will cover the occurrences of emerald within the Canadian Cordillera. The talk includes information on the various types of emerald and gem beryl occurrences, exploration models and background information on the Canadian occurrences in a global framework.

Speaker Biography

Dr. Marshall was born and raised south of Ottawa. He attended Carleton University for his BSc and MSc studies finishing his MSc in 1990. He completed his DSc in Switzerland in 1995 studying the PTt path of the Mont Blanc massif using a variety of thermobarometric techniques, specifically fluid inclusions, on a variety of sub-economic ore occurrences. He did a one year NSERC post-doctoral fellowship on the Sudbury mineralization, followed by a sessional lectureship at Carleton University. In 1998 he moved to the nascent Geology program at Simon Fraser. Currently, his research remains focused on thermobarometry applied to a variety of mineralization types and PTt studies.

14:00-17:00 Sahtu Land Use Plan – Industry Workshop – Yellowknife Inn, Garnet Room

14:00-19:00 Trade Show – Weledeh and St. Patrick's School gymnasium – Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)

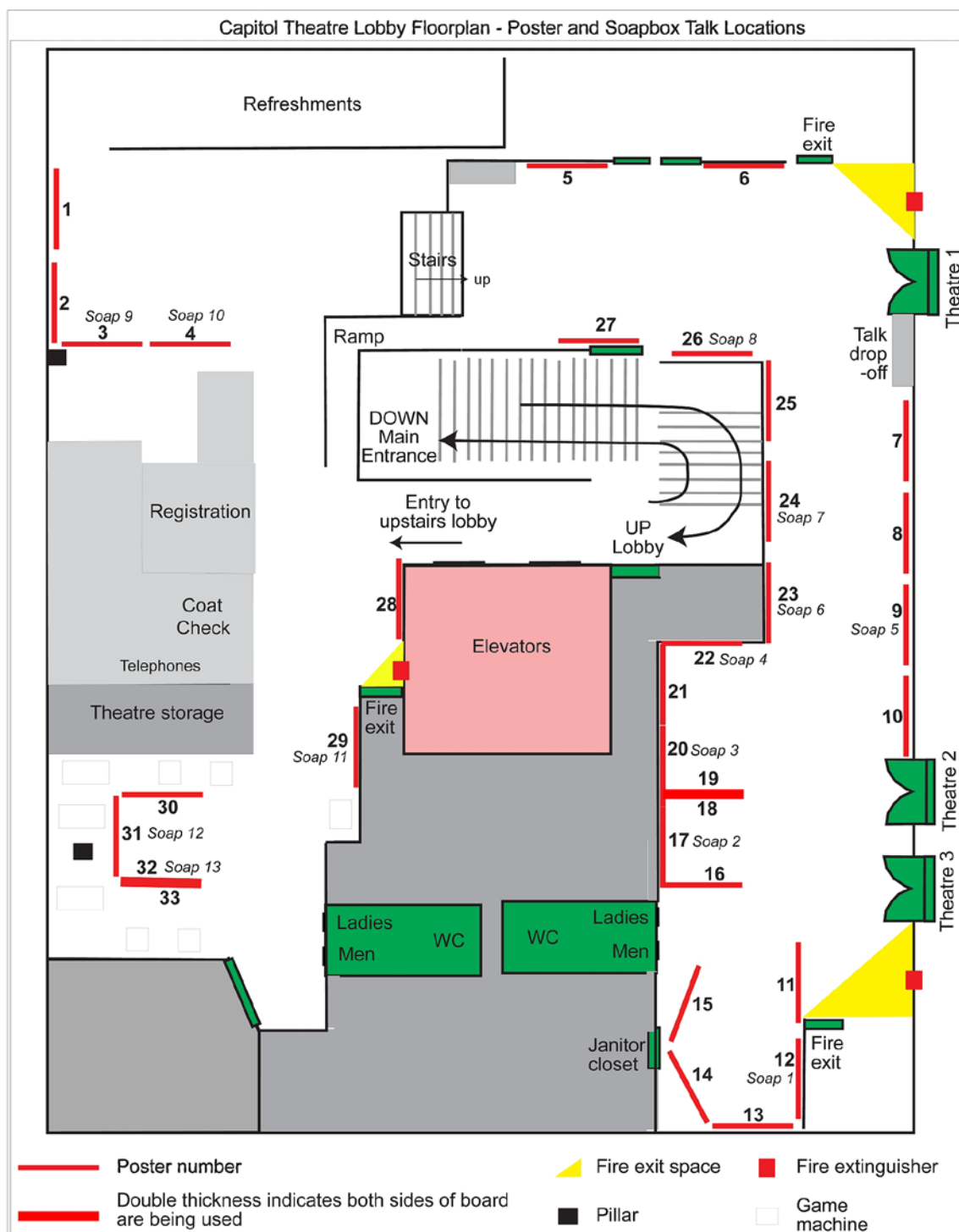
14:50-16:30 Poster Session (Sponsored by Yellowknife 2007) – Capitol Theatre Lobby

16:30- 19:00 Reception (sponsored by Nuna Group of Companies, and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick's School gymnasium – please don't drink and drive. Complimentary rides home are provided by St. Patrick's SADD. Pick-up is in the Weledeh parking lot.

17:00 NAPEG Annual General Meeting The Explorer Hotel, Katimavik Room C

Capitol Theatre Lobby - Poster Session & Soap Box Talks (14:50 to 16:30) (sponsored by Yellowknife 2007)

Chairs: Beth Fischer, Val Jackson



Posters (by Location)

Location	First Author Surname	Title	Category
1	MacLeod[∞]	<i>Manganese and Phosphorous Enrichment In Baffinland Iron Mines Corp. Deposit No. 1, Mary River Iron Formation, Northern Baffin Island, Nunavut</i>	Min Dep - Baffin
2	Sanborn-Barrie	<i>A New Bedrock Geology Map of the Cumberland Peninsula, Nunavut: An Initial Step in Evaluating the Mineral Potential of Eastern Baffin Island</i>	Geoscience - Baffin
3	Tschirhart^{*∞}	<i>Preliminary 3D geophysical modeling of the Aberdeen Sub-Basin, Thelon Province, Nunavut</i>	Geophys - Thelon
4	Peter[*]	<i>Hyperspectral Surveying in Support of Mineral Exploration in Canada's North; Rationale, Methodology, and an Example from the Hackett River Greenstone Belt, Nunavut</i>	Rem Sens - Slave
5	Mvondo	<i>Study of a Structural and Stratigraphic Link between Elu and Hope Bay Greenstone Belts, NE Slave Craton</i>	Geoscience - Slave
6	Kerswill	<i>Activities under the Mineral Resource Assessment Component, GEM Minerals Program</i>	Remote Mapping
7	Ootes	<i>Is Our Bedrock 'Green'stone? Dimension and Building Stone Opportunities in the North Slave</i>	Min Dep - Slave
8	Mumford[∞]	<i>The Petrology of the Blachford Lake Intrusive Suite: Putting HFSE and Cu-PGE Mineralization into Context</i>	Min Dep - Slave
9	Smith^{*∞}	<i>Characterization of Gold and Base-Metal Mineralization Styles in the North End of the Yellowknife Greenstone Belt</i>	Min Dep - Slave
10	Ripple	<i>Fluid and Thermal History of a Breccia Zone of the West Bay Fault, Northwest Territories</i>	Min Dep - Slave
11	Cheng	<i>Chemicals Management from Cradle to Grave</i>	Environmental Mgmt
12	Macumber^{*∞}	<i>High Resolution Paleoclimatic Study of Lacustrine Sediments along Tibbitt Contwoyto Ice Road, Yellowknife, NWT, Canada</i>	Climate Change
13	Whalen	<i>The Changing River Morphology of the Mackenzie Delta</i>	Infrastructure / Geomorph
14	Jones	<i>Regional Geoscience Studies and Petroleum Potential, Peel Plateau and Plain, Northwest Territories and Yukon: Final Deliverables</i>	Energy
15	Kerr	<i>Tri-Territorial Surficial Geology Map Integration</i>	Surficial
16	Baldwin	<i>Community Mapping Program: Fort McPherson, NWT</i>	Outreach
17	Tappert[*]	<i>The Future of Core Logging: The Reflectance Spectroscopy of Hematite and Micas from the IOCG Deposit at Olympic Dam, South Australia</i>	Wopmay/IOCG
18	Montreuil	<i>IOCG Environments in the Great Bear Magmatic Zone</i>	Wopmay/IOCG
19	Acosta Gongora[∞]	<i>Preliminary Observations of the IOCG Mineralization at the DAMP, FAB, and Nori Showings, Great Bear Magmatic Zone</i>	Wopmay/IOCG
20	Lee^{*∞}	<i>Geophysical Interpretation of the South Wopmay, Northwest Territories, Canada</i>	Wopmay/IOCG
21	Jackson	<i>South Wopmay Bedrock Mapping Project: Highlights from 2009</i>	Wopmay/IOCG
22	Smar^{*∞}	<i>Initial Investigations into the P-T-T-D History of Paleoproterozoic Supracrustal Rocks at Grant and Brownwater Lakes, Southern Wopmay Orogen</i>	Wopmay/IOCG

Posters by Location

Location	First Author Surname	Title	Category
23	Milton* [∞]	<i>The Redstone Copperbelt, Northwest Territories, Canada</i>	<i>Min Dep - Cordillera</i>
24	Fernandes* [∞]	<i>Searching for SEDEX-Style Mineralization in the Northwest Territories: Barite as a Possible Vector</i>	<i>Min Dep - Cordillera</i>
25	Hicken* [∞]	<i>Indicator Mineral and Surficial Geochemical Study of the Izok Lake Zn-Cu-Pb-Ag Volcanogenic Massive Sulphide Deposit, Nunavut</i>	<i>Min Dep / Surficial - Slave</i>
26	Bédard*	<i>Geochemical and Mineral-Chemical Systematics from a Picritic Franklin Sill on Victoria Island, N.W.T.: Insights on Internal Fractionation Processes</i>	<i>Geoscience - Islands</i>
27	Bédard	<i>The Booth River Intrusive Complex, Nunavut: Preliminary Results</i>	<i>Geoscience - Slave</i>
28	Wright	<i>Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park – An Update</i>	<i>Resource Assessment</i>
29	Hamre*	<i>NWT Protected Areas Strategy: Research Used for Protected Areas Decision Making</i>	<i>Land Withdrawals</i>
30	Marcheggiani-Croden	<i>Diavik Boart - Unrelated to Gem Diamond and Fibrous Coats?</i>	<i>Diamonds</i>
31	Johnson* [∞]	<i>The Micro-/ Macro-Diamond Relationship: A Preliminary Case Study on Diamonds from Artemisia Kimberlite (Northern Slave Craton, Canada)</i>	<i>Diamonds</i>
32	Cross*	<i>The Diamond Potential of the Tuwawi Kimberlite (Baffin Island, Nunavut)</i>	<i>Diamonds</i>
33	Beales	<i>Got Kimberlite – NTGO is the Custodian of a Major Kimberlite Collection</i>	<i>Diamonds</i>

*** soapbox talk will be given; see schedule below**
[∞] student presentation

Soapbox Talks Schedule (14:58 to 16:30)

Chairpersons: Beth Fischer & Val Jackson

Location	First Author Surname	Soapbox Talk	Approx Time	Title	Category
12	Macumber*	1	14:58	High Resolution Paleoclimatic Study of Lacustrine Sediments along Tibbitt Contwoyto Ice Road, Yellowknife, NWT, Canada	Climate Change
17	Tappert	2	15:05	The Future of Core Logging: The Reflectance Spectroscopy of Hematite and Micas from the IOCG Deposit at Olympic Dam, South Australia	Wopmay/IOCG
20	Lee*	3	15:12	Geophysical Interpretation of the South Wopmay, Northwest Territories, Canada	Wopmay/IOCG
22	Smar*	4	15:19	Initial Investigations into the P-T-T-D History of Paleoproterozoic Supracrustal Rocks at Grant and Brownwater Lakes, Southern Wopmay Orogen	Wopmay/IOCG
9	Smith*	5	15:26	Characterization of Gold and Base-Metal Mineralization Styles in the North End of the Yellowknife Greenstone Belt	Min Dep - Slave
23	Milton*	6	15:33	The Redstone Copperbelt, Northwest Territories, Canada	Min Dep - Cordillera
24	Fernandes*	7	15:40	Searching for SEDEX-Style Mineralization in the Northwest Territories: Barite as a Possible Vector	Min Dep - Cordillera
26	Bédard	8	15:47	Geochemical and Mineral-Chemical Systematics from a Picritic Franklin Sill on Victoria Island, N.W.T.: Insights on Internal Fractionation Processes	Geoscience - Islands
3	Tschirhart*	9	15:54	Preliminary 3D geophysical modeling of the Aberdeen Sub-Basin, Thelon Province, Nunavut	Geophys - Thelon
4	Peter	10	16:01	Hyperspectral Surveying in Support of Mineral Exploration in Canada's North; Rationale, Methodology, and an Example from the Hackett River Greenstone Belt, Nunavut	Rem Sens - Slave
29	Hamre	11	16:08	NWT Protected Areas Strategy: Research Used for Protected Areas Decision Making	Land Withdrawals
31	Johnson*	12	16:15	The Micro-/ Macro-Diamond Relationship: A Preliminary Case Study on Diamonds from Artemisia Kimberlite (Northern Slave Craton, Canada)	Diamonds
32	Cross	13	16:22	The Diamond Potential of the Tuwawi Kimberlite (Baffin Island, Nunavut)	Diamonds

* student presenter

THURSDAY, NOVEMBER 19 (MORNING)

Theatre 1 – Exploration & Geoscience

Chairs: Pattie Beales, Aleksandar Miskovic

- 08:40 Kjarsgaard, B.A. and Snyder, D.B.** - The GEM Diamond Project: An Overview
- 09:00 Holmes, P., Pell, J., Clements, B., Grenon, H., and Sell, M.** - The Chidliak Diamond Project, Baffin Island, One Year after Initial Discovery
- 09:20 Mather, K. A., Pearson, D. G., Kjarsgaard, B. A., and Stachel, T.** - A New Look at Slave Lithosphere Palaeogeotherms and the “Diamond Window” (*student presentation*)
- 09:40 Kopylova, M. G., Navon, O., and Dubrovinsky, L.** - Carbonatitic Affinity of Natural Diamond-Forming Fluids
- 10:00 Coffee** (sponsored by Aurora Telenet (Canada) Inc.)
- 10:40 Bruce, L.F., Kopylova, M.G., Longo, M., Ryder, J., and Dobrzhinetskaya, L.F.** - Cathodoluminescence of Diamonds in Metamorphic Rocks
- 10:40 Hunt, L., Stachel, T., and Armstrong, J.** - Trace Element Systematics of Microxenoliths and Xenocrysts from the Renard Kimberlites, Quebec (*student presentation*)
- 11:00 Smart, K.A., Chacko, T., Heaman, L.M., Stachel, T., and Muehlenbachs, K.** - Multiple Origins of Eclogitic Diamonds from the Jericho Kimberlite, Nunavut (*student presentation*)
- 11:20 Mustafa, J.** - Snap Lake Diamond Mine – Update
- 11:40 Coffee** (sponsored by SRC Geoanalytical Laboratories)
- 12:00 Rainbird, R.H., Davis, W.J., Hahn, K., Furlanetto, F., and Thorkelson, D.** - Revised Correlation of Late Paleoproterozoic Sequences in Northwestern Canada and Linkage of the Forward and Racklan Orgenies
- 12:20 Hahn, K., Rainbird, R.H., Cousens, B., and Davis, W.** - Provenance and Depositional Setting of the Upper Hornby Bay Group, NWT and Nunavut (*student presentation*)
- 12:40 Harris, J.R.** - A Review of Remote Predictive Mapping (RPM) Activities in Canada’s North
- 13:00 Lunch** (sponsored by First Air – The Airline of the North, and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick’s School gymnasium
- 10:00-15:00 Trade Show** – Weledeh and St. Patrick’s School gymnasium. Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs).
- 14:00 Business Card Draws, and Passport to Diamond Draw** – Weledeh and St. Patrick’s School gymnasium

Theatre 2 – Mining & Environmental Management

Chairs: Kirsty Ketchum, Erika Nyysönen

- 08:40 Wollenberg, P.** - Environmental Management Systems in Exploration at Areva Resources
- 09:00 Jamieson, H.E. and Wrye, L.A.** - The Presence and Persistence of Arsenic Trioxide in Soils near Giant Mine and Giant Town Site
- 9:20 Momeyer, S.A., Smith, L., Gupton, M., Neuner, M., Blowes D., and Sego, D.** - Hydrology of Unsaturated Waste Rock in Semi-Arid Permafrost Environment (*student presentation*)
- 9:40 Taylor, A.** - Prairie Creek Mine: Update

- 10:00 Coffee** (sponsored by Aurora Telenet (Canada) Inc.)
- 10:20 Ehrlich, A.** - The Significance Spectrum
- 10:40 Munro, K., Sibbald, C., and Nicol, S.** - Finding Efficiencies in Environmental Monitoring Programs: Baseline Aquatic Studies for Environmental Assessments and Future Environmental Effects Monitoring Programs, Nechalacho Deposit as a Case History (*student presentation*)
- 11:00 Cliffe-Phillips, M.A., Clark, K.M., and Erasmus, E.** - Marion Lake Watershed Monitoring and Management Program
- 11:20 Macneill, S.C., Schmidt, N.P., and Purcka, L.G.** - Monitoring and Remediation of Fish Passage at an Undersized Road Culvert at Hill Creek, NWT
- 11:40 Coffee** (sponsored by SRC Geoanalytical Laboratories)
- 12:00 Cheng, W.W. and Blenkinsopp, S.** - Chemicals Management from Cradle to Grave
- 12:20 Paget, T.M.** - Waste Management in Remote Camps in the Northwest Territories
- 12:40 Fox, D., Chandler, A. J., David, A., Lewis, M., and Hamilton, M.** - An Overview of the Technical Document for Batch Waste Incineration
- 13:00 Lunch** (sponsored by First Air – The Airline of the North, and NWT & Nunavut Chamber of Mines) – Weledeh and St. Patrick’s School gymnasium
- 10:00-15:00 Trade Show** – Weledeh and St. Patrick’s School gymnasium. Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs).
- 14:00 Business Card Draws, and Passport to Diamond Draw** – Weledeh and St. Patrick’s School gymnasium

THURSDAY, NOVEMBER 19 (AFTERNOON)

Theatre 1 – Exploration & Geoscience

Chairs: John Ketchum, Edith Martel

- 15:10 Corriveau, L., McMartin, I., Brouillette, P., Bleeker, W., Jackson, V.A., Montreuil, J.-F., Mumin, H., Harvey, B., Kiss, F., and Carson, J.** - The IOCG/Multiple Metals - Great Bear Region (NWT) Project, Geomapping for Energy and Minerals Program: Field Results, Status and Progress
- 15:30 Ootes, L., Davis, W.J., Bleeker, W., and Jackson, V.A.** - Exposing the Hottah Terrane and Its Volcano-Sedimentary Cover
- 15:50 Goad, R., Rinaldi, T., Schryer, R., Samuels, M., and Mucklow, J.** - Development Update for the NICO Gold-Cobalt-Bismuth-Copper Deposit, Northwest Territories
- 16:10 Mumin, A.H., Phillips, A., Katsuragi, C.J., and Mumin, A.** - Oblique Extension, Tectonics and Mineral Deposition, Great Bear Magmatic Zone, NWT, Canada
- 16:30 Student Presentation Awards – Theatre 1**
- 10:00-15:00 Trade Show** – Weledeh and St. Patrick’s School gymnasium. Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)

Theatre 2 – Mining & Environmental Management

Chairs: Kirsty Ketchum, Erika Nyssonen

15:10 Murray, D.J. - The Establishment of National Parks in the NWT, an Update

15:30 Panayi, D. - Caribou Monitoring at the Diamond Mines and Implications for Effects Mitigation

15:50 Panayi, D. and Carter, L. - A Tool for Cumulative Effects Assessment

16:30 Student Presentation Awards (Theatre 1)

10:00-15:00 Trade Show – Weledeh and St. Patrick's School gymnasium. Parking is available at 4503 52 Ave. (look for the Geoscience Forum signs)

Abstracts – Oral Presentations

THE NUNAVUT INDICATOR MINERAL COMPILATION AND THE CANADIAN DATABASE OF GEOCHEMICAL SURVEYS: A STRATEGY FOR HARMONIZED MANAGEMENT AND DISSEMINATION OVER THE INTERNET

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As part of the Tri-Territorial Geoscience Integration Project under the Geomapping for Energy and Minerals (GEM) Program, a compilation and re-examination of archived heavy mineral concentrates from published assessment files, reports, and private exploration company holdings has commenced to assist exploration in Nunavut. These data will complement the KIDD-KIMC and till geochemistry data sets provided by INAC and NTGO, and include indicator minerals of all commodities. The information will be captured in the Canadian Database of Geochemical Surveys (CDoGS), which accommodates the comprehensive information required for all varieties of geochemical surveys. This includes the material processing and analytical methods metadata required for publishing geochemical data according to international standards. The CDoGS web portal exposes these surveys in query-able fashion so that those of interest can be identified for further examination. Literature references are connected to each survey, and many are complete with links to full metadata/reference downloads for the main source and related references on Geoscan and on capable Provincial-Territorial reference database sites. GSC-held analytical data is itself made downloadable in three convenient spreadsheet-compatible formats that differ in the treatment of missing values and detection limits. Because there is a high degree of variability in sample collection, processing, and analytical methods between different surveys, particularly among those collected and processed by different organizations, survey results are released as separate, survey-specific files. Whether or not to merge spreadsheets for a given purpose is left up to users, who can base their choices on the metadata provided.

Internet Earth browsers such as Google Earth have quickly become the new, universal visualization tool for geographic data. Analytical data are increasingly being delivered in KML format (an OGC-approved standard) which permits quick visualization of survey areas and sample analyses for each chemical element of interest via an Earth browser. The CDoGS system allows interactive selection of an element of interest using a graphical periodic table tool.

For geochemical data held and distributed by other organizations, links to those distribution sites are also provided through the CDoGS portal. Whether or not this will work efficiently for links to NWT- and Nunavut-based portals will depend on the severity of Internet access obstacles related to relaying via satellite. Potential for duplication or mirroring of data sets with translation from the GSC format to territorial formats will be addressed by GSC IM experts and territorial counterparts.

AN UPDATE ON THE HAMMER AND AVIAT PROJECTS, NUNAVUT

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A new kimberlite occurrence was discovered in the Coronation Gulf/North Slave Diamond District during a brief prospecting program in late July 2009. The Hammer kimberlite is located approximately 120 kilometres NNW of the Jericho deposit and 30 km SE of the Artemisia kimberlite. The Hammer property is a joint venture between Stornoway (75% and operator) and North Arrow Minerals Inc. (25%

participating). The Hammer kimberlite is located at the head of a previously defined but unexplained kimberlite indicator mineral train containing diamond inclusion chemistry. The kimberlite was discovered in frost heaved material in two localities on the up-ice side of a prominent topographic feature and a hand dug pit encountered frozen, weathered kimberlite material on the south central side of the topographic feature. The topographic feature is 225m long, between 15 and 100m wide, and has a surface expression of approximately 1 hectare, although the true nature and size of the body is not known at this time. Future work plans may include additional prospecting, kimberlite sampling for micro diamond recovery, ground geophysical surveys or drilling.

The Aviat Project is located on the Melville Peninsula in eastern Nunavut, and is a joint venture between Stornoway Diamond Corporation (90%) and Hunter Exploration Group (10%). During the 2008 field season a 191 tonne (dry weight) sample was collected from the ES1 kimberlite, the largest body within the Eastern Sheet Complex (ESC). Two localities within the ES1 kimberlite were sampled and processed separately, but represent exposures of the same "ES1" kimberlite sheet. Dense Media Separation ("DMS") processing utilizing both x-ray sorter and grease table recovery circuits were employed for diamond recovery. During the first quarter of 2009 the results of the kimberlite sampling were released. The sample collected at the "AV6" exposure returned 89.6 carats of diamonds from 42.7 tonnes (dry weight) of kimberlite, representing a diamond recovery of 210 cpht (carats per hundred tonne). The sample collected at the "AV2" outcrop, returned 213.2 carats of diamonds from 148.3 tonnes (dry weight) of kimberlite, representing a diamond recovery of 144 cpht. Collectively the two combined samples returned 302.7 carats of diamonds (retained on the +1 DTC screen) from the 190.9 tonnes of kimberlite for an overall diamond recovery of 159 cpht.

A conceptual study at Aviat authored by SRK Consulting (Canada) Inc. in the fall of 2008, concluded that based on the drilling undertaken to the end of the 2008 summer season, the ESC contained an estimated 12.4 to 16.0 million tonnes of kimberlite material within four separately distinguishable kimberlite sheets of the ESC. The ES1 sheet (subject of the sampling reported above), spans an area of some 260 hectares and represents about 78% of the total kimberlite volume. The next stage in the project will be to determine a representative diamond valuation on the more than 340 carats returned to date from ES1, and to undertake desktop analyses of viable mining methods for this large potential deposit.

VICTORIA ISLAND GEM PROJECT: BASE AND PRECIOUS METAL POTENTIAL OF MINTO INLIER AND SURROUNDING REGION, N.W.T. AND NUNAVUT

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Victoria Island is the size of Great Britain, but is under-explored for most mineral commodities, in part due to the lack of modern, detailed geoscience maps (bedrock, geophysical and surficial) that can help target exploration and track showings along-strike. In fact, over 75% of the Minto Inlier and surrounding region (the target area for the study) has not been mapped beyond reconnaissance (1:1,000,000) scale. The Minto Inlier is a broadly folded, northeast-striking uplift of Proterozoic supracrustal rocks, unconformably overlain by lower Paleozoic sedimentary rocks and variably mantled by Quaternary glacial deposits.

The supracrustal rocks include the Neoproterozoic Shaler Supergroup, a 4-km thick succession of siliciclastic, carbonate and sulphate evaporite sedimentary rocks and basaltic lavas deposited in a major basin developed in the interior of the supercontinent Rodinia. The Shaler Supergroup hosts deposits of carving stone, used by local artisans, and has as strong potential for sediment-hosted Cu in sandstones and Cu-Zn in shales. The basalts host historically significant native Cu mineralization. Detailed sedimentological, sequence stratigraphic and geochemical studies will identify marker horizons for regional mapping, establish the depositional history of the basin and identify prospective horizons for base-metal exploration. The Shaler Supergroup basalts were probably fed by the numerous underlying sills that may host Norilsk-type Ni-Cu-PGE orebodies. These rocks belong to the 723 Ma Franklin magmatic event, which extends across the Canadian Arctic and possibly to Siberia. Petrological and geochemical studies will clarify the processes acting in these sills, and help focus mineral exploration to possible Norilsk-type throughflow systems. Unconformably overlying Paleozoic marine carbonate rocks have promising potential for Mississippi Valley Type (Pb-Zn) mineralization and are currently being explored for kimberlite-hosted diamonds. Sedimentological studies will improve our understanding of the stratigraphy and basin evolution, with possible linkages to offshore oil industry efforts and GEM-Energy studies. Compilation and focused fieldwork on the Quaternary geology will generate ice-flow maps to facilitate diamond exploration. A new airborne electro-magnetic survey will aid regional mapping in regions of poor outcrop and generate diamond exploration targets. Together with newly acquired satellite imagery, it will also help produce a remote predictive map that will be used to focus field-based mapping in 2010-2011.

The natural resource industry benefits many northern residents. The principal objective of this project is to provide an improved understanding of the geology of central Victoria Island, NT, to increase the chances of mineral discoveries by the private sector. Collaboration with Northwest Territories and Nunavut geological surveys will ensure alignment with Territorial goals. University partners will be involved from the outset in all facets of the project, to train highly qualified personnel, import specialized expertise, and tap into external funding. Where possible, industry partners will be involved to share logistical costs of fieldwork and to facilitate efficient dissemination of information of potential economic pertinence. The exceptional preservation and exposure of the rocks and sediments in the study region will allow cutting-edge science to be done on a plethora of topics, through the participation of university-based researchers and graduate students.

DRAFT NWT WATER STEWARDSHIP STRATEGY

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The Government of the Northwest Territories (GNWT), Indian and Northern Affairs Canada (INAC) and Aboriginal Governments have developed the draft NWT Water Stewardship Strategy (the Strategy) to ensure the waters of the NWT remain clean, abundant and productive for all time. Clean and abundant freshwater ensures healthy, productive ecosystems and is essential to the social, cultural and economic well-being of Northwest Territories (NWT) residents. The Strategy is designed to improve decision-making processes, information sharing and communications amongst all parties involved in water stewardship in the NWT. Over winter 2009-10, the NWT public has the opportunity to shape the direction of water stewardship in the NWT. A “living” Strategy will be finalized in spring 2010.

SEABED GEOHAZARD CONSTRAINTS TO DEEP WATER EXPLORATION DRILLING IN THE CANADIAN BEAUFORT SEA

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Hydrocarbon exploration in the Canadian Beaufort Sea is shifting from the inner shelf to the outer shelf and upper slope region in water depths of 60 to 1200 m. In response to this change, seabed geohazard research is also moving into deep water. Few data exist in the deep water environment to establish the regional framework of geohazard conditions required for environmental and engineering assessments. In 2009 the Geological Survey of Canada, Canadian Hydrographic Service and University of New Brunswick worked in collaboration with Imperial Oil Limited to collect seabed stability data. Coast Guard vessels Nahidik and Amundsen functioned as the survey platforms. Seabed scouring by ice keels, subsea permafrost, low strength seabed sediments and mud volcanism hazards are common to both shallow and deep water. The deep water introduces additional hazards that need to be investigated. These include slope stability, seabed faulting, seabed sediment mobility and mud diapirism. Geohazard survey technologies used during the field programs included multibeam and sidescan sonars, subbottom profilers, a high resolution multichannel seismic system and sediment corers.

CATHODOLUMINESCENCE OF DIAMONDS IN METAMORPHIC ROCKS

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The purpose of this study is to explore the effects of metamorphism on cathodoluminescence (CL) of diamond. Diamond displays a supreme resistance to chemical and mechanical weathering, ensuring its survival through complex and prolonged crustal processes, including metamorphism and exhumation. For these reasons, volcanic sources and secondary and tertiary collectors for detrital placer diamonds, like Yukon diamonds, may be difficult to determine. If metamorphic processes leave their marks on diamond, they can be used to reconstruct crustal geologic processes and ages of primary diamondiferous volcanics.

Four diamond suites extracted from metamorphic rocks have been characterized using optical CL, infrared and CL spectroscopy. The studied diamonds are from sedimentary conglomerate and lamprophyric breccia metamorphosed in the greenschist facies (Wawa, Southern Ontario, Canada), and from the ultra-high pressure terranes of Kokchetav (Kazakhstan) and Erzgebirge (Germany). Wawa diamonds (Type IaAB and Type II) displayed green, yellow, orange, and red CL colours controlled by the CL emittance at 520, 576 nm, and between 586 and 664 nm. The UHP diamonds show much weaker CL; few luminescent stones show CL peaks at 395, 498, 528 nm and a broad band at 580-668 nm. In contrast, most common diamonds found in unmetamorphosed rocks (octahedrally grown Type IaAB stones) luminescence blue, emitting light at ~415-440 nm and 480-490 nm.

There is a noticeable difference between cathodoluminescence of metamorphosed and unmetamorphosed diamonds. The studied diamonds that experienced metamorphism show a shift of CL emission to longer wavelengths (above 520 nm) and to green, yellow and red colours. This shift is comparable to the CL effect of the high pressure - high temperature (HPHT) treatment of diamonds, although the reason for this

phenomenon is yet to be found. Our data show that the CL characteristics superimposed by metamorphism could survive through 2.7 billion years of the geological history. Thus, a low abundance of octahedrally grown Type IaAB diamonds with blue CL colours among detrital diamonds may indicate that the stones may have once been a part of a metamorphic terrane. This record of metamorphic processes within the diamond crystal lattice and in its physical properties provides an opportunity for a better reconstruction of the diamond crustal history and for provenance studies.

SEDIMENTARY COPPER, LEAD AND ZINC IN THE NWT

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The Northwest Territories and the Slave Province in particular, is well known for its numerous deposits hosted by the Precambrian. Less well known are the sedimentary deposits that have produced a lot of wealth for the Territories as they do not have the romantic ring of gold and diamonds. These deposits have mainly been the lead-zinc deposits such as Pine Point, Polaris and Nanisivik located within Proterozoic or Paleozoic sediments in places that had economic transportation.

The western NWT has received very little exploration as it has been perceived as a place that had no transportation, no energy sources and no mineralization. This perception is due to change dramatically as a result of exploration in the area for gas, oil and lead, zinc and copper mineralization plus the addition of an all weather road to Inuvik that parallels the Mackenzie from Wrigley to the north.

The area west of the Mackenzie is almost totally underlain by sedimentary rocks on which roads can be easily built without the problems road building faces in the Slave province where all weather roads can cost millions of dollars per mile. The sedimentary rocks west of the Mackenzie are also host to a large gas and oil fields, which can supply both gas and electricity to the area. The Mackenzie River also provides a means of transportation for materials going up and down the river.

Where is the mineralization? Sedimentary copper is hosted by Proterozoic carbonates and the only known deposit is the Redstone copper deposit located just south of the Ravensthorpe River. Copper showings have been found for a 140 km distance to the north of the Redstone Copper deposit to north of the Keele River area within the Proterozoic carbonates. Mississippi Valley lead-zinc deposits are found to the east of the Proterozoic outcrops within Paleozoic carbonates.

The history of exploration in the area started in 1961 when Redstone Mining discovered the Redstone copper deposit which has an historical resource of 33.6 million tonnes of 3.92% Copper with attendant silver. In 1971 the Nite occurrence was discovered by Mr. Pete Risby and then in 1975 Shell Canada began exploration in the area with extensive mapping and drilling until 1978. The June and Jay deposits were discovered at this time with the June discovery hole returning 52 meters of 2.3% Copper and outcrops of up to 7% Copper. Shell abandoned all mineral exploration in 1978 and further copper exploration was not done until 2005 when Mr. Risby and Kaska staked the property and dealt it to Freeport McMoran. Exploration from 2005 to 2008 led to the discovery of nine new showings and 2 new copper bearing horizons. FreePort McMoran decided to eliminate their Canadian exploration in 2008 and the claims are now owned by Mr. Risby.

AN ALTERNATIVE FOR LACK OF MARINE INFRASTRUCTURE: OCEAN GROUP'S FLOATING WHARVES

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Economical, environment-friendly and efficient, Ocean Group offers industrial floating wharf services for the mining industry, municipalities and governments. These steel wharves are built using sectional barges adapted to the needs and geography of the location where they will be installed. They can be as long as needed and are adaptable to tide fluctuation.

They are used for loading and unloading of all types of cargo, even oversize. Adaptable to maximize cargo operations, the floating wharves are stable and can accommodate multiple barges at the same time, on a 24 hour basis. Cost efficient, they do not require dredging, dynamiting, pouring concrete or rock filling. Ocean's temporary industrial wharves are eco-friendly and can be installed in less than a week.

CHEMICALS MANAGEMENT FROM CRADLE TO GRAVE

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Medicines, computers, food, personal care products, drugs, fuels—nearly every aspect of our lives involves chemicals. While we all depend on the benefits of chemical substances, there are risks that some can pose to human health and the environment.

The Chemicals Management Plan (CMP), launched on December 8th, 2006, is Canada's world-class program for both categorizing and assessing existing chemical substances. The Government of Canada is committed to address all of the legacy substances that have been identified through categorization via successive rounds of assessment. The government will work with key industry sectors to develop and codify sound management practices that will protect Canadians and the environment and, where necessary, will take regulatory action.

