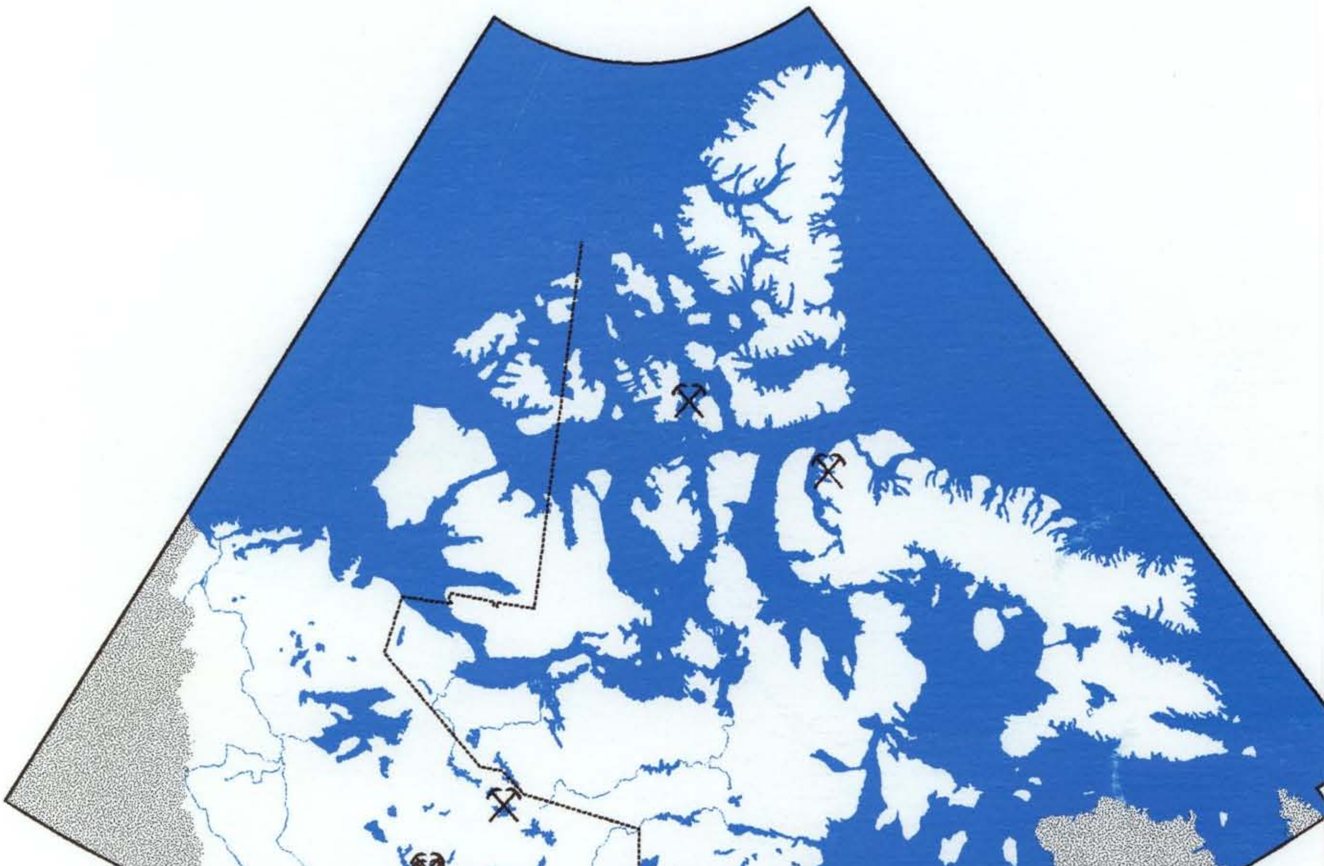
28th Yellowknife Geoscience Forum

Program & Abstracts of Talks & Posters

22 - 24 November 2000



NWT Chamber of Mines

Yellowknife Geoscience Forum
November 22-24, 2000, Explorer Hotel, Yellowknife
Program at a Glance

Technical Talks:

Location/Day	**Katimavik Room A**	**Katimavik Room C**
Wednesday am	Mineral Exploration - NWT *	Oil and Gas
Wednesday pm	Government Geoscience - NWT	
Thursday am	Mineral Exploration - Nunavut	Environmental Session
Thursday pm	Government Geoscience - Nunavut	
Friday am	EXTECH -III	Regulatory Session
Friday pm	EXTECH-III Workshop	Diamonds
Saturday (all day)	NWT Geoscience Needs Workshop	

* Keynote Speaker: Dr. Andrew Kerr, Geological Survey of Newfoundland and Labrador, will be speaking on Ni and PGE exploration in Canada

Technical Posters:

Located in the Cumberland, Ellesmere and Cornwallis Rooms: open daily at 08:30, cash bar 16:00-18:00 Wed. and Thur.

Exploration Room:

Located in the Melville Room: open daily at 08:30, cash bar 16:00-18:00 Wed. and Thur.

Regulatory Room:

Located in the Granfield Room: sessions start daily at 10:00; see schedule in lobby and posted outside door

Commercial Displays:

Located in Katimavik Room B and Hallway: open daily 08:30 to 18:00

Special Events:

Icebreaker: Tuesday 19:00 - 22:00 at the Black Knight Pub. Sponsored by DeBeers Canada
BHP Mixer: Wednesday 17:00 - 19:00 at the Visitors Centre
Camsell Talk: Wednesday 19:30 at the Great Hall of the Legislative Assembly Speaker: Pascal Lee of NASA, on the Mars expedition to Devon Island
Covello, Bryan and Associates' Hockey Night in Yellowknife: Wednesday 22:00- 24:00 at Gerry Murphy Arena
Chamber of Mines' Annual General Meeting Luncheon: Thursday 12:00 - 13:00 at the Black Knight Pub
DiamondEx Resources Mixer: Thursday 17:00-19:00 at the Visitors Centre

Wednesday Morning, November 22, 2000

NWT Mineral Exploration Session, Katimavik Room A

Chair: Steve Goff

08:40 Welcome and Introductory Remarks:
Mike Vaydik, NWT Chamber of Mines
Joe Handley, GNWT Minister of Resources, Wildlife and Economic Development
Pierre Alverez, Canadian Association of Petroleum Producers

09:00 Karen Gochnauer
Overview of Exploration in the Northwest Territories

09:20 Dave Webb and Mumin, A.H.
Porphyry-related cobalt-copper-gold mineralization in the Great Bear lake area of the northern Great Bear Magmatic Zone, NWT

09:40 Robin Goad, Neale, K.L., Mulligan, D.L., Duke, N.A. and Mumin, A.H.
Geology and progress report on the Nico cobalt-gold-bismuth and Sue-Dianne copper-silver deposits, southern Great Bear Magmatic Zone, Northwest Territories, Canada

10:00 COFFEE BREAK

10:20 Terry Pepper
Thor Lake project update

10:40 Mark Fields and Carlson, G.G.
The world-class Howards Pass zinc deposit

11:00 Keynote Speaker: Andy Kerr, Geological Survey of Newfoundland and Labrador
Exploring for new nickel - copper - PGE deposits in Canada: The good, the bad and the ugly

Wednesday Afternoon, November 22, 2000

NWT Government Geoscience Session, Katimavik Room A

Chair: Carolyn Relf

13:30 Kate MacLachlan, Relf, C., Cairns, S.R., Hardy, F., Davis, W.J.
New multidisciplinary geological investigations in the Walsmley Lake area, southeastern Slave Province

13:50 Scott Cairns, Relf, C. and MacLachlan, K.
Field relationships in metasedimentary rocks in the Walmsley Lake area, parts of 75 N/5, 11, 12, 13, & 14

14:10 Jim Renaud, Armstrong, K., Gochnauer, K. and Duke, N.
The stratigraphy and economic potential of the Aylmer Lake Volcanic Belt, central Slave Province, NWT

14:30 Alan Jones, Snyder, D and Spratt, J.
Magnetotelluric and telelseismic experiments as part of the Walmsley Lake Project: Experimental designs and preliminary results

14:50 COFFEE BREAK

15:10 Wouter Bleeker
The ca. 2680 Ma Raquette Lake Formation and correlative units across the Slave Province: Further evidence for a craton-scale overlap sequence

15:30 Valerie Jackson
The Snare River Project: Results from 2000 mapping

15:50 Venessa Bennett, Dunning, G. and Indares, A.
Preliminary data from the Kwejinne Lake supracrustal belt - Ghost Lake granulite domain transect: Impact of a steep thermal gradient on upper crustal rocks

16:10 Norm Duke
World class metamorphogenic lode gold deposits within plutonic orogenic settings: Examples in the Slave Province, NWT

Wednesday, November 22, 2000

Oil and Gas Session, Katimavik Room C

Chairs: Todd Burlingame, Cal Brackman and Adrienne Jones

08:30 Welcome and Introductory Remarks:
Mike Vaydik, NWT Chamber of Mines
Joe Handley, GNWT Minister of Resources, Wildlife and Economic Development
Pierre Alvarez, Canadian Association of Petroleum Producers

08:55 Todd Burlingame
Introduction to Oil and Gas Session

09:00 Keynote Speaker: To be Announced

09:20 Giles Morrell
Oil and gas exploration and development in the Northwest Territories - 2000 update

09:40 Dave Morrow and MacLean, B.C.
Trout and Slave Plains: A petroleum frontier in the Northwest Territories

10:00 COFFEE BREAK

10:20 Jim Dixon
Exploring for hydrocarbons in Mesozoic strata, Mackenzie Delta

10:40 Larry Lane
Temporal-spatial evolution of Tertiary deformation, Beaufort Sea-Mackenzie Delta region

11:00 Gerry Reinson and Drummond, K.
Hydrocarbon potential and exploration play trends, Northwest Territories and Yukon - A Review

11:20 Benoit Beauchamp
Arctic Islands Petroleum Geology

11:40 LUNCH

13:30 Jim Good
Update: Canadian Porest Oil Ltd.'s exploration in the Fort Liard area

13:50 Rob Taerum
The Fort Liard gas project

14:10 Barry Hunter
Sahtu Land Use Planning Board

14:30 Ed Porter
For the north, with the north: Enbridge perspectives on a Mackenzie Valley gas pipeline

14:50 COFFEE BREAK

15:10 Steve Bart
Westcoast energy

15:30 Ken Lengyl
The seismic process - Impacts and benefits

15:50 Cal Brackman
Pipeline options for Mackenzie Delta and Alaska North Slope natural gas: A comparison of netback prices

16:00 Jones, A., Doug Matthews, Brackman, C. and Marshall, R.
Canada's Pipeline

16:10-18:00 Open Bar: hospitality courtesy of Kee Scarp

Thursday Morning, November 23, 2000

Nunavut Mineral Exploration Session, Katimavik A

Chair: Jason Sharp and Dave Scott

08:20 Jason Sharp
Nunavut Exploration Overview

08:40 Bob Krause
The Ferguson Lake Project

09:00 Isabelle McMartin, Hall, G.E.M., Kerswill, J.A., Sangster, A.L., Douma, S. and Vaive, J.E.
Mercury cycling in glacial sediments underlain by permafrost, Kaminak Lake area, Nunavut

09:20 Rob Carpenter and Duke, N.A.
Regional timing constraints on gold mineralization at West Meliadine, Nunavut

09:40 Ross Sherlock, Alexander, R.B., March, R., Kellner, J. and Barclay, W.A.
Geologic setting of the Meadowbank iron formation-hosted gold deposits

10:00 Brian Alexander
Meadowbank gold deposits, Nunavut, Canada

10:20 COFFEE BREAK

10:40 Dean MacDonald
The Hope Bay gold project

11:00 Ken Armstrong
Exploration update - Oro claims, Hope Bay Greenstone Belt, Nunavut

11:20 Bill Coulter
The Victoria Island diamond project

11:40 Martin St. Pierre
An exploration review of Tahera Corporation core properties

Thursday Afternoon, November 23, 2000

Nunavut Government Geoscience Session, Katimavik Room A

Chair: Dave Scott and Jason Sharp

13:20 Carolyn Relf and Hanmer, S.
A summary of post-Archean magmatic and tectonothermal events in the Western Churchill NATMAP area: To the mantle and back

13:40 Hamish Sandeman, Hanmer, S. and Davis, W.J.
Archean granite greenstone belts of the Hearne domain, Western Churchill Province, Nunavut: A petrochemical case for intraoceanic suprasubduction zone extension?

14:00 William Davis
Overview of geochronological results from the Western Churchill NATMAP Project

14:20 Simon Hanmer, Hamish Sandeman and William Davis
Neoarchean tectonic setting of the Hearne domain, western Churchill Province: Is there a modern analogue?

14:40 Eva Zaleski, Davis, W.J. and Wilkinson, L.
Basement/cover relationships, unconformities and depositional cycles of the Woodburn Lake Group, Western Churchill Province, Nunavut

15:00 Thomas Hadlari and Rainbird, R.
Sequence stratigraphy and structure of the ca. 1.83 Ga Baker Lake Sub-basin

15:20 COFFEE BREAK

15:40 Dave Scott
An overview of scientific activities of the Canada-Nunavut Geoscience Office

16:00 Hamish Sandeman, Brown, J., Studnicki-Gizbert, C., Greiner, E., Hyde, D., Johnstone, S, MacHattie, T.
Results from bedrock mapping in the Committee Bay Belt, Laughland Lake area (NTS 56K), Central Mainland, Nunavut

16:20 Corrigan, D., Dave Scott and St.-Onge, M.R.
Geology of the northern margin of the trans-Hudson Orogen (Foxe Fold Belt), Central Baffin Island, Nunavut

Thursday, November 23, 2000

Environmental Session, Katimavik Room C

Chair: Lorraine Seale

09:20 Paula Pacholek
Northern Ecosystem Initiative Cumulative Effects Management Framework Model - Update

09:40 David Livingstone
NWT cumulative effects assessment and management framework - Update

10:00 Ann Gunn
A cumulative effects framework for caribou

10:20 COFFEE BREAK

10:40 Angela Stadel and Heidi Heder
A year in the life of the NWT Protected Areas Strategy

11:00 Nick Lawson and/or David Lemon
Using sectoral and regional environmental assessments to address cumulative environmental effects

11:20 Mike Hardin
Cumulative Environmental Effects: What the Courts are Saying

12:00 LUNCH

13:40 Karen Etherington
Managing environmental assessment

14:00 Ken Reimer
Arsenic contamination resulting from 60 years of gold mining operations in Yellowknife, NWT

14:20 Jim Millard
Waste rock seepage, special effects monitoring: EKATI™ Diamond Mine

14:40 Callum Thomson
Archaeological investigations of winter access routes and mineral exploration areas in Slave Geological Province, NT

15:00 Helen Butler
Reclamation strategies at the EKATI™ Diamond Mine, NWT

Friday Morning, November 24, 2000

EXTECH III Session, Katimavik A

Chairs: Lyn Anglin and Deb Archibald

08:40 Lyn Anglin
Overview of the Yellowknife EXTECH Project

09:00 John Armstrong
Archean lamprophyre dyking, Yellowknife Greenstone Belt: Relationships between mantle sourced magmatic events, metamorphism and mineralisation

09:20 Jonathon Katsube, Mwenifumbo, J., Kerswill, J., Connell, S., and Perez, N.
Electrical resistivity and spectral-IP characteristics of mineralized and non-mineralized rocks from the Yellowknife Mining District: Implications for exploration

09:40 Jonathon Mwenifumbo, Kerswill, J., Pflug, K.A., Elliott, B.E., Thompson, P. and Falck, K.
Spectrometric gamma-ray logging application to gold exploration in the Yellowknife area, Northwest Territories

10:00 Xavier Garcia and Jones, A.
Regional-scale magnetotelluric survey of the Yellowknife fault

10:20 COFFEE BREAK

10:40 Peter Thompson
Metamorphism and the origin of gold deposits in the Yellowknife Greenstone Belt, Phase 2 - New data and first applications

11:00 Edith Martel, Bleeker, W. and Lin, S.
Structural geology of the Jackson Lake Formation, Yellowknife, NWT

11:20 Hendrik Falck and Kerswill, J.
Yellowknife gold: A double-double of arsenopyrite and base metals?

11:40 James Siddorn and Cruden, A.R.
Timing of gold mineralisation in the Giant and Con gold deposits, Yellowknife, Canada

12:00 LUNCH

Friday Afternoon, November 24, 2000

EXTECH III Workshop, Katimavik A

Chairs: Lyn Anglin and Deb Archibald

13:30 Sign-in and Introduction

14:00 Short presentations (5 minutes each)

15:00 COFFEE BREAK

15:15 Open discussion of this year's research and priorities and areas for collaboration for next year

16:00 Discussion of format for final publication and dissemination of project results

17:00 Wrap-up

17:00 - 19:00 Poster Session and Cash Bar

Friday Morning, November 24, 2000

Regulatory Session, Katimavik C

Chairs: Malcolm Robb

09:00	Ken Weagle Consultation under the new regulatory system
09:20	Ken Weagle What is contained in a complete land use application
09:40	Heidi Klein Environmental assessment under the MVRMA
10:00	George Govier Water licencing and land use permitting within the Sahtu Settlement Area
10:20	COFFEE BREAK
10:40	Robert Alexie Water licencing and land use permitting within the Gwich'in Settlement Area
11:00	Linda Graf Environmental screening and review in the Inuvialuit Settlement Region
11:20	Adrianne RubinHawes and Macauley, T. BC Securities Commission's "New Rules for Public Disclosure and Technical Reports"
11:40	Wayne Johnson Mineral management on Inuit Owned Lands

Friday Afternoon, November 24, 2000

Diamond Session, Katimavik C

Chairs: John Armstrong

13:15	Peter Diorio, Lockhart, G.D., Liu, G. and Gonzales, A.M. Airborne gravity gradiometer survey over the Ekati property
13:45	Roy Eccles, Grunsky, E.C., Grobe, M. and Weiss, J. Structural-emplacement model for kimberlitic diatremes in northern Alberta
14:10	Bruce Kjarsgaard and Wilkinson, L. Understanding the diamondiferous Lac de Gras kimberlite field
14:20	COFFEE BREAK
14:30	Darnley Bay Kimberlites. Speaker TBA
14:50	Alan Jones, Snyder, D. and the POLARIS group POLARIS: Current knowledge and future plans
15:15	John McConnel The Snap Lake diamond project: An update
15:40	Melissa Kirkley Snap Lake - title TBA

Friday, November 24, 2000

EXTECH III Posters, Katimavik A

(All day)

Armstrong, J.P.

The Archean gold continuum: Linking prograde metamorphism to the development of gold-bearing retrograde shear zones at Yellowknife, NWT

Armstrong, J.P. and Gochnauer, K.

A preliminary discussion of intra and inter sample variation in gold fineness from a variety of Au showings, EXTECH-III Field area

Belincourt, G.

Yellowknife basin airborne magnetic compilation for Yellowknife EXTECH Program, 2000

Cousens, B. and Falck, H.

Peeking under Yellowknife Bay: Bedrock geochemistry from drill core, southern Yellowknife Belt

Kerr, D.E., Knight, R.D., Smith, D. and Nickerson, D.

Drift prospecting investigations in the Yellowknife Greenstone Belt, Northwest Territories

Kerswill, J. and Falck, H.

Lithogeochemical indicators of gold potential in the Yellowknife EXTECH area: Guides to ore and enhanced genetic models

Kirkham, G., and Siddorn, J.

Progress report on the creation of the 3D GIS model for the Con and Giant Mines

Martel, E., Bleeker, W. and Lin, S.

Structural geology of the Jackson Lake Formation, Yellowknife, NWT

Ootes, L. and Lentz, D.R..

Preliminary structural, mineralogical and geochemical analysis of the Crestarum gold deposit, Yellowknife volcanic belt, NWT

Siddorn, J.P. and Cruden, A.R.

Timing of gold mineralisation in the Giant and Con gold deposits, Yellowknife, Canada

Van Hees, E.H., Shelton, K.L. and Hauser, B.L.

Lithogeochemistry of wallrocks in the Con Gold deposit: Project status report

Van Hees, E.H., Shelton, K.L. and Falck, H.

Is there a deep extension to the Giant Gold deposit?

Wright, D, and Irwin, D.

