38th Annual
Yellowknife Geoscience Forum
Abstracts of Talks and Posters
November 16-18, 2010

Compiled by E. Palmer

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http://www.nwtgeoscience.ca/forum/

Cover photographs clockwise from top:
Ammonite fossil in Canol Fm, Carcajou Ridge, Mackenzie River, Len Gal
-30°C, Yellowknife, NT, Doug Irwin
Aviat, NU, Mike Stubley
Native gold in quartz vein, Discovery Mine, Prince of Wales Northern Heritage Museum collection, Luke Ootes
Sheet of native copper, Natkusiak Formation, Victoria Island, Luke Ootes

TABLE OF CONTENTS

ABSTRACTS – POSTER PRESENTATIONS

Tuesday, November 16 (morning)

Theatre 1 – Exploration & Geoscience
Chairs: Aleksandar Miskovic, John Ketchum

08:40 **The Northwest Territories Geoscience Office – 2010 Activities** - Cairns, S. and Ketchum, J.
09:00 **2010 Northwest Territories Mineral Exploration Overview** - Gochnauer, K.M.
09:20 **NUNAVUT 2010: Mine Development and Exploration Continues** - Senkow, M.D.
09:40 **The GEM Diamond Project: An Update of 2010 Activities and a View Forward to 2011** - Kjarsgaard, B.A. and Snyder, D.B.

10:00 **Coffee** (sponsored by Discovery Mining Services Ltd.; Sub-Arctic Surveys Ltd.)

10:20 **Petrography of Kimberlites and Mantle Xenoliths: Solid Foundation or Slippery Ground?** - Kopylova, M. and Polozov, A.
10:40 **Component Distributions In Kimberlites: A Case Study using Olivine from DIAVIK, NWT** - Moss, S.
11:00 **High-Al Kimberlite Produced by Monticellite Fractionation** - Patterson, M.V. and Francis, D.
11:20 **The Micro-/Macro-Diamond Relationship: A Case Study from the Artemisia Kimberlite Northern Slave Craton (Nunavut, Canada)** - Johnson, C.N., Stern, R., Stachel, T., Muehlenbachs, K., and Armstrong, J.

11:40 **Coffee** (sponsored by Det'on Cho Stantec)

12:00 **Understanding the Lithosphere Beneath Arctic Canada – An Example from the N. Slave Craton** - Mather, K.A., Pearson, D.G., Kjarsgaard, B.A., and Jackson, S.
12:20 **Innovative Methods to Search, Download and Display Indicator Mineral Data: A New Tri-Territorial Indicator Mineral Database** - Paulen, R.C., Adcock, S.W., Spirito, W.A., Chorlton, L.B., McClenaghan, M.B., Oviatt, N.M., Budulan, G., and Robinson, S.

12:40 **Welcome** (Theatre 1)
Yellowknives Dene Drummers
Bob McLeod - Minister of Industry, Tourism and Investment

13:00 **Lunch** (sponsored by Associated Engineering; Aurora Geosciences Ltd.; Boart Longyear Drilling Services; Northern News Services Ltd.) – Weledeh and St. Patrick's School gymnasium

<u>Tuesday, November 16 (morning)</u>

Theatre 2 – Energy in Canada's North
Chairs: Adrienne Jones, Ryan Lemiski, Angela Norris, Andy Graw

08:40 Canada's Discovered Oil and Gas Resources North of 60 - Drummond, K.J.
09:00 Government of Canada's Action Plan to Improve Northern Regulatory Regimes - Traynor, S.
09:20 Updating the Stratigraphic and Structural Understanding of Mackenzie Corridor, Northwest Territories - Fallas, K.M., MacNaughton, R.B., Lemiski, R., and Hadlari, T.
09:40 Amendment of the Mackenzie Valley Resource Management Act - Lobsinger, A.

10:00 Coffee (sponsored by Discovery Mining Services Ltd.; Sub-Arctic Surveys Ltd.)

10:20 Sedimentology, Stratigraphy and Reservoir Potential of the Upper Devonian Imperial Formation, Northwest Territories - Rose, R.M., Hadlari, T., and Hubbard, S.M.
10:40 Legislative Proposal for the Northwest Territories Surface Rights Board - Vezina, C. and Traynor, S.
11:00 Petroleum Potential Studies of Devonian Horn River Group and Cambrian Mount Clark/Mount Cap Formations, Mackenzie Plain Area, Northwest Territories - Pyle, L.J., Lemiski, R.T., Gal, L.P., and Jones, A.L.
11:20 An Introduction to the Northern Projects Management Office - James, D.

11:40 Coffee (sponsored by Det'on Cho Stantec)

12:00 MGM's Best Practice Measures for 2D Seismic Acquisition in the Mackenzie Delta and Colville Hills, NWT - Enachescu, M.E., Price, P.R., and Kierulf, F.
12:20 Certainty and Clarity in Land and Water Board Processes - Nevitt, Z.

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Tuesday, November 16 (morning)

Theatre 3 – Geoscience Outreach/Aboriginal Capacity and Success
Chairs: Diane Baldwin, Tom Hoefer

09:00 **Experiential Science** - Daniel, S.
09:20 **Tundra Science Camp at the Tundra Ecosystem Research Station** - Yuill, S.
09:40 **Nunavut Prospectors' Program: Starting Point for Interaction between Communities and Mining Industry** - Suluk, R., Beauregard, M., and MacIsaac, H.

10:00 **Coffee** (sponsored by Discovery Mining Services Ltd.; Sub-Arctic Surveys Ltd.)

10:20 **Skills for Success: Mine Training Creates New Futures** - Jones, H.
10:40 **Breaking the Cycle of Dependency and Empowering our People** - Erasmus, R.
11:00 **Using a Girl's Best Friend to Grow a Multi-Million Dollar Aboriginal Corporation –** Robertson, C., Roeland, L.
11:20 **Building Capacity through Technical Training Initiatives** - Chouinard, R.

11:40 **Coffee** (sponsored by Det'on Cho Stantec)

12:00 **Uranium Exploration in the Thelon Basin - Can Mineral Exploration, Development, Wildlife, and Cultural Values Share Space?** - Zaluski, G., Hunter, R., Savinova, E., Lesperance, J., and Willy, S.

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Tuesday, November 16 (afternoon)

Theatre 1 – Exploration & Geoscience
Chairs: Pattie Beales, Karen Gochnauer

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 **2010 Hackett River Project Update: At the Threshold of Development** - Burgess, S.
15:10 **Exploration Update on Sabina Gold & Silver's Back River Gold Properties** - Cater, D. and Leonard, K.
15:30 **Microstructures, Metamorphism, and Mineralization in the Link Between Hope Bay and Elu Greenstone Belts, NE Slave Craton** - Mvondo, H., Lentz, D., and Bardoux, M.
15:50 **Exploring for High-tonnage, Low-grade Gold Deposits within the REN Property, Point Lake, NWT** - Walker, E.C.
16:10 **3-D Mapping of the Interface Between Geological Units and Their Depths, Including Basement Topography Using Magnetic and/or Gravity Survey Data** - Sha, L., Dogan, F., Tuncer V., and Lambert J.

16:30-19:00 **Reception** (sponsored by First Air, The Airline of the North; De Beers Canada Inc.; Northern News Services Ltd.) **–** 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. Brian Cousens** - Iceland: Fire, Ice, and the 2010 Eruption of Eyjafjallajökull Volcano (sponsored by NAPEG) **–** Prince of Wales Northern Heritage Centre

Tuesday, November 16 (afternoon)

Theatre 2 – Energy in Canada's North
Chairs: Adrienne Jones, Ryan Lemiski, Angela Norris, Andy Graw

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 **The Inuvik Gas Project – 14 Years of History** - Nikiforuk, C.F.
15:10 **Proposed New Wildlife Act** - Fleck, S. and Yonge, L.
15:30 **3D Seismic Acquisition in the Northwest Territories, Canada** - Kierulf, F., Cooper, M., Price, P.R., and Enachescu, M.E.
15:50 **Regional Characterization of Seabed Geohazards on the Beaufort Outer Shelf and Upper Slope in Relation to Deep Water Hydrocarbon Development** - Blasco, S., Bennett, R., MacKillop, K., Hughes-Clarke, J., Church, I.
16:10 **Ellef Ringnes Field Project – Update on Activities** - Grasby, S.E.

16:30-19:00 **Reception** (sponsored by First Air, The Airline of the North; De Beers Canada Inc.; Northern News Services Ltd.) – 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. Brian Cousens** - Iceland: Fire, Ice, and the 2010 Eruption of Eyjafjallajökull Volcano (sponsored by NAPEG) – Prince of Wales Northern Heritage Centre

<u>Tuesday, November 16 (evening)</u>

Charles Camsell Talk (sponsored by NAPEG) **–** open to the public (free)
Prince of Wales Northern Heritage Centre (PWNHC)

19:00 **Dr. Brian Cousens, Carleton University** - Iceland: Fire, Ice, and the 2010 Eruption of Eyjafjallajökull Volcano

Abstract - Iceland, like the island of Hawaii, is composed almost entirely of young volcanic rocks erupted from the over 130 volcanoes on the island. However, Iceland is unique on our planet in that it sits directly on the Mid-Atlantic Ridge where the North American and Eurasian tectonic plates are being pulled apart. Iceland is also partially covered by large glacial ice sheets perched on the summits of several active volcanoes, such that volcanic eruptions melt portions of the capping ice sheets to produce catastrophic floods. Lava-ice interaction also has a large effect on volcanic landforms. Icelanders benefit from the large volume of surface water that interacts with hot rock and magma at depth, providing abundant geothermal power and hot water.

In the past, Icelandic volcanic eruptions have had a major impact on Icelanders, but only rarely on inhabitants of other nations. This changed during March and April of 2010 with the eruption of Eyjafjallajökull volcano in southern Iceland. The first phase of volcanic activity in late March and early April occurred on the flank of the volcano and consisted of relatively passive eruption of lava, which became a major tourist attraction. However, on April 14th the eruption site shifted westward beneath the Eyjafjallajökull glacier, and the eruption became much more dynamic until it ended on May 21st. Explosive eruption of ash particles formed clouds that rose as high as 11 km into the atmosphere, which were then driven by southeast-trending winds towards Europe. The presence of ash caused the closure of many airports in Europe, including a six-day stretch, stranding huge numbers of airline passengers in foreign countries or at home. The cause of the airport closures involved two factors. First, the second eruption tapped a more viscous, gas-rich magma body in the core of Eyjafjallajökull volcano, which then reacted with glacial meltwater to form steam explosions. Second, airline safety officials considered any volcanic ash in the atmosphere, regardless of its concentration, as grounds to stop flights and close airports. The threat to air traffic diminished after April 21st, as ash emissions dropped, wind direction shifted, and as air safety officials lowered the limitation on flying through low ash concentrations. There is no reason why this kind of volcanic event could not occur again in the near future, and airline passengers should add "volcanic hazard" to the list of potential "trip interruptions".

Biography - Brian obtained his B.Sc. in Geology at McGill University in 1979 and obtained his M.Sc. in Geological Sciences and Oceanography at UBC in 1982, and then worked as a Research Assistant in the Oceanography department for three years. Brian decided to move to sunny California in 1985, and obtained his Ph.D. in Geological Sciences at the University of California, Santa Barbara in 1990. After a two-year appointment as a Visiting Researcher at the Université de Montréal, Brian moved to Ottawa to take up a Research Associate position and Postdoctoral Fellowship at Carleton University. He was appointed as a Research Adjunct Professor in 1997. Between 1997 and 2007, Brian taught several different Introductory Geology courses offered by the Earth Sciences department at Carleton, as well as advanced courses at both undergraduate and graduate levels at Carleton and the University of Ottawa. In July 2007, Brian was appointed to an Assistant Professor position in Earth Sciences at Carleton, and in July 2009 was promoted to Associate Professor. He teaches field courses in volcanic regions such as eastern California, Hawaii and Iceland. Brian conducts research into the geochemistry of modern volcanoes along the west coast of North America, on the sea floor in the northern Pacific Ocean, at Hawaii, and on ancient volcanic sequences in the Northwest Territories, Ontario and Nunavut. He also specializes in the application of radiogenic isotope geochemistry in geological, environmental and archaeological studies.

Wednesday, November 17 (morning)

Theatre 1 – Exploration & Geoscience A
Chairs: Luke Ootes, Carl Ozyer

08:40 **Prairie Creek Mine** - Taylor, A.
09:00 **The Geology of the Redstone Copperbelt** - Milton, J.E., Hickey, K.A., and Gleeson, S.A.
09:20 **Stratigraphy, Petrology and Geochemistry of Sediment-Hosted Barite Sequences in the Mackenzie Mountains, NWT: Understanding the Geochemical Conditions of Barite Mineralization in the Upper Canol Formation, and in the Selwyn Basin during the Middle to Late Devonian** - Fernandes, N.A., Gleeson, S.A., Sharp, R.J., and Martel, E.
09:40 **New Stream Sediment Survey Results from the Cranswick River area NTS 106 F and G and an Overview of the Mackenzie Mountains** - Falck, H. and Day, S.

10:00 **Coffee** (sponsored by Intact Insurance; Norland Insurance Agencies)

10:20 **Application of Seismic Shothole Drillers' Log Records to Drift Geochemical Exploration and Natural Resource Development** - Smith, I.R.
10:40 **Maximizing the Potential of Your Samples for Greenfields Exploration** - Greenlaw, L.
11:00 **Who's Protecting It, Anyway? Protected Areas, Land Use Plans and Other Means of Land Protection in the NWT** - Hamre, K.
11:20 **A Remote Predictive Mapping (RPM) Approach for the Mapping of Surficial Materials North of 60** - Harris J.R., Grunsky E., Russell, H., Parkinson, W., and Juanxia He

11:40 **Coffee** (sponsored by Nunami Stantec)

12:00 **Victoria Island GEM Project: Results from 2010 Field Mapping and Thematic Studies** - Rainbird, R., Bédard J., Dewing, K., Hadlari, T., Kiss, F., Miles, W., Ootes, L., Rayner, N., and Williamson, M-C.
12:20 **RPM Utilizing High Resolution Satellite Imagery, Western Minto Inlier, Victoria Island, NWT** - Behnia, P., Rainbird, R.H., and Harris, J.H.
12:40 **Sequence Stratigraphy of the Shaler Supergroup; New Insights from the GEM Minerals Victoria Island Project, Western Minto Inlier, Victoria Island, NWT** - Thomson, D., Rainbird, R. H., and Krapez, B.

(Afternoon)
13:00 **Lunch** (sponsored by Yellowknife 2007; NWT & Nunavut Chamber of Mines) **–** Capitol Theatre
13:00 **NWT & Nunavut Chamber of Mines AGM** (ticket is required) **–** Yellowknife Inn, Tungsten Room
14:00-14:50 **Keynote Presentation** (open to delegates) **–** Theatre 1
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)
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17:00 **NAPEG Annual General Meeting** - Champagne Room, 5004 50th Ave.

<u>Wednesday, November 17 (morning)</u>

Theatre 2 - Exploration & Geoscience B
Chairs: Aleksandar Miskovic, Pattie Beales

08:40 **Update on GeoMapping for Energy & Minerals (GEM) of Cumberland Peninsula, Baffin Island, Nunavut** - Sanborn-Barrie, M., Young, M., Whalen, J., Rayner, N., Berman, R.G., Hamilton, B., and Wodicka, N.
09:00 **The Melville Peninsula Geology Revisited: A Contribution to the GEM Program** - Nadeau, L., Corrigan, D., Tremblay, T., Brouillette, P., Wodicka, N., Machado, G., Houlé, M., Erdmann, S., Laflamme, C., Richan, L., Rigg, J., Partin, C., Ganderton, N.G., and Kuiper, Y.
09:20 **Surficial Geological Mapping in the Wager Bay Area, Nunavut - Filling in the Gaps** - Campbell, J.E. and McMartin, I.
09:40 **Ni-Cu-(PGE) Mineralization within Mafic and Ultramafic Rocks of the North-Central Churchill Province: New Insights from the GEM Melville Peninsula Project** - Houlé, M.G., Gibson, H.L., Richan, L., Erdmann, S., Corrigan, D., Nadeau, L., Machado, G., and Bécu, V.

10:00 **Coffee** (sponsored by Intact Insurance; Norland Insurance Agencies)

10:20 **Improved Mapping of Basement Faults in the Northeast Thelon Basin by Source Edge Processing of Aeromagnetic Data** - Tschirhart, V., Morris, W.A., and Jefferson, C.
10:40 **Geology of the Foxe Fold Belt, Central Baffin, Nunavut, with Implications on the Gold Mineralisation – Project Summary and Preliminary Results** - Rubingh, K.
11:00 **The GEM Chesterfield Gold Project: Understanding Controls on Western Churchill Gold Endowment from the Bottom Up** - Pehrsson, S.J. and Coyle, M.
11:20 **Advancement of the Three Bluffs Gold Deposit Committee Bay Project, Nunavut** - Turner, A.

11:40 **Coffee** (sponsored by Nunami Stantec)

12:00 **The Chidliak Diamond District, Nunavut: 50 Kimberlites and Counting** - Pell, J.
12:20 **Transforming a Diamond Mine: the Jericho Diamond Mine Update** - Strand, P., Lassonde.J., and Burgess, J.
12:40 **Exploration in the Pelly Bay Region** - Kienlen, B.

(Afternoon)
13:00 **Lunch** (sponsored by Yellowknife 2007; NWT & Nunavut Chamber of Mines) **–** Capitol Theatre
13:00 **NWT & Nunavut Chamber of Mines AGM** (ticket is required) **–** Yellowknife Inn, Tungsten Room
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17:00 **NAPEG Annual General Meeting** - Champagne Room, 5004 50th Ave.

<u>Wednesday, November 17 (morning)</u>

Theatre 3 – Regulatory
Chairs: Angela Norris, Andy Graw

08:40 **Granular Resource Management in the Mackenzie Delta Portion of the Inuvialuit Settlement Region** - Bridge, D. and Fraser, J.
09:00 **Cultural Considerations in Environmental Impact Assessment and Project Planning** - MacDonald, A.
09:20 **A Tool for Cumulative Effects Assessment in the NWT** - Panayi, D. and Krizan, J.
09:40 **New Regulatory Framework for Nunavut** - Nicholl, G.

10:00 **Coffee** (sponsored by Intact Insurance; Norland Insurance Agencies)

Theatre 3 – Geothermal Energy for Northern Canada
Chairs: John Ketchum, Jim Sparling

10:20 **Geothermal Energy 101 and the Geothermal Potential of the Northwest Territories** - Ketchum, J.
10:40 **Geothermal Potential in Canada's North** - Grasby, S.E. and Majorowicz, J.
11:00 **Building a Policy and Regulatory Framework for Geothermal Development in the NWT** - Holroyd, P. and Dagg, J.
11:20 **Con Mine – A Heating Resource – Today's Opportunity for Tomorrow's Future** – Long, B.

11:40 **Coffee** (sponsored by Nunami Stantec)

12:00 **Geothermal Energy Development in Ft. Liard, Northwest Territories** - Dunn, C.

(Afternoon)
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Wednesday, November 17 (afternoon)

Theatre 1 – Keynote Address

14:00-14:50 Keynote Presentation (open to delegates)
Dr. Barbara H. Scott Smith, Scott-Smith Petrology Inc - After the Canadian Diamond Rush: Insights into Kimberlites and Their Evaluation

Abstract - Insights into kimberlites result from investigations undertaken as part of the development of diamond resources. Prior to the Canadian diamond rush landmark publications on kimberlites focussed on the diamond mines of southern Africa and many kimberlite pipes were represented by one summary geological model. This model was applied to other parts of the world, including some of the many hundreds of kimberlites discovered in Canada during the diamond rush. The requisite detailed investigations to develop the Canadian mineral resources, including many in the Arctic, resulted in a wealth of new data. As found elsewhere, the significantly diamondiferous deposits formed from repeated kimberlite magmatism across Canada. Summary geological models for the Canadian discoveries, however, reveal at least three distinct types of kimberlite pipes, only one of which is comparable to the southern African type. The two new types of kimberlite pipes had not been previously recognised and application of the southern Africa model to completely different types of kimberlites misled some evaluation projects. The three contrasting types of kimberlite pipes found in Canada are characterised by fundamentally different emplacement products, processes and, importantly, diamond distributions. Three new summary geological models were developed to (i) provide a norm for comparison or indicate new geological situations, and (ii) act as a guide for the successful application of predictive geology during the development of new resources. Macroscopic petrography, using olivine as a proxy for diamond, further enhances the prediction of macrodiamond contents. Summary geological models and macroscopic petrography, together, improve the assessment of new deposits by maximising the value of expensive drillcores and related materials leading to better evaluation strategies and more reliable and economically relevant geological models. In turn, this increases the degree of confidence in the resulting resource estimates which are used to determine whether the diamonds present can be extracted economically. The concepts outlined above will be illustrated using mainly examples from the Arctic.

Biography- Dr. Scott Smith earned her Ph.D. in 1977 from Edinburgh University and then worked as a principal research mineralogist on diamond-related ventures for Anglo American Research Laboratories and the De Beers Kimberlite Petrology Unit in South Africa. Since 1982, she has been based in Vancouver, Canada as an independent consultant offering specialist services in applied kimberlite geology relating to world-wide diamond exploration and mining projects for a variety of major to junior companies.

Professional travel has taken Barbara to 25 countries (USA, Greenland, Australia, Europe, South Africa, Lesotho, Zambia, Namibia, Botswana, Zimbabwe, Tanzania, Ivory Coast, China, India, Brazil, Yakutia and Arkhangelsk in Russia). Also, over the last two decades investigations have included most kimberlite fields across Canada. Consulting and related research has led to many publications including over 40 peer reviewed papers. During the period April 2001-October 2003 Dr. Scott Smith created and directed the De Beers Canada Kimberlite Petrology Unit until its planned transfer from Vancouver to the head office in Toronto. Since then, in addition to continued consulting, she continues to share her extensive experience and expertise through Scott-Smith Petrology Inc. which now also offers unique opportunities to learn about kimberlites through "hands on" courses, mentoring and coaching. The dedicated training facility has also become a focus for kimberlite research.

Throughout her career Barbara has participated in mentoring and training a number of M.Sc. and Ph.D. students and many employees of client exploration and mining companies. In 2000 she became Adjunct Professor at the Earth and Ocean Sciences Department of the University of British Columbia where she participates in kimberlite research, postgraduate teaching and supervising postgraduate students with her fellow volcanologists and kimberlite petrologists.

In 2003 Barbara co-convened the 8th International Kimberlite Conference and in 2006 the International Workshop on Kimberlite Emplacement and was Guest Editor of both Proceedings Volumes. Professional affiliations include: Association of Professional Engineers and Geoscientists of the Province of British Columbia, Canada (P. Geo.) and Chartered Geologist of the Geological Society of London, UK (C. Geol.). Dr. Scott Smith is the 2009 recipient of the Hugo Dummett Diamond Award for excellence in diamond exploration and development.

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)

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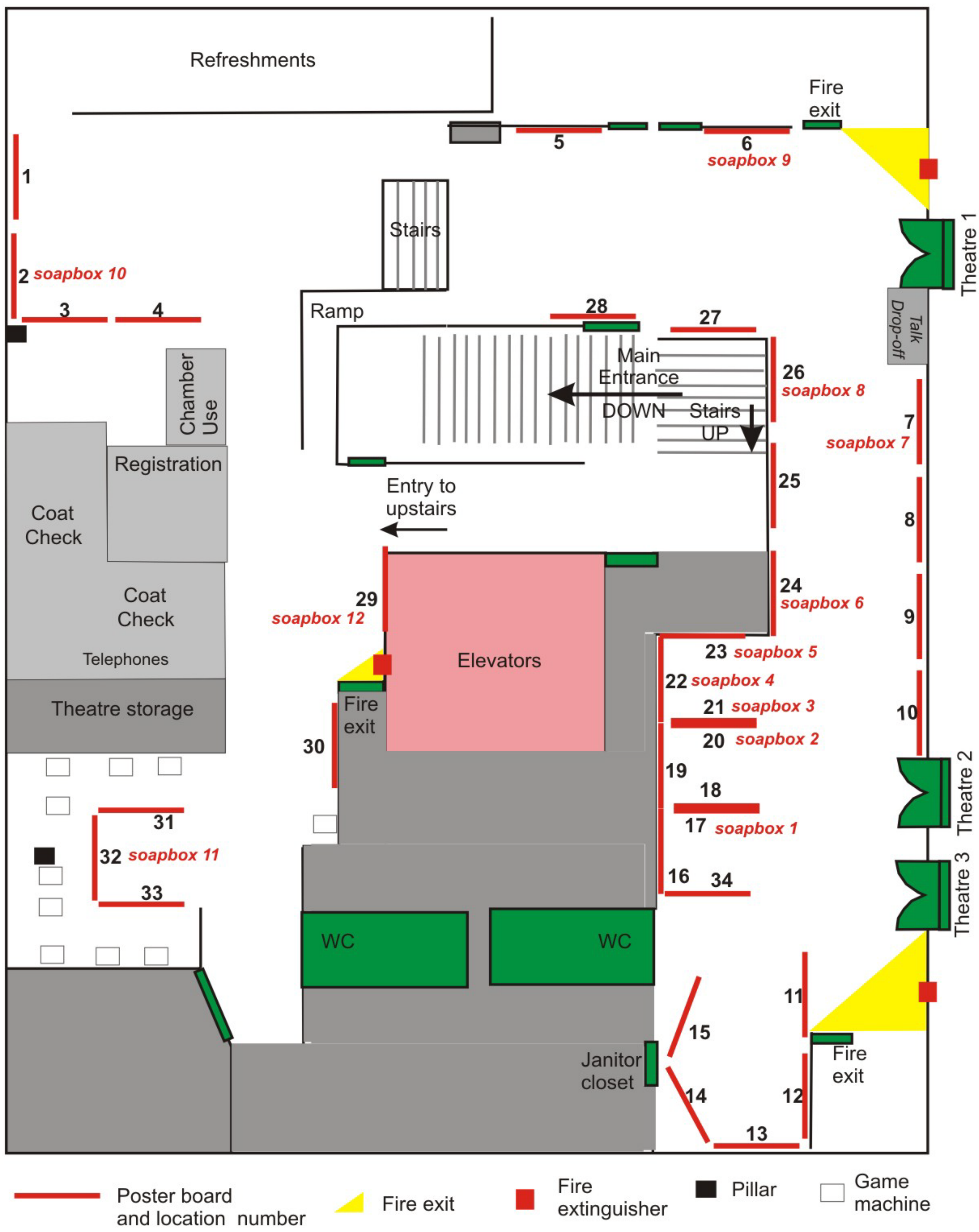

POSTERS BY FIRST AUTHOR		
Location	**First Author**	**Title**
23	Anderson, M.O.*	Trace-Element Geochemistry of Muscovite in the Moose II Lithium-Tantalum Pegmatite Deposit and Associated Faulkner Lake Pegmatite Field, NWT
14	Campbell, J.E.	Surficial Geological Mapping in the Wager Bay Area, Nunavut - Filling in the Gaps
9	Durbano, A.*	Sedimentology and Stratigraphy of the Lower Clastic Unit of the Cambrian, Northwest Victoria Island
16	Harris, J.R.	SINED Hyperspectral Survey and Ground Follow-Up – Izok Lake & High Lake Greenstone Belts, Nunavut Preliminary Results
6	Hewton, M.*	Geology and Geochemistry of the Mountain River Beryl Showing, Mackenzie Mountains, Northwest Territories
17	Hicken, A.*	Indicator Mineral and Surficial Geochemical Study of the Izok Lake Zn-Cu-Pb-Ag Volcanogenic Massive Sulphide Deposit, Nunavut
31	Kerr, D.	GEM Knowledge Management Program Tri-Territorial Surficial Database Project
32	Kerswill, J.	Activities Under the Mineral Resource Assessment Component, GEM and MERA Programs
8	Kiss, F.	New High-Resolution Aeromagnetic Survey, Minto Inlier, Victoria Island, NT
3	Klump, S.	Geothermal Favourability Map, Northwest Territories
11	Lambert, J.	Functional Gridding of Airborne or Ground Geophysical Data for High Resolution Mapping of Local Geophysical Anomalies
15	Machado, G.	A Closer Look at the Prince Albert Group on the Western Part of the Melville Peninsula, Nunavut
22	Mackay, D.*	A Metamorphic and Structural Analysis of Metasedimentary Rocks of the Akaitcho Group, Little Crapeau Lake, Southern Wopmay Orogen, Northwest Territories
1	Macumber, A.L.*	High Resolution Multiproxy Study of Lacustrine Sediments from Waite Lake Along the Tibbitt Contwoyto Winter Road, NWT, Canada
24	MacWilliam, K.D.*	Albitisation of the Thor Lake Layered Alkaline Complex and Associated Nechalacho REE Deposit
18	McMartin, I.	Indicator Mineral Method Development for IOCG Exploration in Glaciated Terrain: An Update from the IOCG-Great Bear Project, NWT
20	Montreuil, J.-F.*	Breccias as Markers of Tectono-Hydrothermal Evolution of Iron Oxide-Bearing Hydrothermal Systems in the Great Bear Magmatic Zone
21	Newton, L.O.*	Petrology and SHRIMP U-Pb Geochronology of Detrital Zircons from the Holly Lake Metamorphic Complex, Leith Ridge, NWT

Location	First Author	Title
28	Okulitch, A.V.	Geological Compilation of the Mainland Region, Northwest Territories: Contributing to the "Map of Everything"
27	Oviatt, N.*	Indicator Mineral and Till and Stream Sediment Geochemical Glacial Dispersal Study at the Pine Point Pb-Zn Mississippi Valley-Type (MVT) Deposits, Northwest Territories
5	Ozyer, C.	Non-Renewable Resource Assessments (NRAs) – Minerals; An Update of NRA Activities for Protected Area Strategy (PAS) Candidate Areas
2	Patterson, R.T.*	Distribution and Environmental Significance Arcellacean (Thecamoebian) Assemblages from Lakes along the Tibbitt to Contwoyto Winter Road, Northwest Territories, Canada
29	Peats, J.*	Aviat Diamonds as a Window into the Deep Lithospheric Mantle Beneath the Northern Churchill Province
19	Potter, E.G.	Iron-Oxide-Copper-Gold ±U in the Great Bear Magmatic Zone: Nature of Uranium in IOCG Systems
26	Reford, S.	Exploring for Metals and Diamonds at Darnley Bay, NT – A Reality in 2010
12	Robinson, S.V.J.*	Characterization of Indicator Mineral and Till Geochemical Signatures of the Kiggavik Uranium Deposit, Nunavut
7	Schwarz, S.H.	Testing the Potential Application of High Resolution Satellite Imagery to Identify and Count Wildlife such as Caribou in the Northwest Territories
25	Smith, A.*	Geochemical Studies of Gold and Base-Metal Mineralization in the North End of the Yellowknife Greenstone Belt
30	Smith, E.*	X-ray Diffraction Study of the Mineral and Fluid Inclusions in Fibrous Diamond
4	Taylor, M.	The Professional Advantage
10	Williamson, N.*	Physical Volcanology of the Neoproterozoic Natkusiak Formation Flood Basalts of the Franklin Magmatic Event, Victoria Island, NWT, Canada
33	Wright, D.F.	Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park
13	Young M.	A Preliminary Stratigraphic Architecture of the Paleoproterozoic Hoare Bay Group of the Cumberland Peninsula, Eastern Baffin Island: Update from the 2010 GEM Cumberland Project Field Season
*	indicates student presentation	
	indicates soap box presentation - see schedule below	

POSTERS BY LOCATION		
Location	**First Author**	**Title**
1	Macumber, A.L.*	High Resolution Multiproxy Study of Lacustrine Sediments from Waite Lake Along the Tibbitt Contwoyto Winter Road, NWT, Canada
2	Patterson, R.T.*	Distribution and Environmental Significance Arcellacean (Thecamoebian) Assemblages from Lakes along the Tibbitt to Contwoyto Winter Road, Northwest Territories, Canada
3	Klump, S.	Geothermal Favourability Map, Northwest Territories
4	Taylor, M.	The Professional Advantage
5	Ozyer, C.	Non-Renewable Resource Assessments (NRAs) – Minerals; An Update of NRA Activities for Protected Area Strategy (PAS) Candidate Areas
6	Hewton, M.*	Geology and Geochemistry of the Mountain River Beryl Showing, Mackenzie Mountains, Northwest Territories
7	Schwarz, S.H.	Testing the Potential Application of High Resolution Satellite Imagery to Identify and Count Wildlife such as Caribou in the Northwest Territories
8	Kiss, F.	New High-Resolution Aeromagnetic Survey, Minto Inlier, Victoria Island, NT
9	Durbano, A.*	Sedimentology and Stratigraphy of the Lower Clastic Unit of the Cambrian, Northwest Victoria Island
10	Williamson, N.*	Physical Volcanology of the Neoproterozoic Natkusiak Formation Flood Basalts of the Franklin Magmatic Event, Victoria Island, NWT, Canada
11	Lambert, J.	Functional Gridding of Airborne or Ground Geophysical Data for High Resolution Mapping of Local Geophysical Anomalies
12	Robinson, S.V.J.*	Characterization of Indicator Mineral and Till Geochemical Signatures of the Kiggavik Uranium Deposit, Nunavut
13	Young M.	A Preliminary Stratigraphic Architecture of the Paleoproterozoic Hoare Bay Group of the Cumberland Peninsula, Eastern Baffin Island: Update from the 2010 GEM Cumberland Project Field Season
14	Campbell, J.E.	Surficial Geological Mapping in the Wager Bay Area, Nunavut - Filling in the Gaps
15	Machado, G.	A Closer Look at the Prince Albert Group on the Western Part of the Melville Peninsula, Nunavut
16	Harris, J.R.	SINED Hyperspectral Survey and Ground Follow-Up – Izok Lake & High Lake Greenstone Belts, Nunavut Preliminary Results
17	Hicken, A.*	Indicator Mineral and Surficial Geochemical Study of the Izok Lake Zn-Cu-Pb-Ag Volcanogenic Massive Sulphide Deposit, Nunavut
18	McMartin, I.	Indicator Mineral Method Development for IOCG Exploration in Glaciated Terrain: An Update from the IOCG-Great Bear Project, NWT

Location	First Author	Title
19	Potter, E.G.	Iron-Oxide-Copper-Gold ±U in the Great Bear Magmatic Zone: Nature of Uranium in IOCG Systems
20	Montreuil, J.-F.*	Breccias as Markers of Tectono-Hydrothermal Evolution of Iron Oxide-Bearing Hydrothermal Systems in the Great Bear Magmatic Zone
21	Newton, L.O.*	Petrology and SHRIMP U-Pb Geochronology of Detrital Zircons from the Holly Lake Metamorphic Complex, Leith Ridge, NWT
22	Mackay, D.*	A Metamorphic and Structural Analysis of Metasedimentary Rocks of the Akaitcho Group, Little Crapeau Lake, Southern Wopmay Orogen, Northwest Territories
23	Anderson, M.O.*	Trace-Element Geochemistry of Muscovite in the Moose II Lithium-Tantalum Pegmatite Deposit and Associated Faulkner Lake Pegmatite Field, NWT
24	MacWilliam, K.D.*	Albitisation of the Thor Lake Layered Alkaline Complex and Associated Nechalacho REE Deposit
25	Smith, A.*	Geochemical Studies of Gold and Base-Metal Mineralization in the North End of the Yellowknife Greenstone Belt
26	Reford, S.	Exploring for Metals and Diamonds at Darnley Bay, NT – A Reality in 2010
27	Oviatt, N.*	Indicator Mineral and Till and Stream Sediment Geochemical Glacial Dispersal Study at the Pine Point Pb-Zn Mississippi Valley-Type (MVT) Deposits, Northwest Territories
28	Okulitch, A.V.	Geological Compilation of the Mainland Region, Northwest Territories: Contributing to the "Map of Everything"
29	Peats, J.*	Aviat Diamonds as a Window into the Deep Lithospheric Mantle Beneath the Northern Churchill Province
30	Smith, E.*	X-ray Diffraction Study of the Mineral and Fluid Inclusions in Fibrous Diamond
31	Kerr, D.	GEM Knowledge Management Program Tri-Territorial Surficial Database Project
32	Kerswill, J.	Activities Under the Mineral Resource Assessment Component, GEM and MERA Programs
33	Wright, D.F.	Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park
*	indicates student presentation	
	indicates soap box presentation - see schedule below	

SOAPBOX TALKS SCHEDULE
Chairpersons: Val Jackson & Dave Watson

Location	First Author	Soapbox Talk #	Approx Time	Title
17	Hicken, A.*	1	15:00	Indicator Mineral and Surficial Geochemical Study of the Izok Lake Zn-Cu-Pb-Ag Volcanogenic Massive Sulphide Deposit, Nunavut
20	Montreuil, J.-F.*	2	15:07	Breccias as Markers of Tectono-Hydrothermal Evolution of Iron Oxide-Bearing Hydrothermal Systems in the Great Bear Magmatic Zone
21	Newton, L.O.*	3	15:14	Petrology and SHRIMP U-Pb Geochronology of Detrital Zircons from the Holly Lake Metamorphic Complex, Leith Ridge, NWT
22	Mackay, D.*	4	15:21	A Metamorphic and Structural Analysis of Metasedimentary Rocks of the Akaitcho Group, Little Crapeau Lake, Southern Wopmay Orogen, Northwest Territories
23	Anderson, M.O.*	5	15:28	Trace-Element Geochemistry of Muscovite in the Moose II Lithium-Tantalum Pegmatite Deposit and Associated Faulkner Lake Pegmatite Field, NWT
24	MacWilliam, K.D.*	6	15:35	Albitisation of the Thor Lake Layered Alkaline Complex and Associated Nechalacho REE Deposit
7	Schwarz, S.H.	7	15:42	Testing the Potential Application of High Resolution Satellite Imagery to Identify and Count Wildlife such as Caribou in the Northwest Territories
26	Reford, S.	8	15:49	Exploring for Metals and Diamonds at Darnley Bay, NT – A Reality in 2010
6	Hewton, M.*	9	15:56	Geology and Geochemistry of the Mountain River Beryl Showing, Mackenzie Mountains, Northwest Territories
2	Patterson, R.T.*	10	16:03	Distribution and Environmental Significance Arcellacean (Thecamoebian) Assemblages from Lakes along the Tibbitt to Contwoyto Winter Road, Northwest Territories, Canada
32	Kerswill, J.	11	16:10	Activities Under the Mineral Resource Assessment Component, GEM and MERA Programs
29	Peats, J.*	12	16:17	Aviat Diamonds as a Window into the Deep Lithospheric Mantle Beneath the Northern Churchill Province

*** indicates student presenter**

<u>Thursday, November 18 (morning)</u>

Theatre 1 – Exploration & Geoscience
Chairs: John Ketchum, Scott Cairns

08:40 **Delineation of Fluid Pathways and Resulting Alteration and Breccia Signatures of IOCG Systems, Great Bear Magmatic Zone, Northwest Territories** - Corriveau, L., Montreuil, J.-F., Hayward, N., Enkin, R., Craven, J., Roberts, B., Kerswill, J., Lauzière, K., Brouillette, P., Boulanger-Martel, V., and Simard, S.
09:00 **Development Update for the NICO Gold-Cobalt-Bismuth-Copper Deposit, Northwest Territories** - Rinaldi, T., Schryer, R., Samuels, M., Mucklow, J., and Goad, R.
09:20 **Trace Element Geochemistry of Magnetite and its Relationship to Mineralization in the Great Bear Magmatic Zone, NWT, Canada – Preliminary Findings** - Acosta Góngora, P., Gleeson, S.A., Ootes, L., Jackson, V.A., Samson, I., and Corriveau, L.
09:40 **Geophysics of the Great Bear Magmatic Zone – Northwest Territories** - Lee, M., Morris, B., Harris, J. , Jackson, V., and Corriveau, L.