Out of the 23,000 chemical substances reviewed on the Domestic Substances List (DSL), 500 were identified as high-priority substances. The 500 high-priority substances are being addressed as follows: about 190 "Challenge" substances were identified the highest priorities for risk assessment and appropriate controls, as they are still in commerce and are potentially harmful to human health or the environment; there are about 145 substances no longer in commerce in the Canadian market, and the Government of Canada controls the re-introduction of these potentially harmful substances through the "Significant New Activity (SNAc)" provisions; there are about 160 "Petroleum" substances being addressed as part of the Petroleum Sector Stream Approach, to be addressed within the same timeframe as the "Challenge" substances. The Government of Canada is challenging *manufacturers, importers* and *users* of industry and civil society to provide new information regarding the scientific properties of these 193 "Challenge" substances, or best management practices associated with the use of these substances that might contribute to improved decision making. The CMP constitutes a "cradle-to-grave" chemicals management from manufacture ("cradle") to use phase and disposal phase ("grave"). Chemicals, manufactured items containing chemicals, by-products, contaminants and wastes are all reportable.

As part of the Chemicals Management Plan, the Government of Canada has launched an Internet portal. The portal provides Canadians with information about categorization, news about actions to manage and

prevent risks to human health and the environment, and links to information collections on chemical substances in Canada. According to Health Canada's industry and economic analyses of the Alberta/NWT region, the mining and mineral products sector is one of the top sectors based on GDP growth. Thus, Health Canada would like to engage the Northern Canadians with the message on CMP and its relevancy.

INVESTIGATING COMMUNITY MINE EDUCATION STRATEGIES: A CASE STUDY WITH THE TLICHO COMMUNITY, NWT, CANADA

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This research explored an effective model for developing educational programs related to mining for communities in an iterative manner that speaks to the needs and values of the community. The lessons learned provide direction on methods to replicate an effective education program for communities. The success of a process that was used to develop an education program in a mining context for a particular case has been evaluated. Reasons for why learning does or does not transpire for this case were explored.

A case study of the Tlicho community in Canada's Northwest Territories was conducted to investigate this query. A combination of theories, approaches, and methods were utilized in the development of the education program, the collection and interpretation of data, and the formation of key findings. The inquiry led to the following four key conclusions:

- 1) Knowledge and understanding are effectively acquired by situating information as primary experiences or through oral accounts by persons who have experienced.
- 2) The objects of learning for education programs must be valuable, useful, and meaningful to the intended learners. Each individual must be given the autonomy to decide what topics or concepts are appropriate for him or her. Thus, choice and flexibility must be built into the programs. The "I am going to teach you..." approach to education is less superior than a humble humanistic approach to education.
- 3) The process to develop programs should involve cycles of action and reflection, input from the intended learners, and repetition.
- 4) Assimilation of information occurs through the experience of knowledge that is presented in culturally based frames informed by particular stories, experiences, teachers, places, values, histories, and materials.

These conclusions provide some insight on how governments and mining companies can and should engage with communities to learn. Enhanced knowledge and understanding through learning by communities, governments, and mining companies, strengthen relationships and agreements. When everybody's knowledge and understanding improves, better decisions can be made.

MARION LAKE WATERSHED MONITORING AND MANAGEMENT PROGRAM

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The long-term objective of the Marian Lake Watershed Monitoring and Management Program (MLWMMP) is to implement an integrated environmental monitoring program to assist the Wek'eezhii Forum (Tlicho Lands Protection Department, Wek'eezhii Renewable Resources Board, and the Wek'eezhii Land and Water Board) with their management decisions, as well as provide other government agencies, Tlicho Communities, educational institutions and others with information in an accessible and comprehensible manner. The MLWMMP will develop a framework document that outlines the requirements for monitoring within the Marian Lake Watershed.

The MLWMMP will help guide and coordinate not only the Wek'eezhii Forum, but also other agencies when designing and implementing monitoring programs within the Marian Lake Watershed. It is envisioned that the Wek'eezhii Forum will only conduct monitoring programs within their own mandate, but through the MLWMMP will coordinate other monitoring activities within the Marian Lake Watershed, as well as provide standard protocols for monitoring, sampling and design.

A key component of the program will involve the input and participation of Tlicho communities, elders, and students in the design, implementation, collection and reporting of monitoring data. Ultimately, this project will enable the Wek'eezhii Forum to collect sufficient data to assess cumulative impacts at a regional scale for the Marian Watershed.

Data that is collected under this program and other relevant programs will be brought together, synthesized and reported back to diverse audiences such as the general public, Tlicho citizens, government agencies and researchers in a culturally appropriate manner whether it be through website, print or community presentation.

Ultimately, this project will enable the Wek'eezhii Forum to collect sufficient data and integrate it with other relevant datasets to assess cumulative impacts at a regional scale for the Marian Lake Watershed.

THE GEM-MINERALS PROGRAM ON MELVILLE PENINSULA: PROJECT SUMMARY AND PRELIMINARY REPORT

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The Melville Peninsula Project (MPP) is one amongst a number of new geo-mapping projects that were initiated under the Federal Government Geo-mapping for Energy and Minerals (GEM) Program. The

principal objective of the MPP is to renew the geoscience database and upgrade the knowledge base for the Precambrian and Quaternary geology, and stimulate mineral exploration in the area. Limited understanding of the overall geology and significant economic endowment in time-correlative geological units outside of the map area (e.g., Committee Bay, Piling Group), justifies a closer examination of the geological setting and mineral potential of Melville Peninsula.

Prior to the 2009 field season, a GIS compilation of selected public-domain point, image and geophysical data was assembled, to be released as a GSC Open File in winter 2010. Pre-field season preparatory laboratory work consisted of INA analysis of archived till samples collected north of 68° in the mid-1990's, as well as re-analysis by ICP-MS and INA of 2,200 archived lake sediment samples. Furthermore, two separate geophysical surveys totalling 88,000 line km were flown at 400m spacing, at a nominal altitude of 150m above ground. The first, aeromagnetic-only survey (41,000 line km), was flown over the central portion of Melville Peninsula (NTS sheets 47A and 47B) over the main occurrences of Prince Albert Group. The second, combined radiometric-aeromagnetic survey (47,000 line km), was flown over the Paleoproterozoic Penrhyn Group, where a previous, 5 km spacing, regional radiometric survey indicated abnormally high gamma ray signals. Data from the two airborne surveys will be released in February 2010 and April 2010, respectively. In support of ongoing crustal and mantle studies, a ground magnetotelluric survey, using both long-period and broadband instruments, was acquired along an across-strike transect extending from the northern to southern extent of the Peninsula.

The majority of field work in 2009 was concentrated within the Archean terrains in central Melville Peninsula. The main effort from a bedrock geology perspective was invested in attempting to provide a better understanding of the stratigraphy and tectonothermal evolution of the Prince Albert Group, as well as clarify its relationship with granitoid gneiss (basement?) and various intrusive suites. In addition, numerous gossan zones were visited to better understand the nature of those mineralized geological units and to assess their mineral potential. Initial investigations show sulphide enrichment in folded silicate- and oxide-facies banded iron-formation, in ultramafic sills/flows, in a layered mafic-ultramafic intrusion, in a gabbroic pluton, and in hydrothermally altered basalt. Three separate fly camps supporting thematic studies by graduate students were set up on the Penrhyn Group. The research topics included *i*) basin evolution and nature of polymetallic black shales, *ii*) nature and mineral potential of Proterozoic intrusions, and *iii*) structural and metamorphic evolution of the Penrhyn Group. Concurrent with the bedrock mapping, the 2009 field work comprised an important component of surficial mapping and till sampling, following-up on leads brought upon by earlier studies. Preliminary results, following the first field season, will be discussed during the presentation.

THE IOCG/MULTIPLE METALS - GREAT BEAR REGION (NWT) PROJECT, GEOMAPPING FOR ENERGY AND MINERALS PROGRAM: FIELD RESULTS, STATUS AND PROGRESS

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The Great Bear Magmatic Zone (GBMZ) of the Northwest Territories contains all the right geological ingredients for hosting significant multiple metals iron oxide-copper-gold (IOCG) deposits. Two IOCG deposits are currently known. The Au-Co-Bi-Cu NICO deposit is an atypical magnetite-group IOCG deposit hosted within a severely hydrothermally-altered metasedimentary sequence while the Cu-Au-Ag

Sue Dianne deposit typifies hematite-group IOCG deposits and is hosted within GBMZ volcanic rocks. These deposits served as a knowledge hub for re-examining the potential of the southern GBMZ during the IOCG/Multiple Metals - Great Bear Region (NWT) project fieldwork in 2009. In addition, the hydrothermal systems that host former mines in the Camsell River district (e.g., Terra) and known showings in the central GBMZ were re-examined. Parallel to field work, an airborne geophysical survey was flown over part of the northern GBMZ and legacy (pre-1995) synthesis and detailed geological maps of the northern GBMZ were prepared for publication. The project is conducted in very close partnership with the Northwest Territories Geoscience Office and its South Wopmay bedrock mapping project (see Jackson et al. this volume) and in collaboration with industry, academia and First Nations governments.

IOCG-directed fieldwork evolved around two poles: provision of a better geological and geophysical exploration framework, and development and testing of new or improved exploration approaches, methods and vectors for iron oxide-copper-gold deposits in the GBMZ. Alteration mapping and economic geology research on selected targets led to validation of the IOCG model and placement within an alteration to mineralization zoning framework providing a better indication of the potential fertility of several GBMZ showings. Prioritisation of virgin areas for alteration mapping through remote predictive mapping modelling and re-examination of legacy data led to discovery of the mineralized IOCG-type alteration systems and fluidized and structural breccias reported by Montreuil et al. (this volume). Such breccias are known to be key fluid and metal pathways for IOCG deposits (e.g., Cloncurry district, Australia) while the prevailing amphibole-magnetite-K-feldspar-biotite alteration hosting the NICO deposit shares characteristics of satellites to world-class deposits in the Andes and in the Cloncurry district. The former Terra mine in the Camsell River district is hosted within a regional-scale IOCG-type hydrothermal system that comprises extensive and intense albite, amphibole-magnetite, K-feldspar-magnetite and chlorite-hematite alteration zones associated with breccias and disseminated chalcopyrite. Indicator mineral and till geochemical studies of the NICO and Sue Dianne deposits aim to develop new exploration methods for glaciated terrains while the on-going lithogeochemical, rock physical property measurements, structural, tectonic and Deep Earth geophysical studies aims to better decipher the geodynamic setting, the thermal catalysts, the metal and fluid sources and potential location of fertile mineralizing systems along the GBMZ. Release of the 2009 airborne geophysical survey and current research papers, combined with a series of short courses using the GBMZ IOCGs as case examples will anchor future exploration in the GBMZ. Though seriously under-explored and under-mapped in terms of alteration systems, the GBMZ has potential for base (Cu, Fe, Pb, Ni, Zn), precious (Au, Ag, PGE), rare earth, strategic (Co, Bi, V) and nuclear metals (U) but remains significantly under-explored.

CLIMATE CHANGE ADAPTATION AND NORTHERN TRANSPORTATION

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Average circumpolar temperatures have increased at twice the rate of the global average and average temperatures at the surface of permafrost have increased by up to 3°C. Permafrost warming and thawing is expected to continue with rising air temperatures.

A significant portion of NWT transportation infrastructure is among the most vulnerable of transportation systems to the impacts of climate change including ice roads, and infrastructure built on thaw sensitive permafrost. Front-line staff in the Government of the Northwest Territories (GNWT) Department of Transportation (DoT) are observing and contending with the impacts of climate change on transportation infrastructure on a daily basis.

This presentation will provide an overview of climate change impacts on NWT transportation infrastructure. Furthermore, an overview of DoT's actions to respond to the impacts of climate change will be summarized, including: a) Operations and management efforts; b) capital projects; c) studies & best practices; d) partnerships; and e) research and development. Challenges and opportunities for marine shipping, infrastructure built on permafrost and winter roads will be summarized and the implications for the oil & gas and mining industries will be discussed.

EXPERIENTIAL SCIENCE

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The Department of Education, Culture and Employment, for the NWT, has developed a new pathway for high school science education called Experiential Science. These courses, offered at grades 10, 11 and 12 respectively, are designed to engage students in hands-on learning while applying scientific knowledge, processes and protocols in a context based learning environment. The program of studies is designed to appeal to a wide variety of students by providing learning opportunities that engage their own learning style. The curriculum for Experiential Science integrates Western science and Aboriginal knowledge and principles through field and laboratory experiences and applications. The program of studies investigates ecology and geology through the systems approach. Each course has a specific focus: Grade 10 - Arctic and Subarctic Terrestrial Systems; Grade 11 - Arctic and Subarctic Marine Systems; and Grade 12 - Arctic and Subarctic Freshwater Systems. A balance between classroom and field investigations allows students to learn in a dynamic environment, which fosters a better understanding of ecological and geological principles and processes. The presentation will focus on the completion of the grade 11 student textbook, its implementation in schools and ongoing teacher inservice. This update will discuss the current status of the project and types of support for implementation.

TARSIUT-AMAILIGAK FAULT ZONE, BEAUFORT SEA ULTIMATE OIL AND GAS RESOURCES

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The Beaufort Sea has a large resource of discovered oil and gas and a very significant potential for future undiscovered oil and gas. The Tarsiut-Amailigak Fault Zone play is one of the more important plays in the Beaufort Sea, with discovered resources of 378 MMB of recoverable oil and 3,298 BCF of recoverable gas. The undiscovered potential is estimated to be 846 MMB of recoverable oil and 6,785 BCF of recoverable gas.

The Tarsiut-Amailigak Fault Zone play includes all pools and prospects within delta front sandstones of the Kugmallit sequence. The reservoirs at Amailigak are proximal delta front sandstones which become more distal to the west towards Tarsiut. The play is bounded to the south by the facies boundary with the delta plain facies of the Kugmallit sequence (Netserk play), and to the east and west by the disappearance of a potential reservoir at the fringes of the delta. To the north the play is bounded by the Kugmallit shelf edge and the deeper water sandstones of the Kopanoar play.

The play area is entirely offshore in water depths between 12 and 35 metres. The delta front facies of the Kugmallit sequence is characterized by upward-coarsening sandstones, with overall net sand content between 20 and 30 per cent. Reservoir sandstones are between 5 and 15 meters thick, with an average

porosity of 22 per cent. The larger fields contain numerous stacked pools. Thick interbedded shales and the overlying Mackenzie Bay shale succession provide a good seal.

The majority of traps in the play are structural, created by major post-depositional movement on long, sinuous east-northeast trending faults of the Tarsiut-Amauligak Fault Zone. Major post-depositional movements on faults of the Tarsiut-Amauligak Fault Zone have resulted in the development of large rotated fault blocks. Pinchout of the sandstone/siltstone packages adds a stratigraphic component to trapping.

Exploration began with the spudding of Dome et al Tingmiark K-91 in the summer of 1976. During the years 1976 to 1989 a total of 32 wells were drilled on 18 structures in the play, resulting in the issue of 11 Significant Discovery Licences, for a success rate of 61%. The last well drilled was the gas discovery Gulf et al Amauligak O-86.

The only production is from Gulf et al Amauligak I-65B, which was production tested in the summer of 1986. Combined drill stem tests and extended flow tests produced a total of 422 thousand barrels of oil, of which 302 thousand barrels was shipped via tanker through the Bering Sea. The well flowed at a maximum rate of 18,060 barrels per day.

BEDROCK GEOLOGY AND MINERAL RESOURCES OF IOL PI-17, NORTH-CENTRAL BAFFIN ISLAND

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Geological mapping at 1:50,000 and evaluation of the mineral resource potential of heritage land package PI-17 was carried out through partnership of Nunavut Tunngavik Inc., Baffinland Iron Mines Corporation and the University of Western Ontario. IOL PI-17 covers an approximate 15X60 km area of north-central Baffin Island, immediately north of the Central Borden Fault, which juxtaposes Ordovician platformal carbonate cover to the southwest and polydeformed Precambrian basement gneiss to the northeast. The basement comprises re-folded keels of the Neoarchean Mary River Group preserved on the west-closing terminations of gneiss domes plunging moderately southeast. The domes are cored by flow-folded tonalite-trondjemite gneiss incorporating enclaves of Mesoarchean basement in Neoarchean plutonic assemblages. Low angle straight gneiss of the same derivation increases towards dome margins and gives way to sheets of Hudsonian augen gneiss that dominate areas bordering on the Mary River Group; non-gneissic augen granite bodies locally intrude into the marginal Mary River successions. Late red “quartz-eye granite” with locally associated pegmatite follow structures paralleling the Central Borden Fault, indicating this fault reactivated the terminal Hudsonian tectonic grain. The Mary River Group is preserved as moderately southeast plunging F3-refolded F2 isoclinal at the northeast McOuat Lake closure, at the central Mary River closure and at the poorly exposed easterly Glacier Lake closure. The tectonostratigraphic make-up of the Mary River Group comprises basal pillowed to massive basalt and komatiite flows, greywacke, banded iron formation, upper komatiite flows and quartzite; consistent with the lithological make-up of the Prince Albert and Woodburn Lake groups on the mainland.

The primary mineral resource on IOL PI-17 is Baffinland’s high grade direct shipping iron oxide ores. These form topographic highs, so they are ideal for open pit extraction. Although occurring along regional iron formation units, the massive magnetite-hematite ores demonstrate secondary coarse granoblastic texture, internal stratification is only defined by minor garnet-chlorite schist. The typical chert layering is absent, suggesting magnetite migration into and/or quartz out of F3 fold hinges. Coarse

specularite schists develop where massive magnetite is crosscut by late shears. The strong stratigraphic correlation of the Mary River Group to the Prince Albert and Woodburn Lake groups, together with their shared tectonometamorphic history, supports an environment favourable for iron formation-hosted lode gold, similar to Meadowbank in the Woodburn Group and Three Bluffs in the Committee Bay Belt. These deposits share similar Neoproterozoic host-rock settings overprinted by Hudsonian high-grade regional metamorphism. This gold potential is currently being addressed, with promising targets defined at the McQuat Lake closure and along the southeast arm of the Mary River closure bordering on the Central Borden Fault Zone. Of note, the serpentinized komatiites along this same arm have provided attractive carving stone to local communities.

SELWYN PROJECT: POISED FOR DEVELOPING HIGH-GRADE ZINC & LEAD

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Selwyn Project is currently the largest undeveloped zinc-lead deposit in the World and is equal or better grade than any of its comparables in its peer group. Since 2005, Selwyn has spent more than \$53M directly on exploration activities in the Yukon demonstrating the vast size of the deposit and the expanding high-grade core zones. It is these high-grade core zones that are the focus of future work plans, as Selwyn moves the project forward through preliminary engineering, additional metallurgy, environmental assessment studies, community consultation with the Sahtu and Kaska, as well as upcoming submittals for advanced permitting in the Yukon.

Currently, the Indicated mineral resources for the Selwyn Project now total 154.35 million tonnes grading 5.35% zinc and 1.86% lead and the Inferred mineral resources total 234.15 million tonnes grading 4.54% zinc and 1.41% lead. It is important to note that the global mineral resource includes a high-grade subset with Indicated mineral resource of 16,063,800 tonnes grading 10.25% zinc and 4.43% lead and Inferred mineral resource of 26,704,000 tonnes grading 8.81% zinc and 2.81% lead. These high-grade mineral resources are spread out over 22 kilometres and are amenable to bulk underground mining methods. The 2008 discovery of XY West, a 1.1 kilometre step-out northwest of the XY Central high-grade underground deposit, means that there remains significant additional opportunity for further discoveries within the known mineral potential. It is these high-grade underground deposits that will drive the permitting, and development future of Selwyn Project.

Selwyn is currently undertaking an internal Prefeasibility-level study to optimize the project for large-scale underground mining in the XY Central area. The evaluation of power supply alternatives is currently focused on hydroelectric sites in both the Yukon and Northwest Territories. Preliminary evaluation indicates an attractive run-of-river hydroelectric opportunity in the Yukon that could provide up to 20 megawatts of power on a seasonal basis, minimizing the requirement for diesel power generation. Ongoing studies are now evaluating the feasibility of adding some water storage to extend the availability of power in the winter months. The addition of hydroelectric power would provide Selwyn Project an assured supply of reasonable cost power and an operating cost benefit compared to many other base metal mines that are wholly dependent on diesel power.

Another recent development is the evaluation of concentrate pipeline as an alternative means of transporting concentrates from the site. A preliminary evaluation of capital and operating costs is in progress following a favourable initial assessment. The concept provides for the pumping of concentrates through an approximate 18 centimetre diameter buried pipe to either the Robert Campbell Highway or North Canol road to a facility where the concentrates would be de-watered and shipped onward by truck to the concentrate shipping facility. A concentrate pipeline would largely alleviate the need for a new access road to the Selwyn Project site and significantly reduce unit concentrate haul costs.

THE SIGNIFICANCE SPECTRUM

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How do decision makers in an environmental impact assessment (EIA) decide whether a given issue should be addressed during EIA or during the regulatory processes that follow? The significance spectrum provides a model for making this determination, and explores the roles and relationships of EIAs and regulatory processes. This talk will also consider the appropriate level of detail when analyzing issues in EIA, and how decision makers maintain a high-level, big-picture perspective even when technical details may be important.

CREATING PARTNERSHIPS THROUGH TRAINING

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The Mine Training Society is a vehicle for partnerships between industry, aboriginal governments and public governments to facilitate the achieving of employment targets and bring life to Socio-Economic Agreements. Over the past four years, the Mine Training Society has worked with industry and aboriginal governments to creatively solve human resource challenges in the mine and mine services sector. As an Aboriginal Skills and Employment Partnerships fund holder, the Mine Training Society has the capacity to work with industry and aboriginal governments with financing community and industry based programs.

NEW STREAM SEDIMENT SURVEY RESULTS FROM THE ARCTIC RED AND MOUNTAIN RIVERS, MACKENZIE MOUNTAINS, NTS 106 A AND B

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Regional stream sediment surveys have been carried out over much of the Canadian Cordillera using the National Geochemical Reconnaissance (NGR) methodology but have been conspicuously absent in the Northwest Territories. Since 2003, the Northwest Territories Geoscience Office, in partnership with the Geological Survey of Canada, have sought to remedy this situation and are conducting a systematic stream sediment survey of the Mackenzie Mountains. Funding support for this survey has been from the Strategic Investments in Northern Economic Development program, the Protected Areas Strategy, Geo-mapping for Energy and Minerals and the Polar Continental Shelf Project.

Traditionally, these surveys collected a grab sample of stream silt sediment and a corresponding water sample at a target sample density of one site per 13 km². The silt samples are analyzed for 64 chemical variables and the waters for 55. With increased interest in diamonds, bulk sampling of stream sands and gravels for heavy mineral picking was incorporated into the methodology. Heavy mineral concentrate samples are picked for kimberlite indicator minerals (KIMs), magmatic massive sulphide indicator minerals, and gold grains. A one hundred heavy mineral grain count is also carried out on each sample, and the KIMs and low-chrome diopside grains are probed for their chemistry.

In 2008, a survey was carried out over the headwaters of the Arctic Red and Mountain rivers in the Northwest Territories. This sampling program collected 1691 silt, 1616 water, and 33 bulk stream sediment samples from 1622 sites in NTS map sheets 106A, 106B, 106F and 106G. Samples of silt and

water have been analyzed and the results from 106A and B are being compiled. This data, augmented by results derived from heavy mineral picking are being prepared as a joint NTGO Open Report/GSC Open File.

The results have been examined for element associations characteristic of mineral deposits types found in other parts of the Mackenzie Mountains including: redbed-associated Cu, carbonate-hosted Zn-Pb, intrusion-related base metal and tungsten skarns, and shale-hosted SEDEX Zn-Pb. Known showings within the survey area can be identified by anomalous silt and water chemistry but several styles of mineralization known to be present in the area (e.g. carbonate-hosted Zn-Pb) do not have prominent impacts on the chemistry data. However, this mineralization type can be recognized using the bulk sampling results.

More exciting, our results include anomalous samples containing suites of elements that are inconsistent with any of the known mineral showing types, suggesting that further exploration might reveal not only new showings but also mineralisation types previously undiscovered in this area. The results also demonstrate naturally elevated concentrations of several biologically significant elements including mercury. The distribution of these anomalous concentrations, as demonstrated in the silt samples, may help to explain unusual concentrations of heavy metals found in the internal organs of moose occupying these mountain ranges. With continued support, future plans are to complete the silt sampling program next field season in the Coates Lake area and to increase the density of bulk samples in areas of interest outlined by the Protected Areas Strategy.

AN OVERVIEW OF THE TECHNICAL DOCUMENT FOR BATCH WASTE INCINERATION

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Environment Canada has developed a Technical Document for Batch Waste Incineration to provide guidance for owners and operators of batch waste incinerators regarding proper system selection, operation, maintenance and record keeping, with the goal of assisting them in achieving the intent of the Canada-wide Standards for dioxins/furans and mercury, and reducing releases of other toxic substances.

Incineration is recognized as an effective and environmentally sound disposal method for a wide range of wastes, and is used in facilities and jurisdictions across Canada. Waste generators located in remote areas may have limited options for cost-effective and environmentally sound waste management, and incineration may therefore be considered an appropriate waste management option. Remote commercial activities, such as exploration and development of natural resources, can create large volumes and varieties of wastes that must be managed appropriately. In certain locations, incinerating waste is an important means of avoiding potentially dangerous interactions between humans and wildlife. In all cases, reduction and diversion should be the primary waste management objectives, prior to considering any disposal option.

There are, however, some important potential environmental concerns associated with waste incineration that must be addressed through proper equipment selection, operation, maintenance and record keeping. These include potential releases of mercury, as well as dioxins and furans (PCDD/F), which are persistent organic pollutants (POPs). Mercury and POPs bio-accumulate in the environment and may cause adverse effects to human health and the environment. Dioxins/furans can be generated when inadequate incineration technology is used or when an incinerator is improperly operated. Mercury is not created in

an incineration system; emissions are directly related to the presence of mercury in certain waste materials. Therefore, the best method to control mercury emissions is to limit the quantity of mercury in the waste fed to the incinerator.

This presentation will provide an overview of the Technical Document for Batch Waste Incineration. The full document and executive summary can be downloaded from the website: <http://www.ec.gc.ca/drgd-wrmd/default.asp?lang=En&n=82401EC7-1>

DEVELOPMENT UPDATE FOR THE NICO GOLD-COBALT-BISMUTH-COPPER DEPOSIT, NORTHWEST TERRITORIES

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The NICO Gold-Cobalt-Bismuth-Copper Project is located in Tlicho Territory in the southern part of the NWT, approximately 160 km northwest of the City of Yellowknife and 50 km north of Whati. Access is by winter road from the highway at Behchoko and will be upgraded to all-weather capability. NICO is in the environmental assessment (EA) process to permit a vertically integrated project that includes a mine and concentrator in the NWT. A refinery will also be constructed in Saskatchewan or Manitoba to produce high value metal products including gold doré, cobalt and bismuth cathode co-products, and copper cathode and nickel carbonate by-products.

NICO and Fortune's nearby Sue-Dianne deposit are the only Canadian examples of IOCG deposits. They are situated in the Proterozoic Bear Structural Province of the Canadian Shield near the south end of the Great Bear Magmatic Zone. The NI 43-101 compliant Mineral Reserves are 21.8 million tonnes containing 760,000 ozs of gold, 61 million lbs of cobalt and 76 million lbs of bismuth.

The NICO deposit will be mined using a combination of open pit and underground extraction methods to feed a conventional crushing and grinding plant and concentrator producing a bulk flotation concentrate from the 5% sulphide fraction. The concentrate will be trucked to the rail head at Hay River for rail transport to the refinery in southern Canada. This Southern Hydrometallurgical Facility will employ secondary flotation to produce selective cobalt and bismuth concentrates. The cobalt concentrate will be processed by pressure acid leach in an autoclave, then purified by ion exchange, and electro-wonned to produce 99.8% cobalt and 99.9% copper cathodes. A nickel carbonate by-product is also precipitated. The bismuth concentrate will be subjected to ferric chloride acid leach and then electro-wonned to 99.5% cathode. Gold is recovered from cyanidation of the leach residues and electro-wonned to doré.

The NICO project has been successfully test mined to verify the grade and continuity of the deposit and produce a large sample for pilot plant testing. The pilot plant verified the process flow sheet, production of high value metal products, and verified or improved the metal recoveries used in an earlier positive bankable feasibility study. This study indicates a Pre-Tax internal rate of return of 32.3% and an 8% discounted net present value of \$361 million. Fortune Minerals also purchased and successfully dismantled the Golden Giant Mine at Hemlo, Ontario in order to relocate approximately \$40 million in equipment and buildings for the NICO development.

Fortune Minerals is currently completing the EA for the NICO Project. Applications were submitted to the Wek' eezhii Land and Water Board in November 2007 and regrettably, the project was not referred to EA until February 2009. The Company is expecting to complete the EA process in 2010 for mine commissioning in 2012. NICO will provide business and employment opportunities for Tlicho and

northern companies and diversify and sustain a mineral industry upon which the economy of the NWT is dependent.

COMMUNITY MAPPING PROGRAM: GEOSCIENCE OUTREACH WITH A HANDS-ON APPROACH

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The Northwest Territories Geoscience Office (NTGO) delivers geoscience outreach programs that describe local and regional geology, geological processes and timescales, and the ongoing search for mineral and petroleum resources. Students, teachers, and community members are key audiences for these programs. NTGO's Community Mapping Program is a great example of an outreach activity which incorporates all of these elements.

Each year, a different community within the Northwest Territories is selected to participate in the Community Mapping Program. Selection is based on level of community interest in the program. A team typically consisting of one or two geologists, four students, and two guides examine the geology around the community. Approximately ten days of field work are carried out. Field techniques are explained and demonstrated by visiting outcrops, observing and measuring geological features, recording information, and documenting locations. Students are also involved in photo-documentation of geological and geomorphological features. The observations and photos are used to create a poster for the community with non-technical explanations of the local geology. Once the poster is complete, NTGO staff return to the community to formally present the poster to community members. Copies of the poster are distributed and can be used as an educational tool or for tourism purposes. Copies are also distributed to other schools and organizations throughout the NWT. For the general public, posters may be obtained in person at the Northwest Territories Geoscience Office or from www.nwtgeoscience.ca.

This year, the Community Mapping Program took place in Fort McPherson. An overview of the project at Fort McPherson will be discussed, focusing on the geological landforms and features we investigated, as well as the logistical planning and execution of the program.

PROVENANCE AND DEPOSITIONAL SETTING OF THE UPPER HORNBY BAY GROUP, NWT AND NUNAVUT

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Stratigraphy of the Proterozoic Hornby Bay Basin, located along the Nunavut-Northwest Territories border north of Great Bear Lake, consists of two siliciclastic to carbonate sequences (>4000m), the Hornby Bay and Dismal Lakes groups, which unconformably overly deformed magmatic and supracrustal rocks of the Wopmay Orogen. These are overlain by a thick succession of continental basalt flows and fluvial sandstones, the Coppermine River Group. The Hornby Bay, Dismal Lakes, and Coppermine River groups define four sequences, all within Proterozoic Sequence A of western Canada (Young et al. 1979-Geology): A1, consisting of the Big Bear and Fault River formations; A2, consisting of the Lady Nye, East River, and Kaertok formations; A3, consisting of the LeRoux Formation and Dismal Lakes Group and; A4, consisting of the Coppermine River Group.

Sedimentologic studies were focused on sequences A2 and A3, the boundary of which represents an important horizon for uranium mineralization. The Lady Nye Formation conformably to unconformably overlies the Fault River and Big Bear formations and consists of fluvial sandstones that grade upward into shallow marine deltaic deposits. The Lady Nye is overlain by interbedded stromatolitic carbonates, siltstones and volcanic arenites of the East River Formation, which records gradual development of a storm-dominated carbonate platform during continued marine transgression. Mixed siliciclastic rocks of the gradationally overlying Kaertok Formation suggest renewed deltaic sedimentation, which was influenced by syndepositional faulting. The LeRoux Formation is a fluvial to marine quartzarenite that unconformably to disconformably overlies strata of sequence A2 that were faulted and folded during the 1620-1600 Ma Forward orogeny. The Fort Confidence Formation of the Dismal Lakes Group conformably overlies the LeRoux Formation and is composed of interbedded wavy- and lenticular-bedded sandstone and carbonaceous mudstones, which are interpreted to represent tidal flat deposits.

U-Pb detrital zircon geochronology of sandstones from the Hornby Bay basin identified several sediment sources which, in conjunction with this study's examination of Nd isotopes from siliciclastic mudstones of sequences A2 and A3, further constrain sedimentary provenance. In the East River Formation, epsilon Nd ranges from -4.75 to -2.34 (at 1600 Ma) with model ages (T_{DM}) from 2059-2657 Ma, and epsilon Nd in the Kaertok Formation ranges from -8.24 to -7.75 with T_{DM} between 2563-2822 Ma. In the Fort Confidence Formation, epsilon Nd ranges from -9.78 to -5.08 (at 1400 Ma) with T_{DM} between 2262-2554 Ma. Epsilon Nd values from the East River and Fort Confidence formations plot within the Nd isotopic evolution field determined for rocks of the 1.9 Ga Wopmay orogen and the 1.9-1.8 Ga Trans-Hudson orogen. The Kaertok Formation plots within a more negative epsilon Nd evolution envelope, which suggests a more isotopically evolved crustal source region, such as the 2.0-1.9 Ga Talston-Thelon orogen. Euhedral zircons with U-Pb ages ranging from 1660-1620 Ma are present in volcanic arenite of the East River Formation and are considered to approximate its age of deposition based on correlation with the 1660 Ma Narakay Volcanic Complex. This juvenile source likely contributed to the less negative Nd isotope signature of the East River Formation.

GEOSCIENCE OUTREACH: ROCK AND MINERAL KITS ACROSS NUNAVUT

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Nunavut formed in 1999 and as Canada's youngest territory contains both the sparsest and demographically youngest population. Since its inception, exploration expenditures have increased ten-fold. Recent NRCAN statistics, based on these expenditures, rank Nunavut as fourth in the country with 2009 spending estimated at \$168 million. This same updated survey lists 11 of Nunavut's exploration properties within the top 100 projects Canada-wide. With one gold mine (Meadowbank) scheduled to begin commercial production in the spring of 2010, and other advanced projects continuing development, many mine-related jobs will be available in Nunavut over the next decade. However, participation in exploration and mining by the people of Nunavut has been, and continues to be, traditionally low. Increasing geoscience appreciation, interest and understanding will help Nunavut and its people realize the potential and economic benefits of exploration and mining.

Partners in Nunavut have worked to expand geoscience outreach initiatives within the territory. These partners include Indian and Northern Affairs Canada (INAC), Canada-Nunavut Geoscience Office (CNGO), and the Government of Nunavut (GN). Outreach efforts include annual community visits (with the eventual goal of visiting every community at least once), the Nunavut Mining Symposium (held

annually and attracting industry, government and stakeholder participation), community-based prospector training, and community consultations. An increased interest in, and appreciation of, geoscience by people in Nunavut will lead to feelings of ownership and greater participation in the benefits that research, exploration and mining have to offer the territory.