Yellowknife EXTECH - 2D GIS digital data compilation

Yellowknife Geoscience Forum Posters, Cumberland, Ellesmere and Cornwallis Rooms

Wednesday November 22 to Friday November 24

Open daily at 08:30, cash bar Wednesday and Thursday between 16:00 and 18:00

Bennett, V., Dunning, G. and Indares, A.
Preliminary data from the Kwejinne Lake supracrustal belt - Ghost Lake granulite domain transect: Impact of a steep thermal gradient on upper crustal rocks

Bleeker, W.
The ca. 2680 Ma Raquette Lake Formation and correlative units across the Slave Province

Eccles, R., Grunsky, E.C., Grobe, M. and Weiss, J.
Structural-emplacement model for kimberlitic diatremes in northern Alberta

Greene, S.
A preliminary evaluation of the petroleum data of the Mackenzie Corridor

Hanmer, S. and Williams, M.L.
Daly Bay Complex, Hudson Bay, Nunavut

Jackson, V.
The Snare River Project: Results from 2000 mapping

Kjarsgaard, B. and Wilkinson, L.
Understanding the diamondiferous Lac de Gras kimberlite field

Lane, L.S.
Temporal-spatial evolution of Tertiary deformation, Beaufort Sea - Mackenzie Delta Region

Lane, L.S., Fallas, K.M. and Miles, W.F.
Geology of the Fort Liard region, Yukon and Northwest Territories: Initial results of new mapping by the Central Foreland NATMAP Project

Kate MacLachlan, Relf, C., Cairns, S.R., Hardy, F., Davis, W.J.
New multidisciplinary geological investigations in the Walsmley Lake area, southeastern Slave Province

MacLean, B.C.
Regional subsurface structure maps and seismic sections, Ft. Liard

Morrow, D.
Geological Atlas of the Northern Canadian mainland Sedimentary Basin

Mumin, A.H., Norman, P.E., Goad, R.E. and Camier, W.J.
Metallogeny of the southern Great Bear Magmatic Zone

Ross, G.
U-Pb geochronology of Subphanerozoic basement of the southwest Northwest Territories: A preliminary report

Sage, B., Heimbach, J. and Armstrong, J.
Mineral occurrences in the NWT

Scott, D.
An overview of scientific activities of the Canada-Nunavut Geoscience Office

Tella, S., Hanmer, S., Sandeman, H., Ryan, J.J., Davis, W.J., Berman, R., Mills, A. and Wilkinson, L.
1:100,000 scale bedrock geology compilation map of the MacQuoid Lake - Gibson Lake - Akunak Bay area (parts of NTS 55M and 55N), Kivalliq Region, Nunavut

Wilkinson, L.
Western Churchill NATMAP Project: Sources of information and data

Wilkinson, L., Pehrsson, S., Zaleski, E., Kerswill, J. and Alexander, B.
Woodburn Lake Group: Structural geometry of the Meadowbank deposit area - Implications for genesis of a major gold deposit in the Western Churchill Province

Exploration Room, Melville Room

Wednesday November 22 to Friday November 24

Open daily at 08:30, cash bar Wednesday and Thursday between 16:00 and 18:00

Companies Confirmed:

Diamondex
Fortune Minerals
Shear Minerals
Starfield Resources
Tyhee Development Corporation

Independent Prospectors Confirmed:

Hugh Arden
Lane Dewar
Walt Humphries
Doris Rose-Smith
Dave Smith

MEADOWBANK GOLD DEPOSITS, NUNAVUT, CANADA

Brian Alexander
Cumberland Resources

LOCATION

The Meadowbank Gold Project (100% Cumberland) is located 70 km north of the barge accessible community of Baker Lake, Nunavut.

STORY:

Gold was discovered in the Meadowbank area in 1989. By 1992 a small resource of 203,982 oz. was delineated in the Third Portage deposit.

By April 2000, with 50,000 meters of diamond drilling, the four deposits contained an expanded resource of 11.24 million Tonnes grading 5.73 g/t (2.1 Million ounces). Resource classification outlines 5.5 million Tonnes grading 5.44 g/t (963,000 oz) of proven and probable reserves in the four near surface deposits. Recently completed pre-feasibility studies projected total cash costs at under $US200 per ounce gold with a 2500 ton per day operation, employing a base case fly in/out open pit and underground mining concept extending over eight years (160,000 oz/year). The study indicated additional resources were required to meet a minimum ten year mine life.

Current drill results have allowed the recently discovered Vault zone to be upgraded to deposit status. Mineralized intersections were returned over 850m by 300m and traced the zone from surface to 300m down dip. The deposit remains open for expansion in all directions from surface. The majority of intersections surpass the required cut-off grade and occur at shallow depths offering potentially low strip ratio open pit additions. The addition of the Vault marks the fifth gold deposit discovered at the Meadowbank Gold Project.

GEOLOGY

The Meadowbank gold deposits are hosted by iron formations and volcano-clastic sediments of the Archean Woodburn Lake Group in the Churchill Supergroup. The four closely spaced deposits: North Portage, Third Portage, Bay Zone and Goose Island, occur along a 3 km by 1 km wide trend. The volcanic hosted Vault Deposit is located 5 km north. The deposits are hosted in a structurally complex narrow neck of supracrustal rocks, sandwiched between granite plutons. The distinct structural fabric imprints of three to four principle deformation increments are preserved throughout the property.

Host stratigraphy includes an intercalated sequence of dominantly oxide facies iron formation, quartzo-feldspathic clastic and/or intermediate volcaniclastic rocks, which are isoclinally folded. Third Portage area gold mineralization is intimately associated with sulphide mineralization (dominantly pyrrhotite/pyrite) with a notable lack of arsenopyrite and quartz veins. These sulphides occur as a replacement of magnetite in the oxide iron formation in the plane of S0//S1, and as fracture fill +/- silica and disseminations in both the iron formation and surrounding clastic units. The bulk of the gold mineralization in the deposit is contained within the iron formations, with mineralization in the clastic/volcaniclastic units probably representing remobilization and secondary enrichment by gold-bearing fluids.

The Vault Deposit is a second style of gold mineralization, volcano-clastic hosted in hydrothermal alteration (along the S0/S1 plane) consisting of sericite, silica, carbonate and pyrite.

CURRENT STATUS

Revised resource estimates are currently underway. Exploration potential in the 20km long gold trend has proven to be exceptional and is expected to continue into the 2001 season

OVERVIEW OF THE YELLOWKNIFE EXTECH PROJECT

C.D. Anglin
Geological Survey of Canada

The EXTECH program (EXploration science and TECHnology) was initiated by the Mineral Resources Division of the Geological Survey of Canada in 1989 to promote the development of new approaches to mineral exploration in Canada. Development of the program was prompted by declining economic reserves in Canada's established mining camps, reflecting reduced expenditures on exploration in these camps and changes in global metal prices.

The EXTECH program is an integrated, multidisciplinary approach to mineral exploration research. Cooperation is encouraged among specialists in the various fields of geology, geophysics, and geochemistry by focusing their efforts on understanding a specific deposit-type in a specific mining camp. Expertise is derived from federal, provincial/territorial, university and industry scientists. The goals are to develop an integrated deposit model, that incorporates the geological, geophysical and geochemical signatures of the deposit, and to refine exploration techniques/approached for the deposit-type. In addition, the regional geoscience knowledge base of the mining camp is enhanced and specific exploration technologies are developed or enhanced. The integrated deposit model will ideally assist in renewed exploration and resource assessments. The data, technologies and models developed during the EXTECH are transferred to various client groups through collaboration, workshops and publications.

The first EXTECH examined base metal mineralization in the Rusty Lake-Snow Lake area in Manitoba, and the second EXTECH focused on the Bathurst base metal mining camp in New Brunswick. The Yellowknife EXTECH is the third such program undertaken by the GSC, and is the first to be directed at the examination of Archean gold deposits.

EXTECH III: Yellowknife Gold Belt

The Yellowknife mining camp is one of Canada's major gold mining districts, and one of the best preserved and exposed Archean volcanic belts in North America. The two largest producers in the camp, the Con and Giant mines, have produced more than 5.5 million and 7.1 million ounces of gold respectively (Northern Miner June 19, 2000). The Con Mine poured its first gold bar in 1938 and the Giant Mine commenced production about 10 years later. However, with the recent weakness of the price of gold, diminishing reserves in the camp, and an interest on the part of the mining companies in the camp to develop a comparative understanding of the mineralization at the two operating mines, the Yellowknife camp became a prime candidate for an EXTECH-type study.

Scientific objectives and priorities for the Yellowknife EXTECH project were determined by a group of university, industry and government geologists at a public Needs Assessment Workshop in November, 1998 in Yellowknife. This workshop resulted in the identification of themes and priority objectives for the project. The project officially commenced with a public call for proposals in the spring of 1999. The proposals were reviewed by the Advisory Committee based on the agreed objectives and priorities, and funding announcements were made in June 1999. A similar process was followed for work in Year 2 (2000-2001). Twenty-six projects were funded in the first year, many of them feasibility or scoping projects. A smaller selection of projects (sixteen) are being funded in Year 2 based on results of the first year of research and updated priorities. The Yellowknife EXTECH project is profiled for completion in March, 2003, with its final year (2002-2003) planned mainly for integration and write-up of results and preparation of a final publication.

The Yellowknife EXTECH (aka EXTECH III) project involves collaboration among earth scientists from the Geological Survey of Canada (GSC), the Government of the Northwest Territories (GNWT), the Department of Indian and Northern Affairs (DIAND), private industry and professors and students from several Canadian universities. GNWT and DIAND support is through the C.S. Lord Northern Geoscience Centre in Yellowknife. The project is managed by the

EXTECH III Advisory Committee, with one member from each of DIAND, GNWT, GSC and 3 industry representatives, on the committee. The EXTECH III supporting partners include Miramar Mining Inc.(Con and Giant mines), the Government of the Northwest Territories, DIAND, and NSERC through participating university researchers.

Annual publication and or dissemination of information at the NWT Geoscience Forum is a requirement of EXTECH III support. In addition, interim results may be published in GSC Current Research or Open Files or DIAND EG reports. A yearly workshop of EXTECH III participants and interested stakeholders is held at the Yellowknife Forum. The final results of this project will be published in a joint GSC-GNWT-DIAND report to permit all participants to communicate their research.

Results of the first complete year of research are encouraging, including: anomalous gold grain counts, and diamond indicator minerals were identified in preliminary surficial mapping and till sampling work (Kerr, Smith and others); preliminary testing of biogeochemical prospecting techniques yielded encouraging results for their application in exploration for gold and base metals in this terrain (Nickerson); study of geophysical rock properties and response of mineralized and unmineralized rock (Katsube and Mwenifumbo) is enhancing understanding of geophysical characteristics of the ore; integration of previous metamorphic grade indications, and new mapping of metamorphic isograds is providing new tools for interpreting regional structures (Thompson); study of geochemistry of alteration at Giant has indicated interesting trends, and possible geochemical vectors to ore (Van Hees); a detailed study of showings throughout the belts is leading to a regional metallogenic synthesis (Kerswill and Falck); and, detailed comparative structural observations underground at both Con and Giant mines is leading to a better understanding of structural controls on mineralization and the possible genetic relationship between the two mines (Siddorn).

Results of the second year of field work will be presented at this year's Geoscience Forum in a series of talks and posters and in discussions at the EXTECH Workshop. EXTECH III presentation authors include: Armstrong, Armstrong and Gochnauer, Falck and Kerswill, Garcia and Jones, Katsube et al, Kerr et al, Kirkham, Kerswill and Falck, Martel, Mwenifumbo et al, Ootes, Siddorn, Thompson, Van Hees, and Wright and Irwin.Further details of the Yellowknife EXTECH III, including copies of abstracts from the 1999 Yellowknife Forum presentations, and themes and priority objectives of the project as determined by consultation with researchers, partners and stakeholders, are available at <<http://www.extech.yellowknife.nt.ca/ >>

THE ARCHEAN GOLD CONTINUUM: LINKING PROGRADE METAMORPHISM TO THE DEVELOPMENT OF GOLD-BEARING RETROGRADE SHEAR ZONES AT YELLOWKNIFE, NWT

Armstrong, J.P.
NWT Geology Division, DIAND

The economic gold concentrations in the Yellowknife Greenstone belt are spatially restricted to shear zones that transect amphibolite facies metabasalts of the Yellowknife Bay Formation. The retrograde nature of the mineralized domains within these shear systems is manifest by chlorite-carbonate-white mica assemblages that downgrade the Al-hornblende and Ca-plagioclase dominated host rocks. Initiation of shear zone development accompanied and post-dates early Defeat suite plutonism. Evidence for initiating shearing at near peak metamorphic conditions is demonstrated by the occurrence of relict amphibole schist along the strike length of several known gold-bearing shear zones. Previously described assemblages (Armstrong, 1997) occur in the hangingwall of the Campbell shear (5900L), and as horses within and along the northern strike extent of the Con Shear. Further samples from the Fox Shear and an unnamed shear zone proximal to the Western Plutonic Complex provide further evidence that near peak metamorphic conditions preceded retrogression in the structural evolution of the these shear

Whereas amphiboles within host metabasalts at lower metamorphic grade are ubiquitously zoned from actinolite cores to Mg-hornblende rims, at higher metamorphic grade amphiboles are homogenous and trend toward ferro-tschermakite. Amphiboles that define a preferred orientation (ie amphibole schist) are characterised by the lack of any coherent zonation patterns and compositions that range from Mg-hornlende to ferrotschermakite, indicating growth at near peak metamorphic conditions. Amphibole schists along major and minor shear zones appear to be of slightly lower metamorphic grade than host metabasalts. Amphibole schists may be further retrograded to chlorite and epidote.

The documentation of early amphibole schist along auriferous shears and their ultimate evolution to greenschist facies assemblages within the Yellowknife camp provide a critical link between high and low temperature Archean lode gold camps. The greenschist facies shear zones of the Yellowknife camp, hosted within mid-upper amphibolite facies metabasalts, are intermediate in setting between greenschist gold in low greenschist hosts rocks (Abitibi) and high grade metamorphic settings such as Ulu in the High Lake greenstone belt and the Australian Mt. York and Griffins Find deposits. The Yellowknife deposits share similarities to those of the Red Lake gold camp. The restriction of metallurgically distinct refractory ores to greenschist shears in amphibolite hosts, identifies a distinct metallurgical niche within the Archean gold continuum.

A PRELIMINARY DISCUSSION OF INTRA AND INTER SAMPLE VARIATION IN GOLD FINENESS FROM A VARIETY OF AU-SHOWINGS, EXTECH-III FIELD AREA

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Samples from a series of geographically disparate Au-showings covering a spectrum of mineralisation styles and host rocks have been examined petrographically in conjunction with electron microprobe determinations of Au, Ag and Hg for individual gold grains. This study represents the first systematic determination of gold fineness for Au/Ag showings within the Yellowknife Greenstone belt outside of the Con Mine, and specifically targets showings in the northern portion of the belt. Polished thin sections were examined from the Ormsby, Clan, Nicholas, and Goodwin Lake showings and the Mon Mine. Gold fineness determinations for individual gold grains provides an opportunity to document Au/Ag variations independent of other Ag-bearing phases within a paragenetic context.

Gold fineness for showings examined ranges from 916 to 571 ([Au/(Au+Ag)]*1000). Mercury values are negligible. Samples from the Mon Mine demonstrate little variation in fineness (836-850); gold occurs in silicate and sulphide gangue. Ormsby Zone samples do not demonstrate intra-sample variation, however two populations of gold are present in the data (810-824 and 698-715); lower fineness gold grains occur as inclusions in pyrite while the other gold population occurs isolated in silicate gangue or attached to pyrite grains. Analysed gold grains from Nicholas Lake exhibit the greatest range in gold fineness (571-875) with 5 discrete populations. The five populations are: Au included in pyrite (858-875), Au associated with chlorite in fractured pyrite (705-716), Au along fractures in pyrite (646-654), Au inclusions in galena (604-607), and Au along fractures in arsenopyrite (571-585). Gold grains from a gold showing immediately east of Goodwin Lake exhibit a range in fineness from 743 to 916 with three discrete associations: Au inclusions in pyrite (850-916), Au in weakly polygonalised quartz (890) and Au in a quartz gangue (743-798).

The range in gold fineness observed in the current study in part overlaps with the range of gold fineness observed for the Con Mine (Armstrong, 1997) but with the exception of a few samples the degree of intra-sample variation in fineness was not observed at the Con Mine. Where intra-sample variations were documented within the Con Mine paragenetic similarities exist with the current study. Intra-grain zonation in Au/Ag was documented at the Con Mine but not in the current study. Overall the range in gold fineness for the Yellowknife Greenstone Belt deposits falls well outside of the expected/postulated restricted range (>850) for both Archean and Slate Belt gold deposits (Morrison et al., 1991). The paragenesis for each population of gold will be determined in order to distinguish 1) discrete mineralizing events, and/or 2) re-mobilization events, and to place each Au/Ag showing in the proper metamorphic context.

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ARCHEAN LAMPROPHYRE DYKING, YELLOWKNIFE GREENSTONE BELT: RELATIONSHIPS BETWEEN MANTLE SOURCED MAGMATIC EVENTS, METAMORPHISM AND MINERALISATION

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A series of narrow lamprophyre dykes intrude metabasalts of the Yellowknife greenstone belt and metasediments of the Burwash basin. These dykes are in addition and related to the previously described lamprophyre "diatreme" dyke (Nikic et al. 1980, Webb and Kerrich, 1988) found within the workings of the Con Mine and the lamprophyre dykes within the Con Intrusive Corridor (Strand, 1993; Armstrong, 1997). These newly documented and heretofore undescribed dykes include: a) a set of three NNW trending dykes, approximately 300 metres apart, in the hangingwall of the Con Shear; b) an east-west trending swarm of narrow (10-45 cm) dykes exposed within the thermal aureole of the Stock Lake plug; c) a narrow body west of the B1 pit at Giant, and d) a series of north striking dykes cutting metasediments along the shoreline at Dettah. The metallogenic significance of this alkaline/calc-alkaline magmatic event and its relationship to metamorphism has remained obscure.

All lamprophyre dykes in question share similar major element and trace element characteristics. Major element discrimination plots characterise the dykes as overlapping the calc-alkaline and alkaline lamprophyre fields. Dykes, relative to host basalts, are characterised by variable SiO_2 (41-50 wt%), moderate MgO (6.7-14 wt%), variable CaO (8.5 to 14.4 wt%), elevated P_2O_5 (to 2 wt%), Cr (to 455 ppm), Sr (to 2000ppm), Ba (to 2300 ppm), La (to 340 ppm), and Ce (to 611 ppm). Although there is both inter-dyke and intra-dyke variability in mineralogy the dominant phases are amphibole, biotite-phlogopite$_{ss}$, calcite, plagioclase, chlorite, and trace spinel, apatite, pyrite, and quartz. Amphiboles retain a Mg-hastingsite signature locally overgrown by actinolite and with increased alteration Mg-hastingsite is replaced by actinolite and chlorite. In contrast the host metabasalts, including gabbro dykes, demonstrate a ubiquitous prograde metamorphic signature with actinolite cores mantled by hornblende. Biotite-phlogopite$_{(ss)}$ occurs as psuedo-hexagonal intergrowths, fine grained groundmass microphenocrysts, and may replace amphibole. Significantly biotite-phlogopite$_{(ss)}$ displays intra and inter sample chemical variation. Psuedo-hexagonal biotite are Cr_2O_3 enriched (to 1wt%Cr_2O_3), while groundmass and microphenocrysts are Ba enriched (to 2 wt% BaO). All biotite-phlogopites$_{(ss)}$ are enriched in F (to 1wt%). Geochemically and mineralogically these lamprophyres are identical to the "diatreme" lamprophyre dykes that occur hangingwall to the Campbell Shear zone.

The lack of prograde assemblages and preservation of deuteric alteration precludes any prograde overprint acting on the dykes. The Cr, Ba, and F would be mobilised from primary mica and primary/deuteric carbonate would be transformed by prograde calc-silicate reactions. Nevertheless, the occurrence of isolated blocks of sheeted lamprophyre within breccias associated with earliest Defeat plutonic activity (2632-35Ma) demonstrates that lamprophyre dyking predates granite emplacement. Therefore lamprophyre injection occupies a critical time period between peak metamorphism and granite emplacement. Injection of mantle derived CO_2 enriched alkaline magmas into the thermal aureole indicates structural linkage with the mantle prior to hydration of developing shear systems. A close temporal relationship of peak metamorphism, lamprophyric magmatism, and granite plutonism is evident at many Archean lode gold districts and has contributed to the lack of consensus as to the respective roles these "disparate" processes played in gold concentration.