10:00 **Coffee** (sponsored by SRC Geoanalytical Laboratories)

10:20 **South Wopmay Bedrock Mapping Project II: Highlights From 2010** - Jackson, V., Ootes, L., Smar, L., and van Breemen, O.
10:40 **Investigations into the P-T-t-d History of Paleoproterozoic Rocks of the Coronation Supergroup, Southern Wopmay Orogen** - Smar, L., Hickey, K., and Jackson, V.
11:00 **Components of Hottah Terrane vs. Great Bear Magmatic Zone: New Chronostratigraphy and Implications for Mineral Deposits** - Ootes, L., Jackson, V.A., Davis, W.J., Bleeker, W., Acosta-Gongora, P., Smar, L., and Newton, L.
11:20 **Post-Collisional Detachment Faults: Cases of an Under-Appreciated Metallogenic Setting** - Duke, N.A.

11:40 **Coffee** (sponsored by KAVIK-AXYS Inc.)

12:00 **Update on Tyhee Development Corp's Yellowknife Gold Project** - Webb, D.R., Pratico, V.V., and Regular, M.
12:20 **Geochemistry, Origin, and Stratigraphic Role of Felsic Tuffaceous Units of the Yellowknife Greenstone Belt** - Cousens, B.L., Rahim-Abdolrahim, A., Falck, H., Ketchum, J., and Ootes, L.
12:40 **Developing the World-Class Pine Point Property** - Schleiss, W.A. and Burns, R.R.

13:00 **Lunch** (sponsored by First Air, The Airline of the North; 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

<u>Thursday, November 18 (morning)</u>

Theatre 2 – Environment and Earth Sciences
Chairs: Carl Ozyer, Steve Kokelj

09:00 **The Cumulative Impact Monitoring Program (CIMP)** - Lange, M., Kokelj, S.V., and Marchildon, C.
09:20 **Paleoclimatological Assessment of the Central Northwest Territories: Implications for the Long-Term Viability of the Tibbett to Contwoyto Winter Ice Road** - Patterson, R.T., Galloway, J.M., Macumber, A.L., Falck, H., and Madsen, E.
09:40 **The Dynamics of Mega-Scale Permafrost Disturbances and their Effects on Aquatic Systems, Richardson Mountains, NWT** - Kokelj, S.V., Lacelle, D., Lantz, T.C., Clark, I., Malone, L., Lauriol, B., Tellier, L., Chin, K., Tunnicliffe, J., Czarneki, A., and Joynte, A.

10:00 **Coffee** (sponsored by SRC Geoanalytical Laboratories)

10:20 **Fish Habitat Compensation and Mining in the North** - Landry, F., Denholm, E., and Hanks, C.
10:40 **Analytical and Traditional Knowledge Approaches to Water Quality Monitoring at Colomac Mine, NT** - Vanderspiegel, R. and Lafferty, G.
11:00 **Baker Creek Arctic Grayling: Assessing Fish Habitat use in a Reconstructed Stream** - Vecsei, P. and Machtans, H.
11:20 **Investigation of Cause at a Closed Gold Mine: The Insight, Implications and Consequences of Conducting an IOC Study in a Year without Effluent** - Machtans, H., Crowe, J., Sharpe, R., Connell, R., and Daniels E.

11:40 **Coffee** (sponsored by KAVIK-AXYS Inc.)

12:00 **Diavik Waste Rock Project: Blasting Residuals in Waste Rock Piles** - Bailey, B.L., Smith, L.J.D., Blowes, D.W., Ptacek, C.J., Smith, L., and Sego, D.C.
12:20 **Hidden Lake Mine Site Remediation** - Kupchanko, R., deRidder, G., Rowe, M., and Lee, J.

13:00 **Lunch** (sponsored by First Air, The Airline of the North; 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

<u>Thursday, November 18 (afternoon)</u>

Theatre 1 – Exploration & Geoscience
Chairs: Pattie Beales, Hendrik Falck

15:10 **Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park** - Kjarsgaard, B.A. , Wright, D. F., and Kerswill, J.A.
15:30 **Advancements in the Blachford Lake Intrusive Suite Project; Mapping Results and Preliminary Geochemistry** - Mumford, T.R., Falck, H., and Cousens, B.L.
15:50 **The Nechalacho Heavy Rare Earth and Rare Metal Deposit, Thor Lake, Northwest Territories, Canada** - Heiligmann, M., MacWilliam, K., Mercer, W., Pedersen, C., Sheard, E., Trueman, D., and Williams-Jones, A.E.
16:10 **Development Plans for the Nechalacho Heavy Rare Earth and Rare Metal Deposit, Thor Lake, Northwest Territories, Canada** - Swisher, D.

16:30 **Student Presentation Awards**

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)

<u>Thursday, November 18 (afternoon)</u>

Theatre 2 – Environment and Earth Sciences
Chairs: Carl Ozyer, Steve Kokelj

15:10 **Variability of Active-Layer Freezeback and Implications for Winter Overland Travel, Mackenzie Delta, Northwest Territories** - Kanigan, J.C.N., Kokelj, S.V., and Coutts, R.
15:30 **Mapping the Geochemistry of Lake Sediments near Yellowknife, NT** - Galloway, J.M., Sanei, H., Patterson, R.T., Babalola, L.O., Mosstajiri, T., and Falck, H.
15:50 **Environmental Impacts and Geohazards in the Mackenzie Delta and Shallow Beaufort Sea** - Whalen, D., Solomon, S.M., Forbes, D.L., Couture, N., Lintern, G., and Lavergne, J.C.

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

Trace Element Geochemistry of Magnetite and its Relationship to Mineralization in the Great Bear Magmatic Zone, NWT, Canada - Preliminary Findings

Acosta Góngora, P.[1], Gleeson, S.A.[1], Ootes, L.[2], Jackson, V.A.[2], Samson, I.[3], and Corriveau, L.[4]
(1) Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB
(2) Northwest Territories Geoscience Office, Yellowknife, NT
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The Great Bear Magmatic Zone (GBmz), in the Northwest Territories is the focus of exploration for iron oxide copper-gold (IOCG) mineralization, such as that found at the Sue-Dianne and NICO deposits. The aim of this project is to characterize the nature and geochemistry of the fluids responsible for the mineralization in these deposits and other prospects found in the GBmz.

Petrographic and hand specimen descriptions of 65 samples resulted in the definition of preliminary paragenetic sequences for the DAMP, FAB, Nori showings, Terra magnetite-apatite (mgt-apt) bodies, and NICO and Sue Dianne advanced exploration projects. The mineralization at DAMP, FAB (Cu-U) and Sue Dianne is hosted by felsic volcanic rocks and is characterized by an early stage of hematite and magnetite, followed by the deposition of chalcopyrite, bornite and chalcocite as the main Cu ore minerals. The FAB showing contains two generations of magnetite; an early phase disseminated on the breccia lithoclasts and a younger phase found as the matrix of a breccia and veins. At Nori (Cu-Mo-U), tourmaline-biotite-uraninite veins crosscut the Treasure Lake metasedimentary rocks and also show two generations of magnetite: i) disseminated on the wallrock (early stage) and ii) occurring in veins with K-feldspar coeval with molybdenite, uraninite and chalcopyrite mineralization. Terra Mine magnetite-apatite bodies exhibit coeval deposition of magnetite and apatite, followed by a later stage of actinolite. At the NICO (Au-Bi-Co-Cu) deposit, the ore minerals are hosted by metasedimentary rocks of the Treasure Lake Group. At least two generations of magnetite have been recognized and correspond with pre- (magnetite in laminations) and syn-mineralization episodes (magnetite in veins and/or strongly overprinting the host metasedimentary structure). Thus, magnetite is found in all the mineral showings and advanced exploration projects within this area, and it is often closely related to mineralized rocks.

This preliminary study combined with the results obtained by an electron microprobe (EMPA) analysis demonstrates that the trace elements in magnetite, especially V, have a distinctive signature between the different showings and advanced exploration projects. Furthermore, local variations in V, Co and Ti can be used to distinguish between pre- and syn-mineralization magnetite deposition episodes. The fact that FAB, DAMP and Sue Dianne host rocks have a felsic volcanic composition and that differences in the magnetite trace element signature are considerable between them suggests magnetite geochemistry is not directly affected by wall-rock input (leaching). Conversely, these differences in trace elements may better reflect slight geochemical variations of the individual hydrothermal systems. The low concentration of Ti, widely observed in all sites, is consistent with other magnetite composition seen in other iron oxide dominated deposits. This study suggests that the trace element signature of magnetite may be a suitable tool for mineral exploration at the GBmz. Further investigation involving higher resolution analysis (e.g ICP-MS) will be carried out on elements at very low concentrations to confirm the results reported here.

Diavik Waste Rock Project: Blasting Residuals in Waste Rock Piles

Bailey, B.L.[1], Smith, L.J.D.[2], Blowes, D.W.[1], Ptacek, C.J.[1], Smith, L.[3], and Sego, D.C.[4]
(1) University of Waterloo, Waterloo, ON
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Mining generates and moves the highest volume of material in the world. At mine sites throughout the world, explosives are used to fragment rock into workable size fractions. Mine water chemistry may be influenced by residual blasting agents used during mining. Ammonium nitrate mixed with fuel oil (ANFO) is the primary blasting agent used in metal and coal mining, quarrying and civil construction. ANFO is relatively inexpensive and safe to transport, store and use. Blastholes are filled with ammonium nitrate prill and fuel oil, which is mixed on-site. Ammonium nitrate is hygroscopic, and with any increase in moisture content the explosive loses strength, potentially resulting in a failure to detonate releasing NH_4 and NO_3 to pit water, pore water and effluent. These dissolved constituents present the opportunity to examine flow characteristics and geochemical processes within mine wastes.

The Rio Tinto/Harry Winston Diavik diamond mine is located 300 km northeast of Yellowknife, NWT, Canada, on a 20 km^2 island in Lac de Gras. Waste rock generated from the open pit mining operation is stockpiled on site. Three large-scale test piles, measuring 60 by 50 m in area and 15 m in height, were constructed from waste rock at Diavik as part of a comprehensive research program. Ongoing monitoring of the water chemistry began in 2007, and blasting residuals comprised a large proportion of dissolved constituents in the pore water and effluent.

Variations in concentrations and the gradual rates of dissipation of blasting residuals provide an indication of the test pile heterogeneity and the relative contribution of different flow paths. The first flush of this resident tracer indicated complex dynamics of unsaturated flow in waste rock. As the temperature within the piles increased in response to the seasonal increase in the ambient temperature, and as a higher proportion of the pile contributed to flow, increased concentrations of blasting residuals were observed in waste rock effluent.

The % residual N within waste rock piles can be determined by calculating the mass of N released (N_{loss}) in effluent from the waste rock piles and determining the total N in the explosives used to blast the mass of waste rock (N_{total}). Typical N_{loss}:N_{total} ratios at Daivk range between 0.1 to 6 %, but were generally < 3 %. These ratios were within the typical range observed for mine sites.

Sulfate is released from the oxidation of sulfides during blasting and from oxidation following disposal in the waste rock pile. The initial concentration of sulfate released from waste rock stockpiles is highly correlated to blasting residuals. Mass balance calculations based on the ratios of SO_4:NO_3 can be used to estimate the relative contributions of sulfide oxidation within the piles and sulfate released when sulfur in the host rock is oxidized during blasting. These calculations can also provide an estimate of S mass released during the first flush of the piles. This research will aid in understanding the release of constituents caused by blasting and waste rock hydrology.

RPM Utilizing High Resolution Satellite Imagery, Western Minto Inlier, Victoria Island, NWT

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The very high spatial resolution and stereo capability of GeoEye-1 images were utilised to analyze and map the geology of a part of western Neoproterozoic Minto Inlier on Victoria Island. The GeoEye-1 data set consisted of four stereo pairs covering NTS 87H/05. Digital image processing techniques were used to mask out the water, ice, and vegetation to enhance the images and obtain a better discrimination between various lithological and structural features. Stereo visualization was obtained by creating epipolar images for each stereo pair using rational polynomial coefficients (RPC) positioning from the sensor. To optimize the results of predictive mapping, a Landsat ETM^+ image, which has higher spectral resolution than the GeoEye imagery, was used in concert with the GeoEye-1 images.

The predictive bedrock geology map, interpreted based on 3D stereo visualization, presents much more detailed information compared to the existing 1:500,000 scale geological map of the area. Based on the existing geology map, the main lithological units exposed in the study area include the Minto Inlet, Wynniatt, and Kilian Formations of the Shaler Supergroup. The sedimentary strata are intruded by gabbro-diorite sills and dykes of Franklin magmatic event. With the aid of recent reconnaissance-level field observations, one of the main map units (Wynniatt Formation) was divided into four sub-units (members) and these are recognized in GeoEye images throughout most of the map area. The high spatial and moderate spectral resolution allow us to distinguish a black shale unit (black shale member) and resolve subtle spectral and textural differences between massive stromatolitic dolostones (stromatolitic carbonate member), and underlying and overlying dolostones containing fine-grained interlayers (lower and upper carbonate members, respectively). As well, an important distinction could be made between Proterozoic sedimentary strata and unconformably overlying interlayered sandstone and carbonate rocks of Cambro-Ordovician age, which is not indicated in the existing geology map. The SWIR bands in the Landsat image proved to be very useful in identifying the gabbro-diorite sills.

A geological map of NTS 87H/05 based on 2010 field work is being used to evaluate the remote predictive map. The GeoEye-1 image proved to be successful in providing information about both structural and lithological features in most of the study area. However, there were some discrepancies between the remote predictive map and the ground truth data which mostly arose from the complicating spectral signatures of overlying glacial sediments and/or other overburden materials. The spectral similarity between different stratigraphic units comprising similar lithologies, especially in small or poorly exposed outcrops, also contributed to differences between the predictive map and field data.

Regional Characterization of Seabed Geohazards on the Beaufort Outer Shelf and Upper Slope in Relation to Deep Water Hydrocarbon Development

Blasco, S.[1], Bennett, R.[1], MacKillop, K.[1], Hughes-Clarke, J.[2], and Church, I.[2]
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Beaufort Sea hydrocarbon exploration has shifted from the inner shelf to the outer shelf and upper slope region in water depths ranging from 70 to 1200m. Knowledge of seabed stability conditions related to exploration drilling in this region is limited. As a result, a collaborative IOL, BP, GSC and ArcticNet research program was initiated in 2009 and continued in 2010. The Canadian Coast Guard Ships Amundsen and Nahidik were used as survey platforms. Key seabed survey technology included multibeam sonar, subbottom profilers, piston and box sediment samplers and an ROV submersible fitted with video cameras.

The focus of the GSC program was to provide a regional stratigraphic and structural framework for the characterization of geohazard conditions in this deep water environment. Initial results covering a limited geographic area indicate a variety of seabed stability conditions exist along the outer shelf and upper slope.

Seabed scouring by ice keels has been observed in water depths greater than 400 m. Subsea ice-bearing permafrost may exist out to the shelf edge in 100 m water depths. The shelf edge is associated with localized concentrations of mud volcanoes. Gas venting occurs in association with these features as well as from a featureless seabed. Soft low-strength sediments thicken down slope from the shelf edge where they may be thin to absent. Submarine slumping occurs at the shelf edge as well as down slope. Ongoing research will focus on mapping the spatial distribution and temporal activity of these features, as well as determining the interrelationships among stability features. Whether these features are recent or relict will determine the relative severity of these geohazards to Beaufort deep water hydrocarbon exploration.

Granular Resource Management in the Mackenzie Delta Portion of the Inuvialuit Settlement Region

Bridge, D.[1] and Fraser, J.[2]
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Granular resources in the Mackenzie Delta portion of the Inuvialuit Settlement Region (ISR) are sparse, generally of poor quality and difficult to access and develop. Of the known sources, few are well documented or investigated and what little data that is available is often decades old. The lack of good, economic granular resources presents a serious hurdle to infrastructure development in the ISR especially in anticipation of two possible megaprojects- the Mackenzie Gas Pipeline and the Inuvik-Tuktoyaktuk all-weather highway.

As a land manager, the ILA is acutely aware of the limited supply of granular resources in the ISR. Consequently the ILA has developed policies and procedures that aim to make granular resources more accessible and available to proponents operating in the ISR as well as ISR residents. The ILA along with INAC, have assembled a regional Granular Resource Management Plan that covers both Inuvialuit private lands and crown lands and has undertaken reconnaissance studies on potential granular resources that have not been previously identified or investigated. The ILA is also working to make ISR communities more sustainable by opening up private land sources of granular resources to community use. In doing so, the ILA is ensuring that communities and residents have a reliable supply of granular materials for infrastructure construction and maintenance.

The overall intent of the Granular Resource Management Plan is to ensure that granular resources are conserved and utilized consistently throughout the ISR while maintaining the independence of the two land management agencies.

2010 Hackett River Project Update: At the Threshold of Development

Burgess, S.
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Sabina Gold & Silver Corp. is an emerging precious metals company with district scale, world class undeveloped assets in Nunavut. The properties include the world class Hackett River Silver and Zinc Project and the surrounding 3,000 km^2 Wishbone claims; as well as the proximal Back River Gold Project.

Sabina's Hackett River Project is located approximately 480 km NE of Yellowknife, and approximately 75 km from Bathurst Inlet. The project is located 23 km from the proposed all season Bathurst Inlet Port and Road to Bathurst Inlet, and 105 km by road from the proposed tidewater port facility. The settlement of Bathurst Inlet, the closest community, is 100 km to the North. The Hackett River VMS project consists of three main silver/zinc-rich deposits: Main Zone, Boot and East Cleaver, as well as a satellite deposit, the JO Zone. All the deposits are located within a 2 km by 5 km window, along the contact between underlying felsic volcanics and overlying pelitic sediments.

Since Sabina optioned the property, in 2004, we have drilled approximately 96,653m, in 366 holes to date, resulting in an increase of over 400% in the resource. All told, approximately 106,016m has been drilled in 548 holes. Hackett River is one of the largest undeveloped silver - zinc volcanic massive sulphide ("VMS") deposits in the world. In late 2009, an updated Preliminary Economic Assessment ("PEA") was completed on the project, with indicated resources totalling 43.3 million tonnes grades of 4.65% zinc, 144 g/t silver, 0.42% copper, 0.64% lead and 0.30 g/t gold. An additional inferred resource totalling 14.6 million tonnes with grades of 4.46% zinc, 136 g/t silver, 0.31% copper, 0.57% lead and 0.31 g/t gold is also contained at Hackett River. The deposit is precious metals-rich with approximately 45% of the value of the resource in silver, and the 12,000 tpd mining model envisages the production of three payable concentrates over a planned 16 year mine life.

The main objectives of the work done in 2010 were to find higher grade copper/gold stringer mineralization, expand and improve the pit economics and identify new deposits. The 2010 work program included 78 holes, totalling 19,441m, with more than half concentrated on the Main and East Cleaver deposits. An additional 42 holes, and 8,105m was drilled on the Wishbone project. Currently, work is ongoing to produce a revised geological model. Work is also ongoing with whole rock sampling and petrography to better understand alteration patterns and mineral zoning around the existing deposits and numerous exploration targets within the core area of the property.

Highlights include: at East Cleaver, the discovery of a significant new lens of massive sulphide mineralization immediately to the west of the deposit; at Main Zone West, the definition of a new strong zone of copper stringer mineralization in the immediate footwall to the deposit; and at Boot, the extension of the deposit to the north.

The Northwest Territories Geoscience Office – 2010 Activities

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The Northwest Territories Geoscience Office (NTGO) is a partnership between Indian and Northern Affairs Canada – NWT Region and the Government of the Northwest Territories, Department of Industry, Tourism and Investment. Research activities include geological mapping, geochemical and geophysical surveys, evaluation of mineral and petroleum systems, non-renewable resource assessments, targeted climate change research, and information technology developments. NTGO also maintains an earth science library, provides outreach and educational services, and administers portions of the Canada Mining Regulations.

2010 activities include a variety of field-based projects across the Northwest Territories. With few exceptions our field activities are carried out in partnership with a host of other university and government partners. NTGO regional mapping projects and related studies were active in the southern Wopmay Orogen, the Mackenzie Mountains, and the Slave Province. NTGO carried out regional geochemical stream sediment and water sampling programs in the Mackenzie Mountain's

proposed protected area. We are cognizant of our role in training geoscience students, and most projects support university-level geology students either through providing career-relevant field experience, or direct thesis support. NTGO field programs provide excellent opportunities for hands-on training of university geology students.

Outreach activities at the NTGO are designed to increase awareness of geology and mineral exploration within NWT communities as well as inform the public of NTGO research around their communities. Activities run the spectrum from short school visits and rock walks to partnering in the University of Alberta fourth year field school.

Curation and dissemination of information is another pillar of the NTGO. We continue to add to our digital and hard copy collections and to make our online data discovery and dissemination systems easier to use and more efficient.

Surficial Geological Mapping in the Wager Bay Area, Nunavut - Filling in the Gaps

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The Wager Bay area, mainland Nunavut, lies within one of the more active diamond exploration areas of the Western Churchill Geological Province. The surficial geology in this area has never been field mapped, and as a result, the glacial history and Quaternary framework necessary for the implementation of successful exploration programs by the diamond industry is lacking. As part of Canada's Geomapping for Energy and Minerals (GEM) Program, a Quaternary mapping activity under the Diamonds Project was initiated in the Wager Bay area to address and fill in these knowledge gaps namely: 1) the surficial mapping coverage; 2) the regional drift composition and glacial transport characteristics at both regional and detailed scales; 3) the glacial history and ice-flow sequences, particularly as they relate to the eastern extension of the Keewatin Ice Divide, the interaction between Keewatin and Melville ice masses, and the late-glacial ice streaming events, and 4) the marine limit determinations and knowledge of the post-glacial uplift history in a strategic coastal area. Both remote predictive mapping and field based investigations will be used to accomplish these objectives

During the 2010 field season, surficial geological mapping and regional till sampling were completed northwest of Repulse Bay in the southwest part of NTS map sheet 46M. Till samples were collected at 42 sites (~ 7 km spacing) and will be analysed for geochemistry, indicator minerals and gold grains. Preliminary field observations have implications for the glacial history and the reconstruction of the interaction between Keewatin Sector and Melville ice. Glacially polished and striated surfaces and roches moutonnées indicate warm-based glacial conditions. Multiple ice-flow directions, including ice-flow reversal over the Rae Isthmus (late flow south into Repulse Bay), superimposed streamlined landforms, and divergent ice-flow directions on either side of end moraines were recorded. Diverse Quaternary sediments and depositional environments with notable landforms were observed. Till blankets and till veneers are scattered through the area but are dominant above the marine limit. Sand and gravel above the marine limit mainly occur in pro-glacial outwash trains, glaciofluvial aprons/deltas and ice-contact landforms (eskers, kames). The marine sequence includes, from the limit of marine incursion to the present-day coastline, thick sequences of deltaic sands and gravels, extensive areas of exposed and gullied clayey silts, marine offlap sands and silts, and sand and gravel littoral sediments. Sand veneers and patches of wave-washed tills are present below the marine limit. Extensive areas of exposed bedrock occur south of Committee Bay and in the vicinity of Repulse Bay. Contrasting marine limit elevations at the eastern (140-150 m a.s.l.) and western (~ 240 m a.s.l.) extents of marine incursion over Rae Isthmus were confirmed and suggest the ice remained much longer on the eastern side of the Isthmus. This may have implications for regional post-glacial uplift patterns.

Exploration Update on Sabina Gold & Silver's Back River Gold Properties

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The Back River Project is located 525 kilometres northeast of Yellowknife and consists of a number of individual properties including Goose Lake, George Lake, Del, Boot Lake and Boulder Pond that are actively being explored for gold. The Goose and George gold deposits together contain NI 43-101 compliant measured & indicated gold resources of 3.4 million tonnes grading 10.9 g/t Au for 1.19 million ounces of gold and inferred resources of 3.6 million tonnes grading 10.2 g/t Au for 1.16 million ounces of gold.

The Goose Lake property has been the focus of exploration activities over the past two exploration seasons by Sabina. The property is underlain by folded Beechey Lake turbiditic sediments with subordinate oxide and silicate banded iron formation units. This sequence is cut by felsic and gabbroic dykes. Gold is dominantly hosted in iron formation. Deformation of the BIF units promoted emplacement of quartz veins and the conversion of magnetite to sulphides. The mineralization occurs within silicified and variably sulphidized iron formation and to lesser extent sedimentary units that appear to have a spatial association with narrow porphyritic felsic dykes. Sulphide minerals observed includes pyrite, arsenopyrite, and pyrrhotite. Sulphide mineralization may be associated with accessory chlorite, carbonate, hornblende and grunerite. Visible gold is locally present, especially when sulphides are greater than 10% and when coarse-grained arsenopyrite is present.

Gold mineralization at the Goose Lake deposit is structurally controlled and is predominantly stratabound. The deposit is located within the Goose Lake Antiform structure, which is situated within a 500+ metre wide corridor of widely spaced, sub parallel north to northeast trending, southeast dipping and normal faults. The bulk of gold mineralization occurs within the sulphide-rich lower iron formation. Very minor gold and sulphide mineralization is developed in the upper iron formation. Visible gold can often be seen to be associated with pyrrhotite and/or pyrite in the presence of arsenopyrite and within the quartz veins.

In 2010, Sabina focused on exploring for new zones on the Goose property. Targeting was based on looking at areas of iron formation that had a similar geological and geophysical expression to that of the Goose deposit. This methodology has been very successful and two new discoveries were made. Llama was the first to be discovered. It is located approximately 8 kilometres north of Goose. Umwelt was discovered shortly thereafter and it is located 1.3 kilometres south of Llama. Assay results are still arriving on these new discoveries, and the focus of this talk will be on the geology and discovery of these new zones.

Building Capacity through Technical Training Initiatives

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Staff members of the Wek'eezhii Land and Water Board (the Board) have been exploring strategies to develop and deliver technical training programs that build capacity within our organization and for the communities that we serve. Training modules developed to date have focused on improving the Board's understanding of topics that will aid in their decision-making. Other training initiatives designed for organizations outside of the Board are underway to support communities in achieving compliance with their water licence requirements.

For these training endeavors, attention has been placed on effective modes of training and educating within a regional context. Outcomes from R.Chouinard's two-year research dissertation on effective education strategies from a Tâîchô context have been used to guide program development. Such strategies include: using a variety of "teachers" with primary experiences, incorporating primary experiences into the training (outdoors if possible), taking the training to the intended learners, relating the training material to local realities, breaking down the student-teacher barriers, starting from the beginning, and incorporating repetition into the program.

In this presentation, we will describe some of the WLWB's technical training initiatives and report on our progress.

Delineation of Fluid Pathways and Resulting Alteration and Breccia Signatures of IOCG Systems, Great Bear Magmatic Zone, Northwest Territories

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The Geomapping for Energy and Minerals Program and its partners are developing a tectono-hydrothermal-magmatic framework of the Great Bear magmatic zone (NWT) and new vectors, methods and technologies to aid mineral exploration for iron oxide copper-gold (IOCG) deposits in this and other glaciated terrain (Lee et al.; McMartin et al.; Potter et al.). During summer 2010, our current predictive IOCG alteration to mineralization model and alteration mapping protocol were initially tested at the NICO deposit. This magnetite-group IOCG deposit records a cyclical build-up of high-temperature calcic-iron-potassic alteration and associated mineralization without the significant early sodic alteration and subsequent low temperature potassic-iron (hematite) alteration predicted by the model. Delineation of pathways (fault zone, unconformity and/or breccia) for the inferred early and subsequent fluids, metals and elements was undertaken across volcanic and metasedimentary rocks, their unconformity, and hypabyssal intrusions using alteration mapping assisted by gamma-ray spectrometry and measurements of magnetic susceptibility. This approach led to the discovery of a 2 by 0.5 km structural breccia corridor with syn- to post-tectonic hydrothermal iron oxide (magnetite to hematite) breccias and U-Th-arsenopyrite±molybdenite anomalies within either sodic-, potassic- or silica-altered metasedimentary rocks. This new system is spatially distinct from the NICO ore zone (which does not contain uranium) and may represent a pathway for both incoming and outgoing fluids involved in the formation of the

NICO deposit. The presence of late tectonic tourmaline breccias and syn- to post-tectonic porphyry dykes in this magnetite-to-hematite group IOCG system, combined with new data from two other IOCG systems studied this summer - the Fab Lake system (studied in collaboration with the Community Government of Gamèti; Potter et al.) and the Cole Lake breccia - provide further constraints on the structural, magmatic and hydrothermal events that led to the IOCG-porphyry continuum documented in the Great Bear magmatic zone. As part of this project and the South Wopmay Bedrock Mapping project (Jackson et al.), two large targets derived from RPM modelling of recent magnetic and radiometric surveys were examined and led to the discovery of hydrothermal systems with iron oxide breccias. The hematite breccias east of Hottah Lake (Montreuil et al.) provide linkages between unconformity uranium prospects in the Hottah terrane (Ootes et al.) and IOCG systems in the Great Bear magmatic zone. The Grouard Lake system is hosted within the Labine Group and displays large breccias with amphibole-magnetite alteration, local chalcopyrite occurrences and skarn alteration of stromatolite-bearing carbonate rocks. It bears affinities with magnetite-group IOCG systems. In contrast, the overlying Sloan volcanic rocks studied both at Grouard Lake and across the northern Great Bear magmatic zone, appear to represent an impermeable cap during development of IOCG environments, yet are a common host for epithermal-type propylitic, argillic and siliceous alteration and mineralization. Beyond the scientific progress reported herein, this presentation will also provide an overview of forthcoming geological maps, IOCG alteration database and revised GIS in addition to preliminary results from the deep-Earth-probing geophysical surveys, physical rock properties measurement and paleomagnetic method development to study IOCG deposits.

Geochemistry, Origin, and Stratigraphic Role of Felsic Tuffaceous Units of the Yellowknife Greenstone Belt

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In Archean greenstone belts, uncommon felsic tuffaceous units commonly provide the only definition of geochronology and geochemistry in primarily mafic volcanic and intrusive suites. In some cases, these felsic units may be correlative across the greenstone belt, in which case they serve as important stratigraphic marker beds where faulting and deformation have obscured or repeated portions of the belt. The ca. 2.7 Ga Kam Group of the Yellowknife Greenstone Belt (YGB) is divided from bottom to top into the Chan, Crestaurum, Townsite, Yellowknife Bay, and Kamex Formations based primarily on the occurrence of felsic tuffs within the now-dismembered volcanic pile. At Dwyer Lake, a felsic tuff in the Central Slave Cover Group underlying the YGB is 2853 +2/-1.5 Ma in age (U-Pb zircon, Ketchum et al., in prep.). The top of the Chan Formation is defined by the Ranney chert and tuff, which include mostly discordant, inherited zircons with poorly-defined ages between 2722 and 2842 Ma (Isachsen, 1992). Lacking felsic units, the exact age and origin of the Chan Formation is currently uncertain. Felsic tuff horizons in the Crestaurum Formation exhibit near-concordant U-Pb zircon systematics and range in age from 2712 to 2707 Ma (Isachsen, 1992). Felsic volcanic units in the Townsite Formation are dated at 2705 to 2702 Ma (Isachsen, 1992). The Bode Tuff, a prominent interflow sediment with abundant rhyodacite fragments that occurs at the top of the Yellowknife Bay Formation, has ages of 2704 to 2701 Ma (Isachsen, 1992).

We have undertaken a detailed geochemical and Sm-Nd isotopic study of Kam Group felsic tuffs, along with U-Pb age determinations in the Chan Formation, to better define the origin of the felsic rocks and to better pin down the age of the Chan Formation. In the Chan Formation, a late, quartz-porphyritic, metagabbro “sheeted” dyke that cuts the volcanic pile yields a U-Pb baddeleyite age of 2738 +3.5/-3.0 Ma (Ketchum et al., in prep.). This unit is ca. 25 Ma older than Crestaurum Formation tuffs but 110 Ma younger than the Dwyer Lake basement tuff. Ranney chert and tuff horizons have extremely low rare earth element abundances, are enriched in Zr and Hf relative to the rare earths, and are distinct geochemically from Crestaurum Formation tuffs. Ranney chert/tuff units have Nd isotope ratios (epsilon Nd > 0) that are also distinct from Crestaurum and Townsite formation tuffs. We conclude that the Ranney chert and tuff are more sedimentary in origin than the stratigraphically higher tuff units of the Kam Group, thus including higher detrital quartz and zircon contents. Using the distinct Ranney trace element signature, we have determined that tuffs mapped as Ranney chert and tuff at Fred Henne Park, Joe Lake, and at Daigle Lake (Crestaurum Mine area) are actually Crestaurum Formation tuffs. Thus there is no Chan Formation preserved south of the Akaitcho Fault.

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 12 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.

Canada's Discovered Oil and Gas Resources North of 60

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A wide diversity of basins characterizes Canada's sedimentary area north of 60 degrees north. The sedimentary basins of Northern Canada occupy an area of 2.5 million square kilometres (965,255 square miles), with approximately 62% offshore. Significant occurrences of oil and gas have been discovered in several of the basins.

One of Canada's earliest oil discoveries was made at Norman Wells in 1920. The Norman Wells oil field has produced 260 million barrels of oil to August 31, 2010, with remaining oil reserves of 42 million barrels. Significant discoveries were made in the Mackenzie Beaufort Basin and the Arctic Islands in the 1970's and 1980's. A resurgence of activity in the 1990's and 2000's has resulted in discoveries in the Cameron Hills, Liard Plateau, Mackenzie Plain, Mackenzie Delta and Beaufort Sea.

The total discovered recoverable oil and gas resources for Canada north of 60 degrees are 1,917 million barrels of oil and 33,714 billion cubic feet of natural gas. Initial recoverable resources by territory are, Northwest Territories – 1,189 MMB oil and 17,246 Bcf gas, Nunavut – 323 MMB oil and 15,963 Bcf gas, and the Yukon – 406 MMB oil and 504 Bcf gas. Cumulative production to August 31, 2010 is; Nunavut –

2.8 MMB oil, Northwest Territories – 262.4 MMB oil and 513 Bcf gas, and Yukon – 242 Bcf gas. The onshore/offshore distribution of recoverable resources is onshore – 472 MMB oil and 15,283 Bcf gas and offshore – 1,445 MMB oil and 18,431 Bcf gas.

In Northern Canada 47 fields have discovered oil with original recoverable resources of 1,917 MMB, of which 265 MMB has been produced to August 31, 2010. There are 97 fields with initial recoverable gas of 33,502 Bcf, of which 755 Bcf has been produced to August 31, 2010. There are 113 discovered fields, 31 oil and gas, 16 only oil and 68 only gas. The 31 fields with oil and gas contain 1,123 MMB of recoverable oil and 11,601 Bcf of recoverable gas. The 16 oil fields have 794 MMB oil and 212 Bcf associated gas and the gas only fields have 21,901 Bcf of gas.

Fields with oil production include Norman Wells, discovered in 1920, Bent Horn (1974), Amauligak (1983) and Cameron Hills (2003). Gas fields with production include Beaver River, Pointed Mountain, Kotaneelee, Liard K-29, Liard P-66, Ft. Liard F-36, SE Ft Liard N-01, Cameron Hills, and Ikhil. Currently producing fields include, Norman Wells, Cameron Hills, Kotaneelee and Ikhil.

The largest discovered oil resource is the 1.3 billion barrels in the Beaufort/Mackenzie. Largest discovered recoverable gas resource is in the Sverdrup Basin with 17.4 Tcf, followed by the Beaufort/Mackenzie with 12.1 Tcf.

Post-Collisional Detachment Faults: Cases of an Under-Appreciated Metallogenic Setting

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Detachment faults have been a hot tectonic topic since they were first documented in the SW US Cordilleran in the early 1980s. These develop at the brittle/ductile transition during extensional unroofing of tectonically thickened metamorphic infrastructures coring collisional orogens. Tectonic denudation of the brittle upper crust results in detachments coinciding with orogenic ash tuff volcanism over rapidly unroofed plutons. The detachment is characterized by transpositional mylonite, capping lower plate amphibolite facies gneisses undergoing lateral ductile flow, below chlorite cemented breccia flooring the brittle orogenic superstructure tectonically thinned by listric-normal fault-block rotation. Ingress of crustal fluids into hot mylonite causes hydrothermal disaggregation and associated mineralization. Since near-actualistic recognition in the post Laramide, detachment fault tectonics is now considered normative for accommodating the return of gravitational stability to collisional orogens that punctuate the geological column.

Much has been published on the tectonics of post collisional extension, but less written on the metallogenic significance of detachments accommodating terminal orogenic collapse. Post Laramide detachments are best known for hosting epithermal precious metal concentrations within volcanically active environs. This particular metallogenic setting is also evident in the northern Cordilleran, accounting for the lode source of the widespread placer gold districts across the Yukon-Tanana uplands. Analogies in paleo-orogens are rarely preserved due to erosion however do exist below remnant ash tuff blankets. The classic Archean structural breaks, juxtaposing retrograded schist against “Temiskaming facies” ash tuff and polymictic conglomerate at several gold camps have considerable similarity. The polymetallic iron oxide breccia deposits of the Southern Bear Province are related to a K-feldspar altered boundary separating transposed amphibolite facies metasedimentary basement and remnants of an unmetamorphosed ash tuff blanket of the same age. A deeper-seated “ductile” detachment is in evidence in the Mary River District in north Baffin. Here, direct shipping iron oxide ores develop where Archean BIF directly overlies chlorite schist separating high grade gneisses from bordering supracrustals. These

Paleoproterozoic cases demonstrate detachment-fault tectonics plays a role in the global diversity within the IOCG class. The tectonized and metamorphic boundary conditions that occur with some Mesoproterozoic unconformity-related uranium deposits, particularly in evidence in the Pine Creek terrane of Northern Australia, indicates mineralization of a hot active detachment fault rather than a cold static depositional surface.

Post collisional extension may have been particularly sensitive to secular changes in geothermal gradients through time. With high heat flow in the Archean, complete melting of the Kenoran infrastructure resulted in re-establishing isostacy through granite diapirism across shields, while partial melting of Proterozoic infrastructures resulted in “dome and keel” mobile belts. The brittle superstructures of ancient orogens may have been poorly developed as the tectonic style of their infrastructures indicates late vertical ductile extension accommodated plutonism. The high strain gradient between rising plutons and sinking supracrustals supplies a common structural control for thermal aureole lode gold systems. With secular cooling, increasingly brittle low-angle detachments become sites for iron oxide/chlorite replaced mylonite/breccia, which forms a physical-chemical trap for polymetallic sulphide and/or uranium enrichment.

Geothermal Energy Development in Ft. Liard, Northwest Territories

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Geothermal (or earth heat) energy is a clean, renewable source of both power and heat. It is proven technology that provides baseload (24 hours a day, 365 days a year) power, has low to no emissions, and has one of the smallest environmental footprints of any power supply.