Nunavut's Department of Education is currently developing middle and high school level Earth Science curricula for use in its schools. Geologists from INAC and the GN focused recent efforts on the development of comprehensive Nunavut-based rock and mineral teaching kits to support and complement the curricula territory-wide. The Nunavut Common Rocks and Minerals kits contain over 60 samples of the main minerals and rock types that students will find useful for a 'hands-on' and basic understanding of geology. Many key Nunavut localities were sampled and are represented by specimens in the kit. Each kit consists of four sample collections to cover the Igneous Rocks, Sedimentary and Metamorphic Rocks, Rock-forming and Common Minerals, and Ore Minerals. A dedicated guidebook, written by government geologists, and keyed to the samples in the kit, is included. This guidebook, in all four of Nunavut's official languages, explains the properties of the rocks and minerals, how to identify them, where they occur in Nunavut, and their traditional and commercial uses. Basic identification tools (e.g. hand lens, magnet) used by geologists are included with the kits, as well as a published guide for extended learning. In 2009, the kits were distributed to educators across Nunavut, every Middle and High School in the territory, the Nunavut Arctic College, the prospector training program, and mining companies with educational outreach programs.

NUNAVUT: GROWING INTO THE NEXT DECADE

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Mineral exploration, although less robust in 2009, remained strong with projects distributed across Nunavut's three regions (Kitikmeot, Kivalliq and Qikiqtani). Evaluations of new discoveries and advancement of existing projects will be on-going for the territory over the next decade and years beyond.

Gold exploration, deposit delineation and mine development were major components of 2009 activities. Agnico-Eagle Mines Ltd. worked to bring its Meadowbank gold deposit (Kivalliq region; probable gold reserves of 3.6 million ounces) into production. Newmont Mining Corporation was busy in the western Kitikmeot region, delineating and refining the three known deposits (Doris, Boston, Madrid) which have indicated and inferred resources of more than 10 million ounces of gold.

Sabina Silver Corporation now controls most of the Hackett River volcanic belt (western Kitikmeot); they own the Hackett River deposit and, following their take-over of Dundee Precious Metals, the Back River Project (George and Goose lakes projects). Hackett River, the silver-rich volcanogenic massive sulphide deposit with an indicated resource of 43.34 million tonnes, hosts at least eight known deposits. Back River's gold deposits contain indicated resources of 1.193 million ounces Au and inferred resources of 1.161 million ounces Au.

Comaplex Minerals Ltd. worked to advance the Meliadine gold project (Meliadine West and Meliadine East properties), Kivalliq region, towards a feasibility study. Junior explorer Commander Resources Ltd. signed an agreement with AngloGold Ashanti Holdings Plc for AngloGold to be a partner in Commander's Baffin Island gold project.

China Minmetals Non-ferrous Co. Ltd. took ownership of OZ Minerals Limited in 2009. Through its Canadian entity, MMG Resources Inc., Minmetals now owns all of OZ's base metal and gold assets in the

Kitikmeot region. These assets include Izok Lake, Gondor, Hood, High Lake, the former Lupin gold mine and the Ulu gold deposit.

Work continued on Baffinland Iron Mines Corporation's Mary River iron ore project on Baffin Island. Activities in 2009 included baseline studies, metallurgical test work, and delineation drilling of Deposit 1. Uranium exploration activities, limited to the Kivalliq region in 2009, were led by the most advanced project, Kiggavik, owned by AREVA Resources Canada Ltd.

Diamond work in 2009 was reduced from past years. The largest program, Peregrine Diamonds Ltd.'s (partnered with BHP Billiton) Chidliak property (Qikiqtani region), was the focus of a \$9.2 million program. Three diamond-bearing kimberlites were discovered in 2008, followed by 13 more discovered in 2009. The Amaruk diamond (with gold potential) project (Diamonds North Resources Ltd.) in the eastern Kitikmeot region has delineated twenty-four kimberlites, most diamondiferous. Anglo American Exploration (Canada) Ltd. and Vale Inco both picked up large blocks of ground considered prospective for nickel-PGM occurrences on Southampton Island. These acquisitions followed the release of government geophysical work led by the Canada-Nunavut Geoscience Office.

Nunavut, formed in 1999, has faced both challenges and opportunities throughout its first decade. Since 2007, senior companies have become more involved in Nunavut with juniors maintaining a strong presence. With this activity, Nunavut will once again become a mineral producer in 2010 with the commissioning of the Meadowbank gold mine.

NWT PROTECTED AREAS STRATEGY: STATUS OF LAND ACCESS AND PROTECTED AREAS DECISION MAKING

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The Northwest Territories (NWT) Protected Areas Strategy (PAS) is a community-based partnership process for establishing protected areas in the NWT. The PAS process respects the priorities of communities, industry and the environment. This presentation will include a brief overview of the PAS process including an update on recent progress, and will then focus on several aspects of the PAS process that are of particular interest to industry: interim protection, access, and the decision-making process.

Protected Areas may be designated under a variety of legislation, each with its own suite of protective regulations and permissible activities. Under the PAS process, communities identify areas they want to protect and apply to government to sponsor these areas, with the goal of protecting these areas under government legislation. If government agrees to sponsor these sites, a working group, consisting of key stakeholder interests, is established. Industry is invited to participate in each working group. The working group guides the evaluation of the candidate protected area and makes internal decisions on the boundary and management objectives. These decisions form the basis of working group recommendations to government on the designation of the protected area.

Under the PAS process, sponsoring agencies can apply for interim protection of candidate protected areas so that new third party interests are not granted while the area is being evaluated. The interim withdrawal does not affect pre-existing interests, which may continue to access existing claims and leases.

The Canadian Wildlife Service sponsored two new candidate National Wildlife Areas in August: Ka'a'gee Tu (in the Dehcho) and Shúhtagot'ine Néné (in the Sahtu). Much of Ka'a'gee Tu is already withdrawn under the Dehcho Interim Measures Agreement. An application for the interim withdrawal of

the Shúhtagot'ine Néné ("Mountain Dene Land") area is being drafted. The presentation will also provide a brief update on other areas and complementary processes, highlighting areas where access is currently affected and the timelines associated with these limitations.

PAS decision-making within the working group involves the collection and evaluation of cultural, ecological, non-renewable, renewable and socio-economic values. Mineral resource assessments are led by the Northwest Territories Geoscience Office. The Geological Survey of Canada has provided hydrocarbon potential assessments. Communities lead the collection of cultural data. Government agencies, such as the Canadian Wildlife Service or the Territorial Department of Environment and Natural Resources, or consulting biologists, lead the ecological data collection. Renewable resource, social and economic data collection is led by consultants. The working group uses spatial and non-spatial data and public consultation input to make recommendations on the area boundaries, designation and management. The presentation will describe examples of how the collected information is used in consultation and consensus decision making.

Throughout the process, the PAS encourages land users to speak to us about the PAS process, their land values, the opportunities to work with communities, and the implications for land access.

THE DUTY TO CONSULT AND ACCOMMODATE: CURRENT JUDICIAL AND STATUTORY DEVELOPMENTS

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Although the pivotal decisions of the Supreme Court of Canada in *Haida Nation*, *Taku River Tlingit* and *Mikisew Cree* brought greater structure and increased clarity to this challenging area, First Nations have continued to question the adequacy of consultation and accommodation in a wide variety of circumstances.

This presentation will review a number of recent court cases related to natural resource development projects, with a particular focus on decisions that consider the extent to which regulatory processes of the kind conducted by the National Energy Board and similar provincial agencies can discharge the Crown's constitutional duty to consult and, where appropriate, accommodate any potential infringement of Aboriginal interests.

It will also provide an update on the current proposal by the Government of Ontario to codify the duty to consult and accommodate by amending the provincial *Mining Act*, and outline the principal issues raised in two consultation-related cases from the Northwest Territories that are presently before the courts.

NUCLEAR NORTH OF 60° – TOTAL ENERGY SUPPLY FOR REMOTE HUMAN HABITATIONS

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This presentation will examine the direct application of nuclear energy solutions in the far north and other remote areas of Canada. It will challenge the existing energy network based on the shipment of fossil fuels to remote areas. The presentation will further examine the use of small, modular, and/or deployable nuclear plants in these locations.

The use of these small reactors and some newly emerging technologies could provide a near total energy, and food supply in these remote locations. In particular low grade heat processes, district heating, the ‘local’ production of motive fuels (synthetic gasoline, diesel, and aviation kerosene) from atmospheric CO₂ capture, and local food production will be examined. The economic and social impact of moving the value added side of many of these processes to the local communities will also be very briefly discussed.

At present there are approximately 5 to 8 developers, and vendors of small, modular, or portable reactors. These products range in size from a few kilowatts to 50 megawatts. Most of these units can be ‘ganged’ together to produce even larger outputs if required. It is important to note that at least one vendor of portable reactor technology is presently taking orders.

A REVIEW OF REMOTE PREDICTIVE MAPPING (RPM) ACTIVITIES IN CANADA’S NORTH

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RPM is a data-focused, iterative approach to geoscience mapping that underpins a new paradigm for “geological maps” as digital, interactive products. It entails the complete integration of all available geoscience datasets throughout all phases of the mapping process, from prioritization and planning to production. Housed in GIS databases, predictive layers show geological structures, rock units, surficial materials, landforms, alteration zones, anomalies, mineral potential, or a combination of the above, depending on the objectives of the particular mapping program.

This presentation will review RPM activities over the last year (2008-2009) and will highlight the following mapping themes:

- The use of high-resolution SPOT for mapping in the Cumberland Peninsula
- The use of LANDSAT and DEM data for the surficial mapping of large areas in the North – Preliminary lithologic information from optical remote sensing – Victoria Island
- Algorithm development for the automatic extraction of glacial landforms from a DEM
- Structural mapping from remotely sensed data – Melville Peninsula
- Geophysical mapping for RPM – algorithms and products
- RPM using high and low resolution geophysical data – Wopmay Orogen
- A proto-type bedrock predictive map – Wopmay district
- RPM for mapping in the Thelon basin
- The RPM special issue of the Canadian Journal of Remote Sensing
- Radar data acquisition over the North

- Hyperspectral data acquisition and research

SEISMIC EXPLORATION GUIDANCE FOR THE PROTECTION OF LAND, FOREST, AND WILDLIFE IN THE NORTHWEST TERRITORIES

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The departments of Environment and Natural Resources, Government of the Northwest Territories, Indian and Northern Affairs Canada, and Environment Canada agreed in January 2007 to jointly sponsor the creation of guidelines for seismic operations for the Northwest Territories. These guidelines were to help minimize the impact to woodland caribou, to be pro-active in addressing environmental impacts, and to ensure all proponents are treated in a transparent and equitable manner. The goal was to have guidelines available for March 2008.

The Guidance Document was developed:

- To provide staff of the three agencies a framework within which to offer consistent, expert advice to regulatory authorities that assign terms and conditions to permits aimed at limiting adverse environmental impacts resulting from seismic programs;
- To outline the information ENR, EC and INAC require to efficiently and consistently review applications during the screening process to determine if further information (information requests) or review (environmental assessment) is warranted.
- To assist seismic proponents and regulators of seismic programs in understanding the expectations of ENR, EC and INAC for minimizing those ecological impacts of seismic exploration in the NWT under the jurisdiction of ENR, EC and INAC;
- To assist ENR, EC and INAC in the issuance of any permits that may be required for seismic programs; and
- To promote the use of innovative practices and equipment for environmental protection.

Guideline materials were subsequently drafted and distributed for consultation in 2008. Consulting bodies included regulatory boards, First Nations, industry representatives, other government agencies, and private and interested parties. Consultative meetings were held in Inuvik, Norman Wells, Yellowknife, Hay River, and Calgary.

This work resulted in a guidance table. This table includes identification of valued components, operational outcomes, and guidance statements. The document also includes explanations of the application and purpose of this work, guiding principles, and expectations around digital information. Appendices provide a glossary of definitions, information on seismic practice and innovation, departmental mandates, and background on wildlife sensitivities and an ecological context for this work.

The guidance document is expected to be used over a two year period, at which time the three departments will assess the application of these materials and include follow-up activities.

THE CHIDLIAK DIAMOND PROJECT, BAFFIN ISLAND, ONE YEAR AFTER INITIAL DISCOVERY

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The discovery of diamond-bearing kimberlites on the 980,000 hectare Chidliak project, 120 kilometres northeast of Iqaluit, on Baffin Island, by Peregrine Diamonds Ltd. is an example of a successful grass roots exploration programme using traditional diamond exploration techniques.

Reconnaissance-scale till sampling from 2005 to 2007 identified an area with abundant kimberlite indicator minerals (KIMs). Ten percent of the peridotitic pyrope grains had a high chrome/low calcium harzburgitic, or “G10” geochemical signature. Diamond inclusion field eclogitic garnets and chromites were also recovered. Clinopyroxene thermobarometry indicated that the area was characterized by a cool geotherm, similar to that of the Slave Province.

In July and August 2008, an 11,700 line-kilometre helicopter-borne geophysical survey was completed over areas with high concentrations of KIMs. Field checking of three high priority magnetic anomalies in 2008 resulted in the discovery of three diamondiferous kimberlites at surface, CH-1, CH-2 and CH-3. A 2.3 tonne mini-bulk sample, collected from an outcrop at CH-1 yielded 34 commercial-size diamonds larger than 0.85 mm weighing a total of 3.55 carats, a diamond content of 1.56 carats per tonne. The largest stone was a 2.01 carat gem. In November 2008, BHP Billiton elected to exercise its earn-in rights at Chidliak and is entitled to earn a 51 percent interest in the project by incurring \$22.3 million in exploration expenditures.

The 2009 Chidliak exploration programme with a budget of approximately \$9.2 million is fully funded by BHP Billiton. Accomplishments during the programme include the discovery of 13 new kimberlites (CH-4 to CH-16), seven by drilling and six by prospecting, the collection of a surface sample of approximately 50 tonnes from CH-1, the collection of 1,273 till samples, completion of 1,100 line kilometers of ground geophysics and completion of an initial environmental baseline study. Initial diamond results have been received for five of the 13 new kimberlite discoveries. After caustic fusion analyses, a 399 kilogram sample of drill core collected from CH-6 yielded 2,730 diamonds larger than the 0.075 mm sieve size including 131 stones larger than the 0.600 mm sieve size. The largest diamond recovered from the sample was a 0.62 carat white, transparent aggregate. A 221 kilogram sample of surface material collected from CH-7 yielded 664 diamonds larger than the 0.075 mm sieve size including 11 larger than the 0.600 mm sieve size. The largest diamond recovered from the sample was a 0.64 carat transparent octahedroid.

Since July 2008, 16 kimberlites have been discovered at Chidliak; eight have been tested for diamonds and all are diamond-bearing. The diamond results from 2.3 tonne, 399 and 221 kilogram samples collected from the CH-1, CH-6 and CH-7 kimberlites, respectively, have coarse diamond size distributions that are consistent with economic potential and require further work.

Planning is underway for the 2010 Chidliak exploration programme which is currently scheduled to commence in April and include an expanded high resolution geophysical survey, multiple drill rigs to test new targets and drill kimberlites demonstrating economic potential, and more prospecting for kimberlites exposed at the surface.

CLIMATE (TEMPERATURE) AND GROUND TEMPERATURE DYNAMIC NORMALS FOR NORTHERN CANADA

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Northern Canada has and will continue to experience major climate warming that will impact infrastructure, roads and pipelines, water reservoirs and reclaimed waste storage facilities. The existing 30 year Climate Normals information provided by Environment Canada needs to best reflect the rapid warming that has already occurred in northern regions when used for design of new facilities or retrofits/adaptation of existing facilities. Some recent discussions internationally have suggested that the traditional approaches of using 30 year averages or Climate Normals for various climate parameters may not be sufficient for regions where rapid climate changes are already underway. This is the reality for many regions of Northern Canada.

This presentation will provide results from analyses of Environment Canada's historic air temperature records using 50 climate stations across northern Canada. Supplementary data in the form of shorter temperature records from mine sites was added to reduce the impact of data scarcity in some regions. The analyses considered alternatives to traditional climate temperature Normals, including use of "Dynamic Normals" or "Optimal Normals", as described by the National Oceanic and Atmospheric Organization (NOAA), World Meteorological Organization and others. The analyses results indicated that variations of the "Dynamic Normals" approaches provided the suitable climatic design information for use in Northern Canada.

This presentation will provide an overview of historic and current air and ground temperatures as well as appropriate design temperatures for design of infrastructure in permafrost regions. The final results will be published in two reports. The first report will develop the concepts and maps, illustrate results for representative locations and include climate change model projections, limitations and sample downscaled future temperature values. A second report is intended to provide the detailed design data for selected Northern Canada locations, including Dynamic Normal information for mean annual temperatures (updated to 2008), monthly and seasonal warming rates and estimated mean annual ground temperatures (updated to 2008).

EXPLORING THE DEBATE OVER "FREE-ENTRY" MINERAL STAKING

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Mineral staking regulations that determine exploration processes in the Northwest Territories are guided by a historically based assumption, sometimes referred to as "the free-entry" principle. This principle is also known as an open access system, which is fundamental to mineral staking legislation. Non-Governmental Organizations and First Nations groups throughout Canada have criticized free-entry or open-access mineral staking because staking *can* take place prior to consultation with First Nation communities and private landholders, the latter being particularly relevant in southern Canada. Consultation sometimes does take place prior to claim staking, but this is not legally required. Many see an open access system as the only way that mineral claim staking can function, largely due to the secretive nature of mineral exploration work. Nevertheless, it appears free-entry is being challenged. This causes property rights questions to arise that are relevant during the onset of staking and exploration ventures. This presentation examines "free-entry" mineral staking in Canada with a focus on the

Northwest Territories and the legal elements that surface during the polarized debate over mineral staking regulations.

TRACE ELEMENT SYSTEMATICS OF MICROXENOLITHS AND XENOCRYSTS FROM THE RENARD KIMBERLITES, QUEBEC

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Xenoliths and xenocrysts provide a means to directly study the Earth's upper mantle. In the case of kimberlitic samples they provide direct insights into the origin and evolution of the lithospheric mantle keels beneath cratons. Whilst the analysis of major elements provides important information on initial processes of craton formation, subtle indications for subsequent modification are often missed. Trace elements are more sensitive to secondary events which have modified the lithosphere. Tracing such events is important for the understanding of craton evolution and helps identify the specific conditions controlling the growth, survival and destruction of diamonds.

The Renard kimberlites are located on the Superior craton within Quebec. Nine kimberlite pipes have been discovered within a 2km² area in the northern Otish Mountains. To better constrain the diamond sources in the underlying lithospheric mantle, 116 microxenoliths and xenocrysts were collected.

Applying the single mineral geothermometer of Nimis and Taylor (2000), clinopyroxene xenocrysts indicate that a cold Slave-type geotherm was present when the kimberlites erupted 630Ma ago. Using LA ICP-MS, Ni contents of the garnets were analysed and the single phase garnet thermometer of Canil (1994) applied. Projecting the garnet temperatures onto the geotherm, established via clinopyroxene geothermobarometry, shows consistency in the depth of origin of the mantle sample studied. The majority of grains are derived from a restricted depth range, between 95-140km, within the graphite stability field. Previous analyses by Stornoway Diamond Corp. have shown clinopyroxene grains to fall along a geotherm to depths of 190 km. In the current work such deep samples are rare. This likely reflects a sampling bias, with deeper material absent in the sieve size collected for this research.

The majority of garnets analysed for their trace element composition plot in the Iherzolitic (G9) field (Sobolev et al., 1973; Grütter et al., 2004). Focusing on this population there is considerable variability in the chondrite normalized trace element patterns, indicating varying degrees and styles of mantle metasomatism.

Using the Y versus Zr discrimination plot of Griffin et al. (1999), including the additional metasomatic trends by Creighton et al. (2009), the Renard garnets show a complicated metasomatic history. A large population shows MARID (mica-amphibole-rutile-ilmenite-diopside; Dawson and Smith, 1977) type melt metasomatism, characterized by increasing Y with very low to no Zr enrichment. A second population is indicative of "conventional" melt metasomatism, associated with simultaneously increasing Y and Zr. A small subpopulation fall along the low temperature phlogopite (fluid) metasomatism trend, with minor increase in Y compared to Zr enrichment.

When the style of metasomatism is plotted versus depth, the MARID metasomatism falls within a restricted temperature range of 900-1000°C (~130km depth). The conventional melt metasomatism covers the entire depth range of the sample set. Whilst the majority of samples studied here are derived from the graphite stability field, it appears reasonable to suggest that melt metasomatic events extended into the diamond stable portion of the lithospheric mantle. Similar to findings elsewhere (e.g. Malkovets et al.,

2007), it may have been the interaction of these enrichment events with more depleted regions in the subcratonic lithospheric mantle that promoted diamond formation.

URANIUM IN THE THELON BASIN – A FUTURE FOR RESPONSIBLE MINERAL DEVELOPMENT IN CANADA’S NORTH?

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The Thelon Basin of Nunavut and the Northwest Territories has the potential to be a significant source of future uranium production. This ca. 1720 Ma (Paleoproterozoic) sandstone basin is one of very few areas in the world with a geological setting similar to that of the Athabasca Basin – the world’s premier uranium producing region, which supplies about 30% of global uranium production. Mineralization known in the northeast Thelon (the Kiggavik - Andrew Lake - End deposits of AREVA Resources Canada) and historic showings in the southwest (Boomerang) are classified as the unconformity uranium type. This type of exploration target is well suited for the mineral industry in arctic Canada. The high grades and large deposit sizes of unconformity uranium deposits provide not only an economic advantage (minimize the surface extent of development required and the amount of material moved) but also environmental and socio-economic advantages because of their small sizes. Uranium mining in northern Saskatchewan has proven to be safe to workers and the environment, with radiation exposures well below the regulatory requirements of the Canadian Nuclear Safety Commission.

Successful exploration for uranium deposits in remote, poorly known regions is particularly challenging. The approach of Cameco involves traditional field geology along with geophysics, geochemistry, and new technology to maximize the effectiveness of the exploration efforts. Key to the success is a good understanding of the relationship of these methods to real world geology, particularly in the arctic environment.

Cameco Corporation has a strong commitment to corporate social responsibility; minimizing impact to the environment and supporting local communities in its operations. That same commitment would be applied not only to mine development in the north but is applied currently at the exploration stage. Uranium exploration projects emphasize the best technical exploration methods and practices, minimize impact to the environment, use local businesses, hire local employees, and are responsive to community concerns. Economic development through the uranium mining industry can coexist with social/environmental protection concerns in arctic Canada.

GEO-MAPPING FOR ENERGY AND MINERALS (GEM): STUDIES OF THE BEAUFORT-MACKENZIE BASIN THERMAL REGIME

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A multi-year government-industry funded study of petroleum systems of the Beaufort-Mackenzie region is continuing under the new NRCan Geo-Mapping for Energy and Minerals (GEM) Program. The study is multi-faceted with emphasis on oil-source correlation, stratigraphic refinement and petroleum resource assessment. An understanding of the basin thermal history is necessary for constraining petroleum generation histories and assessing petroleum potential. The present thermal state of the basin is an important boundary condition for models of thermal history and the distribution of permafrost provides an upper thermal boundary condition for constraining basin geotherms and the gas hydrate stability zone.

Seismic survey (check shot velocity, Crystal Cable), digital log and shallow temperature (from shut-in permafrost monitor wells) data were compiled and used to map the base of permafrost (essentially at 0°C) across the region. Drillstem test and bottomhole temperatures (“Horner-corrected” for mud circulation effects) were compiled and quality-ranked for approximately 250 petroleum exploration wells and the better quality data were used to construct a geothermal gradient map. Thermal conductivity measurements were made on selected sandstone, shale and carbonate core samples of Cenozoic to Paleozoic age from the area to constrain heat flow calculations. Vitrinite reflectance, Rock-Eval and apatite fission track data were also acquired for key wells to constrain basin paleotemperatures.

Permafrost is thin or absent in deformed and exhumed strata of the western Beaufort Sea but thickens rapidly eastward, attaining a maximum thickness of >700 m in the northeast part of Richards Island on the west side of Kugmallit Bay. Much of the basin is characterized by normal geothermal gradients (25-30 °C/km) but elevated gradients (30-50 °C /km) occur near fault zones (Tarsiut-Amauligak, Taglu, Eskimo Lakes) and along the southeast basin margin. Higher temperatures near major fault zones could be related to fluid movement along the faults. Low gradients (<25 °C/km) are associated with rapidly deposited Plio-Pleistocene strata on the outer Beaufort Shelf. Rapid burial has also led to low thermal maturity and a deeper petroleum generation zone.

The history of surface temperature change and permafrost development is poorly understood for this region but is important for thermal history modelling because surface cooling can influence deep basin temperatures, depending on its duration. Preliminary models indicate that calculated deep basin temperatures can vary by tens of degrees, causing the predicted thickness and depth of the petroleum generation zone and the timing of modelled petroleum generation to vary by hundreds of metres and millions of years, respectively. Geologically-constrained forward and inverse modelling approaches are being developed and applied to reduce this uncertainty. In particular, multi-kinetic apatite fission track thermochronology allows for enhanced resolution of pre- and post-depositional thermal histories, providing time-temperature information on exhumed sediment source regions and buried and exhumed successions within the basin.

THE PRESENCE AND PERSISTENCE OF ARSENIC TRIOXIDE IN SOILS NEAR GIANT MINE AND GIANT MINE TOWNSITE

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Soils in the Yellowknife region are naturally enriched in arsenic associated with gold mineralization, and anthropogenically enriched in arsenic near the Giant gold mine as a result of mining and processing activities. Thousands of tonnes of As₂O₃ dust were emitted from the roaster stack, most of it during the first ten years of operation before emission controls improved.

Soil sampling was designed to target areas impacted by historic atmospheric dispersion of stack emissions based on air photographs, wind directions and previous studies. Twenty-three of these samples were soil cores (30-60 cm in length) and ten were taken from small vegetated pockets of soil on outcrops.

The soil profiles from the Giant mine show elevated arsenic and antimony in surface soils and decreasing concentrations with depth. A combination of techniques including synchrotron-based X-ray diffraction, X-ray absorption and electron microscopy were used to identify remnant arsenic trioxide in many surface samples, including the outcrop soils sampled west of the stack and adjacent to the townsite. The presence of arsenic trioxide is not correlated with total arsenic, but is positively correlated with antimony and

organic carbon concentration. The proportion of total arsenic that can be attributed to arsenic trioxide in our samples varies from 25 to 63%.

A selective sequential extraction designed specifically to target arsenic was applied to ten samples. Arsenic trioxide appears to be released in the relatively strong HCl leach steps based on the assumption that the antimony present in arsenic trioxide is released simultaneously. Between 15% and 85% of the total As in the samples is released from the first three extractions (adsorbed exchangeable, organics and carbonates). How this loosely-bound arsenic is hosted in the soil is not well understood.

Arsenic trioxide is normally considered one of the most soluble and bioaccessible forms of arsenic found in contaminated soils. However, in the case of the soils near Giant, the arsenic trioxide particles appear to have persisted for decades and are not easily released in the selective sequential extraction.

UPDATING THE NORTHERN LAND USE GUIDELINES FOR THE NORTHWEST TERRITORIES AND NUNAVUT

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The Northern Land Use Guidelines are a series of 11 volumes published by Indian and Northern Affairs Canada (INAC) that are intended to assist industry and regulators when planning and assessing land use activities, identifying related environmental effects, and minimizing environmental impacts. The guidelines are applicable to small and medium-sized land use operations, such as quarrying or mineral exploration, on federal Crown land in the Northwest Territories and Nunavut. These guidelines are useful for land use operators because they explain INAC's role in northern land management, recommend baseline information needs and sources for land use permitting, and discuss current northern-specific operating techniques that comply with permit conditions and minimize land disturbance.

Two volumes that describe the administrative regime of the territories are currently available (www.publications.gc.ca). The Administrative Framework volume summarizes INAC's current role in land management in the Northwest Territories and Nunavut, and reviews resource management and environmental legislation applicable to land use operations. The Administrative Process volume outlines the different land use permitting and environmental assessment processes in Nunavut, the Inuvialuit Settlement Region and the Mackenzie Valley of the Northwest Territories. In 2010, two operational volumes will be published. The Pits & Quarries and Roads & Trails volumes outline northern-specific considerations for site planning, development, operations, and reclamation of quarries and roads in the two territories.

Guidelines under development in the series include: Permafrost, Camp and Support Facilities, Mineral Exploration, Hydrocarbon Exploration, Closure and Reclamation, and Sustainable Development.

NORTHWEST TERRITORIES GEOSCIENCE OFFICE: OVERVIEW OF CURRENT ACTIVITIES

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The Northwest Territories Geoscience Office (NTGO) represents a partnership between Indian and Northern Affairs Canada - NWT Region and the Government of the Northwest Territories, Department of Industry, Tourism and Investment. The NTGO functions as the Geological Survey of the Northwest

Territories and focuses on original geoscientific research and service delivery to a wide variety of clients. Research includes geological mapping, geochemical and geophysical surveys, non-renewable resource assessments, evaluation of mineral and petroleum systems and regional potential, and information technology developments. Services include data management and delivery, outreach and education, maintaining an Earth Science library, responding to numerous client requests, and administering portions of the Northwest Territories and Nunavut Mining Regulations. The office currently houses 23 staff members and is located in Yellowknife.

During the summer of 2009, NTGO field work took place in the Mackenzie Mountains, Mackenzie Valley, Wopmay Orogen, Yellowknife Greenstone Belt, Blachford Intrusive Complex, and Churchill Province. Two important aspects of field projects are that (i) they are regularly carried out in partnership with university-based or other colleagues, and (ii) they typically encourage and support student training. In tandem with the Geological Survey of Canada, NTGO staff also participated in field work on Victoria Island. Although field projects mainly support economic development goals, some non-renewable resource assessment projects are carried out under the auspices of the Protected Areas Strategy.

Information technology represents a vital part of the NTGO mandate to make geoscience information readily available to clients. Our flagship NT GoMap web-GIS portal continues to grow in terms of data availability, functionality, and performance. A recent development is the addition of two diamond databases to this platform, with more diamond-related and other databases to be added in the future. The Gateway web application provides access to NTGO publications as well as a variety of other digital mineral and petroleum reports. Digital field data collection using Pocket PCs continues to underpin most NTGO mapping projects.

The NTGO outreach program offers a variety of services. This year we would like to highlight the considerable contribution made by two industry partners who recently hosted the NTGO – University of Alberta third-year undergraduate field school. Avalon Rare Metals Inc. and GGL Resources Corp. have graciously supported this student training exercise over the past three years. We are grateful for the very high level of support provided and the vision that these companies share with us in developing the next generation of field geologists.

Finally, this presentation and the entire Exploration and Geoscience Session is dedicated to the memory of our long-time colleague Dr. Stephen Goff, who passed away unexpectedly in August 2009.

UNEXPLORED POTENTIAL OF THE AMARUK PROJECT

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The Amaruk project is located 40 kilometres south of Kugaaruk, Nunavut, within the Archean Rae Domain of the western Churchill Province. This area has been subjected to Paleoproterozoic successor sedimentation, magmatism, and tectonothermal reworking. The project area lies at the southern margin of the Boothia Uplift. Mapping of the area by the GSC shows moderately high-grade gneissic terrain dominated by Neoproterozoic metaplutonic rocks, lesser Archean and Paleoproterozoic supracrustal sequences, and migmatitic gneiss.

Amaruk remains one of Canada's top opportunities for a significant diamond discovery. Exploration on the Amaruk project began in 2003 and thus far Diamonds North has completed 128,000 line kilometres of airborne geophysics, 567 ground based magnetic surveys and drilled 140 exploration RC holes. This has resulted in discovering 25 separate & discrete kimberlites of which at least 80% are diamondiferous. As

exploration has progressed, Diamonds North has utilized innovative techniques to reduce the exploration cycle time and cut costs on target testing. Techniques such as non-commercial ultra-high resolution fixed wing magnetic surveying, waterless reverse circulation drill target testing, and one tonne kimberlite samples for inexpensive dense media separation rather than traditional caustic fusion diamond recovery.

Kimberlite exploration remains a key focus of the company and the Amaruk property shows high economic potential based on the geochemistry of key indicator minerals. The company believes that the diamondiferous mantle below Amaruk is a minimum of 22 km thick which given the right conditions of sampling kimberlites could entrap enough diamond-bearing mantle to be economic. Diamond exploration at Amaruk is focused on discovering new kimberlites and rapidly testing them for macrodiamond content. During the 2009 season a 6780 kg sample was collected from the Beluga-3 kimberlite and one new kimberlite was discovered by drilling.

The Tunerq nickel prospect discovered in 2007 and drill tested in 2008 has revealed the potential for Ni/Cu deposits within the Amaruk property. The Tunerq gabbro/ultramafic gossan returned 35m of 1.05% Ni including 9m of 2.5% Ni. Limited exploration this season has revealed numerous gabbro and ultramafic occurrences across the property, some with significant mineralization.

Significant gold potential has recently been demonstrated on the property. A continuous rock chip sample across an oxidized sulfide zone yielded 9.4 g/t gold over 3 metres. A nearby grab sample of un-oxidized altered Quartz Feldspar Porphyry (QFP) which extends laterally tens of metres beyond the oxide zone contained 24 g/t gold. The oxidized sulfide zone, which was the target for gold exploration has been observed over a length exceeding 100 metres and 3 to 8 metres wide, increasing up to 20 metres wide locally. The extent of the QFP is unknown. In addition, this past season saw the first project wide prospecting for gold which has resulted in numerous areas of interest with sulfide mineralization (assays pending at time of abstract submittal).

Diamonds North Resources is rapidly evolving and committed to building long-term value for shareholders through ongoing discoveries and leveraging business opportunities from our vast land holding.

THE CANTUNG MINE: USING 3D MODELLING FOR EXPLORATION TARGETING AND RESOURCE/RESERVE CALCULATIONS

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Three-dimensional computer models have become important tools for the investigation of ore deposits. The ability to view a deposit as a three-dimensional volume on a computer screen, allows the geologist to discern patterns and trends invisible in the standard two-dimensional data presentation format of level plans, cross-sections and long-sections. The compilation of structural and geochemical information in three dimensions, in addition to the lithological and assay data normally recorded by a mining operation, permits new insights into the genesis of ore concentrations.

The Cantung Mine is an unusually large and high-grade deposit that developed in a package of folded and overturned limestones above a Cretaceous granite intrusion (95 Ma). Indicated mineral resources are estimated at 1,505,476 Tons at a grade of 1.27% WO₃ with current probable reserves as of July 1, 2009

estimated at 1,020,699 Tons at a grade of 1.08% WO₃ published in the NI43-101 Technical Report dated August 2009.

Cantung, the western world's largest tungsten producer, was placed into care and maintenance in October 2009, as it has a large stockpile of processed concentrates. The current plan is to develop additional resources and reserves during the shut down using 3D modeling. Upon the anticipated re-opening, when global markets stabilize, these resources and the 3D model would be the basis for a more efficient, sustainable development of the mine. In addition, the 3D models will greatly assist with the exploration of targets within the active mine area and to highlight opportunities in close proximity to the existing mine infrastructure.

2009 EXPLORATION UPDATE FOR THE PROVIDENCE NICKEL DISCOVERY, SLAVE PROVINCE, NT.

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The Providence Lake Nickel Discovery (**PLND**) is located 270 km NE of Yellowknife NT, and 55 km west of the E'kati diamond mine. The discovery is situated near Desteffany Lake on the claims held by Arctic Star Diamond Corp. (ADD-TSX). At the **PLND**, Ni-Cu-Co-PGE bearing massive and disseminated sulphides occur in mafic and ultramafic rocks near the base of the Central Slave Cover Group (CSCG) (Bleeker, et al¹). The discovery history and drilling results were presented last November at this Geoscience convention (see abstract-2008).