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EXPLORATION UPDATE - ORO CLAIMS, HOPE BAY GREENSTONE BELT, NUNAVUT

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The Oro property is located approximately 125 km southwest of Cambridge Bay, at Hope Bay on the Arctic Coast in Nunavut. The 4121ha property consists of 5 mineral claims covering the northern most extent of the Hope Bay greenstone belt (HBGB). Under the terms of an option agreement signed in 1997, Navigator Exploration Corp. acquired an undivided 100% interest in the Oro claims.

Exploration of the project area through the 1960's, 70's and 80's led to the discovery of the Ida Bay and Roberts Lake silver deposits as well as the Ida Point and Wombat (Granite) gold showings. Both silver deposits were mined for a brief period in the early 1970's. The Ida Point gold showing, including the northeast trending Elu shear zone, is located at the northern end of the property. Previous work on the showing consisted of detailed mapping, trenching and drilling. Work by Navigator in 1998 included ground magnetometer and VLF-EM surveys, channel sampling of 15 trenches and 595m of drilling in 4 holes. Channel sampling along a 400m segment of the Elu shear returned an average grade of 11.6 g/t Au across an average width of 1.85m. The Wombat showing, located in the southeastern corner of the property, occurs within the granite intrusion flanking the eastern edge of the HBGB. Located 500m east of the eastern greenstone/granite contact, the showing consists of auriferous quartz veins within a northeast trending near vertical shear zone that forms a prominent lineament within the granite. Trenching and drilling by previous workers returned gold values of up to 20.5 g/t Au over 5.64m. In 1998, Navigator drilled 3 holes (for a total of 278m), all of which intersected low-grade gold values.

In 2000, Navigator undertook a re-evaluation of the Oro claim area, with emphasis on determining the gold potential of under explored areas on the property. In particular, work focussed on determining the possibility that the structure hosting Miramar Mining Corp. / Hope Bay Gold Corp.'s Doris deposits continues northwards onto the Oro claims. A brief field investigation in August identified a previously unknown gold showing on the ORO 5 claim (up to 9540ppb Au in a grab sample). Evidence was also found for a potentially large alteration/shear system within a prominent northeast trending valley that cuts a gabbro sill running along the western edge of the property. In September the entire property was covered by a helicopter-borne magnetic/electromagnetic geophysical survey flown at 100m line spacing. An additional small survey block was flown at 50m line spacing over the northeast trending valley. Preliminary survey results delineate several prominent magnetic lows that could potentially be associated with alteration systems within the volcanic rocks.

Exploration of the Oro claims in 2001 will likely include detailed mapping and soil sampling of overburden covered areas and exploration drilling of the most promising targets.

YELLOWKNIFE BASIN AIRBORNE MAGNETIC COMPILATION FOR YELLOWKNIFE EXTECH PROGRAM, 2000.

Georges Belcourt,
Covello, Bryan and Associates Ltd.

The work completed to date has included locating all available geomagnetic data from surveys flown over the Yellowknife basin area. Permission has been granted to publish those data not already in the public domain. The data have been corrected, compiled, merged and levelled, producing a draft map printed on a base hydrology map.

The available data consist of twenty surveys flown over a period of ten years using various airborne platforms, sensor types and data reduction protocols. The data sets were acquired by CBA in the most raw form possible and then all data were treated by similar data reduction and levelling algorithms in Geosoft Montaj to help ensure standardization between the data sets. The detailed exploration survey data were then merged with, and levelled to, a regional GSC NATMAP data set, again using Geosoft Montaj, (Gridknit utility). The resulting data set was projected in NAD 83 Canada Mean, UTM zone 12N projection for ease of use as the survey area straddles the 11 N/ 12N boundary. A draft map has been produced and will be displayed for comment and discussion at the Yellowknife Geoscience Forum in November.

PRELIMINARY DATA FROM THE KWEJINNE LAKE SUPRACRUSTAL BELT – GHOST LAKE GRANULITE DOMAIN TRANSECT : IMPACT OF A STEEP THERMAL GRADIENT ON UPPER CRUSTAL ROCKS.

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Geological mapping over the course of three summers (1998 - 2000), in conjunction with a multi-year, regional, DIAND mapping project (see Jackson, this volume) has revealed the presence of an extensive area of high temperature - low pressure granulite facies rocks in the southwestern Slave Province. A detailed geological transect within the area forms the basis of a geochronological and tectonometamorphic Ph.D. study.

The granulite terrain has a wedge-like geometry and is abruptly truncated on the eastern margin by a long curvilinear fault system, which separates amphibolite facies rocks to the east from granulite facies rocks to the west. Most recent movement along this fault is speculated to be Proterozoic, and may represent reactivation of pre-existing Archaean faults. Onlapping and faultbound sedimentary rocks of the Wopmay Orogen mark the western boundary of the terrain.

Three distinct structural subdomains (I,II and III) are defined from west to east across the transect. The highest structural levels are exposed within subdomain I to the west, where interlayered metaturbidites and mafic schists are tight - isoclinally folded and exhibit a greenschist to amphibolite metamorphic grade increase. Subdomain II, in the central part of the transect, consists of metasedimentary migmatites, metatexites, diatexites, rare mafic gneisses and granites that display a broad north easterly trending regional fabric. These rocks exhibit a mid amphibolite to granulite facies grade increase and on a local scale this subdomain lacks a systematic fabric. Subdomain III is comprised of two structural domes consisting of interlayered granulite facies metamorphic rocks and granitic rocks. It is speculated that this easternmost subdomain represents a different crustal block, likely from slightly deeper levels (consistent with the higher pressure assemblages of garnet + orthopyroxene), that has subsequently been faulted adjacent to the rocks of the subdomain II.

Along the transect 6 metamorphic zones are delineated ; (a) Biotite zone (indicator minerals biotite + muscovite), (b) Cordierite (muscovite + biotite + cordierite), (c) Sillimanite + melt (fibrolite + biotite + leucosome), (d) Cordierite - 2nd (iolite +/- sillimanite + biotite) (e) Garnet (garnet + iolite +/- sillimanite +/- spinel) and (f) orthopyroxene (garnet + orthopyroxene). The transition from zones (a) to (e), i.e. a greenschist to granulite facies grade increase, was observed in subdomains I and II, whereas a transition from zones (d) to (f), i.e. an upper amphibolite to granulite facies transition, was observed in subdomains II and III. It is noteworthy that the orthopyroxene zone (f) appears to be restricted to the core of the two dome structures in subdomain III.

There are very few places in the world where rocks displaying such an extreme thermal gradient are preserved at the earths surface, as appears to be the case here, in the southwestern Slave Province. As such, this study represents a truly rare opportunity to examine the nature and internal workings of a late Archean high temperature, tectonothermal event.

THE CA. 2680 MA RAQUETTE LAKE FORMATION AND CORRELATIVE UNITS ACROSS THE SLAVE PROVINCE: FURTHER EVIDENCE FOR A CRATON-SCALE OVERLAP SEQUENCE

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The Raquette Lake Formation (Henderson, 1985) unconformably overlies the SW flank of the Sleepy Dragon Complex 70 km NE of Yellowknife. It was deposited at ca. 2680 Ma across an intra-volcanic unconformity developed in part on the domed synvolcanic intrusion of Ross Lake Granodiorite.

Circa 27 lithostratigraphic sections were recorded through the Raquette Lake Formation and the correlative Detour Lake Formation along strike. These sections have been compiled and laterally correlated to obtain a single stratigraphic fence diagram documenting the detailed stratigraphy of the Raquette and Detour Lake formations and their relationships with adjacent units. This section, and the underlying field mapping, provide the basis for a broadened definition of the Raquette Lake Formation to include all units overlying its basal unconformity up to and including a black mudstone unit on the contact with the Burwash Formation turbidites.

This definition includes a variety of clastic, volcaniclastic, volcanic, and chemical sedimentary rocks, and two distinct rhyolite horizons, the upper one of which has been referred to as the Cameron River Rhyolite (Bleeker et al., 1997).

Black mudstone at the top of the formation probably marks an interval of starved sedimentation and basin deepening just before the onset of turbidite sedimentation of the Burwash Formation. Along strike to the north, this interval correlates with the Webb Lake Andesite and Dome Lake Basalt formations (Lambert, 1988).

It is proposed that the sub-Raquette Lake unconformity correlates with the third of four temporally distinct unconformities in the Point Lake greenstone belt as documented by recent fieldwork. This testable hypothesis would allow detailed long-distance correlations in the Yellowknife Supergroup across the extent of the Central Slave Basement Complex (Bleeker et al., 1999). Lithological associations similar to the Raquette Lake Formation have also been observed from west to east across the Slave Province and may reflect a craton-scale "marker horizon" of ca. 2690-2680 Ma age that overlaps the putative basement boundary at depth (Davis and Hegner, 1992; Bleeker et al., 1999).

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PIPELINE OPTIONS FOR MACKENZIE DELTA AND ALASKA NORTH SLOPE NATURAL GAS: A COMPARISON OF NETBACK PRICES

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For the first time in over a decade, the development of Mackenzie Delta and Alaska North Slope natural gas is looking extremely positive. This optimism is being driven by a robust demand for gas in North America, anticipated strong demand in the future, and the maturation and depletion of southern basins. As a result, numerous commercial interests have proposed both complimentary and competitive northern pipeline route options. This presentation will review recent studies that examine the netback prices (also referred to as the field price) of the different options to each basin, with an examination of the implications for Mackenzie Delta gas development.

RECLAMATION STRATEGIES AT THE EKATI™ DIAMOND MINE, NWT.

Helen Butler
BHP Diamonds Inc.

Low native plant availability and slow growth rate create challenging reclamation objectives in a land with such extreme climate and growing conditions as those found in Canada's northern tundra. One of the ongoing reclamation efforts at the BHP EKATI™ Diamond Mine typifies these challenges. The Panda Diversion Channel was originally excavated to redirect watershed drainage around two open pit mines; Panda and Koala Pits. The total channel length is approximately 3.4 kms, primarily through granitic bedrock, with a drop in elevation of 17 metres. As a component of BHP's 1996 Stream Habitat Compensation Agreement with the Department of Fisheries and Oceans (DFO), monitoring of channel habitat stability is required during the open water season for a 10 year period. Based on this component of the Agreement, habitat construction and assessment of physical stability of the channel commenced in the 1998 open water season and continued in 1999. In 2000 physical habitat construction was mostly complete and efforts focused more on maintenance and assessment of the viability and fish use of structures. Revegetation efforts, since 1998 have focused on constructing riparian habitat within the channel and along its banks to also encourage fish habitat and passage, and for stabilization of channel banks.

FIELD RELATIONSHIPS OF METASEDIMENTARY ROCKS IN THE WALMSLEY LAKE AREA, PARTS OF 75N/5, 11, 12, 13, 14.

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2 DIAND NWT Geology Division
3 Geological Survey of Canada

Year 2000 fieldwork for the Walmsley Lake Project was focused in the northwest corner of the Walmsley Lake map area. The area is underlain by turbidites intruded by two generations of plutonic rocks. The southeast portion of the map area hosts older, pre- to syn-tectonic plutons with compositions of biotite-granodiorite to hornblende diorite. A later generation plutons with granitic compositions post date the peak regional metamorphism and is distributed across the map area.

The metamorphic grade of the metaturbidites generally increases towards the pre- to syn-tectonic plutonic suite in the southwest. Four regional isograds, representing the first appearance of a given mineral phase in pelites are associated with regional, peak metamorphic conditions. Only two outcrops of chlorite grade sedimentary rocks were found, poor outcrop in the area precludes drawing a rigorous isograd. The biotite isograd is represented in pelitic layers by a gradational transition from slatey-cleaving chloritic mudstones to biotite +/- muscovite schists. The regional cordierite isograd was pinned to within 50 metres in the northwestern part of the map area. The occurrence of cordierite gives a nodular appearance to the mica schists. Andalusite occurs locally in pelitic beds within the regional cordierite zone, its first appearance is slightly upgrade from the cordierite isograd. Garnet is common up-grade from andalusite. Garnet is present in pelitic and psammitic compositions, but is most abundant in the latter. The presence of garnet is strongly compositionally controlled, and thus can not be mapped as an isograd. The regional sillimanite isograd is locally poorly constrained due to a paucity of outcrop. Sillimanite first develops as fibrolite, commonly intergrown with quartz. Upgrade of the sillimanite isograd, fibrolite occurs as rims overgrowing andalusite and cordierite. Coarse sillimanite blades do not occur until a kilometre or more, in map view, above the isograd. A fourth isograd corresponds to the first appearance of granitic melt within pelitic beds in the turbidites.

Two mineral growth events are attributed to localized heating during emplacement of post-tectonic granitic plutons. Locally one to three millimetre compact nodules of fibrolite occur in otherwise cordierite grade metatubidites, adjacent to post-thermal peak granite plutons. The sillimanite nodules are too localized to be traced as an isograd. A second growth of cordierite in pelites, occurs on the west margin of a two mica granite in the north portion of the map sheet. Typically these overgrowths do not contain a fabric.

Microprobe thermometry and barometry work on suitable mineral assemblages in the turbidites, (Cairns) and geochronology of various plutonic lithologies with known relative age relations (Maclachlan), will enable the construction of a the quantitative P-T-t section for the Walmsley Lake area.

REGIONAL TIMING CONSTRAINTS ON GOLD MINERALIZATION AT WEST MELIADINE, NUNAVUT

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Several lode gold deposits are located along the trace of the Pyke Break occurring in the northern margin of the 2.66 Ga. Rankin Inlet belt of the Hearne Domain, Western Churchill Province. The regional geophysical expression of the break is a linear magnetic discontinuity traceable for over 65km. The break may be a structural boundary within the Western Churchill Province, separating the northern MacQuoid-Gibson and Yathkyed belts from the southern Kaminak and Rankin? belts. Mapping at West Meliadine defines the break as a several kilometer-wide zone comprised of poly-deformed greenschist grade supracrustal rocks bounded by amphibolites to the north and south. The geological setting at Meliadine shares many similarities with Archean breaks in the Superior Province (e.g. the Destor-Porcupine and Cadillac-Larder Lake Breaks of the southern Abitibi belt). These similarities include: (a) regionally extensive transposed stratigraphic panels separated by parallel trending high strain zones; (b) the presence of molasse-type Timiskaming sediments; (c) multiple ages of intrusive activity; and (d) a regional association with lode gold mineralization.

Based on mapping and drill core inspection a relative timing of structural events at West Meliadine has been developed. The S_{2a} fabric is the dominant schistosity that trends parallel to the ESE trace of the Pyke Break. This cleavage is overprinted by an S_{2b} fabric trending east-west. The S_{2a} fabric is interpreted to be a dominantly flattening fabric, whereas, S_{2b} is associated with dextral Z-drag folding. A later S_3 crenulation cleavage can be observed in fine grained pelitic or mica-rich units. Field evidence suggests that gold-bearing quartz veins formed during the waning phase of S_{2b} deformation. Veins that host gold do not appear to be strongly deformed and arsenopyrite grains associated with ore are randomly oriented and idioblastic, suggesting paragenetically late mineral growth. White mica associated with quartz vein selveges and chlorite internal to veins are clearly cut by the S_3 cleavage: therefore mineralization is pre-S_3.

The absolute timing of events such as regional metamorphism, plutonism, fabric development and gold mineralization is still poorly constrained. Current studies are underway to resolve these timing issues via Ar/Ar studies of metamorphic hornblende / biotite and hydrothermal white mica, as well as U/Pb zircon analyses of felsic and mafic intrusive rocks. A maximum age for S2b fabric development and mineralization is constrained by overprinted gabbroic dykes. Several species of gabbro are known, and field relations indicate both Archean and Proterozoic dykes are deformed. An absolute minimum age for gold mineralization is constrained by intrusion of lamprophyre dykes associated with the 1.84 Ga. Dubawnt Supergroup, since these mica-rich lamprophyres are undeformed and can be observed cutting mineralization. Moreover, the S_3 crenulation cleavage which overprints ore zones, is not present in lamprophyres, implying S_3 occurred prior to 1.84 Ga. and that gold deposition and lamprophyre injection are unrelated.

GEOLOGY OF THE NORTHERN MARGIN OF THE TRANS-HUDSON OROGEN (FOXE FOLD BELT), CENTRAL BAFFIN ISLAND, NUNAVUT

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The northern flank of the Trans-Hudson Orogen on central Baffin Island comprises a basement of reworked Archean rocks of the Rae craton overlain by metasedimentary and minor volcanic cover rocks of the Paleoproterozoic Piling Group. The Archean rocks consist of banded tonalitic and granitic orthogneiss, and rare pelitic to psammitic metasedimentary and mafic metavolcanic rocks of the Mary River Group; all are intruded by massive to strongly foliated biotite granite and minor K-feldspar megacrystic granodiorite-monzogranite and gabbro-anorthosite. From north to south, the Piling Group comprises a lower package of clastic and carbonate rocks that are interpreted as a passive margin sequence, and an upper package that consists of sulphidic black shales that pass upward into classic sand-mud turbidites that are interpreted as a foredeep sequence. A panel of massive mafic-ultramafic flows and sills as well as pillowed basalts tectonically overlies the turbidites. The southernmost exposures of the Piling Group are intruded by a suite of monzogranite to granodiorite plutons that have been interpreted as the northern edge of the ca. 1.86 Ga Cumberland Batholith.

Although the Piling Group sits structurally above the Archean basement, the contact, where exposed, is tectonized such that a primary depositional relationship (unconformity) has not been observed. Much of the contact is obscured by biotite syeno- to monzogranite plutons that intrude both the Piling Group and Archean basement, further limiting the potential to observe earlier relationships between basement and cover. Repetitions of the distinctive elements of the lower part of the passive margin sequence illustrate that some craton-directed thrusting has occurred; the lack of distincitve marker horizons has precluded field-identification of such structures in the foredeep sequence. The Archean basement, Piling Group cover and subsequent granitic intrusions have been folded into a series of ~ENE-trending folds. Deformation within the turbidites of the foredeep sequence is characterised by upright to slightly overturned, tight to isoclinal folds. Metamorphic grade increases progressively from greenschist in the north through amphibolite to incipient granulite facies toward the Cumberland Batholith. Late cross-folding generates significant structural relief in the area, and controls the final map pattern.

The platformal carbonate rocks of the lower sequence have potential to host MVT Zn-Pb mineralization; the past-producing Black Angel mine is hosted in similar rocks along strike in West Greenland. The sulphidic black shales that cap the carbonates contain extensive pyrite and pyrrhotite, illustrating the SEDEX potential of this map unit. The overlying turbidites may host Carlin-type Au mineralization, and the ultramafic rocks of the uppermost volcanic panel have potential for Ni-Cu-PGE mineralization.

PEEKING UNDER YELLOWKNIFE BAY: BEDROCK GEOCHEMISTRY FROM DRILL CORE, SOUTHERN YELLOWKNIFE BELT

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The Yellowknife greenstone belt has been subdivided into two volcanic rock packages, the 2.72-2.70 Ga Kam Group and the ca. 2.64 Ga Banting Group. The Kam Group is dominated by tholeiitic mafic volcanic rocks, whereas the Banting Group includes a high proportion of felsic volcanic and epiclastic rocks. The contact between the two units is unconformable where it is exposed. Rocks proposed to be transitional between the Kam and Banting (e.g., the Giant Section) have been reconsidered to be part of the upper Kam Group as a new unit, the Kamex Formation. The extents of the Kamex formation are difficult to determine and sample, largely because they are exposed as islands along the western edge of Yellowknife Bay. Thus, further definition of this formation and other units that are not exposed is only possible through the investigation of drill core samples.

This work focuses on drilling at the south end of Yellowknife Bay, on the Marlin and Mirage claims, performed between 1995 and 1997 by Royal Oak Mines. Potential drill core samples were identified from core logs and collected from drill core in the storage area at the Giant mine site. Samples from a wide variety of lithologies were selected based on freshness as described in the drilling logs. Rock types include komatiites, massive and pillowed mafic to intermediate flows, felsic volcanic rocks, and granitoids. Major, trace element, and Nd isotopic analyses of twenty different rock units are in progress.

One of the primary questions that geochemistry will address is assignment of the lavas to either the Kam or Banting Groups, following up on 1999-2000 EXTECH-funded projects in bedrock geochemistry. The felsic volcanic rocks from the drill cores will be particularly useful in this regard, since Kam and Banting felsic units have dramatically different trace element and Nd isotopic signatures. The komatiite lavas exhibit spinifex texture in drill core, and are among the few extrusive ultramafic rocks found in the Slave Province. The geochemistry of this unit will hopefully lead to a better understanding of its stratigraphic position.