Unlike our other national energy resources like oil, gas, coal, and wind, high temperature geothermal energy for electricity projection has yet to be developed or even effectively mapped as a resource in Canada. Effective mapping and pilot projects for deep geothermal resources are required to aid exploration and project development. International geothermal energy development for electricity production has long been focused on larger scale (>20MW) development and production opportunities. However, smaller scale and distributed energy generation (<10MW) from geothermal resources may offer a viable solution for many remote communities like those in Northern Canada.

Over 1,800 oil and gas exploration wells drilled in the Western Canadian Sedimentary Basin, Mackenzie Corridor, and Mackenzie Delta provided Borealis with a key dataset for mapping of geothermal resource potential in the North. Information like bottomhole temperature data, downhole porosity, and water production were crucial to understanding deep geothermal energy potential. This information is gathered during drilling operations and provides direct support for the heat resource potential at depth and possible heat recovery. Other datasets for initial research were hotspring location, water geochemistry, and various geophysical datasets from oil and gas and mining operations.

In January 2010, the Acho Dene Koe/Borealis Geothermal Energy Project, an innovative renewable heat and power project for a remote community in Northern Canada was approved for potential funding by the Natural Resource Canada’s Clean Energy Fund (Renewable and Clean Energy Demonstration Projects). Since January 2010, Borealis, in conjunction with the ADK, has worked to involve all the key parties involved with the project including NTPC, GNWT-ENR, potential partners, and GNWT-ITI.

This project will consist of a geothermal power plant which will deliver <1 MWe of electrical power (sufficient for ~750 homes or the entire community) with the opportunity for direct heat capabilities. This renewable heat and power green energy project will demonstrate how a northern community can use a renewable, geothermal "earth heat" resource to generate electricity and heat thereby reducing the entire community's fossil fuel demands and energy costs.

MGM's Best Practice Measures for 2D Seismic Acquisition in the Mackenzie Delta and Colville Hills, NWT

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During the past five years, MGM Energy Corp. (MGM) and its predecessor company Paramount Resources Ltd., acquired and processed several 2D seismic surveys in the Northwest Territory. A three year cycle was generally needed to adequately plan, execute, process and interpret a 2D seismic program consisting of 4 to 6 lines and totalling approximately 100 km. The tasks of designing, supervising and monitoring a seismic survey in the north has traditionally been divided between the oil and gas exploration company (such as MGM), a seismic management company (such as Aquila or Explor) and a seismic contractor based in NWT with significant local content (such as Trace Exploration).

In order to complete these seismic programs, MGM dedicated extensive efforts and manpower to mitigate environmental considerations within in the survey area while respecting federal, territorial and local regulations and maintaining the good and productive relationships developed with the area's first nations and northern groups. A series of "Best Practice Measures", based on the extensive northern work knowledge and expertise of MGM, its contractors and the local communities, were adopted in the successful completion of these projects. This paper will outline these "Best Practice Measures" and how MGM and its contractors continue to modify and learn from the completion of each project.

Breaking the Cycle of Dependency and Empowering our People

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Det'on Cho Corporation is the economic development arm of the Yellowknives Dene First Nation and exists to create prosperity for the Yellowknives Dene. Det'on Cho's story is one of determination and hard work. With no land claim or self government settlement to finance its businesses, Det'on Cho began with a $15,000 grant in 1988. Today DCC has turned that modest seed capital into 20 subsidiaries and counting, with annual earnings of more than $30 million. Det'on Cho is horizontally integrated, providing end to end services for resource industries- from exploration through development, operation, and remediation. Services include a full-spectrum of mine related services, transportation, logistics and expediting, the provision of human resource services and construction and management services.

In looking for opportunities, Det'on Cho focuses on three core businesses:

Mining-related products and services
Human resource services
Property development and project management

Our business culture is one where we share in both the risks and rewards with our partners, thereby building capacity and increasing our physical and corporeal assets. Our successes lead to breaking the cycle of dependency and serve to empower our people.

The milestones that we have achieved over the years include the following and are representative of our core companies:

Akaitcho Territory Builders (ATB) was established in 1996 as a construction and construction management company. As one of the first of the Det'on Cho companies, ATB creates training, apprenticeship and job opportunities for members of the Yellowknives Dene First Nation. ATB specializes in the construction of residential and commercial properties such as managing the construction of the Dettah Community Centre and several apartment complexes in Yellowknife.

Bouwa Whee Catering is a wholly owned subsidiary of the Det'on Cho Corporation, serving the Yellowknife area as a premium event and contract catering company since 1990. With 100% northern aboriginal ownership and close to 20 years of operation, Bouwa Whee has grown from catering out of the kitchen of the Vital Abel Boarding Home and operating the Legislative Assembly Cafeteria and Smokehouse Café to providing full time catering, camp management, housekeeping and janitorial services for a major northern diamond mine.

Established in 2009, Det'on Cho Logistics provides expediting and logistics, freight forwarding and consolidation, and air cargo handling services across the North. Along the full life cycle of an exploration project, from exploration through remediation, DCL can put together and deliver the needed services: camp set up and construction logistics; camp catering and maintenance, supply logistics and expediting, and site clean-up and remediation.

The Det'on Cho Training & Conference Centre is a multi-functional, fully equipped training facility. It is a state-of-the-art training facility nestled in the midst of nature. The Det'on Cho Training & Conference Centre is a multi-functional, fully equipped training facility. The Centre is equipped to manage small group meetings, a conference of up to 50 people with break out groups, or a long-term training course requiring on-site accommodations. It includes five boardrooms (three of which convert to training labs), a large theater-style presentation room, a day office, sleeping quarters and full kitchen services.

Trinity Helicopters is a full-service helicopter charter company. Established in 2009, Trinity specializes in supporting base metal and diamond exploration, forest fire suppression and research, oil and gas exploration, wildlife capture and government transport. Highly trained and experienced crews are experts in northern operations, precision vertical reference and project management.

New Stream Sediment Survey Results from the Cranswick River Area NTS 106 F and G and an Overview of the Mackenzie Mountains

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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, has sought to remedy this situation and is 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 NWT Protected Areas Strategy, Geo-mapping for Energy and Minerals Program 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 km^2. 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 KIM and low chrome-diopside grains are analyzed by microprobe for their chemistry.

In 2008, a survey was carried out over the Cranswick River Area in the Northwest Territories. This sampling program collected 366 silt, 360 water, and 7 bulk stream sediment samples from 346 sites in parts of NTS map sheets 106F and 106G. Samples of silt and water have been analyzed and the results are being compiled and prepared as a joint NTGO Open Report 2010-010/GSC Open File 6271.

The best known mineral showings in the survey area include the AB zone carbonate-hosted lead-zinc showing and the Crest banded iron formation. The stream silt data highlights these two deposit types but also demonstrates element associations characteristic of mineral deposits types found in other parts of the Mackenzie Mountains including: redbed-associated Cu, intrusion-related base metal and tungsten skarns, and shale-hosted SEDEX Zn-Pb. These anomalies are not only significant on a local survey level but can also be compared on a regional basis. New showings and elemental anomalies can now be evaluated on a much broader scale with the compiled data for the majority of the Mackenzie Mountains.

With continued support, for 2011 plans are to complete the silt sampling program in the Coates Lake region. Additional research is also being planned to examine the physical and chemical processes involved in the transition from mineral showing to silt sample to better interpret the results of these large regional surveys.

Updating the Stratigraphic and Structural Understanding of Mackenzie Corridor, Northwest Territories

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Field studies contributing to the Mackenzie Delta and Corridor Project, part of the Geo-mapping for Energy and Minerals (GEM) Program of the Geological Survey of Canada (GSC), includes bedrock mapping and stratigraphic studies in the Mackenzie Corridor. Field activities are being conducted by GSC Calgary staff with colleagues from the Northwest Territories Geoscience Office (NTGO), Laurentian University, and the University of Calgary. The study area, encompassing Norman Wells and Tulita, includes those parts of the Franklin Mountains, Mackenzie Plain and eastern Mackenzie Mountains in NTS map areas 96C, 96D, 96E, and 96F.

The 2009 and 2010 GSC mapping seasons saw significant progress in recognition of key structural and stratigraphic relationships. Mapping documented Proterozoic to Cambrian extensional structures, overprinted by folding and contractional faulting in the Cretaceous. This has implications for understanding the lateral continuity and complications of structural culminations with respect to trap development.

The presence of several unconformities within the stratigraphic succession complicates map compilation. Map units have been locally misidentified at the Proterozoic – Cambrian boundary, impeding understanding of the distribution of Cambrian source rocks and reservoir facies. Mapping of unconformities clarifies deposition vs. erosion cycles on paleotopographic features, such as Keele Arch, and their effect on thermal maturity of source rocks.

Stratigraphy, Petrology and Geochemistry of Sediment-Hosted Barite Sequences in the Mackenzie Mountains, NWT: Understanding the Geochemical Conditions of Barite Mineralization in the Upper Canol Formation, and in the Selwyn Basin during the Middle to Late Devonian

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The Devono-Mississippian Earn Group in the Selwyn Basin contains a number of sediment-hosted barite sequences which outcrop in the Mackenzie Mountains, NWT. These barite sequences were previously thought to be the distal expression of sedimentary-exhalative (SEDEX) Zn-Pb-Ba deposits (Carne and Cathro, 1982). The stratigraphic position of these units has been constrained to the upper part of the Canol Formation (Fernandes et al., 2010), a sequence of mudstone, siltstone and shale found within the Lower Earn Group. The same stratigraphy hosts known SEDEX deposits in the MacMillan Pass region of the Yukon (Large, 1980).

Barite in all showings displays a remarkable variety of textures from laminations, to elongate to spherical nodules of –mm and –cm diameter respectively (Fernandes et al., 2010). A petrographic study and stable isotope geochemistry of the barite was initiated to understand the mineralogy of the sequences, and their relationship with hydrothermal fluids and seawater/porewater geochemistry during their time of deposition.

The barite laminations are composed almost entirely of interlocking, 100 – 300 μm, subhedral barite crystals. Rare ~ 150 μm, euhedral crystals of hyalophane (Ba, K-bearing feldspar) and 20 -30 μm, subhedral pyrite crystals occur and post-date barite. $\delta^{34}S$ values for barite in laminations ranges from +24 to +34 ‰. Primary, synsedimentary barite $\delta^{34}S$ values may reflect seawater as a source for sulphate at the time of deposition. $\delta^{18}O$ values in laminated barites range from +14 to +18 ‰ which is more or less consistent with Devonian seawater sulphate (Claypool et al., 1980).

Nodular barite can be monomineralic, composed of large, fibrous crystals and/or very-fine grained, anhedral crystals, or composed of barite and varying amounts of late, 100 – 400 μm, euhedral crystals of unzoned hyalophane + fine-grained pyrite ± cymrite (hydrous Ba-feldspar). Ba-silicates are replaced to some extent by secondary barite. $\delta^{34}S$ values for barite in nodules ranges from +31 to +56 ‰. Nodular barite, which is a product of sub-seafloor crystallization, has consistently elevated $\delta^{34}S$ values relative to laminated barite. Bacteriogenic sulphate reduction (BSR) may cause such enriched values, and late pyrite is an indicator of this process. However, a closed system with respect to sulphate would be necessary to drive $\delta^{34}S$ values to the +50 ‰ level. The presence of large, possibly diagenetic Ba-silicates indicates extremely low concentrations of sulphate in the fluids that precipitated barite nodules. $\delta^{18}O$ values in barite nodules shows a wider range of values (+9.2 to +19.3 ‰) compared to laminated barite.

Primary barite in the Canol Formation, which is present in all showings, must have crystallized in an oxygenated (sulphate-rich) environment. This is contrary to previous studies (e.g. Goodfellow, 1987) that suggested that anoxic (sulphate-poor) conditions prevailed above the sediment-water interface (SWI) during the Late Devonian. The overall abundance of secondary barite indicates remobilization under extremely reducing conditions below the SWI due to the stability field of barite. This process has been documented in modern and Palaeozoic continental margin settings (Torres et al., 2003). The barite horizon in the Lower Earn Group may represent a basin-wide barite mineralizing event.

Proposed New Wildlife Act

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This presentation is an overview of the proposed new NWT Wildlife Act with a focus on proposed legislative tools for wildlife habitat management. An update on proposed Critical Wildlife Areas under the NWT Protected Areas Strategy will also be provided.

Mapping the Geochemistry of Lake Sediments near Yellowknife, NT

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The purpose of this study is to examine environmental properties of lakes in the Yellowknife area to better understand aquatic ecosystems in northern Canada. Forty-nine sediment samples were collected from 19 lakes with similar basin morphology, bedrock, and surrounding vegetation. The samples span 140 km on an east to west transect through Yellowknife along Highway 3 and 4. Lake sediments are characterized by sedimentary grain size, organic matter, and trace element geochemistry. Results of sedimentary analyses are mapped to delineate spatial distributions of six federally regulated trace elements (As, Cd, Cr, Cu, Pb, Zn) in the study area.

Aluminum, iron, titanium, vanadium, and yttrium are highly correlated with one other and co-vary with Pb, but are weakly or not at all correlated with the five other trace elements examined. Total organic carbon (TOC) varies considerably among study lakes but is not correlated to trace elements of concern. Total organic carbon may behave as a diluting factor for the metals fraction in sediment samples, suggesting applicability of this parameter as a normalizing factor to delineate the spatial distribution of chalcophile elements within the study region.

The spatial distribution of TOC-normalized metals display divergent patterns that suggest multiple pathways of transport and deposition and/or discrete areas of natural occurrence. The TOC-normalized distribution of As and Cd show elevated concentrations to the west of Yellowknife with rapid decrease with increasing distance. This pattern may reflect aerial emission and atmospheric transport and deposition associated with mining activities and the direction of the prevailing winds in the region. In contrast, the spatial distribution of Cr, Cu, Pb, and Zn show highest concentrations to the immediate NE of Yellowknife.

2010 Northwest Territories Mineral Exploration Overview

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In 2010, with gold prices rising above $1300US, gold remained at the forefront of exploration. Delineation and/or exploratory drilling was completed on advanced projects: NICO gold-cobalt-bismuth-copper, Yellowknife Gold, Courageous Lake, and Damoti Lake (Indin Lake area) to increase mineral resources; and drilling of the REN project (Point Lake area) was designed to expand lower grade zones adjacent to historic drilled high grade zones.

Exploration for rare earth elements was focused primarily on the advanced exploration of the Nechalacho deposit at Thor Lake.

A resurgence of base metals exploration has returned these commodities to the forefront of exploration along with gold and rare earth elements. This was evidenced by drilling for base metals near Paulatuk and the formerly advanced Wrigley zinc-lead deposit, and delineation/exploratory drilling to increase resources of the currently advanced projects: Prairie Creek zinc-lead-silver; and Pine Point zinc-lead. A small amount of work was conducted on the NWT side of the IZOK lake zinc-lead deposit, with the majority of work in Nunavut. Howard's Pass zinc-lead-silver deposit, straddling the Yukon-NWT border, was drilled on the Yukon side.

The three operating diamond mines, Diavik, Ekati, and Snap Lake, have all recovered from the 2009 slowdown with increased efficiency. Diamond exploration was quiet until three new kimberlites were drilled near Paulatuk this fall, after detailed geophysical surveys were completed. Advanced exploration projects await a recovery in the diamond market; in the meantime companies are taking advantage of re-analyzing and evaluating a large wealth of exploration, metallurgical and geotechnical data. Advanced projects such as Gahcho Kué and DO-27 are well poised for a market resurgence as recent news suggests that demand is greater than supply for gem quality rough diamonds.

The Cantung tungsten mine has recommenced production, after a year-long temporary shut-down, pursuant to a rebound in tungsten prices and an upgraded operational and financial plan.

An overview of 2010 exploration projects will be presented.

Ellef Ringnes Field Project – Update on Activities

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The Geological Survey of Canada undertook a large field project on Ellef Ringnes Island in the summer of 2010 to update geological mapping as well as to conduct new assessments of resource potential. Parrallel with this work several university research projects where supported. A summary of field operations, research being conducted on petroleum systems, and new findings will be presented.

Geothermal Potential in Canada's North

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This paper examines depth-temperature relationships near population centres in comunities in northern Canada in order to provide a first order assesment of EGS potential for electrical generation. Quantities of EGS thermal power output and electrical generation are dependent on output temperature and flow rate. We relate these potential power rates as a whole to drilling and installation cost for the doublet systems and triplet system. Results show areas with significant EGS potential in northern Alberta, northeastern British Columbia, and southern Northwest Territories related to high heat flow and thermal blanketing of thick sedimentary cover.

Maximizing the Potential of your Samples for Greenfields Exploration

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With ever increasing global demand for commodities it is now more important than ever to improve our methods of Greenfields exploration. One way of doing this is maximizing the potential of collected samples. Gone are the days when analyzing for 1 element at a time was considered a practical geochemical approach to exploration. With low detection limits on geochemical data it is now possible to apply geochemistry extensively to greenfields exploration targets. By increasing your analytical elemental suite and choosing packages with lower detection limits it is now possible to see patterns in fingerprinting elements for a variety of deposit types. Lower detection limits also allow explorationists to delineate mineralization deeper than ever before.

This presentation will go through a series of case studies for a variety of deposit types demonstrating what patterns can be seen when detection limits are decreased and different elemental suites are analysed.

Who's Protecting it, Anyway? Protected Areas, Land Use Plans and Other Means of Land Protection in the NWT

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In the Northwest Territories, establishment of most protected areas is coordinated through the NWT Protected Areas Strategy (PAS). In addition to the PAS process, two other processes for protecting areas are at play: national parks establishment and land use planning. All three processes work in association with signed land claim agreements or land claim processes. Where in place, any form of land protection or any protection process must conform to land claim agreements. All processes can significantly change industry access to the land.

This presentation will review the relationship between these processes, outline the differences and similarities of the process for the mining industry, and give a status update on areas being established through the PAS.

Land use planning differs in status or substance in each region in the NWT. Just over 50% of the NWT, covering four regions, has regional land use planning provisions through signed land claim or interim measures agreements. The Gwich'in regional land use plan was approved in 2003. The Sahtu regional land use plan is in Draft 3, with Draft 4 scheduled for next year. The Tlicho agreement includes the possibility for planning on Tlicho lands (underway) and Wek'èezhìi lands (not started). The Dehcho First Nation Interim Measures Agreement provides for the creation of an interim land use plan (underway). No interim agreement for land use planning has been signed for the Akaitcho or Northwest Territory Métis Nation claim processes, and the Inuvialuit claim relies on non-binding community conservation plans rather than a binding regional land use plan.

Through the PAS, there are a variety of candidate protected areas proposed in the Sahtu, Dehcho and Wek'èezhìi regions.

While there are considerable similarities between land use planning and PAS processes, the PAS results in something quite different than regional land use plans. What that is depends significantly on the type of protected area being sought. 'National parks' are often thought of as synonymous with 'protected area'. In reality, a variety of legislative options allow for different levels of development. National parks do not allow industrial development; the legislative designations available through the PAS have more variability. Industry involvement in the process is important to the success of the PAS process and protected area establishment and management.

A Remote Predictive Mapping (RPM) Approach for the Mapping of Surficial Materials North of 60

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The Remote Predictive Mapping (RPM) project which forms part of the GEMS program is developing protocols for producing surficial material maps of large portions of the Canadian Arctic territory that are not well-mapped (i.e "grey spaces"). These maps will contribute to filling in these "grey space areas" assisting the TRI-T compilation of surficial geological maps, an ongoing project also under the GEMS program.

The methodology is based on a supervised classification approach utilizing defined training areas of typical surficial materials defined by Quaternary geologists from the Geological Survey of Canada. As these are predictive maps based on remotely sensed imagery accompanying maps showing the certainty of the classification are also produced using a Monte Carlo technique to bracket both statistical and spatial uncertainty associated with the classification process.

The methodology is discussed using various examples from Canada's North. These examples include the use of both optical and microwave remotely sensed data and the well-known maximum likelihood classification algorithm. Pros and cons of this approach will also be presented and discussed. The eventual aim is to derive a standardized method for producing such maps over large areas thus facilitating regional exploration activity and infrastructure development throughout Canada's North.

The Nechalacho Heavy Rare Earth and Rare Metal Deposit, Thor Lake, Northwest Territories, Canada

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The Nechalacho Heavy Rare Earth Element ("HREE") deposit is located on Avalon Rare Metals Inc Thor Lake property, 100 km east of Yellowknife, NWT. Recent drilling has changed the geological interpretation of the mineralization and highlighted the fact that the deposit is of exceptional size, concentration of REE and especially its unusually high content of HREE (Eu through Lu + Y). Presently published Inferred Mineral Resources are 182.6 million tonnes of 1.40% TREO (total rare earth oxides) and an additional Indicated Mineral Resources of 30.43 million tonnes of 1.64% TREO.

The Nechalacho deposit is hosted by the Aphebian Blachford Lake alkaline layered intrusive complex emplaced within the Slave Structural Province. The Lake Zone REE mineralization is hosted in a tabular hydrothermal alteration zone, in a previously unrecognised nepheline-sodalite syenite unit of the complex. It is exposed over an area in excess of one km^2 and averages 100-150m in thickness. It is characterized by near-complete replacement of the primary mineral assemblage by chlorite, magnetite, biotite, zircon, monazite, allanite, bastnaesite and fergusonite. The deposit exhibits a distinct horizontal layering with

HREE content generally increasing towards the base of the deposit. The lowermost layer, called the "Basal Zone" contains between 1.5 and 2.5% total rare earth oxides (TREO) over thicknesses in the order of 20m, with HREE ranging between 15% and 30% of the total REE present.

A geological model is presented that includes the REE and rare metals being originally precipitated as cumulate minerals as part of the magmatic process, possibly as eudyalite, zircon and other complex REE minerals. Subsequent hydrothermal activity altered these to the presently seen assemblage of REE minerals resulting in bands of REE-Nb-Ta-Zr mineralization dominated by zircon. The light and heavy rare earths may have behaved differently during this alteration process resulting in both REE enrichment and differential zonation of these elements.

The Nechalacho deposit is thus a result of a complex interplay of magmatic and hydrothermal processes, complicating geological interpretation.

The drilling has indicated that the deposit is still open in at least three directions and tonnage expansion is a strong possibility. Drilling continues in order to develop further higher grade indicated and measured resources, but also targeting acquisition of about 20 tonnes of mineralized rock for large scale pilot plant testing.

Building a Policy and Regulatory Framework for Geothermal Development in the NWT

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The geothermal energy industry in Canada is still in its infancy. Geothermal energy is an important part of Canada's energy future, and there are substantial resources in parts of Western and Northern Canada. Geothermal electricity has the potential to provide long-term, low-impact electricity in the North to help displace imported fossil fuels while meeting a growing demand. Key policy and regulatory issues will be defined, and drawing from leading jurisdictions, recommendations will be made for developing a policy framework for geothermal development in the Northwest Territories.

Ni-Cu-(PGE) Mineralization within Mafic and Ultramafic Rocks of the North-Central Churchill Province: New Insights from the GEM Melville Peninsula Project

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As part of the Melville Peninsula Project (GEM-Minerals), geological reconnaissance mapping was conducted to better understand the nature and the distribution of mafic and ultramafic rocks within the Melville Peninsula, Nunavut This survey will allow a modern assessment of the economic potential for magmatic Ni-Cu-(PGE) sulfide mineralization within the Prince Albert Hills area of the Melville Peninsula, with possible implications for the entire Churchill Province.

Beside important iron ore deposits, significant discoveries in base or precious metals are still to be made. Based on the occurrence of numerous gossans and many similarities with other greenstone belts that have

proven mineral endowment, a general optimism exists toward the mineral potential of the region. During the current survey numerous gossans were encountered, including previously known occurrences but also many new gossanous zones were examined. Current inventory reveals more than 350 gossans within the entire peninsula, with a significant proportion of these in association with supracrustal rocks of the Prince Albert Group.

Magmatic Ni-Cu-(PGE) sulfide deposits are associated with a wide range of mafic-ultramafic rocks but, on Melville Peninsula, this type of mineralization mainly occurs within mafic intrusions and ultramafic (komatiitic) flows or intrusions. The best example of mineralization associated with mafic intrusions is the 'Bil showing' drilled by Aquitaine Resources in 1973. This intrusion is approximately 200 x 600 m in size and is dominated by gabbroic rocks. The Ni-Cu mineralization is composed of 10 to 15% disseminated to locally net-textured sulfide hosted in melanocratic grabbroic rocks near the presumed base of the intrusion. The second type of nickel mineralization, associated with ultramafic flows/intrusions, was not recognized until recently when reconnaissance mapping in mid-July 2010 led to the discovery of the Adamson River nickel showing (new name) within the Prince Albert Group. This Ni-Cu-(PGE) sulfide occurrence is hosted by an ultramafic body composed of a well-developed and preserved peridotite, which is presumably of komatiitic affinity. The mineralization is located along the irregular basal contact of the peridotite where it is in contact with underlying mafic volcanic and gabbroic rocks. The surface expression of this showing consist of three small main gossanous zones found within small depressions (2 x 3m) over a strike length of ~35m, where the Fe-Ni-Cu sulfide mineralization varies from massive to semi-massive and disseminated sulfides.

Therefore, this new showing illustrates the opportunity for new Ni discoveries within mafic intrusions and ultramafic flows/intrusions in the Melville Peninsula. Although based only on preliminary results, the geological setting and metal content of this new nickel discovery highlights the fertility and prospectivity of the Prince Albert Group to host komatiite-associated Ni-Cu-(PGE) mineralization not only within the Melville Peninsula but also elsewhere within other parts of this semi-continuous, northeast trending, komatiite-bearing greenstone belt succession interpreted as the Prince Albert and Woodburn Lake Groups (Committee Bay and Baker Lake areas, respectively) of the western Churchill Province.

South Wopmay Bedrock Mapping Project II: Highlights from 2010

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Through systematic and targeted regional mapping, this project aims to provide a cohesive bedrock map of Wopmay Orogen between latitudes 64°30'N and 65°N. In 2010 bedrock mapping operated from Rodrigues Lake (eastern area) and Hottah Lake (western area). Related thematic studies are reported elsewhere in this volume; see Acosta et al., Corriveau et al., Lee et al., Mackay et al., Newton et al., Ootes et al., and Smar et al.

From east to west the main components of Wopmay Orogen are: 1) Archean basement of the Slave craton, 2) Coronation margin, a ca. 1900 Ma Paleoproterozoic cover overlying Slave basement with an internal metamorphic zone, defined by a thrust sequence of cover and plutonic rocks, 3) the north-striking Wopmay fault zone, 4) the Great Bear magmatic zone (GBMZ), represented by ca. 1875-1865 Ma arc-like volcanic rocks and extensive ca. 1865-1855 post-orogenic intrusions, 5) the Hottah Terrane, a basement block composed of ca. 2400-2200 Ma plutonic and metamorphic rocks upon which a ca. 2000-

1900 Ma volcanic arc, rift sequence, and the GBMZ were constructed, and 6) the outboard Fort Simpson Terrane lying beneath the Paleozoic platform.

Two major plutonic phases of the Coronation margin intrude Snare Group metasedimentary and gneissic rocks of uncertain age and provenance. The K-feldspar porphyritic to megacrystic Rodrigues pluton was previously considered part of the syn-orogenic ca. 1885 Ma Hepburn intrusive suite. Field relationships from mapping in 2009 and recent U-Pb zircon data that indicate a crystallization age of ca. 1850 Ma preclude this correlation and raise significant questions regarding the timing of metamorphism, deformation and plutonism in this part of the orogen (Smar et al., this volume). An older suite of plutonic rocks consists of locally foliated K-feldspar porphyritic granite to granodiorite with an earlier phase of diorite to monzodiorite. We interpret these as potential Hepburn intrusive suite counterparts (on previous maps they are assigned to the post-orogenic ca. 1855 Ma Bishop intrusions). Towards Rodrigues pluton, metamorphic grade of the Snare Group increases from greenschist facies slates to upper amphibolite and granulite facies migmatites. Sub-horizontal crenulations, extensional shear bands, and asymmetric porphyroblasts are suggestive of transcurrent and vertical tectonics and require an explanation in the predominantly ascribed thrust-and-fold models for orogen development (Smar et al., this volume).

Highlights from 2010 in the GBMZ include the discovery of flow-banded rhyolite preserved within the granitoids and chalcopyrite-bearing quartz veins in the Bode Lake area. In addition, granitoids tentatively correlated with the Hottah Terrane have been extended eastward within the magmatic zone. Our mapping in the Hottah Terrane confirmed the general lithological subdivisions of the previous maps, but suggests that stratigraphic revisions are required (see Ootes et al., this volume). Intense hematite alteration and possibly uranium mineralization is associated with unconformities, notably at Beaverlodge Lake and central Hottah Lake (e.g., "Mount Doom", Ootes et al., this volume). Magnetic anomalies associated with rocks assigned to the Holly Lake metamorphic suite (the oldest component of Hottah Terrane) were found to coincide with banded magnetite-bearing siliceous rocks (iron formation?).

In 2011, the final field season dedicated to the project, new mapping will focus on the central area, proximal to Wopmay fault zone. Outstanding questions from previous seasons will also be addressed.

An Introduction to the Northern Projects Management Office

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The Northern Projects Management Office (NPMO), contained within the Canadian Northern Economic Development Agency (CanNor), is responsible for coordinating the regulatory work of all federal departments and agencies on large resource development and infrastructure projects in the territories. Working with federal partners, regulatory boards, proponents, territorial and aboriginal governments, the NPMO coordinates federal regulatory participation, tracks project progress, and will maintain the Crown consultation record on northern projects. The NPMO has staff in all three territories and an executive office in Yellowknife.

The NPMO is actively monitoring and coordinating projects, to varying degrees, building strategic linkages with northern regulatory boards, stakeholders, federal partners and other governments, and assisting proponents navigate a multi-faceted, northern regulatory framework. In addition, NPMO is developing and implementing tools intended to ensure review and approval process proceed smoothly on northern projects. The NPMO is uniquely positioned to assist proponents and Aboriginal communities align common interests, opportunities, and leverage government development programs.

The principal venue for gathering project intelligence, issue identification and resolution, and building relationships between federal and territorial regulators will be in project management committees established in each territory. First meetings of the NWT and Nunavut project committees will occur in Fall 2010 with the purpose of establishing business practices, defining roles and responsibilities, developing relationships and operational frameworks.

The Micro-/Macro-Diamond Relationship: A Case Study from the Artemisia Kimberlite Northern Slave Craton (Nunavut, Canada)

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This study focuses on the geochemical signature of diamonds and their sources in the sub-continental lithospheric mantle beneath the Northern Slave Craton using carbon stable isotopic compositions and nitrogen characteristics of diamonds from Artemisia kimberlite. Artemisia is located in the Coronation Gulf Diamond District close to the northern-west margin of the Slave Craton. Of an initial suite of 961 diamonds from Artemisia, ranging in size from 0.106mm to 1.70mm (Tyler sieve class, ie. +0.106mm sieve class), 209 micro- (<0.5mm) and macro-diamonds (>0.5mm) have been evaluated to determine the nature of their genetic relationship.

The carbon stable isotopic composition ($\delta^{13}C$) of a diamond is largely dependent upon the isotopic composition of the carbon source, which is a reflection of diamond paragenesis. Peridotitic diamonds are characterized by a narrow range in $\delta^{13}C$ values about a mode consistent with carbon isotopic values assumed for the Earth's mantle (-5‰). Cumulatively, eclogitic diamonds from worldwide sources display the same mode at -5‰ but show much greater variability in $\delta^{13}C$ (-40 to +3‰). Our results for the Artemisia kimberlite have shown that the micro-diamond population (n=101) ranges in $\delta^{13}C$ from 1.6‰ to -9.3‰ with two modes about -3.0‰ to -3.5‰ and -4.5‰ to -5.0‰. The macro-diamond population (n=108) ranges in $\delta^{13}C$ from -0.2‰ to -24.5‰ and displays a bi-modal distribution about -4.5‰ to -5.0‰ and smaller peak from -3.0‰ to -3.5‰.

Nitrogen is the most common impurity in diamond. Nitrogen abundance and aggregation state in diamond is dependent on the nitrogen concentration in the diamond forming fluid/melt, mantle residence temperature and time. Nitrogen abundances of the micro-diamond population (n=98) range from below the limit of detection (<10at.ppm) to 960at.ppm with the majority of the suite (68%) being characterized as Type II (N below detection) diamonds. Nitrogen abundances of the macro-diamond population (n=108) range from below detection to 1850 at.ppm, with the majority of the suite (61%) being Type IaAB diamonds, with aggregation states ranging between 10 and 90% B (concentrations B/[B+A]).

The diamond suite from Artemisia displays compositional differences between the micro- and macro-diamond size populations. The range of the micro-diamond population is shifted to isotopic heavier values. Additionally, the presence of isotopically light values (<-20‰) in the macro-diamond population, indicative of derivation from an eclogitic source, is not observed in the micro-diamond population. In addition, the proportion of Type II diamonds drops 47% relatively from the micro-diamond population to the macro-diamond population.

The variability in $\delta^{13}C$ and nitrogen characteristics between the micro- and macro-diamond populations is considered to be statistically significant, suggesting variable contributions from distinct diamond source parageneses or distinct diamond forming fluids. This implies that the origins of the micro- and macro-diamond size populations from Artemisia kimberlite may in fact be partially or entirely different.

Skills for Success: Mine Training Creates New Futures

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The Mine Training Society is an innovative partnership between Aboriginal governments, the minerals industry and public government. Operated as a non-profit society, representatives from each of the partners help guide the society through the MTS Board.

The MTS was originally created in the 1990s as an advisory board to the Minister of Education, Charles Dent. Early years saw small training programs developed but it was not until diamonds were discovered that the MTS opportunity mushroomed. In 2004, MP Ethel Blondin-Andrew signed on behalf of HRSDC a multi-million dollar commitment to fund the MTS over 5 years, with the provision that partners would provide matching funding or in-kind services. Working closely with other training partners including Aurora College with its high tech mining equipment simulator, MTS has trained more than 800 people, of which over 580 are employed in the mine and mine services sector.

With the renewal of core funding, the MTS continues to deliver training programs for the minerals industry today. Programs offered have included Underground Miner Program, Mineral Process Operator, Environmental Monitor, Diamond Driller and Medical First Responder. The most sincere form of flattery was felt when the Yukon and Nunavut adopted the Mine Training Society model to deliver mine training in their jurisdictions.

Variability of Active-Layer Freezeback and Implications for Winter Overland Travel, Mackenzie Delta, Northwest Territories

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In the resource-rich Mackenzie Delta region, winter overland access to remote seismic or drilling locations is often required. The impacts of historic overland travel have persisted for many decades causing regulators to seek ways to minimize future environmental impacts. Vehicle travel in early winter over terrain that is unfrozen or lacking sufficient snow cover can cause damage to vegetation, surface erosion, active-layer deepening, and surface subsidence in areas of ice-rich permafrost. These disturbances can lead to increased soil moisture and long-term vegetation change. The purpose of this research is to determine the variability of snow, active-layer freezeback, and soil strength among four common terrain types of the outer Mackenzie Delta in the early winter. Results will contribute to the development of appropriate practices to minimize terrain disturbance associated with winter overland travel. Two years of data have been collected in each of the four terrain types to characterize the natural variability of the ground thermal regime, soil moisture content, snow accumulation, soil strength, and vegetation community composition. Site conditions and freezeback dates vary significantly between the terrain units. A calibrated ground thermal model was used to investigate the effects of changing environmental conditions on ground temperatures in each of the terrain units, including the timing of snow arrival and air temperatures. The modeling demonstrates that the timing of active layer freezeback for a particular terrain unit may vary by several months as a function of early winter snow cover. If frozen ground becomes the key regulatory criteria for overland access in early winter, the timing of on the land access could vary significantly between terrain units and from year to year. Further study is required to examine the relationships between active-layer freezeback, ground hardness and sensitivity of the respective terrain units.

Geothermal Energy 101 and the Geothermal Potential of the Northwest Territories

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Abundant heat energy is stored within and constantly generated (via radioactive decay) by the Earth. Although the geological details of this form of energy are relatively well known, the use of geothermal energy for heating and electrical power generation remains somewhat limited. Countries like Canada and the United States have good potential to harness geothermal energy but have not yet fully researched and capitalized on the opportunity.

This talk provides an overview of geothermal basics and then examines the situation in the Northwest Territories (NWT). Parts of the southwestern NWT and Mackenzie Valley have some of the best potential for deep geothermal energy in Canada. However, to date these resources have not been widely appreciated. Anomalously high heat flows and high geothermal gradients indicate that temperatures of 150 degrees Celsius are reached at depths of less than 5 km, within reach of current drilling technologies. At this temperature the geothermal resource can potentially be used both for district heating and for electricity generation.

Shallower-depth geothermal heating systems, including heat extracted from abandoned mines, also have the potential for future development growth in the NWT. For instance the Con Mine in Yellowknife is currently undergoing a geothermal assessment as a source of district heating.

Geothermal energy developments can be costly and come with a number of associated risks. As high-grade resources are identified, technologies are improved, and other economic conditions change, geothermal energy will increasingly become recognized as a viable source of renewable clean energy. The NWT is well positioned to benefit from this evolution.

Exploration in the Pelly Bay Region

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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 Neoarchean metaplutonic rocks, lesser Archean and Paleoproterozoic supracrustal sequences, and migmatitic gneiss.

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. Diamond exploration at Amaruk focused on the collection of a 25,000 kg mini-bulk sample from the Beluga-3 kimberlite pipe.

Gold exploration was carried out across the Amaruk property and on the central Boothia Peninsula. Numerous areas have shown potential to host significant Au mineralization and half of the budget was spent exploring over 16 showings.

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. Metals and Mining Group (MMG) has signed a letter of intent with

Diamonds North Resources Ltd to explore for base metals, specifically Ni-Cu, on the Amaruk property. In 2010, MMG mobilized a diamond drill, flew an airborne 1400 line kilometre time domain EM-mag survey over the central project area, and conducted prospecting across the property to assess the extent of mafic-ultramafic intrusions and the potential for Ni-Cu mineralization.

Numerous challenges present themselves to companies working in the Northwest Territories and Nunavut. Although we have been implementing cost cutting techniques over the past few years to help mitigate the high costs of northern exploration, exploration dollars are getting harder to come by for early and mid stage exploration projects in Canada's north. Incentives to explore are diminishing and other jurisdictions are attracting more of the limited private sector financing. Industry and all levels of government will need to adapt to this reality if exploration is to continue north of 60°.

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.

3D Seismic Acquisition in the Northwest Territories, Canada

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A transition zone 3D seismic program was executed during the winter of 2007/2008 in the Mackenzie Delta Region, NWT including portions of the Ellice and Langley islands, Mackenzie River channels and the shallow Beaufort Sea.

MGM Energy Corp. operated several Exploration Licenses in the area and contracted Aguila Exploration Consultants Ltd (Aquila) to project-manage the North Ellice 3D geophysical operations. Veri-Illuq Geophysical (a CGGVeritas Company) was the principal acquisition contractor. The survey was acquired during a 111 day period (December 10, 2007 – March 29, 2008). Field operations related to the survey had to begin in September 2007 to pre-position the equipment and camp prior to freeze up of the Mackenzie River.

The 3D survey was located on the northwest edge of the Mackenzie Delta with the transition between onshore and offshore being solidly frozen during acquisition. The survey had 59 receiver lines and 31 source lines laid out in an orthogonal pattern. The program covered 144 sq km and required 4505 Dynamite (on ice) and 2125 Vibroseis (on land) source points to be occupied. The survey was executed using Best Practice environmental guidelines for a Canadian northern seismic operation. Several issues that arose during field operations will be highlighted.