During the 2008 program, Arctic Star discovered significant nickel, copper, cobalt and platinum group element (Ni-Cu-Co-PGE) mineralization on the Credit Lake Property. Of fourteen drill holes that intersected massive and disseminated sulphides, diamond drill hole 08CR-18 cut the thickest intercept of massive sulphides from 98.35-103.45m, for 5.1 meters that averaged 1.73% nickel, 1.75% copper, 0.17% cobalt and significant platinum group elements. This drill intersection is certainly one of, if not, the most significant Ni-Cu-Co-PGE results discovered on the Slave Craton, and demonstrates the potential for economic magmatic Ni-Cu-Co-PGE mineralization in ancient Central Slave Cover Group lithologies on claims held by the company.

In preparation for its 2010 program, exploration by Arctic Star, conducted during August-September, 2009, focused on the development of drill-ready targets from the 2008 VTEM magnetic-electromagnetic survey flown over the CSCG belt within the Arctic Star Credit Lake claim block. This endeavour was successfully completed with the identification of 28 priority drill targets through the employ of ground geophysical surveys (MaxMin & magnetics). In addition to VTEM anomaly confirmation and drillsite location, numerous new occurrences of outcropping mineralization (pyrrhotite-chalcopyrite) were discovered at some of these priority targets. Assay results have not yet been received for the samples collected at these sites but these new occurrences of mineralization are hosted in mafic to ultramafic lithologies, usually in contact with or near the contacts of sulfide facies iron formations.

During the 2009 field season, detailed ground magnetics (10 meter-20 meter line spacing) was completed over approximately two-thirds of the 18km long belt of favourable geology on Arctic Star's claims. Additionally, the entire belt within the claim block has now been covered with a soil sampling survey with samples collected every 50 meters along two hundred meter spaced grid lines. Both the detailed magnetics and soil surveys, conducted during the 2008 program proved to be excellent pathfinders to mineralization and favourable host rocks.

¹ “The Central Slave Basement Complex, Part I: its structural topology and autochthonous cover”, Wouter Bleeker, John WF Ketchum, Valerie A. Jackson, and Michael E. Villeneuve, Canadian Journal of Earth Sciences, Volume 36, Number 7, July, 1999, Pages 1083-1109, ISSN 1480-3313.

MINERAL AND ENERGY RESOURCE ASSESSMENT (MERA) FOR THE AREA OF INTEREST FOR THE PROPOSED EAST ARM NATIONAL PARK

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The Mineral and Energy Resource Assessment (MERA) process for the area of interest for the proposed East Arm National park completed its second and final year of the MERA Phase II field work in the summer of 2009. The MERA process was established in 1980 as the mechanism to ensure that the economic and strategic significance of mineral and energy resource potential is duly considered in the national park establishment process in Federal lands north of the 60th parallel. In June 2007, at the request of Parks Canada, the GSC initiated Phase I of the East Arm MERA process. This involved compiling an inventory of all existing public domain data in the study area and identifying data gaps. Phase I compilation results were used to design the Phase II field studies work plan, which was approved in February 2008. MERA Phase II studies involve five main types of field investigations: Quaternary, bedrock, geophysical, metallogeny and hydrocarbon. The majority of the field program was carried out in 2008, with fill-in and follow-up work undertaken in 2009.

An updated 1:125,000 scale digital Quaternary map based on air photo interpretation and field observations was completed in 2009. Fifty additional till samples were collected during the 2009 field season as part of a detailed follow-up work on three selected areas, based on analysis of heavy minerals from 465 till and esker samples collected during the 2008 field season. In 2009, an additional 150 bedrock sites were visited, complimenting the 350 sites from the 2008 field season. Bedrock field studies in 2009 concentrated in the less well mapped and understood Rae domain and the Talston and Thelon magmatic zones. An updated digital geology map is currently being compiled. The ten teleseismic stations installed during the 2008 field season as a linear array extending across the entire study area from Gardinia Lake in the south, crossing Artillery Lake, to Cook Lake in the north, continued to operate well and collect seismic data. All stations were serviced in the spring and fall of 2009, with data interpretation currently in progress. Fifteen known mineral occurrence sites were visited during the summer of 2009 in addition to the 35 sites visited in 2008. These metallogenic field investigations, plus subsequent geochemical and thin section analysis have contributed significantly to understanding the character and distribution of the different deposit types found in the study area. Occurrences of organic rich shales from the Paleoproterozoic East Arm Supergroup were examined and sampled in 2009 to evaluate potential for unconventional oil and gas accumulations.

The next steps include laboratory data acquisition and interpretation in the fall of 2009, followed by mineral potential modelling and report writing during the winter of 2010. The final report, including internal and external review processes, is expected to be completed by Spring 2010.

THE GEM DIAMOND PROJECT: AN OVERVIEW

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The goal of the GSC's new GEM Diamond Project is to unravel the history of the mantle lithosphere north of 60° in 4-D, and to determine and delineate areas suitable for diamond formation and stabilization. The project is multidisciplinary, encompassing geophysical, mantle and crustal petrology,

diamond and kimberlite petrology and Quaternary deposit studies. These studies are being carried out by the GSC with university and industry partners. In 2009, a variety of different field- and laboratory-based projects were undertaken.

The GSC in 2009 acquired mantle- and crustal-sounding magnetotelluric (MT) data on Melville Peninsula, and crustal sounding MT data on Cumberland Peninsula, Nunavut. The GSC also installed five new teleseismic stations located at: (1) Diamond North's Hepburn Lake camp, (2) Sanatana's Sulky Lake camp, (3) GSC's Cumberland Peninsula camp, (4) Peregrine Diamond's Chidliak Discovery camp, and (5) near Ulukhaktok (Holman) on Victoria Island. The GSC maintained fourteen existing stations within the Rae craton and fourteen existing stations on the margins of the Slave craton, and continuously analysed data from new earthquake records at these stations. In 2009 the GSC also supported the maintenance of the University of Bristol's nine stations located between Southampton Island and Iqaluit. The Bristol group also added new stations on Charles Island and at the Baffinland Iron Mary River camp.

Lower crustal xenolith sampling in 2009 was undertaken by INAC and the GSC on Sanatana's Dharma kimberlite. Petrology and geochronological studies on crustal xenoliths from kimberlites located in Shear Minerals' Churchill/Sedna project are currently in progress (D. Petts, Ph.D., University Western Ontario). Petts also sampled Repulse Bay area kimberlite cores for lower crustal xenoliths. Mantle xenolith sampling was undertaken in the field at Stornoways's Artemesia kimberlites, in support of a M.Sc. thesis on eclogites (S. Coombs, University of Alberta) and Ph.D. thesis on peridotites (K. Mather, Durham University). Mather also continued petrology (thermobarometric and Re-Os) studies on mantle xenoliths from Gahcho Kué, Diavik, Ekati and Jericho.

Early comparative results of the deep-sounding geophysical surveys on Melville Peninsula reveal different trends within the mantle lithosphere (50-250 km depths). MT polarization strike directions are predominantly NE-SW whereas teleseismic discontinuities dip westward with nearly N-S strikes. Similar comparative studies within the Wopmay Orogen near Gameti reveal similar orogen-related structures in the crust and mantle as were interpreted from the Lithoprobe SNORCLE transect further to the south. A teleseismic transect across the MacDonald fault near the East Arm of Great Slave Lake reveals considerable Moho topography and some uppermost mantle structures.

In summer 2010 multidisciplinary studies based out of Repulse Bay are planned. These include Quaternary studies, new MT acquisition, field studies of kimberlites and mantle and crustal xenolith sampling, and redeployment of some teleseismic stations. Redeployment of teleseismic stations located on the western (near Gameti) and southeastern (near Reliance) margins of the Slave craton will also occur if sufficient quality data has been acquired at those sites.

CLIMATE WARMING, PERMAFROST DEGRADATION AND IMPACTS TO AQUATIC ENVIRONMENTS, WESTERN ARCTIC, NWT, CANADA.

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Many arctic regions with abundant lakes and ponds are characterized by ice-rich terrain sensitive to thermokarst disturbance. In the Mackenzie Delta region, permafrost degradation in the form of retrogressive thaw slumps commonly develop adjacent to tundra lakes and individual disturbances may impact several hectares of terrain. The abundance, size and growth rates of slumps have increased significantly since the 1970s with rising air and regional permafrost temperatures. Thousands of lakes in the western Arctic are impacted by retrogressive thaw slumping. To examine the chemical effects of thawing permafrost on lake water quality we assessed water chemistry for a large number of slump-disturbed and undisturbed lakes across tundra uplands in the Mackenzie Delta region. The environmental factors typically evoked to explain variation in tundra lake water quality, including surficial geology and proximity to the treeline or to the coast, were subordinate to the main driver, permafrost degradation. Thaw slump-affected lakes had elevated ionic concentrations and surprisingly, higher water clarity in comparison with undisturbed lakes. The strength of the ionic impact was positively associated with the proportion of catchment affected by slumping and inversely related to disturbance age. We also found that fire-induced active-layer deepening had a detectable influence on lake water ionic strength. Preliminary evidence suggests sedimentary diatom assemblages track the changes in chemical and physical limnology coincident with the timing of thermokarst slumping, and thus, may prove a valuable tool for inferring changes at the base of the aquatic food web in these lakes and could provide insight into the timing, magnitudes and effects of past permafrost degradation events. In a warming arctic, we can anticipate that thermokarst processes will increase in importance as a driver of ionic chemistry and optical properties of small lakes and ponds with potential to alter aquatic food webs.

LARGE SCALE IMPACTS OF A STORM SURGE IN THE OUTER MACKENZIE DELTA, N.W.T.

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The Mackenzie Delta, in northwest Canada, is the world's second largest Arctic delta and is considered a wetland of global ecological significance. The region is also underlain by significant discovered and

anticipated oil and gas reserves. The interaction between rising sea level, decreased sea ice cover, and the increased frequency and intensity of storms under warming climatic conditions are likely to increase the occurrence and severity of flooding in the outer Mackenzie Delta. Here we present the results of an ongoing, multiproxy investigation utilizing permafrost chemistry, dendrochronological, paleolimnological and remote sensing techniques to document and explain a widespread and possibly unprecedented disturbance event linked to an extreme storm surge. Our data indicates that in late fall 1999 a storm surge resulted in seawater incursion and flooding of vast portions of the outer Mackenzie Delta. The flood salinized low-lying terrestrial environments causing vegetation die off over areas of approximately 100 km². The remotely sensed imagery indicates that the vegetation was impacted by 2000. A disturbance date of fall 1999 is confirmed by alder dendrochronology, which in conjunction with geochemical profiles from permafrost suggests that such large scale salinization events have not occurred over the past century. Continued monitoring of the impacted areas combining field and remote sensing techniques will help determine the rates and nature of ecological recovery. Inuvialuit traditional knowledge holders confirmed the magnitude and unprecedented nature of this event in addition to providing insights into the causes and implications of the resulting impacts. For important environments such as the Mackenzie Delta where susceptibility to ecosystem change and development potential overlap, implementation of a robust environmental monitoring system becomes a critical tool for development planning, impact assessment and effective resource management.

PERMAFROST AND TERRAIN CONDITIONS AT NORTHERN DRILLING-MUD SUMPS: IMPACTS OF VEGETATION AND CLIMATE CHANGE AND THE MANAGEMENT IMPLICATIONS

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Permafrost can provide a containment medium for drilling wastes deposited to in ground sumps, but tall shrubs may proliferate on covers causing snow to accumulate, active layers to deepen and the ground to thaw. We evaluate these effects using a 2-dimensional heat conduction model to simulate the thermal evolution of sumps in warm (-3.0°C Mean annual ground temperatures (MAGT)) and cold (-6.0°C MAGT) permafrost under varying snow and climate conditions.

Application of climate and snow normals for Inuvik, Northwest Territories, south of the tree line, and Tuktoyaktuk, on coastal tundra, maintained wastes within frozen ground at temperatures below -1.5°C and -3.0°C, respectively. A gradual increase in snow depth from 0.17 m to 1.5 m, simulating the effect of shrub growth, caused thawing by the third decade. Moderate climate warming also caused sump thawing midway through the third decade for the warm scenario, but for the cold scenario wastes remained below -2°C through to year 40. Climate warming and increasing snow depths hastened thermal degradation.

Sump degradation due to deepening snow is corroborated by snow and ground temperature measurements, collapse of shrub covered sumps and the local absence of permafrost where deep snow accumulates over mineral soils. Although thawing may increase contaminant mobility, subsidence of the sump and adjacent areas may inhibit lateral movement. Several factors combine to influence the integrity of sumps in permafrost indicating the need for a long-term management strategy.

CARBONATITIC AFFINITY OF NATURAL DIAMOND-FORMING FLUIDS

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In the last few decades there has been mounting evidence of the vital importance of mantle metasomatism in the diamond formation process. The nature of elusive diamond-friendly metasomatic agents is not, however, well understood. Rare specimens that may shed light on this problem are diamonds with fluid inclusions which capture fluid equilibrated with diamond.

We studied a suite of 20 cubic fibrous diamonds with fluid inclusions to determine the affinity of the fluid. The mineralogy of the fluid, that is, an assemblage of daughter minerals precipitated from it, is central to understanding how and where the fluid formed. Each diamond rich in fluid inclusions contains millions of submicroscopic inclusions, and previous microanalytical studies found extreme heterogeneity between individual fluid inclusions with respect to crystallizing phases. Further progress in deciphering the nature of the fluid depends on our understanding which of these daughter minerals are abundant and essential ("fluid"-forming) and which are relatively rare (accessory). To identify the most common daughter minerals of the fluid we employ techniques that provide an integral, representative mineralogical analysis of the entire volume of the diamond rather than point analyses of selected single microinclusions. One of these methods is the analysis of the bulk composition of the fluid and its representation as a mix of mineral end-members. Another integral method of the mineral analysis is the powder X-ray diffraction (XRD) used in a novel way. Multiple inclusions of daughter minerals in the fluid scattered throughout the diamond act as randomly oriented crystallites in a regular powder XRD method thus yielding an analyzable bulk XRD pattern. Fluid inclusions and minerals precipitated from them were also investigated using infrared (FTIR) and Raman spectroscopies.

Most common phases precipitated from the fluid are found to be high-Si micas (90-30% of the solids volume), complex non-crystalline Na-Ca-Mg-Fe carbonate matter and apatite (together 5-70%), leaving a residual aqueous solution of K, Cl and carbonate ions, and gaseous CO₂. The modes of the most abundant phases are controlled by chemical trends of the bulk fluid compositions. Other relatively rare, 30 or so minerals, including various minerals with structural and coordinated H₂O, are detected by the vibrational spectroscopic and X-ray diffraction analyses. The XRD analysis expanded the list of minerals crystallized from the fluid, emphasized the importance of hydrous phyllosilicates and suggested the presence of non-crystalline carbonate material. The fluid also contains hydrocarbons associated with the carbonate material. The presence of some rare minerals and the exotic compositions of solid-solution minerals in the fluid suggest crystallization from a closed system with an atypical high salinity - high activity of H₂O and CO₂ that persisted to relatively low temperatures and pressures. The identified dominant assemblage of micas, Na-Ca-Mg-Fe carbonates and apatite suggests carbonatitic melt as the best analogue of the diamond fluid.

THE ROLE OF MINERALOGY IN EXPLORATION

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In the last 20 years a great revolution has taken place in the world of mineralogy that shows no signs of stopping. This revolution has been propelled by the advancement of Automated Scanning Electron Microscopes (SEM) (i.e. MLA & QemSCAN) that were developed to carry out rapid identification and

association of mineral constituents of a feed sample used in mineral processing testwork. As a result these units have provided metallurgists with rapid and inexpensive means to understand the ores that they are beneficiating and SEMs have thus been well entrenched in the characterization of ores in processing laboratories. This has provided a spotlight to focus on the need to understand the orebody early on in the mining cycle and has resulted in such disciplines as Geometallurgy. It is this advancement that now highlights the different mineralogical needs of exploration. Traditionally mineralogy carried out during an exploration program would be limited to X-ray Diffraction of drill core assay reject and occasionally some petrographic analysis to assist in rock identification and petrogenesis of the deposit. With the incorporation of automated SEMs into the commercial laboratory, it is possible to incorporate more detailed mineralogical analyses into the exploration program. In particular the MLA technology offers the exploration geologist a variety of differing measurement tools that can be applied to the various stages of exploration. This instrument can now provide routine mineral abundance, grain size and mineral association data. Ultimately data can be gathered to produce mineral release curves for liberation studies and grade recovery curves for predictive mineralogy.

This paper will examine the role that mineralogy and the use of the MLA can play in areas of exploration including geochemical RIMS (Resistate Indicator Mineral Suite) identification, diamond drill core analysis, geometallurgical data population, and petrogenesis and alteration detail.

TECTONIC, SEDIMENTARY AND METALLOGENIC RE-EVALUATION OF BASAL STRATA IN THE MESOPROTEROZOIC BYLOT BASINS (NU): ARE UNCONFORMITY-TYPE URANIUM CONCENTRATIONS A REALISTIC EXPECTATION?

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The Mesoproterozoic Borden, Fury and Hecla, Aston and Hunting, and Thule basins, collectively known as the Bylot basins, were a series of sub-parallel extensional depressions, associated with the Mackenzie Igneous event at ~1270 Ma. In the Borden basin, basal strata of the Echaluk Group are dominated by tholeiitic volcanic rocks and siliciclastic sandstones. These rocks were previously interpreted as predominantly terrestrial basalt flows and fluvial sandstones. New field data indicate that thick basalt flows in the Nauyas Formation contain cryptic pillow structures and typically have fine-grained, fragmental tops. A subaqueous origin for these flows is supported by the presence of stromatolitic carbonate on the top of several flows, and the presence of sand-injectites at the base of flows. Associated quartz arenites are all of marine origin. Although much of the overlying Adams Sound Formation was previously interpreted as fluvial, there is little evidence for this, except locally at the base of the succession near Paquet Bay (extreme southeast of the Borden Basin). Paleocurrents do not exhibit a strong unimodal pattern to the NW, as indicated in earlier work, but indicate a less areally restricted basin. Most of the Adams Sound Formation was deposited on a tide- and storm-dominated shelf, with local development of large sand-wave complexes. A similar, marine-dominated setting can be demonstrated for basal terrigenous clastic units in both the Aston and Hunting and Fury and Hecla basins. The latter contains thin sheets of fluvial deposits only in the Nyeboe Formation on the south side of the basin, and in the basal 3 m of the Whyte Inlet Formation on the NE margin of the basin.

Paleocurrent patterns in all three basins do not reflect confinement between the walls of restricted grabens. This suggests that the early development of the basins may have been related to transtensional extension rather than aulacogen development.

Although uranium present in basement granites north of the Fury and Hecla Strait may have been scavenged by fluids well after lithification of the Mesoproterozoic basin fill to produce local vein-type U deposits, the potential for extensive unconformity-type deposits, analogous to those in the Athabasca

Basin, is exceptionally low in these basins. Most of the sandstone units have early siliceous cements and a low initial feldspar content, both of which would have inhibited development of extensive secondary porosity.

**GEO-MAPPING FOR ENERGY AND MINERALS (GEM):
2009 GSC-NTGO FIELD STUDIES IN THE MACKENZIE CORRIDOR**

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Geo-Mapping for Energy and Minerals (GEM) is the Government of Canada's new program aimed at providing geoscience to guide the discovery and development of new energy and mineral resources. The GEM-Energy component focuses on encouraging new and effective energy exploration in the Canadian north, with the ultimate goal of socially and environmentally responsible resource development. Principal outputs will be detailed regional resource assessments for oil, gas and uranium.

The Geological Survey of Canada (GSC) has begun a new "Mackenzie Delta and Corridor Project" to encompass most GEM-Energy activities in the Northwest Territories. In the Mackenzie Corridor, GSC is undertaking new bedrock mapping and working jointly with the Northwest Territories Geoscience Office (NTGO) on hydrocarbon-related thematic studies. During field work in July and August, 2009, field work was conducted in the Franklin Mountains, Mackenzie Plain and eastern Mackenzie Mountains. The focus of GSC staff was bedrock mapping whereas that of NTGO staff was stratigraphic work; the crews also worked collaboratively at key sites. Both crews collected samples for biostratigraphy, organic geochemistry, and thermal maturity.

Bedrock mapping during the project will produce new, GIS-enabled map compilations at 1:100 000 scale for NTS map areas 96C, 96E, 96F, and the northeastern part of 96D. Traverses and spot-checks were conducted in each map area during the field season. The new map compilations will build on work done by the Geological Survey of Canada's Operation Norman (1968-1970). Original data and map compilations from Operation Norman are being incorporated into GIS datasets for the new map compilations. Interpretations from publicly available seismic also will be incorporated.

Stratigraphic work encompassed strata from the Proterozoic to the Cretaceous. To establish reference sections for future work in the area, sections were measured through Lower to Middle Paleozoic formations along Little Bear and Imperial Rivers. The unconformity between the Cretaceous Arctic Red and Slater River formations, previously documented by the Peel Project at Hume River, also outcrops at Imperial River; samples were collected for palynology and Rock-Eval/TOC. New sections exposing Upper Cretaceous strata were identified south of Great Bear River; microfossil samples were collected at these sites from Slater River, Little Bear, and East Fork formations.

Future field work will complete the bedrock mapping, refine the stratigraphic framework for the Norman Wells region, and ultimately contribute to a new basin analysis for the region. The goal is to provide data in support of new exploration models for the region.

MONITORING AND REMEDIATION OF FISH PASSAGE AT AN UNDERSIZED ROAD CULVERT AT HILL CREEK, NWT

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As part of the regulatory process for the Highway 3 upgrades, in 1998 the GNWT Department of Transportation (DoT) conducted a detailed aquatic inventory and fish habitat assessment at all stream and culvert crossings. According to this survey, Hill Creek served as a migratory corridor for a spawning population of Northern Pike.

Following the completion of the Highway 3 upgrade, regulators expressed concerns about insufficient culvert capacity at the Hill Creek crossing. They noted elevated flow velocities in the culvert during freshet conditions appeared to impede fish passage, as Northern Pike were observed schooling downstream of the culvert during subsequent freshets.

To address these concerns, DoT monitored velocities through the Hill Creek culvert. The study concluded that, the combined influences of the culvert extension and the armoring of the channel, resulted in elevated velocities through the culvert which was an impediment to fish passage.

Follow-up studies suggested that DoT's only alternative was to remove a section of highway, and replace the culvert with one of larger diameter. However, a hydrological analysis conducted by Golder Associates Ltd in 2008, indicated that it was possible to construct a downstream riffle to enhance fish passage at the Hill Creek culvert thereby allowing passage of adult northern pike on a more frequent basis. The analysis indicated that if the stream bed were raised by 1.5 m over a total stream length of 135 m, spring flow velocities in the culvert could be reduced to acceptable levels. The hydrological analysis, construction and follow-up monitoring program will be discussed.

NEW DISCOVERIES AT THE WISHBONE SILVER - ZINC AND BACK RIVER GOLD PROJECTS

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Sabina Silver's 100% owned Wishbone and Back River Projects are located 485 and 520 km northeast of Yellowknife respectively and are within 100 km of Bathurst Inlet. The Wishbone and Back River Projects were purchased from Dundee Precious Metals in June, 2009.

The Wishbone Project covers an extensive portion of the 150 by 30 km Archean Hackett River Greenstone Belt that hosts a number of silver-rich volcanogenic massive sulphide deposits ("VMS") including Sabina's 100% owned Hackett River deposits. The Back River Project covers Archean-aged iron formations (silicate and oxide) within greywackes and mudstones that host gold deposits at George Lake (Locale 1, Locale 2, Lone Cow Pond, Slave and GH) and Goose Lake.

Hackett River is one of the largest undeveloped silver - zinc VMS deposits of its type in the world with indicated resources totaling 43 million tonnes grading 144g/t silver, 4.65% zinc, 0.42% copper, 0.64% lead and 0.30 g/t gold and an additional inferred open resource totalling 14.6 million tonnes grading 136 g/t silver, 4.46% zinc, 0.31% copper, 0.57% lead and 0.31 g/t gold. Back River hosts measured and indicated resources of 3.4 million tonnes at 10.9 g/t for 1.19 million ounces gold and inferred resources of 3.6 million tonnes at 10.2 g/t for 1.16 million ounces gold.

One of Sabina's 2009 objectives was to explore for additional new resources. This exploration has resulted in the discovery of the May VMS Zone at Wishbone and the Echo gold discovery at Back River. The May Zone discovery is located approximately 15 km to the east of the Hackett River deposits and occurs within similar volcanic stratigraphy. The zone has been traced down to a depth of 100 m over a length of 600 m defining a structure that dips shallowly to the south at approximately 15 degrees where it remains open. Results from drilling on this target include:

Hole SWB-09-06

10.60 m grading 73 g/t Ag, 10.86% Zn, 0.28% Cu, 1.15% Pb, 0.19 g/t Au

Mineralization consists of massive, semi massive and stringer sphalerite, chalcopyrite, galena and pyrite within cordierite – anthophyllite altered felsic volcanic rocks. The area is underlain by shallowly southerly dipping strongly cordierite and anthophyllite altered felsic volcanic rocks.

The newly identified Echo Zone sits approximately 2,000 meters from the existing Goose Lake deposit in a broad zone of thick folded iron formation units that have been strongly altered to the extent that the magnetic signature of the iron formation has been washed out. The large 2 by 3 km target area has had no prior drilling.

It was immediately apparent that the Echo Zone displayed the same geological, structural and mineralization style as the Goose Lake deposit. A total of six holes have been collared in the zone. The results include:

Hole 09GSE08 which returned 8.57 g/t Au over 6.05 m

Hole 09GSE26 which returned 8.17 g/t Au over 15.15 meters including 9.00 g/t Au over 13.20 meters.

The zone remains open in all directions holes targeting mineralization no deeper than 150 meters from surface.

SELWYN-MACKENZIE SHALE BASINS PROJECT: IS ANOTHER RED DOG HIDING IN THE MISTY CREEK EMBAYMENT?

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Following the successful Sekwi Mountain mapping project and in response to client feedback, NTGO has initiated a multi-year project in the NWT Cordillera, focusing on the Lower Paleozoic Road River Group and related rocks (deposited in the Selwyn Basin and Misty Creek Embayment), and the Middle Devonian Earn Group. The Howard's Pass lead-zinc deposits, which resemble the producing Red Dog deposits of Alaska, are hosted in Selwyn Basin strata, and the Tom and Jason deposits are hosted by the Earn Group. Project objectives are to improve understanding of the architecture and evolution of both basins in order to derive new vectors to shale-hosted base metal mineralization. The geographic emphasis for the project is NTS sheets 106B and 105I. Collaboration with other surveys, universities, and exploration companies has begun. The project is funded by the Strategic Investments in Northern Economic Development (SINED) program.

The first season, in 2009, consisted of six weeks of reconnaissance in 106B and mapping in 105I. Follow-up on the results of a 2007 NTGO stream silt survey in 106B identified three spatial associations: 1) gold anomalies with Marmot volcanic rocks, 2) zinc with both Cambrian to Devonian carbonate rocks and a prominent regional fault, and 3) Cu-U with rocks of the Road River and Earn groups. The specific sources

of most of the anomalies remain undiscovered, however, a significant new base metal prospect, here named the Dap showing, was found associated with a Zn-Pb silt anomaly. Disseminated to massive sphalerite and galena, with minor copper sulphides, are associated with a coincident fault and stratigraphic contact between the Sekwi and Hess River formations. The deposit is hosted mainly within heavily altered Sekwi Formation and remains open in all directions. Sphalerite grade by visual estimate is consistently high along the 400m strike-length and for 2-7m down-dip along the contact/fault plane. Galena occurs in isolated clusters of massive pods, each pod up to 30cm long. This showing has no associated gossan or other surface expression which would have revealed it without the stream geochemistry.

Three weeks of mapping at Howard's Pass reveal clear evidence of bedding transposition and suggest an extreme degree of complication by imbricate thrusting. The highly deformed state of the host, underlying, and overlying rocks was not fully appreciated in the past, and many tectonic fabrics have previously been described as sedimentary. The presence of regional-scale detachments encompassing the deposit suggest that it is situated in a duplex structure. Further structural analysis is essential to effectively predict sub-surface deposit locations where the mineralized trend extends into the NWT.

Future field seasons in both study areas will include regional mapping, stratigraphic studies, and thematic projects for release as NWT Open Files and graduate theses. Sample analyses will provide better biostratigraphic and geochronological control and elucidate differences in depositional and diagenetic environments, including the unusually carbonaceous nature of the host Duo Lake Formation at Howard's Pass. This work will clarify our understanding of the relationship of mineralization to structure and depositional setting, and delineate economically prospective formations.

A NEW LOOK AT SLAVE LITHOSPHERE PALAEOGEOTHERMS AND THE "DIAMOND WINDOW"

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Cratonic palaeogeotherms are important tools of direct interest to the diamond exploration industry. They can be used to estimate the thickness of the region within the lithosphere where diamond is stable (the "diamond window").

Currently, the accepted method is to use the palaeogeotherm constructions of Pollack and Chapman (1977) for different heat flow values. These paleogeotherms are based on the extrapolation of a conductive (crustal) geotherm to lithospheric depths. The obtained Pressure-Temperature (P-T) estimates for a xenolith suite are plotted against a range of pre-calculated geotherms and a best-fit to the data is obtained qualitatively.

This method is unsatisfactory for a number of reasons. Firstly, the resulting geotherm shape bears little resemblance to intuitive models of the thermal structure of continental lithosphere. Secondly, it is a purely qualitative fit to the Pressure-Temperature (P-T) data. Thirdly, estimates of the depth of the base of the lithosphere (and the resulting thickness of the "diamond window") are obtained from the deepest xenolith, rather than being based on the geotherm shape and its intersection with the mantle adiabat.

Other, more sophisticated methods are available with which to estimate cratonic palaeogeotherms (McKenzie 1989, Russell et. al. 2001). In this contribution the McKenzie et. al. (2005) model is used. It

is a computation-based method which uses accurate estimates for the thermal properties of cratonic lithosphere to obtain a realistic palaeogeotherm, which is calculated directly from the P-T data from a particular locality. The advantage of this method is that it calculates an estimate of lithospheric thickness from the intersection of the palaeogeotherm with the mantle adiabat, and also, that it is not subject to the bias inherent when fitting data to a pre-calculated line. As a result, the McKenzie method allows clearer and easier comparison between the - often dramatic - effect of using different combinations of geothermobarometers on lithospheric thickness and "diamond window" estimates.

We present a comprehensive comparison of the two methods (Pollack and Chapman, 1977 versus McKenzie, 2005) using new and existing xenolith derived P-T data from Slave craton kimberlites, together with resulting implications for the diamond mining industry and academia.

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McKenzie, D. (1989). *Earth and Planetary Science Letters* 95: 53-72

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TUNDRA SCIENCE CAMP AT THE TUNDRA ECOSYSTEM RESEARCH STATION

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The Tundra Science Camp is a summer outdoor environmental education program for high school students and teachers in the Northwest Territories. The program includes ten days at the Department of Environment and Natural Resources' Tundra Ecosystem Research Station at Daring Lake, NT. Participants work closely with a variety of instructors including educators, scientists, on-site university researchers and Dene elders. Program emphasis is on learning field and laboratory techniques in wildlife ecology, ornithology, plant ecology, geology, archaeology, and human history. Traditional knowledge is an integral part of this cross-cultural education program.

Since 1995, more than 200 students and teachers have participated in this outdoor environmental education program. It has inspired young people, both aboriginal and non-aboriginal, to embrace science by providing insight into the nature of science, its methodologies and applications in resource management. Bringing students, educators, elders and scientists together in a residential setting gives everyone involved the opportunity to improve communication skills, understand different cultures and bridge the gap between western science and traditional Dene knowledge. For many of the participants, this is their first opportunity to experience the tundra landscape.

This program is unique to the Northwest Territories. High school students and teachers have a rare opportunity to work with scientists in the field. This contact has proven to motivate students, helping them refine their interests in science and traditional knowledge, and provides teachers with the skills and knowledge to make their science courses in the classroom more relevant. Participants also learn about decision-making, resource management and development issues in this diamond mining region of the Northwest Territories. Graduates often comment that the camp had a profound effect on the way they view science, traditional knowledge and the environment. Many of them have continued with post-secondary education in the sciences and are returning to the North to be employed in the private and public sectors.

WORKING EFFECTIVELY WITH THE MINERAL ANALYSIS LABORATORY

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Significant costs are involved in collecting geological samples for analysis and significant decisions are made based on the data provided by mineral analysis laboratories. Therefore, it is critical to work effectively with the laboratory and have a good understanding of how the data is produced.

This presentation will offer several key recommendations that will provide the following benefits for project geologists and exploration managers:

- help improve your experience when working with any mineral analysis laboratory
- help you know what questions to ask the lab and what options to consider
- help improve your due diligence when selecting a laboratory
- help ensure your expectations for the data are met

HYDROLOGY OF UNSATURATED WASTE ROCK IN SEMI-ARID PERMAFROST ENVIRONMENT

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The Diavik Diamond Mine, located 300 km northwest of Yellowknife, is host to a collaborative waste rock research project between the University of Alberta, University of British Columbia, and University of Waterloo. Results from the project will provide insight to the relationship between the hydrological, geochemical and thermal regime on the behaviour of waste rock piles situated in a semi-arid continuous permafrost environment. Application of this study contributes to development of sound closure plans which aim to limit future metal loadings to the surrounding environment. Beginning in 2006, the progression of the wetting front through waste rock and changes in moisture content have been monitored through instruments installed within and at the base of constructed experimental waste rock piles. Precipitation records indicate a drier than average period over the length of the experiment. The thermal regime experienced at the piles limits the annual duration for water movement. Characterization of flow through, and hydrologic properties of, waste rock is complicated by internal structures created during deposition, the heterogeneous clast composition and the unsaturated nature of the rock piles.

This investigation consists of three test piles, each with an approximate 3000 m² footprint and approximate 14 m height, constructed by end dumping and bulldozer push dumping. One pile is composed of Type I rock (containing an average sulphur concentration of 0.037% by weight); a second pile is constructed of Type III rock (containing an average sulphur concentrations of 0.063 % by weight); and a third pile consists of a core of Type III rock re-graded and covered with a compacted till layer and thermal cover of Type I rock. Outflow discharge rates are continuously monitored at the base test piles by a basal collection system and basal collection lysimeters. Instrumentation installed within the piles include: time domain reflectometry (TDR) for moisture content determination; ECH₂O also for determining moisture content as well as temperature, and electrical conductivity; and tensiometers for monitoring matric potential.

To address questions of the appropriate scale required to predict the quantity and quality of the drainage from full scale waste rock pile, the experiment also consists of four collection lysimeters, 1000 L PVC tanks, two filled with Type III rock and two with Type I rock. Additionally hydraulic properties of the waste rock have been characterized with a 32 m³ field scale permeameter.

Results of discharge characteristics and changes in volumetric moisture content through the most recent summer are presented as well as results of a large scale field permeameter. The wetting front reached the base of the Type III pile two years after pile construction, reflecting several applied irrigation events, whereas the Type I pile, which has not been subject to applied rainfall events, is still in the process of wetting up. In 2008/2009 the covered pile experienced outflow through the winter months, while the other two piles were frozen. The porosity of the waste rock was estimated to be 27 +/- 1% and saturated hydraulic conductivity between 10⁻² and 10⁻³ m/s via the field permeameter.