OVERVIEW OF GEOCHRONOLOGICAL RESULTS FROM THE WESTERN CHURCHILL NATMAP PROJECT

William J. Davis
Geological Survey of Canada

A greatly expanded geochronological and geological database resulting from the Western Churchill NATMAP serves to refine the timing of Archean and Paleoproterozoic crust formation and deformation within the Rae and Hearne domains west of Hudson Bay, and permits for the first time broad-scale correlation of volcanic, plutonic and metamorphic events within the area. Although complicated by the effects of Paleoproterozoic reworking, regional variations in the nature and timing of Neoarchean magmatism and tectonism can be used as a basis for subdividing the Western Churchill Province into: 1) the Rae domain in the north; 2) a north Hearne subdomain parallel to the trace of the Snowbird zone that experienced a separate Neoarchean tectonic history at 2.6-2.5

Ga relative to the central part of the Hearne; and 3) a south Hearne domain that records a relatively simple history with no indication of significant tectonism following initial stabilisation at 2.7-2.65 Ga (Davis et al 2000). The exact boundaries between these domains remain to be defined, and may in large part be Paleoproterozoic, rather than Neoarchean features. However, the subdomains themselves can be outlined by their Neoarchean characteristics, in particular, the age and lithological association of supracrustal rocks (2.74-2.63 Ga in Rae; 2.71-2.66 Ga in Hearne), and perhaps most significantly for the Hearne, the restriction of ca. 2.6 Ga plutonic rocks and ca. 2.55-2.50 Ga metamorphism and deformation to a zone within the Hearne southeast of the trace of the STZ zone.

Proterozoic reworking is locally extensive and includes widespread mafic dykes of the ca. 2.45 Ga Kaminak (south Hearne) and ca. 2.19 Ga MacQuoid/Tulemalu swarms (north Hearne); ca. 1.9 Ga metamorphism in the north Hearne domain and Chesterfield Inlet segment of the STZ (Berman et al 2000); and metamorphism and regionally localized deformation in the interval between 1.83 and 1.81 Ga (MacLachlan et al 2000). The 1.83-1.81 Ga event involves intrusion of granites across large parts of the Rae and Hearne domains and is most likely associated with orogenic events related to development of the Trans-Hudson orogen (Peterson and van Breemen 2000). The relationship of the older ca. 1.9 Ga event to regional tectonic events remains conjectural. The last major event includes development of the Baker Lake basin and intrusion/extrusion of ca. 1.75 Ga alkaline magmatism of the Nueltin suite.

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AIRBORNE GRAVITY GRADIOMETER SURVEY OVER THE EKATI PROPERTY.

Diorio, P. A.; Lockhart, G.D.; Liu, G. and Gonzales, A. M.
BHP Minerals

Gravity has often been used as an exploration tool for kimberlite pipes but due to the logistical difficulties, survey costs and the small amplitude of the expected anomalies it has usually been relegated to small-scale follow-up surveys. In January 2000 BHP announced the deployment of the world's first airborne gravity gradiometer suitable for mineral exploration, under the project name Falcon. This has opened the door for rapid, inexpensive, large-scale high-resolution gravity surveying.

In May through August 2000 a large, detailed airborne gravity gradiometer survey was flown over the entire Ekati property. The survey successfully detected many of the known pipes and generated a number of previously unknown targets. Case studies will be shown for several pipes. As well, the application of the method to geologic mapping will be discussed.

EXPLORING FOR HYDROCARBONS IN MESOZOIC STRATA, MACKENZIE DELTA

James Dixon
Geological Survey of Canada
Publication number 2000150

Mesozoic strata in the Mackenzie Delta-Tuktoyaktuk Peninsula area consist of Jurassic and Cretaceous shale- and sandstone-dominant formations. No Triassic strata are known in the subsurface and only thin remnants are present in the adjacent Richardson Mountains. There have been seven discoveries of oil and gas in Cretaceous rocks to date, the largest being the gas discovery at Parsons Lake, where the reservoirs are sandstones of the Martin Creek and Kamik formations. Other, lesser discoveries include gas at Tuk (Kamik Formation) and Unak (Rat River Formation), and oil at Atkinson Point (Atkinson Point Formation), Kugpik (Kamik Formation), Kamik (Kamik Formation), and Imnak (Mount Goodenough Formation).

Prospective reservoir horizons include the Bug Creek Group (Lower to Middle Jurassic), Martin Creek Formation (Berriasian), Kamik Formation (Valanginian-Hauterivian), Rat River Formation (Aptian), Atkinson Point Formation (Barremian to Aptian), and basal sandstones of the Arctic Red Formation (late Aptian to early Albian). Of lesser prospectiveness are sandstones within the Husky Formation and lower Mount Goodenough Formation.

Potential source rocks include the Husky Formation (Upper Jurassic to Berriasian), McGuire Formation (Valanginian), Mount Goodenough Formation (Barremian), Arctic Red Formation (Albian), Boundary Creek Formation (Cenomanian-Turonian), and Smoking Hills Formation (Santonian-Campanian). Of these, only the Smoking Hills Formation has been geochemically typed as an oil source rock - correlatable with the oils at Atkinson Point and Kugpik. Geochemical characterization of the other units is poor and more work is required.

Trap types include rollover anticlines associated with normal faults, horst blocks, and closure against normal faults. The effects of Late Cretaceous-Early Tertiary compression on creating or enhancing existing traps is still poorly understood.

The Mesozoic succession under Mackenzie Delta and Tuktoyaktuk Peninsula has all the right characteristics to be prospective for hydrocarbons, and the current round of exploration will be a test of its worthiness for additional, more intense exploration.

WORLD CLASS METAMORPHOGENIC LODE GOLD DEPOSITS WITHIN PLUTONIC OROGENIC SETTINGS: EXAMPLES IN THE SLAVE PROVINCE, N.W.T.

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The excitement of new gold discoveries in the young circum-Pacific porphyry/epithermal environments through the 90's has overshadowed the fact that the majority of the historical world class lode gold camps formed within deeper (5-10 km) plutonic settings. Nor are plutonic lode gold deposits as restricted in occurrence as the shallower porphyry/epithermal-types as plutonic lodes are well represented throughout the geological column. Examples include: many Archean lode gold camps (Yellowknife >20 Moz is a prime example); deposits of the Pine Creek Inlier N. Australia (>15 Moz) are early Proterozoic; the Telfer Deposit of W. Australia (> 15 Moz) is late Proterozoic; the worlds largest single deposit, Muruntau in Uzbekistan (>40 Moz within a district that has produced >4000t Au!) is late Paleozoic; and the Tintina gold belt (@>25Moz) is latest Mesozoic. Their absents in Tertiary settings can be accounted for by plutonic settings of this age still to be unroofed. In all cases the associated granite plutons relate to the major collisional orogens that have punctuated earth history. Preferential emplacement into zones of post-collisional extension can well account for the longstanding room problem.

Emplacement mechanisms not only define the configuration of the associated thermal aureoles but also the nature of related deformation overprinting wall rocks; ranging from isolated domical patterns to development of regional arches and accommodation faults. Long-lived structures, commonly showing a transit from ductile to brittle behavior over time, are the most important conduits for fluid migration. Multiple fluid reservoirs are implicated, including devolatilization reactions within the thermal aureole, peak metamorphic injection of H2O-granite and CO2-lamprophyric melts, post peak fluid evolution due to continuous fluid/rock reactions within ductile shear zones, and late ingress of deep crustal water into still active brittle fault/fracture zones. The deposits range from peak metamorphic vein systems associated with high temperature (>600C) calc-silicate replacements to low temperature (<300C) quartz stockworks in carbonatized-sericitized-sulphidized shear zones.

The distribution of plutonic lode gold deposits in the Slave Province reflect two fundamentally differing settings. The greenstone-hosted ores of the Yellowknife-type relate to retrograde cooling following emplacement of Defeat Suite I-type granodiorites at 2635-2620 Ma. The metasediment-hosted ores such as Lupin, Discovery and Gordon Lake relate to retrograde cooling following the emplacement of the Prosperous Suite S/A-type granites at 2585-2550 Ma. The radical difference in tectonic setting between the monoclinal greenstone belts rimming Defeat granodiorite and the polydeformed metasediments enveloping Prosperous granite indicates these two settings were decoupled. Nevertheless, in both cases the outer boundary of the thermal aureole, i.e. the amphibolite to greenschist transition, is key for fluid generation and gold concentration. Also in both cases, gold can be critically linked to stepped retrograding paragenetic lineages stemming from peak metamorphic calc-silicate reactions (hedenbergite-garnet) through intermediary actinolite-epidote-biotite-magnetite-apatite, to late hydrothermal chlorite-calcite with diagnostic sericite- ankerite-pyrite envelopes on mesothermal quartz vein systems.

The plutonic lode gold deposits are best interpreted as metamorphogenic in formation. Gold is partitioned into metamorphic fluids that evolve through early calc-silicate reactions into increasingly volatile H2O-CO2-H2S rich hydrothermal cells that become structurally ponded and precipitate gold with quartz accompanying suphidization down the cooling gradient post pluton emplacement. Tying the prograde metamorphic/retrograde hydrothermal paragenetic stages of mineral growth to structural overprinting of the host lithologies is paramount in deciphering the specific timing of gold fixation. Where post-collisional extension causes collapse and tectonic removal of the overlying brittle upper crust, plutonic gold settings may be quite rapidly exhumed and eroded. Reworking of plutonic lodes is much more common in the developement of major placer gold districts than is the erosion of the shallower porphyry/epithermal lode gold systems, e.g. the Klondike placers account for a further 25 Moz of gold production in the Tintina gold belt.

STRUCTURAL-EMPLACEMENT MODEL FOR KIMBERLITIC DIATREMES IN NORTHERN ALBERTA

D. Roy Eccles, Eric C. Grunsky, Matthias Grobe and Jill Weiss
Earth Sciences Report 2000-01
Alberta Energy and Utilities Board
Alberta Geological Survey

A study to evaluate structural controls on the Buffalo Head Hills kimberlites in the Peerless Lake area of north-central Alberta was initiated because of the recognition of a set of north-trending lineaments that appear to be spatially correlated with the orientation of the Loon River lowlands, irregularities in the Phanerozoic sedimentary cover, and the emplacement of several kimberlitic diatremes. The combination of aeromagnetic and Radarsat imagery, draped on a digital-elevation model, clearly depicts the relationship between kimberlite intrusions and the intersection of north- and northeast-trending fault sets observed at surface.

A structural-emplacement model constructed for the Buffalo Head Hills kimberlites is consistent with worldwide examples in which kimberlite diatremes are associated with Phanerozoic grabens that result from the frequent transcurrent and/or extensional reactivation of a deep-seated mobile zone.

The Precambrian basement in the Peerless Lake area has been greatly modified by a long tectonic history. The contact between the Buffalo Head and Utikuma subdomains of the Buffalo Head Terrane is inferred to represent a deep-seated crustal feature due to the presence of

- a differentiated horst-and-graben block structure indicative of crustal uplift;
- sharply defined, north-trending lineaments of deformed Precambrian surface and pronounced elongated, linear aeromagnetic signatures that suggest dominant structural controls;
- localized geothermal patterns and retrograde metamorphism;
- a distinct north-trending gravity low that may be associated with deep-seated topographic displacement and/or granite plutonism; and
- low $\delta 18O$ values, similar to those reported from the Kimiwan Anomaly, which are believed to be indicative of extensional tectonism.

A basement to surface cross section (approximately 1600 m), orientated west to east in the study area, shows that the Phanerozoic strata in the Peerless Lake area have been affected by structural events throughout its depositional history. The locations of three north-trending, steeply dipping, normal faults were identified. The faults appear to propagate through the entire Phanerozoic and possibly provided important pathways for the emplacement of kimberlitic diatremes. Extensional reactivation events likely occurred during the Paleoproterozoic, Middle to Late Devonian, and Late Cretaceous. During deposition of Middle to Late Devonian Woodbend and Winterburn sedimentary rocks, the faults defined the boundaries of a graben structure that coincides with the boundaries of the Loon River lowlands and has been informally named the Loon River graben. The main border fault, located on the western edge of the Loon River graben, correlates with the north-trending parallel fault sets that exist at surface. These fault sets are thought to represent a dispersed flower structure formed by the fault in the Cretaceous sedimentary rocks.

The authors speculate that the regional distribution of the known Buffalo Head Hills kimberlites is controlled by the extension of deep, north-trending basement fault zones at the regional scale. It is further speculated that the older, northeast-trending faults have significant impact on the location and shape of specific kimberlite bodies. To date, advanced bulk-sample testing of selected kimberlites for diamonds has occurred mainly on the western edge of the graben. This work may support the conclusion, drawn from other studies, that the most significant diamond concentrations occur on the main border fault or western shoulder of the graben.

This study shows that surficial lineaments in Cretaceous strata can direct exploration companies to tectonic zones in the Phanerozoic and basement, and therefore to potential conduits for kimberlites and metalliferous hydrothermal systems. Furthermore, the structural features at the exposed surface of the Phanerozoic stratigraphic sequence reflect a complex tectonic history that extends as far back as the early Proterozoic.

YELLOWKNIFE GOLD: A "DOUBLE-DOUBLE" OF ARSENOPYRITE AND BASE METALS?

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The Yellowknife endowment of gold (14,000,000 oz.) is the product of a complex series of different processes that spanned a period from 2700 Ma to 1300 Ma. Overprinting alteration, metamorphism and deformation have helped to confound the story, but distinct mineral assemblages can still be recognized. Attempts to compile regional zonation patterns have largely failed because different mineralization events produced similar sulphide minerals. Four important assemblages, two rich in base metals and two with arsenopyrite as the main sulphide mineral, need to be differentiated.

The earliest assemblage contains an abundance of banded galena and sphalerite. This synvolcanic assemblage can be characterized by low gold/high silver contents and abundant admixed pyrite-pyrrhotite. Deposits are strataformal and associated with silicified and/or epidotized wallrock. In contrast, the second base metal assemblage is typified by vein or fracture-filling sphalerite with minor galena. These veins cross cut rocks as young as the Defeat Suite (2620 Ma) and contain abundant free gold and high silver. Pyrite-pyrrhotite and chalcopyrite may be present but are not abundant. Wallrock alteration is restricted to narrow bleached to silicified zones 5 to 10 cm around the veins.

Chrryssoulis (1990; MDA Final Report) demonstrated that two styles of arsenopyrite were present at the Giant mine. This work can be extended to other deposits where arsenopyrite can also be divided into two groups based largely on the crystal size. The earliest gold-bearing arsenopyrite to be precipitated is very fine to fine-grained arsenopyrite crystals in fractures, along foliation planes or as a component of a broad silicification. This arsenopyrite contains an abundance of gold (average of 450 ppb) in the crystal lattice. Antimony concentrations are elevated in this assemblage, possibly as a solid solution member in the lattice or as fine needles of stibnite accompanying the arsenopyrite. Deposits containing this assemblage appear to be restricted to the greenstone belt. In contrast, the second arsenopyrite-rich assemblage is present in all units in the Yellowknife region excluding the Proterozoic dykes. The arsenopyrite crystals are coarse to fine-grained crystals or may form massive amorphous fracture fills. The lattice gold content is lower than in the first assemblage (150 ppb average) but free gold is also present as fracture fills and as inclusions in the crystals. This style of arsenopyrite is often found as massive arsenopyrite with variable amounts of white to grey quartz. Antimony concentrations are low.

Based on these assemblages, new regional zonation patterns are emerging that may help focus future exploration and research efforts.

THE WORLD CLASS HOWARDS PASS ZINC DEPOSIT

Fields, Mark and Carlson, Gerald G.
Copper Ridge Explorations Inc.

The Howards Pass zinc-lead-silver-cadmium deposit was discovered during a reconnaissance exploration program by Placer Development in 1972. The key exploration tool was stream sediment geochemistry, followed by prospecting. Three main deposits were discovered along a strike length of over 40 km. During the next decade, approximately $15 million was spent on exploration. The work included mapping, soil sampling, diamond drilling and an underground bulk sample from the XY deposit. In 1975, Placer joint ventured the project with US Steel, which spent $10 million to earn 49%.

In July, 2000, Copper Ridge Explorations Inc. reached an agreement with Placer and US Steel to purchase a 100% interest in the Howards Pass deposit for $10 million in cash and shares over four years, plus a $5 million bonus on a production decision. Copper Ridge subsequently reached an agreement with Billiton Metals Canada, whereby Billiton will assist Copper Ridge with the evaluation of the deposit and will have the right to earn a 70% interest in the project by placing it into production

Howards Pass is situated within the Paleozoic to Mesozoic Selwyn Basin. The oldest rocks in the area are late Proterozoic clastics unconformably overlain by the Rabbitkettle Formation, platformal limestone and mudstone. These grade into the Upper Ordovician-Silurian Road River Formation (locally the Howards Pass Formation), host to the XY, Anniv and OP deposits. The stratigraphic footwall of the deposits is a carbonaceous, pyritic, cherty mudstone. The host unit to the mineralization is referred to as the Active Member (a mixed black cherty to calcareous mudstone unit) and the hangingwall sediments are carbonaceous chert overlain by a bioturbated, laminated mudstone. Above this, is the Devonian Lower Earn Group calcareous and dolomitic mudstone and siltstone, capped by the Iron Creek Formation, consisting of baritic, grey mudstone and shale. An unconformity marks the beginning of high-energy deposition of mudstone, siltstone, sandstone and chert pebble conglomerate of the Upper Earn Group.

Mineralization, consisting predominantly of sphalerite and galena, is fine grained, finely banded and concordant with sedimentary textures indicating soft-sediment deformation. The highest grade mineralization is associated with crosscutting veinlets of re-mobilized galena and sphalerite that lie in cleavage planes. Pyrite content of the mineralized section is 5% or less.

Placer calculated resource estimates in 1981 for the XY and Anniv deposits. In the indicated resource category, Placer calculated 55.0 million tonnes at 8.3% combined zinc plus lead at the XY deposit and 55.5 million tonnes at 7.1% combined zinc plus lead at the Anniv deposit, using a 4% combined cut-off. Zinc to lead ratios are approximately 3:1.

While earlier evaluations of the deposit focused on a small, high grade underground operation shipping concentrate to smelters, Copper Ridge is re-evaluating the deposit with a vision to large scale, open pit mining. Milling would produce a low grade bulk concentrate designed to maximize zinc recovery, followed by hydrometallurgical processing, likely pressure oxidation and electrowinning to produce a pure zinc product for shipping. Key infrastructure requirements are transportation and power. It is proposed that the electrical requirements will be met by turbines powered by gas either from the proposed Alaska Highway gas pipeline or new gas fields being developed in the Fort Liard area.

Copper Ridge has commenced a Concept Study, budgeted at $2.2 million, which will include a significant amount of drilling directed at developing new, near-surface resources. The study will also include preliminary engineering, metallurgical and environmental work. If successful, this work will lead to pre-feasibility and feasibility studies that could lead to a production decision by 2004.

REGIONAL-SCALE MAGNETOTELLURIC SURVEY OF THE YELLOWKNIFE FAULT

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During the 1996 Lithoprobe magnetotelluric, MT, survey measurements were made at sites from west of Yellowknife -Northwest Territories, Canada- across the Yellowknife fault to the east. The 2D interpretation of this profile showed the most anomalous response at the site located north of Yellowknife virtually on the Yellowknife fault.

The first MT study carried out during winter 2000 have been located 10 km north of the previous profile, on a profile extending 20 km with variable station spacing from the Yellowknife fault. The main objective of this study is the study of the Yellowknife fault as a regional feature and the possible relation of the enhanced conductivity with the gold deposits.

The second MT study realized in the area consisted of two short AMT profiles located south of the city of Yellowknife, close to the Kamex islands. The first profile consists on 8 stations and is located over a shear zone that contains a gold deposit. The second one consists on 5 stations and is located south of the first profile over the same shear zone where no mineral has been found. Different geophysical studies realized in the area failed to locate the mineral deposit. The main objective of this study is whether the MT method is valid to locate gold deposits in the Yellowknife area and an understanding of this shear zone and its relation with the Yellowknife fault.

In this work we present the 2D modeling of these three profiles.