The seismic data processing was contracted to WesternGeco who processed the data to prestack time migration. Processing into a 3D bin grid consisting of 583 inlines (oriented NNE-SSW) and 654 crosslines (oriented NNW-SSE) had to overcame the significantly different seismic responses recorded on the ice compared to data collected over the islands. About 65 % of the source points were drilled dynamite shotholes through floating sea ice. Examples of the raw and final data will illustrate the challenges of processing and interpreting the variable seismic data quality throughout the data cube.

The GEM Diamond Project: An Update of 2010 Activities and a View Forward to 2011

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The GSC in 2010 acquired mantle- and crustal-sounding magnetotelluric (MT) data on a transect from Repulse Bay to Kugaaruk, Nunavut, with support from Diamonds North. Also, in 2010, the GSC installed three teleseismic stations in the Colville Lakes area, with support from Sanatana Diamonds, and a station at Kugluktuk, in addition to maintaining nine stations across the East Arm area (Slave - Churchill margin transect). The GSC moved a teleseismic station from Repulse Bay to the Simpson Lake DEW-line site near Kugaaruk (with support from Diamonds North) and another from north of Rankin Inlet to a location 30 km to the west (support from Shear Minerals). The University of Bristol (UK), in collaboration with the GSC, visited ten teleseismic stations across northern Hudson Bay and on Baffin Island. The GSC repaired stations at Hepburn Lake (Diamonds North), Baker Lake, Chidliak (Peregrine), and at Diamonds North's Amaruk camp. The GSC analysed data from new earthquake records at all of the above stations.

Lower crustal xenolith petrology and geochronology studies on samples from kimberlites located in Shear Minerals' Churchill/Sedna project are currently in progress (D. Petts, Ph.D., UWO). Petts also completed sampling of Stornoway's Repulse Bay area kimberlite cores, and field sampling at Repulse Bay and Amaruk (Diamonds North) kimberlite fields for lower crustal xenoliths. Crustal xenolith studies are in progress for samples from Stornoway's Artemesia kimberlite, in support of a M.Sc. thesis (S. Coombs, UofA). Studies on mantle peridotite xenoliths from Artemesia are ongoing (Ph.D. thesis of K. Mather, Durham University). Mather also completed new method development on paleogeotherm determinations derived from mantle xenolith/xenocryst data sets (see Mather et al., this conference).

Campbell and McMartin conducted Quaternary geology studies (surficial geology mapping, till sampling and glacial transport studies) in the area north of Repulse Bay, including more detailed work in the Repulse Bay kimberlite field to resolve transport direction issues (see Campbell and McMartin, this conference).

Russell, Cummings and Sharpe conducted a detailed field sampling study of kimberlite indicator minerals in sand, pebble, gravel, cobble and boulder facies esker sediments in the New Liskeard area. They also examined the relative survival rates of hypabyssal and fragmental kimberlite rock types in surficial systems via laboratory experiments. New laboratory experiments in progress target the survival of kimberlite indicator minerals (olivine, Cr- diopside, Cr-spinel, ilmenite, Cr-pyrope garnet).

In summer 2011, a number of field studies are planned. These include regional Quaternary mapping in the Wager Bay – Repulse Bay area, and new MT acquisition in the region between Wager Bay and Chesterfield Inlet. Field sampling of kimberlites for petrology studies in Nunavut continues, and mantle and crustal xenolith sampling for university-related thesis studies continues in Nunavut and the Northwest Territories. A major redeployment of teleseismic stations is also currently being examined (extension of Slave – Churchill transect to the southeast, or, infilling and extension of NW Slave margin transect). Detailed surficial indicator mineral studies are planned for the central and/or southern Slave province to re-examine the issue of 'headless' kimberlite indicator mineral trains.

Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park

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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 1 compilation results were used to design the Phase II field studies work plan, which was approved in February 2008. MERA Phase II studies involves 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. In in the fall of 2009 and in 2010 laboratory data acquisition and interpretation, were undertaken, followed by mineral potential modelling and report writing during the summer and autumn of 2010. Deposit types that were identified and modelled in the East Arm area of interest include kimberlitic diamond, volcanogenic massive sulphide, magmatic sulphide, polymetallic veins, base metal veins, uranium-bearing veins, uranium in sandstone, IOCG-like, chromitite and Proterozoic rare metals in syenite and pegmatite. The final report, including internal and external review processes, is expected to be completed by Spring 2010.

The Dynamics of Mega-Scale Permafrost Disturbances and their Effects on Aquatic Systems, Richardson Mountains, NWT

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Permafrost temperatures have increased across the circumpolar north in response to 20th Century climate warming. Amongst the most dramatic landscape responses to changing climate conditions is the increase in thaw slump activity. The largest retrogressive thaw slumps documented in the NWT, (< 10 ha), are developing along the stream valleys that drain the Peel Plateau. A collaborative study involving university and government scientists and community members from Fort McPherson was initiated through the Cumulative Impact Monitoring Program. The aim of the study is to investigate the dynamics of these slumps and the geomorphic, geochemical and ecological implications of these disturbances. In the summer of 2010, time lapse photography of a single large slump was coupled with climate station data. Preliminary analysis shows diurnal patterns in mudflow activity driven by solar radiation and headwall ablation. However, several intense rainfall events in the summer of 2010 saturated the slumps and stimulated the mass movements of scar materials, which exceeded the diurnal pulses in transport volume by an order of magnitude. Our monitoring data provide empirical support for the notion that intense rainfall events can drive the net removal of materials from the headwall area. These events are significant because they can lead to development of large debris flow deposits in valley bottoms, maintain the height of headwall exposures and perpetuate slump growth. Our field data confirm local observation that slump materials have infilled several nearby stream valleys. The impacts of mega-slumps on stream water

quality are also profound. Suspended sediment and ionic concentrations in slump runoff are up to two orders of magnitude greater than in undisturbed terrain. Water quality sensors deployed in impacted and unimpacted streams illustrate dramatic contrasts in turbidity and conductivity. In streams impacted by thaw slumps, turbidity and, to a lesser extent, conductivity, exhibit diurnal variations driven by solar radiation, headwall ablation and slump melt-water runoff contributions. These unique patterns of variation were also evident at the basin scale indicating the significant influence these mega-disturbances can have on the geochemical and sediment regimes of northern streams.
A summer increase in sulphate concentrations over the past four decades in the Peel River suggests that permafrost degradation is also influencing the geochemical flux in the large northern rivers.

Petrography of Kimberlites and Mantle Xenoliths: Solid Foundation or Slippery Ground?

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Rock sampling and examination of thin sections is a key first step in all geochemical and petrological studies. Petrographic techniques are used to assign correct rock names, select specimens for further analyses, isolate mineral associations and reconstruct the history of rock formation. These are crucial to geological models of mineral deposits and magma genesis, paleotectonic and thermobarometric reconstructions and theories of lithospheric processes**.** Correct and thorough petrographic analysis is therefore vital for geological models. Yet too often thin sections are examined hastily or even not studied at all, turning petrographic analysis from solid foundation and into a slippery ground.

Hypabyssal kimberlites often assimilate crustal xenoliths and crystallize pseudo-primary minerals. Assimilation of felsic xenoliths causes kimberlite melt to become enriched in Si and Na and to crystallize pectolite, diopside, melilite and phlogopite, as happened, for example, in the 5034 pipe of the Cambrian Gahcho Kué kimberlite cluster (Slave craton, northern Canada). These "hybrid" minerals are evenly distributed throughout the kimberlite groundmass, and their connection with "digested" xenoliths is not immediately evident. Rushed petrographic examination of such rocks can lead to their inaccurate classification as Type II kimberlites or to erroneous large-scale constraints on the origin due to their isotopic compositions intermediate between Group-I and Group-II kimberlite.

Assimilation of chloride-bearing carbonate xenoliths and evaporates lead to an atypical mineralogy of the kimberlite, as in the Udachnaya-East kimberlite (Siberia). The kimberlite contains uncommonly abundant olivine microphenocrysts, no primary groundmass serpentine, and crystallizes hybrid alkali carbonates, gypsum, sodalite and chloride minerals. The assimilation occurs at relatively high, magmatic temperatures and causes a reset of the Sr isotopic system and a capture of Cl-rich fluid inclusions in olivine fractures. An erroneous interpretation of these features as primary and mantle-related unjustifiably calls for "significant rethinking of the kimberlite parental melt compositions and melting processes responsible for kimberlite formation".

A major hazard for petrologic studies of xenoliths is the inability to recognize petrographic and mineralogical signs of reactions between primary mantle minerals and late hydrous fluids, which may be kimberlite-related. The strong interaction with the fluid causes recrystallization of peridotitic pyroxenes and spinel and formation of phlogopite and chlorite, but a less intense reaction leads to selective leaching of Al from pyroxenes. Using peridotites of the Gahcho Kué kimberlite as an example, we will demonstrate subtle textural features indicative of the latent fluid-mantle interaction. If the petrographic evidence for the interaction is not examined thoroughly, the altered pyroxene compositions could be used for thermobarometry. This, in turn, results in the significant underestimation of pressures and temperatures and erroneous constraints on mantle lithological columns and geotherms. Geochemical properties acquired due to late penetration of pre-kimberlite fluids may be mistakenly assigned to the steady-state shallow Archean mantle stratigraphy. Petrographic analysis is therefore vital for ascertaining the textural and chemical equilibrium between minerals used for thermobarometry and for ascribing calculated pressures and temperatures to the correct "time slice" of the evolving mantle.

Hidden Lake Mine Site Remediation

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The Hidden Lake Mine is located on the eastern shore of Hidden Lake within the Mowhi Gogha De Nitlee area, as defined in the Tłįchǫ (Tlicho) Land Claims and Self-Government Agreement, and proximate (45 km east) to Yellowknife and the Akaitcho Dene First Nation communities of Dettah and N'dilo. Hidden Lake Mine was also called the Ragged Ass Mine, which is also the name of the "Ragged Ass Road," a popular historic location in the City of Yellowknife. The mine was originally staked in the 1930s and worked between 1940 and the late 1960s. Water problems ultimately resulted in the closure of the mine. The Hidden Lake Mine existed as an abandoned site under management of Indian and Northern Affairs Canada (INAC), Contaminants and Remediation Directorate (CARD), with assistance from Public Works and Government Services Canada (PWGSC).

The mine site was a small scale/advanced exploration site that produced a small amount of tailings actually milled on site. It consists of two camp areas and the mine area proper. Until 2010 it was impacted with debris, hazardous materials, and soil contaminated by tailings and petroleum hydrocarbons. INAC completed the remediation of these impacts and decommissioned the abandoned shafts in June 2010. This presentation summarizes the remediation process for the mine site.

Onsite work for the remediation project began in March 2010 with the construction of a winding 13 km winter road, and the hauling of remediation equipment; summer access to the site is by float plane, helicopter or boat only. All the necessary heavy equipment was imported including an excavator, loader, generators, portable camp and trailers, site vehicles, and containers to store hazardous waste. The equipment was winterized and locked down until snow-melt.

In June 2010, decommissioning and clean-up of the site began. In total, approximately 200 tonnes of mostly metal debris was removed and containerized; mine machine of cultural value was separated for preservation by the NWT Mining Heritage Society. Asbestos and lead paint containing materials were collected, and the mine tailings and hydrocarbon contaminated soils were excavated, isolated and contained. Confirmatory samples were collected and analyzed at an accredited laboratory. In total 90 containers of hazardous material were staged onsite; including 61 containers of contaminated tailings, and 27 containers of hydrocarbon contaminated soil, and 2 containers of asbestos/lead paint debris. The remedial works included re-grading of waste rock in the mine area to suitable slopes and capping of the abandoned shafts. One shaft was decommissioned using rock fill, the other using an engineered rock-filled stabilized concrete cap designed in accordance with the *Ontario Mining Act*.

Fish Habitat Compensation and Mining in the North

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Fish and fish habitat are protected under a variety of federal, territorial and provincial regulatory acts and principles, including the *Fisheries Act*. The Act prohibits the "harmful alteration, disruption, or destruction (HADD) of fish habitat" through physical, chemical or biological means without an authorization. However, the construction of mines almost always involves the construction of infrastructure over fish-bearing waterbodies. Examples of these structures include tailings impoundments within lakes, pilings for large bridges and rock-filled dock structures.

Under Section 35(2) of the *Fisheries Act*, any project or activity that causes a HADD requires an authorization from Fisheries and Oceans Canada (DFO). One of the requirements to obtain a fisheries authorization is the development of a Fish Habitat Compensation Plan that will identify the HADDs and propose the construction or enhancement of fish habitat to compensate for the lost habitat. A Plan is also required for a listing under Schedule 2 of the Metal Mining Effluent Regulations (MMER), which is specific to tailings impoundments. This presentation will review two northern case studies and the habitat compensation measures that were undertaken in a marine and a freshwater environment in order to be granted fisheries authorizations.

The EKATI Diamond Mine has two compensation projects that are currently being monitored. The first is the Panda Diversion Channel (PDC), which was built in 1997 to compensate for stream habitat lost as a result of mining activities. Various structures such as rock groins, boulder clusters, rocky ramps, and rock vanes were constructed within the channel to enhance complexity. Monitoring of the channel over the last 13 years has demonstrated that the PDC serves as productive fish habitat for Arctic grayling and other fish species. The second compensation project at EKATI involved the placement of gravel pads within a stream over a three-year period (2005 to 2007) to enhance spawning habitat as compensation for bridge construction. Monitoring results have shown that the enhancement is successful and that the pads are being used for spawning by two fish species.

For the Doris North Mine in Nunavut, four underwater rock reefs (shoals) were built in the marine environment as compensation for the construction of a barge landing jetty. As part of the monitoring program conducted in 2009, several variables were monitored including algae, invertebrates, and fish. Results indicated that periphyton and benthic invertebrate communities found on the shoals were similar to nearby natural shoals and that fish were seen in greater abundance on the constructed shoals. These results suggest that the enhancement has been successful at replacing productivity lost at the jetty site.

Mine construction often involves the necessary disruption of natural fish habitat, leading to an increasing need for compensation and enhancement projects. These case studies demonstrate that with proper planning and follow-up monitoring, compensation projects in the Arctic can be successful in achieving the principle of "No Net Loss" required by DFO.

The Cumulative Impact Monitoring Program (CIMP)

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The Cumulative Impact Monitoring Program (CIMP) is an environmental monitoring program that assesses the cumulative effects of development and reports on the health of the environment in the Northwest Territories (NWT). The program is designed to guide and support the collection and analysis of environmental data relevant to northerners and to make that information accessible to decision-makers, communities and the general public. The CIMP multiparty working group has articulated the mission statement "*To watch and understand the land and to use it respectfully forever*". This broad objective will be recognized by supporting the following activities: A) Facilitating governance and partnerships including coordinating and funding a network of public, private and community-based partners that conduct environmental monitoring and research, and providing oversight and administration of the CIMP program; B) Supporting and guiding the collection, analysis and syntheses of environmental information and the delivery of workshops and training; C) Developing and maintaining an Information Management System which includes developing an information portal and supporting a data management network; and D) Reporting and communicating which includes the production of public reports, academic publications and the NWT Environmental Audit. In 2010, CIMP funded over 20 projects to conduct environmental monitoring and research, traditional knowledge and capacity building activities throughout the NWT through a Request for Proposals (RFP) process. An enhanced RFP process in the future will ensure that high-quality monitoring and research projects are conducted in a partnership approach and yield accessible and relevant environmental information. The next CIMP Annual Request for Proposals will occur in early 2011. The NWT Environmental Audit is also underway and is anticipated to be completed in December 2010, along with the Supplementary Report on the Status of the Environment. CIMP is in the process of developing or promoting existing data collection protocols, and will work with partners towards developing a broader framework which articulates the steps, approaches and principles involved with initiating and implementing environmental monitoring and research projects that yield information relevant to northern communities and decision makers.

Geophysics of the Great Bear Magmatic Zone – Northwest Territories

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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. Moreover, several episodes of volcanism or sedimentation form cover sequences over older units, making it difficult with field work to explore with solely geological criteria the deposits they may host. 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 optimize 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.).

An understanding of the geological framework and localized structural constraints are critical to hydrocarbon and mineral deposit exploration. Map products prepared from available geophysical data were used to outline the distribution of possible geological contacts. These include lineament tectonics, multiple-scale derivatives, and signal curvature analysis. Lineament tectonics has been used successfully to delineate global oil and ore deposits as lineaments provide information on terrane boundaries, fault and fracture systems, and intrusive bodies. Multiple-scale derivatives and signal curvature allow for filtering geological sources at various depths and spatial extents.

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, for example, alteration due to magnetite or hematite replacement is resolved through magnetic surveys. As a follow-up to field work completed in 2009, additional local scale magnetic susceptibility measurements and paleomagnetic samples were collected over the NICO and Sue-Dianne deposits during the 2010 summer field season. These are used as geological and geophysical constraints for interpretation of additional potential areas of mineral interest and contribute to related studies being conducted by Corriveau et al. and Acosta et al.

Amendment of the Mackenzie Valley Resource Management Act

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What is the *Mackenzie Valley Resource Management Act*?

The *Mackenzie Valley Resource Management Act* (1998) creates an integrated co-management regime for land and waters in the Mackenzie Valley, as set out in the Gwich'in, Sahtu and Tlicho comprehensive land claim agreements. More specifically, it establishes land use planning, land and water regulatory and environmental impact review structures for the Mackenzie Valley in the Northwest Territories.

The Act establishes a number of principles related to resource management in the Mackenzie Valley, including:

- Co-management of resources through institutions of public government (boards)
- An integrated system with clear jurisdictional roles and responsibilities
- Opportunities for the participation of residents of the Mackenzie Valley in the management of its resources for the benefit of the residents and other Canadians

The Act is composed of seven Parts: general provisions respecting boards (Part I); land use planning and the establishment of associated boards (Part II); land and water regulation and the establishment of associated boards (Parts III and IV); environmental assessment and the establishment of the associated board (Part V); cumulative impact monitoring and audit (Part VI); and transitional provisions and consequential amendments (Part VII).

Why amend the *Mackenzie Valley Resource Management Act* now?

Various studies, reviews and audits over the years have highlighted issues and problems with the Act, including the lack of timelines, term of board appointments, issues with referral of projects to EA, orphan measures, need for additional definitions in the Act, amongst many others.

What is the process for amending the *Mackenzie Valley Resource Management Act*?

As a result of these issues, as well as the calls for change that have come from stakeholders, the Act will be amended over the next year as a key deliverable for the Action Plan to Improve Northern Regulatory Regimes. Working with NWT Aboriginal organizations, the Government of the NWT, boards and other interested parties, INAC will amend the Act to:

- Improve efficiency and address ambiguities and duplication
- Add modernizing elements to the legislation
- Implement the amendments agreed to through the Joint Examination Project (Mitchell Review)
- Implement the results of the Pollard negotiations regarding the restructuring of the land and water regulatory regime of the NWT (if required)
- Implement any necessary housekeeping amendments that have arisen since the Act was introduced

Con Mine – A Heating Resource – Today's Opportunity for Tomorrow's Future

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The City of Yellowknife is evaluating the potential for a community energy system to provide heating services to buildings in the downtown core. The basic concept involves recovering heat from the abandoned Con Mine approximately 1 km outside of downtown to heat buildings via a network of distribution piping. Biomass and heating oil capacity is also included to reduce costs, limit reliance on a single source, and allow fuel choice flexibility.

Cultural Considerations in Environmental Impact Assessment and Project Planning

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The Mackenzie Valley environment includes people, the resources they rely on, and the places and spaces they live in and value. As outlined in the *Mackenzie Valley Resource Management Act*, one of the Mackenzie Valley Environmental Impact Review Board's guiding principles for environmental assessment (EA) is to have regard for " . . . the protection of the social, cultural and economic well-being of residents and communities in the Mackenzie Valley". Another is "the conservation of well being and way of life of the Aboriginal peoples of Canada and who use an area of the Mackenzie Valley".

Both guiding principles require full consideration of potential cultural impacts a proposed development may have, alone and in combination with other activities. Impacts on traditional harvesting, access to land for traditional activities, sensitive burial sites and spiritual places, and the contributions of development to the loss of language and other valued components of Aboriginal culture have been raised in many recent Mackenzie Valley EAs. Aboriginal input to these EAs regularly highlight that the health of their culture and people depends on the health of their land, language and means of transferring knowledge to future generations.

Despite their importance and prevalence, the treatment of cultural considerations during project planning (including during EA) remains a challenging and controversial field. Perspectives of different stakeholders vary as to what constitutes a cultural impact, how they are contributed to by industrial development, how to determine their significance, and what (sometimes, even whether) mitigation can be used to minimize the cultural impact of a proposed development.

This presentation will focus on the author's work with the Review Board, most recently drafting *Cultural Impact Assessment Guidelines* for a forthcoming public comment period. It will also draw from a co-authored chapter (with G. Gibson and C. O'Faircheallaigh) in the new edition of the Society for Mining, Metallurgy and Exploration's *Mining Engineering Handbook*. The talk examines how industry can conduct respectful cross-cultural engagement, understand and appreciate cultural differences earlier in the corporate-community relationship, recognize the warning signs of potential cultural impacts from a project, conduct (or facilitate) effective cultural impact assessment and significance determination, and work with culture groups to proactively and cost-effectively mitigate predicted cultural impacts. The presenter will identify ways to minimize risks to Aboriginal cultures and to project success, and how developers can work proactively with Aboriginal communities to find solutions, both inside and outside the formal EA process.

Investigation of Cause at a Closed Gold Mine: The Insight, Implications and Consequences of Conducting an IOC Study in a Year without Effluent

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The Con Mine, a closed gold mine in the Northwest Territories entered into Investigation of Cause (IOC) under the Canadian Environmental Effects Monitoring (EEM) program in 2009. The mine was one of the first in Canada to enter into IOC. Treated effluent at the mine exceeds Canadian water quality guidelines for the protection of aquatic life, in particular for ammonia and some metals, and effects in fish were detected in two consecutive studies in 2005 and 2008. Although there was no discharge of effluent in 2009, the mine was required to conduct IOC. While seemingly counter-intuitive to conduct an IOC without effluent, this IOC did allow the opportunity to look for a change in the pattern of response in fish. The Phase 3 EEM program was thus designed to address the question: what caused the response pattern of fish in the exposure area? Two surveys were completed in fall 2009: (1) a non-lethal young-of-year survey to investigate the differences between a period of effluent and no effluent discharge; and (2) a lethal adult survey examining liver histology and appropriate biomarkers of exposure. The study included water quality, sublethal toxicity testing, and an update on the effluent dilution and dispersion model. A weight of evidence approach was used to identify the cause of effects at the exposure area. Based on available information, the most likely explanation of the pattern of response in Phases 1 and 2 was identified as differences between the exposure and reference areas in concentrations of nutrients or major ions, in particular ammonia, nitrates, and chloride/sulphate. Implications of this study to both the mine and industry will be discussed.

Understanding the Lithosphere beneath Arctic Canada – An Example from the N. Slave Craton

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While a detailed understanding has been gained of the deep lithosphere beneath the central part of the Slave Craton, the age and chemical characteristics of much of the remaining craton – and that beneath the rest of Arctic Canada - remains rudimentary. The GEM program, together with a recently funded CERC initiative at the University of Alberta, aim to improve this understanding via detailed petrological and geochemical studies of mantle samples, integrated with new and existing geophysical constraints. Here we report the results of a GEM-funded project that has studied mantle xenoliths from the Artemisia kimberlite, N. Slave Craton.

A collection of >100 mantle xenoliths was recovered from the Artemisia kimberlite during joint sampling with Stornoway in 2009. A sub-set of peridotites from this suite has been characterized for mineral compositions, bulk rock chemistry and Re-Os dating. Peridotites from this locality were extensively serpentinised leaving little of the original mineralogy, or were poor in/devoid of cpx, hampering the application of traditional thermobarometry techniques. We have applied new trace element thermometry approaches to garnets and olivines to try to constrain equilibration temperatures and hence estimate depths of derivation by extrapolation to a geotherm.

New Re-Os dating results for Artemisia peridotites show a predominance of Meso-Proterozoic depletion ages, with Archean ages being scarce. Mixture modeling picks out a dominant component (70% of the dataset) at 1.1 +/- 0.1Ga, with a secondary component (~ 305) at 1.9 +/- 0.1 Ga suggesting either significant new lithosphere generated at these times, or major re-working of existing Archean lithosphere. This contrasts with central Slave craton peridotites such as at Ekati and Diavik where Archaean ages predominate (55% of data define a component at 2.6 Ga from mixture modeling) with subsidiary younger components (e.g., 0.9 +/- 0.1 Ga, 17% of data). We note a clear and progressive trend of an increasing proportion of Meso-Proterozoic ages with increasing distance North from the Central Slave Province. This effect may reflect the increasing influence of the Wopmay Orogeny (1.9-2.1 Ga) and thermal effects relating to the McKenzie Plume head (1.27Ga). We discuss the possible role played by large scale thermal events in the evolution of the Slave lithosphere and its diamonds and show how newly developed analytical techniques can be applied in the study of the Canadian Arctic Lithosphere.

We thank John Armstrong and Stornoway for logistical assistance.

The Geology of the Redstone Copperbelt

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The Redstone Copperbelt spans an arcuate zone within the Mackenzie Mountains of approximately 300 km x 15 km and is primarily hosted in Neoproterozoic strata belonging to the Coates Lake Group and to a lesser degree, the Rapitan Group. At the Coates Lake deposit a NI-43-101 compliant inferred resource contains 1.3 Mt of Cu within 33.6 Mt ore @ 3.92% Cu with 9 g/t Ag. This deposit stands out as the largest discovered deposit of the copperbelt, the remainder of which comprises many other showings and minor deposits. The Redstone Copperbelt has many similarities to the Central African Copperbelt or the

Central European Kupferschiefer and mineralization conforms to the sedimentary rock-hosted copper deposit model.

A six week field season was completed in 2009: field work focused on the examination of 16 copper showings or deposits across the copperbelt supported by the logging of core from the Coates Lake deposit and the Keele River showings. In 2010, nine weeks were spent mapping and measuring sections in the Coates Lake, Hayhook and Keele River embayments: failed intracratonic rift basins filled with red-beds and evaporites that are capped by a transgressive marine sequence.

At least two episodes of mineralization were observed. The 'early' phase comprises stratiform disseminated chalcocite-bornite-chalcopyrite hosted in strata of the Transition Zone between the Redstone River Formation and the Coppercap Formation. The 'early' phase of mineralization can be accompanied by veining and locally it is spatially related to NE-SW trending synsedimentary growth faults. Mineralization occurs as copper or copper-iron sulphides that are generally zoned across a reduction-oxidation front: from the oxidized to the reduced side of the front the assemblage comprises chalcocite-bornite-chalcopyrite-pyrite. Mineralization is hosted within more permeable, reducing lithologies, including fenestral limestones and dolostones. The orebodies are generally stratiform but can be pod-like, linear or sinuous and can show no stratigraphical control. Previous workers have postulated early diagenetic mineralization, however mineralization may be low-temperature hydrothermal or late diagenetic in origin.

The 'late' hydrothermal phase comprises chalcopyrite-tetrahedrite-bornite hosted within dolomite-calcite-quartz veins, breccias or vuggy hydrothermal dolomites and is often found in structural traps. These traps include: unconformities; stratigraphical pinchouts; mega-conglomerates; fault zones; and within the hinge zones of early-formed antiforms. In the area of the historical Nite showing, spectacular large scale synsedimentary folds are developed in the Sayunei Formation and Coates Lake Group. These folds developed due to early folding that occurred during the deposition of the Sayunei Formation likely to be caused by either slump folding or salt tectonics. The 'late' phase is observed over a wide stratigraphical interval spanning the Little Dal Group Upper Carbonate Formation, throughout the Coates Lake Group to the Shezal Formation encompassing significant regional unconformities. Mineralization is observed to occur in rocks of relatively high permeability where fluid flow has been focussed. Synsedimentary growth faults may provide vertical fluid pathways for mineralizing solutions in addition to their role in controlling basin architecture and facies changes. The Redstone Copperbelt shows a prolonged history of basin-wide fluid flow and hosts multiple stages of mineralization.

Component Distributions in Kimberlites: A Case Study using Olivine from DIAVIK, NWT

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Olivine is commonly cited as a possible indicator of diamond grade. Similar size ranges, shapes and densities between olivine and diamond allow for the hypothesis that, if behaving as isolated, solitary crystals, olivine crystals and diamonds may exhibit similar behavior in kimberlite eruptions. To test the hypothesis, population properties from both olivine and diamond in pyroclastic kimberlite must be collected and compared. However, direct comparison of the distribution of olivine and diamond crystals in pyroclastic rocks is inherently problematic: the volume of rock required to collect statistically significant numbers of crystals (e.g., 600) for each component is drastically different (V_d = 3,000 – 6,000kg; V_{ol} = 0.5kg). For example, a characteristic crystal size distribution (CSD) for diamond cannot be defined for scales of observation smaller than several tonnes (i.e., 2-4 m^2), while a representative CSD for olivine can be defined within a thin section. Thus, because olivine is easier to statistically quantify at smaller scales of observation, it may be better suited than diamond CSD data to describe component distributions within some kimberlite pipes.

For example, mean stone sizes (MSS) of a population of diamonds from best-fit model equations are typically used to describe diamond CSDs for specific deposits of kimberlite (Chapman and Boxer, 2004). Calculation of a MSS can be accomplished for global (throughout the entire pipe) or local scales. The degree to which a mean stone size is consistent throughout the deposit is reflective of the homogeneity (i.e., stationarity) in particle distributions. Here, olivine CSDs are collected from 15 sample locations and multiple scales of observation within a pyroclastic kimberlite deposit by image analysis. The CSDs are used to test a second hypothesis that a single central value (i.e., median or mean crystal size) can accurately describe component distributions for olivine within volcaniclastic kimberlite at deposit scale.

Samples from within a single kimberlite body at Diavik are found to have statistically different central values. Thus, at the deposit scale (100 x 100m), olivine crystal populations within a volcaniclastic deposit of kimberlite cannot be defined by a single mean central value. This result has possible implications on the use of olivine towards more accurate diamond grade estimation for drilled areas of kimberlite pipes lacking grade data.

Advancements in the Blachford Lake Intrusive Suite Project; Mapping Results and Preliminary Geochemistry

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The Blachford Lake Intrusive Suite (BIS) is located along the northern shore of the Hearne Channel in the East Arm of Great Slave Lake, Northwest Territories. Phases in this Aphebian alkaline intrusive suite range from gabbro to nepheline syenite, and hosted in the most evolved phases is the world class Nechalacho REE deposit. By studying the petrogenesis of the BIS as a whole, this project aims to gain insight into the fundamental controls on REE mineralization.

The 2009 and 2010 field seasons involved mapping and sampling of all discreet phases within the BIS, as well as potentially associated rocks within the East Arm, e.g. Simpson Island Dyke (SID). Mapping within the BIS identified numerous heterogeneities and new crosscutting relationships that were not documented during previous regional mapping, including an exposure with evidence of magma mixing / immiscibility between the Grace Lake Granite and a more mafic phase. Detailed mapping of the two Compton Intrusive units indicates the presence of a brecciated layered mafic intrusion, which was disrupted by the emplacement of the two small pipes. In addition, the observed crosscutting relationships between the Compton Intrusives and late Hearne diabase dykes conflict with the age estimate for the intrusives, and therefore the nature of their relationship with the BIS. Fieldwork on the SID resolved discrepancies in previous mapping, and added to the understanding of emplacement dynamics for the anomalous composite dyke.

Trace-element geochemistry and Sm-Nd systematics of samples from the 2009 field season, suggest that the Western (ε_{Nd} +0.83 to +3.39) and Eastern lobes (ε_{Nd} +1.05 to +3.39) of the BIS are genetically related to a single source, comparable to the SID (ε_{Nd} +0.90). If the BIS and SID can be conclusively linked, both temporally and compositionally, they could be used to independently model various processes controlling evolution of these alkaline magmas, constrain the areal extent of the source, and evaluate the possibility of a mantle plume. Future fieldwork will also investigate other temporally related alkaline complexes within the southern Slave province (e.g. Big Spruce Alkaline Complex, Squalus Lake, Duck Sill), so these too can be compared to the BIS and SID.

Field relationships, preliminary radiometric dating and geochemistry all indicate that the BIS formed from periodic injections of one or more evolving but coeval deep-seated chambers. Additional geochemical and isotopic analyses of samples from the 2010 field season will be used to further substantiate this hypothesis, and resolve the discrepancies related to the Compton Intrusives.

Microstructures, Metamorphism, and Mineralization in the Link Between Hope Bay and Elu Greenstone Belts, NE Slave Craton

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The Elu greenstone Belt (EB), in the northeast Archean Slave Craton, is underexplored compared to the adjacent Hope Bay Belt (HBB) known to host important gold deposits. Field mapping in the Elu Link that joins the two N- to NE-trending belts has delineated pillowed metatholeiites with subordinate interleaving metadacites ± metarhyolites and discrete metapsammites and iron formation. The rock sequence, deposited in a back-arc setting where it suffered D_1+D_2 fabric-forming deformation phases, forms discontinuous lenses of various sizes and orientations intruded by syn- to late-D_2 sheet-like bt ± am metagranites and am ± bt metagabbros. A syn-D_1 migmatitic orthogneiss in the EB eastern flank indicates a progressive eastward metamorphic gradient and shows that the Elu Link represents the deep level equivalent of the HBB. The entire rock assemblage is cut by late NE-trending dolerite and granite pegmatite dykes.

S_1+S_2 strain fabrics associated with F_2 microfolds in the supracrustal rocks and the migmatitic gneiss, as well as S_2 foliation in the metagranites and the metagabbros, are defined by the Crystal Preferred Orientation (CPO) of insoluble minerals (chl, ms, bt, and am). The rocks generally depict a bimodal grain size distribution with fine grains (≤0.2 mm) occurring along conjugate microshear bands and open fractures amid coarser grains (1-2 mm) defining pinch and swell microstructures. Plagioclase and quartz grains, in particular, commonly show aligned boundaries parallel to S_1+S_2 fabrics. This together with the occurrence of abundant quartz and epidote veins in the host rocks suggests that solution creep and grain boundary sliding were the main flow mechanisms during D_1 and D_2. The rock-forming minerals in the dolerites and the pegmatites show no CPO.

Three main metamorphic mineral assemblages (M_1-M_3) can be texturally defined relative to preserved magmatic mineral relics (M_0) found in syn- to post-D_2 intrusions. M_1 assemblage including S_1-forming minerals occurs exclusively in the supracrustal rocks and the orthogneiss. M_2 including S_2 fabric minerals are common to both syn-D_2 granitoids and their hosts, whereas M_3 minerals lacking any CPO occur in all the rock units. M_1 and M_2 assemblages define post-hydrothermal prograde and retrograde metamorphism, respectively, with peak conditions in epidote-amphibolite facies. By contrast, M_3 is a greenschist mineral association illustrating static recrystallization.

No native gold has been observed, but M_1-M_3 base-metal sulfides and As-Au-Cu-Zn anomalies occur irrespective of the rock type including the migmatites. The mineralization was likely amplified by emplacement of the metagabbros. M_1 sulfides are locally folded, form inclusions in titanite blasts, and depict strain fringes. M_2 grains parallel S_2 fabrics and D_2-microshear zones, whereas M_3 sulfides form euhedral grains with inclusions of early-formed ones. These three sulfide generations suggest superimposed magmatic and tectonometamorphic hydrothermal histories in the Elu Link.

The Melville Peninsula Geology Revisited: A Contribution to the GEM Program

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The Melville Peninsula Project, part of the Federal Government Geo-mapping for Energy and Minerals (GEM) Program, aims to renew the regional geoscience knowledge, and to stimulate mineral exploration to support economic and societal development of northern communities.

Melville Peninsula is located in the north-central Rae Craton of the western Churchill Province (wCP). In essence, the wCP is a collage of polymetamorphic and polydeformed Archean cratons and micro-continents including Rae, Hearne and Meta Incognita, in part unconformably overlain by Paleoproterozoic sedimentary sequences and intruded by various suites of predominantly intra-plate Proterozoic magmatic suites. It is characterized by widespread tectonothermal reactivation related to the NUNA assembly (1.95-1.80 Ga.).

Melville Peninsula comprises four contrasting lithotectonic subdivisions: i) a northern granulite-facies orthogneiss block, ii) the Prince Albert terrain, comprising Meso- to Neoarchean crust singled-out by inliers of Prince Albert Group volcanosedimentary rocks, itself further reworked to the southeast along with iii) the Paleoproterozoic Penrhyn Group cover sequence as the Foxe Fold belt, the latter flanked by iv) the Repulse Bay block across the Lyon Inlet boundary zone. Rock units and structural fabric across Melville Peninsula allow for bridging the geology of the wCP with that of Baffin Island.

Prince Albert Group rocks occur as three main belts, two located in the Prince Albert Hills in the west, and a more extensive belt of +150 km of strike length in the east centered on Roche Bay and its iron deposit. The largest of the western belts is traceable unbroken for over 50 km, and extends discontinuously as multiple-kilometre-size panels across the peninsula. Prince Albert Group belts on Melville Peninsula bridge the Committee Bay belt and the Eqe Bay belt of central Baffin Island. However, in spite of sharing many lithological similarities, individual belts are distinguished by characteristic extrusion ages (ca. 2970 and 2770-2760 Ma).

The south-central part of Melville Peninsula is underlain by metamorphosed siliciclastic and carbonate units of the Paleoproterozoic Penrhyn Group, an epicontinental sequence intruded by voluminous and compositionally-varied, potentially continental arc-related plutons predating NNW-vergent Foxe Fold Belt deformation. Some strata of the Penrhyn Group are correlative with the Piling Group of central Baffin Island (e.g., Flint Lake and Longstaff Bluff formations). However, the Penrhyn Group appears to be stratigraphically more complex, suggesting intra-basinal facies variations. Although numerous “Bravo Lake formation-like” units consisting of sulphide-rich siliciclastic and chemogenic rocks are present, Melville Peninsula is lacking abundant basaltic flows that are a hallmark of the Bravo Formation on central Baffin Island. Reconnaissance mapping of the Repulse Bay Block of southern Melville Peninsula reveals close lithological and structural similarities with the Meta Incognita micro-continent on Baffin Island with which it is expected to be correlative.

Glacial ice-flow studies in the north-central Melville Peninsula are indicative of a three stage history involving i) NW-W (LGM?), ii) W, converging to Garry Bay (deglacial) and iii) SE, ice flow reversal to Foxe Basin (deglacial). This provides important clues for the proper interpretation of till geochemical and indicator mineral dispersion patterns.

Clarity and Certainty in Land and Water Board Processes

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In March 2008, the Mackenzie Valley Land and Water Board (MVLWB), the Gwich'in Land and Water Board, the Sahtu Land and Water Board, and the Wek'èezhìi Land and Water Board established the Standard Procedures and Consistency Working Groups. The purpose of these Working Groups is to improve regulatory consistency and clarity across the Boards, while recognizing regional differences.