OBLIQUE EXTENSION, TECTONICS AND MINERAL DEPOSITION, GREAT BEAR MAGMATIC ZONE, NWT, CANADA

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Evidence from both the northern and southern areas of the Great Bear Magmatic Zone (GBMZ), Northwest Territories, Canada suggest origin of this magmatic belt through an extensional tectonic event that post-dates east-directed subduction under the western margin of the Slave Craton. Southeast trending crustal fracturing with northeast-southwest extensional opening facilitated development of southeast trending volcano-plutonic belts. These belts are systematically and predominantly right-lateral displaced by numerous northeast trending (orthogonal) transform fracture zones. For example, cumulative extension in the Echo Bay stratovolcano complex may exceed several kilometres as evidenced by the total width of linear plutons, stocks, dykes, and the hydrothermal veins that infill these structures and the myriad associated fractures. Coeval NE displacement is on the order of ~ 7 km perpendicular to the exposed 25 km SE trend of the Echo Bay complex. These crustal scale structures are oblique to the current N-S trend of the west margin of the Slave Craton and earlier subduction front. This pattern of repeated oblique crustal-scale extension structures and orthogonal dislocations is presently interpreted to result from an incipient failed rift along the western margin of the Slave craton, in a segmented tectonic spreading pattern similar to that of present day Baja California.

The most voluminous intrusive, volcanic and hydrothermal activity, and mineralization occurred during this extensional tectonic event. Hydrothermal alteration and mineralization are most abundant along and at the intersections of the orthogonal set of extension related SE and NE trending syn-volcanic fault and fracture corridors. Myriad faults and fractures in all orientations associated with the major crustal stresses are also locally mineralized. In the Port Radium area, a well mineralized pull-apart-basin formed as a consequence of gradual dislocation along a NE directed shear. Resultant tensional fractures produced the several kilometre-scale lozenge-shaped pattern of economically mineralized veins.

Similar southeast and northeast trending patterns of volcano-plutonic activity and mineralization are observed in the southern GBMZ. Overall, the best locations for significant mineralization in the GBMZ appear to be: 1) along SE trending extension structures, either marginal to or overlying syn-tectonic, sub-volcanic intrusions, 2) at and near to the intersection of SE trending extensional structures with NE trending orthogonal faults, 3) in extensional pull-aparts, 4) at and near to the intersection of NE structures and N trending faults, and 5) near the intersection of any structure with sub-volcanic intrusions related to the extensional tectonic event.

**FINDING EFFICIENCIES IN ENVIRONMENTAL MONITORING PROGRAMS: BASELINE
AQUATIC STUDIES FOR ENVIRONMENTAL ASSESSMENTS AND FUTURE
ENVIRONMENTAL EFFECTS MONITORING PROGRAMS, NECHALACHO DEPOSIT AS A
CASE HISTORY**

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Effects of mines on the aquatic environment are a primary focus at the planning stage for proposed mines and during operations. The planning stage encompasses baseline studies and effect predictions under the Canadian Environmental Assessment Act and territorial or provincial legislation. The operations stage falls under the jurisdiction of the Metal Mine Effluent Regulations and Environmental Effects Monitoring programs (EEM) of the federal *Fisheries Act*, as well as water licenses and other permits. Planning ahead to accommodate the needs of future operational monitoring requirements is both good scientific practice and an efficient use of resources.

We discuss some of the challenges and benefits of considering future EEM monitoring requirements during the environmental assessment phase, based on experience to date for Avalon Rare Metals' Nechalacho rare earth elements deposit at Thor Lake, north of Great Slave Lake. As always, consultation with regulatory agencies is helpful in defining the scope of studies and issues of concern.

The purpose and objectives of environmental assessment and EEM differ: environmental assessment is done for planning purposes, to provide baseline information about a wide area, and to identify ways of protecting the environment and reducing potential effects of the project on the environment. Detailed design of the mine and decisions about footprint, water treatment options and location of effluent outfalls are typically not available when baseline studies begin. EEM studies focus on the effects of the effluent on the receiving environment during operations and/or closure. The statistical requirements are quite high (number of replicate samples) and types of endpoints analyzed differ from the environmental assessment phase. The sentinel species of fish also differ. The environmental assessment typically focuses on fish consumed by humans and of conservation concern, with less emphasis on forage fish. The EEM program often focuses on small bodied species with a limited geographic range, and since the programs run over many years, tends to avoid targeting species whose populations could be reduced through scientific sampling programs.

We discuss how we have used knowledge of EEM requirements in design and modification of the baseline studies for environmental assessment of the Thor Lake project, in terms of spatial design, fish and aquatic biota studies.

THE ESTABLISHMENT OF NATIONAL PARKS IN THE NWT, AN UPDATE

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Parks Canada has been working for many years on the establishment of new national parks. This presentation will provide an overview of the process to establish national parks in the north and the present status of the establishment proposals now underway.

Three projects will be discussed in some detail: the expansion of Nahanni National Park Reserve, the proposed establishment of Nááts'ihch'oh National Park Reserve and a park reserve around the East Arm of Great Slave Lake.

Parks Canada worked closely with the Dehcho First Nations on the project to expand Nahanni National Park Reserve. The project culminated in an expanded park reserve of 30,000 square kilometres protected under the *Canada National Parks Act* in June 2009. The new boundaries were designed to protect the most significant conservation values, while taking into account the mineral potential and existing mineral tenures.

The proposal to create a new park reserve to be called Nááts'ihch'oh is underway in the area of the headwaters of the South Nahanni River. For this proposal, Parks Canada is working with the land corporations and renewable resource councils of the Tulita District of the Sahtu Settlement Area. Consultations with Aboriginal groups, stakeholders and the public will be taking place over the next several months.

The proposal to establish a national park reserve in the area of the East Arm of Great Slave Lake is supported by the Lutsel K'e Dene First Nation and the Akaitcho Treaty 8 negotiators. The Geological Survey of Canada is managing a Mineral and Energy Resource Assessment (MERA) of the proposed park area. Following the publication of the results of the MERA and other studies, Parks Canada will initiate consultations with Aboriginal groups, stakeholders and the public on the proposal.

SNAP LAKE DIAMOND MINE – UPDATE

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The Snap Lake mine is located 220 km northeast of Yellowknife (NT) and it's Canada's first fully underground diamond operation. The mine is now in production stage and officially started commercial production on January 16th, 2008.

The Snap Lake kimberlite dyke is emplaced into the Archaean Slave Province craton and is exposed on the Northwest Peninsula of Snap Lake. A large portion of the kimberlite dyke is hosted within intrusive granitoids, with a minor portion emplaced within overlying metavolcanics and metasediments of the greenstone belt. Rb-Sr aging indicates emplacement during the mid to Late Cambrian. The dyke has an areal extent of several kilometers and dips gently to the northeast at about 15 degrees with an average thickness of 2.8 m.

The dyke is controlled by local host rock features with discontinuities changing the orientation and introducing large splays off the main dyke. In the strongly folded metavolcanic rocks, the dyke undulates following the foliation. In the more brittle granitic rocks, the kimberlite has intruded along a primary set of flat joints that are affected by secondary joint sets giving an angular step like nature to the dyke. Spacing of joint sets is very irregular in the host rocks. On a local scale, the dyke splits around host rock features creating branches or splays and separate lenses. On a regional scale, only one area has been identified so far that has formed a complete break in the dyke.

The dyke is not a uniform sheet but is composed of a series of ramps, jogs, undulations and bifurcations with local offsets. Complexity of the dyke is currently being delineated by using a Wheel-tracked diamond drill. The long term definition drilling to define the resources is being targeted from cutouts on the advanced Footwall drives. There is a potential for resource extension down dip to the north and further to the east of the current mining blocks.

In order to maximize the output from the diamond drill holes, a borehole radar tool is being used to map the geology and the structure of the dyke. This tool has been also used in Snap Lake to detect potential water bearing structures in advance of mine development.

In some areas of the mine, fractures along the dyke are strongly weathered with material properties similar to clay. In other areas, fractures are dry with no weathering displayed. In order to understand the hydrologic system at Snap Lake, the intrusion mechanism of the dyke in relation to the permeability of the host rocks, as well as detailed modeling of the structural/ fault zones, and fracture patterns have to be well defined and are being updated regularly.

The kimberlite is currently being mined using the Room and Pillar method with future improvement in extraction by the Drift and Slash method with paste backfill. At Snap Lake Mine, dilution is an important element of daily operation. There is a great effort to minimize the dilution by keeping the ore drives to design with aggressive grade control, through resuing narrow parts of the dyke, and use of the wheel-tracked diamond drill in uncertain/complex areas to track the dyke ahead of the ore development.

THE IMPACTS OF CLIMATE CHANGE ON WATER AND WASTEWATER SYSTEMS: ASSESSMENT AND MONITORING IN THE NWT

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The Western Canadian Arctic has experienced some of the most rapid and intense climate changes on Earth. Annual temperatures have increased by 1-2°C over the past 50 years – twice the global average. Temperatures in the Western Arctic are predicted to increase by another 4-7°C by 2080. This warming has led to changes in precipitation in the NWT. Warming temperatures and precipitation changes are shortening the ice season, reducing ice thickness, melting permafrost, and reducing the area of permafrost.

These changes may have impacts on the location, availability, and quality of water in the NWT, ultimately affecting communities' water and wastewater treatment processes and infrastructure. NWT communities thus need to take action to ensure that they have the knowledge and capacity to understand and address the impacts of climate change on their water and wastewater systems.

Ecology North recently produced a discussion paper to provide a preliminary assessment of the potential impacts of climate change on water and wastewater systems in the NWT and recommend actions to increase the capacity of communities to respond to those impacts. We will (1) discuss the findings and recommendations of this paper and (2) present a current collaborative project to assess and monitor the vulnerability of water and wastewater systems to climate change impacts in NWT communities.

One of the primary impacts of climate change in northern ecosystems is permafrost melt. Permafrost melt due to climate change may have effects on source water quality, wastewater management, water and wastewater infrastructure, and leachate movement. Permafrost melt may alter levels of organic and mineral compounds in source water, raise the level of sediment in water bodies, increase the chlorine required for water treatment, and release previously frozen contaminants into water bodies. Permafrost thaw has and will continue to cause structural damage to water and wastewater infrastructure and may pose a risk to the stability of wastewater lagoons. Ground and surface water contamination may increase due to changes in water flow and storage around sewage lagoons and treatment wetlands and melting permafrost around solid waste sites may change the movement of landfill leachate, possibly contaminating surrounding freshwater ecosystems.

Increases in precipitation may lead to early wastewater releases if lagoons reach capacity before treatment is completed. One positive impact of climate change is that increased temperatures may extend the biological treatment season, thus improving the quality of wastewater effluent.

Given the potential impacts of climate change in the NWT, Ecology North will develop a system to assess and monitor the vulnerability of community water and wastewater systems to climate change impacts. This project will involve three pilot communities who will be involved in planning and revising the monitoring system.

EXPOSING THE HOTTAH TERRANE AND ITS VOLCANO-SEDIMENTARY COVER

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The >1900 Ma Hottah Terrane is the westernmost component of the Paleoproterozoic Wopmay orogen and figures prominently in tectonic models of the orogen's development. Hottah Terrane has been interpreted as an exotic lithospheric block, composed of a composite crust (ca. 2200-2400 Ma) and younger volcanic arc (ca. 2000-1900 Ma) that collided with the Archean Slave craton at ca. 1885 Ma. Alternatively, Hottah Terrane has been interpreted as a rifted segment of the Slave craton. The character and extent of the terrane is poorly known and the information is derived from limited bedrock outcroppings, a small number of U-Pb ages, evolved radiogenic isotopic signatures in younger volcano-plutonic rocks, and interpretations of the Slave-Northern Cordillera geophysical transect. Hottah Terrane has been identified in outcrop at a few localities in the Hottah Lake, Rainy Lake, and Beaverlodge Lake areas. These bedrock exposures allow 'access' and 'fingerprinting' of the Hottah Terrane through the use of U-Pb age dating and other radiogenic isotopic studies.

The Hottah Terrane was deformed and metamorphosed prior to the intrusion of the extensive volcano-plutonic rocks of the Great Bear magmatic zone (ca. 1875 to 1855 Ma). Based on current data, a time-gap between Hottah Terrane and Great Bear magmatism is inferred to span from 1900 Ma to about 1875 Ma. There are, however, a number of volcano-sedimentary successions that may bridge this time gap (e.g., Bell Island Group, Conjuror Bay Formation, Treasure Lake Group). These volcano-sedimentary units are interpreted to lie unconformably on Hottah basement and are in turn unconformably overlain by volcanic rocks of the Great Bear magmatic zone. Contiguous regional correlation of these units is hampered by the spatial distribution of the sequences, reworking by Great Bear intrusions, and lack of reliable age data. Detrital zircons (U-Pb, Lu-Hf, and $\delta^{18}\text{O}$ data) from these sequences can assist in resolving regional correlations, and as it is likely at least some of these sequences pre-date collision with the Slave craton, they provide direct access to Hottah crust.

Elucidating the crustal components of the Hottah Terrane and resolving its cover stratigraphy has a number of mineral deposit-related implications. 1) Recent diamond discoveries west of the Slave craton appear to be sourced through Hottah basement. Is there an Archean component to the Hottah and what of its diamond potential? 2) Uranium deposits of possible unconformity-type occur at or near the ca. 1900 Ma unconformity. How do these compare to Mesoproterozoic unconformity-related uranium deposits (e.g., Athabasca and Thelon basins) and what is the significance of these 'old' uranium prospects? 3) The Great Bear magmatic zone hosts a wide-variety of mineral deposits types. How has the Hottah basement-cover sequence influenced the formation of these deposits? To answer some of these mineral deposit-related questions, our ongoing work aims to provide reliable age and isotopic data for the Hottah Terrane and the post-Hottah, pre-Great Bear stratigraphy.

WASTE MANAGEMENT IN REMOTE CAMPS IN THE NORTHWEST TERRITORIES

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Due to the remoteness of many camps, difficulty of northern operating conditions, and limited waste management options and infrastructure in the Northwest Territories (NT), thorough and diligent waste management planning is required well prior to any field operation.

The Department of Environment and Natural Resources (ENR) recognizes that timely and responsible management of camp waste is of critical importance to help minimize health and safety risk to personnel and wildlife. It also reduces or eliminates preventable environmental impacts and economic impacts to operators and various stakeholders of the NT.

Burning is a practice historically used in the north in effort to ensure timely disposal of food and food contaminated waste that may attract wildlife. However, burning waste does not preclude the need for proper waste management, including segregation and storage. Poor management practices may lead directly to wildlife attraction, regardless of any effort to burn waste. Burning of camp waste can attract wildlife that may lead to wildlife conflicts, releases numerous toxic pollutants that increase risks to health and safety and the environment, and /or cause forest fires. Hence, diligent planning well in advance is required if burning is proposed - both in the context of due diligence and regulation.

Through and diligent waste management planning well in advance of regulatory applications and field operations will:

- Protect field personnel and the public;
- Help prevent dangerous and costly interactions with wildlife;
- Reduce the costs of hauling;
- Reduce costly hauls to landfills;
- Prevent tent and forest fires;
- Protect municipal infrastructure; and
- Reduce the release of pollutants that endanger you and your physical surroundings.

Although remote exploration camps vary in purpose and size in the Northwest Territories (NT), similar principles apply to all when it comes to waste management. ENR is developing waste management planning and management Guidance applicable to small and moderate sized remote camps in the NT. The presentation and discussion will cover the underlying principles and direction under development by ENR.

PERMAFROST CONDITIONS ACROSS THE TREELINE: A CASE STUDY FROM THE MACKENZIE DELTA AREA

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The Mackenzie Delta area is characterized by the transition from boreal forest near Inuvik to arctic tundra near the Beaufort Sea coast. Air temperature records from the Mackenzie Delta show an increase in mean annual air temperature of 1.9°C since 1926. Contemporary ground temperature data compared with historical measurements made by Dr. Ross Mackay in the 1970's show that permafrost temperatures

throughout the Delta region have responded to rising air temperatures. For example, permafrost warming of up to 2°C was measured in upland tundra locations.

In this paper we describe ground temperature, vegetation and snow conditions across the forest tundra transition. The data indicate the highest mean annual ground temperatures were in subarctic boreal forests south of the tree line and in the tall shrub tundra characterized by dense stands of tall willow and alder shrubs. The permafrost was up to 5°C colder at the north end of the transition in low Arctic tundra where snow cover was consistently low.

Near-surface ground temperatures in the subarctic boreal and tall shrub tundra sites were predominately controlled by winter conditions and varied substantially between years in response to interannual differences in snowfall. Ground temperatures at tundra sites were similarly controlled by winter conditions, however, there was little interannual variation in temperature as snow conditions are consistently low. These data suggest that the proliferation of large willow and alder shrubs into low shrub tundra environments will increase the snow retention capacity, inhibit ground heat loss in winter and increase ground temperatures. There were also major interannual differences in active layer freezeback dates, in particular south of the treeline where early winter snowfall varied significantly. During high snowfall years, deep accumulations in the tall shrub tundra and boreal areas slow ground cooling, regardless of air temperatures. As a result, freezeback may take several weeks longer than in nearby tundra environments. In low snow years, freezeback may coincide between sites across the treeline transition.

This finding is of relevance to development initiatives and the regulatory regime because overland winter travel is generally authorized once active layer freezeback is complete, in an attempt to limit impacts to the ground surface. In areas of similar soil properties, variation in the date of active layer freezeback is dependant on the magnitude and timing of early season snow fall, which can vary significantly from year to year at sites south of treeline. These data also show that a northward migration of shrubline will interact with winter snow conditions, warming permafrost and significantly compounding the effects of rising air temperature alone.

CARIBOU MONITORING AT THE DIAMOND MINES AND IMPLICATIONS FOR EFFECTS MITIGATION

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There have been three diamond mines operating in the central Canadian Arctic since the opening of Ekati in 1998. All three are within the range of the Bathurst caribou herd. Intensive caribou monitoring has been conducted during construction and operation of all diamond mines. Data from satellite-collared females, aerial surveys, ground-based observations, and incidental observations around the mine sites are used to determine indirect and direct effects at the regional and local scales. Study designs, objectives, methods, and results are reviewed by both government and independent monitoring agencies.

Currently, the value of monitoring caribou for feedback into the adaptive management and operations of the diamond mines has been limited. Although the data indicate regional-scale changes to caribou behaviour and distribution, there are few options for further changes to mine operation. Fortunately, their value has been recognized in recent environmental assessments.

A TOOL FOR CUMULATIVE EFFECTS ASSESSMENT

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Cumulative effects refer to the combined effects of all past, present and proposed developments. Thus, assessment of cumulative effects requires an understanding of current and historic development and human activity. Unfortunately, development and human activity information has not been collected with this application in mind. We present a database, created from a number of data sources, that summarizes development and human activity within the North and South Slave Regions, and illustrate how this information can be used to conduct cumulative effects assessments.

THE MAUNOIR OIL DISCOVERY – A CAMBRIAN CLASTIC OIL DISCOVERY WITHIN THE SAHTU SETTLEMENT REGION OF THE CENTRAL MACKENZIE VALLEY, NWT

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The Maunoir Oil Discovery is located on the Maunoir Ridge near the Arctic Circle and within the K'Asho Got'ine District of the Sahtu Settlement Region of the NWT, approximately 230 kilometers north-northeast of Norman Wells and 1,850 kilometers (1150 miles) north of Calgary, Alberta. The discovery, operated by MGM Energy Corp., was situated on the now expired Federal Exploration License, EL 399 and is defined by 4 wells and a grid of proprietary seismic data together with a network of reprocessed trade data and a regional high resolution aeromagnetic grid. The seismic mapping (both in time and depth) confirms a multisided fault-bounded anticlinal structure from the lower Paleozoic surface strata down to the Proterozoic unconformity.

The four wells that define the accumulation penetrated a typical Lower Paleozoic sequence and terminated in metasediments of Proterozoic age. The oldest well, Colville D-45, drilled in 1973, found a thick section of porous reservoir quality Cambrian-aged sandstones mantling the Proterozoic unconformity. While wet, these sandstones had significant hydrocarbon shows. In 2004, a new well was drilled on the Maunoir Ridge at Lac Maunoir C-34, approximately 2.6 kilometers south-southeast of D-45, based on an improved grid of proprietary 2D seismic data. The Lac Maunoir C-34 well discovered oil within the Cambrian Mt Clark Formation and flowed oil at a stabilized rate of 5.8m³/d (36 Bbls/d) with no sign of formation water from a single zone. This zone was stimulated only to get by the near well-bore damage. If this interval and all the other intervals identified as pay bearing were stimulated to obtain full productive capacity, then the C-34 well is expected to be able to sustain production in the 200 plus Bbls/d range. The Lac Maunoir C-34 well is currently suspended as a potential Mt Clark oil producer.

The Lac Maunoir C-34 well was followed up in 2005 by the drilling and testing of the Lac Maunoir A-67 well (abandoned), 6.4 kilometers to the north-northwest along strike and slightly down structure and by the Lac Maunoir E-35 well (abandoned) 2.5 kilometers to the north and down structure. A fifth well, Lac Maunoir L-80, was drilled in the area on a separate structure and was abandoned after encountering porous but wet Mt Clark reservoir strata.

Hydrodynamic (Pressure-Elevation) information from the 4 wells suggests an oil-water contact at -310 mss giving a 75 m column for the Maunoir Mt Clark oil pool. The reservoir net pay averages 13 m with an average effective porosity of 13% and an average water saturation of 35%.

Analysis of the C-34 sweet light gravity crude oil shows it to be dark brown in colour with an absolute density of 819.4 kg/m³ @15 deg C and an API gravity of 41.1, a sulphur content of 1.17 grams/kg and a pour point of -60.0 deg C as per ASTM.

In 2008 MGM Energy, on behalf of itself and partner Apache Canada Ltd., applied for and was granted by the NEB Significant Discovery Status for the Maunoir Discovery within EL 399. Currently there are no oil collection, processing or transmission infrastructure in place in the Maunoir area but MGM along with its partner Apache are examining various alternatives to bring this oil to market in a timely and cost effective manner.

CLARITY, CERTAINTY AND CONSISTENCY IN LAND AND WATER BOARD PROCESSES: A WORK IN PROGRESS.

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In March 2008 the Land and Water Board's of the Mackenzie Valley initiated a collaborative process to provide greater certainty and clarity in regulatory processes for industry and other partners. Through the establishment of a series of Working Groups, the Boards are creating clear and consistent policies, procedures and processes. This initiative addresses a number of concerns about the northern regulatory system raised in *Road to Improvement: the Review of the Regulatory Systems across the North* (the "McCrack report"), the 2005 NWT Environmental Audit, and the 2005 Auditor General's report.

Six Working Groups have been established each consisting of staff from the Mackenzie Valley Land and Water Board, the Gwich'in Land and Water Board, the Sahtu Land and Water Board and the Wek'èezhìi Land and Water Board. The purpose of these Working Groups is to review existing policies and procedures of all the Boards and develop or revise, where required, policies, procedures and guidelines that will ensure regulatory consistency while respecting regional diversity and land claim requirements. Areas of Board operations being reviewed by the Working Groups includes, but is not limited to, public engagement and consultation, standardized permit conditions, setting effluent quality criteria, management plan guidelines, data sharing and application processes.

In this presentation, we will describe the Working Groups initiative and report on our progress.

REVISED CORRELATION OF LATE PALEOPROTEROZOIC SEQUENCES IN NORTHWESTERN CANADA AND LINKAGE OF THE FORWARD AND RACKLAN ORGENIES

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Thick, fine-grained deposits of the late Paleoproterozoic Muskwa assemblage and Wernecke Supergroup, preserved along the western paleo-continental margin of Laurentia, are considered to represent the marine, deep-water complement of thinner but broadly correlative terrestrial sandstones preserved today in intracontinental basins of the Canadian shield such as the Hornby Bay, Athabasca and Thelon (Fraser et al. 1970, Geological Survey of Canada Paper 70-40, p.113). Regional paleocurrents derived from crossbedded sandstone units interpreted as braided river deposits are dominantly west-directed in the

mid-upper parts of these intracontinental basins but are variable in the lower parts, supporting distinct initial basins that were later joined by broad fluvial braidplains originating from sources along active orogenic uplands located to the east (e.g., Trans-Hudson orogen). The sediment from these rivers may have been shunted westward across the craton and ultimately deposited along Laurentia's western margin. Seismic and potential field geophysical data suggest that the distal parts of these river systems are preserved in the subsurface of northwestern Canada and are contiguous with fine-grained siliciclastic and carbonate rocks of the Wernecke and Muskwa successions. This paleogeographic model was tested by comparing the provenance of different parts of this sedimentary system using detrital zircon geochronology. Previous studies of the Muskwa assemblage (Ross et al. 2001, *Precambrian Research*, v. 111, p. 57) were compared with data for the Athabasca Group of the Athabasca Basin (Rainbird et al. 2007, Geological Survey of Canada, Bulletin 588, p. 193). A prominent peak of ages between 1.9-1.8 Ga is present in both successions and suggests common provenance from the Trans-Hudson orogen and delivery of detritus to the western margin of Laurentia by a >1000 km long drainage system.

Based on correlation of seismic sections, MacLean and Cook (2004, *Precambrian Research*, v. 129, p. 271) proposed that the Wernecke Supergroup is equivalent to the lower part of the Hornby Bay Group (Sequence A1) in the Hornby Bay Basin. Recent detrital zircon studies of the Wernecke Supergroup (Furlanetto et al., 2009, *YEG* 2008, p. 125) indicate that it correlates with the upper part of the Hornby Bay Group (Sequence A2) based on comparable provenance, including the presence of a suite of zircons ranging in age from 1660-1620 Ma. Potential sources for these zircons are present in the Narakay Volcanic Complex and in volcanic arenites of the East River Formation of Sequence A2. The East River is a carbonate platform succession that thickens and deepens toward the west. Our detrital zircon and stratigraphic studies permit that it could be a cratonic correlative of the Gillespie Lake Group (Wernecke Supergroup). Further tests of this correlation will be made by comparing stable isotope stratigraphy of carbonate units and Nd isotopes of mudstone units (see Hahn et al., this volume). If this revised correlation is correct, then it strengthens a proposed linkage between the Racklan orogeny of the northern Cordillera and the Forward orogeny, recognized in the subsurface Northern Interior plains and Hornby Bay basin (Thorkelson et al., 2003, *European Geophysical Society*, Abstract 04633), and constrains its timing to ~1620-1600 Ma.

EVOLVING STANDARDS FOR NORTHERN FIELD WORKER SAFETY

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Northern workers in exploration, mining, consulting, regulatory, and other sectors are exposed to difficult and complex job conditions. Extreme cold, remote locations, small crew sizes, proximity to wildlife, pressure to complete expensive field programs as quickly as possible, and a lack of immediate medical and emergency support result in a working environment that is risky and provides little margin for error. The fatality rate for workers in the Northwest Territories and Nunavut from 2000 to 2007 was two to five times higher than the Canadian average. The Canada Labour Code dictates that "every employer shall ensure that the health and safety at work of every person employed by the employer is protected", and although hazard mitigation measures for remote field workers are not as clearly identified as for some other hazards (e.g. working at heights), field worker safety is rapidly catching up and will become an integral part of employer responsibilities. The legal - and moral - implications of sending field workers into remote areas of Canada's north requires a thorough assessment of safety procedures and employer and employee roles. Mitigation strategies including planning, training, and current industry best practices are discussed.

COLLAPSIBLE FUEL TANKS – ECONOMIC AND ENVIRONMENTAL BENEFITS FOR ARCTIC OPERATIONS

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Traditionally used for temporary remote locations by the Department of National Defence (DND), collapsible fuel tanks have serviced mineral companies, remote construction as well as disaster relief and helicopter operations for decades.

Collapsible fuel tanks offer several economic advantages over drum fuel; they not only reduce transportation costs of thousands of drums to site but eliminate the need to clean, crush and re-transport thousands of drums from a remote site for proper disposal. Furthermore collapsible fuel tanks enable operators to purchase bulk fuel, eliminate the deposit costs for drums and reduce the labour needed to handle fuel. All of this can significantly save operators money.

Collapsible fuel tanks also have several environmental benefits. The first one is obvious, less handling of fuel drums means less minor spills. Collapsible fuel tanks also have a smaller foot print which causes less damage to sensitive arctic tundra, the economic benefits realized by using collapsible fuel tanks can be used to improve overall fuel handling systems including smaller transfer areas, fewer operators and better security for fuel caches. Once again any improvement to general operations will prevent spills. Collapsible fuel tanks also make site reclamation easy and ensure that abandoned drums are a thing of the past.

SEI Industries Ltd., a Canadian company, is a world leader in the manufacture of collapsible fuel bladders for harsh climates. It has been at the center of a lot of publicity about collapsible fuel tanks in recent months. A recent revision of the Canadian Environmental Protection Act, led a dialogue between key industry leaders, government officials and landowners. This has led to product and operational improvements as well as better regulations for collapsible fuel tanks. This information will also be shared during the presentation.

DEVELOPING THE WORLD-CLASS PINE POINT PROPERTY

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Mineralization at Pine Point is typical of Mississippi Valley Type (MVT) deposits. It is primarily hosted within the middle Devonian Pine Point Formation, an east-west striking barrier reef complex. Structurally, the reef complex lies on or is in close proximity to the McDonald fault, a continental scale dextral strike-slip fault which separates the Slave and Churchill Provinces.

Paleo-karst features, such as caverns, collapse structures and underground channels, formed during sub-aerial exposure, acted as channel ways and traps for mineralizing fluids. Three NE-SW trending zones of mineralization, North, Main and South, have been identified. Alteration consists of pre-mineral stage coarse grained dolomitization, locally called Presquilization. Genetically, Pb-Zn mineralization is thought to have formed by the mixing of metal rich brines derived from dewatering of shales along the north flank of the reef complex and sulfur rich waters derived from evaporites along the south flank of the reef.

Tamerlane recently completed an NI 43-101 technical report and feasibility study on six underground deposits defining proven reserves of 7.8 million tonnes grading 9.26% Zn+Pb located on the western,

down plunge extent of the main trend. Additionally, these six deposits contain measured and indicated resources of 8 million tonnes grading 3.4% Zn+Pb and inferred resources of 4.1 million tonnes grading 3.2% Zn+Pb. Combined with known historical resources, the Pine Point camp is host to over 70 million tonnes of commercial zinc and lead ore.

Permitting at the Pine Point Project is complete. The Company received its Type A land use permit at the end of May, 2008 and its water permit earlier this year. In addition, the Company has received its new land use permit for exploration and is planning to complete confirmation drilling on a number of deposits including the N204 deposit. N204 is a large low grade open pit deposit that has no water issues since it sits above the local water table.

Mining at Pine Point will utilize current and proven technologies that will propel future mining both underground and on the surface. These technologies include underground long-hole stope mining, utilization of a 6.7 meter diameter shaft that will encompass a cage for men and materials and a vertical conveyor for hoisting ore. Tamerlane will also use proven freezing techniques, where applicable, to form an impervious frozen wall of ice around the entire perimeter of an ore body including all underground infrastructure which will prevent the influx of water. Dense media separation (DMS) and conventional flotation without the use of cyanide will be used to up-grade the ore at Pine Point to a direct shippable concentrate grading 62% zinc and 72% lead. In the case of the N204 deposit, the DMS circuit will allow the lower grade material to be upgraded by a potential factor of 10 and allow the ore to be trucked to the mill profitably.

CONSIDERING CLIMATE CHANGE IN NORTHERN DEVELOPMENT

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There is clear evidence that recent climate warming has resulted in warming of the permafrost in the Canadian Arctic. This has led to, in many cases, instability due to thaw settlement, reduced bearing capacity, or uncontrolled seepage.

Today's permafrost engineers must address the problem of preserving structures on permafrost foundations under projected climate change. Engineering tools, such as geothermal modeling, are available to aid in the design. However, there is currently no clear guideline for how to select design climate change parameters, particularly in the arctic.

One method of projecting design climate change parameters is to project future trends based on linear-extrapolation of current trends. However, in the Canadian North, there are few meteorological stations with sufficiently long-term records. Secondly, caution should be exercised when projecting far into the future, well beyond the period over which the extrapolation was made.

A second approach is to use climate change projections from Global Climate Models (GCMs) and Regional Climate Models (RCMs). However, there are numerous models and climate change scenarios available, and collectively, projected changes in air temperature and precipitation vary widely, both seasonally and spatially. It is recommended that a range of future climate change projections be obtained from a number of GCMs and RCMs and plausible greenhouse gas emission scenarios to not only determine the most likely trend, but also to bracket the range of possible outcomes.

CLIMATE CHANGE AND WILDLIFE IN CANADA'S NORTH

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Mean global temperatures are increasing, and changes are predicted to be greatest in northern latitudes. Along with increased temperatures, increased precipitation in the northern hemisphere, as well as increased variability in temperature and precipitation have been predicted. These changes are likely to have measureable impacts on wildlife and wildlife habitat. The dominant predictions regarding the likely effects of climate change on northern Canadian wildlife species were synthesized from the available literature.

Plant communities, which form an important part of wildlife habitat, are closely associated with climate variables. Northern range shifts have been predicted for most tree species. However, the advance of the boreal forest may be limited by soil and nutrient constraints. This translates to a reduction in area for the boreal forest, as well as the abundance and range of those species that are most successful within it. Also, climate warming is predicted to increase the frequency and severity of forest fires, which, along with shifting terrain due to melting permafrost on the tundra, may dramatically alter the northern landscape. In addition, the invasion of pests and disease from warmer climates are expected, along with an increase in the virulence of existing pathogens.

Wildlife species are predicted to respond to a warming climate in numerous ways, some of which have already been observed. Wildlife species will likely shift their ranges, where possible, to stay within suitable habitat. An earlier spring could also mean alterations in the life cycle of many species. These changes, along with changes to habitat and the climate itself, may increase the populations of some species, and decrease those of others. Predictions from the literature regarding the potential effects of climate change on northern wildlife species such as moose, polar bears, caribou, and muskoxen will be explored.

Any stress placed upon wildlife species by climate change will not act in isolation, but will exacerbate other environmental selection pressures on wildlife species. For example, invasive species, overharvest, pollution, as well as habitat loss through agricultural intensification and land use all contribute as stressors to wildlife populations and habitat.

EXPLORATION AGREEMENTS IN THE AKAITCHO REGION – THE YELLOWKNIVES DENE PERSPECTIVE

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In fall 2008, the Chiefs and Councils of the three Akaitcho communities ratified the text for a regionally developed, but locally implemented Exploration Agreement. Implementation in the Yellowknives Dene Chief Drygeese Territory began almost immediately, with the first agreements being completed in early 2009.

The focus of this presentation is implementation of that agreement – the rewards and challenges. Recent Supreme Court challenges have fundamentally changed the relationship between the mining industry,

Canada, and First Nations. These court rulings required consulting and accommodating First Nation's concerns when development projects would infringe on their constitutionally protected rights.

The development and implementation of this agreement represents the preferred method of consultation & engagement of the Akaitcho First Nations. The YKDFN hope that in time, all parties will come to prefer this method as it addresses many of the concerns that have been raised in recent years – certainty, efficiency and cost effectiveness.

MULTIPLE ORIGINS OF ECLOGITIC DIAMONDS FROM THE JERICHO KIMBERLITE, NUNAVUT

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Understanding the origin of diamonds and the processes that surround their formation in the Earth's mantle is hampered by a scarcity of diamond-bearing xenoliths. Diamond-bearing xenoliths provide direct information on the composition and origin of the diamond source rocks, while carbon and nitrogen extracted from their diamond population is invaluable to determine mode of diamond formation. Although single diamonds extracted from kimberlites during processing can also be linked to source rocks (through diagnostic mineral inclusions), and may lead to speculations on diamond origins, diamond-bearing xenoliths provide a tangible link to diamond genesis in the lithospheric mantle. Here we present compositional data for silicate minerals in two compositionally distinct diamond-bearing eclogite suites from the Jericho kimberlite in the northern Slave craton, which are complemented by distinct nitrogen and carbon data for the diamonds. These initial results suggest that eclogitic diamonds from Jericho may have multiple origins.