GEOLOGY AND PROGRESS REPORT ON THE NICO COBALT-GOLD-BISMUTH, AND SUE-DIANNE COPPER-SILVER DEPOSITS, SOUTHERN GREAT BEAR MAGMATIC ZONE, NORTHWEST TERRITORIES, CANADA

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The NICO cobalt-gold-bismuth and Sue-Dianne copper-silver deposits of the

Mazenod Lake area, Northwest Territories, are currently being drill-delineated by Fortune Minerals Limited. They are the only known significant Canadian examples of the Proterozoic iron oxide-hosted polymetallic class, more commonly referred to as hydrothermal iron oxide copper-gold deposits. NICO and Sue-Dianne are located in the southern part of the Great Bear magmatic zone, the central tectonic subdivision of the Bear Province. It is a post-collisional plutonic terrane with related continental volcanic rocks dating from 1867 Ma and culminating with the emplacement of A-type rapakivi granite plutons at approximately 1856 Ma. Iron oxide occurrences are widely distributed within the Great Bear magmatic zone, ranging from Salobo-type magnetite-rich schists and ironstones in receptive basement rocks to Kiruna-type magnetite-apatite-rich veins and Olympic Dam-type sulphidized magnetite-hematite breccias in overlying volcanic rocks.

NICO is the largest known deposit in the area with a diluted, indicated resource of 42.1 million tonnes, grading 0.10% cobalt, 0.5g.t gold and 0.12% bismuth. The deposit is hosted in iron- and potassium-altered, brecciated basement sedimentary rocks of the Snare Group at, and beneath the unconformity with overlying potassium-rich felsite of the Faber Group. Mineralization is preferentially hosted in subarkosic wacke altered to "black rock" amphibole-magnetite-biotite schists and ironstones with disseminated and fracture filling sulphides. Recent work included in-fill drilling (34 holes) which are being used to update the resources of the deposit. Sue-Dianne is 25 kilometres north of NICO and contains a measured and indicated resource of 17.3 million tonnes, grading 0.72% copper and 3.3g/t silver. The deposit is hosted within a well-zoned diatreme breccia complex, which crosscuts a tilted Faber Group ash flow tuff sequence above the regional unconformity. Mineralization is hosted in iron- and potassium-altered breccias with disseminated and fracture filling sulphides. At both NICO and Sue-Dianne, ongoing detailed paragenetic studies demonstrate that early, reduced, high-temperature mineral assemblages are overprinted by late, oxidative, low-temperature assemblages. These together with stratigraphic relationships, indicate fluid mixing at shallow crustal levels was important in deposit formation. Proximity of the NICO and Sue-Dianne deposits to subvolcanic porphyries, rapakivi granite and various border phases of the Marian River Batholith, together with geochronology and mineralogy studies, suggest they are all genetically related. The occurrence of diverse iron oxide deposit types within the Great Bear magmatic zone, makes this region favourable for exploration and for the study of the Proterozoic iron oxide class as a whole.

A PRELIMINARY EVALUATION OF THE PETROLEUM DATA OF THE MACKENZIE CORRIDOR

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There is renewed interest to identify significant new hydrocarbon accumulations in the Mackenzie Corridor. This stems from the decision by the Government of the Northwest Territories to encourage a future pipeline linking the Mackenzie Delta oil and gas discoveries with existing pipeline south of 60o latitude. This commitment will enable areas such as Colville Hills to tie-in and put into production already proven gas discoveries. For other areas, it will open up the opportunity to advance exploration. The GNWT has taken initiative in participating with the Geological Survey of Canada in a three year joint study to assess the petroleum resource potential of the Mackenzie Corridor.

The analysis methodology will be a Resource Volumetric Assessment relying on geological and reservoir parameters taking into consideration all petroleum data available including: seismic sections, well log data, geochemistry, geothermal studies, and outcrop and core descriptions. The area covered in the assessment is about 558 300 km2 and covers the areas between Mackenzie Delta in the north to the Liard Plateau in the south. The studied areas in the first phase of the project will include: Anderson Plain, Horton Plain, Colville Hills, Great Bear Plain, Peel Plateau, Peel Plain, Mackenzie Plain, and Plateau Overthrust. The petroleum data synthesized into the assessment will be unique to that area. The second phase will examine the Liard and Horn Plateaus and Great Slave Plain areas.

A preliminary evaluation of the petroleum data available was required in the initial stages of the assessment. The objectives being 1) to prepare existing information on the Mackenzie Corridor for consideration 2) to identify play types and appropriate assessment methods as a function of available data. A thorough literature search of all publicly available material was completed and an inventory of all petroleum data contained in these publications was compiled for each area. This was a comprehensive search to include all formations from the Pre-Cambrian to surface for possible source, reservoir and seal forming rocks.

The result of the preliminary evaluation is a systematic organization of synthesized petroleum data into plays by area for analysis and the subsequent assessment of the hydrocarbon resource potential of the Mackenzie Corridor.

SEQUENCE STRATIGRAPHY AND STRUCTURE OF THE CA. 1.83 GA BAKER LAKE SUB-BASIN

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In the Baker Lake Sub-basin, strata of the ca. 1.83 Ga Baker Lake Group (BLG) have characteristics that suggest they were deposited in a north-facing half-graben. On the northern margin of the basin, north of Pitz Lake, the BLG is ~500 m thick and comprises five unconformity-bounded intervals interpreted as 3rd-order depositional sequences (the Baker Lake, Wharton and Barrensland groups are considered to be 2nd-order sequences). On the southern margin of the basin at Thirty Mile Lake it is over 2000 m thick and comprises at least four 3rd-order depositional sequences. This difference is interpreted to reflect differential subsidence and accommodation accompanying the development of a major north-dipping detachment on the south side of the basin. Paleocurrents indicate that alluvial fans at the northern and southern margins of the basin transported detritus into the centre of the basin. These fed braided rivers that flowed eastward, along the axis of the basin.

Ultrapotassic volcanic deposits of the Christopher Island Formation (upper Baker Lake Group) are time-stratigraphic equivalents of the South Channel and Kazan formations (lower Baker Lake Group). Near volcanic centres in the Thirty Mile Lake area the volcanic succession, from oldest to youngest is 1) felsic minette flows, 2) mafic minette flows and, 3) felsite flows.

Two sets of faults offset the BLG and Wharton Group (1765-1750 Ma). The first is a set of east-trending normal faults that have rotated strata into the basin. The second is a conjugate set of strike-slip faults that offset the normal faults. Faulting ceased before deposition of the Barrensland Group (ca. 1.72 Ga).

DALY BAY COMPLEX, HUDSON BAY, NUNAVUT*

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*Contribution to the Western Churchill NATMAP Project

The Daly Bay Complex was originally defined as an association of quartzo-feldspathic gneisses intruded by gabbro and anorthosite, and metamorphosed at granulite facies, and was mapped as a synform with a core of "pyroxene granulite" underlain by a "boundary shear zone" (Gordon, 1988). It has been included as an anchor point in the trace of the northeastern Snowbird tectonic zone. New, strategically targeted fieldwork indicates that the core is predominantly composed of orthopyroxene-plagioclase ±garnet (opx-plag) rock cut by orthopyroxene tonalite and aluminous garnet leucogranite, both emplaced synkinematically during a single foliation forming deformation event. Subtle modal layering in the opx-plag rock is locally anorthositic in composition. A large panel of aluminous garnet leucogranitic gneiss occurs in the eastern core. Although it is of paragneissic origin and was intruded by the opx-plag rock, it contains graphite but little or no sulphide.

With the exception of the aluminous garnet leucogranitic gneiss, the same lithologies and single regional foliation dominate the boundary zone that, while it contains local mylonites and a more pronounced southeast plunging lineation than the core, is not a high strain zone and should not be considered as a shear zone that accommodated significant displacement of the Complex. The boundary zone contains ~100 m thick sheets of anorthosite, as well as a discrete pluton of the same material. Mafic sheets were preferentially intruded into the pluton and locally cross-cut the regional foliation within it. These mafic sheets appear to be ferro-gabbros petrologically related to the anorthosite, and suggest that the anorthosite was also emplaced during the regional foliation forming event. In contrast to the orthopyroxene-plagioclase assemblages of the core, the boundary zone shows abundant development of clinopyroxene-garnet. The metamorphic minerals are commonly wrapped by the regional foliation. In places, orthopyroxene is replaced by garnet and iron oxide that weather to produce large swaths of rusty, friable rock that can be mistaken for gossan from a distance.

The Daly Bay Complex appears to represent a large volume of mafic to anorthositic magma, derived by partial melting in the upper mantle, that was intruded into the lower continental crust. Tonalite may either represent partial melting of lower crustal mafic rocks, or the end product of fractional crystallisation of the mafic component of the Complex itself. We suggest that advection of heat by these melts led to granulite facies metamorphic conditions localised within the Daly Bay Complex. Isobaric cooling of the magmatic rocks resulted a metamorphic transition from high temperature to cooler granulite facies conditions. The history of uplift and exposure of these apparently deep crustal rocks remains to be elucidated. Meanwhile, we speculate that it may be related to structures external to the Daly Bay Complex.

Gordon, T. M. 1988:GSC Memoir, 422, p. 21.

NEOARCHEAN TECTONIC SETTING OF THE HEARNE DOMAIN, WESTERN CHURCHILL PROVINCE: IS THERE A MODERN ANALOGUE?

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The Neoarchean Hearne domain, Western Churchill Province, is principally composed of large, ~2700-2680 Ma, volcanosedimentary belts and contemporaneous granitoid plutons. Recent geological (Hanmer et al., 2000; Tella et al., 2000), geochronological (Davis et al., 2000) and petrological studies (Sandeman et al., 2000a,b) of the Kaminak and MacQuoid supracrustal belts illustrate the nature of the Neoarchean crust across the width of the Hearne domain (see also Yathkyed and Angikuni supracrustal belts; Aspler et al., 2000; MacLachlan et al., 2000). Considered as a whole, the Hearne domain is a vast tract of juvenile crust with both MORB and arc-like geochemical signatures (Sandeman, this volume), yet there is no evidence for either laterally extensive, localised, arc-like volcanic edifices, or accretionary wedges and mélanges. Furthermore, unlike modern oceanic arc systems, there is no evidence for a temporal polarity within the Hearne at ~2700-2680 Ma over a minimum across-strike width of 225 km, as measured after deformation. Kilometre-scale intercalation of MORB-like and arc-like geochemical signatures in the absence of tectonic imbrication, combined with the stratigraphic interlayering of mafic to felsic volcanic rocks throughout the eruptive history, does not resemble a classical volcanic arc built on a basement of oceanic crust.

Bloomer et al. (1995) formulated a general model for the early ("infant arc") stages of arc development based on Eocene intra-oceanic tectonics in the SW Pacific. The model initiates when a lower plate subsides vertically, driven by gravitational instability. Combined with hinge retreat, subsidence induced extension of the upper plate and convective flow in the subjacent mantle. Adiabatic decompression, together with the addition of water from the subsiding crust, lead to mantle melting with magma production and eruption rates much greater than for modern arcs, but comparable with those of slow spreading ridges. The result is production of a swath of juvenile crust ~200-400 km wide in ~10 m.y. A localised arc did not develop until the Oligocene, when lower plate subsidence was replaced by subduction.

Processes pertaining to an analogous suprasubduction, extensional environment could account for many of the features that characterise the juvenile Hearne crust. The subsidence-to-subduction transition may have been prevented in the Neoarchean due to lack of negative buoyancy, as higher geothermal gradients disfavoured the basalt-eclogite transformation in the lower plate. If the analogy proposed here is valid, it may influence future prospecting strategies in the Hearne domain.

Bloomer, S. H. et al. 1995: in Active Margins and Marginal Basins of the Western Pacific, (ed.) B. Taylor, & J. Natland; Denver, Colorado, American Geophysical Union, p. 1-30.

Other references available at: http://www.geocanada2000.com/frameset.html

THE SNARE RIVER PROJECT: RESULTS FROM 2000 MAPPING

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In 2000 field work continued for the multi-year Snare River Project, in the southwestern Slave Province, N.W.T. (parts of 85N and 85O). The main aim of the project (Jackson, 1998) is to produce 1:50,000 scale geological maps of part of the area that was mapped in the late 1930's at 1:253,440 scale by Lord (1963). In 2000 the project is supporting two BSc. theses and is continuing to collaborate with the more detailed investigations of Venessa Bennett (Ph.D. thesis, Memorial University of Newfoundland, see this volume).

During the past field season, mapping was focused in the complex terrane of Archean granitoid and supracrustal rocks near Cowan Lake and "Spirit" Lake. Highlights of this mapping are summarized below.

Highlights of 2000 Mapping:

Supracrustal rocks were further delineated in the area that Lord (1963) previously mapped as an unsubdivided granitoid terrane. These rocks, which include middle-upper amphibolite to granulite facies migmatites and gneisses, are interpreted to have volcanic and sedimentary protoliths. A newly defined unit consists of interlayered felsic volcanic and pelitic rocks and locally, minor carbonate. Gossanous zones are developed within the felsic volcanic layers, and are particularly concentrated near the adjacent pelitic rocks.

South of Cowan Lake, lower grade sedimentary rocks (metamorphosed to cordierite and sillimanite zone of amphibolite facies) are locally interbedded with banded magnetite ± sulfide iron formation (BIF). This sedimentary package is interpreted to be correlative with the BIF-bearing metagreywacke-mudstones at Russell Lake.

The transition from granulite to lower amphibolite facies supracrustal rocks was mapped near Cowan Lake, on the west side of a major fault defined by Henderson (1998). Preliminary results from mapping on either side of this fault suggest that similar lithologies are present on both sides, but metamorphic grades may be juxtaposed.

The complex basin and dome-like pattern revealed on detailed aeromagnetic maps provided by Covello, Bryan and Associates Ltd. are proving to coincide with major structural features e.g. near "Spirit" Lake, "Zed" Lake and "Forked" Lake dome. An Archean magnetite-bearing granitoid, containing abundant magnetic mafic enclaves, coincides with aeromagnetic highs and outlines many of the structural interference patterns.

Henderson, J.B. (1998): GSC Open File 3609, scale 1:50,000.
Jackson, V.A. (1998): DIAND, 1998 Geoscience Forum, Program and Abstracts.
Lord, C.S. (1963): GSC Memoir 235, 55p.

CANADA'S PIPELINE

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Canada's Pipeline is a computer-generated movie and multimedia presentation that outlines the importance of the proposed Mackenzie Valley natural gas pipeline to Canada. In a continent where growing demand for energy for heating and electricity must be balanced by a concern for the environment, natural gas has become the fuel of choice for the new century. North American natural gas demand is up and rising, reserves are down and falling, and pipeline systems in the south need additional product to remain efficient. Northern resources can meet the demands of southern Canada and the United States for more gas.

A pipeline up the Mackenzie Valley is the way to move northern gas to market. A Valley pipe could move 1 billion cubic feet, or more, a day the 1800 km from the Delta to just east of Boundary Lake in Alberta. There the gas will join existing pipeline systems and move to all parts of the continent. For the North, such a project will mean increased economic activity during the construction phase, followed by additional exploration and development work once the pipe is operating. For the provinces to our south, the economic impact will also be significant. A project of this scale will cost in excess of $3 billion for the pipeline alone. The exploration and development work that will proceed and follow the pipe will be in addition to this amount. Canadian companies could capture a full 98 % of these expenditures. In addition to the parts, Canadian companies can provide all the engineering, the project management, and the inspection services that will be required.

The continental demand for gas will continue to grow while conventional supplies will continue to shrink. Northern gas can fill the gap, for the benefit of all Canadians.

POLARIS: CURRENT KNOWLEDGE AND FUTURE PLANS

Alan G. Jones, David Snyder, and the POLARIS group

POLARIS (Portable Observatories for Lithospheric Analysis and Research Investigating Seismicity) is a multi-institutional program for the creation of a network of portable, satellite-linked geophysical observatories in Canada. The infrastructure was recently funded by the Canadian Foundation for Innovation, with matching funds from Ontario and B.C., plus other contributions. This program brings together scientists in universities, governments, and the private sector in an innovative research project dedicated to interdisciplinary studies of subcontinental mantle architecture and earthquake ground motions (and related hazards). The major components of POLARIS are a network of 90 three-component broadband seismometers, 30 magnetotelluric (MT) systems, complementary data acquisition and satellite communications equipment, and three satellite downlink facilities. Over the initial four-year start-up phase the network will be deployed as three arrays of 30 instruments.

This new geophysical infrastructure will enable ground-breaking research in combined applications of collocated teleseismic and magnetotelluric arrays for lithospheric analysis. Data collected by this system will be available in real-time over the Internet, and will be permanently archived by the Geological Survey of Canada.

One of the three initial arrays will be deployed on the Slave craton, and will extend significantly previous deep-probing geophysical studies of the craton using seismic and electromagnetic techniques. This paper will review existing information and present POLARIS array designs and deployment plans.

MAGNETOTELLURIC AND TELESEISMIC EXPERIMENTS AS PART OF THE WALMSLEY LAKE PROJECT: EXPERIMENTAL DESIGNS AND PRELIMINARY RESULTS

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The southeastern part of the Slave craton offers high potential for diamonds as well as possibly for base and precious metals. However, this region is poorly known geologically and geophysically compared to other parts of the craton. The Walmsley Lake project addresses this deficiency with acquisition of collocated bedrock, isotope and geophysical data. This paper describes the initiation of the geophysical component of the project, which comprises magnetotelluric and teleseismic observations, and presents the preliminary qualitative results of the data from the magnetotelluric component.

The main preliminary qualitative result is the discovery of a large conductivity anomaly within the Thelon-Talston Magmatic Zone comparable in scale to the North American Central Plains (NACP) conductivity anomaly. This contrasts sharply with the lack of a significant conductor in the Wopmay orogen.

ELECTRICAL RESISTIVITY AND SPECTRAL-IP CHARACTERISTICS OF MINERALIZED AND NON-MINERALIZED ROCKS FROM THE YELLOKNIFE MINING DISTRICT: IMPLICATIONS FOR EXPLORATION

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Electrical resistivity, spectral-IP and porosity characteristics are being investigated for rock samples from Giant and Con Mine areas (Northwest Territories). The purpose is to provide information for development of exploration strategies and aiding interpretation of down-hole, ground and airborne electromagnetic survey data. Samples include material from gold-bearing quartz veins, sericite schist, chlorite schist and unaltered basalt.

Results, to date, indicate that electrical resistivity (ρ_r) values decrease from 4,000-31,000 Ωm (basalts) through 1,500-14,000 Ωm (chlorite schist) to 400-3,400 Ωm (sericite schist), as the intensity of deformation and alteration increases. Electrical anisotropy (λ) values increase from 2:1 - 3:1 through 3:1 - 7:1 to 4:1 - 14:1, respectively, for these rocks. These represent a decrease in ρ_r of 10-80 times and an λ increase of 1.3-7 times, from unaltered basalt to deformed and altered sericite schists. The gold-bearing quartz veins display ρ_r and λ values of 40-3,400 Ωm and 2:1-50:1, respectively. However, these low ρ_r values likely represent only local mineralized sections of the quartz vein, typically characterized by values of 10,000-100,000 Ωm. The lower ρ_r values for sericite schist are due to both increased porosity and sulphide mineralization. The lower ρ_r values (40-400 Ωm) for ore and sericite schist are on the higher side of low resistivity rocks, due to poor sulphide grain-to-grain inter-connectivity. Good sulphide grain-to-grain connectivity should result in ρ_r values well below 10 Ωm. Rock samples from Giant Mine, representing effects of earlier generation quartz veins, generally show distinctly higher porosity values (1.5-3.0 %) than those (0.4-1.2 %) from Con Mine, likely representing effects of later generation quartz veins.

The spectral-IP results for ore and sericite schist samples, containing sulphides of 2-10 %, showed weak to strong IP effects (percent frequency effect: PFE=2-30 %). The PFE values used here are calculated from ρ_r values at two frequencies half a decades apart. In some cases the PFE values increase with increased frequency, and in others they decrease with frequency. The PFE values often show a variation with direction of measurement.

These results indicate that non-mineralized rocks display ρ_r values of 2,000-31,000 Ωm. Some sections of the gold-bearing quartz vein display low ρ_r values (30-100 Ωm), but without evidence of continuity. Sericite schist with sulphide mineralization displays intermediate ρ_r values (400-1000 Ωm) and with better continuity along foliation and the adjacent gold-rich quartz veins, implying that it might form a good exploration target. However, inappropriate survey line orientation could cause EM surveys to miss the gold rich zones, due to relatively strong anisotropy (<10:1) characteristics of the sericite schist. It is necessary to understand the significance of the effect of frequency and anisotropy on the IP responses, in order to reduce the possibility of missing the sulphide mineralization.