Six Standard Procedures and Consistency Working Groups were established:
#1 Public Engagement and Consultation
#2 Plan Review Process and Guidelines
#3 Water/Effluent Quality Guidelines
#4 Terms and Conditions
#5 Data Standards and Sharing
#6 Application Processes

Products being developed by the Working Groups include:

- A public engagement and consultation policy and guidance document
- Waste management guidelines
- Closure and reclamation guidelines in collaboration with Indian and Northern Affairs Canada and interested landowners
- A water and effluent quality policy (i.e., how to set EQCs and other terms and conditions relating to the deposit of waste)
- A standard list of terms and conditions for water licences and land use permits
- An improved online registry
- A complete valley-wide water licence applications process guidance document
- A complete valley-wide land use permit applications process guidance document

The Working Group initiative began prior to the Federal Government's appointing of Neil McCrank whose report, *The Road to Improvement*, offers suggestions on how to streamline regulatory systems in the North. The MVLWB, after almost twelve years of growth and maturation through direct experience, understands that there are shortcomings in its operations, and the Working Groups are designed to address those weaknesses and overcome them with recommendations for improved practices throughout the Mackenzie Valley.

The presentation will outline the MVLWB's role in the NWT regulatory regime, explore the rationale behind the creation of the Working Groups, and provide an update on the groups' progress and products.

New Regulatory Framework for Nunavut

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Anticipation is growing in Nunavut as a new regulatory framework moves closer to reality with the introduction of Bill C-25, the Nunavut Planning and Project Assessment Act (NuPPAA) in the House of Commons on May 12, 2010. Bill C-25 advances the objectives of both the *Northern Strategy* and the *Action Plan to Improve Northern Regulatory Regimes.*

The Nunavut Land Claims Agreement (the Agreement) requires new legislation for the land use planning and environmental impact assessment processes in Nunavut. A Nunavut Legislative Working Group had been working towards this goal since 2002 with representation from the federal and territorial governments and Nunavut Tunngavik Incorporated, and supported by the Nunavut Planning Commission (the Commission) and the Nunavut Impact Review Board (the Board).

The proposed Act will formally establish the Commission and the Board, who have been working under provisions of the Agreement since 1996. The Act will define how, and by whom, land use plans will be prepared, amended, reviewed and implemented in Nunavut, and it will describe the process by which the Commission and the Board will examine, consult and respond to development proposals and assess how land use activities and specific development projects will affect the Nunavut Settlement Area.

This is an innovative bill which will add clarity and predictability to the land use planning and environmental assessment processes in Nunavut. All parties - proponents and environmental assessment practitioners alike - will appreciate the improvements proposed. Among these: more detail and clarity in defining what types of activities constitute a project; efficiency will be improved with the Commission representing the single entry point into the review process for all project proposals; there will be greater predictability with timelines instituted at all key decision points; there will be improved flexibility to review transboundary projects; a comprehensive enforcement scheme will put "teeth" in the land use planning and environmental assessment processes; and land use plans will be implemented on Inuit Owned Lands. The end result will be clarity, predictability, consistency, and legal certainty as projects are reviewed and assessed, which will promote investor confidence and economic development in Nunavut.

Understanding this new legislation will be of particular interest to companies operating in the northern territories who will want to be familiar with the differences between this and other legislative schemes such as CEAA, YESAA or the MVRMA. For example, under the new Act the planning authority will represent a single window into the system where project proposals will be subject to a conformity determination, rather than through the regulators or the environmental assessment board. Understanding some of the other innovative features such as the treatment of transboundary projects, which may be imported into other northern legislation, will also be beneficial. All those who operate in Canada's north are encouraged to take advantage of this opportunity to learn more about this new legislation.

The Inuvik Gas Project – 14 Years of History

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The Inuvik Gas Project gained momentum with local stakeholders in the mid-1990's with the desire to "Develop Gas from the North for the North." The Ikhil Gas Pool was viewed as a secure local supply of fuel for power generation and residential and commercial heating at a reduced cost to diesel being shipped annually from Edmonton. During 1996 and early 1997, the Inuvialuit Petroleum Corporation (IPC) was able to purchase and consolidate a 100% working interest in the Significant Discovery License 029 associated with the Ikhil Gas Pool which is located 50 km northwest of Inuvik. IPC was joined by AltaGas Marketing Inc. early in 1997 as a partner in the project. In spring of 1997, the original 1986 Gulf Canada Resources et al K-35 Ikhil discovery well was re-entered which confirmed excellent reservoir productivity and established a reserves base to justify continued development of the project. Over the winter of 1997/98, a 3-D seismic and 2 well drilling program was undertaken to further confirm overall gas supply. In early 1998, Enbridge Energy Inc. joined the partnership as the project continued to progress with regulatory approvals, design, construction and eventual start-up with first gas flowing in May of 1999. In the fall of 2008, ATCO Midstream NWT Ltd. acquired Enbridge's one third interest in the "Ikhil Joint Venture."

The Ikhil Gas Pool is contained in the Tertiary Aged Reindeer Sequence Taglu Delta sand formation at a depth of approximately 1100 m. The permafrost is roughly 280 m deep at this location requiring continuous injection of methanol down hole to prevent the formation of gas hydrates as the gas is produced. The Ikhil Gas plant has two identical gas processing trains to ensure redundancy and reliability. A Joule-Thompson process is utilized in conjunction with the injection of methanol to process the 99+% methane gas to sales quality and to cool the gas to maintain pipeline integrity in the permafrost. The 6" pipeline from Ikhil to Inuvik is buried except for the above ground portion on steel pilings at Douglas Creek. The pipeline design and construction methods employed for the Inuvik Gas Project have resulted in a very successful operation to date. The pipeline ROW required some remedial profiling and re-vegetation as anticipated after the first summer thaw cycle. There are currently no significant frost heave or thaw settlement issues identified along the ROW which is routinely monitored by operations.

Gas has flowed uninterrupted since May of 1999 maintaining a continuous supply of gas to the town of Inuvik. In March of 2009, work was conducted to re-configure the K-35 well to allow for continuous lifting of condensed water and methanol. This wellbore configuration has enabled higher quality pressure data to be obtained for the Ikhil gas pool over the past year and a half. The original 3-D seismic data shot in 1997/98 was re-processed and re-interpreted this spring to confirm with confidence concurrence between the geophysical/geological model and engineering model associated with recent pressure data and 11 years of production history.

Components of Hottah Terrane vs. Great Bear Magmatic Zone: New Chronostratigraphy and Implications for Mineral Deposits

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Since 2005, we have re-investigated rocks of the >1900 Ma Hottah Terrane in the vicinity of Hottah, Beaverlodge, and Rainy lakes and Leith Peninsula, NWT. Previous bedrock geology studies from the 1940's (Henderson) and the 1970's and 1980's (McGlynn and others, Hildebrand and others, and Reichenbach) were used target studies. From these investigations we have confirmed and expanded interpretations of the geological evolution of the Hottah Terrane and the overlying Great Bear magmatic zone. The timing of Hottah-Slave interaction plays a key role in the development of the Coronation margin to the east and the central Great Bear magmatic zone. This interaction controlled the nature, style, and timing of mineral deposits in this region. For example, the components of the Hottah Terrane may prove important for diamond exploration under the Phanerozoic cover to the west.

Compilation of new and historic data coupled with observations in the above mentioned areas demonstrate the following Hottah Terrane components: 1) a cryptic and unidentified crust that formed between ca. 2200 and ca. 2400 Ma; 2) the >1940 Ma Holly Lake metamorphic complex (HLMC), a complex and poorly preserved supracrustal sequence that is intensely intruded by; 3) ca. 1940 to 1930 Ma (now) foliated granite through quartz diorite and intrusive porphyry of the Hottah arc; 4) the ca. 1900 Ma Bell Island Bay Group - rhyolites and rhyodacites with a basal quartz arenite member that unconformably overlie the HLMC and Hottah arc; and, 5) an unconformable cover of Conjuror Bay Formation, cross-bedded quartzite that grades upwards into mudstone and siltstone and is overlain by a thick package of basalt (Bloom basalt). U-Pb detrital zircon analyses indicate that the Conjuror Bay Formation was deposited shortly after the Bell Island Bay volcanism, around ca. 1900 Ma and, notably, this quartzite contains a few Archean zircons. Sedimentation likely continued after eruption of the Bloom basalt and may be represented by the upward shallowing <1895 Ma Treasure Lake Group to the south, which was strongly deformed by ca. 1875 Ma.

East of Hottah Lake, the above mentioned rocks are extensively intruded by ca. 1875-1855 Ma Great Bear magmatic zone granitoids, within which are locally preserved ca. 1872-1868 Ma volcanic complexes. The post-Hottah, pre-Great Bear rift-sequence was likely responsible for localized, but intense low temperature hydrothermal alteration of the basement, in many ways similar to younger continental basins (e.g., Athabasca Basin).

Overall, the geological relationships and available age data indicate the post-Hottah rift opened at ca. 1900 Ma and closed by 1875 Ma. The rift contains both Hottah Terrane and Archean zircons with ages that correspond to known Slave igneous events. This could imply that the Hottah Terrane and Slave craton collided (Calderian orogeny) prior to 1900 Ma, much earlier than the currently accepted ca. 1885 Ma interpretation. This revised interpretation may necessitate the total re-evaluation of the evolution of the Calderian orogeny and perhaps the outboard role of the Fort Simpson Terrane to the west. The components of the Hottah Terrane and the interaction with the Slave craton ultimately control younger mineral deposit formation.

A Tool for Cumulative Effects Assessment in the NWT

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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. Unfortuately, records have not been kept with this purpose in mind. We present a spatial database, created from a number of different information sources, that summarizes development. Currently, the database includes the North and South Slave regions, and the Inivualuit Settlement Region. This presentation describes the database and how it was derived, and provides some examples of how it may be used in cumulative effects assessment.

High-Al Kimberlite Produced by Monticellite Fractionation

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High-Al kimberlite (3+ wt% Al_2O_3) is typically considered to be contaminated. Clement's original Contamination Index (C.I.)[1], has been replaced by a number of trace element indices[2-3] because of the C.I.'s apparent inability to distinguish between contemporaneous crustal and mantle contamination. Regardless of which indices or combination of indices are applied, however, kimberlites that have Al_2O_3 contents over ~3 wt% are usually considered contaminated. Monticellite fractionation, however, may produce high-Al kimberlites without crustal contamination.

Two hypabyssal kimberlite dykes in the Foxtrot Kimberlite Field (FKF), the Lynx and Hibou dykes[4], have aphanitic margins with high Al_2O_3 contents. The margins exhibit mm-scale cyclic banding parallel to the dyke contact that is defined by alternating concentrations of opaque oxides. Fresh macrocrystic kimberlite from the interior of the Hibou dyke has up to 5% modal (<2 mm) monticellite exhibiting euhedral habit. Although silicates (~40 modal %) in the aphanitic margins are serpentinized, the pseudomorphs exhibit similar habit and size to monticellite within the interior of the dykes.

The Al_2O_3 contents of the dyke interiors is typical for hypabyssal kimberlite (~1.5-2.5 wt%), however, the aphanitic margins have Al_2O_3 contents ranging from ~2 to 10 wt% as SiO_2 decreases from 28 to 13 wt%. The margin samples have relatively constant MgO contents (25-30 wt%), but FeO increases from 8 to 18 wt% with Al_2O_3. Comparing SiO_2 with CO_2 gives a similar pattern, in that CO_2 remains constant at ~9 wt% as SiO_2 varies from 28 to 13 wt%. $\delta^{13}C$ remains relatively constant at mantle values (~4-5 ‰$_{VPDB}$) across the Lynx dyke, but $\delta^{18}O_{VSMOW}$ increases from 20 ‰ in the dyke interior to 10 ‰ in the dyke margins.

Contamination indices indicate that the aphanitic margins are not contaminated, despite their elevated Al_2O_3 contents. The constant mantle-like $\delta^{13}C$ across the dyke indicates alteration has not affected the kimberlite carbonate; however, the increase of $\delta^{18}O$ toward the center of the dyke suggests that meteoric water alteration increases toward the interior. The concomitant decrease of SiO_2 with increasing Al_2O_3 would be consistent with olivine fractionation; but the constant MgO over a large variation in FeO negates this possibility. The compositional variation in the aphanitic margins is however, consistent with monticellite fractionation that mimics forsterite fractionation in many chemical plots (e.g. aluminum versus silica), however, the two are clearly distinguished in plots of Si versus Mg+Fe.

Monticellite fractionation has been interpreted as the result of CO_2 degassing at the expense of carbonate (calcite or more likely dolomite) with monticellite becoming stable[5]. The cyclic banding in the aphanitic margins suggests successive coating of the conduit walls during fluid flow, indicating that the kimberlite magma is boiling off CO_2 along the margins. Monticellite cannot be distinguished in the aphanitic margins due to completely serpentinization, however the similar habit and size of the serpentine pseudomorphs to monticellite in the interiors suggests that the margins were monticellite rich. Thus, high-Al kimberlite found as aphanitic dyke margins are not necessarily contaminated, but may provide examples of CO_2 degassing with concomitant monticellite fractionation.

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2 Kjarsgaard, B. A., et al. (2009).
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Paleoclimatological Assessment of the Central Northwest Territories: Implications for the Long-Term Viability of the Tibbett to Contwoyto Winter Ice Road

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The Tibbitt to Contwoyto Winter Road (TCWR) is the world's longest heavy haul ice road (586 km) extending from Yellowknife, NT into southern NU. The TCWR is critical to the economy of the NT with more than $500 million per year in goods passing north to service mines along the route. Our research is mandated to provide a detailed assessment of the impact of climate change on the TCWR, as archived in Late Holocene (last ~3500 years) lake sediments and peat bog archives, as well as tree ring records for the last 400 years.

As 87% of the TCWR is built over lakes, any change in ice stability, thickness, and duration of cover associated with climate variability impacts use of the road. For example, the unusually mild and stormy El Niño influenced, winter of 2006 shortened winter road operations to 26 days below average, resulting in only 6,841 loads going north. As a consequence there were substantial industry losses. With projected future growth in truck traffic it is critical that policy makers, planners, and mine developers have reasonable data upon which to base economic forecasts, as alternate transportation costs (e.g. air transport) are prohibitively high.

In support of our multi-disciplinary research 80 water property data and sediment/water interface samples and glew cores, as well as 16 freeze cores have been collected from 43 lakes along the length of the TCWR. Additional lakes and bogs will be sampled during 2011. Based on this database we are developing subdecadal resolution information on climate variability and its affects on aquatic and terrestrial environments in the central NT. Our methodology permits us to recognize cycles and trends that have impacted climate change. Through use of time series analyses we will predict possible future trends in climate and ice cover. This information may be used by stakeholders (e.g. industry, government, non-government organizations, and First Nations groups) to strategically manage northern ecosystems and to inform policy makers and planners of potential climate conditions that may prevail in the coming decades.

Innovative Methods to Search, Download and Display Indicator Mineral Data: A New Tri-Territorial Indicator Mineral Database

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To assist exploration in northern Canada, a compilation of heavy mineral data collected from surficial sediments is ongoing at the GSC as part of the Geomapping for Energy and Minerals (GEM) Program. Information about indicator mineral data is being acquired from published government reports, assessment files, reports, and private exploration company holdings.

These data will complement the KIDD-KIMC and till geochemistry data sets provided by territorial partners, 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 and indicator mineral surveys. Documentation of these surveys' analytical metadata is ongoing. The CDoGS web portal (http://gdr.nrcan.gc.ca/geochem) exposes these surveys in query-able fashion so that those of interest can be identified for further examination. To date, metadata for 34 GSC surveys and 216 assessment reports have been completed. Links to digital versions of publications are provided, where they are available (e.g., GeoScan, NUMIN, NORMIN).

An example will be shown using GSC OF 6040, from bulk till samples collected in the Boothia Peninsula, Nunavut. The results of various indicator mineral commodity types are displayed here using Google Earth©, where instant linkages and interpretations can be made from seeing the data plotted in association with regional glacial landforms.

The GEM Chesterfield Gold Project: Understanding Controls on Western Churchill Gold Endowment from the Bottom Up

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Assessing the potential for orogenic gold in Precambrian terranes involves understanding processes on varying time and space scales. At the largest scale, research has shown greater favorability and gold endowment when in proximity to major lithospheric breaks, most easily delimited at the surface by reworked ancient continental margins or suture zones. Greatest favorability appears to be where the lithosphere has been modified through metasomatism, such as sites of delamination, subduction flip on collision or plume interaction with a subduction zone (Bierlein, 2008; Betts et al., 2010). Recent crustal and metallogenic studies in the western Churchill Province are bringing this bottom up view to understanding its gold endowment. A common element to its major gold deposits (Meadowbank, Meliadine), past-producers (Cullaton), and current exploration targets (Ayak, Sy, Churchill, Happy Lake) is their involvement in intense Paleoproterozoic orogenesis about the margins of the Archean Chesterfield block. The Chesterfield block is hypothesized to be a microcontinent with its own lithospheric mantle, which was involved in both latest Neoarchean and Paleoproterozoic subduction-accretion events and is bounded by both Neoarchean (north) and Paleoproterozoic (south) suture zones, potentially providing a focus for metasomatic events that ultimately contribute to orogenic gold. The aim of this 3-year project is to address the incomplete understanding of the location and character of its bounding structures, age and architecture of the gold deposits, and tectonostratigraphic controls on gold-bearing units and thereby improve gold exploration targeting marginal to the Chesterfield block. The project will develop a better understanding of the complex reworking of the suture zones and test the present models of overlapping Paleoproterozoic/Archean gold localization through targeted structure/stratigraphic/deposit studies in areas of known potential. During this presentation the results of a new 110,000 line km high resolution aeromagnetic survey over poorly-exposed parts of the Chesterfield block-Hearne margin will be shown simultaneously with national release of digital survey itself.

The Chidliak Diamond District, Nunavut: 50 Kimberlites and Counting

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Kimberlite Indicator Minerals were first identified on south Baffin Island ("Chidliak") in 2005 as a result of a reconnaissance sediment sampling programme conducted by Peregrine Diamonds Ltd ("Peregrine") and BHP Billiton. Diamond-bearing kimberlites were discovered on the 980,000 hectare Chidliak project ("Chidliak") by Peregrine in July 2008. Chidliak is situated on the Hall Peninsula of Baffin Island, Nunavut approximately 120 kilometres northeast of Iqaluit, the territorial capital. Since the initial discovery, 50 kimberlites have been discovered, 34 of those in 2010. Twenty-four of the discoveries to date have been made by prospecting and 26 by drilling (18 core, 8 reverse circulation). Only five of the kimberlites discovered to date are under lakes and the rest are land-based. At least four of the 17 kimberlites that have been tested to date are thought to have economic potential in Arctic settings: CH-1, CH-6, CH-7 and CH-28. Canada's newest diamond district now stretches approximately 70 kilometres in a north-south direction and 40 kilometres east-west.

Seventeen of the 50 kimberlites have been tested for diamonds as of September 30, 2010 and all but one of these are diamond-bearing. In the coming months, diamond results are forthcoming for kimberlites discovered in 2010, and for 14 and 50 tonne mini-bulk samples collected from the CH-6 and CH-7 kimberlites respectively. The four kimberlites discovered thus far with economic potential, CH-1, CH-6, CH-7 and CH-28, have promising coarse diamond size distributions. The initial results from CH-6 are some of the most promising that have been released since the discovery of the A154 kimberlite at Diavik™ in 1994: 4737 diamonds larger than the 0.075 mm sieve size were recovered from a 569 kg sample of CH-6. The sample contained 109 commercial-sized stones (>0.85 mm) weighing 4.58 carats, including four diamonds larger than 0.3 carats.

Seven of the kimberlites discovered to date are likely to be greater than one hectare in size based on drill data and ground geophysical signatures. Highlighting the probability for large kimberlites and associated tonnage at Chidliak is CH-31, where interpretation of the geophysical and drill data and the distribution of kimberlite float indicate a kimberlite vent over five hectares in size.

The Chidliak kimberlites display a wide range of textural varieties and geophysical signatures. Both extrusive, volcaniclastic kimberlites and intrusive, coherent kimberlites have been encountered and, in some cases, both phases are present in a single body. Some of the kimberlites are magnetic highs and others are magnetic lows. Several have strong electromagnetic signatures and distinct topographic expressions.

There are numerous unexplained indicator mineral anomalies and high-priority kimberlite-type geophysical anomalies that remain to be evaluated at Chidliak. The 2011 exploration programme will start with the drilling of lake-based anomalies in March and will include further evaluation of kimberlites with economic potential and exploration for new bodies.

Two diamondiferous volcaniclastic kimberlites were discovered in 2010 on Peregrine's adjacent, 100%-owned Qilaq project, further expanding the potential of this prolific diamond district.

The Chidliak project is a joint venture between Peregrine (49%) and BHP Billiton (51%).

Petroleum Potential Studies of Devonian Horn River Group and Cambrian Mount Clark/Mount Cap Formations, Mackenzie Plain Area, Northwest Territories

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Mackenzie Plain is a petroleum producing and exploration area that lies within the central Mackenzie Valley and contains the Devonian oil fields at Norman Wells with potential for additional conventional and unconventional petroleum resources. A five-year (2009-2014), field-based project initiated by the Northwest Territories Geoscience Office is aimed at updating and improving geoscience knowledge of key petroleum plays. Field work in 2010 focused on two stratigraphic intervals: Devonian Horn River Group and Cambrian Mount Clark/Mount Cap formations. Field activities in 2010 also included: 1) reconnaissance in southern Mackenzie Plain in search of possible reef development within the Hume Formation, a carbonate unit that underlies the Horn River Group, and 2) documenting representative outcrop localities for a regional field guidebook of Mackenzie Plain area, including the northern Mackenzie Mountain front and Franklin Mountains.

The Devonian Horn River Group (Hare Indian, Ramparts, and Canol formations; Givetian-Frasnian in age) in Mackenzie Plain is equivalent to strata of the shale gas play currently being developed in the Horn River Basin of northeastern British Columbia. Within the Ramparts Formation, a Kee Scarp reef structure acts as the primary reservoir for the oil field located at Norman Wells. The source for this petroleum system is the Canol Formation shale. The unconventional shale gas potential of Horn River Group in NWT remains unexplored. Field studies focused on measurement and detailed sampling of four Horn River Group sections in the northern Mackenzie Mountains to characterize their source rock and unconventional petroleum potential. Throughout each section, spectral gamma ray measurements were taken and chip samples were collected for Rock-eval pyrolysis, mineralogic, and elemental analyses. Information from outcrop studies will be integrated with subsurface data from exploration wells across Mackenzie Plain.

The Cambrian Mount Clark/Mount Cap formations extend throughout the northern Interior Plains and have proven oil, gas, and condensate discoveries in the Colville Hills area northeast of Mackenzie Plain. These formations outcrop in the northern Mackenzie Mountains and Franklin Mountains. A total of eight previously measured sections were examined and samples were collected for Rock-eval pyrolysis and porosity-permeability analysis. Results from surface sampling will be integrated with data from subsurface wells that penetrate the Cambrian succession in Mackenzie Plain area.

Victoria Island GEM Project: Results from 2010 Field Mapping and Thematic Studies

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The principal objective of the Victoria Island GEM project is to provide an improved understanding of the geology of the Minto Inlier, which has known potential for concentrations of magmatic Ni-PGE. Close collaboration with the NWT and Nunavut geoscience offices is ensuring alignment with territorial goals. Partnerships with universities in Canada, the U.S., the U.K. and Australia has enabled training of students, scientific input of experts, and leveraging of external resources. Summer 2010 was the first season of detailed (1:50,000) geological mapping in western Minto Inlier, located in a region centred at the head of Minto Inlet (NTS 87H/5,6,12; 87G/9,10). Field mapping identified a ca. 50 km-wide, ENE-striking, fault zone that links with a previously identified zone to the northeast. The zone is a corridor of evenly spaced horsts and grabens that offset all stratigraphic contacts (pre-Devonian) throughout the area. The map pattern is largely controlled by the relative displacements of adjacent fault blocks, as shown by new aeromagnetic data. An older generation of NNW-striking faults may have controlled ascent of mafic magmas of the ca. 720 Ma Franklin magmatic suite (gabbroic sills, dykes and basaltic flows) in several places. One striking example of a well preserved sill-dyke-sill system was mapped in detail and provides insights into the structure and mechanisms of sill-dominated plumbing systems beneath large igneous provinces. The contact metamorphic aureole is unusually wide, and implies significant magmatic throughflow. A series of magnetite+sulphide skarns are developed in carbonate rocks that form the roof of the feeder system, and extend along strike for several km. These skarns constitute favourable Au-Pt-Pd targets.

Stratigraphic studies focused on detailed cliff-section description of shallow marine carbonate rocks and deeper-water shales of the Wynniatt Formation, and of restricted basin evaporite rocks of the Minto Inlet Formation of the early Neoproterozoic Shaler Supergroup. Additionally, a continuous rock record recovered from mineral exploration drill cores was described and sampled, enabling key gaps in the stratigraphy to be filled. New sequence boundaries were identified that will lead to a revised stratigraphic framework for correlation with adjacent inliers. Future work will focus on integrating detailed stratigraphy and sedimentology with stable isotope stratigraphy (C, O, S), and regional facies mapping. Secondary (hydrothermal?) dolomitization/silicification and related porosity development of Wynniatt carbonate units is similar to textures preserved in the correlative Gayna River, NT, Zn-Pb deposit.

Five, formation-scale, stratigraphic units are recognized within the unconformably overlying Cambro-Ordovician succession: Early Cambrian sandstone; Lower or Middle Cambrian dolostone; Middle Cambrian mixed carbonate-clastic; ?Middle Cambrian to Lower Ordovician carbonate (with four locally mappable members); and an Upper Ordovician fossiliferous carbonate unit. Significant lateral variations in thickness and facies within the basal sandstone probably were determined by paleotopography, and enhanced by the block faulting.

In addition, a ca. 25 km diameter astrobleme, herein termed the Collinson Crater, was discovered near Richard Collinson Inlet on NW Victoria Island. The crater is marked by extensive shatter cones, a concentric lake pattern, and widespread faulting. Proterozoic rocks of the Shaler Supergroup are exposed in the central crater uplift.

Development Update for the NICO Gold-Cobalt-Bismuth-Copper Deposit, Northwest Territories

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The NICO Project is comprised of a proposed mine and concentrator in the NWT and a hydrometallurgical plant in Saskatchewan to process concentrates produced at the mine to gold doré, cobalt and copper cathode, bismuth cathode or ingot and a nickel carbonate by-product. In the NWT, the NICO deposit is located in Tlicho Territory, approximately 160 km northwest of the City of Yellowknife and 50 km north of Whati. Current access is by winter road, but this road is planned to be re-aligned and upgraded to all-weather capability as part of Fortune's proposed development. The mine and Saskatchewan refinery are both in the environmental assessment (EA) process.

NICO and Fortune's nearby Sue-Dianne deposit are the only Canadian examples of IOCG (Olympic Dam) –type 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 31 million tonnes containing 908,000 ozs of gold, 82 million lbs of cobalt, 109 million lbs of bismuth and 27 million lbs of copper. NICO 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 loading onto rail and delivery to the refinery in Saskatchewan. This refinery further employs flotation at 12 µm following regrind to produce selective cobalt and bismuth concentrates, followed by acid leaching and electro-winning to high value metal products.

The NICO deposit 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 improved the metal recoveries previously used in the Company's 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 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 and reduce development costs and project risk.

While Fortune Minerals completes its EA for the NICO Project, several improvements have been made to the design of the development that will reduce potential impacts to the local environment while still increasing the efficiency of the overall operation. The Company is expecting to complete the EA process in 2011 for mine commissioning in 2013. 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.

Using a Girl's Best Friend to Grow a Multi-Million Dollar Aboriginal Corporation
Tlicho Investment Corporation

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The Tlicho Investment Corporation (TIC) is owned by the Tlicho Government for Tlicho people. Our goals are to enhance the economic self-reliance, prosperity, and future certainty for Tlicho citizens by creating sustainable economic development. TIC group of companies comprises 37 active entities with a variety of expertise consisting of mining, transportation, engineering & remediation, construction, hospitality, retail, business services and power generation.

The Tlicho had humble beginnings in the 1980s when its first companies were created to do small community based services, but it wasn't until the discovery of diamonds in the 1990s that the Tli Cho were provided with a significant economic platform onto which to develop opportunities and benefits for the Tlicho people. Through Impact Benefit and Participation Agreements with the Ekati, Diavik and Snap Lake diamond mines, the Tli Cho negotiated for training, employment and business opportunities for the Tli Cho people.

Since its first mining company, the Tlicho grew a business empire now under the umbrella of the Tlicho Investment Corporation Group of companies, which today has annual revenues in excess of $100 million, and employs up 700 workers including 68% Tlicho and other Aboriginal workers. It has an admirable safety program and record. Tli Cho Logistics Inc. and I&D Management Services Ltd. have both enjoyed over a million man-hours without a lost time injury. In 2009 the Prospectors & Developers Association of Canada awarded Tli Cho Logistics Inc. the Skookum Jim Award for Aboriginal achievement in the mineral industry, for supplying a range of high quality services to diamond mines in the Northwest Territories.

Sedimentology, Stratigraphy and Reservoir Potential of the Upper Devonian Imperial Formation, Northwest Territories

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The Upper Devonian Imperial Formation extends along the Mackenzie Corridor from the Mackenzie Delta in the north to 64° N latitude in the south. It consists primarily of siliciclastic shale, siltstone and very fine- to fine-grained sandstone, with thin fossiliferous carbonate beds in proximity to Norman Wells. Previous workers have indicated a marine origin for the formation, including southwestward prograding shoreline, shelf, slope and submarine fan depositional systems.

Preliminary analysis of the Imperial Formation has included regional mapping (subsurface) and stratigraphical analysis of outcropping sections in the vicinity of Norman Wells. Regional mapping reveals that the eastern extent of the formation is delineated by erosion associated with the overlying sub-Cretaceous unconformity. To the west, the formation is overthrust by the Mackenzie Mountain front ranges.

In the outcrop belt at Imperial River and eastward, the Imperial Formation can be divided lithostratigraphically into a lower fine-grained interval (120 - 140 m thick), a middle interval ~285 - 350 m thick characterized by punctuated sandstone packages 3 - 44 m in thickness, and an upper shale interval ~478 m thick. The sandstone packages in the middle portion of the formation, which are dominated by hummocky cross-stratification, represent the most promising conventional reservoir units. The entire formation grades into deeper water facies in a basinward direction to the west, where sandstones are commonly attributed to deep-water submarine fan sedimentation.

Geology of the Foxe Fold Belt, Central Baffin, Nunavut, with Implications on the Gold Mineralisation – Project Summary and Preliminary Results

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In the Trans-Hudson Orogen in Central Baffin Island, Nunavut, gold mineralisation is typically associated with complexly deformed iron formation horizons of the Paleoproterozoic Bravo Lake formation and, to a lesser extent, with quartz vein systems. The Bravo Lake formation is a metavolcanic belt, which is continuous over a lateral extent of more than 140km and contains multiple iron formation horizons and associated gold prospects. Since 2003, Commander Resources has identified 16 gold prospects across the belt, 4 of which have been the focus of more detailed exploration programs, including prospecting, mapping, geophysics and drilling programs. Anglo Gold Ashanti acquired an interest in the properties in 2009 and funded the exploration program for 2010.

A field based PhD project was established and commenced in 2010, with as its main objective to develop a better understanding of local and regional controls on gold mineralisation, through development of a comprehensive knowledge of the structural, metamorphic and geochronological evolution of the Foxe Fold Belt, Central Baffin. The project is undertaken at Laurentian University, with annual support from the Canada – Nunavut Geoscience Office (CNGO). CNGO financial support is provided by Strategic Initiatives in Northern Economic Development (SINED). Field, logistical and technical guidance is provided by Commander Resources Limited, AngloGold Ashanti Limited and GeoVector Management Inc (management consultants).

Prior to the 2010 field season, previous research by the Geological Survey of Canada (GSC) in 1988 - 1989 and subsequently in 2000 – 2003 established a consistent regional framework for the stratigraphy of the Piling Group. The Piling Group comprises a basal quartzite of the Dewar Lakes formation, overlain by carbonates of the Flint Lake formation, volcanics of the Bravo Lake formation, shales of the Astarte River and the Longstaff Bluff formation turbidites. Their work produced the first regional map of the belt. Information garnered during the 2010 field season was primarily in two areas of the belt centered on two economically important prospects. In addition, regional traverses were done across the Archean domes outside the metavolcanic belt, in order to resolve the structural and metamorphic events that affected the belt. Drill core was reviewed and rock samples were collected from each of the prospects.

The 2010 geological mapping program at 1:15,000 identified differences with the previously published stratigraphical interpretation of the belt. The basal quartzite, which was previously identified to underlie the entire metavolcanic belt, was only present at one of the Archean domes, and this contact is not typically a thrust contact. The Bravo Lake formation appears to be contained within the Longstaff Bluff formation and itself contains graphitic siltstone layers previously correlated with the Astarte formation to the north. The Malrok structure, previously identified as a klippe, showed no evidence of a basal thrust contact. A bedding parallel foliation, which was previously considered to be the earliest foliation, is at some localities preceded by an earlier foliation. These preliminary findings suggest that the stratigraphy and structure of the belt are more complex than previously thought and this will have important future implication on the controls on gold mineralisation.

Update on GeoMapping for Energy & Minerals (GEM) of Cumberland Peninsula, Baffin Island, Nunavut

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The Cumberland Peninsula represents a frontier region for resource exploration and development. Prior to NRCan's GeoMapping for Energy & Minerals (GEM) initiative, reconnaissance understanding of the geology - based on early 1970's 1:1 million scale mapping - and lack of regional aeromagnetic, geochronological and glacial data, presented a significant gap in knowledge which detracted from investment and local opportunities. New mapping has resulted in a vastly improved understanding of eastern Baffin Island's lithological associations, crustal architecture and mineral potential, necessary to meet the needs of the exploration industry and provide relevant public geoscience for the Inuit communities of Pangnirtung and Qikiqtarjuaq.

To date, the project has released approximately 58,000 line kilometers of high-resolution aeromagnetic data flown in 2008. Bedrock and surficial mapping conducted over the southern part of the peninsula in 2009 was extended across the northern part in 2010. In contrast to all previously published and unpublished maps, it is now recognized that ancient (2.8-3.0 billion year old) tonalitic basement underlies about 60% of Cumberland Peninsula, thus opening up its prospectivity for diamonds. New interest is highlighted by prospecting permit coverage (1.5 million hectares) over the 2009 map area (Peregrine Diamonds Ltd.'s CUMBERLAND PROJECT), stemming from the similarity of plutonic basement to the south on Hall Peninsula where 50 diamond-bearing kimberlites were recently discovered (Peregrine's CHIDLIAK & QILAQ PROJECTS). 2010 mapping has further delineated Archean tonalitic basement throughout northern Cumberland Peninsula. Younger supracrustal strata of the Paleoproterozoic Hoare Bay group form a topographically and structurally high belt across the central part of the peninsula. This younger sequence hosts a black shale - iron formation - volcanic association and probably formed on an ancient continental margin dominated by tonalite, with which it is infolded. Isolated, 3-5m thick occurrences of marble±quartzite in the SW and N parts of the peninsula, and occurrences of black shale and volcanic rocks in the E, provide evidence of a tectonically disrupted paleo-shelf to basin succession. Elevated concentrations of multiple metals in the black shale and associated iron formation present an exploration target for polymetallic zinc-copper-nickel-gold. Both the plutonic basement and younger cover strata are cut by a NE-trending belt of ca. 1.89 Ga felsic plutonic rocks that extends over 200 km from Pangnirtung to Qikiqtarjuaq.

Consultation and engagement with residents of Pangnirtung and Qikiqtarjuaq remain integral to the success and productivity of the GEM Cumberland Peninsula project. Essential elements have included community-based school visits, remote First Aid training, employment opportunities both in the field and in the hamlets, youth geoscience retreats, resumé service, on-site visits by Elders and community representatives, and consultation on incorporating traditional knowledge into new topographical maps.

The GEM Cumberland Peninsula project highlights the impact of government geoscience whereby a vastly improved geological database, attained through targeted fieldwork, geophysical surveys, and analytical support, leads to new mineral exploration plays, and a more knowledgeable, experienced, and qualified group of northerners, better-equipped to engage in follow-up exploration activities.

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.

The Pine Point Project is fully permitted. The Company's feasibility study was overwritten by PAH in 2008. The Company also received its Type A land use and water permits in 2008 and 2009 respectively, along with its land use permit for exploration. Project infrastructure consists of existing hydro power, paved roads and rail access. Tamerlane is currently in the process of securing funding for the construction phase of the project. Once funding has been secured, it is anticipated construction will begin within 9-12 months.

In 2010, Tamerlane conducted a 23 hole confirmation drilling program at the N204 deposit. N204 is a large, low grade lead-zinc deposit hosted within the B-Spongy facies of the Pine Point Formation. Geologic block modeling suggests that, dependant on the grade cut-off utilized, the tonnage of the deposit varies between 4 and 16 Mt. Due to the shallow occurrence of mineralization, the deposit is amenable to open pit mining methods.

Drilling identified two ore horizons, a Main and Upper Zone. The Main zone varies in thickness from 1 to 20m, dips slightly to the SW and is higher in grade. The Upper Zone is more discontinuous, thinner and of much lower grade. Metallurgical testing consisting of DMS and/or x-ray sorting techniques will be utilized to determine the best method for ore upgradability.

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, vertical conveyance to hoist ore and freeze ring technologies to inhibit groundwater infiltration. At N204, innovative open pit mining technologies will be utilized to limit ore dilution. These technologies will allow for the selective removal of small layers of material, either as waste or ore, at a time. This method will allow for very concise grade control, especially within the thin, less continuous, lower grade Upper ore horizon. N204 will extend the life and positively affect the economics of the Pine Point Project.

NUNAVUT 2010: Mine Development and Exploration Continues

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Mineral exploration spending has increased from 2009, with active projects in each of Nunavut's three regions (Kitikmeot, Kivalliq and Qikiqtaaluk). Significant new discoveries were made in the past year and several existing projects are nearing a production-decision.

Agnico-Eagle Mines Ltd. (AEM) brought its Meadowbank gold deposit (Kivalliq) into production in June. Meadowbank is Nunavut's only operating mine. AEM also completed its acquisition of Comaplex Minerals giving the company 100% control of the Meliadine gold deposit. In the Kitikmeot region, Newmont Mining Corporation continued work on the Hope Bay Project, which has potential for up to 9 million ounces of gold, and North Country Gold Corporation extended the strike-length of mineralization at its Three Bluffs Project. Gold exploration was also conducted by Commander Resources Ltd. on its Baffin Island Gold Project (Qikiqtaaluk).

Sabina Gold & Silver Corporation continued work on its Hackett River (VMS) and Back River (gold) Projects in the Kitikmeot. As part of the Back River Project, two new gold discoveries (Llama Lake, Umwelt Lake) were made, both with high-grade gold intercepts.

MMG Resources Inc. (MMG) continued exploration on Izok Lake (Kitikmeot) and has announced that it will be conducting a pre-feasibility study on the deposit. MMG also signed a letter of intent with Diamonds North Resources Inc. to conduct exploration on the Amaruk Nickel Project.

Baffinland Iron Mines Corporation's Mary River iron ore project (Qikiqtaaluk) discovered two new deposits in 2010, bringing the total to seven. Baffinland has continued to work to secure funding to bring the project into production, and was the subject of an unsolicited takeover bid by Nunavut Iron Ore Acquisitions Inc. in September.