Jericho diamond eclogite xenoliths can be separated based on mineral composition into Mg-rich Group A and Fe-rich Group B, with the latter suite being compositionally similar to diamond eclogites worldwide. Compared to Group B diamond eclogites, garnets from Group A diamond eclogites have high MgO (20.2 vs. 14.7 wt.%), Cr₂O₃ (0.56 vs. <0.1wt.%), Sc (103 vs. 46 ppm) and Zr (33 vs. 7.9 ppm) and low Na₂O (0.05 vs. 0.11wt%) contents and are characterized by highly fractionated HREE patterns ([Lu/Gd]_N=5.5 vs.1.03). Clinopyroxene from Group A diamond eclogites is Na-poor (1.7 vs. 4.9 wt.%), and LREE-enriched (La_N 84 vs 1.5; Ce_N 95 vs. 2.0; Nd_N 95 vs. 2.5) relative to clinopyroxene from Group B eclogites. Calculated temperatures (at 5 GPa) for Group A eclogites (970-1015°C) are lower than those for the Group B eclogites (1080°C).

Diamonds from Group A eclogites have consistently low N contents (<10 to 81 ppm) and aggregation states (all are type IaA). In contrast, diamonds extracted from the Group B eclogites have extremely high N contents (1300 to 5200 ppm) and exhibit moderate aggregation states, from 23 to 56%B (i.e., they are Type IaAB). Thus far, we have only obtained carbon isotope data for Group A diamonds, but, similar to the results reported by De Stefano et al. (2009), these analyses record the lowest $\delta^{13}\text{C}$ values (-35 to -41‰) known from any diamond suite worldwide.

The different equilibration temperatures of the two diamond eclogite groups suggest that they resided in different parts of the Slave lithospheric mantle, and may have separate origins. We previously proposed that the Group A eclogites formed via partial melt extraction from low-MgO eclogite coupled with peridotite interaction. Here we speculate that, like many other eclogite suites, the Jericho Group B eclogites represent subducted oceanic crust. Group A and B diamond populations may also have separate origins, forming from distinct carbon sources and/or by different processes. Alternatively, Group A and B diamonds may be genetically related if the carbon-bearing fluid/melt evolved compositionally upon

percolation through the lithospheric mantle. Further isotopic and geochemical investigations will help determine the origin of eclogitic diamonds at Jericho.

PRAIRIE CREEK MINE: UPDATE

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The Prairie Creek Mine, located in the Mackenzie Mountains 200 kilometres west of Fort Simpson in the Northwest Territories, is 100% owned by Canadian Zinc Corporation. A 43-101 compliant mineral resource calculation was completed in October 2007 which defines an overall Measured and Indicated mineral resource within the Vein and Stratabound totalling 5.2 million tonnes grading 10.8% Pb, 11.3% Zn, 175 g/t Ag and 0.4% Cu. In addition to this well defined resource there is an open-ended inferred resource of 5.5 million tonnes grading 11.4% Pb, 13.5% Zn, 215 g/t Ag and 0.5% Cu.

Based on a positive 1980 Feasibility Study new mine infrastructure, which included a 1,000 tpd mill, workshops, accommodations and facilities, was set up by Cadillac Exploration financially backed by the Hunt Brothers of Texas. The mine never achieved production but at the time of closure in 1982 had received all the required operating permits for production and the site infrastructure was 90% complete.

At the Prairie Creek Mine high grade base metal mineralization occurs in two types of geological settings, Vein and Stratabound type. The high grade Vein is located within a steeply dipping fault zone cross-cutting Ordovician to Silurian age sedimentary sequences, which includes the Whittaker and Road River Formations, along the axial plane of a doubly plunging regional antiform. Stratabound base metal mineralization has also been drill located adjacent to the vein within the same stratigraphy.

Nahanni National Park Reserve finalized their plans to expand the Park when it received formal royal assent from the Government of Canada in June 2009. The expanded 30,000km² Park now completely surrounds the minesite area and the Government of Canada has allotted a 320km² area for a operations along with guaranteeing rights of access by road into the minesite. While the announcement clarified some land positions it creates more multi-jurisdictional issues for the future operation of Prairie Creek.

Recognizing the eco-sensitive location of the site creative innovative approaches to operations needed to be incorporated in order to mitigate both long and short term impacts to the environment. The use of paste backfill along with further water management and upgrade of some facilities will provide a further reduction of environmental impact than the original Cadillac operation provided for.

The application for operations was submitted to the MVLWB in June 2008 and was referred to Environmental Assessment under the Mackenzie Valley Environmental Review Board. Terms of Reference were finalized in June 2009 and Canadian Zinc is now compiling a Developers Assessment Report for the EA Review.

NORTHERN REGULATORY IMPROVEMENT INITIATIVE: UPDATE ON PROGRESS

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The regulatory regimes across the North, in particular that of the Northwest Territories, have been criticized frequently, at a time when there was increasing development pressure across the North, with stresses from major projects and exploration. Given the expectations and appetite for change, the Northern Affairs Organization developed a strategy for regulatory improvement in the North, the

Northern Regulatory Improvement Initiative (NRII). The NRI initiative began in November 2005, with a two phased approach; the first was immediate operational changes in response to the OAG's report on the NWT Regulatory System and the second, a strategic review of the northern regulatory system through a Ministerial Special representative.

In November 2007, Minister Strahl appointed Neil McCrank as a Ministerial Special Representative with a mandate to review the Northern Regulatory System across the North and report back in six months. Neil McCrank's report entitled "Road to Improvement" was released on July 18, 2008 in Yellowknife. In preparing his report and resulting 24 recommendations for regulatory improvement, Mr. McCrank held over 100 bilateral meetings with partners and stakeholders in all three northern territories and in the south, concluding his engagement with a two day roundtable in Yellowknife.

Since the release of the report, the Department of Indian and Northern Affairs has continued to make progress in improving the regulatory environment across the North. These advances in the system, ranging from policy to regulation, continue to advance the predictability and consistency of the regulatory process in the North. There is still much to do and it will require consultation with Aboriginal Organizations and Northerners to continue to complete the regulatory system in the North and improve upon it.

QUATERNARY GEOLOGY STUDIES IN NORTHERN MELVILLE PENINSULA, NUNAVUT

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In 2009, the Geological Survey of Canada and the Canada-Nunavut Geoscience Office commenced Quaternary fieldwork on the northern Melville Peninsula as part of the Geo-Mapping for Energy & Minerals (GEM) Multiple-metals - Melville Peninsula Geoscience Project. An important component of this project is dedicated to adding to an already substantial amount of Quaternary data and knowledge, mainly the results of years of studies by Lynda Dredge (GSC). The 2009 field season was preceded by analysis of till samples from the north half of Melville Peninsula, as well as re-analysis of approximately 2,200 archived lake sediment samples, mainly from the central part of the peninsula, using modern LA-ICP-MS techniques. The new field studies from summer 2009 focus on *i*) providing a better understanding of the ice flow history in the region, and *ii*) providing tighter till sample grids over areas down-ice from known bedrock mineralization, or in areas showing existing till anomalies. The geochemistry and mineralogy of both heavy mineral concentrates from till and silt-sized till matrix will be analyzed to obtain results regarding base metals, gold and diamond potential. The existing till geochemical analysis results and the new observations concerning ice flow history will be the focus of this presentation, while results from new till sampling are awaited for spring 2010.

RIFT-RELATED SHALE LITHOSTRATIGRAPHY, CHEMOSTRATIGRAPHY AND METAL PROSPECTIVITY, MESOPROTEROZOIC BORDEN BASIN, NU

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The marine mudstone (shale)-dominated Arctic Bay Formation overlies basalt and sandstone deposited during the early development of the Borden Basin. Although overlying carbonate rocks of the Nanisivik and Iqqittuq formations (formerly Society Cliffs Fm.) are known to host numerous base-metal showings, the prospectivity of the Arctic Bay Formation for shale-hosted mineralisation has not been determined.

Three well-exposed sections through the Arctic Bay Formation in the Milne Inlet Graben (MIG) were documented (a) using standard lithostratigraphic techniques to evaluate the possibility of basinal characteristics known to be favourable for SEDEX mineralisation, and to characterise the tectonic setting of the shale basin, and (b) using in-situ XRF to test for anomalous metal values and for the presence of redox-sensitive trace elements.

Lateral differences in deep-water sedimentation style and sediment composition, over both short and long distances, indicate that the basin was differentiated into smaller-scale depocentres. This pilot study can identify only a western zone (exposed near the head of Adams Sound) and a central zone (west of Tremblay Sound). Conspicuous and abundant intraformational truncation surfaces and growth faults in the western domain attest to significant syndepositional extension. In the western zone, truly black shale is present in the upper 150-200 m of the 300 m exposed (full thickness of the formation is unknown), whereas in the central domain, where the formation is in excess of 800 m thick, only two ~100 m covered intervals have potential to contain black shale. Although no penecontemporaneous volcanism is known, the possibility of locally enhanced heat-flow at the sea-floor remains, particularly in the context of ongoing extension and in light of the slightly earlier volcanism present at the base of the sedimentary succession. The three troughs of the Borden Basin began to form during deposition of the Arctic Bay Formation, rather than earlier, as demonstrated by temporally equivalent, coarse, immature terrigenous material present in the vicinity of graben-bounding faults.

Geochemical profiles were obtained from outcrop using a portable XRF device, for two closely spaced sections (5 km apart) in the uppermost Arctic Bay Formation in the western MIG. Stratigraphic spacing of analyses in the black shale intervals was on average 2-3 m. At this locality, Zn (<156 ppm) and Pb concentrations (<100 ppm) are generally low to negligible. Zn reaches 428 ppm in rare, thin, deep-water nodular lime mudstone units, and one Pb anomaly of 582 ppm is present in black shale. Base metal content does not covary with pyrite content, as reflected in either weathering colour or Fe values. Molybdenum is present only in a thick (>100 m) black shale interval (<65 ppm), and U is present at subeconomic yet elevated levels (<50 ppm) in the black shale. The consistent presence of these two redox-sensitive elements throughout the black shale interval indicates that although no significant metals were supplied to the basin area tested by this pilot study, basin bottom-water was O₂-depleted and could have had the potential to carry base-metal concentrations in other areas of this segmented, tectonically active rift system.

UPDATE ON TYHEE DEVELOPMENT CORP'S YELLOWKNIFE GOLD PROJECT, NWT

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Tyhee Development Corp has commenced Preliminary Feasibility studies on its wholly-owned Yellowknife Gold Project in 2009. Initial conclusions based upon a Preliminary Assessment envision a 3,000 tpd combined open pit and underground operation extracting ore from the Nicholas Lake Main Zone and the Ormsby Zone over a seven year period. A central mill next to the Ormsby Zone would contain crush, grind, and gravity circuits with flotation and cyanidation finish to recover 95% of the gold yielding an average of 165,000 ounces per year.

Baseline environmental studies, initiated in 2005 were included in a Project Description Report which was revised and resubmitted in mid to late 2008. The development proposal was referred to the Mackenzie Valley Environmental Impact Review Board and the Final Terms of Reference and Work Plan

were received in early 2009. The Developers Assessment Report is being completed concurrent with the Preliminary Feasibility studies, both of which should be completed in early 2010.

Ongoing exploration results at the Goodwin Lake and Clan Lake properties released subsequent to the completion of the Preliminary Assessment saw significant resource additions and therefore ultimately the inclusion of these properties into the Yellowknife Gold Project. Continuing exploration in late 2009 expanded the Clan Lake Main Zone by 400% and saw seven new showings identified. Much of the exploration success is due to basic prospecting and mapping, however the evolution of the shear zone model and its application in a more inclusive manner has materially contributed to our efforts.

Shear zones are structural features (curviplanar domains across which differential displacement has occurred) and do not have to have any particular mineralogy (i.e. chlorite, sericite, carbonate). Metasomatic alterations within shear zones are separate events and must be considered as such to identify potentially mineralized rocks.

THE CHANGING RIVER MORPHOLOGY OF THE MACKENZIE DELTA

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A better understanding of seabed and river morphology in the Mackenzie Delta is essential for a proper assessment of the cumulative effects of climate change and development in this extremely sensitive region. Also an increased level of oil and gas activity in the area has prompted a renewed investigation of channel morphology and dynamics and of implications for the design of infrastructure, pipeline crossings, and other transportation routes. The Geological Survey of Canada is using high resolution interferometric sonar data in combination with satellite imagery and air photo analysis to investigate channel morphology and bank stability of selected areas of interest over the last 30 years.

Channel bed morphologies include large asymmetric current-generated megaripples (wavelength 10 m and height of 0.5 m), erosional scarps with relief of 0.7-1.5 m and associated flutemarks produced by turbulent flows at the bed. Current speeds in excess of 2 m s⁻¹ were measured in the water column one week prior to the spring peak water level near the mouth of Kumak Channel. The greatest depth in the survey area, near a proposed pipeline crossing, reaches 20 m at the apex of a gentle bend in the channel. The river bank adjacent to this hole has experienced approximately 30 m of erosion over the past five years (~6 m/yr). Earlier studies recorded rates between 1.8 and 2.2 m/yr. Comparisons with previously acquired channel cross sections measured in the 1970s and 1990s suggest that there has been in-channel deposition downstream of rapidly eroding banks. At other survey locations in the delta such as East Channel near Inuvik, the channel appears to be more stable, as it also does at some enigmatic deep scour holes.

Important questions remain on the role of climate warming, increasing active layer thickness, varying flood levels and rising sea level in the evolution of delta channels. Flooding in the outer Mackenzie Delta occurs during spring break-up and also during significant storm surge events that create backwater in delta channels. We are examining the role two major storm surge events of 1999 and 2000 may have played in the sedimentology and dynamics of the outer delta. These studies demonstrate both the utility of baseline data collected more than 30 years ago and the application of modern methods for understanding processes in the outer delta environment. Climate change contributors to coastal erosion, such as increased storm surge levels, slope instability from thaw of ice rich sediments, increased active layer thicknesses, and sea level rise can be related to bank erosion in the delta. A better understanding of

climate change and its relationship to the dynamics of channel morphology will aid in future decision-making for development and management of the outer delta region.

ENVIRONMENTAL MANAGEMENT SYSTEMS IN EXPLORATION AT AREVA RESOURCES CANADA INC.

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AREVA Resources Canada Inc. (ARC) is a Canadian company based in Saskatoon, Saskatchewan. It is part of the larger AREVA group, the world leader in CO2 free nuclear-wind-bio mass power generation. ARC owns and operates mining and milling facilities which produce uranium concentrate. The company is also active in uranium exploration and participates in joint ventures with other organizations at various mining and exploration sites within Canada.

ARC uses an integrated approach to quality and environmental management in all of its activities, commencing with uranium exploration through development, mining and milling and culminating with the decommissioning of previous mine sites. This cycle originates with exploration projects in the Athabasca Basin of Northern Saskatchewan and the Thelon Basin of Nunavut, continues with the McClean Lake mine - a uranium mining and milling facility and is completed with the decommissioning of the Cluff Lake site - a uranium mine which ceased production in 2002.

The system is designed to provide an integrated approach to ensure that:

- all activities are conducted in a safe and efficient manner and satisfy all applicable regulatory and internal requirements
- the requirements of the ISO 14001:2004 International Standard are met and
- the principles of Sustainable Development are implemented throughout the organization

To this end the exploration activities in Saskatchewan, mining and milling at the McClean Lake site, the decommissioning activities at Cluff Lake and feasibility studies for the Kiggavik project in Nunavut are all certified to the ISO 14001:2004 International Environmental Management Standard. The McClean mine site is also certified for the 18001 OHSAS International Occupational Health And Safety Management System. ISO 14001 Certification of the exploration work in Nunavut is planned for the very near future.

This presentation will briefly discuss the development of the integrated environmental management system and expand on the operational experience at ARC drawing upon examples from the operating activities particularly those in the areas of exploration. Challenges and further opportunities will also be presented.

THE SAHTU LAND USE PLAN: CHALLENGES & SOLUTIONS

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The Sahtu Land Use Planning Board (SLUPB or “the Board”) was established in 1998 under the *Mackenzie Valley Resource Management Act* in fulfillment of Article 25 of the Sahtu Dene and Metis Comprehensive Land Claim Agreement. The SLUPB is responsible for preparing, adopting, and monitoring implementation of a land use plan for the Sahtu Settlement Area (SSA), excluding lands managed under the *National Parks Act* and *Historic Sites and Monuments Act*, and lands within the

boundaries of a local government. The Plan will provide for the conservation, development and use of land, waters and other resources in the SSA. Once the plan is completed and approved, all uses of land, water or deposit of waste requiring a licence, permit or other authorization must conform to the land use plan.

The Board released Draft 2 of the Sahtu Land Use Plan in May 2009, and held detailed consultations over the past summer to seek guidance on further revisions. Key issues that were raised in consultations and written submissions were:

- 1) the need to better integrate economic development considerations in planning decisions;
- 2) eliminate duplication with existing regulatory processes; and
- 3) ensure that implementation processes are clear, workable and do not add to existing timeframes.

In this presentation, the Board will discuss how it will address these issues, including future zoning analysis, regulatory workshops and conformity determination trials. The presentation will set the stage for a separate workshop to be held during the Geoscience Forum for interested participants to discuss ideas and solutions with the Board and staff.

THE CUMBERLAND PENINSULA GEM PROJECT: OVERVIEW OF 2009 FIELD RESULTS AND INSIGHTS INTO EXPLORATION POTENTIAL

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The Cumberland Peninsula project, initiated as part of NRCan's Geomapping for Energy and Minerals (GEM) Program, is a multidisciplinary study of a frontier region of eastern Baffin Island, Nunavut. In partnership with the Canada-Nunavut Geoscience Office, University of Calgary, University of Saskatchewan and Dalhousie University, the project is aimed at providing publicly accessible geoscience information, a modern understanding of the tectonic and glacial histories, and metallogenic potential of this underexplored and poorly known area of eastern Baffin Island. The project offers opportunities for Nunavummiut to be integrated into multifaceted aspects of geoscience and the resource exploration economy.

Highlights of the 2009 field season include: 1) significant revision to the existing bedrock map resulting in a vastly improved understanding of the stratigraphy, structure and tectonic setting of the Precambrian record including identification of rock units and lithologic associations prospective for base and precious metals, 2) new and significant updates to the surficial map including unraveling a complex ice flow history and glacial dynamics, 3) release of 57,000 line kilometers of aeromagnetic data and a follow-up ground-based magnetotelluric survey to image conductive units at depth, 4) deployment of a long-term teleseismic station, 5) analysis of remotely sensed data for bedrock and surficial interpretation, 6) collection of over 400 till geochemical samples and approximately 50 samples for multiple metal assay, and 7) participation of Nunavummiut in geoscience activities including hiring and training of 22 residents from Pangnirtung, wilderness first aid certification training, and Prospector Training certification.

Precambrian rocks of Cumberland Peninsula (CP) occur in an area where the proposed boundaries between three Archean cratonic fragments and their associated Paleoproterozoic cover rocks converge. Mapping in 2009 has revealed a rock record similar to that of the Rae Craton and Piling Group to the north in central Baffin Island. In general, the southern CP is underlain by north-dipping panels of voluminous tonalite to monzogranite injection orthogneiss with subordinate sedimentary and mafic volcanic rocks. Paleoproterozoic supracrustal rocks are extensive in the north and include varying thicknesses of a lower sequence of quartzite-psammite-marble, overlain by mafic-ultramafic volcanic and

intrusive rocks, sulphidic black shale, chert and silicate- to oxide-facies iron formation, in turn overlain by an upper sequence of semipelite and siltstone commonly containing calcareous concretions. All of the aforementioned units are intruded by massive to weakly deformed bt +/-opx +/-gt granodiorite to monzogranite most likely related to the ca. 1.86 Ga Cumberland Batholith. Late bt-ms-gt-tour pegmatites cut all rocks.

The volcanic – black shale – iron formation association commonly hosts significant gossanous zones with varying amounts of pyrite-pyrrhotite+/-chalcopyrite and is reported to host Zn-Cu metamorphosed massive sulphide deposits in the southern map area. Correlative (?) units in the Piling Group of central Baffin Island consist of iron formation-hosted gold occurrences. Layered ultramafic rocks intrude into the CP volcanic – black shale – iron formation sequence and may have potential for Cu-Ni-PGEs. The recent discovery of diamondiferous kimberlites on the neighbouring Hall Peninsula highlights the diamond potential of the CP.

Abstracts – Poster Presentations

PRELIMINARY OBSERVATIONS OF THE IOCG MINERALIZATION AT THE DAMP, FAB, AND NORI SHOWINGS, GREAT BEAR MAGMATIC ZONE

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The Great Bear Magmatic Zone (GBMZ), Northwest Territories is the focus of exploration for iron oxide copper-gold (IOCG) mineralization such as at the Sue-Dianne and NICO deposits. The aim of this project is to constrain the nature of the fluids responsible for the mineralization in the deposits and various other prospects found in GBMZ. The first field season focussed on collecting samples at the past-producing Terra-Norex mines (Camsell River area, Great Bear Lake), and at the Nori, FAB and DAMP showings (southeast of the Great Bear Lake). The latter three showings are the focus of this presentation.

At Nori, molybdenum-U-Cu (\pm magnetite) mineralization is found in tourmaline-biotite veins, with K-feldspar-quartz segregations that crosscut the host Treasure Lake Group sedimentary rocks. In contrast, The FAB and DAMP showings contain primarily Cu-U mineralization in the matrix of brecciated felsic rocks of the Faber Group and plutons of the GBMZ, respectively. Detailed mapping of the DAMP showing resulted in the definition of two principal field units; red and pink breccia units. The pink breccia unit corresponds to a strongly silicified, medium to fine-grained rhyodacite breccia that commonly envelopes the red breccia unit. The matrix of the pink breccia unit is dominated by quartz with minor epidote-hematite. The red breccia unit comprises a medium to coarse-grained, monomictic, strongly hematized-potassically altered, rhyodacitic breccia that hosts the Cu-U mineralization. The matrix of this unit consists dominantly of specular hematite-magnetite with minor lenses of disseminated chalcopyrite-pyrite and uranium oxides. A scintillometer registered maximum values of uranium, thorium, and potassium concentrations for the uranium oxide lenses of 3682 ppm, 169 ppm, and 49.6 % respectively. Two main fracture systems containing quartz and epidote crosscut and control the mineralization in the red breccia unit; the northeast system is dextrally displaced by the northwest-west veinlets.

Preliminary observations indicate that Nori has a distinctive style of mineralization, not seen in other showings; however, the lack of hematite suggests a deeper-higher temperature episode of an IOCG hydrothermal system. In contrast, DAMP and FAB exhibit the typical breccias-hosted mineralization,

commonly observed in IOCG deposits, with hematite-magnetite and disseminated copper sulfides in the matrix. The red breccia at Damp is structurally controlled and the close association with the pink breccia unit makes both units suitable exploration criteria targets for this style of mineralization in the GBMZ.

COMMUNITY MAPPING PROGRAM: FORT MCPHERSON, NWT

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The Northwest Territories Geoscience Office delivers geoscience outreach programs that describe local and regional geology, geological processes and timescales, and the ongoing search for mineral and petroleum resources. Students, teachers, and community members are key audiences for these programs. One such activity is the annual Community Mapping Program which in 2009 was carried out near Fort McPherson, Northwest Territories.

A team consisting of two geologists, four students, and two guides examined the rocks and landforms around the community. Ten days of field and office work were carried out. Field techniques were explained and demonstrated by visiting outcrops, observing and measuring geological features, recording information, and documenting locations. All students were involved in photo-documenting geological and geomorphological features. An information and orientation session was held at the start of the project for participants, and a later public session for community members provided an opportunity to view rock samples and field photographs.

The information collected was used to create a poster for the community of Fort McPherson with explanations of the local geology. It will be sent to the Gwich'in Renewable Resource Council to be used as an educational tool in the local school and to inform the community, and will also be distributed to other NWT schools. Copies will be available to the public at the Northwest Territories Geoscience Office or on the website at www.nwtgeoscience.ca.

GOT KIMBERLITE – NTGO IS THE CUSTODIAN OF A MAJOR KIMBERLITE COLLECTION

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2009 marks a significant year in the evolution of the Northwest Territories Geoscience Office (NTGO) Core Library. The core collection increased dramatically with the donation from BHP Billiton Diamonds Inc. of approximately 3500 core boxes, filled primarily with kimberlite core. The core is from diamond exploration programs that were carried out by BHP and their partners in the NWT Diamonds Project between 1992 and 2007 in the vicinity of, and at, the Ekati Diamond Mine. This valuable resource of diamond drill core with accompanying drill logs will be used for research and educational purposes.

The donation consists of drill logs and core from 150 holes delineating 128 kimberlite pipes, some of which have been mined, or are currently being mined, at the Ekati Diamond Mine. The core will provide an exceptional opportunity for researchers to garner and distribute a wealth of information about kimberlite. The results of the studies could lead to improvements in exploration techniques that may contribute to the discovery of further diamondiferous kimberlites, which in turn could engender further mining development in the north and elsewhere.

This donation complements substantial donations of core made previously by Kennecott Canada Exploration Ltd. Kennecott donated core from 198 drillholes that tested kimberlite targets from several exploration projects drilled during the 1990s. At least 40 of the holes cut kimberlite. The NTGO kimberlite collection also includes kimberlite cut by Tradewind Resources Ltd. and SouthernEra Resources Ltd.

Clients are encouraged to request access to the core and to propose potential research topics to the NTGO. Core sampling will be approved if certain conditions are met. However, some restrictions will apply, i.e. no bulk destruction of the core will be allowed (as is the case when caustic fusion analysis is performed).

An NTGO geologist will be developing a database over the next few months that will include data compiled in part from the donated drill core logs. Spatial data from the logs will be used to build a GIS-based compilation that will expand on existing data found in NWT Open Report 2003-003 (A compilation and Interactive Map of Diamond Drill Core Held by the C.S. Lord Northern Geoscience Centre).

Currently the NTGO Core Library does not have a facility within which clients can work. The core is stored outside and weather conditions limit the availability of the core. The NTGO will strive, as custodians and managers of the core library, to provide access to the core and to preserve the integrity of the collection.

In the future the NTGO hopes to work in collaboration with research institutions to encourage innovative research topics and to assist with the dissemination of study results. Select samples will be available to Canadian universities to be used for teaching purposes. In the NWT, costs associated with the donation of core are usable for assessment credit and lease reduction credit.

THE BOOTH RIVER INTRUSIVE COMPLEX, NUNAVUT: PRELIMINARY RESULTS

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Archean mafic-ultramafic layered intrusions such as the Bushveld (South Africa) and Stillwater (Montana) complexes host most of the world's resources of Cr and PGE but the emplacement and formation of these intrusions and the mineralizing processes are still not fully understood. To improve our understanding of how these types of complexes form, as well as to address the economic potential of a relatively unknown intrusion previously prospected (unsuccessfully) for nickel, copper and precious metals, this study was initiated to investigate the 2025 Ma Booth River Intrusive Complex (BRIC). The BRIC is a large mafic intrusion exposed along both flanks of the Kilohigok sedimentary basin, located approximately 50 km SW of Bathurst Inlet, Nunavut. Field work on the northern limb of the BRIC during the summer 2009 season involved detailed mapping of selected areas and collection of two complete sample sections.

The northern exposure of the BRIC trends NE and is approximately 20 km long and up to 1500 m wide. Weak layering and oriented inclusions indicate that the intrusion dips shallowly to the SE. The majority of the BRIC is constituted of vari-textured gabbro-gabbro-norite, with olivine-rich ultramafic rocks occurring very locally in the westernmost part of the intrusion. The modal, compositional and textural changes between layers are gradational, with a few local exceptions. Further classification of the intrusion into meaningful subunits will result from petrographic and geochemical examination. Pegmatoidal pods, metres in diameter, are present throughout the BRIC and appear to truncate gabbroic successions. Moderate concentrations of sulfide and oxide minerals are associated with these

pegmatoidal patches, but do not appear to be presently economically viable. However, their origin is being investigated to improve our understanding of the scale of metal scavenging processes during the post-cumulus stage.

The BRIC intrudes Archean metapelites, metaquartzites, minor oxide-facies iron formation and local granitoids at its base. Its upper parts were eroded in Proterozoic time, and the sediments of the Kilohigok basin were deposited upon this unconformity. Previous investigators recognized gossanous zones near the base of the intrusion which appear to correspond with the location of banded iron formations in the footwall. The basal contact is very irregular. Our detailed mapping suggests that these are not topographic or fault effects, but reflect the upwelling into the intrusion of diapiric plumes of meta-sedimentary rocks from a destabilized footwall. The plumes are spaced approximately 2 km apart, and transfer abundant meta-sedimentary material upward several hundred meters from the lower contact. Mixing and dissolution of such xenoliths could represent an effective crustal contamination mechanism.

Improved understanding of BRIC will provide insights with regards to the mode of emplacement and the contamination, crystallization and sulphide saturation history of large mafic intrusive complexes. By increasing our understanding of how metals partition and move within such intrusions, we hope to increase the chances of mineral discoveries by the private sector, both here and elsewhere in Canada.

GEOCHEMICAL AND MINERAL-CHEMICAL SYSTEMATICS FROM A PICRITIC FRANKLIN SILL ON VICTORIA ISLAND, N.W.T.: INSIGHTS ON INTERNAL FRACTIONATION PROCESSES

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The feeder system to the Natkusiak flood basalts (ca 723Ma) is superbly exposed in the Minto Inlier of Victoria Island, as 10 to 100m-thick sills extending laterally over 50-100 km. The sills (26-30 in number) are hosted by the Neoproterozoic Shaler Supergroup, composed of clastic metasediments, carbonates, mudstones and evaporites, and capped by the cogenetic Natkusiak lavas. The upper sills are near-monotonous dolerites and resemble distal Franklin sills. Our sampling has focused on a set of olivine-rich sills with significant potential for Noril'sk-type mineralization. Olivine is significantly enriched in the lower third of these sills (increasing up-section to ca 55% by weight). Thin clinopyroxene cumulates containing euhedral, sector-zoned clinopyroxene overlie the olivine cumulates, and give way up-section to olivine gabbros, pigeonite gabbros, magnetite-gabbros and granophyric gabbros. So far, analytical work has concentrated on a sill that was sampled during a Great Northern Mining and Exploration drilling program (DDH 6-2). In this sill, the near-aphyric (1-5% olivine, Fo86, NiO=0.32%) lower chilled margin has 13wt% MgO. Summations of sill chemistry are nearly indistinguishable from the chill composition, suggesting this sill crystallized as a closed system, and at the sample site does not represent a Noril'sk-type throughflow channel. The Fo and NiO contents of the olivines decrease up-section. Olivines in the uppermost peridotites, pyroxenites, and gabbros fall between model equilibrium and fractional crystallization trends in Fo-NiO space, suggesting that these olivines accumulated from melts that had evolved by an 'intermediate' process. One possible mechanism is partial reequilibration of olivine with evolved melts being expelled from underlying cumulates. It is not yet clear if this occurs after olivine accumulation, by reaction with migrating pore melt; or by expulsion of fractionated pore melts into an open, olivine-saturated, still-liquid core to the sill. In contrast, the olivines in the lower border zone and lower olivine cumulate zone follow a flatter trajectory, with negligible NiO-depletion despite extensive Fo-depletion. The simplest explanation for this trend is reequilibration of accumulated olivine with

abundant trapped melt. Small globular sulphides occur throughout the sill, suggesting that the melt was close to sulphide saturation when it was emplaced. Sulphide globules near the base of the sill are pentlandite + pyrrhotite ± chalcopyrite, presumably exsolved from monosulphide solid solution, while those near the top are composed of chalcopyrite + pyrite, presumably exsolved from intermediate sulphide solid solution. This pattern appears to reflect sulphide melt fractionation in the cooling sill.

CHEMICALS MANAGEMENT FROM CRADLE TO GRAVE

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Medicines, computers, food, personal care products, drugs, fuels—nearly every aspect of our lives involves chemicals. While we all depend on the benefits of chemical substances, there are risks that some can pose to human health and the environment.

The Chemicals Management Plan (CMP), launched on December 8th, 2006, is Canada's world-class program for both categorizing and assessing existing chemical substances. The Government of Canada is committed to address all of the legacy substances that have been identified through categorization via successive rounds of assessment. The government will work with key industry sectors to develop and codify sound management practices that will protect Canadians and the environment and, where necessary, will take regulatory action.

Out of the 23,000 chemical substances reviewed on the Domestic Substances List (DSL), 500 were identified as high-priority substances. The 500 high-priority substances are being addressed as follows: about 190 "Challenge" substances were identified the highest priorities for risk assessment and appropriate controls, as they are still in commerce and are potentially harmful to human health or the environment; there are about 145 substances no longer in commerce in the Canadian market, and the Government of Canada controls the re-introduction of these potentially harmful substances through the "Significant New Activity (SNAc)" provisions; there are about 160 "Petroleum" substances being addressed as part of the Petroleum Sector Stream Approach, to be addressed within the same timeframe as the "Challenge" substances. The Government of Canada is challenging *manufacturers, importers and users* of industry and civil society to provide new information regarding the scientific properties of these 193 "Challenge" substances, or best management practices associated with the use of these substances that might contribute to improved decision making. The CMP constitutes a "cradle-to-grave" chemicals management from manufacture ("cradle") to use phase and disposal phase ("grave"). Chemicals, manufactured items containing chemicals, by-products, contaminants and wastes are all reportable.

As part of the Chemicals Management Plan, the Government of Canada has launched an Internet portal. The portal provides Canadians with information about categorization, news about actions to manage and prevent risks to human health and the environment, and links to information collections on chemical substances in Canada. According to Health Canada's industry and economic analyses of the Alberta/NWT region, the mining and mineral products sector is one of the top sectors based on GDP growth. Thus, Health Canada would like to engage the Northern Canadians with the message on CMP and its relevancy.

THE DIAMOND POTENTIAL OF THE TUWAWI KIMBERLITE (BAFFIN ISLAND, NUNAVUT).

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Baffin Island, underlain by Archean crust of the Rae craton with Paleoproterozoic reworking, is known to contain several kimberlites of possibly Cretaceous age. The most recent findings of kimberlite are located at the northwestern end of Baffin Island on the Brodeur Peninsula. The Tuwawi kimberlite, one in the cluster of 3 kimberlites, has an inverted cone shape. We studied drill core samples of kimberlite and mantle xenoliths from the Tuwawi kimberlite to constrain its diamond potential.

Hypabyssal and volcanoclastic kimberlite types have been identified among available kimberlite core. Hypabyssal kimberlite is the predominant type in Tuwawi. The kimberlite consists of olivine macrocrysts set in a carbonate-serpentine groundmass with olivine microphenocrysts, phlogopite and spinel. Volcanoclastic kimberlite is characterized by the presence of 1) irregularly-shaped juvenile lapilli; 2) two semi-intermixed dark cryptocrystalline matrix materials; 3) olivine grains with a restricted size distribution and angular shapes. These features suggest mild sorting of the kimberlite, a possible incorporation of mud to the matrix, an epiclastic origin and formation in the crater facies.

Peridotites and a garnet clinopyroxenite are found as xenoliths in the Tuwawi kimberlite. Peridotites include garnet lherzolite, garnet, spinel, and garnet-spinel harzburgites, and dunite. Both coarse and deformed (porphyroclastic and mosaic-porphyroclastic) textures are present within the peridotite xenoliths, and Cr-diopside from deformed xenoliths shows higher TiO₂ (0.16 wt%) content than in coarse peridotites. Pyrope (Mg₇₀₋₈₂) is present in all but one sample, whereas spinel occurs only in coarse peridotites and shows strong heterogeneity. It is controlled by random intra-grain compositional changes in FeO (from 12 to 16 wt%), MgO, Al₂O₃ and Cr₂O₃ (from 43 to 57 wt%). Olivine and orthopyroxene in all xenoliths are very magnesian (Fo₈₅₋₈₇ and En₈₆₋₈₉), slightly more so in coarse peridotites.