EXPLORING FOR NEW NICKEL - COPPER - PGE DEPOSITS IN CANADA : THE GOOD, THE BAD AND THE UGLY

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The world-class Voisey's Bay discovery of 1994 vividly illustrated the potential for new Ni-Cu-PGE districts in poorly-explored regions of northern Canada, but the initial buoyant optimism faded when the post-discovery exploration rush failed to unearth other economic deposits, despite the recognition of apparently favourable geological environments. In retrospect, given the special challenges that magmatic sulphide deposits present to explorationists, we were naïve to expect that a second example would be found as easily as the first. These deposits are products of high-temperature, magmatic processes that can result in compact high-density sulphide accumulations, but cause essentially no hydrothermal alteration in the surrounding host rocks. Magmatic sulphide deposits are thus small and elusive targets, particularly when their lack of associated alteration zones is taken into account. For example, the Ovoid deposit at Voisey's Bay alone contains as much copper as some porphyry-style deposits, but it is about two orders of magnitude smaller. If exploration is like looking for a needle in a haystack, looking for these deposits is more like trying to thread the eye of the needle.

Geochemical exploration is certainly useful in defining regional target areas, but cannot always distinguish between anomalies caused by silicates and those related to sulphides; regional anomalies linked to mineralization may be very subtle features. Magmatic sulphide deposits are typically associated with strong magnetic and electromagnetic signatures, and this is the standard exploration methodology following definition of a suitable regional environment. The EM prospecting approach is very effective in shallow environments, but the common association of blind deposits with magnetic mafic host rocks and with dispersed, low-grade disseminated mineralization can present significant problems in deep exploration. The contrasts between the geophysical expressions of the near-surface Ovoid deposit and the blind Eastern Deeps deposit illustrate these problems well. Gravity surveys are probably useful only in simple near-surface situations or in environments where the geology is well-known in three dimensions. Seismic imaging methods are certainly able to detect known magmatic sulphide deposits, but are expensive and difficult to apply in remote exploration situations. Overall, exploration strategies for for magmatic Ni-Cu and PGE deposits benefit from a clear understanding of the key geological factors that control their development and localization, and at least some of these principles can be directly applied in exploration.

The first prerequisite for a magmatic sulphide deposit is crustward transportation of metals that normally reside in the mantle, via a mafic or ultramafic magma. Suitable parental magmas for Ni-Cu deposits are fairly readily generated, but small amounts of residual sulphides remaining in the mantle source region can significantly downgrade the PGE potential of magmas. The source magmas must then ascend to suitable upper- to mid-crustal levels before they undergo too much fractional crystallization, which acts to remove Ni and some of the PGE; crustal-scale tectonic boundaries may assist in this respect, but are probably not essential. In the case of Ni, the degree of fractionation of the source magmas directly controls the potential metal contents of associated sulphides, and it may also control the geochemical balance between various members of the PGE. Separation of even trivial amounts of sulphide liquid during ascent will strip much of the PGE from the magma, but has a lesser effect on the Ni-Cu budget. In normal magmatic systems, the separation of immiscible sulphide liquids is a late-stage event, and occurs after most of the Ni has already been taken out by silicates. Unusual circumstances are thus required to permit coexistence of Ni-rich magmas and sulphide liquids, and the direct addition of sulphur and/or sudden reductions in sulphide solubility induced by contamination appear to be important in many deposits worldwide. This factor is probably less important in the case of PGE-only deposits, as Pt-Pd (+/- Au) can behave incompatibly in the fractionating magma. The extraction of metals from a magma by sulphide liquids is a complex and poorly-understood business, and the results depend heavily upon the physical environment and the relative proportions of silicate and sulphide magmas. For example, systems with excessive relative amounts of sulphur will produce dilute, pyrrhotite-rich Ni deposits with limited economic potential. In examples associated with mafic rocks, such as Voisey's Bay and Nor'ilsk, multistage extraction from several successive magma batches (akin to zone refining) is apparently required to explain the observed metal contents, and this may also be a factor in some ultramafic-hosted deposits. Ironically, the very process that can upgrade a sulphide liquid to economic levels could also destroy it completely, and redissolve all the metals, if it proceeds too far. From an exploration perspective, the extraction of metals by sulphide liquids marks silicate magmas with distinctive geochemical signatures, which may be useful tools on both regional and local scales. For a deposit to be mineable, physical concentration of magmatic sulphides in a suitable "trap" must take place, and this is perhaps the most poorly understood of all controls. Simple gravitational accumulations at the bases of magma chambers, though possible, may actually be less common than situations where concentration of sulphides is linked to flow-regime variations in conduits of both plutonic and volcanic types. Following concentration and accumulation, sulphide liquids must themselves crystallize, and they behave in much the same manner as a fractionating magma. The late-stage, residual sulphide liquids are relatively enriched in Cu, Pt and Pd and can become trapped as small but high-grade pockets, or escape to migrate beyond the boundaries of the main deposit. In cases where open-system behaviour has prevailed, the footwall region appears to be the favoured location for these attractive PGE-enriched residual zones.

To summarize, the chain of circumstance that leads from the upper mantle to a mineable magmatic Ni-Cu or PGE deposit in the upper crust is a long one, and the vital links within it must be assembled in the correct sequence and remain unbroken. The evidence for and against the existence of each of these links must be carefully evaluated in the consideration of new target areas for mineralization of this type

DRIFT PROSPECTING INVESTIGATIONS IN THE YELLOWKNIFE GREENSTONE BELT, NORTHWEST TERRITORIES.

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In response to declining ore reserves at producing gold mines and reduced exploration by the mining industry in the Yellowknife area, the Yellowknife EXTECH program was initiated to support multi-disciplinary, integrated geoscientific studies for mineral exploration. Terrain Sciences Division (GSC) undertook surficial geology studies in 2000 to increase the till geochemistry and biogeochemical databases over the Yellowknife Greenstone Belt (NTS 85J/ 8, 9, 16; 85O/1 and 85P/4). Contracts were also issued for additional kimberlite indicator mineral and gold grain sampling in the Drybones Bay area, NTS 85I/4, (Fig.1) by D. Smith, whereas biogeochemical samples were collected in the Yellowknife area by D. Nickerson.

Samples collected for geochemical analyses include: sixty-seven 10 kg soil samples to document the range and background concentrations of gold grains over the Yellowknife Greenstone Belt, 10 spruce bark, 4 leaf litter fall and 4 humus samples samples as part of the regional biogeochemical study, pebble samples from 65 sites for provenance and glacial transport investigation, as well as detailed soil profile studies at 3 sites to document post-depositional mobilization of selected elements. Glacial striae were measured at 44 regional locations. An additional 25 till samples of 20 kg have been submitted for kimberlite indicator mineral and gold grain analyses as part of a detailed dispersal train study in the Drybones Bay area, southeast of Yellowknife. Biogeochemical orientation surveys were conducted in the vicinity of Yellowknife to document 3 case studies in which Labrador tea and spruce bark are assessed as exploration tools. A total of fifty-six 400 g samples of Labrador tea stems and thirty-three 200 g samples of spruce bark have been submitted for geochemical analyses. In order to estimate pre-mining baseline concentrations of elements, 18 black spruce tree ring samples from 2 locations near the Giant Mine roaster were taken; the tree ring increments represent 10 year intervals from 1900 and 1920 to the present. Lastly, 2 bulk samples (1 kg) of Labrador tea and spruce bark were collected in order to compare sample preparation and analytical methods: washed vs unwashed, and maceration vs ashing.

A basic understanding of ice flow history is necessary in any drift prospecting investigation. The detailed mapping of ice flow indicators throughout the study area is generally consistent with the dominant regional southwestward flow across the area, and did not reveal any significant new directions of ice movement. Minor striae variations of less than 10 degrees are common at most sites.

As an aid to mineral exploration, the lithology of pebbles in till was examined to illustrate patterns of glacial dispersal and to estimate transport distances. Granitoid rocks were chosen as an indicator lithology because they have a clearly defined source area, and because the granitoid clasts can be distinguished easily from metasedimentary and metavolcanics rocks. However, the complex bedrock structures, and visual similarities of metasedimentary and metavolcanic clasts in the 1-3 cm size range, remain an obstacle for provenance studies. Although the highest concentrations of granitoid clasts in till (86 to 45 %) occur in 4 regions underlain by granitoid plutons (the Nicholas Lake area, between Prelude and Duncan lakes, and terrain east and south of Yellowknife Bay in the Defeat Lake area), metasedimentary clasts predominate over all rock types, with few exceptions. The lowest concentrations of granitoid clasts in till (0 to <20 %) are found overlying volcanic and metasedimentary bedrock. The dilution of granitoid clasts in till, even in areas underlain by granitoid bedrock, is indicative of the ease at which other rock types were glacially eroded, fragmented and transported. Glacial transport distances of clasts are in the order of 25-35 km or more.

The preliminary analysis of heavy mineral concentrates (<2 mm fraction) of 11 regional bulk till samples in areas underlain by granite and metasediments suggests that the background value for visible gold grains in till is approximately 0-1 per 10 kg of till. An anomalous concentration of gold grains (n=19) was discovered in a till sample in granitic terrain southeast of Drybones Bay. The source of the gold remains unknown, but may relate to gold-bearing quartz veins in granite, similar to the Nicholas Lake property; the anomaly is currently being investigated.

LITHOGEOCHEMICAL INDICATORS OF GOLD POTENTIAL IN THE YELLOWKNIFE EXTECH AREA: GUIDES TO ORE AND ENHANCED GENETIC MODELS

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As a component of the regional metallogeny project of the Yellowknife EXTECH, lithogeochemical analyses have been obtained for 132 samples of barren and mineralized rocks collected in 1999 from nine different zones on six properties (Con: Con Shear and Campbell Shear; Giant: Brock, LAW and Supercrest zones; Crestaurum; Duckfish; Homer Lake and Nicholas Lake). The new data have been integrated with data on 220 samples obtained by Falck during a previous study. A variety of plots and data manipulations have been generated for several sample populations to help document the character, distribution and timing of the different styles of gold mineralization throughout the EXTECH area.

Although gold itself is commonly the most reliable indicator of gold potential in Archean greenstone belts, our work to date indicates that As, Bi, Te, Pb, Ag, Sb, Se, Hg and S may also be useful vectors to ore. Arsenic is moderately to strongly positively correlated with gold in the three composite sample populations [n=352 (new data + Falck data), n=220 (Falck data) and n=132 (new data)], in samples of both the fine-grained and the coarse-grained varieties of arsenopyrite (n=38 and 22, respectively; see Falck and Kerswill, this volume) and in the samples from the Campbell Shear, LAW and Supercrest. There are very strong Au-As correlations in the samples from Con Shear, Crestaurum, Duckfish, Homer Lake and Nicholas Lake. Arsenic is strongly correlated with bismuth and tellurium in most populations. Sb is the best discriminator with respect to the two different arsenic-rich sample populations. Many of the fine-grained samples contain greater than 1000 ppm Sb (Con, Giant and Crestaurum; all the coarse-grained samples contain less than 200 ppm Sb (Homer Lake and Nicholas Lake). Gold contents are similar for both varieties of arsenic-rich mineralization even though there is commonly more arsenic in the coarse-grained variety.

Pb is moderately to strongly positively correlated with gold in the three composite populations, in the fine-grained, but not the coarse-grained, arsenic-rich variety and in the samples from Con Shear, Campbell Shear, LAW, Supercrest, Crestaurum, Duckfish and Nicholas Lake. Although Pb is strongly correlated with Zn in most populations, correlations between Zn and Au are commonly poor to inverse.

There is a strong correlation between Au and Ag in most populations as well as significant variation in Ag/Au ratios from less than 0.10 to greater than 10.0. The greatest Ag contents and highest Ag/Au ratios occur in Pb- and Zn-rich samples from either coarse-grained arsenopyrite-rich mineralization as at Homer Lake and Nicholas Lake or arsenic-poor turbidite-hosted veins as at Tom, Ptarmigan and Cassidy Point. The high Ag contents, high Ag/Au ratios and presence of significant base metals in these locales are atypical of Archean gold deposits. Such features are more characteristic of Phanerozoic massive sulphide, epithermal and porphyry ores.

Multielement metal associations within the Con-Giant system (see Siddorn and Cruden, this volume) are complex, difficult to interpret, and probably reflect superposition of several distinct mineralizing events in this world-class deposit. Samples from smaller prospects can display simpler metal associations. For example, samples from the VMS-like mineralization at Homer Lake show just two strong associations: Au-Te-Se-As-Bi-S-Sb-Ag and Hg-Pb-Zn-Ag-Sb. Samples from the granitoid-hosted Nicholas Lake deposit show similar associations: Se-As-Bi-Au-Te-S-Ag-Sb and Zn-Hg-Pb-Ag-Sb-S-Bi. These associations may reflect control of metal concentration by magmatic processes. At Homer Lake field relationships suggest that an arsenic event represented by the first association overprints a base-metal event represented by the second association. At Nicholas Lake the relative timing of different mineralizing events has yet to be resolved.

Lithogeochemical indicators of alteration are commonly useful guides to ore. Quartz sericite schists are spatially and genetically associated with many gold-rich zones in the EXTECH area. These schists are characterized by high K_2O/Na_2O ratios accompanied by significant Al_2O_3. Carbonate-rich samples are widespread, typically have high LOI, CaO, Fe_2O_3t, MgO and MnO contents but are relatively low in SiO_2. Chlorite-rich samples, also widespread, commonly possess high MgO and Al_2O_3 contents. For the samples collected to date, there is a much stronger correlation between gold and/or sulphur and the sericite signature, than between these elements and either the carbonate or chlorite signatures. This appears to be true not only at Con and Giant but also at the regional scale.

PROGRESS REPORT ON THE CREATION OF THE 3D GIS MODEL FOR THE CON AND GIANT MINES

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Kirkham Geosystems is currently tasked with creating a 3D GIS model for the Yellowknife camp. Creating a 3D GIS model of the known, or at least the better understood, structures around and between the two active mine sites in the Yellowknife camp, could form an ideal basis for furthering the understanding of the genesis of the area. This in turn could result in improved targets for further exploration drilling and possibly increase in the potential of further gold mining in the Yellowknife area.

In a typical 3D GIS system, 3D data is stored as 3D lines (traverses), 3D points, or 3D shapes (volumes). This allows data to be displayed and plotted on any view or orientation, typically sections or plans. In addition, the data can be viewed using a 3D visualizer.

A 3D GIS model could incorporate some or all of the following:

· Surface Features,
· Surface geology,
· Structural geology,
· Current mining areas, and
· Exploration drilling.

The first phase of the project would model of major faults and shears. Overlay surface geology map, topography, and townsite. Create a model of mined out areas (stopes only). Include all hole data as traces only. The short term goal over the first 18 months will be to focus on the creation of a 3D model of the fault structures and shear zones in addition to the historic mine development.

UNDERSTANDING THE DIAMONDIFEROUS LAC DE GRAS KIMBERLITE FIELD

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The recently discovered Lac de Gras (LDG) kimberlite field, within the Lac de Gras and Aylmer Lakes area, NWT, contains >75% of all known kimberlites in the Slave province and >95% of all kimberlites within the central Slave province. The LDG field is host to the currently producing Ekati Diamond Mine and also the Diavik mine, slated to start production in 2003. This new Geological Survey of Canada project, in co-operation with DIAND in Yellowknife, has multiple areas of focus.

One of the first goals of the project is to collect, collate and publish the vast amount of geological data available for the study area. At the Geoscience Forum, a new, seamless bedrock geology map will be presented, which has been compiled from eight previous mapping projects, covering the entire LDG kimberlite field (76C, 76D, parts of 76E and 76F).

Secondly, preliminary data will be presented on the distribution of Cretaceous and Paleogene sedimentary rocks in the map area. This information is required to fully understand the fundamental problem of near surface kimberlite volcanism, and the formation of volcaniclastic and diatreme facies kimberlite. The multidisciplinary data and synthesis will provide: i) an interpretation of the paleogeographic setting, ideally for periods representing pre- (?), syn- and post-kimberlite pipe emplacement; ii) evaluation of extent of deposition of sedimentary cover, iii) assessment of the amount of strata (i.e., Cretaceous to Eocene) removed by erosion, and thus the extent of removal of near surface kimberlite pipe facies; iv) regional variations in levels of thermal maturity/thermal alteration and degree of burial of Cretacous to Eocene strata and, v) thermal variations in kimberlite facies between and within pipes.

The third major area of focus is the utilization of GIS to develop data visualization and analysis methods to assist in understanding the structural, geophysical, geochemical and topographic characteristics of the Lac de Gras kimberlite field. Evaluation of industry-standard exploration criteria (structural controls, topographic controls, etc.), as well as newer criteria developed from work done by this project (till geochemistry, Landsat TM7, etc.) will be used to generate a model of kimberlite distribution in the Lac de Gras area. Exploration criteria developed here can then be extrapolated to other regions of Canada, thus part of the focus of this aspect of the project is not only the development of this exploration expertise, but also it's transfer to the private industry (technology transfer). The development of an internally consistent, complete Digital Atlas for the LDG area will allow the novice GIS-user to view the kimberlite model and LDG data, and will allow the more advanced GIS user a means of checking/applying our results, and developing their own exploration criteria.

TEMPORAL - SPATIAL EVOLUTION OF TERTIARY DEFORMATION, BEAUFORT SEA - MACKENZIE DELTA REGION

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The Beaufort-Mackenzie Region includes the Beaufort Foldbelt, an offshore foreland element of the Cordilleran orogen, comprising a thin-skinned fold and thrust belt involving syntectonically deposited Tertiary sediments of the Beaufort Sea continental margin (Lane and Dietrich, 1995; Lane, 1998). This important frontier petroleum province contains recoverable reserves of 1.5-2 billion barrels of oil and 12 trillion cubic feet of natural gas in 53 significant discoveries (Dixon et al. 1994). A new 216 km crustal-scale depth-converted cross-section through the central Beaufort Sea incorporates industry seismic and well data, and GSC crustal structure data (Dietrich et al. 1989; Lane and Dietrich, 1991; Stephenson et al. 1994).

The cross-section is divisible into three segments whose boundaries are based on observed variations in age, amplitude and style of structures. Bed length calculations were made for four levels in the Tertiary part of the section: Late Miocene, Late Oligocene and Middle Eocene unconformities, and within the Paleocene Aklak sequence. The calculations are based on regionally resolvable structures and measure only thrust duplication and folding. Additional shortening on small-scale structures and by layer-parallel shortening imply that the shortening estimates are conservative.

Total measured shortening is 14.5% (37 km). Pre-Middle Eocene shortening of 30 km is confined to the two inner segments of the profile, and is dominated by thrust duplication. Late Eocene to Oligocene shortening of 6 km is accommodated by folding, and is concentrated in the central segment. Low amplitude Miocene folding totalling 1 km is concentrated in the outer segment.

This analysis documents that deformation was strongly concentrated in the pre-Middle Eocene part of the Tertiary, and that the locus of deformation progressed toward the foreland through time.

GEOLOGY OF THE FORT LIARD REGION, YUKON AND NORTHWEST TERRITORIES: INITIAL RESULTS OF NEW MAPPING BY THE CENTRAL FORELAND NATMAP PROJECT

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Regional mapping in Fort Liard and La Biche River (NTS 95B, 95C) was resumed during 2000 at a scale of 1:50,000 in the Mount Martin (95C/1), Fisherman Lake (95B/5), and Mount Flett (95B/12) map areas. This continues work begun in 1997 with new mapping in Babiche Mountain (95C/8) and Chinkeh Creek (95C/9). In Mount Martin and Babiche Mountain, a primary focus was the recognition and documentation of four stratigraphic units: the Permian Tika map unit, the Triassic Toad-Grayling Formation, and the Lower Cretaceous Chinkeh and Sikanni Formations. Facies changes and sub-Cretaceous erosion are major controls on the distribution of these units within the project area. Although the regional distribution of map units on existing reconnaissance maps is broadly appropriate, our new mapping already has resulted in substantial revisions and updates.

The distribution of major structures is also being significantly revised as a result of our more detailed investigations. The sinuous appearance in map trace of large structures is largely due to, en echelon linkages of smaller culminations. Thrust faults appear to be less widespread at the surface than was previously indicated. Where mapped, they appear to sole into a décollement horizon in the

Devonian-Carboniferous Besa River Formation.