Uranium exploration remained strong in 2010, with most activity in the Kivalliq. The most advanced project, AREVA Resources Canada Limited's Kiggavik project is undergoing an environmental assessment as part of the regulatory process to bring the project into production. Other active uranium exploration projects include Cameco Corporation's Aberdeen and Turqavik projects, Kivalliq Energy Corporation's Lac Cinquante project and Forum Uranium Corporation's North Thelon project.

Peregrine Diamonds Ltd. (partnered with BHP Billiton) saw continued success at its Chidliak project, discovering 34 new kimberlites in 2010 bringing the property total to 50. This summer BHP completed its funding commitment to gain a 51% interest in Chidliak. Diamonds North Resources Ltd. achieved success on a mini-bulk sample taken in 2009 from the Beluga-3 kimberlite on its Amaruk diamond project, eastern Kitikmeot, and started the collection of a further 25 tonne bulk sample. Shear Minerals Ltd. purchased the former Jericho Diamond mine (Kitikmeot) from Tahera Diamond Corp. and Benachee Resources Inc. in August 2010. The Jericho mine operated from 2006 to 2008.

Based on the statistics' released by NRCan's biannual industry surveys, Nunavut is ranked 5th in Canada for exploration and deposit appraisal expenditures in 2010, estimated at $280.6 million.

3-D Mapping of the Interface between Geological Units and their Depths, Including Basement Topography Using Magnetic and/or Gravity Survey Data

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We present the results of a combination of methods for determining depths of geological units, mapping the crystalline basement topography or mapping other interfaces between geological units in 3-D. This technique uses the data collected by clients from conventional airborne, ground or marine surveys.

The algorithm is initially based upon the Bouguer gravity anomaly of 3D density distributions. However, if gravity data is not available, residual magnetic data is transformed into pseudogravity in real space domain. The results are then used to reconstruct the crystalline basement topography.

Calculation of the first-order depth to the interface is done based on density or susceptibility contrasts. The first-order approximation of depth to the interface is estimated by an infinite horizontal slab model, and then the disturbance contributed by topographic changes in 3D space is computed at each measurement point and applied to correct the first-order estimates. Drillhole data on the depth to the interface can be applied to calibrate the computed depths.

Minimum contrast necessary to produce these maps can be less then 0.1g/cm^3. Numerical experiments with synthesized data demonstrate that it is possible to map displacements that are as small as 25 metres at depths below ground surface of 700 metres. This technique also works well in local areas where there are large density or susceptibility variations.

In this presentation, a number of maps will be presented for applications such as kimberlite, gold, and uranium exploration.

Investigations into the P-T-t-d History of Paleoproterozoic Rocks of the Coronation Supergroup, Southern Wopmay Orogen

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In the southern Wopmay Orogen, Paleoproterozoic sedimentary rocks that lie east of Wopmay fault zone and west of the Archean Slave craton are collectively referred to as the Coronation Supergroup. These rocks form a passive margin sequence that developed at ca. 1990 Ma on the extended Archean basement. The cover sequence and its basement deformed together during the ca. 1885 Ma Calderian Orogeny: an event that resulted in thrusting, shortening, and thickening of the clastic wedge. Post-Calderian cross-folding has been used to explain structural culminations that are commonly basement-cored. Our study aims to document the pressure-temperature-time-deformation (P-T-t-d) history of the southern Coronation margin and to provide quantitative values on the timing of metamorphism relative to the multiple deformation events related to Calderian (and younger?) orogenesis.

The P-T-t-d history of the area will be determined through detailed outcrop mapping and microstructural analysis using spatially oriented thin-sections to 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 will provide absolute time constraints on the structural-metamorphic evolution of the orogen.

Two areas within the Coronation margin were chosen for this study; the Arseno Lake area, adjacent to the Slave craton, and the more westerly Grant Lake area. Near Arseno Lake, the Coronation cover sequence shows a progression from greenschist grade slates adjacent to the Slave Craton to amphibolite or granulite-grade migmatites in the west, proximal to the ca. 1850 Ma Rodrigues granite. The metasedimentary rocks display at least three generations of ductile deformation. The relative timing of porphyroblast growth relative to those deformation stages will require further detailed microstructure analysis. Initial constraints on the spatial distribution of the isograds suggest a steep metamorphic field gradient, particularly closer to the Archean gneiss domes. These gneissic domes were found to contain two zircon populations, at ca. 2556 Ma and 1855 Ma, suggesting a widespread metamorphic/resetting event coinciding with the intrusion of the nearby Rodrigues Pluton.

Rocks of the Grant Lake area show four geometrically distinct generations of ductile deformation, seen in single outcrops and thin section. The dominant foliation, S_1, transposes bedding, the latter being tightly folded into parallelism with the former. In the field, porphyroblasts of cordierite and andalusite appear to be wrapped by S_1, although further microstructural analysis will help determine their timing of growth. S_2 post-dates the main stage of porphyroblast growth. S_3 is only rarely observed in outcrop. A set of leucogranite sills intruded into and were deformed with the metasedimentary rocks, and have been dated at ca. 1878 Ma. S_1 and S_2 have been observed to deform these sills, and therefore we can assume a maximum age for S_1. In outcrop, large-scale folds plunge gently southward.

Application of Seismic Shothole Drillers' Log Records to Drift Geochemical Exploration and Natural Resource Development

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The seismic shothole drillers' log project has undertaken the collection and digital rendering of all available archival data from Northwest Territories and Yukon held by the petroleum and geophysical exploration industries. The present database (~276,000 records) is being updated to a final ~350,000 records, and represents the extent of data holdings of 22 companies (102 companies/successors/data stewards have authorized release of joint-venture data). These formerly unutilized data have provided a wealth of regional baseline, near-surface (10-60 m) geoscience information that has become the foundation for new and original GIS-based reconstructions of: drift and till isopach (thickness) models, till facies, granular aggregate resources (sand and gravel), bedrock outcrop and subcrop, geohazards, muskeg thickness, massive ice and ground ice occurrences, permafrost extents and thicknesses, and bottomfast ice extents.

Drift geochemical exploration/drift prospecting involves the regional sampling of unconsolidated glacial and/or fluvial sediments as a means of identifying bedrock-hosted economic mineral deposits. Successful application of this exploration technique requires detailed knowledge of the character of the unconsolidated sediment cover including sediment erosion-transport-depositional histories. The drillers' log records provide the most extensive archive of surficial geology in the central and western NWT and northern Yukon, extending across fifty-eight 1:250,000 map sheets, of which less than half have been, or are currently the subject of surficial geology mapping. In addition, the drillers' logs have been used to produce drift and till isopach models that identify regional drift dispersal/accumulation patterns including the influence that local topography has had on these. The drillers' logs have also been used to identify regional till facies. Tills predominantly derived from local shale-rich bedrock are typically distinguished in the drillers' log records as blue clay/silt-rich deposits, while tills comprised of distal Canadian Shield-derived bedrock are documented as brown sand-rich deposits. Understanding of these facies relationships and their relative extents are important to both designing effective drift sampling programs, and interpreting what can be disparate till geochemical signatures. The drillers' logs can also be used to identify specific drift exploration targets such as surface and subsurface sorted sediment deposits; often a difficult task in regions characterized by extensive organic and thick drift cover.

With respect to natural resource infrastructure development (e.g., roads, pads, pipelines), the drillers' log-derived geoscience reconstructions are likely to become a fundamental baseline geoscience resource used in infrastructure proposal design, environmental assessment, and construction. Examples of the application of drillers' log data is discussed in terms of identification of granular aggregate resources (gravel and sand, as well as quarriable bedrock outcrop and subcrop localities), and potential hazards to surface construction activities (e.g., buried ice, unfrozen sediments/water at depth, muskeg thicknesses).

Transforming a Diamond Mine: The Jericho Diamond Mine Update

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On August 27, 2010 Shear Minerals Ltd. completed the purchase of a 100% interest in the Jericho Diamond Mine, processing facilities and all supporting exploration assets, located in the Kitikmeot region of Nunavut through a court-sanctioned process.

Jericho is Nunavut's first and only diamond mine. It is located 420 km northeast of the City of Yellowknife and is accessible all year by air and by winter road from Yellowknife. The project was mined from 2006 to 2008, the open pit operation produced 780,000 carats of diamonds from 1.2 million tonnes of kimberlite. Over $200 million was invested in the development of the Jericho operations including the construction of a 2,000 tonne per day diamond recovery plant, maintenance facility, fuel farm, offices and accommodation for 225 personnel.

The Acquisition is a transformational transaction that will strengthen Shear's position as a leading diamond exploration company. The benefits to Shear of this transaction include:

- Extensive operational infrastructure in place and identified opportunities for substantial operational improvements;

- Significant upside potential for existing resources, with a current mineral resource of 1.82 million carats Indicated and 1.13 million carats Inferred. An additional 65,000 carats is readily accessible in a 156,000 tonne surface stockpile. *The resource estimate is a National Instrument 43-101 compliant resource prepared and published by Shear on August 12, 2010;*

- Potential exploration upside below the currently defined pit shell and throughout the 68,000 acres surrounding the Jericho Mine includes; five known kimberlites, five unresolved kimberlite indicator dispersion trains, two kimberlite float discoveries and a number of untested geophysical targets all within 10 km trucking distance to the mine.

Between now and commencement of the new drilling season in the spring of 2011, the priority drilling plan and target list will be finalized to further upgrade and test the Jericho kimberlite complex resource as well as additional nearby targets within trucking distance of the main facility. Existing data will be re-interpreted, re-processed and scrutinized.

Shear has put in place a comprehensive two year advanced exploration business plan with the goal of increasing the total diamond resource base and completing a new economic assessment of the project in late 2011 with the goal of re-opening the mine. This talk will highlight a summary of the project with Shear's future plans and outlook.

Nunavut Prospectors' Program: Starting Point for Interaction between Communities and Mining Industry

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A decade of introductory prospector courses plus financial assistance to resident prospectors has yielded significant exposure to mining and mineral exploration at the community level throughout Nunavut.

The department of Economic Development and Transportation provides technical and financial assistance to Nunavut residents with demonstrated prospecting skills. The program has been in existence since 1999. Up to $8000 in annual financial assistance is available to each successful applicant. Typically, about 15 to 20 individual-based projects across Nunavut are funded each year.

EDT geologists present a six-day Introductory Prospecting Course to Nunavummiut every summer, ongoing since 2000. There are more than 750 graduates from 58 courses delivered in the program's first decade. Course graduates often apply for NPP funding to start their own prospecting programs while others work as field assistants on mineral exploration and government mapping projects. During the past two summers, the Prospecting Course visited 16 communities with 150 graduates. Another 6 deliveries are planned for 2011.

Additional information concerning the Nunavut Prospectors' Program is available on our website <www.edt.gov.nu.ca>.

Development Plans for the Nechalacho Heavy Rare Earth and Rare Metal Deposit, Thor Lake, Northwest Territories, Canada

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Avalon Rare Metals is developing the Nechalacho Heavy Rare Earth Deposit located in the Northwest Territories of Canada. The paper will review current initiatives and project progress in the areas of permitting, community engagement, project development, metallurgical testwork and current economics.

On April 23, 2010, Avalon submitted a land use and water license permit application through the Mackenzie Valley Land and Water Board (MVLWB), for the mining, flotation processing and hydrometallurgical processing in the Northwest Territories. Upon completion of the MVLWB preliminary screening process, the Thor Lake Project was referred to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) on June 11, 2010, for assessment of potential environmental and social impacts. The Project has completed the scoping phase of the environmental assessment process and is currently waiting for the Terms of Reference from the MVEIRB.

Avalon’s work has included contracting to Aboriginal owned businesses, assisting in development of Aboriginal owned businesses, partnerships with the Mine Training Society and others in implementing skills training courses and negotiation of agreements with participating Aboriginal groups.

In June, 2010, a prefeasibility study was completed by independent consultants Scott Wilson RPA that included a mine and flotation mill complex at the Thor Lake project site as well as a hydrometallurgical facility located near the Pine Point mine site. Avalon proposes to mine underground at a rate of 2000 tonnes per day that would generate 132,000 tonnes of rare earth concentrates per year. These rare earth concentrates would be loaded into enclosed intermodal containers and stored 8 kilometres south of the mine site near the proposed temporary barge loading facility along the Great Slave Lake. During the 120 day summer barging season, containers of concentrate would be loaded onto barges and shipped approximately 150 kilometres to a temporary barge facility on the south shore of the Great Slave Lake near the old Pine Point mine site. An existing 8.5 kilometre access road would be utilized to transport containers of concentrate from the Lake shore to the hydrometallurgical facility for extraction of the valuable rare metals including rare earths, niobium, tantalum and zirconium. Final products would be transported in sealed containers 85 kilometres to the Hay River railhead for shipment to Avalon’s proposed separation plant.

Metallurgical testwork has resulted in a final process flowsheet consisting of froth flotation to concentrate at the mine plant, followed by acid baking, caustic crack and solvent extraction to recover the metals from the hydrometallurgical plant. Avalon has commenced pilot testing of the process that was developed on bench scale.

The mine plan calls for an 18 year life incorporating 12 million tonnes of probable reserves. Total capital costs are estimated at 899 million with average cash costs of 267 per tonne of ore mined (including hydrometallurgical processing). The Project is estimated to generate net revenue of 536 per tonne of ore mined. Pre-tax cash flow totals 2.1 billion, with a Net Present Value (NPV) of 428 million (at an 8% discount rate), and the Internal Rate of Return of 14%.

Prairie Creek Mine

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The Prairie Creek Mine is located in the Mackenzie Mountains 200 kilometres west of Fort Simpson in the Northwest Territories. A high grade base metal resource has been defined and this, coupled with already existing mine infrastructure, prompted Canadian Zinc to apply for operating permits and the applications are presently in the regulatory Environmental Assessment stage.

A 43-101 compliant mineral resource calculation completed in October 2007 calculated a Measured and Indicated Vein and Stratabound mineral resource totalling 5.2 million tonnes grading 10.8% Pb, 11.3% Zn, 175 g/t Ag and 0.4% Cu. This defined resource was sufficient enough to support a 14 year mine life and on this basis the company applied for operational permits to support a mine at Prairie Creek. In addition an open-ended inferred mineral resource of 5.5 million tonnes grading 11.4% Pb, 13.5% Zn, 215 g/t Ag and 0.5% Cu was also outlined.

At the Prairie Creek Mine high grade base metal mineralization occurs within both Vein and Stratabound-type geological settings. The high grade Vein, which contains the majority of the defined mineral resource, is located within a steeply dipping fault zone cross-cutting sedimentary sequences of the Whittaker and Road River Formations. Structurally, the vein-hosting fault zone is located in close proximity to the axial plane of a doubly plunging regional antiform. Stratabound base metal mineralization has also been drill located flanking the vein within the same stratigraphy.

In tandem with the final expansion of Nahanni National Park Reserve being announced in June 2009, the Government of Canada assured the rights of Prairie Creek Mine to operate along with guaranteeing rights of access by road into the minesite through the newly expanded park. While the announcement clarified some land positions it has also created some multi-jurisdictional challenges for the future operation of Prairie Creek since the mine road now crosses both the National Park, under Parks Canada jurisdiction, and Crown land, under the jurisdiction of the Mackenzie Land and Water Board.

Surrounded by the newly expanded National Park and ensuring protection of its ecological integrity has triggered the need for the proposed operation to consider some creative and innovative approaches. The use of paste backfill to negate the need for a tailings pond coupled with innovative water management and upgrade of some facilities will provide a further reduction of potential environmental impact during operations and also post-closure.

Operating applications for the Prairie Creek Mine were submitted to the MVLWB in June 2008 and were subsequently referred to Environmental Assessment under the Mackenzie Valley Environmental Review Board. Terms of Reference were finalized in June 2009 and Canadian Zinc submitted a Developers Assessment Report to the MVRB in March 2010. An initial round of Information Requests and responses were completed by CZN in September 2010. Technical sessions were held in early October and the EA continues.

Sequence Stratigraphy of the Shaler Supergroup; New Insights from the GEM Minerals Victoria Island Project, Western Minto Inlier, Victoria Island, NWT

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Neoproterozoic sedimentary rocks of North America were subdivided into three, first-order stratigraphic cycles or successions; A, B, and C (Young et al., 1979). The Shaler Supergroup is included within succession B and records the history of sedimentation throughout the evolution of the supercontinent Rodinia; from its amalgamation at the end of the Grenvillian orogeny (~1000-900 Ma), to its break-up at ~750-700 Ma. Sedimentary rocks of the Shaler Supergroup were deposited in the Amundsen Basin, and are well exposed in the Minto Inlier on northwestern Victoria Island, Northwest Territories. The Shaler Supergroup includes evaporites (shallow marine-restricted basin), carbonates (shallow marine-open basin), black shales (deep marine basin), and cross-bedded sandstones (fluvial and shallow marine). The sedimentary strata are overlain by continental flood basalts of the Natkusiak Formation, part of the widespread ~720 Ma Franklin magmatic event.

Preliminary results from the 2010 summer field season are reported. Stratigraphic study focused on a detailed re-evaluation of sedimentary rocks of the Minto Inlet and Wynniatt formations of the middle to upper Shaler Supergroup which have a combined thickness of ~825 m. The Minto Inlet Formation is composed mainly of sulphate evaporites with interbedded carbonates of variable thickness. The evaporites are characterized by bedded gypsum and anhydrite, with classic chicken-wire texture, enterolithic folds, satinspar veining and selenite crystals. There are two prominent carbonate units within the Minto Inlet Formation, the lower is a stromatolitic build-up, and the upper consists of cycles of alternating carbonates and evaporites. The Wynniatt Formation is subdivided into four informal members. The lower carbonate member records upward deepening from supratidal carbonates with desiccation cracks, intraformational breccias, and water escape structures, to a prominent orange-weathering intertidal stromatolitic dolostone overlain by deeper water mudstones and siltstones of the black shale member. The overlying stromatolitic carbonate member is a heterolithic interval that gradationally overlies the black shale member. It consists of stromatolitic dolostones, variegated mudrocks, thin beds of quartz arenite and other shallow-marine carbonates, including cross-bedded grainstones and a distinctive oncoidal-stromatolitic dolostone unit. The sharply overlying upper carbonate member marks a significant change from interbedded dololutite and dolarenite with desiccation cracks and intraformational breccias to deeper-water, nodular black calcareous shale and rhythmically bedded turbiditic dolarenites. Upward shallowing is indicated by overlying microbially laminated limestones, cross-bedded quartz arenites and stromatolitic dolostones.

Sequence boundaries are identified and discussed in the context of future work, which will focus on integrating detailed stratigraphy and sedimentology with stable isotope stratigraphy (C, O, S), and regional facies mapping. Together, this dataset will derive a sequence stratigraphic framework that can be correlated with adjacent sequence B inliers, and provide new insights on the paleogeography of the Amundsen Basin and early Neoproterozoic Laurentia.

This project is supported by an NSERC Discovery Grant, an NSERC PGS-D Grant, and the Geological Survey of Canada’s Geo-mapping for Energy and Minerals (GEM) initiative.

Government of Canada's Action Plan to Improve Northern Regulatory Regimes

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Canada wants to see a strong and prosperous North that realizes the region's incredible resource potential while also protecting the environment.

Resource companies want to invest where there is certainty and predictability in the permitting and licensing processes. However, the current regulatory does not always exhibit these two qualities. Investors often face complex and overlapping regulatory processes that are unpredictable, costly and time-consuming.

Over the past four years, we have been working with aboriginal and territorial governments, the private sector, and regulatory boards to fix the Northern regulatory system.

While we have been looking at this bigger picture, we have also made progress with specific improvements to the regulatory system including; investments in training for NWT boards; updating the land use guidelines for Crown land in the NWT and Nunavut; amended to the *Canada Oil and Gas Operations Act* to provide the National Energy Board with the authority to regulate pipeline access; amending the Exemption List regulations to ensure the basic principle of "one project, one environmental assessment; investments in the five year review of the *Yukon Environmental and Socio-economic Assessment Act;* and the development and introduction of the *Nunavut Project Planning and Assessment Act.*

For broader and more significant change, in May of 2010, the previous Minister of Indian and Northern Affairs Canada, the Honourable Chuck Strahl announced the Action Plan to Improve Northern Regulatory Regimes.

The Action Plan includes three main parts:

1. Modernizing and completing the legislative regime including amendments to the *Northwest Territories Waters Act* and the *Mackenzie Valley Resource Management Act*, new Surface Rights legislation and a number of new and amended regulation all of which will provide more certainty and timeliness and less regulatory overlap and duplication. This will require an investment of $11 million over the next two years to speed up the review of resource projects in the region.
2. Strengthening environmental stewardship by supporting the NWT Cumulative Impact Monitoring Program and the Nunavut General Monitoring Program through investments of $8 million over the next two years and $5 million ongoing.
3. Continuing to build on strong partnerships with Aboriginal governments and organizations that have been established and maintained through land claims agreements.

As Minister Strahl stated "committing to this Action Plan means encouraging future investment by investing federal time and resources in these needed changes. It's about strengthening regulatory regimes so that new investment continues in the North."

The Minister also announced the appointment of Mr. John Pollard, as Chief Federal Negotiator, who is responsible for consulting and negotiating with Aboriginal and territorial leaders on how the Land and Water Boards could be restructured in the Northwest Territories.

This Action Plan builds on the progress we've seen to date and it takes action to make the regulatory frameworks strong, effective, efficient and predictable.

Improved Mapping of Basement Faults in the Northeast Thelon Basin by Source Edge Processing of Aeromagnetic Data

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Within the Thelon Basin of Nunavut, northeast of the border with Northwest Territories, the unconformity surface is located at depths as great as 1000 m (Tschirhart et al., submitted). In the search for unconformity-associated uranium deposits, analysis of reactivated faults is an important guide. Detection of faults at surface within the region has included geologic mapping and lineament analysis on topographic and potential field data. Field mapping has identified structures that can be projected laterally using spatial analysis of lineaments, but projecting to the unconformity at depth is problematic. Lineament analysis may also help to determine which faults have been re-activated and altered at or near surface. Myriad lineaments can be identified from topographic data, requiring screening and qualification with geophysical data to prioritize importance and linkages with mapped structures. For regional framework analysis of the prospective Thelon Basin, a non-invasive approach using public domain data is needed to estimate the locations of buried faults that may have offset the unconformity surface but are of uncertain relationship, if any, to surface-mapped structures. Source edge detection analysis of aeromagnetic data offers an objective and quantitative solution to this challenge.

Source edge detection and textural analysis have been used extensively in industry and literature to locate magnetically anomalous source body edges and regions of structural complexity, respectively. A multitude of results are generated using both techniques creating a cluttered image, where it is difficult to distinguish real edges from noise. A new utility is introduced to delineate faults from aeromagnetic data. By gridding the dip-direction computed by the Blakely algorithm, lineaments marking offsets of the magnetically susceptible geology become evident. A multitude of new faults have been identified while validating, refining or rejecting faults inferred from geological discontinuities and linear elevation features. This tool simplifies conventional source-edge detection or textural analysis, effectively reducing clutter and distinguishing true maxima from noise. It has promise for comprehensive mapping of fault symmetries in the basin, understanding its tectonic development and pinpointing prospective intersections.

Advancement of the Three Bluffs Gold Deposit Committee Bay Project, Nunavut

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The Three Bluffs gold deposit, located northeast of Baker Lake, Nunavut, currently hosts an indicated resource of 508,000 ounces (2,700,000 tonnes at 5.85 g/t Au) and an additional inferred resource of 244,000 ounces (1,270,000 tonnes at 5.98 g/t Au) and remains open to the west and to depth.

The Three Bluffs deposit is located within the Committee Bay Greenstone Belt (CBGB) comprising a portion of the Archean-age Price Albert Group of Nunavut. On a more local scale, the deposit is located at the eastern end of a portion of the Committee Bay belt comprising a package of auriferous, iron formation-bearing, supracrustral rocks referred to as the “Walker Lake trend” that has been traced at least five kilometers west. Surface sampling and cursory exploratory drilling completed prior to 2010 had indicated this package to be continuously mineralized. The shearing, alteration and mineralization observed along the trend is interpreted to represent a second order splay of the regional Walker Lake Shear Zone located to the south.

Going into the 2010 season, North Country Gold Corp believed that significant potential existed along the Walker Lake trend and developed a strategy to initially indentify near surface open-pittable gold resources along the exposed strike length of the trend. As a result, the 2010 exploration program at the Committee Bay Project was focused on completing a significant drill program along the Walker Lake trend and at the Three Bluffs deposit. A total of 50 holes was completed along the trend with the following results:

- The extent and grade of the existing resource was confirmed and upgraded.
- The Three Bluffs deposit was extended approximately 650 metres to the west.
- An additional 700 metres of strike length of the mineralized structure was identified at Antler approximately 2km west of Three Bluffs.
- Mineralization was identified over 4 kilometres west of Three Bluffs with high grade intersects at the Hayes occurrence.
- Alteration and mineralization was confirmed along the extent of the Walker Lake trend and confirmed the presence of a mineralized shear, as opposed to a simple iron formation hosted gold deposit model, as gold mineralization has now been identified in almost all lithologies within the stratigraphy including iron formations, volcanics and sediments.

Analytical and Traditional Knowledge Approaches to Water Quality Monitoring at Colomac Mine, NT

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The former Colomac open pit gold mine, located 220 km north of Yellowknife, Northwest Territories operated between 1990 and 1997. The following year, Royal Oak Mines Inc. placed the mine in Care and Maintenance and it reverted to the Crown in 1999 when Royal Oak Mines Inc. went into receivership. The site is currently under remediation by Indian and Northern Affairs Canada (INAC) **-** Contaminants and Remediation Directorate (CARD).

Environmental legacies at Colomac include disposal of cyanide bearing tailings in the Tailings Containment Area (TCA) and hydrocarbon contamination due to fuel spills during mine operations. Major remediation activities completed to date include construction of a new dam at Tailings Lake, capping of tailings in the TCA, construction of a discharge channel at Tailings Lake, hydrocarbon recovery and remediation of hydrocarbon contaminated areas, demolition of the mill, maintenance shop and other infrastructure.

Current remediation activities are regulated by a Type B Water License issued by the Wek’èezhìi Land and Water Board (WLWB). Under the water license, a Surveillance Network Program (SNP) was developed to monitor water quality during the remediation process and to measure progress towards remedial water quality objectives. Water quality samples are collected from 24 active stations as part of the SNP program.

Water quality monitoring in Steeves Lake has focussed on hydrocarbons (BTEX, Extractable Hydrocarbons) and total metals as the main environmental contaminants of concern (CoC). Hydrocarbon and total metals concentrations from SNP stations in Steeves Lake have generally remained below detection limits and CCME FAL guidelines respectively. Water quality in nearby Baton Lake is also monitored, but minimal negative environmental impacts have been detected.

In the Tailings Containment Area, the main CoC is cyanide (total, weak acid dissociable and thiocyanate) due to disposal of cyanide bearing tailings. In 2002 and 2003, water in Tailings Lake was treated by the addition of phosphorus (monoammonium phosphate or MAP). Phosphorus promoted growth of algae naturally present in the water, which converts cyanide and ammonia into non-toxic compounds. This treatment approach is called Enhanced Natural Removal (ENR). Due to the ENR program, remedial objectives for Tailings Lake have been met; Tailings Lake water currently outflows into a wetland area before entering L-Shape Lake with eventual discharge to the Indin River – Indin Lake system. Current monitoring indicates that discharge limits set out in the WLWB Water License are being met.

Monitoring of water quality at SNP stations has been carried out in conjunction with Tłı̨chǫ Traditional Knowledge to assess water quality at Colomac. Elders and youths from the four Tłı̨chǫ communities were invited to complete a fish palatability test of trout, sucker and great northern pike from Steeves and Baton lakes. Characteristics considered were: physical condition, colour and appearance of organs, firmness of flesh, presence of odours during cooking, and taste. Test results indicate there were no adverse effects on fish quality.

Monitoring activities scheduled for 2011 include a Post Discharge Ecological Assessment of the Discharge Channel in the TCA to determine if any ecological impacts have resulted from Tailings Lake discharge on downstream water bodies.

Baker Creek Arctic Grayling: Assessing Fish Habitat Use in a Reconstructed Stream

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Baker Creek originates from a network of small lakes northwest of the city of Yellowknife and flows south through Giant Mine into Yellowknife Bay on Great Slave Lake. In 2006, a 600 m portion of Baker Creek known as 'Reach 4' was realigned to the west side of Highway 6. The primary objectives of the Reach 4 realignment were to isolate the contaminated Mill Pond from Baker Creek, thereby eliminating a source of ongoing contamination, and prevent seepage from Baker Creek into areas of the mine itself (the C1 Pit). A Fisheries Act Authorization required the provision of suitable spawning, rearing, and overwintering habitat for Arctic grayling (*Thymallus arcticus*) as compensation for habitat losses incurred from the realignment. As part of the Authorization, DFO mandated a monitoring program to assess habitat compensation effects on life history stages associated with the realignment. During three years of monitoring, egg site conditions, embeddedness, substrate, flow rates, food availability and overall habitat were studied. In years since the construction of Reach 4, the measured parameters were within ranges suitable for grayling and longnose sucker spawning. The spawning adult population was characterized by individuals ranging from 4 to 11 years of age with near absence of certain age classes. Successful hatching occurred in Reach 4 and young-of year continued to benefit from the available habitat, absence of predators, and appropriate water temperature and flow characteristics of Baker Creek. Young-of-year successfully out-migrated 24 to 38 days after emergence and ranged in size from 36 to 65 mm. Based on our analyses, Reach 4 provides suitable habitat for all grayling life stages.

Legislative Proposal for the Northwest Territories Surface Rights Board

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The proposed Northwest Territories Surface Rights Board Act will provide a dispute resolution mechanism for disputes between land owners and holders of sub-surface interests when a negotiated access agreement cannot be reached.

The legislative proposal would apply to the entire Northwest Territories and would have the potential to improve timely access to sub-surface resources as well as enhance the predictability and consistency of the regulatory system in the NWT.

Exploring for High-tonnage, Low-Grade Gold Deposits within the REN Property, Point Lake, NWT

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Recent gold exploration work completed by Novus Gold Corp. has discovered a number of potential high-tonnage, low-grade, gold deposits within its 100% owned REN gold property. The REN Gold Property, covering 16,260 hectares, is located approximately 310 kilometres north of Yellowknife, at the east end of the North Arm of Point Lake, Northwest Territories. Since September 2009, Novus Gold Corp. has completed 21 drill holes totalling 5,475 metres, relogged 42 historic drill holes completed between 1980 and 1991 totalling 6,485 metres, collected 256 surface grab samples and compiled previously completed exploration work. The presentation will outline current gold exploration advancements and outline key characteristics as to why the underexplored REN property has an excellent potential to host multiple high-tonnage, low-grade gold resources.

Previous exploration work within the REN property had targeted relatively narrow, high-grade, gold-bearing zones of amphibolite iron formation, analogous to Lupin-style gold deposits. Novus Gold's 2009 drilling program at the Main Zone discovered significant quantities of gold within the metasedimentary rocks interbedded with high- and low-grade gold-bearing amphibolite iron formation. As a result, a much wider zone (15 to 30 metres) of lower grade gold (approximately 2 g/t Au) was identified at the Main Zone. In addition, the Main Zone was demonstrated to be stratigraphically related to a possible felsic metavolcanic dome structure overlying mafic metavolcanics. This stratigraphic zone correlates with the Zn, Cu, Pb, and Ag Izok volcanogenic massive sulphide deposit located 25 kilometres north of the REN property. Consequently, a significant, previously unrecognized, volcanogenic component is considered to be related to the gold deposits of the REN property, greatly expanding its gold potential.

In light of the 2009 gold exploration results, further exploration and compilation work was completed during 2010 to assess the potential for additional gold-bearing environments that could host high-tonnage, low-grade gold deposits. The REN property includes 27 known gold occurrences that are distributed along what has been recently described as six "Gold Trends" with a combined strike length of more than 25 kilometres. Gold occurrences within the "Gold Trends" include the Lupin-style gold-bearing amphibolite iron formation and three new environments discovered by Novus Gold Corp. during the 2010 exploration program. In addition, it has also been demonstrated that higher gold values in each of the four gold-bearing environments appear to strongly correlate with prominent, property scale faulting and the transition from relatively higher to lower grade metamorphism. The new gold-bearing geological environments include a brecciated, chloritized and sericitized metasediment, a quartz stockwork hosted in altered metasediment and a brecciated and sulphidized chert.

Update on Tyhee Development Corp's Yellowknife Gold Project

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Tyhee Development Corp advanced its wholly-owned Yellowknife Gold Project in 2010, completing a Preliminary Feasibility Study, discovering two new gold zones on its Clan Lake property, and advancing permitting through the Mackenzie Valley Land and Water Board.

The Yellowknife Gold Project hosts 2 million ounces of Measured and Indicated gold Resource at 3.47 gpt and 269,000 ounces of Inferred gold at 3.29 gpt in five zones. A combined open pit and underground operation on three of the zones results in a Proven and Probable Reserve of 811,000 ounces of diluted recoverable gold. Production of 3,000 tpd is contemplated, processed in a conventional mill leading to an average annual production of 108,000 ounces of gold over 7.5 years. All of the zones are open to depth, two are open along strike in all directions, and two new gold zones have recently been discovered providing for substantial expansion potential.

Baseline environmental studies, initiated in 2004 and ongoing since then plus all exploration and engineering data were compiled and used to develop a Project Description Report which was submitted to the MVLWB in 2005. Due to significant increases in the resources from ongoing exploration after this date, the original application was withdrawn and a new application submitted in 2008 involving a more robust project. It was referred to an Environmental Assessment and Tyhee expects to submit its Developers Assessment Report to the MVEIRB within several months.

Environmental Impacts and Geohazards in the Mackenzie Delta and Shallow Beaufort Sea

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The potential for oil and gas exploration and development in the Mackenzie-Beaufort region continues to raise questions about geological conditions and potential geohazards in the nearshore and coastal region. Recent work has delineated the presence of nearshore geohazards (ice keel scours and strudel scours), coastal erosion and stability, overland flooding and land subsidence in the area. The following provides an update of the most recent activities and discoveries from the Geological Survey of Canada that are focused on these issues.

The shallow gently sloping, silt-dominated inner shelf region offshore of the Mackenzie Delta is characterized by highly mobile sediments and rapidly changing seabed features. In this region, the seabed is scoured by ice and water during fall freeze-up and spring break-up, as well as by currents and waves during moderate storm events that occur in the short open water season. It is now confirmed that the distribution of bottomfast ice plays a critical role in the overflow of water during spring breakup. A portion of the rising spring flood flows out over the bottomfast ice, then drains through cracks at the floating ice boundary, forming strudel scours on the seabed. The floating ice boundary occurs in a similar location year after year so that satellite imagery like synthetic aperture radar (SAR) and moderate resolution optical data can be used to predict the zone of strudel scour formation in future years. A very active strudel drainage field has been observed at the edge of over ice flooding over the past several years. In water depths between 1-1.5 m, scours typically are eroded 1-2 m below the seabed, but can reach 5 m in depth. Detailed sonar mapping in 2009 and 2010 discovered over 20 scour holes each year. More interesting however, is that none of the holes found in 2009 were present in 2010, including 5 m strudel scour. Field observations revealed 15 cm of sediment infill just 7 days after a strudel hole had been created. One strudel hole located 2 m below the seabed in June 2010 had been completely infilled by August 2010. Direct measurements of waves, currents, turbidity, temperature and salinity made during the open water seasons in 2007 – 2010 provide additional information about the role of storms in controlling sediment movement in the shallow delta front environment.

On land, spring flood levels have been measured in excess of 1 m which can have a dramatic effect on the extent of overland flooding, channel stability, and morphology of the very low elevation delta. Recent measurements of long-term average rates of coastal erosion continue to be on par with previously measured levels of 1.3 m/yr along the delta front, however, there are many instances of higher rates (5-10 m/yr) along exposed coastal bluffs. Lastly, subsidence measurements based on GPS continue to show the delta is subsiding at a rate of 5-10mm/yr. A continuous tracking GPS station was installed in 2010 in the outer delta to help verify these findings with continuous data throughout the year.

Tundra Science Camp at the Tundra Ecosystem Research Station

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Imagine a program that emphasizes learning from the land; one that takes students into the classroom then into the field – every day; one that is fun yet educational and emotive; one that bridges the gap between scientific study and traditional knowledge.

Welcome to The Department of Environment and Natural Resources' Tundra Science Camp – a ten-day environmental education program for high school students and teachers in the Northwest Territories. Located 300 kilometres north of Yellowknife at the Department's Tundra Ecosystem Research Station at Daring Lake, the camp takes students out of their comfort zone and onto the tundra and challenges them with incredible learning opportunities.

Participants work closely with a variety of instructors including educators, scientists, on-site university researchers and Dene elders. Topics covered include 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 the program, which 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, scientists and educators together with elders gives everyone involved the opportunity to improve communication skills, understand different cultures and bridge the gap between western science and traditional Dene knowledge.

This contact has proven to motivate students, helping them refine their interests in science and traditional knowledge. It 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.

Uranium Exploration in the Thelon Basin – Can Mineral Exploration, Development, Wildlife, and Cultural Values Share Space?

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The Thelon Basin is host to a number of competing values and interests. It is home to important caribou habitat such as the Beverly and Ahiak herds. It hosts a Canadian Heritage River and is home to areas of great cultural value to both Inuit and Dene people. It also has great potential to become a major uranium producing region in the world. The future of the Thelon Basin is heavily dependent on how we proceed today and in the years ahead. Can we achieve a balance between conservation and development which could provide much needed socio-economic benefits, with which everyone can live?

Cameco Corporation has an excellent reputation and has shown a strong commitment to Corporate Social Responsibility (CSR) throughout it's global operations, especially in Northern Saskatchewan, where it has operated for the past 20+ years. This proactive approach to CSR has allowed Cameco to become the largest employer of Aboriginal peoples in Canada. Furthermore, Cameco meets or exceeds the environmental requirements of the jurisdictions in which it works, including those of the Canadian Nuclear Safety Commission. This commitment to the communities and environment begins at the exploration stage. The Boomerang Joint Venture in the southwest Thelon region of the Northwest Territories is supporting a uranium and nuclear energy education program within the stakeholder communities. Cameco is committed to obtaining community support before resuming exploration. In our uranium exploration programs in the eastern Thelon of Nunavut we employ independent wildlife monitors, consult with the communities, support local businesses, and have undertaken wildlife and archaeological baseline studies. We have taken steps to minimize impact on wildlife and the environment during our field programs.

Management of diverse land uses with the goal of providing economic benefits while preserving environmental and cultural values requires cooperation and trust by all parties. Accurate delineation of priority areas for competing land uses is necessary to minimize overlaps and conflicts. Industry must act responsibly to minimize its impacts and address the concerns of local communities. Cameco is committed to that goal from exploration through to development.

Trace-Element Geochemistry of Muscovite in the Moose II Lithium-Tantalum Pegmatite Deposit and Associated Faulkner Lake Pegmatite Field, NWT

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The Moose II rare-metal granitic pegmatite, located along the shore of the Hearne Channel of the Great Slave Lake, approximately 115 km east of Yellowknife, NWT, displays extreme fractionation and is characterized by advanced accumulation of rare lithophile elements, including: lithium (spodumene, Li-muscovite, and amblygonite), tantalum and niobium (columbite-tantalite), cesium, beryllium, tin, and rubidium. The north-trending Moose II dyke is a large (approximately 430 m long and up to 61 m wide), irregularly zoned body that dips moderately to the west and is hosted within metasedimentary rocks of the Yellowknife Supergroup. It conforms to the spodumene-subtype of the LCT-suite classification of pegmatites. This deposit is a historical producer of lithium and tantalum (1946-1954); recent exploration by International Lithium Corp. has noted high-grade assays with potential for sizeable resources.