Pressures and temperatures of mineral equilibria for the xenoliths were estimated using various two-pyroxenes, garnet-pyroxene, olivine-garnet, and olivine-spinel geothermobarometers. Porphyroclastic garnet lherzolite and garnet clinopyroxenite were formed at 1100-1140°C and 54–56 kb. Deformed peridotites are equilibrated at higher temperatures and pressures than coarse peridotites. Garnet peridotites and pyroxenites show higher temperatures than spinel peridotites. These patterns match the commonly observed mantle lithological columns below cratons. In comparison to temperature and pressure data from kimberlites of Somerset Island, xenoliths from Tuwawi plot farther into the diamond stability field and at a lower geothermal gradient (~42 mW/m²). The majority of mantle xenoliths from Cretaceous Somerset Island plot in the graphite stability field along a geotherm of ~44 mW/m².

Our study identified several factors that give a positive outlook on the diamond potential of the Tuwawi kimberlite. These factors include 1) a preservation of the crater facies kimberlite, and 2) kimberlite sampling of the deep diamondiferous mantle. The diamond potential is reduced by the estimated 42 mW/m² geothermal gradient that is hotter than the desired low geotherm for Archean cratons.

SEARCHING FOR SEDEX-STYLE MINERALIZATION IN THE NORTHWEST TERRITORIES: BARITE AS A POSSIBLE VECTOR

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The Selwyn Basin, Canada is host to several large Sedimentary-Exhalative (SEDEX) base metal deposits including Tom (15.7Mt at 11.7% Zn+Pb), Jason (10.1Mt at 11.1% Zn+Pb) and Howard's Pass (115.4Mt at 7.46% Zn+Pb). Reduced, acidic brines are believed to transport lead and zinc sourced in the deeper parts of the basin to the sea-floor where interaction with seawater results in precipitation of base metals. Also transported in these fluids is barium which reacts with seawater sulphate to produce barite. Precipitation of barite occurs distal to a vent site and is a major component of the deposits in the MacMillan Pass region of the Yukon. The barium anomaly at Howard's Pass is thought to reflect an anoxic sub-basin formed within the Selwyn Basin.

A number of bedded barite showings are found in the Mackenzie Mountains of the western Northwest Territories. These are hosted primarily in shale, siltstone and mudstone in the upper part of the Devonian-Mississippian aged Canol Formation of the Earn Group, below the overlying debrites and turbiditic siliciclastic rocks of the Imperial Formation (also Earn Group). The primary aim of this study therefore, is to see if the barite in these settings can be used as a vector towards finding new SEDEX deposits in the NWT.

The initial field work focussed on measuring and sampling. Stratigraphic sections were measured through seven sedimentary barite showings in the Mackenzie Mountains (Anita, Wise, Bunk One, Bunk Two, Harp, Ax and Bedded Barite). The showings typically occur in sections of black, carbonaceous Canol Formation shale (the host of the Bedded Barite showing is in fault contact with Devonian carbonates). Strata in the measured sections are moderately to steeply dipping, and range from 22-40 m true thickness. Lower parts of the showings are composed primarily of laminated black mudstone with rare wispy sub-millimetre crystals of white barite. These grade upwards into beds dominated by sub-centimetre barite nodules. The long axes of the nodules are oriented along laminations and displaying varying degrees of deformation. Barite nodule size generally increases to 1-3cm towards the top of these subunits. There is a third subunit consisting of grey, very thinly-bedded (0.2-1 cm) siltstone/shale with 1-2 mm inter-laminations of microcrystalline barite. There is a systematic change from nodular to deformed-nodular to bedded barite up-section and a general thickening of the subunits. Overlying the barite-bearing subunits, is a barite-poor, silvery grey weathering, recessive shale that may also belong to the Canol Formation. The contact with the Imperial Formation is not typically exposed but occurs within 5-25 m from the tops of sections.

The minerals and textures observed in the measured sections compare favourably with those thought to represent distal parts of a mineralized hydrothermal system. Detailed petrography and geochemical analyses on these samples will be compared with analyses with barite and ferroan carbonates collected from the vent-proximal Tom and Nidd deposits hosted in similarly aged rocks in the Yukon. This may provide a means of evaluating the potential for base metal deposits to be associated with strata-bound barite in the NWT.

NWT PROTECTED AREAS STRATEGY: RESEARCH USED FOR PROTECTED AREAS DECISION MAKING

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The goal of the NWT Protected Areas Strategy (PAS) is to protect natural and cultural areas as well as core representative areas in each ecoregion of the NWT. The level of protection in protected areas can vary: some areas are meant to be quite prohibitive in terms of permissible activities, while other areas can allow development activities as long as important values are protected.

Identifying the important values within potential protected areas is therefore a critical step in terms of determining boundaries and long-term management objectives of protected areas. The PAS process promotes the collection, use and comparison of scientific and traditional knowledge for sound establishment and management decisions.

This poster will give examples of the types of information collected, why and when it is collected, and how it is used by candidate area working groups and sponsoring agencies.

The PAS process requires studies on the ecological, cultural and economic values of potential protected areas. This information is collected through a series of studies including ecological assessments, renewable and non-renewable resource assessments, documentation of cultural values and socio-economic assessments.

For example, ecological information is generally collected through a Phase 1 literature review and Phase II field-based assessment which integrates where possible community knowledge with scientific methods. Additionally, ecological representation analyses are done as a key means of evaluating biodiversity protection.

Non-renewable resource information includes oil and gas as well as mineral potential. Mineral studies generally include a Phase 1 literature review and Phase II field-based resource assessment, which (depending on location) typically involves bulk stream sediment sampling, glacial till sampling, water sampling, and geochemical analysis.

Candidate protected area working groups are responsible for evaluating the information collected through the PAS process. Working groups are typically comprised of community, government, industry and environmental group representatives. The working group uses spatial and non-spatial data and public consultation input to make recommendations on the area boundaries and level of protection (e.g., designation, management). Where possible, recommendations are made in a consensus manner. The working groups' recommendations are summarized in a recommendations report that forms the basis of a formal proposal to the sponsoring agency to legally protect the area.

INDICATOR MINERAL AND SURFICIAL GEOCHEMICAL STUDY OF THE IZOK LAKE ZN-CU-PB-AG VOLCANOGENIC MASSIVE SULPHIDE DEPOSIT, NUNAVUT

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Indicator minerals are mineral species that indicate the presence of a specific type of mineralization, alteration or lithology. Indicator mineral methods that have been successfully applied to diamond exploration should also be applied in the search for volcanogenic massive sulphide (VMS) deposits in metamorphic terrain. However, few case studies have been conducted that document the indicator mineral signature of a VMS deposit in glaciated terrain. The Izok Lake Zn-Cu-Pb-Ag deposit, located in the west-central part of the Slave structural province, is an ideal setting for a bedrock and glacial dispersal case study to characterize pathfinder minerals and elements associated with the Izok Lake deposit. This research is being undertaken as part of the requirements for a M.Sc. degree at Queen's University and is being funded by the Geological Survey of Canada (GSC) through its Geo-mapping for Energy and Minerals (GEM 2008-2013) project as a contribution to geoscience information to stimulate exploration and development in northern Canada, in collaboration with Minerals and Metals Group (MMG), the owners of the Izok Lake deposit.

The Laurentide Ice Sheet, sourced from the Keewatin Ice Divide, covered the Slave Province, sculpting the landscape and depositing glacial sediments. Previous surficial mapping by the GSC established the ice flow history of the region, with an oldest flow oriented towards the southwest, the dominant flow towards the west north-west (270°-290°) and the youngest flow towards the north-northwest. Based on knowledge of ice flow patterns across the region from previous work and observations made during this field program, a widely spaced till sampling survey was carried out across the Izok Lake region with closely spaced sampling around the Izok Lake deposit and the West Iznogoudh Lake showing. A total of 76 till samples and 30 bedrock samples were collected for detailed examination of their indicator mineral signatures. Till samples were collected up-ice, overlying and up to 3 km down-ice of the deposit. The relative abundance of specific indicator minerals occurring in the till will be a function of the mineralogy of the bedrock in the source areas.

Selected indicator mineral grains relevant to this VMS study will be photographed and analyzed using SEM, electron microprobe and laser ablation ICP-MS techniques. These techniques will be applied to mineral grains in both polished thin section and loose grains recovered from disaggregated bedrock and till by heavy mineral processing. To understand the types of indicator minerals that could be used as tracers in till, the indicator mineral signature of the bedrock must be defined first by investigating the rock concentrate and petrography. Pebble counts will be carried out on the clast fraction (0.5 to > 2.0 cm) of till to determine approximate direction(s) and distance of glacial transport. Geochemical analysis will be carried out on the <0.063 mm fraction of till to characterize the geochemical signature of the deposit.

SOUTH WOPMAY BEDROCK MAPPING PROJECT: HIGHLIGHTS FROM 2009

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The project aims to provide a cohesive bedrock map of Wopmay Orogen between latitudes 64°30'N and 65°N. In 2009 bedrock mapping was concentrated at Brownwater, Hardisty, and Grant lakes; highlights

are given below. Related thematic studies are reported elsewhere in this volume; see Acosta et al., Corriveau et al., Lee et al., Ootes et al., and Smar et al.

In a simplified east-to-west “zonal” scheme the main components of Wopmay Orogen are: 1) Archean basement of the Slave craton; 2) Coronation margin - an external zone - with ca. 1900 Ma Paleoproterozoic sedimentary (\pm volcanic) cover overlying Slave basement; 3) the metamorphic internal zone, a thrust sequence of cover and plutonic rocks; 4) the north-striking Wopmay fault zone; 5) the Great Bear magmatic zone (GBMZ), represented by ca. 1875-1865 Ma arc-like volcanic rocks and extensive ca. 1865-1855 post-orogenic intrusions; 6) the Hottah Terrane, a crustal block composed of ca. 2400-2200 Ma components upon which a ca. 2000-1900 Ma volcanic arc and the GBMZ were constructed; and 7) the outboard Fort Simpson terrane, which lies beneath the Paleozoic platform.

At Brownwater Lake, in the Coronation margin, field mapping focused on refining the plutonic, metamorphic, and structural relationships. Previously, the Rodrigues pluton was considered characteristic of the syn-orogenic ca. 1880 Ma Hepburn Intrusive Suite, but the low degree of deformation and preserved metamorphic aureole suggest it may represent later, possibly post-orogenic magmatism. A zone of rusty metasedimentary rocks continues from Ingray and Castor lakes through Brownwater Lake; however, few sulfide-bearing rocks were encountered.

At Hardisty Lake, rocks of the GBMZ comprise four main plutonic phases; 1) hypabyssal dacitic porphyry with local volcanic remnants, 2) texturally variable ‘Hardisty’ granite, 3) K-feldspar-phyrlic granite, commonly with rapakivi texture, and 4) meso- to melanocratic phases that are locally magnetic with abundant foliated to gneissic magnetite-bearing xenoliths. Mafic plutonic phases are spatially associated with north-striking faults. Elevated magnetic signatures denote areas rich in mafic xenoliths, mafic dykes and magnetite veins, the latter ranging from <1 cm to 1 m in thickness.

The Grant Lake area encompasses rocks of the Coronation margin, the Wopmay fault zone and the GBMZ. The low-grade, volcano-sedimentary Dumas Group lies along the western side of Wopmay fault zone, within the GBMZ, and consists of little-deformed and metamorphosed sandstones, conglomerates and mudstones (locally forming a red-bed sequence), volcanoclastic sedimentary rocks, and massive to amygdaloidal andesitic-basaltic rocks. These rocks are spatially associated with a distinctive, highly altered, red-orange syenogranite, but its relationship to the Dumas Group remains unknown. East of the Wopmay fault zone, a sequence of deformed and metamorphosed siltstone, sandstone, carbonate, and mafic volcanic rocks is assigned to the Grant/Akaitcho Group. The base of this sequence, for which the depositional age is unknown, rests unconformably on highly strained (mylonitic) granite to tonalite of undetermined, but possibly Archean, age. Further east, psammitic to pelitic rocks and interbedded carbonate, quartz pebble conglomerate and quartz arenite that are comparable to the Snare Group, fringe a body of gneissic granitoids which have yielded Paleoproterozoic zircons (Bleeker and Ketchum, unpublished data).

THE MICRO-/ MACRO-DIAMOND RELATIONSHIP: A PRELIMINARY CASE STUDY ON DIAMONDS FROM ARTEMISIA KIMBERLITE (NORTHERN SLAVE CRATON, CANADA)

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Artemisia is a diamondiferous kimberlite pipe located in the Coronation Gulf region of Nunavut. Artemisia intrudes sediments of the Coronation Supergroup situated along the western margin of the Slave Craton, within the Bear structural province. A subset of 961 diamonds was made available for this

study through Stornoway Diamond Corp. from a larger set recovered during bulk sampling of the kimberlite in 2006.

This study of carbon stable isotopic composition and nitrogen characteristics of diamonds from the Artemisia kimberlite investigates the geochemical signature of the diamond sources beneath the Northern Slave Craton. Micro- (<0.5mm) and macro-diamond (>0.5mm) size populations from Artemisia are evaluated separately to clarify their genetic relationship.

The carbon stable isotopic composition ($\delta^{13}\text{C}$) of a diamond is dependent upon the isotopic composition of the diamond source, which in turn is a reflection of diamond paragenesis. Peridotitic diamonds are characterized by a narrow range in carbon stable isotopic values about a mode consistent with the mantle carbon isotopic value (-5‰). Eclogitic diamonds display the same mode but show much greater variability in $\delta^{13}\text{C}$ (-40 to +3‰)

At Artemisia the micro-diamond population (n=70) has carbon stable isotopic compositions ranging from 1.6‰ to -9.2‰, with a mean of -3.3‰. Preliminary results on the carbon stable isotopic composition of the macro-diamond population from Artemisia (n=7) indicate a range of -4.3‰ to -6.7‰, with a mean value of -5.6‰.

Nitrogen abundance in diamond is dependent upon the nitrogen concentration of the diamond source. For a given nitrogen abundance, the degree of nitrogen aggregation, transition of single substitutional nitrogen to pairs and rings of four nitrogen atoms, depends upon mantle residence time and temperature. Preliminary results of nitrogen abundance in diamonds from Artemisia indicate a range from 11 to 644 atomic ppm with a mean value of 175ppm for the micro-diamond samples (n=18), and a range from 18 to 1849ppm with a mean value of 276ppm for the macro-diamond population (n=45). The nitrogen aggregation state range from 10 to 100% B-centre aggregation (rings of four nitrogen atoms) for the micro-diamond samples, and ranges from 2 to 100% for the macro-diamond samples.

In view of the small number of macro-diamonds analyzed, the compositional range and average for this group is currently poorly constrained. Variability in $\delta^{13}\text{C}$ could be attributed to distinct diamond source parageneses or distinct diamond forming fluids for the different sample sets. Nitrogen abundances and aggregation states in both the macro- and micro-diamond populations display a wide range in values and at this stage it cannot be concluded if observed differences are statistically significant.

Further analyses of carbon isotopic compositions and nitrogen characteristics will be completed to clarify if current indications for distinct micro- and macro-diamond populations at Artemisia can be validated.

REGIONAL GEOSCIENCE STUDIES AND PETROLEUM POTENTIAL, PEEL PLATEAU AND PLAIN, NORTHWEST TERRITORIES AND YUKON: FINAL DELIVERABLES

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The objective of the Peel Petroleum Project (2005-2009) was to advance knowledge of hydrocarbon potential and regional geology in the Peel Plateau and Plain, a prospective area in the northwestern NWT/northeastern Yukon in the vicinity of the proposed Mackenzie Gas Project (MGP) natural gas pipeline route. Although no major discoveries have been reported from the area, some encouraging shows are known from 74 existing wells. Following reconnaissance in 2005, two field seasons were conducted on outcrops in the Peel area and proximal mountain ranges (northern Mackenzie Mountains, Richardson

Mountains, and Franklin Mountains) which expose stratigraphy contiguous with the subsurface of Peel area. Field studies examined sedimentology, stratigraphic and structural relationships, and improved regional correlation. Depositional and tectonic histories, basin evolution, as well as petroleum geology and potential were also evaluated. The multidisciplinary project was a successful Northwest Territories Geoscience Office (NTGO) partnership with the Geological Survey of Canada (GSC) and Yukon Geological Survey (YGS), with input from students at the universities of Alberta and Calgary, and Carleton University.

The project yielded about 90 publications over the past four years and final results are presented in a multi-author project volume (NWT Open File 2009-02/YGS Open File 2009-25). The ten chapters therein include structural and seismic interpretation, descriptions of key stratigraphic intervals that constitute conceptual petroleum plays in Peel Plateau and Plain, (Basal Cambrian clastics; Cambro-Ordovician platform; Upper Devonian clastics; Arnica/Landry platform; Kee Scarp; Tuttle Formation; and Cretaceous clastics), and a review of petroleum systems elements for the area. Stratigraphic chapters describe new measured outcrop sections and sedimentology that improve surface to subsurface correlation. New data on potential reservoir rocks and source rocks were collected from both the surface and subsurface.

A GIS Digital Atlas (NWT Open File 2009-03) accompanies the volume and contains all of the spatial data associated with the research. The interactive atlas includes a field "geo-tour", section and core photographs, seismic profiles, core and measured section descriptions, cross-sections, geochemical analyses, and isopach and structural contours.

This poster provides more information on the project's deliverables and highlights the respective findings and new insights of each member of the research team. The project website is www.nwtgeoscience.ca/petroleum/PeelPlateau.html.

TRI-TERRITORIAL SURFICIAL GEOLOGY MAP INTEGRATION

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As part of the Tri-Territorial Integration Project within GSC's Geo-mapping for Minerals Program (GEM), the Surficial Geoscience Activity is producing a digital compilation and queryable database of new and existing surficial geology maps for onshore and offshore areas of Yukon, Northwest Territories, and Nunavut. Other cooperative work is being carried in North-East British Columbia and Alaska.

The Surficial Materials Map of Canada (GSC Map 1880A, 1:5M), was based on information collected prior to 1992. Since then, considerable surficial geoscience mapping in various digital formats has been undertaken in the North. Together with previous compilations, extensive ongoing searches, and assistance from Territorial partners, the following map sources have been identified: NWT - 145 maps (including 75 in digital format); Nunavut >115 maps (including 80 in digital format); Yukon: (~300 in digital format); Northern BC >12 maps (including 9 in digital format).

Map 1880A is a base to which data from more recent (post 1992) digital surficial maps (1:50,000 to 1:1M scale), and related digital databases are added. Consistency of surficial geology units is assured through their integration into standard GIS formats using a national unified legend. Significant effort and resources are currently being applied to conversion of analog geological maps to digital vector GIS format, in the form of high quality, digital vector data ready for cartographic production. It includes

georeferencing, vectorizing line, point and polygon data from scanned maps, attributing data and creating polygon topology and solving discontinuities along map boundaries.

As part of a larger Tri-Territorial database network being prepared in consultation with NRCan and Territorial partners, the surficial geoscience database will enhance understanding of broad-scale spatial relationships between mineral resources and geology. It will ensure effective delivery of web-accessible surficial geology maps, with accompanying queriable map database. The surficial database will be populated with source-map information at source-map scale. Map parsing and populating the database will begin when networks are established. The Tri-Territorial surficial geoscience database will be updated regularly by GSC staff as source-map information becomes available digitally.

By providing a seamless geological context for resource and ecosystem management, environmental impact assessment, geotechnical concerns and infrastructure development, the database will assist northern communities, and industry/university/government geoscientists, GEM Program and GSC/Territorial managers. A web compilation map will facilitate the correlation of regional surficial geology units and changes in ice flow across political boundaries, meeting a key need of aiding resource exploration in the North. The mineral exploration industry is very active in drift-covered areas of Northern Canada and relies greatly on knowledge of glacial sediments, indicator mineral, dispersal trains, and ice-flow history. The exploration sector requires a modern, uniform Quaternary geological database to support more effective drift prospecting relating to diamonds, gold, PGE, and base metal and U deposits in under-explored areas. Production of a Tri-Territorial paper surficial compilation map is also key in documenting and illustrating the ongoing mapping coverage and advances in the North as well as serve to highlight knowledge gaps to better focus future surficial mapping projects.

ACTIVITIES UNDER THE MINERAL RESOURCE ASSESSMENT COMPONENT, GEM MINERALS PROGRAM

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Mineral resource assessment (MRA) is a component of the activities undertaken as part of the integrated Remote Predictive Mapping project of the GEM (Geo-mapping for Energy and Minerals) program of Natural Resources Canada. The principal long-term objectives of the MRA component are to develop viable quantitative methods for the identification of areas prospective for discovery of key deposit types across Canada's North and to provide reasonable estimates of the endowment of the commodities contained within the undiscovered deposits.

Recent work by Chung, Franklin and Hillary has resulted in the development and initial testing of a new knowledge-driven method for the identification of areas favourable for the discovery of VMS deposits. Exploration criteria or "vectors to ore" for VMS were formulated from published regional scale bedrock maps and the new GIS-based approach was tested for the Hackett River belt and then for Slave Province as a whole. Exploration criteria are being identified for additional deposit types (gold, magmatic sulphide, diamonds, uranium, SEDEX, IOCG and porphyry systems). The new methodology will soon be tested for gold deposits.

Recent work by Kerswill, Behnia and Harris demonstrated that data-driven (weights of evidence or WofE) and knowledge-driven models identified similar areas as prospective for BIF-gold deposits in the North Rae Domain of Western Churchill Province, including several targets on Melville Peninsula. This work led to recognition of some data gaps which are being filled by the new geoscience investigations

under GEM Minerals. These new data should improve the evidence layers used to generate the preliminary gold potential maps and thus facilitate better identification of prospective areas. Improved information is needed on the distribution of faults, iron formation, ultramafic rocks, felsic volcanic rocks and quartzite. Work is underway to determine if the best training set consists of all known occurrences (deposits, prospects and showings), or more restricted sets of deposits and prospects, or just deposits.

Recent work by Kerswill and Behnia indicates that both data-driven (WofE) and knowledge-driven models were successful in delineating areas prospective for discovery of IOCG deposits in the southern Great Bear Magmatic Zone (GBMZ). Models based solely on geological criteria defined relatively large targets compared to those generated using only geophysical data; as might be expected, the most useful prospectivity maps appear to be the result of including both geological and geophysical vectors to ore as evidence layers. Related work is being carried out under the IOCG-Great Bear Region project by Corriveau and coworkers.

Recent work by Bretzlaff has resulted in significant improvements to knowledge regarding the distribution and character of mineral occurrences in northern Melville Peninsula and in the GBMZ, two areas covered by projects under GEM Minerals. Such information is critical for the application of data-driven methods that depend upon a training set of known occurrences, and for the validation of knowledge-driven mineral potential maps that do not require a training set.

GEOPHYSICAL INTERPRETATION OF THE SOUTH WOPMAY, NORTHWEST TERRITORIES CANADA

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Mineral deposit models have taught us that specific ore deposit types are associated with particular geological terranes. Having identified terrane boundaries the next stage in the search for an ore deposit is to outline the distribution of geological lithologies and geometries which might be prospective repositories of the specific ore body type. Finally, to locate potential ore resources it is possible that some deposits can be found by the presence of diagnostic physico-chemical signatures. The mineral exploration process therefore progresses from an initial regional scale bedrock mapping to detailed prospect scale surveying.

The Wopmay Orogen, Northwest Territories, Canada comprises a number of distinct geological terranes; (1) the Coronation Margin; (2) the Great Bear magmatic zone (GBMZ); (3) the Wopmay fault zone; and (4) the Hottah Terrane. While the orogen has good surface exposure, our knowledge of the distribution of rock types, their geometry and structure is limited due to difficult access, presence of water bodies and glacial overburden. Many of the lithologies and their associated alteration products are known to have discreet physico-chemical characteristics. In such a situation using available geophysical and optical imagery to prepare a geological template, or 'Remote Predictive Map' in advance can optimise the time and locations to be examined during subsequent field mapping. In this instance, the project aims to provide support to the South Wopmay Bedrock Mapping Project (Jackson et al.).

Map products prepared from available geophysical data were used to outline the distribution of possible geological contacts. Based on physical property responses and mapped physical property contacts it is possible to outline various geological entities (faults, folds, plutons, etc.). The detail resolved by a

geologist is limited by the distribution of outcrops and accessibility. For a geophysicist resolution of lithological complexity is constrained by the spatial sampling employed during a survey and the presence of physical property contrasts between adjacent rock units. The survey data examined in this study, flown at a flight line separation of 800m and 400m terrain clearance, is only capable of delineating regional structures such as the north-south striking Wopmay Fault and broad scale geological contacts. Preliminary studies indicated that many of the lithologies within the Coronation margin do not have strong geophysical signatures (metasedimentary rocks). To better resolve these differences and to characterise the observed geophysical responses, during the 2009 field season, magnetic susceptibility and radiometric readings were recorded at both local (<500m) and regional (>2km) scale sample spacing.

On a more detailed scale the GBMZ is host to two iron oxide-copper-gold (IOCG) deposits, NICO and Sue-Dianne. IOCG deposits are associated with distinct geophysical anomalies, especially magnetic, radiometric, and gravity. For example, alteration due to magnetite or hematite replacement is resolved through magnetic surveys while uranium enriched and potassium-altered areas are resolved through radiometric surveying. During the summer 2009 field season, local scale magnetic susceptibility and radiometrics were also collected over the NICO and Sue-Dianne deposits. These are used as standards for the modelling and interpretation of additional potential areas of mineral interest and contribute to related studies being conducted by Corriveau et al., and Acosta et al.

**MANGANESE AND PHOSPHOROUS ENRICHMENT IN BAFFINLAND IRON MINES CORP.
DEPOSIT NO. 1, MARY RIVER IRON FORMATION, NORTHERN BAFFIN ISLAND,
NUNAVUT**

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Deposit No. 1 of Baffinland Iron Mines Corp. Mary River Project is located on Northern Baffin Island, approximately 160 km south of Pond Inlet. It is hosted within iron formation of the Neoarchean Mary River Group (MRG). The MRG forms supracrustal keels preserved on the western closures of easterly plunging gneiss domes cored by mixed flow-folded Meso to Neoarchean high grade gneiss; substantial Hudsonian augen granite intrudes between the MRG and the polydeformed basement. Iron formations within the MRG are associated with upper komatiitic volcanics and quartzites overlying older amphibolite and paragneiss, so is stratigraphically similar to the upper Woodburn Lake Group of the Prince Albert Group on the mainland. The units of iron formation form regional markers of banded magnetite-chert, massive grunerite, and garnet-actinolite amphibolite, typical of multifacies Algoma-type. The direct-shipping iron ore of Deposit No. 1, forms a resistant ridge having elevations ranging from 250-710 meters and a strike length of ~3,800 m. Drilling has shown that high grade magnetite/hematite forms a near massive tabular body ranging from 105-290 m in thickness, with an average grade of 64.4% Fe. It is the largest and highest grade of five outlined deposits, and is centered on a moderately east-plunging F₃ fold hinge. Deposits 2 and 3 occur on the north limb that extends easterly to the Glacial Lakes area; the south limb extends southeast along the Central Borden fault.

Detailed petrographic examination focused on high grade iron ore with elevated Mn- and P-contents bordering directly on interleaved garnet-chlorite schist. Microscopic examination demonstrates that the high grade iron ore exhibits annealed granoblastic polygonal magnetite with variable hematite. Hematite typically follows magnetite grain boundaries but may locally completely replace magnetite to form martite, and forms porous and platy-textured specularite where sheared. The Mn-enriched magnetite ores locally show significant granoblastic siderite and minor cummingtonite intergrown with magnetite and are commonly crosscut by microveinlets containing varying amounts of siderite, apatite, chlorite, and

cummingtonite. The Mn-rich zones rich in siderite demonstrate two textural variations, primary siderite intergrown with granoblastic polygonal magnetite (6-12% MnO) and trace secondary siderite (20-30% MnO) replacing radiating splays of cummingtonite (2-4% MnO). P-rich zones are due to equigranular fluorapatite disseminated within the high grade magnetite ores (36-41% P₂O₅, 1-6% F). Cacoenite (26-28% P₂O₅) and diadochite (20-21% P₂O₅) occur as secondary P-rich minerals in late microveins. The schistosity of the garnetiferous schist units interleaved within Deposit No. 1 is defined by alignment of foliated and sheafy ripidolite (24-25% FeO, 14-17% MgO). The foliation surfaces envelope almandine-spessartine garnet (27-31% FeO, 8-11% MnO), aligned ilmenite, minor quartz, and trace monazite.

The prograde amphibolite facies metamorphic overprint is related to the Transhudson orogeny. This caused enrichment of original BIF within the F₃ fold hinge by removal of silica and growth of granoblastic magnetite with minor siderite and trace apatite. Fluid migration during cooling and exhumation caused retrogression of the interleaved garnet-chlorite schists, replacement of Mn-cummingtonite by Mn-siderite and remobilization of fluorapatite into the crosscutting microveins with secondary cacoenite and diadochite.

HIGH RESOLUTION PALEOCLIMATIC STUDY OF LACUSTRINE SEDIMENTS ALONG TIBBITT CONTWOYTO ICE ROAD, YELLOWKNIFE, NWT, CANADA

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The Tibbitt to Contwoyto Winter Road (TCWR) in the Northwest Territories is integral to the transportation of goods and services to and from mines north of Yellowknife. In 2006, a shortened ice cover season failed to meet the necessary transportation needs of the mining industry and resulted in the closure of one mine due to the exorbitant costs of flying goods in. Both industry and the territorial government are seeking ways to reduce the economic impact of future shortened ice road seasons through understanding the natural variability in seasonal ice cover in the region as well as the possible future impact of Intergovernmental Panel of Climate Change projected anthropogenic induced warming.

This pilot study involves analysis of freeze cores from Waite and Tibbitt lake, near the southern end of the TCWR. Freeze cores are ideal for high-resolution analysis as the critical sediment/water interface is preserved intact, permitting the paleoclimatic history of the lake to be assessed in the context of the present-day conditions. Use of a freeze core is also advantageous as it can be sliced with great accuracy and precision. The sediment cores were processed using a custom-designed microtome. Subsampling took place at millimeter intervals, and based on preliminary dating of the core, these intervals provide a sub-decadal resolution.

Two lake sediment proxies to be utilized in this research will be grain size and arcellacea (also known as thecamoebians or testate amoebae). Changes in relative grain size in a lake basin over time provide data on climatic change related to variation in precipitation and resultant runoff from the lake catchment. Arcellaceans are very abundant and preserve well in lacustrine sediments, providing detailed information on a host of factors influencing the paleolimnological/paleoclimatic history of a lake. High-resolution analysis of these proxies will provide data on late Holocene climate cycles and trends which can be quantified through use of transfer functions.

Grain size is being analyzed using an LS 13 320 laser diffraction particle analyzer. As analysis on this instrument requires only minimal sample preparation and only a few minutes per analysis it will be

possible generate a very high-resolution paleoclimatic history of the lake catchments over time. Arcellacean analysis is more labor intensive and thus is being carried out at a coarser resolution.

Preliminary results are promising for both grain-size and thecamoebian analysis. In Europe transfer functions have been developed utilizing paleoclimatic data from lacustrine environments to predict seasonal ice cover. The subdecadal-scale analysis of cores that span much of the Holocene will provide an unprecedented level of detail on the trends of long and short cycles that have influenced climate change in the region. The results of this study will be used by future studies as a guideline in generating a suitable transfer function of lake ice cover duration. This data will also provide a baseline for climate model testing, aiding in the determination of whether current climate patterns reflect natural climate variability or if they are potentially anomalous.

DIAVIK BOART – UNRELATED TO GEM DIAMOND AND FIBROUS COATS?

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We studied large piece of boart (54 carats) from the A154-South pipe at Diavik Diamond Mine. This dark grey polycrystalline diamond shows distinct layering, with the major part of the sample being fine grained (<1mm) and visually inclusion free. Separated by a 1mm thick layer of clear diamond, the remaining part of the sample consists of coarser grained (~1mm) diamond crystals intergrown with emerald green clinopyroxene and red garnet (=3mm). To constrain the origin of polycrystalline diamond at Lac de Gras and to place it in the context of what is known about the formation of monocrystalline gem diamonds in the area we studied (1.) the diamond carbon isotopic composition and (2.) the major element composition of the silicate minerals intergrown with it.

The garnets are lherzolitic (G9) in composition and distinctly lower in Cr₂O₃ (~4wt%) and generally higher in TiO₂ (~0.27wt%) than garnet from the same location occurring as inclusions in diamond (Donnelly et al. 2007) and in diamondiferous microxenoliths (Creighton, et al. 2008). Garnet intergrown with framesite from Jwaneng (Botswana; Kirkley et al. 1994) also shows low Cr contents, but due to lower Ca concentrations, falls just on the other side of the G10/G9 division. Despite their harzburgitic nature, the Jwaneng garnets have unusually high Na₂O (0.14wt%) and TiO₂ (0.54wt%) contents, more akin to typical eclogitic garnets. In the Ca-Mg-Fe quadrilateral, Cr-diopside from Diavik boart overlaps with inclusions in diamond from world-wide sources, but in contrast to more Ca-rich clinopyroxene in gem diamonds from Diavik, falls on the Ca-poor end of the population. Cr₂O₃ contents of clinopyroxene from Diavik boart are ~1.0wt%, comparable to lherzolitic inclusions in diamonds. This contrasts with clinopyroxene from Jwaneng framesite, containing 11.6wt% Cr₂O₃.

The carbon isotopic composition across our boart sample is almost constant ($\delta^{13}\text{C}$ of -23.4 to -23.8‰). A compilation of framesites from Botswana, South Africa and Russia reveals a distinct bimodality with populations between -24 to -16 and -10 to -1‰. Our data overlaps with the isotopically light framesite population but is distinct from gem diamonds from the Lac de Gras area showing $\delta^{13}\text{C}$ = -21‰ and -14‰ for the eclogitic (Davies et al. 1999) and peridotitic (Cartigny et al., 2009) suites, respectively. The boart is also distinct from clouded/fibrous overgrowths ($\delta^{13}\text{C}$ = -9‰, Janson et al. 2008) on monocrystalline diamonds at Diavik.

Geothermobarometric calculations, based on silicate phases in our boart sample, indicate crystallization at higher pressure and temperature conditions (~1210°C, 59kbar) than for both diamondiferous

microxenoliths (1010°C, 48kbar; Creighton et al. 1008) and diamond inclusions (1190°C, 52kbar; Donnelly et al. 2007).

Based on these data we relate formation of the boart sample from Diavik to interaction of a subduction derived fluid/melt, characterized by constant very low $\delta^{13}\text{C}$ typically indicative of organic matter, with mantle peridotite. Thermobarometric data imply that this event occurred close to the base of the lithosphere at ~190 km depth beneath Lac de Gras. The fairly fertile character of the silicate phases in the boart sample suggests that this event was associated with metasomatic re-enrichment of the peridotitic host rock.

THE REDSTONE COPPERBELT, NORTHWEST TERRITORIES, CANADA

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Recent studies of stratiform sedimentary rock-hosted copper (SSRHC) deposits have shown that copper mineralization can be an epigenetic, hydrothermal process rather than a diagenetic process. These studies have focussed on areas which are considered to be classic examples of this mineral deposit type, for example within both the Central African Copperbelt and the Kupferschiefer deposits of Central Europe. In light of these studies and a changing scientific paradigm, this study of the Redstone Copperbelt aims to further the scientific understanding of SSRHC deposits in order to build a robust process-based genetic model which can be utilized for exploration.