Newly released aeromagnetic anomaly data for the Fort Liard - La Biche region are dominated by large elliptical anomalies commonly greater than 20 km in diameter. These probably reflect "basement" features at depth. A prominent northeast trending anomaly coincides with the Liard Transfer Fault, an inferred basement feature that has been interpreted to control to the dramatic eastward deflection of the Cordilleran deformation front. Only in the western part of the project area do the anomalies reflect surface and near-surface features. Small elliptical magnetic highs correspond to mapped (and unmapped) Cretaceous and/or Tertiary intrusions and plugs. Locally, steep linear gradients approximate large mapped thrust faults.

USING SECTORAL AND REGIONAL ENVIRONMENTAL ASSESSMENTS TO ADDRESS CUMULATIVE ENVIRONMENTAL EFFECTS

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Jacques Whitford Environment Limited

In this paper, we will examine the use of sectorally and/or regionally based environmental assessments (also referred to as strategic environmental assessments or "SEA") as a backdrop for project-specific or proponent based EAs. Strategic environmental assessment requires that environmental issues be addressed further upstream in the planning process, however it is intended to remain complementary to project-specific EAs. Building on the guidance from the World Bank and other national and international examples, we will outline the key features of an SEA framework(s) that incorporates cumulative environmental effects. The authors will set the context for discussion by providing an overview of the elements of sectoral and regional environmental assessments that relate to or support CEA. In particular, the authors will discuss the benefits and applicability of SEA as a tool for addressing cumulative environmental effects. They will also discuss the roles and responsibilities for conducting SEAs (i.e., regulators/administrators vs. project proponents). Practical examples of sectoral (mining, transportation) and regional (land use planning) environmental assessments will be used to substantiate the discussion where possible.

THE SEISMIC PROCESS-IMPACTS AND BENEFITS

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The high demand for Canadian gas in the United States and the recent talk of a pipeline has spurred a renewed interest by the Oil and Gas Industry in the Canadian North. While the industry has been active in a limited amount around the Norman Wells and Ft. Liard areas for years, it is expected that there will be rapid growth in industry activity in all of the Canadian North over the next few years.

One of the first steps for renewed activity by Oil & Gas Exploration Companies is Seismic. Most of the available seismic data available in the Canadian North is twenty plus years old. During that time, the Seismic industry has gone through dramatic changes.

This presentation will describe the theory of seismic and explain what the seismic process is. It will show the types of equipment used by the industry in various modes of operations as well, the human resources required to conduct a seismic program. It will highlight the changes the industry has undergone through the last twenty years, changes that improve the product, reduce risk to the people, the environment, and to the companies involved. It will detail job & investment opportunities for northerners.

NWT CUMULATIVE EFFECTS ASSESSMENT AND MANAGEMENT FRAMEWORK - UPDATE

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In the NWT, the Mackenzie Valley Resource Management Act and the Canadian Environmental Assessment Act require that the cumulative effects of projects be determined during the environmental assessment process. The Mackenzie Valley Resource Management Act also requires the implementation of a cumulative impact monitoring program, which is currently in the early stages of being developed.

In addition to the development of the diamond industry in the Slave Geological Province, several proposals for the development and transportation of natural gas and to investigate the potential for logging in the Deh Cho region have also been received by government. These initiatives indicate that this area of the NWT will also experience multiple developments in the near future.

The need for a clear and well-defined cumulative effects assessment and management framework for regions experiencing development pressures has been recognized and supported during public consultations on northern development. While many elements of such a framework are already in place in the NWT, more work is required to better define that framework, and to identify and address gaps that may exist.

In response to these development pressures, the Department of Indian Affairs and Northern Development (DIAND) sponsored a multi-stakeholder workshop in Yellowknife in December 1999 to develop a common understanding of the components of a framework, and bring forward recommendations regarding the next steps in formalizing a framework for the NWT. Following the workshop, a broad-based Steering Committee with representation from the federal and territorial governments, industry (mining and oil and gas), Aboriginal organizations, and environmental non-government organizations developed a work plan for the development of the NWT Cumulative Effects Assessment and Management Framework (CEAMF) and is now proceeding with the tasks identified in that plan. The CEAMF initiative is co-sponsored by DIAND and Environment Canada.

The CEAM Framework will incorporate consideration of scientific and traditional knowledge, and encompass both ecological and socio-economic effects. In addition, the framework will:

- enable better coordination of data collection among federal, territorial and Aboriginal governments and industries;
- address gaps in regional monitoring;
- assist in the priorization of research questions;
- facilitate research initiatives to understand important cause-effect linkages related to development activities; and,
- identify research priorities to establish thresholds and carrying capacities.

Programs of action for the Deh Cho region and the Slave Geological Province will be developed as part of the broader framework, and include specific activities to address the particular development pressures facing these two regions.

Implementation of the framework and the plans of action will assist regulators and developers in the use of adaptive management techniques.

NEW MULTIDISCIPLINARY GEOLOGICAL INVESTIGATIONS IN THE WALMSLEY LAKE AREA, SOUTHEASTERN SLAVE PROVINCE

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The multi-disciplinary Walmsley Lake project commenced in the summer of 2000, in the southeastern Slave Province, Northwest Territories. This project is being jointly undertaken and funded by the C.S. Lord Northern Geoscience Centre in Yellowknife and the Geological Survey of Canada under the Targeted Geoscience Initiative (TGI). The goals of this project are: 1) provide integrated, digital, bedrock and surficial maps at a scale of 1:125,000 in the Walmsley Lake NTS sheet (75N); 2) provide U/Pb age constraints on regional tectonic events to facilitate Slave-wide correlations; 3) support thematic studies such as the P-T-t history and petrogenesis of volcanic rocks; 4) use U/Pb ages and tracer isotope studies of granitoid rocks to refine crustal evolution models for the southern Slave Province; and 5) link crustal evolution with geophysical characteristics of the mantle to develop an understanding of lithospheric-scale tectonic controls on preservation of diamonds in sub-continental mantle.

Geological mapping has defined relationships between metamorphism, deformation and plutonism, that suggest plutons similar to the Defeat suite in the Yellowknife domain, were emplaced during peak metamorphism and deformation (D2). Younger peraluminous granites (sensu stricto) similar to the Prosperous suite in the Yellowknife domain are, at least in part, post thermal peak metamorphism and deformation (D2). The predominant fabric throughout the area is a second generation foliation (S2), but the map pattern defined by this fabric is controlled by post-D2 deformation; primarily northeast- and northwest-trending, upright F3 folds. Samples of granitoid rocks were collected to provide absolute time constraints on deformation and metamorphism, which will facilitate correlation with events in the central Slave Province.

Diamond-bearing kimberlites have previously been discovered in the Walmsley area and exploration for more is ongoing. Glacial ice-flow studies have outlined three different sets of straie. The early and late ones appear to have been controlled mainly by large-scale topographic features. This study provides a regional framework of ice flow patterns to serve as a guide for till sampling programs by diamond exploration companies. Au and base metal potential in the northeastern corner of the map area is part of an MSc. thesis reported on elsewhere in this volume (Renaud et al.)

Granitoid rocks were sampled over a broad area of the southeastern Slave Province to examine Sm-Nd and Pb-Pb isotope signatures, which will be used to delineate the eastern extent of Mesoarchean crust at depth. Samples of Defeat-like plutons across the same area were sampled for U-Pb dating to test the hypothesis that this suite is systematically older in the southern Slave Province than elsewhere. These studies, linked with magnetotelluric and teleseismic surveys of the same area, will facilitate the development of tectonic models that link crustal and mantle evolution and provide a framework for understanding the tectonic controls on diamond preservation in the sub-continental lithosphere.

STRUCTURAL GEOLOGY OF THE JACKSON LAKE FORMATION, YELLOWKNIFE, NWT

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The Jackson Lake Formation (JLF), Yellowknife Supergroup, is the youngest formation (< 2605 ± 6 Ma, Davis and Bleeker, 1999) in the Yellowknife area. The JLF is mainly composed of polymict conglomerates and cross-bedded sandstones and has been interpreted as an alluvial fan deposit (Henderson, 1985). On the western margin, the north-south striking, east-facing units of the JLF unconformably overlie the mafic volcanic rocks of the Kam Group (2720-2700 Ma). On its eastern margin, the formation appears in faulted contact with the felsic volcanics of the Banting Group (2687-2660 Ma). The JLF extends over an approximate length of 37 km, from the Sub-Islands south of Yellowknife to north of Greyling Lake.

The main purpose of this project is to study the structures in the Jackson Lake Formation to provide a correlation between regional mapping (Bleeker and Davis, 1999) and the detailed structural study at Giant and Con Mines (Siddorn and Cruden, 2000).

Preliminary field observations and geochronology indicate that the JLF was deposited after regional D1 but prior to regional D2. According to Davis and Bleeker (1999), D1 occurred pre-Defeat magmatism (i.e. prior to ca. 2630 Ma) and D2 was syn-Prosperous magmatism (2596 Ma). Within the Jackson Lake Formation, an earlier NNE-trending S2 foliation is crenulated by an ENE-trending S3 foliation. These foliations are interpreted as S2 and S3 since the JLF post-dates D1 regionally. However, often only one foliation is observed. In order to determine if the one foliation is S2 or S3, specific criteria other than the attitude of the fabrics (e.g., microstructures) need to be investigated due to the effect of cleavage refraction within the different lithologies of the JLF and the adjacent volcanic rocks.

At the Kam/Jackson Lake contact, apparent irregularities are thought to represent depression in the Archean paleosurface that were filled by the basal unit of the JLF (e.g. Henderson, 1985). However, detailed mapping suggests that the irregular contact is largely due to folding. These relatively large-scale folds are plunging moderately to the north and display an S-vergence, forming parasitic synclinal structures. An axial planar, ENE-trending penetrative foliation is observed but, at present, it is not known whether this fabric is related to the D2 or D3 deformation event. It is hoped that through further detailed mapping and microstructural analysis this may be resolved.

According to Siddorn and Cruden (2000), gold mineralisation occurred both during regional D1 and D2 in the Giant and Con gold deposits. Refractory gold formed syn-D1, and free-milling ore zones formed syn-D2. Therefore, the age relationship (pre-D2) and the presence of mineralised shear zones and quartz veins in the JLF suggest that free-milling gold mineralisation potentially occurred in the JLF as well. Furthermore, gold deposited during D1 may occur as paleo-placer gold within the JLF.

The JLF is similar to the Timiskaming-type sediments that are related to major crustal breaks in the Abitibi greenstone belt. It is believed that the genesis of many gold deposits in the Abitibi is related to these breaks. Bleeker and Ketchum (1998; see also Davis and Bleeker, 1999) suggest that a major crustal break (Yellowknife River Fault Zone) occurs on the eastern margin of the Jackson Lake Formation. Bailey (1987) suggests a post-diabase fault on the western margin of the Jackson Lake Formation may be a reactivated Archean shear zone. Both deformation zones may be related to the gold-bearing Giant-Campbell shear zone system, and may represent the first order crustal break in the Yellowknife area.

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MERCURY CYCLING IN GLACIAL SEDIMENTS UNDERLAIN BY PERMAFROST, KAMINAK LAKE AREA, NUNAVUT

McMartin, I., Hall, G.E.M., Kerswill, J.A., Sangster, A.L., Douma, S., & Vaive, J.E.
Geological Survey of Canada

In the Kaminak Lake area, Hg is predominantly associated with local Zn-bearing massive sulphide accumulations and polymetallic veins that are distributed throughout the Kaminak greenstone belt. Additional local sources (gaseous Hg^o) may exist along faults and unconformities in exposed outcrops or directly under Kaminak Lake. Glacial sediments (e.g. till) partly derived from mineralization zones and from local bedrock lithologies form a discontinuous mantle overlying the bedrock surface. Repeated exposure of till to oxidation above the permafrost table and recycling of surface organic matter by cryoturbation have resulted in the continuous release of Hg from the sulphide-rich debris and its subsequent accumulation in the finest organic-rich clay fraction of till. The transportation of Hg bound to humic matter on land (in mineral and organic soils) through surface runoff, and possibly the long residence time of organic matter in soils of cold climates, may play important roles in the creation of bio-available Hg species (methylation) and ultimately concentration in fish. Kaminak Lake trout are known to contain high Hg levels, above the national consumption guideline of 0.5 ppm. However, Kaminak Lake is not the only lake where fish contain high Hg concentrations in the Kivalliq Region. Nearby Maguse Lake has fish with up to 1.8 ppm of Hg; Ferguson Lake has fish with Hg values averaging greater than 1 ppm. All these lakes are underlain by mineralized rocks. In contrast, Kaminuriak Lake, surrounded by Archean gneiss and granite, has an average Hg content below 0.5 ppm in fish. Other than geology, sources of variation among lakes also include the amount of loading of fine grained organic matter which is dependent upon physiography and composition of the catchment. No clear evidence of loading by atmospheric Hg was observed. This research was undertaken as part of the Metals In The Environment (MITE) Program initiated by the Geological Survey of Canada.

OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NORTHWEST TERRITORIES ---- 2000 UPDATE

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High prices for oil and gas and a widely perceived need for new supply regions to feed the increasing appetite across North America for natural gas is driving industry investment in Canada's North. This year, the response to the Federal Government's Calls for Nominations and Bids has been record-breaking.

Calls for Bids on land blocks nominated by industry were held in two regions of the Northwest Territories. Six new exploration licences were issued in the Sahtu region in response to the 2000 Central Mackenzie Valley Call for Bids on Crown lands in Sahtu and Gwich'in for a total of $57.5 million in work commitments. Oil and gas exploration returned to the Mackenzie Delta in 1999 when çompanies acquired four parcels for a total of $183 million in work commitments. The momentum to explore this basin reached yet a higher level this summer when nine exploration licences were awarded for bids totalling $466 million following the 2000 Beaufort Sea - Mackenzie Delta Call for Bids. Much of this investment is predicated on the likelihood of developing and exporting new gas to southern markets within the nine-year life span of the exploration licences.

Exploration activity in winter 2000-2001 is planned in the South Territories near Fort Liard, in the Central Mackenzie Valley and in the Mackenzie Delta regions of the Northwest Territories. Activity levels in the central and southern Northwest Territories may be comparable with last year in both areas. Absent new exploration licences in the southern Territories, exploration activity will be focussed on licences which have already seen recent drilling. Exploration in the central valley is still looking for a success to spur interest. The large area and diverse potential in the Sahtu and Gwich'in have required explorers to expand their focus and explore possibilities beyond the immediate vicinity of Norman Wells. A new focus on gas as well as oil has seen licences taken up adjacent to existing significant discoveries in Colville Hills. A dramatic increase in exploration activity is planned in the Mackenzie Delta where several operators are contemplating extensive seismic programs and drilling operations are planned to commence this winter.

The last two years have seen exciting progress in consolidating the Northwest Territories as a gas as well as an oil producing region. Three new gas fields were brought on-stream in the southern Northwest Territories in April-May 2000: new pipeline segments now connect these to the continental gas market. The Ikhil Gas field in the Mackenzie Delta has also been producing since July 1999, shipping gas through a 50 km pipeline to the town of Inuvik.

TROUT AND SLAVE PLAINS: A PETROLEUM FRONTIER IN THE NORTHWEST TERRITORIES

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Recent gas discoveries in the Liard Basin west of Fort Liard have has led to a return of industry interest in the oil and gas potential of the Trout and Slave Plains east of Fort Liard. However, there are no published reports focussed directly upon the oil and gas potential of this area, as distinct from inventories of existing hydrocarbon resources. The pre-1980's age of publicly-available seismic hampers detailed stratigraphic and structural seismic interpretation, but the existence of a large regional seismic database, particularly in the Trout Plain, aids regional geological interpretation and oil and gas assessment. Improvements in the regional coverage and in the level of detail of geophysical potential field data (aeromagnetic and gravity) and the acquisition of more data on petroleum source rock potential and level of organic maturity have also aided in interpretation of the geology and hydrocarbon potential across this region.

Examination of the available seismic west of longitude 118E in conjunction with data from wells to provide a consistent subsurface interpretation of the Phanerozoic and have focussed on Devonian strata, which contain numerous gas accumulations. As part of a regional structural and stratigraphic analysis of this region, a number of different play concepts have been developed particularly with regard to the Keg River-Slave Point-Nahanni interval and, to a lesser extent, the Jean Marie Formation. The active cooperation of several companies has made it possible to reprocess a number of lines to deeper horizons. This permitted interpretation of structures affecting the Precambrian and that may have influenced the development of structures, thickness and facies changes in overlying strata. Many large northeast directed basement faults (e.g. Rabbit Lake Fault), across both Slave and Trout plains have influenced the development of gas pools.

A typical platform shelf-edge reef gas pool (Netla C-07) discovered by Shell Canada along the subsurface Slave Point edge well penetrated the Slave Point slightly eastward of the shelf. Seismic indicates several other possible Slave Point shelf edges inboard of this gas pool. Similar, multiple Slave Point shelf edges may be seen on seismic around the Arrowhead Salient of the Devonian Presqu'ile Barrier. Many of these shelf edge buildups along the Slave Point edge and shelf interior buildups are located above basement normal faults that have a Late Devonian to Carboniferous time of movement. These structures may have played a role in the localization of Slave Point buildups. Gas-filled porosity in the Slave Point appears to be secondary, rather than primary in silicified and fractured limestones (e.g. Netla C-07) or in dolomitized Slave Point limestone along the west side of the Cordova Embayment (e.g. Island River M-41). Upward directed fluid movements through basement faults may have enhanced fracturing, silicification and dolomitization in overlying Devonian carbonates. The Bovie Fault played a role in determining the shape of the Arrowhead Salient and played a role in the development of structural-stratigraphic plays. Cretaceous features, such as Celibeta High, are sites for late gas entrapment.

METALLLOGENY OF THE SOUTHERN GREAT BEAR MAGMATIC ZONE

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Exploration directed at the search for hydrothermal iron oxide copper-gold and related deposits has stimulated renewed interest in the Great Bear magmatic zone, the central tectonic subdivision of the Proterozoic Bear Province. Most of the activity has been within the southern portion where there is good access and infrastructure. The Great Bear magmatic zone is a continental volcano-plutonic arc emplaced between 1890 and 1850 Ma during regional extension following the 1900 Ma Wopmay Orogen. The geology of the southern part is dominated by a northwest-trending belt of basement sedimentary rocks of the Snare Group that are unconformably overlain by felsic volcanic rocks of the Faber Group. Margins of the belt are intruded to the east by the Marian River monzogranite-granodiorite batholith, to the north by the Faber Lake rapakivi granite pluton, and an unnamed granitic pluton along the west boundary. Iron oxides with or without polymetallic sulphides, uranium, and gold occur within Faber Group felsic tuffs and flows, subvolcanic porphyries and hornfelsed wackes, siltstones and carbonates marginal to the granitic intrusions. The styles of mineralization are variable and include:

1. The stratabound NICO Co-Au-Bi deposit with minor Cu and W hosted in biotite-amphibole-magnetite-K-feldspar altered subarkosic wacke, capped by potassium- and iron oxide-altered felsite and intruded by feldspar porphyry marginal to the Marian River Batholith. Mineralization is temporally and spatially associated with barren to weakly mineralized diatreme breccias related to the onset of volcanism. Principal ore minerals are cobaltian arsenopyrite, cobaltite, native gold, bismuth, bismuthinite and chalcopyrite.

2. The Sue-Dianne Cu-Ag deposit with sporadic Au and U hosted in a felsic volcano-plutonic associated diatreme vent breccia at the intersection of two regional faults. Hematite, magnetite, K-feldspar, epidote, chlorite, fluorite and garnet altered and brecciated rhyodacite ignimbrite host disseminated chalcopyrite, bornite, chalcocite and minor covellite. The deposit originated from the apex of a subvolcanic feldspar porphyritic stock near the paleo-surface.

3. The past-producing Rayrock U mine and Crowfoot U occurrence occur in hematite and chalcopyrite enriched giant quartz veins emplaced within the Wopmay Fault Zone. The fault is a major crustal suture, which separates the GBMZ from older granitoid intrusions of the Hepburn Suite.

4. Calc-silicate skarn and skarn breccias variably enriched in Zn, Cu, Pb, Co, Ni and REE in laminated calcareous siltstones with garnet-pyroxene-K-feldspar +/- biotite and amphibole alteration.

5. Massive vein and/or breccia-style iron oxide deposits comprised of magnetite and/or hematite +/- minor copper sulphides. They are best developed in Snare Group sedimentary rocks as replacement veins or breccia fill associated with K-feldspar, epidote +/- biotite and amphibole alteration marginal to Marian River Batholith border phases.