In order to understand the evolution and mineralization of the Moose II pegmatite, and to enhance the exploration potential for discovering new pegmatite deposits in the region, a detailed petrogeochemical study is being conducted, comprising a total of 108 samples.

With the intention of developing a tool for pegmatite exploration, the trace-element relationships of early white mica are being studied. Muscovite is a particularly informative mineral, because the internal element distributions reflect the trace-element contents in early pegmatite-forming fluids or later metasomitizing solutions, as trace-element partitioning is a function of temperature, element activities, and crystal-chemical aspects of substitution that are thermodynamically controlled. Muscovite is also useful because it crystallizes during nearly all stages of pegmatite formation, in this pegmatite and the Yellowknife pegmatite district. Trace-element data will be determined using a variety of analytical techniques, including the electron microprobe (EPMA) and X-ray fluorescence spectrometry. These trace-element relationships in muscovite may help to understand the overall fractionation and internal evolution of the deposit, and may discern Li-Cs-Ta potential. Whole-rock geochemical analysis is being done on channel and bulk samples by inductively coupled plasma-mass spectrometry, to compliment the muscovite trace-element geochemistry.

The main objectives are to (a) characterize the levels of trace-element enrichment within the pegmatite, (b) establish the ranges of trace-element contents, chemical variations, and fractionation trends within muscovite, (c) establish paragenetic relationships, (d) develop a useful tool for further pegmatite exploration in the vicinity of the Moose II deposit and pegmatite deposits worldwide, and (e) develop a model for the origin of the albite-enriched zones, which are intimately associated with the economically important oxide phases (Ta-Nb).

Surficial Geological Mapping in the Wager Bay Area, Nunavut - Filling in the Gaps

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The Wager Bay area, mainland Nunavut, lies within one of the more active diamond exploration areas of the Western Churchill Geological Province. The surficial geology in this area has never been field mapped, and as a result, the glacial history and Quaternary framework necessary for the implementation of successful exploration programs by the diamond industry is lacking. As part of Canada's Geomapping for Energy and Minerals (GEM) Program, a Quaternary mapping activity under the Diamonds Project was initiated in the Wager Bay area to address and fill in these knowledge gaps namely: 1) the surficial mapping coverage; 2) the regional drift composition and glacial transport characteristics at both regional and detailed scales; 3) the glacial history and ice-flow sequences, particularly as they relate to the eastern extension of the Keewatin Ice Divide, the interaction between Keewatin and Melville ice masses, and the late-glacial ice streaming events, and 4) the marine limit determinations and knowledge of the post-glacial uplift history in a strategic coastal area. Both remote predictive mapping and field based investigations will be used to accomplish these objectives

During the 2010 field season, surficial geological mapping and regional till sampling were completed northwest of Repulse Bay in the southwest part of NTS map sheet 46M. Till samples were collected at 42 sites (~ 7 km spacing) and will be analysed for geochemistry, indicator minerals and gold grains. Preliminary field observations have implications for the glacial history and the reconstruction of the interaction between Keewatin Sector and Melville ice. Glacially polished and striated surfaces and roches moutonnées indicate warm-based glacial conditions. Multiple ice-flow directions, including ice-flow reversal over the Rae Isthmus (late flow south into Repulse Bay), superimposed streamlined landforms, and divergent ice-flow directions on either sides of end moraines were recorded. Diverse Quaternary sediments and depositional environments with notable landforms were observed. Till blankets and till veneers are scattered through the area but are dominant above the marine limit. Sand and gravel above the marine limit mainly occur in pro-glacial outwash trains, glaciofluvial aprons/deltas and ice-contact landforms (eskers, kames). The marine sequence includes, from the limit of marine incursion to the present-day coastline, thick sequences of deltaic sands and gravels, extensive areas of exposed and gullied clayey silts, marine offlap sands and silts, and sand and gravel littoral sediments. Sand veneers and patches of wave-washed tills are present below the marine limit. Extensive areas of exposed bedrock occur south of Committee Bay and in the vicinity of Repulse Bay. Contrasting marine limit elevations at the eastern (140-150 m a.s.l.) and western (~ 240 m a.s.l.) extents of marine incursion over Rae Isthmus were confirmed and suggest the ice remained much longer on the eastern side of the Isthmus. This may have implications for regional post-glacial uplift patterns.

Sedimentology and Stratigraphy of the Lower Clastic Unit of the Cambrian, Northwest Victoria Island

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The Paleozoic rocks of Victoria Island have only been studied at regional scale. In an effort to improve the knowledge of the stratigraphy we completed a two-week study focusing on the basal clastic unit of the Cambrian strata. The main study area, near Minto Inlet on northwestern Victoria Island, was a river cut section with six well exposed outcrop faces. Each section was measured in bed-by-bed detail and photo mosaics were taken in an effort to discern sedimentary processes and depositional history.

In the study area 80 metres of clastic strata rest unconformably over a Franklin gabbro sill that has intruded the Minto Inlet Formation. The stratigraphy consists of alternating packages of bioturbated and cross-bedded sandstones throughout the clastic unit, with some shale and siltstone periodically interbedded with the sandstones in fining upward successions. The typical facies include coarse grained moderately sorted sandstone with large cross-bedding, medium grained well sorted sandstone with parallel bedding and cross bedding, weak to strongly bioturbated medium grained sandstone with intermittent fine parallel laminated shale beds, and bioturbated fine to medium grained recessive sandstone with nodular weathering and occasional parallel lamination. Alternation of bioturbated and cross-bedded sandstones along with reactivation surfaces suggests a tidally influenced shoreline environment.

One of our goals is to correlate the Victoria Island stratigraphy to the mainland. The Cambrian beds of the Northern Interior Plains were deposited on the Lac Des Bois and Blackwater platforms, the depositional setting recognized as a semi-enclosed epicontinental marine basin. The three main stratigraphic units include the Mount Clark, Mount Cap and the Saline River formations. The Mount Clark Formation is a fine to coarse grained transgressive sandstone that rests unconformably on Proterozoic or Archean rocks. The Mount Cap Formation is made up of low energy deposits of clays and carbonate muds. An unconformity at the top of the Mount Cap Formation was created by relative sea-level drop. The Saline River Formation was deposited in restricted marine conditions and contains clays, carbonate muds and evaporite deposits. The Lower clastic unit of the Cambrian on Victoria Island correlates well with the Mount Clark Formation due to similarity of lithology (cross-bedded and bioturbated sandstones) and age of the units determined from trilobites as Early to Middle Cambrian. The unit overlying the basal clastic unit of the Cambrian strata consisted of shale and large beds of carbonate mudstone, which correlate to the Mount Cap Formation.

SINED Hyperspectral Survey and Ground Follow-Up – Izok Lake & High Lake Greenstone Belts, Nunavut – Preliminary Results

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The C-NGO was again awarded funds from SINED (Strategic Investments in Northern Economic Development) in 2010 to test the efficacy of airborne hyperspectral imaging 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. However most of the research on the applcability of hyperspectral data for exploration has been carried out in hot arid and desert terrains; with relatively few studies conducted in Canada's cold north above the treeline. Surveys were flown over parts of the Izok Lake and High Lake greenstone belts, both in Nunavut during early to mid August, 2010. This research will test the suitability of hyperspectral data for delineating hydrothermal alteration footprints of volcanogenic massive sulfide deposits. Hydrothermal alteration styles (e.g., chloritization, sericitization, carbonatization) associated with volcanogenic massive sulfides (VMS) exhibit mineral absorbtion features which are ideal for detection by hyperspectral methods. Challenges include the heavy lichen cover on outcropping rocks, and the lower sun angles at such extreme latitudes.

Fieldwork was conducted at Izok Lake during mid August, and consisted of spectral measurements using ASD Fieldspec Pro and Spectra Vista GER field portable spectrometers on targets for vicarious calibration of airborne data, and on vegetation, outcropping and fresh rock exposures, surficial materials, and drill cores.

This is a cooperative project involving personnel from the Geological Survey of Canada, Canada-Nunavut Geoscience Centre, Canada Centre For Remote Sensing, with logistical and in-kind support provided by industrial partner Minerals and Metals Group Limited. The contractor was SpecTIR, LLC, Reno Nevada. Preliminary data are expected to be publicly available for Izok Lake before end 2010, but data for High Lake will be released at a later date.

Prelimnary analysis of the data indicates that certain alteration styles can be recognized and mapped but lichen cover, which approaches 100% coverage in the study area, seriously impedes the extraction of diagnostic spectra from the airborne hyperspectral data. Thus it appears that in conjunction with other past studies in Northern environments, the use of hyperspectral data for exploration and mapping is dependent on the amount of bedrock exposure, weathering style of the various lithologies and nature and quantity of vegetative cover. We are presently undertaking quantitative experiments which will reveal to what degree lichen impedes the spectral recognition of various alteration minerals associated with VMS environments.

Geology and Geochemistry of the Mountain River Beryl Showing, Mackenzie Mountains, Northwest Territories

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Recent discoveries of emerald in the Yukon and Northwest Territories have prompted interest in the Western Cordillera as a new source of gem-quality beryl. The Mountain River beryl (MRB) showing of the Mackenzie Mountains, NT, was discovered in 2007 during a regional mapping program by the NWT Geoscience Office. The showing consists of several outcrops on a steep slope 10 km south-southeast of Palmer Lake, hosted within thinly bedded to thickly layered pyritic sandstone with minor dolostone units mapped as the Neoproterozoic Twitya Formation. The beryl is found within quartz-carbonate-albite veins with minor disseminated pyrite and trace chalcopyrite, and occurs as brilliant green hexagonal crystals 1 to 5 mm in diameter and up to 4 cm in length. The brilliant green colour of the beryl crystals results from high concentrations of V^{3+} and Cr^{3+} substituting for Al in the beryl crystal structure ($Be_3Al_2Si_6O_{18}$). In addition, aquamarine (blue beryl) was discovered in one thin vein roughly 1 cm thick, which gains its blue colour from the substitution of Fe^{2+} into the crystal structure.

The crystals of the MRB showing are a geological oddity, as the source of hydrothermal fluids responsible for mineralization and its age are unknown. Other emerald occurrences in the Cordillera, including the deposits at Tsa da Glisza and Lened, are related to Cretaceous granitic magmatism, but the MRB does not appear to have formed in the same way, as suggested by markedly different fluids and chemistry. The fluids at Tsa da Glisza and Lened are very weakly saline and formed at temperatures of approximately 350°C (Groat et al., 2002; Marshall et al., 2004). According to preliminary fluid inclusion studies, the fluids at the MRB are highly saline (20 wt% NaCl), dominantly two-phase (brine and carbonic vapour) and suggest low temperature mineralization. Higher fluid salinities at MRB suggest that fluids may have interacted with evaporite units nearby, such as the Coates Lake or Little Dal groups, while lower temperatures suggest that the likely sources of heat for emerald precipitation are distal Cretaceous plutonic rocks or volcanic rocks of nearby diatremes. Since the closest identified Cretaceous granites are over 70 km from the MRB, it is unlikely that they are the source of heat. The Ordovician

Mountain Diatreme and other associated diatreme dykes are located 14 km to the south. Intrusive rocks associated with the diatremes seem to be a more likely heat source for the beryl veins. In addition, diatreme boulders have been identified in the creek below the MRB, which hints that there may be unidentified subvolcanic rocks located much closer to the showing than previously documented. These volcanic rocks may also be the source of V^{3+} and Cr^{3+} that lends the emeralds their green colour.

At present the MRB is poorly understood and much research is needed to understand its genesis. As the MRB appears to have formed in a different manner than current models of emerald mineralization can explain, an understanding of its formation will enhance exploration models for emerald in the Western Cordillera and worldwide.

Indicator Mineral and Surficial Geochemical Study of the Izok Lake Zn-Cu-Pb-Ag Volcanogenic Massive Sulphide Deposit, Nunavut

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The application of surficial indicator mineral methods to diamond exploration is well established because much research has focused on indicator mineral suites characteristic of diamondiferous kimberlites. VMS deposits also have a suite of characteristic indicator minerals, however, little research has been carried out to determine which minerals may be useful to exploration in glaciated terrain and few case studies have been conducted down-ice of known VMS deposits. To optimize exploration in northern Canada, Queen's University, Minerals and Metals Group (MMG) and the Geological Survey of Canada's Geo-mapping for Energy and Minerals GEM (2008-2013) are examining the indicator minerals that characterize the Izok Lake Zn-Cu-Pb-Ag VMS deposit, Nunavut and document their glacial dispersal down-ice.

The Laurentide Ice Sheet affected the geomorphology of the Izok Lake area, which sculpted the landscaped and deposited glacial sediments of varying genesis and thickness. Glaciation of the region deposited a silty sand till that is an ideal sample medium for indicator mineral methods. The oldest ice flow in the Izok Lake area trended in a SW direction (255˚), next was a weak ice flow to the NW (315˚) followed by the dominant ice flow and landform trend at WNW (292˚). The youngest ice flow direction to the NW (318˚) was found only in rock polish in the Iznogoudh Lake area.

Bedrock and till samples were collected around Izok Lake in 2009. Research to date has focused on petrology, Scanning Electron Microscope (SEM) specifically using Mineral Liberation Analysis (MLA), Electron Microprobe (EMP), examination of heavy mineral concentrates, pebble counts and till geochemistry. Preliminary results show gahnite ($ZnAl_2O_4$), chalcopyrite, sphalerite, galena, gold, and pyrite are of the deposit. MLA was used for gahnite grains from till to distinguish gahnite from intergrowths of quartz, mica and amphibole in individual grains prior to EMP.

Using till geochemistry, Zn, Cu, Pb, Au, Fe, and Ag were identified as pathfinder elements for the deposit. All pathfinder elements showed a dispersal pattern around 8 km long trending towards the northwest. Zinc had a strong dispersal pattern with the highest concentrations around the Izok Lake deposit and the West Iznogoudh showing (WIZ). Copper and Pb showed a weaker dispersal pattern with a higher concentration near the Izok Lake deposit. Iron and Ag show a dispersal pattern with high concentrations near the Izok Lake deposit and WIZ.

GEM Knowledge Management Program Tri -Territorial Surficial Database Project

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The Tri-Territorial Surficial Database Project is part of the Geological Survey of Canada's (GSC) Geo-mapping for Energy and Minerals (GEM) Knowledge Management Program. The main objective is to provide an accessible regional-scale surficial knowledge base to support exploration and economic development. This is accomplished through a digital compilation and queriable map database of new and existing surficial geology maps for onshore and offshore areas of Yukon, Northwest Territories, and Nunavut. The Project coordinates with other databases and field mapping activities within the GEM Program. The Tri-Territorial database 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

The current compilation includes 153 maps from the Northwest Territories (including 84 in digital format), 316 maps from Nunavut (including 177 in digital format), and 160 maps in digital format from the Yukon. These various map types include: Surficial Materials, Surficial Geology, Quaternary Geology, Terrain Classification, Remote Predictive mapping (RPM), Topographic maps with surficial data, unpublished manuscript maps, Physical Environment, and selected EGS maps with Quaternary information. These maps represent about 52% by area of the Northwest Territories, so that approximately 48% is covered only by reconnaissance style maps at 250K and 1M scale with no field work. To date, 78 of the NWT map legends have been captured in digital format in an Access database. A legend parsing tool will assist in creating the science language, and help improve search times and ability within the legend database. A new GSC common surficial legend is also being developed to ensure the implementation of standard codes and symbols, and thus facilitate new Quaternary geology mapping and correlation of map units across all Territories. Conversion of older map units to the new legend will also provide significant queriable advantages to the database.

Geographic Information Systems (GIS) and Information Management (IM) processes are integral parts of map database development and implementation. To facilitate data management, an index map was created, delineating the borders of surficial maps, generally by NTS map sheet. An accompanying index database helps track the status of digital progression. Both are linked to provide the ability to visualize the advancement of both surficial mapping and digital conversion coverage.

The following summarizes the various stages in preparing digital maps: base maps and imagery require assembly; imagery gets georeferenced to base map; quality control done to ensure georeferencing accuracy; abnormalities and interpretation issues are resolved either by data manager, project manager or research scientist; final map geodatabase is quality checked for accurate contacts, attribution, direction and sense of features; final digital product is standardized into coverage format; coverage format is separated into lines, points, and geographic polygons; previously digitized maps in various formats (Shapefiles, CAD, Geodatabases, Microstation) are converted to coverage format. Standardized products are added to data repository and the index database is updated. A series of GIS tools were also created to facilitate the standardization of received and historic digital map products. These tools allow users to standardize into coverage formats. Through the use of Python scripted tools, users can still convert these coverages and minimize having to use ArcInfo Workstation.

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Activities under the Mineral Resource Assessment Component, GEM and MERA Programs

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Mineral resource assessment (MRA) is a component of the activities undertaken as part of the GEM (Geo-mapping for Energy and Minerals) and MERA (Mineral and Energy Resource Assessment) programs 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.

Ongoing work by Chung, Franklin and Hillary has resulted in the continued development and testing of a new knowledge-driven method for the identification of areas favourable for the discovery of new deposits. Exploration criteria or "vectors to ore" for gold were formulated from published regional scale bedrock maps and the new GIS-based approach was tested for the Timmins belt and then for Slave Province as a whole. User-friendly software to support the new methodology is under development.

Recent work by Wright and Kerswill in support of the East Arm MERA demonstrated that knowledge-driven models based on the weighted overlay method can be successfully applied to generate mineral potential maps for a spectrum of deposit types. Maps for kimberlitic diamond, volcanogenic massive sulphide, magmatic sulphide, polymetallic veins, base metal veins, uranium-bearing veins, uranium in sandstone, IOCG-like, chromitite and Proterozoic rare metals in syenite and pegmatite were produced. Geological, geophysical, geochemical, picked grain and mineral occurrence data were used to generate evidence layers that were converted into vectors to ore. Work is underway to compare these maps with those generated using a data-driven approach (weights of evidence).

Prior to the 2010 field season, Kerswill expanded previous work directed towards delineation of areas prospective for discovery of IOCG deposits in the Great Bear Magmatic Zone (GBMZ). Six vectors derived from the detailed airborne geophysical survey that was flown in 2009 over the northern GBMZ (GSC Open File 6299) were used to generate a knowledge-driven target map for this area. More than 50 targets were identified, including many in zones that lack known occurrences. Related work is being carried out under the IOCG-Great Bear Region project by Corriveau and coworkers.

Ongoing experiments with the bedrock geology and fault layers of the 1:5000K IPY map for the Arctic (GSC Open File 5816 and soon to be released A-series map 2159) indicate that both data-driven and knowledge-driven approaches can yield useful mineral potential maps for gold in Western Churchill Province. However, areas of high prospectivity are more clearly defined using data compiled at 1:550K.

Recent work by Bretzlaff has resulted in significant improvements to knowledge regarding the distribution and character of mineral occurrences in the GBMZ, southern Melville Peninsula, Cumberland Peninsula, and Victoria Island, four 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.

New High-Resolution Aeromagnetic Survey, Minto Inlier, Victoria Island, NT

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An aeromagnetic survey over the Minto Inlier area of Victoria Island, NT, was funded by the Geomapping for Energy and Minerals Program of Natural Resources Canada. The survey examines the exposed Neoproterozoic rock of the Minto Inlier and images this rock under Paleozoic cover to the north and south. The survey was carried out by Firefly Airborne Surveys during the period between July 15, 2009 and October 10, 2009, and between February 4, 2010 and May 28, 2010. The data were recorded using split-beam cesium vapour magnetometers (sensitivity = 0.005 nT) mounted in each of the tail booms of two Piper Navajo aircraft. The nominal traverse and control line spacings were, respectively, 400 m and 2400 m, and the aircraft flew at a nominal terrain clearance of 150 m. Traverse lines were oriented N22.5°W with orthogonal control lines. The survey was flown on a pre-determined flight surface to minimize differences in magnetic values at the intersections of control and traverse lines.

This poster presents the results of the survey. The residual total magnetic field maps the magnetic intensity, a product of the earth's magnetic field and the magnetic susceptibility of the underlying rock. The first vertical derivative is the rate of change of the magnetic intensity in the vertical direction. This filter removes the longer wavelength from the data and enhances nearer surface sources. Finally, the instantaneous phase, or tilt, of the magnetic field is effective in displaying structural features, such as folds and faults. For example, the survey identified a ca. 50-km wide, ENE-striking, corridor of evenly spaced horst and graben structures in the Minto Inlet area that links with a previously identified zone to the northeast (Rainbird, 1998).

Digital versions of map files, corresponding digital profile and gridded data, and similar data for adjacent aeromagnetic surveys can be downloaded, at no charge, from Natural Resources Canada's Geoscience Data Repository at http://gdr.nrcan.gc.ca/aeromag/ and from the Northwest Territories Geoscience Office at http://www.nwtgeoscience.ca/.

Geothermal Favourability Map, Northwest Territories

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To date only little effort has been put into exploration and exploitation of the geothermal potential of the Northwest Territories (NWT). Existing information as it relates to the geothermal regime in the NWT was compiled and reviewed to advance the understanding of the potential for geothermal energy production in the NWT and to prepare a geothermal favourability map on a territory-wide scale.

The most relevant existing information regarding geothermal potential is subsurface temperature data from oil and gas exploration boreholes which mainly exist throughout the Western Canadian Sedimentary Basin, the Mackenzie Corridor, and Mackenzie Delta. Geothermal gradient derived from subsurface temperature measurements provides direct evidence of geothermal favourability. Other regions, such as large portions of the Cordillera, the Canadian Shield, and the Arctic Platform lack this direct geothermal gradient data and in these areas geology, seismicity, and proximity to major faults and known thermal springs were used to evaluate geothermal potential.

The favourability map also integrates infrastructure data for the NWT, including roads, community power sources (diesel, hydro, and natural gas), community populations, and electrical grids obtained from a variety of sources.

Several areas of medium to high geothermal potential occur in the Mackenzie River Basin extending from the Alberta and British Columbia border in the south to the Mackenzie Delta in the north. The Canadian Shield and the Arctic Islands have a low or low-medium geothermal potential. The Cordillera has medium-low to medium geothermal potential. Considerable uncertainty of the geothermal favourability mapping is inherent in those areas without geothermal-related data. The compiled data that were in a suitable format were used to build an ArcGIS database used to create the geothermal favourability map.

The Liard River and Southern Mackenzie River Basin includes the highest geothermal gradients measured in the NWT. The geothermal gradient near Fort Simpson and Fort Providence is estimated to be in the range of about 50 to 60°C/km, which, extrapolated to a depth of 2 to 3 km, is 100 to 180°C, sufficient for efficient operation of a binary cycle type geothermal power plant. The Mackenzie Corridor, which includes the communities of Deline, Tulita, Norman Wells, and Fort Good Hope, has a medium geothermal favourability, with geothermal gradient values of about 45°C/km and potential subsurface temperatures at 2 to 3 km depth of 90 to 135°C, sufficient for both district heating and geothermal power generation.

Data gaps precluded definitive assessment of geothermal favourability in areas of the NWT that did not have geothermal gradient data compiled from deep well drilling.

Functional Gridding of Airborne or Ground Geophysical Data for High Resolution Mapping of Local Geophysical Anomalies

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In order to achieve high-resolution mapping of airborne or ground survey, the geophysical data must be processed from highly accurate, spatially regularized lattice. In general, the data has been collected in an uneven spatial interval due to terrain conditions, wind or method of measurement. Accurate gridding is necessary to perform calculations that yield more precise results than those obtained from traditional gridding methods. As well, higher accuracy of gridded data improves the signal to noise ratio.

We have developed a gridding technique that accurately interpolates irregular data from 2D or 3D data sets. We have compared our results to several gridding techniques used in commercially available software, including krigging, linear triangulation, radial basis, inverse distance to a power and minimum curvature. Our iterative local update technique has proven to be more accurate for the same or improved efficiency level. This technique can be applied to any spatial axis and is efficient enough to apply to large 3D surveys.

This method is especially useful to identify very localized structures, such as kimberlite pipes or to find local highs within the large scale geophysical anomalies. This method has also been used to map edges, faults, intrusions, dykes and structural contacts.

A Closer Look at the Prince Albert Group on the Western Part of the Melville Peninsula, Nunavut

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The Prince Albert Group was the name given by Heywood in the 1960s to a sequence of metamorphosed sedimentary and volcanic rocks within two greenstone belts in Melville Peninsula, with the largest in the Prince Albert Hills, and one belt southwest of Committee Bay. The Prince Albert Group has been subsequently interpreted to form a semi-continuous, northeast trending, komatiite-bearing greenstone belt succession with a strike length over more than 1000 km from the Baker Lake area (Woodburn Lake Group) to the eastern part of the Melville Peninsula (Prince Albert Group) within the western Churchill Province.

As part of the Melville Peninsula Project, one of the geo-mapping projects that were initiated under the Federal Government's Geo-mapping for Energy and Minerals (GEM) program, several fly camps were set up in order to better understand the physical volcanology, stratigraphy, structural evolution and mineral potential of the supracrustal rocks within the Prince Albert Hills. It has been conducted in collaboration with the Canada-Nunavut Geoscience Office (CNGO). Two master studies are also conducted in the area on the structural evolution and on the physical volcanology of komatiitic rocks of the Prince Albert Hills. This area was previously mapped at a scale 1:125 000 by the Geological Survey of Canada (GSC) in the 1970's and explored by Borealis extensively for iron in the 1970's. There was limited base metal exploration in the region in the 1980's.

The Prince Albert Group within the Prince Albert Hills is characterized by a NNE-SSW trending volcano-sedimentary succession metamorphosed to amphibolite facies and has undergone at least two phases of deformation making it difficult to recognize primary textures at the outcrop-scale. The supracrustal succession is composed dominantly by mafic to intermediate metavolcanic rocks, pelitic metasedimenatry rocks, and banded iron formation with subordinate ultramafic and felsic metavolcanic rocks. Despite the degree of deformation in the metavolcanic rocks, some primary textures are still locally recognisable, for example pillows in mafic volcanics and also graded beds and cross bedding in volcaniclastic rocks (ash tuffs and lappili tuffs).

Numerous gossanous zones have been observed within the Prince Albert Hills. They occur within felsic to mafic metavolcanic rocks near the contact with metasediments and/or granitic rocks, within folded magnetite-silicate banded iron-formation, within gabbroic/dioritic intrusions and within ultramafic intrusions. Those observations highlight the diversity of the mineralization styles related to the Prince Albert Group in the western part of the Melville Peninsula.

Although, no major mineral occurrence other than iron have been inventoried so far in this part of the Melville Peninsula, numerous gossans and geological similarities with other part of the Prince Albert Group (Baker Lake and Committee Bay areas) and other greenstone belts, with proven mineral endowments, demonstrate the mineral potential of this area. A more detailed investigation of the Prince Albert Hills will provide a better understanding of the volcanology, stratigraphy and structural evolution, will help recognize favourable volcanic sequences that host base and precious metals mineralization and renew mineral exploration in the Prince Albert Hills and also within the Prince Albert Group.

A Metamorphic and Structural Analysis of Metasedimentary Rocks of the Akaitcho Group, Little Crapeau Lake, Southern Wopmay Orogen, Northwest Territories

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Metasedimentary rocks at Little Crapeau Lake lie west of the Wopmay fault zone in the southern Wopmay Orogen. These rocks have been assigned to the Akaitcho Group, although whether this group is part of the Coronation margin and evolved on basement of the Archean Slave craton or was derived external to the margin and transported to its current position is under debate. Deformation of the rocks took place during the Calderian orogeny, which is considered to have resulted from collision of the Slave craton with a western crustal block termed the Hottah terrane at about 1885 Ma, however, precise dating of events is lacking.

Recent preliminary U-Pb age dating of intrusive phases within the metasedimentary rocks of the southern Coronation margin have yielded an age of ca. 1877 Ma for pre- to syn-deformational granitic dykes and an age of ca. 1855 Ma for the Rodrigues pluton (once considered part of the syn-collisional Hepburn intrusive suite). These ages suggest that orogenic processes relating to the Calderian orogeny did not shut down, or possibly did not start, for several million years after initially thought.

A small, well exposed island in Little Crapeau Lake was chosen for the study. The island was mapped in detail and numerous oriented samples were taken. Through detailed petrographic analyses of the samples taken, this study aims to characterise the relationships between different generations of metamorphic mineral growth and tectonic fabric development.

The metasedimentary rocks form a sequence of alternating psammite and pelite within which are well-preserved garnet and andalusite porphyroblasts. Bedding outlines north-striking kilometre scale folds that plunge to the south and are associated with a sub horizontal S_1 mica plane fabric. Biotite and muscovite are aligned in the S_1 plane and andalusite (var. chiastolite) has grown with long axes oriented randomly within this plane. Later deformation resulted in a generally north-striking, steeply dipping S_2 crenulation cleavage. Garnet growth was synchronous with, or post dates, development of the S_2 fabric.

Detailed microscopic study of the samples is underway and it is hoped that some of the porphyroblasts contain monazite inclusions so that precise timing of peak metamorphic conditions can be determined. It is also a goal of this study to determine the pressure and temperature conditions of the metamorphic event(s) through geothermobarometry of appropriate metamorphic mineral assemblages.

High Resolution Multiproxy Study of Lacustrine Sediments from Waite Lake along the Tibbitt Contwoyto Winter Road, NWT, Canada

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The Tibbitt to Contwoyto Winter Road (TCWR) is the sole means of ground transportation of goods and services to mines located north of Yellowknife with more than $500 million per year transported along this strategically important route. Since 87% of the route traverses frozen lakes the TCWR is very sensitive to warmer weather, which shortens the annual transportation window. This was the case in 2006 when abnormally warm conditions, associated with a strong El Niño event, resulted in significant financial losses. A NSERC strategic project grant was awarded in 2009 to assess the virtually unknown magnitude of natural climate variability for the region.

Waite Lake (62.84^{0}N, 113.33^{0}W) near the southern end of the TCWR, is one of 15 lakes where freeze cores were collected. The entire 2m length was sliced at mm intervals using a freeze core microtome custom designed by our group. Radiometric dating and modelling suggests a basal date of ~4000 cal. years and that 1mm represents 2-4yr of accumulation, the highest sampling resolution yet achieved in any paleolimnological analysis in the southern NWT. Proxies under examination include magnetic susceptibility, loss on ignition, particle size analysis (PSA), and thecamoebian assemblages.

PSA, a proxy for dynamics in catchment energy and precipitation, was carried out at mm-scale permitting recognition of trends and cycles at subdecadal resolution. Thecamoebians are agglutinated, primarily benthic protists that have been previously demonstrated to respond to climatically induced environmental changes. Three thecamoebian species dominate the core assemblages: *Difflugia amphoralis*, *Centropyxis constricta "*aerophila*"* and *Cucurbitella tricuspis*. The stratigraphic distribution of both *C. constricta "*aerophila*"* and *C. tricuspis* are characterized by sawtooth abundance patterns throughout the core, but in opposite phase, with *C. constricta "aerophila"* characterized by an increase in abundance toward the top of the core and *C. tricuspis* , a species often linked to eutrophication, decreasing in abundance. These trends mirror the variation in observed PSA with *C. constricta "*amphoralis*"* being more abundant in coarser-grained core intervals, as opposed to *C. tricuspis* which is more abundant in the finer, more nutrient rich sediment horizons. These preliminary results indicate that the region has undergone significant climate variability. When the results are calibrated and combined with the other proxies under examination a detailed reconstruction of late Holocene climate change can be generated. Observed trends and cycles will be utilized to generate a model forecast of the nature of climate variability in the coming decades and will be made available to the TCWR Joint Venture and other stake holders to inform policy regarding infrastructure requirements and adaptation strategies.

Albitisation of the Thor Lake Layered Alkaline Complex and Associated Nechalacho REE Deposit

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The Thor Lake Layered Alkaline Complex (TLLAC), which is situated 100km southeast of Yellowknife and hosts the Nechalacho REE Deposit, underwent multiple alteration events. Among these alteration events was one or more episodes of albitisation.

The upper portion of the TLLAC was subjected to intense albitisation, which is most evident as a fleshy pink, bladed variety of albite (cleavelandite). In hand specimen, the rock is observed to comprise two varieties of albite, stubby crystals and cleavelandite, plus relict K-feldspar, fluorite, chlorite, calcite, rare silvery zircon, and "brick-red" bastnaesite. The albitisation was accompanied by extensive dissolution of the rock producing cavities into which euhedral "cleavelandite" crystals terminate. These cavities frequently also contain euhedral fluorite and/or calcite crystals. The K-feldspar relicts show textural evidence of resorption, and clearly preceded albitisation (de St. Jorre and Smith 1988).

In thin section several, texturally distinct, generations of K-feldspar (the relicts referred to above and later crystals) and albite can be observed. This repetitive formation of potassic and sodic alkali feldspar suggests a complex history of fluid-rock interaction and may indicate thermal oscillations in which albite was favoured by higher temperature and K-feldspar by lower temperature. Albite and K-feldspar underwent brittle deformation to form local microbreccias the matrix of which consists dominantly of an intergrowth of quartz and fluorite. Vugs interstitial to the albite and Kspar are filled by fluorite, quartz, and later chlorite and carbonate minerals which partially replace the fluorite. These minerals are commonly accompanied by intergrowths of acicular (Ce)-bastnaesite and monazite. Rapid crystallisation of fluorite likely caused super-saturation of the fluid with bastnaesite and fluorite, by lowering fluoride activity and destabilising REE-fluoride complexes. Fine-grained, euhedral zircon is locally a common phase in interstices between albite crystals where it occurs with fluorite and chlorite. This zircon may be hydrothermal. However, there are also large (mm diameter) zircon crystals, similar to the type 3 variety reported by (Sheard 2010), which are evidently earlier, with embayments filled by quartz and albite and growth zones truncated by albite and K-feldspar.

Intense albitisation is most widespread in the south of the TLLAC, and tapers upwards towards the north. The overprint of this alteration is intermittent, grading in and out downhole in intervals from cms to 10s of ms thick. It is concentrated mainly in the upper parts of drill holes, but has been recognised at depths up to 292.75m (L09-205). Intervals of albitisation display gradational to sharp boundaries, and commonly grade in and out of pegmatitic K-feldspar intervals. The overall geometry of the albitisation is interpreted to represent an upward-flaring of the paths of hydrothermal fluids which originated at depth near the southern margin of the currently delineated TLLAC intrusion.

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Indicator Mineral Method Development for IOCG Exploration in Glaciated Terrain: An Update from the IOCG-Great Bear Project, NWT

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As part of Canada's Geomapping for Energy and Minerals (GEM) Program, a research activity taking place under the IOCG-Great Bear Project in NWT was established to provide a practical guide to geochemical and indicator mineral exploration for Iron Oxide Copper-Gold (IOCG) deposits in glaciated terrain. An orientation study around the NICO Co-Au-Bi deposit, interpreted as a magnetite-group IOCG deposit, was initiated in 2007. Further work was completed in 2009 and 2010 in the vicinity of the Sue-Dianne Cu-Ag-Au deposit, a hematite-group IOCG deposit, and near additional showings thought to be parts of large polymetallic IOCG systems within an IOCG-porphyry-epithermal continuum across the Great Bear magmatic zone (GBMZ). Bedrock and till samples were collected up-ice, proximal to, and down-ice from mineralization, host hydrothermal system and least altered bedrocks, to characterize their indicator mineral and alteration geochemical signatures.

Results from the orientation study at NICO demonstrate that gold grain counts and magnetite composition have the best potential to fingerprint the magnetite-group IOCG mineralization. Pristine-shaped gold grains indicative of a local bedrock source and a short distance of glacial transport are relatively abundant in till samples collected immediately down-ice from several surface showings at NICO and none were recovered up-ice. Using trace elements signatures of Fe-oxides (i.e. magnetite) to fingerprint IOCG deposits is also a prospective indicator mineral method for IOCG exploration. In particular, magnetite from till samples collected over, or directly down-ice of, the NICO deposit have lower Ti + V compositions compared to magnetite from till collected up-ice from mineralization. The non-ferromagnetic heavy minerals at NICO are not particularly effective as indicator minerals of IOCG mineralization. Potential non-ferromagnetic indicator minerals are either not chemically stable in surface sediments (arsenopyrite, chalcopyrite, pyrite), not sufficiently coarse-grained or resistant to glacial transport (bismuthinite, tourmaline, ferroactinolite), or not sufficiently abundant in the mineralized bedrock (scheelite, molybdenite, cobaltite, allanite). In situ trace element analysis of the most resistive minerals (i.e. tourmaline, magnetite) by LA-ICP-MS has been initiated on the NICO bedrock and till samples and further work using this more sensitive technique will be completed on other mineral species (i.e. sulphides).

Preliminary results from bedrock and till samples collected near mineral showings across the south-central part of the GBMZ indicate the presence of chalcopyrite, apatite, pyrrhotite, andradite, Mn-epidote, bornite, allanite, ferroactinolite, fluorite and gold in various concentrations within the indicator mineral fraction (0.25-2 mm; SG>3.2). Particularly surface bedrock samples collected at the Sue-Dianne deposit contain chalcopyrite, malachite, bornite, allanite, gold and hematite/magnetite. Till collected over or immediately down-ice of Sue-Dianne contains a number of apatite and tourmaline grains, while gold, chalcopyrite, gahnite and Mn-epidote are present in low concentrations. SEM examination and x-ray analysis revealed trace amounts of iron oxides in gahnite, apatite, tourmaline and andradite grains (0.25-0.5 mm) from till samples collected down-ice of Sue-Dianne and other showings. Some chalcopyrite grains (0.25-1 mm) are found in association with specular hematite. Electron microprobe analysis and further examination of selected grains will help to develop criteria that contribute vectors to IOCG mineralization.

Breccias as Markers of Tectono-Hydrothermal Evolution of Iron Oxide-Bearing Hydrothermal Systems in the Great Bear Magmatic Zone

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Breccias represent key markers of tectono-hydrothermal evolution of iron oxide copper-gold (IOCG) deposits and other large hydrothermal systems, acting as fluid and magma conduits, strain accommodation zones and preferential environments for leaching and/or trapping of metals. As such, they provide a record of fluids, alteration and mineralization evolution, and timing relationships between magmatism, hydrothermal activity and deformation involved in mineralizing systems. The summer 2010 Geomapping for Energy and Minerals program fieldwork led to the identification of three new hydrothermal systems hosting extensive iron oxide breccias (south of the NICO deposit, east of Hottah Lake, east of Grouard Lake), recognized a new breccia west of Terra Mine, and extended and confirmed a hydrothermal origin for the Cole Lake breccia. The systems south of the NICO deposit and east of Hottah Lake evolve from magnetite to hematite-K-feldspar/sericite alteration, are spatially associated with unconformities and fault zones, record syntectonic to post-tectonic development, and have several kilometres wide potassic alteration haloes.