The Redstone Copperbelt spans an arcuate zone within the Mackenzie Mountains of approximately 300 km x 15 km and includes the Coates Lake and Keele River deposits and showings. At the Coates Lake deposit an inferred resource of 33.6 Mt @ 3.92% Cu and 9 g/t Ag has been defined (NI-43-101 compliant); however this estimate is thought to be conservative and more copper is known to exist within this mineralizing system.

An initial six week field season was completed in the summer of 2009. Field work focused on the examination of 16 copper showings or deposits across the copperbelt supported by the logging of diamond drillcore from the Coates Lake deposit and the Keele River showings. Mineralization in the copperbelt is hosted by rocks belonging to the Mackenzie Mountains Supergroup, the Coates Lake Group and the Windermere Supergroup and hence spans some regionally significant unconformities. Copper mineralization is manifested in a variety of forms, including disseminated stratiform copper or copper-iron sulfides; carbonate-quartz-barite vein hosted sulfides; or as part of the carbonate-quartz cements of breccias. Veins associated with mineralization: can be up to 2 m wide; are comprised of coarsely intergrown carbonates and quartz; and display alteration halos. Disseminated mineralization co-occurs with veins and veinlets and is stratiform on a scale of kilometres; however in some areas mineralization shows no stratigraphical control. Within individual deposits, there is an upwards and lateral zonation of sulfides such that the copper:iron ratio decreases upwards and laterally away from regions of high grade mineralization. Locally, mineralization has been observed to be related to faulting.

In light of this new evidence, it is postulated that mineralization occurred throughout the Redstone Copperbelt as a regionally transgressive redox front and as an epigenetic hydrothermal event. These field-based hypotheses will be tested and the mineralizing systems will be characterised through establishing: the timing of fluid flow events; the temperature and chemistry of the mineralizing fluids; fluid flow pathways; stratigraphical or structural controls on mineralization; alteration associated with mineralization; and the geochemical footprint of the mineralizing system. This will be accomplished

through: detailed petrography; mineral chemistry; whole rock lithogeochemistry; stable isotopes including C, O, S, Cu and Fe; and radiogenic isotopes including the direct Re-Os dating of sulfides; fluid inclusion microthermometry; and low-temperature thermochronometers. These data will lead to an enhanced understanding of the mineralizing processes within large scale hydrothermal systems, fluid flow within evolving sedimentary basins and SSRHC deposit models.

IOCG ENVIRONMENTS IN THE GREAT BEAR MAGMATIC ZONE

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New iron oxide copper-gold (IOCG)-type hydrothermal systems and extensive breccia have been discovered in the southern and central Great Bear Magmatic Zone as a result of protocol development for IOCG-targeted remote predictive mapping (RPM) modelling and alteration mapping, and their application within the IOCG/Multiple Metals - Great Bear Region (NWT) project (Geomapping for Energy and Minerals program).

These protocols are anchored on alteration studies, geochemical modelling and U-Pb geochronology in the Contact Lake belt of the Port Radium-Echo Bay IOCG district that highlight that some metals may be sourced within host intermediate rocks, liberated through strong leaching of mobile and 'immobile' elements (e.g. LILE, REE, Co, Ni, Zn, Nb, Ta and to a lesser extent Zr and Hf) during severe and extensive sodic alteration and subsequently precipitated during intense potassic alteration in the presence of iron oxide. In contrast, a magmatic-hydrothermal fluid associated with the final evolution of felsic magmas would best account for the overall chemical signature of a pseudo-pegmatitic alkali-rich alteration (currently largely albite) with a calcic-iron apatite-magnetite-amphibole assemblage which reach very high REE (up to 8000 ppm), Y (500 ppm) and F (1.6%), and the significant Th (120 ppm) and U (37 ppm) contents where apatite is abundant. Growth of hydrothermal zircons at 1869 ± 9 Ma in albitite is coeval with Great Bear batholith magmatism (ca. 1873 Ma to 1865 Ma) and the new 1872 ± 2 Ma age for the Mystery Island Suite diorite intrusion along which the Contact Lake belt hydrothermal system developed.

This better understanding of chemical behaviour within the IOCG alteration-mineralization zoning model framework and coeval nature of intrusive suites with IOCG systems led to RPM modelling favorability maps that proved efficient in prognosticating zones of interest for alteration mapping based on current geophysical (magnetic and radiometric) and geological knowledge.

In turn, alteration and structural mapping with a gamma-ray spectrometer over these RPM anomalies led to the discovery of 1) a felsic volcanic complex (Cole Lake volcanic sequence) with a 450 m wide fluidized breccia that includes nearly the entire IOCG alteration spectrum and local sulphide-rich zones, and 2) arsenopyrite-rich magnetite-group IOCG showings with up to a few hundred ppm U in potassic-iron (magnetite) alteration zones hosted in amphibole-magnetite altered siltstone beds similar to, and to the south of the NICO Au-Co-Bi magnetite-group IOCG deposit. Structural breccias were also discovered 200 m from and within a fault zone east of the Sue Dianne deposit, within the Wopmay fault south of JLD and Ham showings, and at a granitoid-metasediment contact west of the NICO deposit and previously known breccias. The latter is crosscut by syn-tectonic granite veins.

Finally combination of alteration mapping and ground gamma-ray spectrometer survey has unveiled zones of significant Th enrichment in a pseudo-pegmatitic alteration similar to that in the Port Radium-Echo Bay IOCG district and U-rich zones in the Cole Lake volcanic sequences, 800 m from the fluidized breccia.

THE PETROLOGY OF THE BLACHFORD LAKE INTRUSIVE SUITE: PUTTING HFSE AND CU-PGE MINERALIZATION INTO CONTEXT

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The Aphebian Blachford Lake Intrusive Suite is situated approximately 100 km southeast of Yellowknife along the shore of the Hearne Channel, and is currently one of the most potentially economic alkaline intrusions in the Slave craton. It is primarily hosted in the Burwash Formation of the Yellowknife Supergroup, and is in contact with Archean intrusions of the Dease Plutonic Suite and Morose Granite. Located adjacent to the Athapuscow Aulacogen, the intrusive suite is likely related to the failed Early Proterozoic rifting of the East Arm.

The intrusive suite can be broadly subdivided into two lobes. Rock units of the younger Eastern Lobe have an alkaline/peralkaline signature and consist of alkaline granites, syenites, and nepheline syenites. The Thor Lake Syenite, the central phase of the more evolved Eastern Lobe, has been known for decades to host significant REE-Nb-Y mineralization. The older Western Lobe is characterized by subalkaline intrusives, comprising gabbros, ferrodiorites, and granites. Not until recently has the Western Lobe been explored for its potential as a Cu-PGE source; with relatively little exploration, the Caribou Lake Gabbro has shown with varying degrees of success, the potential for high-grade mineralization.

While exploration within the Blachford Intrusive Suite indicates that each lobe has an associated mineralization type, it is unclear which processes are responsible for their respective enrichments. A detailed study of the entire complex is required in order to place the HFSE and Cu-PGE mineralization into the petrogenetic framework of the Blachford Lake Intrusive Suite. By understanding the processes that govern the petrology, geochemistry, and mineralization it may be possible to direct further exploration in both lobes, and in other alkaline complexes around the world.

To these ends a comprehensive petrogenetic study has been initiated on the entire Blachford Lake Intrusive Suite, involving both mapping and extensive geochemical sampling. Some of the detailed mapping of select areas within the intrusive suite has been completed, and raises questions concerning the relationships between phases, between the two lobes, and with host rocks. One of the more intriguing problems is the contact relationship between the Grace Lake Granite and the Thor Lake 'rim' syenite. No evidence of either a magmatic or structural imposed relationship was observed, yet the sub-circular contact is punctuated by a pronounced change in topography, and a strong airborne magnetic signature.

Future work using trace-element and radiogenic isotope systematics will be used to characterize the various phases, while mineral chemistries, stable isotopes, and *in situ* dating will be used to construct an evolutionary account of the intrusive suite.

STUDY OF A STRUCTURAL AND STRATIGRAPHIC LINK BETWEEN ELU AND HOPE BAY GREENSTONE BELTS, NE SLAVE CRATON.

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The north-eastern part of the Slave Craton (Bathurst Block) includes the ca. 2700 - 2600 Ma Hope Bay and Elu greenstone belts. The Hope Bay greenstone belt (HBB), is N-striking and connects in the south with the arcuate E-W to NE-SW trending, Elu Belt (EB). The Elu Link project focuses on the triple point between the HBB and EB and provides new insights into key geological relationships between the two greenstone belts.

The Elu Link consists of highly strained, predominantly mafic pillowed flows and subordinate intercalations of felsic lavas, psammites, and banded iron formation. These amphibolite grade supracrustal rocks showing D_1 - D_3 strain are flanked to the south and the north by regionally extensive, partly migmatized metagranitoid complexes. They are intruded by syn- D_2 , sheet-like bodies of hornblende metagabbro which are themselves cut by syn- to late- (D_2+D_3) porphyritic and equigranular hornblende +/- biotite metagranites within which abundant leucosomes and migmatitic gneiss occur. Diffuse contacts between migmatitic gneiss and metagranites, together with leucosomes and thin granitic dyke swarms in the metagabbros are indicative of intensive syn- (D_1-D_3) anatexism. Late diabase dykes cut across the entire rock mass in a NE direction.

Bedding (S_0) is demonstrated by the intercalation of supracrustal rock types. A conspicuous bedding parallel foliation (S_0/S_1), also preserved as S_1 surface in migmatitic gneiss, illustrates strong D_1 transposition. D_2 overprints S_0/S_1+S_1 into open to tight parasitic F_2 folds lacking a visible axial plane cleavage. Enveloping surfaces of D_2 folds delineate short-wavelength folds pertaining to large-scale F_2 structures. The latter are curvilinear synclinoria and anticlinoria, generally plunging steeply ($> 65^\circ$) northwards. By contrast, intrusive rocks exhibit unfolded penetrative surface, parallel to F_2 axial plane traces and which is inferred to be the S_2 foliation with a putative S_1/S_2 surface in the host rocks. In both cases, a weak stretching lineation (L_2) imprinted on S_2+S_1/S_2 is broadly coaxial with F_2 hinges. L_2 occurs with well developed and variably symmetric boudins including foliation boudins. Both types of structures denote a subsolidus downdip maximum extension sympathetic with an arcuate reverse shear zone bounding the Elu Link to the north against an extensive metagranitoid complex that impinges upon the HBB and EB. In reverse, symmetric boudins associated with conjugate strike-slip shear zones characterize a subordinate foliation parallel horizontal extension. Along strike and downdip extension, is also evidenced by stretched and folded quartz and leucosome veins. Altogether, D_2 structures indicate a vertical general flattening finite strain with E-W maximum shortening. D_3 deformation is principally illustrated by outcrop-scale cryptic folds folding $S_1/S_2 + S_2$ consistently with protracting E-W compression.

To assist with mapping and to better use available magnetic data, magnetic susceptibility was measured on hand samples (KT-10). The results indicate averages of $1.53 \pm 10.47/-1.30$ (SI) ($n=41$) for metagranites, $1.68 \pm 5.88/-1.31$ for 43 readings on metagabbros, $1.00 \pm 5.19/-0.85$ for 19 readings on metavolcanic rocks, and $8.64 \pm 15.90/-5.60$ ($n=5$) for diabbases, summarized from their log distributions. These values show variations denoting subdivisions within the main lithologic units and demonstrate that magnetic susceptibility data is a useful tool for detailed mapping in this region affected by complex structural relationships.

IS OUR BEDROCK ‘GREEN’STONE? DIMENSION AND BUILDING STONE OPPORTUNITIES IN THE NORTH SLAVE

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The ‘green’ building revolution in North America revolves around environmentally friendly or naturally sourced products that are recyclable, along with being manufactured and used sustainably. Natural stone is such a product. The North Slave region (for this study we consider this region as anything accessible by permanent or winter road north of Great Slave Lake) is extensively underlain by bedrock consisting of granite, basalt, gabbro, sandstone, quartzite, slate, and limestone/marble. Rocks that have particular physical or aesthetic properties, such as appealing colour or texture, widely spaced jointing, lack of microfractures, etc., can be useful and even sought after as dimension stone or building stone (e.g., monuments, sidewalks/paving stone, curbs, cladding, countertops).

Background:

- In 2006 (the last year for which there are statistics):
 - Canada imported 42646 tonnes of granite, the USA imported 2.58 million tonnes, mainly from Brazil, India, and China
 - The average price/tonne was \$254
 - Canada supplies 1.6% of the USA imports
 - Average quarrying cost for granite is \$6.15/tonne

Opportunities:

- There is extensive bedrock accessible by permanent or winter road in the North Slave. Currently between 5000 and 10000 tractor trailer trucks use the road to access operating diamond mines or communities. Many of these trucks return to the south empty, which could provide a transportation opportunity to southern markets, or to rail in Hay River, or barge in Yellowknife.
- Locally sourced natural stone provides a longer life and more natural beauty than fabricated products and because it is locally sourced it should be competitive in price. For a city such as Yellowknife, not only is this natural product environmentally friendly (low transport and fabricating costs), it could provide a long-term cost savings in maintenance.
- First Nations groups could benefit as they control their land and have a knowledge base of rock extraction through past and present mining operations.
- Dimension stone production offers a wide variety of opportunities from entry level “mom and pop” type single person slate picking operations to large integrated industrial building stone production. Capital investment can be very little in the beginning stages allowing a potential producer to test the market before committing to large scale spending.

Challenges:

- ‘Beauty is in the eye of the beholder’. For southern benefaction, a clear marketing network and agreement would likely be required before proceeding with manufacturing.
- Long-term use in local communities requires planning and commitment prior to extraction.
- Investment. Equipment for cutting and polishing (for local sources) would have to be purchased. Skilled artisans require training.
- Variability in product. For example, the single most abundant rock type in the North Slave is granite, but the granite has highly variable colour, composition, and fracturing/jointing patterns.

**HYPERSPECTRAL SURVEYING IN SUPPORT OF MINERAL EXPLORATION IN
CANADA'S NORTH; RATIONALE, METHODOLOGY, AND AN EXAMPLE FROM THE
HACKETT RIVER GREENSTONE BELT, NUNAVUT**

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A SINED-funded, cooperative project involving personnel from the Geological Survey of Canada, Canada-Nunavut Geoscience Centre and Canada Centre For Remote Sensing, the contractor SpecTIR LLC, and industrial partners Newmont USA Limited, Sabina Silver Corporation, was recently initiated to test the efficacy of airborne hyperspectral surveying as a mineral exploration tool in Canada's north.

Spectral methods have been shown to be highly effective in recognizing and delineating zones of hydrothermally altered rocks that are spatially and temporally related to mineralization. In areas of little to no vegetation, such as in hot, arid environments with abundant outcrop and/or regolith, airborne or satellite-based hyperspectral data have been proven effective in mineral exploration. However, there are currently no case-studies in the public domain that demonstrate their efficacy under the unique geographic and climatic conditions of Canada's North, exemplified by cold temperatures, minimal surface weathering, minimal vegetation cover, and variable lichen cover.

Airborne hyperspectral surveys were flown over two greenstone belts in Nunavut: 1) parts of the Hackett River greenstone belt, host to several volcanogenic massive sulfide deposits (Hackett River, Musk, Yava), and adjacent areas immediately to the east, host to several iron formation-hosted gold deposits (George Lake, Goose Lake); and 2) much of the Hope Bay greenstone belt, host to several orogenic gold deposits (Doris North, Boston, Madrid). The salient goal was to test the usefulness of this technology in delineating hydrothermal alteration footprints of the known deposits, and to highlight areas of further exploration interest. Hydrothermal alteration styles (e.g., chloritization, sericitization, carbonatization) associated with volcanogenic massive sulfides (VMS) and orogenic gold deposits are mineralogically ideal for detection by hyperspectral methods.

Hyperspectral data were collected using the high spectral resolution ProSpecTIR-VS sensor at both 1m and 3m spatial resolutions (different areas) during August, 2009. Calibrated reflectance data, and preliminary derivative interpretive products, such as distribution maps of prevalent hydrothermal alteration minerals, are expected to be publicly available for Hackett River before end 2009, but data and derivative products for Hope Bay will remain unavailable until spring 2011, in accordance with a written agreement.

Although the primary impetus for this study was to identify mineral deposits, hyperspectral survey data can also play an important role in assisting in the preparation of bedrock and surficial geological maps and vegetation distribution maps, and the datasets from these two surveys could prove useful in such endeavours. Experiences gleaned from this study will provide useful in the application of new (commercial) spaceborne (satellite-based) hyperspectral sensors that are planned for launch within a few years.

FLUID AND THERMAL HISTORY OF A BRECCIA ZONE OF THE WEST BAY FAULT, NORTHWEST TERRITORIES

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The West Bay Fault (WBF) is a major Proterozoic strike-slip fault in the Yellowknife Greenstone Belt. It is ~250 km in length, strikes N-NW with an almost vertical dip, and has an average horizontal displacement of 5 km. The WBF typically is a sharp, well-defined fault zone, but locally, north of the Giant Mine, it expands into a 10-50 m wide breccia zone developed within granitic rocks. Here, breccia fragments from 1-10 cm in size are bleached a light grey color. They are cemented and crosscut by multiple generations of quartz veins ranging from a few mm up to 10 cm in width, which indicate a complex history of fluid movement. Fluid inclusions and oxygen isotopes are used to document the nature of various fluids that moved along the fault.

Four stages of quartz mineralization are recognized by us in the WBF breccia: I, milky quartz (\pm minor pyrite) veins contained within wall rock fragments; II, cross-cutting, coarse-grained white or pink quartz (\pm minor pyrite altering to hematite) veins; III, open-space-filling veins with euhedral quartz (\pm hematite); and IV, clear quartz veinlets. Because of the brecciated and fractured nature of the samples, it is difficult to determine unequivocally primary fluids. Distinct fluids were determined through interpretation of fluid inclusion homogenization (T_h) and last ice-melt (T_m) values. Most fluid inclusions are two-phase brines (H_2O -rich liquid + vapor) that occur in all stages of quartz. Rare, three-phase inclusions (H_2O -rich liquid + vapor + daughter mineral) were found in some Stage III samples.

Fluid inclusions from Stages I-III have similar T_h values of ~300 to 450°C and T_m values of ~ -10 to -20°C, corresponding to salinities of ~ 15 to > 25 wt. % equiv. NaCl. Those from Stage IV have T_h values of ~270 to 330°C and similar salinities. Obvious secondary inclusions in all stages have lower T_h values of 110 to 250°C and T_m values of -2 to -26°C, reflecting a wide range of salinities. These later, lower-temperature brines trapped in the WBF appear to be ubiquitous throughout the Slave Province.

The $\delta^{18}O$ values of Stage I-III quartz ($n=12$) are 9.1 to 12.2‰ (V-SMOW). That of Stage IV is 3.9‰. Calculated $\delta^{18}O$ values for quartz-depositing waters in Stages I-III (3.9 to 6.8‰) reflect isotopic equilibration of fluids with granitic and metamorphic rocks at high temperatures (300 to 450°C) and low water to rock ratios. The $\delta^{18}O_{\text{water}}$ value for Stage IV is -3.5‰, reflecting incursion of less-evolved meteoric water in the WBF breccia.

The WBF records multiple fluid events throughout its history. Though the fault was not a conduit for fluids involved in primary gold deposition, its high-temperature, saline fluids were capable of remobilizing gold and transporting other metals. Stage IV veins in the breccia zone record similar fluids to those seen in late dolomite + calcite + stibnite veins and vugs in the nearby Giant Mine. The relationship of the WBF's fluids to those in other metal deposits in the district deserves further study.

A NEW BEDROCK GEOLOGY MAP OF THE CUMBERLAND PENINSULA, NUNAVUT: AN INITIAL STEP IN EVALUATING THE MINERAL POTENTIAL OF EASTERN BAFFIN ISLAND

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NRCan's Geomapping for Energy & Minerals (GEM) program has identified Cumberland Peninsula, eastern Baffin Island, as an under-explored, frontier region of Canada with significant diamond potential given the recent discovery of diamondiferous kimberlite on neighbouring Hall Peninsula, and significant base- and precious-metal potential associated with supracrustal rocks correlative with the Piling Group of central Baffin Island. New, high-resolution aeromagnetic data combined with 2009 ~1:150,000 scale geological mapping and satellite imagery analysis form the underpinnings of a new geological map which is markedly different from the existing 1:500,000 scale compilation. The new bedrock map highlights the extent of a previously unrecognized tonalitic plutonic complex worthy of consideration in terms of diamond potential, presumed Paleoproterozoic supracrustal units important to resource exploration, and key structures that control the distribution and geometry of the major map units.

Extensive plutonic rocks of tonalitic to quartz dioritic composition across the southern half of the peninsula form the structural basement to supracrustal rocks that dominate the northern part of Cumberland Peninsula. While the age and affinity of this polydeformed plutonic complex remains to be determined through supporting isotopic and lithogeochemical studies, testable hypotheses include an Archean basement origin (Rae?) and/or syn-tectonic Paleoproterozoic emplacement. Supracrustal rocks occur as isolated and dismembered belts in the southern part of the project area and as an extensive cover sequence in the north. Dominated by metasedimentary rocks, the supracrustal sequence includes silicate- and oxide-facies iron formation, chert, graphitic-pyritiferous shale, minor quartzite and marble, and widespread psammite-semipelite turbidite. At several localities, volcanic rocks of mafic to ultramafic composition preserve primary textures supporting both flow (vesicular and variolitic pillows) and pyroclastic (fragmental) origin, however, additional mafic panels of uncertain origin are widespread. In general, the supracrustal sequence (Hoare Bay Group) contains similar rock types and apparent stratigraphic associations as observed in the Paleoproterozoic Piling Group of central Baffin Island.

Most rocks exposed on Cumberland Peninsula display several generations of structures that can be interpreted in terms of two penetrative tectonometamorphic events and one non-penetrative folding event. Amphibolite-facies assemblages are widespread, with local evidence for the attainment of granulite facies conditions. A notable aspect of the structural geology of the study area is that the most intense strain appears recorded by linear belts of mylonitic plutonic rock, typically in close proximity to lower strain supracrustal rocks of presumed Paleoproterozoic age. These relationships suggest that syn-tectonic magmatic emplacement played an important role in south-directed tectonic imbrication of prospective supracrustal rocks of the Hoare Bay Group during the ca. 1.89-1.8 Ga Trans-Hudson Orogen.

INITIAL INVESTIGATIONS INTO THE P-T-T-D HISTORY OF PALEOPROTEROZOIC SUPRACRUSTAL ROCKS AT GRANT AND BROWNWATER LAKES, SOUTHERN WOPMAY OROGEN

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In the Wopmay Orogen, the Paleoproterozoic sedimentary rocks of the Coronation margin and the underlying Archean basement were deformed together during the ca 1885 Ma Calderian Orogeny. Extensive work in northern parts of the metamorphic internal zone have defined deformational events within the Calderian Orogeny that resulted in thrusting, shortening and thickening of the clastic wedge; such detail is lacking in the southern part of the orogen where the pressure-temperature-time-deformation (P-T-t-d) history is poorly constrained. In addition, quantitative values on the timing of metamorphism relative to deformation are lacking for much of the metamorphic internal zone of the Wopmay Orogen.

This study is focused on the metamorphosed and polydeformed rocks at Grant and Brownwater lakes, in the southern part of the metamorphic internal zone of the Wopmay Orogen, immediately west of the Archean Slave craton. The goal of the study is to characterize the structural geometry of both areas at the meso- and macroscopic scale. A more detailed microstructural analysis using spatially oriented thin-sections from transects across the structural grain will provide a kinematic framework for understanding the evolution of the larger scale geometry. The timing of metamorphic mineral growth relative to foliation and fold development in both field areas will then be combined with geothermobarometry and P-T modeling of garnet growth to constrain the P-T path of the southern Wopmay orogen in time and space relative to its structural evolution. U-Pb dating of cross-cutting intrusive rocks, and in-situ electron-microprobe dating of monazite and/or xenotime, will provide absolute time constraints on the structural-metamorphic evolution of the orogen. Defining the P-T-t-d history of the southern Wopmay orogen will have direct relevance to understanding the development of the hybrid Proterozoic-Archean lithosphere and the geodynamic influence of Archean lithosphere in post-Archean orogenesis.

Observations from the first season of field work at Grant Lake reveal a systematic pattern of overprinting steeply and shallowly dipping foliations developed in rocks that vary from biotite to staurolite+andalusite zone metamorphism. The western side of this area has a well developed high strain zone that likely represents the effect of the Wopmay shear zone.

The Brownwater Lake area extends from the western edge of the Archean Slave craton westward across a belt of steeply dipping and attenuated Proterozoic schist that parallels the Archean craton margin. This steeply southeast dipping belt has a series of steeply dipping, shallow plunging monoclines with a well developed axial plane foliation. The metamorphic grade increases westward across the belt from chlorite zone at the Archean margin, upward through garnet, cordierite, andalusite and sillimanite. In the western half of the Brownwater Lake area the structural grain becomes more west-southwest oriented and the steep southeast dipping fold event becomes less well developed. A southeast dipping foliation is developed but overprints a well developed shallow dipping foliation that is at the most, synchronous with peak metamorphic mineral growth. This relationship suggests that the isogradic surfaces in the belt of steeply dipping rocks to the east are likely folded by the steep southeast dipping fold event.

CHARACTERIZATION OF GOLD AND BASE-METAL MINERALIZATION STYLES IN THE NORTH END OF THE YELLOWKNIFE GREENSTONE BELT

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The Slave Province is well known for hosting many prospective gold showings, but currently there are few active exploration projects in the NWT. Based on the number of historically known prospects, one of the more promising regions is the north end of the Yellowknife Greenstone belt (YGB). Our field observations of showings hosted in the Chan Formation confirm a complexity of mineralization styles with characteristics different from those of the major mines in Yellowknife. Our research aims to characterize the relative timing and nature of different styles of mineralization in the north end of the YGB, with the goal of recognizing the effect of overprinting by multiple systems on the development of economic gold targets.

Prospects at Greyling Lake show evidence of skarn-type alteration associated with thicker accumulations of massive sulfide, possibly indicating an early, pre-metamorphic age for its apparent volcanogenic massive sulfide (VMS) mineralization. In addition to this VMS style, we also found veins and thinner massive sulfide occurring in dilatational zones at intersections of multiple shear zones. The Homer Lake showing contains a band up to 40 cm in width, rich in base-metal sulfides, that extends parallel to stratigraphy (older than 2743 Ma). This horizon is cut by arsenopyrite-bearing shear zones that contain gold and chalcopyrite. Massive sulfide zones occur at intersections of multiple shear zones and reflect early and late generations of both base-metal sulfide- and arsenopyrite-bearing veins. Similar northeast-trending shear zones can be traced to Oro Lake, where they intersect the metamorphic aureole of the nearby Duckfish Lake pluton. However, unlike shear zones at the Con and Giant Mines, these shear zones have been metamorphosed by the 2605 Ma aureole, indicating that gold mineralization in this shear zone predated the intrusion event. In contrast, at the nearby Arseno Lake prospect, northwest-trending shear zones containing arsenopyrite and gold can be traced from the volcanic rocks of the greenstone belt across the contact into the Duckfish Granite, indicating that gold mineralization postdates the intrusion.

In summer 2009, 108 samples were collected from the showings, representing wall rocks, massive sulfides and associated alteration, and multiple types of quartz veins. Rock sections were prepared for fluid inclusion analysis and petrographic-, cathodoluminescent- and ore-microscopy. Fluid inclusion analysis will provide P-T-X constraints on ore formation and help us to determine the degree of overprinting of multiple mineralizing events. Fluid inclusion studies, in concert with cathodoluminescence analysis may permit us to identify individual generations of quartz veining associated with specific ore mineralizing events. That may allow us to document the aerial extent and continuity of hydrothermal systems associated with the multiple generations of base-metal sulfide and gold deposition in the north end of the YGB. Ore microscopy will allow us to determine the relative timing of multiple sulfide-depositing events compared to metamorphic and deformation events.

We hope to develop a petrographic and geochemical methodology that will allow us to fingerprint individual styles of mineralization to assess their potential influence on the development of economic deposits in the region.

THE FUTURE OF CORE LOGGING: THE REFLECTANCE SPECTROSCOPY OF HEMATITE AND MICAS FROM THE IOCG DEPOSIT AT OLYMPIC DAM, SOUTH AUSTRALIA

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Reflectance spectroscopy is a non-destructive analytical technique that is useful for analyzing the composition of rocks and minerals. By analyzing the reflectance spectra collected from drill cores, it is possible to identify different compositional zones. Three hundred meters of drill core from the Olympic Dam IOCG deposit, South Australia, were scanned using HyLogger, an automated core scanning spectrometer developed by CSIRO, Australia. The result was 49,500 visible and near-infrared spectra (400-2500 nm) of the surface of the drill core collected at high resolution (8 mm intervals) along its entire length.

Ore-bearing rocks in the Olympic Dam IOCG deposit were identified by examining the spectral features located at ~890 nm—which are produced by ferric iron (Fe³⁺) in octahedral coordination with oxygen. These spectral features were used to identify rocks that are rich in hematite that host the ore minerals. Whole rock geochemistry results substantiated a relationship between the spectral feature at ~890 nm and the abundance of iron and copper.

Mica-rich, or barren samples, were identified by examining the spectral features at ~2205 nm—which are sensitive to the vibrational bond between aluminum in octahedral coordination with hydroxyl. Muscovite and phengite were the most common micas identified using reflectance spectroscopy. Comparing the results of the spectral calculations with data on whole rock geochemistry, a relationship was observed between the intensity of the spectral feature at ~2205 nm and the abundance of aluminum and potassium.

Plotting the results of the spectral analyses as a function of core depth produced a depth profile that clearly shows the location of the hematite- and mica-rich rocks. Reflectance spectroscopy is unique in that it can be used to distinguish between the different oxidation states of iron, and it is very useful in detecting the presence of alteration minerals. When used in combination with more traditional analytical methods, it is a very powerful tool that generates reproducible results with minimal human interference.

PRELIMINARY 3D GEOPHYSICAL MODELING OF THE ABERDEEN SUB-BASIN, THELON PROVINCE, NUNAVUT

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The north-eastern Thelon Basin, located at the border of Northwest Territories and Nunavut is both tectonically and stratigraphically similar to the Athabasca Basin, known world-wide for its unconformity associated uranium deposits. This poster reports on compilation and interpretation of the existing geophysical and geological data of the area to generate a regional depth-to-basement model of the Aberdeen Sub-Basin. Limited seismic profiling along with sparse borehole data permits only a broad scale regional estimate of the basin. An improved version of the bedrock surface in the Aberdeen Sub-basin is derived from 2D forward modeling of the regional scale gravity and aeromagnetic data. The basic geometric model invokes a more magnetic and dense basement which is unconformably overlain by non-magnetic and less dense sediments of the Thelon Formation. Limited geological constraints on the

inversion models were provided by known borehole, seismic profiling and physical property information from the Kiggavik Mine and Athabasca basin. Integration of the results of the model cross-sections in 3D suggests that the Aberdeen Sub-basin is much deeper than previously thought. This model sets the stage for acquiring new basic petrophysical and borehole constraints to refine designation of specific rock units.

THE CHANGING RIVER MORPHOLOGY OF THE MACKENZIE DELTA

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A better understanding of seabed and river morphology in the Mackenzie Delta and nearshore regions of the Beaufort Sea is essential for a proper assessment of the hazards and constraints to development in these regions. The resurgence of oil and gas activity in the area has prompted a renewed investigation of channel morphology and how it may impact the design of infrastructure, pipeline crossings, and other transportation routes. The Geological Survey of Canada is using high resolution interferometric sonar data in combination with satellite imagery and air photo analysis to investigate channel morphology and bank stability of selected areas of interest over the last 30 years.

Channel bed morphologies include large asymmetric current-generated megaripples (wavelength 10 m and height of 0.5 m), erosional scarps with relief of 0.7-1.5 m and associated flutemarks produced by turbulent flows at the bed. Current speeds in excess of 2 m s⁻¹ were measured in the water column one week prior to the spring peak water level near the mouth of Kumak Channel. The greatest depth in the survey area, near a proposed pipeline crossing, reaches 20 m at the apex of a shallow bend in the channel. The river bank adjacent to this hole has experienced approximately 30 m of erosion over the past five years (~6 m/yr). Erosion rates have dramatically increased over the last five years. Earlier studies recorded rates between 1.8 and 2.2 m/yr. Comparisons with previously acquired channel cross sections measured in the 1970s and 1990s suggest that there has been in-channel deposition downstream of rapidly eroding banks. The relative roles of changing discharge during and after the spring freshet in combination with climate warming are being investigated.

At other locations in the delta such as East Channel near Inuvik, where high resolution sonar data was acquired, there is evidence of bank erosion but on a much smaller scale. In the nearshore region of the delta where water depths are typically less than 2 m, satellite imagery such as Synthetic Aperture Radar (SAR) is being used to track the location and stability of channels in this extremely shallow zone. These studies demonstrate both the utility of baseline data collected more than 30 years ago and the application of modern methods for understanding processes in the outer delta environment. A better understanding of channel morphology and the processes that influence them will aid in future decision-making related to development and management of the outer delta region.

MINERAL AND ENERGY RESOURCE ASSESSMENT (MERA) FOR THE AREA OF INTEREST FOR THE PROPOSED EAST ARM NATIONAL PARK – AN UPDATE

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The Mineral and Energy Resource Assessment (MERA) process for the area of interest for the proposed East Arm National park completed its second and final year of the MERA Phase II field work in the summer of 2009. The MERA process was established in 1980 as the mechanism to ensure that the economic and strategic significance of mineral and energy resource potential is duly considered in the

national park establishment process in Federal lands north of the 60th parallel. In June 2007, at the request of Parks Canada, the GSC initiated Phase I of the East Arm MERA process. This involved compiling an inventory of all existing public domain data in the study area and identifying data gaps. Phase I compilation results were used to design the Phase II field studies work plan, which was approved in February 2008. MERA Phase II studies involve five main types of field investigations: Quaternary, bedrock, geophysical, metallogeny and hydrocarbon. The majority of the field program was carried out in 2008, with fill-in and follow-up work undertaken in 2009.

An updated 1:125,000 scale digital Quaternary map based on air photo interpretation and field observations was completed in 2009. Fifty additional till samples were collected during the 2009 field season as part of a detailed follow-up work on three selected areas, based on analysis of heavy minerals from 465 till and esker samples collected during the 2008 field season. In 2009, an additional 150 bedrock sites were visited, complimenting the 350 sites from the 2008 field season. Bedrock field studies in 2009 concentrated in the less well mapped and understood Rae domain and the Talston and Thelon magmatic zones. An updated digital geology map is currently being compiled. The ten teleseismic stations installed during the 2008 field season as a linear array extending across the entire study area from Gardenia Lake in the south, crossing Artillery Lake, to Cook Lake in the north, continued to operate well and collect seismic data. All stations were serviced in the spring and fall of 2009, with data interpretation currently in progress. Fifteen known mineral occurrence sites were visited during the summer of 2009 in addition to the 35 sites visited in 2008. These metallogenic field investigations, plus subsequent geochemical and thin section analysis have contributed significantly to understanding the character and distribution of the different deposit types found in the study area. Occurrences of organic rich shales from the Paleoproterozoic East Arm Supergroup were examined and sampled in 2009 to evaluate potential for unconventional oil and gas accumulations.

The next steps include laboratory data acquisition and interpretation in the fall of 2009, followed by mineral potential modelling and report writing during the winter of 2010. The final report, including internal and external review processes, is expected to be completed by Spring 2010.