The breccia system south of the NICO deposit is part of a magnetite-to-hematite group IOCG system emplaced along a 2 km long deformation corridor trending 120° within Treasure Lake Group and overlying Faber Group volcanic rocks. Brecciation was initiated in brittle-ductile conditions and is coeval with magmatic (altered, boudinaged to fragmented porphyry dykes) and hydrothermal (albitization, magnetite, silicification/hematization and potassic alteration) activity. A U-Th mineralizing event with arsenopyrite and traces of molybdenite is coeval with brecciation. Late-tectonic magnetite veins and subsequent hematite veins record a shift to brittle conditions during which brecciation was mainly accomplished by hydraulic fracturation and accompanied by emplacement of widespread tourmaline breccias and porphyry dykes (quartz-feldspar porphyries). Strain partitioning occurs between massive and competent Faber Group rhyolite and the stratified, altered and more ductile Treasure Lake Group metasiltstone, focussing much of the brittle-ductile deformation in the altered metasedimentary rocks and then the brittle deformation in both units.

The system east of Hottah Lake comprises extensive hematite monomictic to polymictic breccias that grades locally to zones of magnetite and/or amphibole alteration with one chalcopyrite occurrence below an unconformity between volcanic rocks and overlying Conjuror Bay Formation. The breccias occur within 10-100 m wide corridors parallel or locally at angle to a N-S fault and its associated dominant vein and foliation trends. Pervasive and penetrative potassic alteration and silicification overprint the volcanic rocks and the underlying Hottah basement and are followed by multiple generations of syntectonic alteration (silicification, quartz-hematite, phyllic) and tectono-hydrothermal brecciation under brittle-ductile conditions. A late- to post-tectonic, intense specular hematite alteration crosscuts the foliation in the syntectonic breccias and itself formed numerous crackle breccias, recording more brittle conditions at this later stage.

A third system, east of Grouard Lake, consists of decametre-wide deformation and breccia corridors with locally extensive magnetite and magnetite-amphibole alteration within the Labine Group volcanic rocks. It is also spatially associated with a fault zone.

Petrology and SHRIMP U-Pb Geochronology of Detrital Zircons from the Holly Lake Metamorphic Complex, Leith Ridge, NWT

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The Paleoproterozoic (>1900 Ma) Hottah terrane is the oldest component of the Wopmay orogen and remains poorly understood. Largely overlain by Paleozoic cover and poorly exposed, the Hottah terrane outcrops on the western side of the orogen and is thought to extend as basement underneath much of the Great Bear magmatic zone.

The oldest units within the Hottah terrane are metasedimentary and metavolcanic rocks of the Holly Lake metamorphic complex (HLMC), a scantly preserved supracrustal sequence. The HLMC has been intruded by numerous, 1940-1930 Ma plutons of the Hottah continental arc. Fieldwork within the HLMC was completed in August of 2010 along Leith Ridge, south of Great Bear Lake and northwest of Hottah Lake, where three outcrops of partially migmatised, interbedded psammitic and pelitic rocks were mapped and sampled. These rocks are characterized by biotite-sillimanite-melt pockets (pods) and have a well-developed foliation, striking along 315 degrees and dipping 45 degrees to the northeast. Numerous porphyritic tourmaline-bearing granitic rocks and 0.5-1m wide granodiorite dykes intrude the metapelite outcrops.

Detrital zircons from a psammitic rock will be dated using the U-Pb isotope systematics by ion microprobe technique (SHRIMP II) to clarify the provenance of the Hottah terrane metasedimentary rocks. This age data will provide the first direct evidence of the older Hottah terrane components, and may clarify its relationship with the Archean Slave craton. Moreover, the age dating may help determine if Archean components exist within the Hottah terrane, an invaluable piece of knowledge for further exploration of diamondiferous kimberlites found in the Paleozoic cover sequence to the west. Core-rim relationships, if present within the detrital zircons, will indicate the timing of metamorphism of the psammite, which will significantly further the understanding of the Hottah terrane and its tectonic evolution within the Wopmay orogen. Detailed petrology on metamorphic assemblages and their relation to deformational fabrics will also be a major component of this study from Leith Ridge and selected drill core samples.

Geological Compilation of the Mainland Region, Northwest Territories: Contributing to the "Map of Everything"

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The project aim is to use existing digital geological data to assemble and compile a 1:250,000 scale representation of the bedrock geology of the NWT for inclusion in a Geographic Information System. Current work is focusing on mainland NWT. Subsequent work will concentrate on the Arctic Islands to complete the database.

The bedrock geology of the mainland region (Mackenzie Mountains and the Interior Platform) has been mapped and compiled at a variety of scales and degrees of detail. Compilation and synthesis have resolved the many inconsistencies among the actual representations of the geology in each map. However, several factors such as differing and evolving nomenclature systems, details available only in reports and areas where new information alters geological interpretations, result in an ever-changing and evolving database. Moreover, previous compilation work was at different data densities (equivalent to scales of 1:1 000 000, 1:500 000 and 1:250 000) and limited to the NWT. Therefore, the addition of data at larger scales where available, and further integration of adjacent geology in Yukon Territory, Nunavut and northernmost British Columbia are required to make the map and database seamless and internally consistent.

Digital map database files are the basis for map images and plots at various scales. These can also contain a higher density of information than is usually included on published regional maps. Such information includes paleontological and radiometric ages, rock unit descriptions, locations of measured sections, well core data, mineral occurrence data, etc. essential for comprehensive synthesis of all geological information. The ultimate goal is to provide a bedrock map as a base upon which as many geological data as possible may be incorporated or layered – the "Map of Everything".

Current work is utilizing previous compilations covering 1:1 000 000 scale International Map of the World grid map sheets: Great Bear River, Peel River, and Redstone River. Parts of Ross River, Firth River, and Horton River sheets will soon be incorporated into these earlier compilations to expand the current and consistent regional bedrock database. Where necessary, data density will be revised to be equivalent to 1:250 000 scale but will include greater detail (equivalent to 1:50 000 scale or greater) where available. A new comprehensive legend spreadsheet will be compiled from the compiled map, correlation charts and supplementary data in government and industry reports.

This phase of the NWT mainland geological compilation will be completed with the addition of the Geological Survey of Canada's geological compilations of the Bear and Western Churchill structural provinces.

Indicator Mineral and Till and Stream Sediment Geochemical Glacial Dispersal Study at the Pine Point Pb-Zn Mississippi Valley-Type (MVT) Deposits, Northwest Territories

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Indicator mineral and till geochemical methods for diamond and gold exploration have proven to be very successful exploration tools in glaciated terrain. Research by the Geological Survey of Canada (GSC) under its Geo-mapping for Energy and Minerals (GEM 2009-2013) is currently underway to develop similar methods for base metal and uranium exploration. As part of this indicator mineral research, the GSC and the University of Alberta initiated a case study in 2010 to document the indicator mineral and till geochemical signature of the Pine Point Pb-Zn Mississippi Valley-Type (MVT) deposits and to describe the glacial dispersal signature at varying distances down-ice from the deposit.

The Pine Point mine district is located on the southern shore of Great Slave Lake, Northwest Territories on the eastern margin of the Western Canada Sedimentary Basin. The Laurentide Ice Sheet covered the area, eroded and sculpted the landscape and deposited glacial sediments of varying thickness. A minimum of three phases of ice flow trajectories were identified from landforms and striations on exposed shoulders of several open pits as well as landforms observed on aerial photographs and satellite imagery. Cross-cutting relationships of striae indicate an earliest sustained ice flow direction to the southwest (~230°) with an intermediate phase to the northwest (~300°) followed by the last phase, during deglaciation, to the west southwest (~250°). Glacial landforms are dominated by this last phase of flow, with flutings observed having high length:width ratios.

Till sample locations were chosen following a reconnaissance of each open pit at the Pine Point mine site. Pit O-28 was chosen for detailed sampling because mineralization sub-crops, ice flow history was illustrated by striae on exposed bedrock surface, and approximately 6 m of till overlying bedrock was available for sampling both up and down ice at the pit edges. Till samples were collected from O-28 from hand dug holes in sections and from the bedrock surface. Additional till samples were collected from pits to the northeast and southwest of Pit O-28. Sixty bedrock samples were collected from Tamerlane Ventures Ltd. drill core, waste rock piles and mineralized float samples collected from Pit O-28.

To determine possible indicator minerals relevant to this study, detailed mineralogical and petrographic studies will be carried out on polished thin sections. Heavy mineral concentrates will be derived from till, and bedrock samples for documentation of potential indicator minerals. Selected grains and polished thin sections will be analyzed using a scanning electron microprobe, as well as laser ablation ICP-MS techniques. Geochemical analysis will be conducted on the <0.063 mm fraction of till. Pebble counts will be carried out on the clast fraction (0.5-2.0 cm) of the till samples to determine approximate provenance of clast sources, and relative distance glacial transport. A second field season is planned to commence summer 2011 for the collection of additional regional and detailed till samples at selected sites and to decipher the complicated ice-flow history of the region.

Non-renewable Resource Assessments (NRAs) – Minerals; an Update of NRA Activities for Protected Area Strategy (PAS) Candidate Areas

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The Northwest Territories Protected Areas Strategy (PAS) was established by the territorial and federal governments in 1999 to identify, evaluate, and designate additional protected areas through existing federal and territorial programs. Common reasons for establishing protected areas include: protection of important traditional, cultural, and religious areas; protection of specific natural and cultural features; protection of wilderness; preservation of species and genetic diversity; and maintenance of ecosystems and biodiversity. Other benefits of protected areas include: educational opportunities, tourism and recreation, scientific research, sustainable utilization of renewable resources, clarity for non-renewable resource development, and opportunities for spiritual renewal. Levels of protection vary from strict preservation to accommodation of sustainable commercial activities. Non-renewable resource activities are a vital part of the northern economy, and may be accommodated within certain types of protected areas.

A non-renewable resource assessment may be required depending on the category of protection sought. Candidate protected areas requiring a non-renewable resource assessment are evaluated for petroleum and minerals potential separately. A Phase I Non-renewable Resource Assessment Report identifies petroleum/mineral potential based on available geological information such as, surficial and bedrock geology maps, metallogenic maps, airborne and ground geophysical data, mineral deposit occurrences databases, geochemical data, existing petroleum/mineral studies, exploration assessment reports, and satellite images. The level of confidence and accuracy of a non-renewable resource assessment is dependent upon the amount and quality of geoscience information available for the area of interest. If there is insufficient data to assess the non- renewable resource potential of an area, new data must be collected to fill in the gaps.
Upon completion of a Phase I report, candidate areas requiring a Phase II Non-renewable Resource Assessment – Minerals are evaluated for mineral potential through field investigations which may include collection of silt, heavy minerals, glacial till, and water samples to determine their geochemical composition. Results of geochemical and heavy mineral analyses provide important information which may identify areas prospective for mineral deposit types known to exist in the area. Data may also reveal the presence of mineral deposits types not previously known to exist in the area. Although these studies are conducted on reconnaissance level only, they provide an increased level of confidence in determining the non-renewable resource potential for a particular study area. A Phase II assessment is not required for petroleum resources.

This poster presents an update on PAS candidate areas currently undergoing a Non-renewable Resource Assessment - Minerals. Areas currently being assessed for mineral potential include: Ka'a'gee Tu (Kakisa), Sambaa K´e (Trout Lake), Ts'ude niline Tu'eyeta (Ramparts River and Wetlands), Shúhtagot'ine Néné (Mackenzie Mountains), Kwets'ootł'àà (North Arm of Great Slave Lake).

Distribution and Environmental Significance of Arcellacean (Thecamoebian) Assemblages from Lakes along the Tibbitt to Contwoyto Winter Road, Northwest Territories, Canada

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Arcellaceans (thecamoebians) are primarily benthic protists that are very common in lacustrine environments. They are sensitive to changing levels in nutrients, oxygen, pollution, eutrophication and as a sensitive proxy of climate change. Arcellaceans construct their unilocular agglutinated 'tests' from materials found in their immediate environment, and the shape of the test is used to distinguish between different species and ecophenotypic strains. This study, part of a larger NSERC funded strategic project mandated to assess the nature of climate variability along the route of the strategically important, 568 km long, Tibbitt to Contwoyto Winter Road (TCWR), showcases the morphological variation between different thecamoebian species and strains in relation to varying lacustrine environments in the region.

The research has thus far been carried out during three separate field seasons where approximately 80 water property data and sediment/water interface samples have been collected from 43 lakes for arcellacean and geochemical analysis (ICP-MS and nutrients including Total P, Olsen P, NO_2, NO_3, NO_4). In March 2009 samples from three lakes along the southern end of the TCWR were collected as part of a pilot study. During the summer of 2009, samples from twenty lakes in the Yellowknife area were collected and in March 2010 twenty-three lakes from along the entire route of the TCWR were sampled.

The geochemical and arcellacean distributional data will ultimately form the basis of an a training set, which in turn will be used to construct an arcellacean-based transfer function for the interpretation of paleolimnological and paleoclimate records archived in cores from the route of the TCWR. Transfer functions provide a quantitative link between an environmental parameter, such as temperature, pH, nutrients, etc. and proxy indicators, in this case arcellaceans. Comparison of training set results from a large number of modern lakes encompassing a wide variety of climate and environmental conditions is required to provide an accurate reconstruction of past environments and climates in samples obtained from cores collected along significant latitudinal gradient comprising the route of the TCWR.

Aviat Diamonds as a Window into the Deep Lithospheric Mantle beneath the Northern Churchill Province

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The northern Churchill Province has recently become a hotspot of diamond exploration activity in Canada. However, little is known about the mantle sources and residence history of these diamonds. To address these questions on the Melville Peninsula, diamonds smaller than 1.1mm (-1DTC) were studied from two sample sites within the ES-1 kimberlite sheet on the Aviat property. The diamonds were analyzed for their carbon isotopic composition as well as their nitrogen content and aggregation state in order to characterize their source and residence history in the lithospheric mantle beneath the northern Churchill Province.

Carbon isotopic composition is reported in the standard delta notation ($\delta^{13}C$) and in some instances can be used to differentiate between peridotitic and eclogitic source parageneses for diamond. Both conventional and SIMS techniques were used to obtain $\delta^{13}C$ values for the Aviat diamonds. The majority of diamonds (60/70) were analyzed by SIMS and values were recorded at several points across the crystals to check for carbon isotopic zonation. Subsequently, multiple points for a single diamond were averaged to obtain a single $\delta^{13}C$ value for each sample. $\delta^{13}C$ values for the Aviat diamonds range from -29.7‰ to -1.7‰ relative to the VPDB standard. A pronounced mode is present at approximately -5‰ which is the generally accepted value for mantle derived carbon and is characteristic for both peridotitic and eclogitic diamonds worldwide. The large range of $\delta^{13}C$ values below -5‰ observed here however, are indicative of an eclogitic contribution at Aviat.

Zonation was observed in several of the diamonds, with two trends in $\delta^{13}C$. (1) Highly negative $\delta^{13}C$ values in diamond cores and rim values around -5‰ with evidence for a stage of diamond resorption between the two layers. These diamonds indicate that at least two growth events occurred at Aviat, the first from an eclogitic source and the second event tapping either an eclogitic or peridotitic source. (2) Core compositions with a $\delta^{13}C$ around -5‰ and slightly more negative values for the rims, again with evidence of resorption in between. This second group also advocates for a minimum of two growth events which may be peridotitic or eclogitic in origin.

Nitrogen, due to its similarity to carbon in size and valance, easily substitutes into the diamond crystal structure. Nitrogen aggregation in diamond progresses from single atoms, through pairs of nitrogen atoms, to rings of four atoms and the latter progression is quantified as the %B component of diamond. Aviat diamonds display higher than average nitrogen contents ranging from 10-1500 at.ppm with %B components ranging from 0-98%. Most diamonds cluster in a group with nitrogen contents between 150 and 1100 at.ppm and 0-60% B components. This indicates a range of temperatures (1050-1300°C) of mantle residence as well as multiple sources through the lithosphere for the diamonds.

In concert, the nitrogen content and aggregation state and carbon isotopic composition of Aviat diamonds advocate for multiple growth events and multiple diamond sources beneath the northern Churchill Province.

Iron-Oxide-Copper-Gold ±U in the Great Bear Magmatic Zone: Nature of Uranium in IOCG Systems

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Under the Northern Uranium for Canada project (GEM-Energy Program), the nature of uranium in iron oxide copper-gold (IOCG) systems is being investigated using examples from the Great Bear magmatic zone (GBMZ). Hypotheses being addressed include: Can uranium and thorium serve as vectors to multiple-metal endowments in IOCG systems? What is the potential for GBMZ IOCG systems to contain recoverable energy resources? How can we maximise geological vectoring to ore with the geochemical information retrieved in the field by hand-held gamma-ray spectrometers?

During the summer of 2010, fieldwork focused on known IOCG alteration systems with anomalous uranium (U) and thorium (Th) showings at Lou, Cole and Fab lakes. At Lou Lake, two new U-Th-bearing* breccias were discovered west and south of the NICO deposit. A localized (~1.5 m wide, 3 m long) U lens occurs structurally above and west of the NICO deposit within a polymict breccia containing altered porphyry and metasedimentary clasts set in an amphibole-rich matrix. The breccia occupies the contact between intensely amphibole-magnetite and biotite altered metasedimentary rocks in the vicinity of a feldspar porphyry dyke, and trends parallel to the dominant host foliation (124/82). Up to 525 ppm eU was measured in late hematite-quartz veinlets preferentially concentrated within the breccia. The southern U anomaly occurs within a 2 km long, U-Th-arsenopyrite breccia corridor (eU = 0.01-1%, eTh ≤0.2%) (Corriveau et al.; Montreuil et al.). Portable spectrometers detected anomalous U in thin veinlets of fine grained earthy hematite within bright red silicified and albitized zones in the host metasedimentary rocks. Hematitized magnetite veins and potassium-rich magnetite alteration are also anomalous in U along this corridor.

At Fab Lake, several new thorium and one uranium* anomalies were discovered and the timing amongst the various generations of porphyries and IOCG alteration minerals better constrained. On the east and northwest shoreline, several amphibole-magnetite veins and breccias hosted within medium-grained feldspar porphyry are sharply cross-cut by younger, two-feldspar porphyry dykes trending 045/80. Incipient to intense amphibole-magnetite altered porphyry is brecciated and overprinted by an amphibole-magnetite-K-feldspar assemblage. Although both porphyries contain late potassic (biotite) alteration, the two-feldspar porphyry dykes lack the amphibole-magnetite-K-feldspar assemblage and subsequent brecciation. At the northwest occurrences, amphibole-magnetite veins up to 2 m wide trend165/84 and contain up to 143 ppm eTh. Relative Th enrichment in these zones (Th/U = ~4-10) records either movement of typically immobile Th, or enrichment of Th+U followed by U depletion, thereby decoupling of U and Th. The new U occurrence located on the eastern shoreline occurs within magnetite-rich alteration zones/fronts overprinted by K-feldspar veins containing trace pyrite and cut by another generation of amphibole veinlets. The occurrence comprises several east-west trending <20 cm wide swarms of magnetite veinlets containing up to 3595 ppm eU. The intensity of magnetite alteration ranges from veinlets to near-complete replacement of the host porphyry.

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* eU and eTh concentrations measured in field by portable spectrometer, not verified by geochemical assays.

Exploring for Metals and Diamonds at Darnley Bay, NT – A Reality in 2010

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Drills turned near Paulatuk NT for the first time since 2001. After many years of airborne geophysics, KIM sampling and data analysis, financing in late 2009 and 2010 allowed Darnley Bay Resources Limited (DBL) to embark on one of the largest exploration programs in NT, focused on base and precious metals. In addition, diamond exploration partner Diadem Resources Ltd. financed a drilling campaign for kimberlite pipes on the Parry Peninsula.

For decades, the "Darnley Bay Anomaly" has intrigued mining companies and geoscientists. It is an 80 km x 100 km gravity anomaly measuring 132 mGal in amplitude, with a coincident 1,600 nT magnetic anomaly. It is considered by most to reflect a Precambrian mafic to ultramafic intrusion, buried beneath hundreds of meters of glacial overburden and Paleozoic/Precambrian sediments. It may or may not be related to the Franklin (723 Ma) dolerite-gabbro sills and dykes that outcrop east and southeast of the anomaly in the Brock Inlier. The Geological Survey of Canada and others suggest that the anomaly source may host Noril'sk-style Ni-Cu-PGE deposits. An alternative IOCG model, characteristic of the Olympic Dam Cu-Au-U-REE deposit, was proposed by DBL in 2008.

Exploration highlights of late 2009 and 2010 include the following:

- Conclusion of a new mineral concession agreement with the Inuvialuit Regional Corporation for the 7(1)(a) lands over the core of the Darnley Bay Anomaly (DBA)
- Acquisition of 16 prospecting permits, expanding DBL's 100%-owned land holdings to 4,600 km^2 in the Paulatuk area
- Conclusion of a new agreement with Diadem for a 50/50 joint venture over the Parry Peninsula
- Contracted Geotech Ltd. to carry out a VTEM time-domain electromagnetic and magnetic survey, comprising 2,750 line-km at 400 m line spacing over the eastern part of the DBA
- Contracted Sander Geophysics Limited to carry out an AIRGrav gravity and magnetic survey, comprising 6,190 line-km at 500 m line spacing over the core of the DBA
- Contracted Aurora Geosciences to carry out ground magnetic, gravity and electromagnetic surveys over metals and kimberlite targets and manage the drill program (Northtech Drilling)
- Drilled four kimberlite pipe targets on the Parry Peninsula, locating three new kimberlite pipes, bringing the total discovered to thirteen kimberlite pipes
- Currently drilling metals targets related to the DBA
- Planning drill programs for metals and kimberlite pipes in 2011

An important aspect of any exploration program in the north is the partnerships with the aboriginal residents and authorities. The DBL programs are located in Inuvialuit lands. As with any development on these lands, the company participates in a rigorous permitting process designed to protect the environment and wildlife, and must follow through during exploration. Monitors are contracted through the Paulatuk Hunters and Trappers Committee and Inuvialuit Land Administration. Several Inuvialuit residents are being employed and trained in the camp and field. In cooperation with the Inuvialuit Regional Corporation, training programs are ongoing in Paulatuk and planned for 2011. Numerous Inuvialuit-owned businesses and partnerships are providing their services. DBL has worked with the Paulatuk Development Corporation (PDC), CanNor (federal agency) and the territorial government for PDC to take ownership of a 30-person exploration camp, service it and lease it to DBL and other mining companies, as well as utilize it for cultural activities and tourism.

Characterization of Indicator Mineral and Till Geochemical Signatures of the Kiggavik Uranium Deposit, Nunavut

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Over the past 20 years, mineral exploration in Canada has successfully utilized till indicator mineral methods for diamond and gold in glaciated terrain. More recently, indicator mineral methods for base metals and other commodities have been developed, however, very few published case studies document the signatures of uranium deposits with indicator mineral that can routinely be recovered from glacial sediments.

In the summer of 2010, a drift prospecting case study was initiated at the Kiggavik uranium deposit as a collaborative effort between the Geological Survey of Canada, Queen's University and Overburden Drilling Management Limited in association with Areva Resources Canada Incorporated. The purpose of this project is to investigate and characterize glacial dispersal of uranium-rich debris (till) down ice of the Kiggavik deposit. Representative sampling of hydrothermally altered and unaltered host rocks of mineralized zones within sub-cropping bedrock of the Kiggavik deposit were collected for mineralogical and geochemical comparisons with the till at, and at varying distances down ice from, the deposit.

The deposit is within the zone overlain by the Keewatin Ice Divide of the Laurentide Ice Sheet. Multiple ice flow trajectories were observed, documented and considered prior to sampling. The oldest ice flow phase observed was a subtle E-SE ice flow, possibly during the onset of the Laurentide Ice Sheet (early Wisconsin?). A powerful NW-NNW ice flow, assumed to have occurred during the Last Glacial Maximum, is dominant, with most landforms conforming to this trajectory. Lastly, a westward ice flow related to the Dubawnt ice stream is commonly observed in striations on outcrop and is believed to have been the last ice flow that eroded the deposit. Unweathered surface till samples (n=70) were collected from mud boils up ice, directly overlying and at specific distances in a fan-shaped pattern down-ice of the deposit (10 m, 100 m, 200 m, 500 m, 1 km, 2 km, 3 km, 5 km, 10 km) with respect to the NNW, NW and W ice flows.

Till and bedrock samples will be processed to produce heavy mineral concentrates from which indicator minerals will be examined and analyzed. The <0.063 mm and <0.002 mm fraction of till will be analyzed geochemically and compared to geochemical signatures of mineralized and unmineralized rocks to identify pathfinder elements. Moreover, pebble counts will be carried out to aide in the interpretation of the local ice flow history at the Kiggavik deposit.

Testing the Potential Application of High Resolution Satellite Imagery to Identify and Count Wildlife such as Caribou in the Northwest Territories

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Aerial surveys of wildlife species such as caribou, moose and muskoxen in the Northwest Territories and throughout northern Canada are expensive, in large part due to the remote and vast areas that need to be covered. As a result, wildlife biologists and managers need to consider the potential use of alternative methods for counting these ungulate species. We explored the potential use of two commercially available high resolution satellites to specifically determine if caribou could be identified and counted from space. The Quickbird satellite was used in 2008 and the GoeEye satellite was used in 2009.The Yukon Wildlife Preserve (YWP) near Whitehorse, Yukon, served as a test area since caribou, moose, deer, elk, bison, muskoxen, and sheep are confined in fenced pastures and pens.

The intended use of the Quikbird satellite image (60 cm resolution) was to evaluate the potential to identify wildlife, and specifically caribou, in snowy conditions, with the assumption that a white snow covered background would improve the contrast and visibility of wildlife from space. Although some larger wildlife was observed, we were generally not able to identify different species in the various pens and pastures even though exact numbers were provided by staff at the YWP. Specifically, no caribou were identified. Although the results from the Quikbird image were inconclusive we were interested in trying a further test using the finest resolution imagery available at the time from the GeoEye satellite (50 cm resolution). In this image, a variety of wildlife was observed, and to some degree, caribou-like animals were distinguished from larger animals (e.g. muskox / bison). In one area, there appeared to be a herd of caribou-like animals, although it is not possible to clearly distinguish each animal. As such we were not able to definitively count individual animals.

We have identified three significant limitations on the use of high resolution satellite imagery to identify and count caribou and other wildlife.

1) For wildlife surveys, timing is crucial and images need to be collected when the animals are relatively close together, however programming the satellite to take an image may require a minimum of 48 hours notice.
2) Cloud cover can obscure the view for satellites, yet aircraft for aerial surveys can be more easily re-positioned.
3) Satellite resolution is limited by United States government regulation of all US-based private satellite companies.

In summary, the use of satellite imagery with their resolution and legal limitations may not yet be able to replace traditional aerial surveys to identify and count wildlife. However, further research on other techniques, such as unmanned drone (UAV) with video capability, should be considered in the coming years as a means to accurately identify and count culturally significant wildlife species such as caribou in the NWT.

Geochemical Studies of Gold and Base-Metal Mineralization in the North End of the Yellowknife Greenstone Belt

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A complexity of gold-mineralization styles is recognized within the north end of the Yellowknife greenstone belt (YGB), ~30 km north of Yellowknife. These include volcanogenic massive sulfides, sulfide zones at intersections of shear zones, and quartz veins crosscutting metavolcanic and intrusive rocks. Gold-mineralized areas in the northern part of the YGB are hosted in Kam Group (Chan Formation) and Banting Group metavolcanic and metasedimentary rocks, which are older and younger, respectively, than rocks that host major ore bodies at the Con and Giant mines. Ore petrology of each group shows early arsenopyrite-pyrite-gold deposition followed by later base-metal sulfide overprinting. Mineralization in the Banting Group is dominated by abundant pyrrhotite, a feature not observed in the Chan Formation. This may indicate that chemically unique ore-depositing systems operated within the Kam and Banting groups. Fluid inclusion, cathodoluminescence and stable isotope studies allow us to document the nature of multiple fluids that affected these rocks.

We have identified four types of fluid inclusions in the Kam Group showings. H_2O-CO_2 inclusions were found in relatively undeformed quartz grains and have T_h values of 316°-394°C. These inclusions are thought to represent ore fluids penecontemporaneous with regional metamorphism of the host rocks. These fluids are similar to primary ore fluids found in other greenstone-hosted gold deposits. Carbonic (CO_2±CH_4) inclusions likely formed by subsequent modification of H_2O-CO_2 inclusions. Halite-bearing and aqueous brine inclusions are ubiquitous in the Kam and Banting groups, in both mineralized and barren quartz veins. T_h values for these inclusions are dominantly 110°-260°C, with a minor higher temperature population >270°C. These aqueous brines are similar to those observed in quartz veins in the Proterozoic West Bay Fault to the south and likely represent brine movement associated with reactivation of similar faults.

Dolomite-ankerite in quartz veins of the Kam Group exhibits similar cathodoluminescence (CL) zoning in mineral showings up to 5 km apart. Similar zoning is not observed in carbonates in the Banting Group. However, paragenetically later calcite exhibits similar CL patterns in both stratigraphic groups, likely indicating that both were affected by a common hydrothermal system.

Quartz veins in mineralized metavolcanic rocks of Chan Lake, Greyling Lake, Homer Lake, and Oro Lake (Kam Group) have $\delta^{18}O$ values of 9.9-11.8‰ V-SMOW (n=16). Quartz veins from Banting Group rocks (Kingfisher Island, Ann showing, Banting Lake and Samex Island) have $\delta^{18}O$ values of 13.2-14.9‰ (n=5), reflecting the influence of metasedimentary rocks in this group. Similar influences of metavolcanic and metasedimentary fluid sources were documented in previous studies of the Giant Mine.

We interpret these data to indicate distinct gold mineralization styles in the Kam and Banting groups were formed by their own individual hydrothermal systems. Post-ore, dolomite-ankerite-depositing fluids indicate a continuity of fluid circulation through the Kam Group, but a lack of fluid communication between the Kam and Banting groups. Later fluids, evidenced by calcite CL and aqueous brine inclusions, moved ubiquitously throughout both groups. We are extending our studies northward to see if these conclusions are more regionally applicable to the north end of the YGB.

X-ray Diffraction Study of the Mineral and Fluid Inclusions in Fibrous Diamond

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Fibrous diamond occurs both as cuboids and as coatings over non-fibrous diamond. It is translucent due to the presence of millions of inclusions. The inclusion population can be divided into single-phase mineral inclusions and multi-phase submicron fluid inclusions, which contain daughter minerals crystallized from the fluid. The size of mineral inclusions can range from sub-micron to several microns, while fluid inclusions are typically less than 1 micron. Common mineral inclusions in fibrous diamond, such as garnet of olivine, are similar to inclusions in non-fibrous diamond. Fluid inclusions are water and CO_2-rich with carbonatitic to saline and silicic compositions.

Infrared and Raman spectroscopy, secondary ion mass spectrometry, electron microprobe, and TEM techniques have proven to be effective for the study of fluid inclusions in fibrous diamond. Mineral inclusions have not been studied as intensely, possibly due to the fact that they are absent from studied polished surfaces cleaned with HF acid. In theory, the abundance and random orientation of inclusions in fibrous diamond make them similar to a powder that can be analyzed by X-ray diffraction (XRD). XRD is quick, non-destructive, and it provides a bulk analysis, potentially making it a powerful complementary tool.

An X-ray beam passing through a fibrous diamond should interact with many thousands of micro-inclusions and produce a diffraction pattern. Such a technique has been tested using two XRD setups. The first setup consisted of a high-brilliance rotating anode X-ray source and a CCD area detector. The second set of XRD analyses were carried out using synchrotron X-rays and an image plate detector at the Advanced Photon Source. The fibrous diamond samples analyzed are from the Democratic Republic of Congo (19 samples); Wawa, Ontario (10 samples); Panda kimberlite, Northwest Territories (8 samples); and Jericho kimberlite, Nunavut (1 sample). All samples contained visibly turbid regions that were analyzed. Some samples had been studied previously with electron microprobe and infrared spectroscopy.

Most fibrous diamond samples gave no diffraction pattern besides that of the diamond itself. 8 out of the 38 analyzed samples showed diffraction patterns corresponding to olivine, clinopyroxene, pyrope, or chromite mineral inclusions. Electron microprobe and TEM data in the literature indicate that the types of daughter minerals in fluid inclusions should be carbonates, chlorides, high-Si mica, phosphates and related phases. Judging from mineral chemistry and the visual appearance of diffraction spots or rings, only 8 (a different set of 8) out of the 38 analyzed diamonds yielded diffraction patterns for phases that are likely to be part of the fluid inclusion population. These minerals were sylvite, phlogopite-like mica, and carbonates.

The absence of a diffraction pattern for the fluid inclusions in the majority of the samples has three possible explanations: (1) the attenuation of the diffracted X-rays prevents detection; (2) the size and/or abundance of minerals in fluid inclusions is too small to be detected; (3) a large proportion of "mineral" phases in fluid inclusions are actually amorphous or dissolved in volatiles. Calculations for attenuation in diamond and inclusion size and abundance rule out explanation (1).

The Professional Advantage

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NAPEG has a legislated responsibility to the public of the Northwest Territories and Nunavut to ensure that engineers and geoscientists practicing in the North have the education, experience and good character required to the protect and serve their interests.
This poster has been developed to provide information to the general public and to geoscientists and engineers who are seeking registration that will allow them to promote themselves as professionals.

Physical Volcanology of the Neoproterozoic Natkusiak Formation Flood Basalts of the Franklin Magmatic Event, Victoria Island, NWT, Canada

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The Natkusiak Formation flood basalts are located in the Minto Inlier on western Victoria Island, Northwest Territories. The basalt flows are the erosional remnant of the extrusive portion of the Neoproterozoic ca. 720 Ma Franklin magmatic event and are exposed as two NE-trending cores of a regional syncline. The Minto Inlier mainly consists of a well exposed, weakly deformed, succession of deep to shallow marine carbonate rocks, evaporites, and fluvial sandstones known as the Shaler Supergroup. The sedimentary succession is intruded by diabase sills and dykes, capped by the Natkusiak flood basalts, and overlies granitic rocks of the Archean Slave Province in the northeast part of the inlier. The Franklin magmatic event is interpreted to be the result of a mantle plume generated hotspot and related to rifting and eventual breakup of the supercontinent Rodinia. Previous work on the Natkusiak flows focused on the northern lobe and includes limited major element geochemistry, stratigraphy and physical volcanology. The Natkusiak flows are typical continental tholeiitic basalts with a significant crustal contamination as determined by earlier isotopic and trace-element analysis.

In the summer of 2010, a total of eight days were spent mapping volcanic facies and measuring two detailed stratigraphic sections to identify important structures and textures that may better constrain the environment of emplacement and eruption characteristics of the basalts. The structures and textures observed within the flows are typical of flood basalts. The thinner flows of 1 to 10 metres thick demonstrate massive amygdaloidal bases and highly vesicular flow tops, while the flows thicker than 10 metres typically exhibit colonnades consisting of poorly developed columnar jointing (except in one case), as well as entablatures. In addition, a couple of significant pyroclastic units were observed in both locations and consist of what is currently thought to be unwelded lapilli tuff. Systematic sampling of each flow and unit was undertaken for petrological and geochemical analyses with the goal of better understanding the physical volcanology as well as magma composition and evolution.

Native copper was observed within the more massive flows, and the intrusive sills and dykes are thought to host potential Ni and PGE mineralization, previously suggested to be comparable to the Noril'sk-Talnakh Ni-Cu-PGE deposits in Russia. The examination of the basalts has the potential to resolve the physical and chemical evolution of the magmatic centre in much greater detail than working on the sills alone because the temporal relationship between flows can be easily established. The model of the volcanic evolution thus supplements and calibrates the subvolcanic intrusive complex hosting the mineralization potential.

This project is supported by the Geological Survey of Canada's Research Affiliate Program (RAP) as well as their Geo-mapping for Energy and Minerals (GEM) minerals initiative.

Mineral and Energy Resource Assessment (MERA) for the Area of Interest for the Proposed East Arm National Park

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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. A MERA Phase II study involves 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. In the fall of 2009 and in 2010 laboratory data acquisition and interpretation, were undertaken, followed by mineral potential modeling and report writing during the summer and autumn of 2010. Deposit types that were identified and modeled in the East Arm area of interest include kimberlitic diamond, volcanogenic massive sulphide, magmatic sulphide, polymetallic veins, base metal veins, uranium-bearing veins, uranium in sandstone, IOCG-like, chromitite and Proterozoic rare metals in syenite and pegmatite. The final report, including internal and external review processes, is expected to be completed by Spring 2010.

A Preliminary Stratigraphic Architecture of the Paleoproterozoic Hoare Bay Group of the Cumberland Peninsula, Eastern Baffin Island: Update from the 2010 GEM Cumberland Project Field Season

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The Cumberland Peninsula is an area of minimal historic exploration but with potential for many different mineral commodities. The 2010 field season focused on the northern part of the peninsula following on 2009 mapping of the southern part. This poster summarizes the bedrock mapping component of the project and highlights advances in our understanding of the stratigraphy, tectonic setting and mineral potential of the Paleoproterozoic Hoare Bay group.

Approximately 60% of Cumberland Peninsula is underlain by Archean tonalite and plutonic orthogneiss, now known to be Archean (3.0-2.7 Ga) in age. This previously unrecognized Archean basement complex is tectonically intercalated with the Paleoproterozoic Hoare Bay group cover rocks via isoclinal folds and thrusts. Overall, the intercalated panels dip gently to moderately toward the north exposing increased volumes of the cover rocks in the north.

As a whole, the presently exposed Hoare Bay group appears to represent a tectonically disrupted passive margin sequence likely deposited on the Archean orthogneiss complex. The thickest orthoquartzite (<ca. 2.64Ga) and marble units occur in a northeast-trending belt in the western part of the map area, whereas thick ultramafic to mafic volcanic and black shale units are restricted to the eastern part of the map area. This spatial distribution points to the paleo-shelf margin to the west and basinal equivalents to the east. Minor clastic rocks interbedded with carbonate rocks in the west at Tundra Lake and in the southeast on Ilikok Island yielded similar detrital populations with the youngest grains at ca. 1.99 Ga. Thin carbonate horizons interbedded with ultramafic volcanic rocks and the continuity of overlying chert-iron formation suggests that carbonate shelf facies are time correlative with basinal ultramafic volcanic and black shale units. Well-preserved sections of the ultramafic rocks, such as found on Totnes Road peninsula, typically exhibit variolitic pillowed and fragmental textures. Geochemically, these rocks are Al-undepleted komatiite and basaltic komatiite with E-Morb and within-plate affinities.

Iron formation and correlative chemical sedimentary rocks are widespread across the map area but vary in thickness and composition. Manganese-rich, silicate-facies iron formation and garnetite is common in the west whereas magnetite-rich, oxide-facies iron formation is common in the east. This compositional transition lends further support for shelf to basin succession from west to east. The black shale – chemical sediment units likely represent foundering of the shelf with subsequent onset of deeper water turbidite deposition over the entire region. These turbidites are bracketed between ca. 1.99 Ga and intrusive rocks at ca. 1.89 Ga. Alkalic fragmental volcanic rocks erupted at ca. 1.89 Ga and are discontinuous but occur over a large region in the eastern map area and may be the high-level equivalents of the time-correlative plutonic rocks. These rocks are in turn overlain by <1.88 Ga clastic sediments. Tonalite, trondjemite and monzogranite dykes, mylonitized in some areas, intrude all rocks at ca. 1.88-1.87 Ga. The two regionally penetrative episodes of deformation and metamorphism likely occurred at 1.86 and 1.84 Ga.