6. Giant quartz veins and stockworks with variable but minor iron oxide, Cu, Zn and Pb sulphides and U mineralization. The veins can occur in metasedimentary rocks but are most prominent in the felsic volcanics where they are exposed for up to 4 km in length and 100 m in width. They have many structural and mineralogical features consistent with near-surface, low-temperature deposition.

The known deposits and showings in the SGBMZ are all located near the volcanic-sedimentary-plutonic unconformity, and are synchronous with Faber Lake/Marian River volcano-plutonic activity. Mineralization is ubiquitously associated with widespread iron oxide and potassium metasomatism. Our investigations suggest a common genetic link for the various styles of mineralization in the SGBMZ. Fractionation of felsic magmas and exsolution of volatiles together with plutonic heat driven secondary convection, and mixing with meteoric waters deposited metals into a variety of host rocks and structures within the region.

SPECTROMETRIC GAMMA-RAY LOGGING APPLICATION TO GOLD EXPLORATION IN THE YELLOWKNIFE AREA, NORTHWEST TERRITORIES

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2 Thompson Consulting
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Natural gamma-ray spectrometric measurements were made in four drill holes at the Giant mine in the Northwest Territories as part of the EXTECH III sub-project to document the borehole geophysical characteristics of gold deposits in the Yellowknife area. Chemical and petrographic data obtained from 22 core samples from two holes, selected using geophysical logs, provided a means of calibrating the geophysical responses against the altered and unaltered lithologies and the corresponding greenschist grade metamorphic mineral assemblages intersected by the drill holes. The lithologies encountered include unfoliated meta-lamprophyre dykes, massive to moderately-foliated greenstone (metabasalt and metagabbro) and intensely foliated carbonate-chlorite-white mica phyllite and talc-chlorite-carbonate phyllite. The foliated, carbonate rich-rocks are interpreted to be altered equivalents of greenstone and meta-ultramafic rocks that are identified by their distinctive chemistry.

Prominent K-Th anomalies on the gamma-ray spectrometry logs are associated with the biotite-rich meta-lamprophyre dykes. The K contribution to the anomalies is mainly from biotite. Pleochroic halos in biotite indicate the presence of radioactive minerals such as monazite and zircon that account for the high thorium concentrations. Strong correlations among Th, La and P suggest that thorium is mainly hosted by the accessory mineral monazite. High proportions of accessory apatite in these rocks may also contribute to the thorium anomalies.

Lesser but still significant gamma-ray anomalies, characterized by a high contribution from K relative to Th, are associated with the muscovite-bearing phyllites. These rocks appear to be products of hydrothermal alteration of basalt/gabbro and can be linked directly to gold mineralization in high strain zones.

Gamma-ray spectrometry can assist gold exploration through the rapid and accurate identification of unusual lithologies and muscovite-bearing alteration zones on the basis of radioelement distribution that might be missed in the standard visual logging process.

CUMULATIVE EFFECTS MANAGEMENT FRAMEWORK PROJECT NORTHERN ECOSYSTEM INITIATIVE:ENVIRONMENT CANADA

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Environment Canada is coordinating the development of a Cumulative Effects Management Framework Model for application in areas of the Canadian North experiencing development pressure. The framework will provide an approach to the management of cumulative effects at a regional level in support of site or project specific planning, assessment and management efforts by communities, industry, regulators and governments. Framework development and implementation is founded on the principle of "best practice". It builds on current experience in regional resource management, what has worked well, what has not worked well, to develop the best options for moving forward in areas of the North experiencing development pressure.

Key challenges in the development of the framework and ultimate implementation will include the identification of mechanisms for determining:

1. Environmental thresholds and carrying capacities
2. Acceptable levels of environmental change
3. How best to facilitate coordinated and collaborative work among diverse stakeholders, disciplines and issues in the North.

The application of adaptive management measures on a regional scale (versus project specific scale) will be a key element of the framework. The framework is viewed as a consensus, non-confrontational approach delivered through existing regulatory instruments as well as other non-regulatory, collaborative efforts by interested stakeholders.

ARSENIC CONTAMINATION RESULTING FROM 60 YEARS OF GOLD MINING OPERATIONS IN YELLOWKNIFE, NWT

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Since 1938 two gold mines have been in operation in Yellowknife, NWT, Canada. Gold ore in the Yellowknife area is associated with arsenopyrite, which during milling and refining releases a considerable amount of arsenic waste. This was the second phase of a multi-year study to determine the nature, extent, and bioavailability of arsenic contamination in the Yellowknife area. Soil, tailings, sediment cores, porewater, and surface water samples were collected from the Con Mine property, Giant Mine property, the surrounding area (including several lakes), and the City of Yellowknife. Soil and sediments were analyzed by neutron activation analysis (NAA) for total arsenic. Total levels of arsenic in surface water and pore waters were determined by hydride generation (HG)-atomic absorption spectrometry (AAS) following a microwave digestion of the samples with nitric acid. HG-gas chromatography (GC)-AAS was used to determine arsenic species in surface and pore waters.

Arsenic concentrations in almost all soil samples exceeded the federally recommended soil quality guideline of 12 ppm. In some cases unconfined tailings material with arsenic concentrations between 1 000 - 12 000 ppm are located near or in residential areas. All sediment values for arsenic (10 - 5 500 ppm), exceed guidelines for freshwater sediments, leading to the potential for severe effects on benthic communities. Through the use of principal components analysis (PCA), the background range of arsenic in Yellowknife soils and sediments was determined to be 4 to 100 ppm.

Of particular concern to Yellowknife residents were arsenic concentrations in several high use recreational lakes that exceed (in some cases 20 fold - 500 ppb) the recommended Canadian Drinking Water Guidelines (25 ppb). The predominate form of arsenic in surface waters is arsenate (As(V)), a relatively toxic form of arsenic. However, the City of Yellowknife draws its water from the uncontaminated Yellowknife River, which has an arsenic concentration of <2 ppb, well within the recommended guidelines.

As a result of this phase of the study, public health officials are attempting to increase public awareness of arsenic related health issues and have posted signs around the contaminated lakes suggesting that residents restrict their use. This information has also been presented to the Yellowknife Arsenic Soil Remediation Committee, in order to aid them in developing a site-specific arsenic remediation strategy for the mine sites.

PRELIMINARY STRUCTURAL, MINERALOGICAL, AND GEOCHEMICAL ANALYSIS OF THE CRESTAURUM GOLD DEPOSIT, YELLOWKNIFE VOLCANIC BELT, NWT

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The Crestaurum gold deposit is located at Daigle Lake, 600 meters east of Ryan Lake, and 20 kilometers north of Yellowknife, NWT. This deposit is hosted by a northeast-striking, east-dipping shear zone (Crestaurum Shear Zone) that transects stratigraphy, including the contact between the Chan and Crestaurum formations. The Chan Formation, is the basal unit of the Kam Group, a dominantly volcanic package in the Archean Yellowknife Supergroup.

The lithologies of the Chan and Crestaurum formations in the area consist of massive to pillowed basalt flows, including variolitic and amygdaloidal flows. A 25m thick package of overturned, west-striking, north-dipping, interlayered siltstone, ash tuff, chert, and minor rhyolite (cherty-tuff) overlies the Chan Formation and defines the base of the Crestaurum Formation. Numerous, dominantly northeast-striking, syn-volcanic and post-volcanic gabbro dykes cut the sequence. Later east-striking diorite dykes are also present. A granodioritic-dioritic pluton cuts the Chan Formation near Ryan Lake. Quartz-feldspar porphyry dykes that strike southeast from the pluton appear to be associated with the granodioritic phase.

Mafic volcanic lithologies near the top of the Chan Formation, as well as the cherty-tuff and mafic volcanic lithologies throughout the Crestaurum Formation, appear to be spilitized to varying degrees. Gabbro dykes are unspilitized, implying seawater alteration occurred shortly after deposition of the Crestaurum Formation. This seawater alteration event may be associated with a pyrite + pyrrhotite ± magnetite-bearing stockwork, part of an exhalative volcanogenic massive sulphide formation discovered in drill core from under the northeast end of Daigle Lake (DDH 95-4). Northeast of Daigle Lake, a thinly bedded, magnetite-chert iron formation (BIF) was discovered underlying a small body of cherty-tuff, further evidence of exhalative activity.

The anastomosing north-east to north-northeast striking foliation that dominates the area, is consistent with the foliation defined as S_2 on a regional scale. North-trending fabrics were locally evident, although their relation to the S_2 foliation requires further analysis. The syn- to late deformational regional metamorphism varies from amphibolite grade at the contact with the granodiorite pluton to greenschist grade east of the Crestaurum Shear Zone (030°/60°E). The Crestaurum Shear Zone and related brittle to ductile fault splays have been hydrothermally altered to greenschist assemblages, that are dominated by chlorite, sericite, quartz, carbonates, and sulphides. The Crestaurum Shear Zone appears to be at the regional metamorphic transition from amphibolite- to greenschist-grade conditions (epidote-amphibolite facies?). Therefore the alteration assemblages are a retrograde-hydrothermal effect, i.e. post-peak regional metamorphism.

Where exposed, the Crestaurum Shear Zone consists of a highly chloritized, strongly sheared/foliated hanging wall with ribboned and boudinaged quartz and carbonate veins. The main body of the shear zone consists of upright folded quartz veins containing massive and disseminated arsenopyrite, pyrite, stibnite, visible gold, and chalcopyrite. C-S fabric relationships are complex with the S surfaces locally crenulated by the C fabric. Preliminary analysis of C-S relationships, rotated porphyroclasts, and mineral lineations suggest the Crestaurum Shear Zone is a reverse shear with a minor sinistral component. Apparent fault splays off of the Crestaurm Shear Zone strike between 345° to 045°. Several splays contain massive sphalerite and galena with disseminated pyrite (± chalcopyrite, and visible gold). Near Ryan Lake, a north-trending splay cuts through the granodiorite; it contains disseminated molybdenite and pyrite (± chalcopyrite) in a quartz-dominated vein with biotite, sericite, and K-feldspar alteration selvage.

THOR LAKE PROJECT UPDATE

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The Thor Lake project is a beryllium property about 100 km southeast of Yellowknife and 8 km north of the Hearne Channel of Great Slave Lake. The deposit is part of the Blachford Lake alkaline complex. Minerals of interest in the deposit are phenacite, the principal beryllium mineral, and bastnasite, containing rare earth elements.

In July 1996, Mountain Minerals Co. Ltd., an industrial minerals company resident in Alberta, acquired the assets of Highwood Resources Ltd. one of which was Thor Lake. Since then the two companies have merged into Highwood Resources. Since 1997, Highwood has pursued permitting for a large bulk sample and demonstration mineral processing facility in the NWT. This would have allowed for optimization of processes prior to construction of commercial facilities. Opposition to the project by area communities, as well as a change in Highwood ownership and management were among the factors that led to Highwood's decision to step back and redesign the project.

Dynatec Corporation replaced Royal Oak Mines as majority owners of Highwood's stock in late 1999. The new leadership brought by Dynatec has a successful history of dealing with community concerns in mining projects and has since provided this guidance to the project. Dynatec has also brought a more balanced vision of all areas of the project. The result is a staged program of developing the key aspects of the project.

The new program will advance the project in three segments: technical, permitting, and marketing. Technical issues that will be assessed are verification of mineral resources and processing technology. Permitting issues that are being addressed include dealing with community concerns and meeting the requirements of regulatory agencies. Marketing issues cover confirmation of market data, development of a formal marketing plan and formation of a development company or joint venture.

These will all be evaluated and addressed in several stages leading to the commercialization of this project. Initially, in the current work, existing information is being reviewed and verified. A second stage will involve performing testwork, and developing and establishing community contacts. A third stage will comprise pilot plant testing, final permitting, and market development. If all the above are successful, commercial development will follow.

The presentation will share some of the progress made to date.

FOR THE NORTH, WITH THE NORTH: ENBRIDGE PERSPECTIVES ON A MACKENZIE VALLEY GAS PIPELINE

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Development of a Northern natural gas pipeline is an opportunity, for Northerners as well as southerners.

There are numerous routes and potential projects currently being discussed to move Northern natural gas to markets in the south. But to date, no specific project has yet been advanced that has the support of the resource owners, the producers.

What are the forces driving the current talk about Northern pipeline development? The basic driver is supply and demand. With the expectation of a 30 TCF North American market within a decade, the demand for natural gas is growing and will continue to grow.

Producers have taken a renewed interest in the North. Imperial, Gulf, Shell and Mobil are studying the feasibility of developing Mackenzie Delta gas - a study that Enbridge has participated in. In January, an historic meeting of Aboriginal leaders of the N.W.T. resulted in a declaration of support for a Mackenzie Valley pipeline. That led to establishment of an Aboriginal Pipeline Working Group with a mandate to develop a business outline and business plan.

What exactly would a Mackenzie Valley pipeline involve? It would be buried, and the gas chilled to protect the permafrost. It could be as big as a line capable of transporting up to 1.7 Bcf/d, and costing over $4 billion. Or it could start smaller and be more modest in scope, at about 800 MMcf/d and cost about $3 billion.

What are the major issues and challenges facing development of a Northern gas pipeline? They are numerous, and they are significant.

· Economics: Current economics appear to support a project, but they could change.
· The approvals process: Numerous agencies and government bodies have areas of jurisdiction, but how they will all fit together remains an unknown.
· Long lead-times: Even an optimistic estimate suggests Mackenzie Delta gas is unlikely to flow for at least seven years.
· Environmental protection.

· Socio-economic concerns.
· Northern benefits. A Northern pipeline can not just bypass the people of the North. It has to provide direct and ongoing economic benefits.

The bulk of long-term benefits will result from the ongoing exploration for and production of oil and gas. That in turn will generate other opportunities for Northerners. There will also be investment opportunities for Northerners, but there is a need to keep expectations realistic.

Enbridge believes it has an advantage in development of a Northern gas pipeline. The company has a customer focus, considerable financial capability and extensive project and pipeline experience elsewhere. Enbridge also built the Norman Wells oil pipeline in 1985 and has operated it ever since. More recently, Enbridge participated in the building of a gas pipeline from the Ikhil gas field to Inuvik, and distribution of gas to Inuvik residents.

Whatever happens, whichever pipeline or pipelines are ultimately built, Enbridge intends to be there, lending its expertise to make development in the North and with the North a true and lasting benefit for the North.

HYDROCARBON POTENTIAL AND EXPLORATION PLAY TRENDS NORTHWEST TERRITORIES AND YUKON-A REVIEW

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For the last few years, there has been renewed interest in the oil and gas potential of the Northwest Territories and Yukon Territory. In light of this interest, the purpose of this study was to provide a summary overview, review and technical inventory of the hydrocarbon potential and exploration trends in these 2 territories. The Northwest Territories and Yukon were divided into 13 exploration regions based largely on physiographic and geological controls and the regions compared with respect to discovered resources and overall ultimate potential.

With respect to discovered oil and gas resources, it is readily apparent that the Mackenzie Delta/Beaufort Sea region is by far the most attractive. The discovered oil resources of 1015 MMbbl in the Mackenzie Delta/Beaufort Sea region are almost 4 times that discovered in the other 12 exploration regions combined (272 MMbbl). Most of the mainland oil resource is found in the Mackenzie Plain region (260 MMbbl reflecting the Norman Wells field). With respect to discovered gas resources, the volumes in the Mackenzie Delta/Beaufort Sea exploration region (9

Tcf) are more than 4 times the combined volume discovered in the other exploration regions (2 Tcf). The second most prolific gas bearing region is Liard Plateau which has a discovered resource approaching 1.3 Tcf.

With respect to undiscovered resource potential, the Mackenzie Delta/Beaufort Sea numbers are far greater than the total assigned to the other 12 exploration regions. Undiscovered resources for the Mackenzie Delta/Beaufort Sea region are estimated at 5.4 Bbbl oil and 53 Tcf gas, as compared to 0.4 Bbbl oil and 16 Tcf gas for the mainland exploration regions. Of the mainland exploration regions, Liard Plateau (4.1 Tcf), Peel Plain (4.4 Tcf), Southern Territories (1.9 Tcf), Colville Hills (1.4 Tcf) and Mackenzie Plain (1.5 Tcf) have significant estimated undiscovered gas potential as indicated by the bracketed numbers.

In summary, the Mackenzie Delta/Beaufort Sea is the most attractive of all the exploration regions with respect to both oil and gas potential. The Liard Plateau region, which straddles the Yukon/Northwest Territories border, is highly prospective for the occurrence of natural gas in large volumes. The Southern Territories, Mackenzie Plain, Colville Hills and, in particular, Peel Plain, are exploration regions also considered to be favourable with respect to exploring for, and discovering, viable economic reserves of natural gas.

A SUMMARY OF POST-ARCHEAN MAGMATIC AND TECTONOTHERMAL EVENTS IN THE WESTERN CHURCHILL PROVINCE: TO THE MANTLE AND BACK

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In 1997, the Western Churchill NATMAP working group* set out to unravel the history of the Western Churchill Province, which is distinguished from other Archean cratons by a protracted history of tectonic and thermal reworking between ca. 2.6 and 1.7 Ga. One of our primary goals was to "lift the veil of Paleoproterozoic tectonothermal overprinting", in order to understand the craton's Archean origin. The field component of the NATMAP project is now complete, and geochronological, petrogenetic and metamorphic studies are approaching their final year. Although our glimpses under the aforementioned "veil" have revealed a complex chronology of enigmatic and contradictory events, some of which we are still unable to reconcile, we have made significant progress in understanding the crustal architecture across the study area, and have generated some testable models.

The Western Churchill NATMAP area comprises three subdomains: Rae, North Hearne and South Hearne, established during the late Archean and sustained during subsequent Paleoproterozoic tectonothermal and magmatic events. Some events, such as ~ 2.55-2.50 Ga crustal imbrication, and ~ 1.9 Ga high-pressure metamorphism, were apparently restricted to North Hearne subdomain. Other events, such as ~ 2.6 Ga plutonism and formation of shallow water intracratonic basins between ~ 2.45-2.11 Ga, effected two or more subdomains. At ~1.83 Ga, the boundary conditions of Paleoproterozoic reworking appear to have shifted from an intracratonic scale, controlling events within and between subdomains, to a much broader scale, transcending subdomain boundaries and involving faults that tapped into the underlying lithosphere. This shift coincided with collision along the Trans Hudson Orogen, supporting a growing body of evidence which suggests the effects of the orogen were more widespread than previously recognised.

A geophysical transect across the three subdomains provides a clearer picture of their relationship in the third dimension. For example, magnetotelluric data reveal a south-dipping conductive anomaly beneath North Hearne subdomain which may coincide with the southern edge of the Rae crust. Furthermore, new isotopic data have helped track interaction between isotopically distinct crustal segments, such as the identification of a fault-bounded fragment of crust with Rae-like affinity within Northern Hearne subdomain.

Considered together, the ideas evolving from our new data are helping piece together the Churchill's history and have implications for metallogenic syntheses. For instance, although data from the South Hearne subdomain suggest depositional/diagenetic processes significantly influenced ore formation (Goff and Kerswill, GSC Paper 99-1C), re-interpretation of volcanic rocks in this area as a product of suprasubduction zone spreading (Hanmer et al, this volume) may open up new possibilities for mineralization models. Furthermore, the influence of protracted reworking must be factored into metallogenic analysis of the North Hearne subdomain.

* Churchill NATMAP working group: Larry Aspler, Rob Berman, Bill Davis, Simon Hanmer, Doug Irwin, John Kerswill, Kate MacLachlan, Isabelle McMartin, Tony Peterson, Carolyn Relf, Jim Ryan, Hamish Sandeman, Subhas Tella, Rob Rainbird, Lori Wilkinson, Eva Zaleski, and their collaborators.

THE STRATIGRAPHY AND ECONOMIC POTENTIAL OF THE AYLMER LAKE VOLCANIC BELT, CENTRAL SLAVE PROVINCE, N.W.T.

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The Aylmer Lake dome is situated within low-lying barrenlands in the northeastern corner of the Walmsley Lake map sheet, 350km northeast of Yellowknife and 70km west of the Thelon Front. The Aylmer Lake sheet (75 N/16) was first mapped in the late 1940's by the Geological Survey of Canada at a scale of 1:256,720 (Folinsbee, 1950). This mapping defined a structural dome comprised of undifferentiated volcanic rocks rimming core granites and enveloped by peripheral metaturbidites of the Yellowknife Supergroup. The area has been intermittently explored since the early 1960's for base metals and kimberlites. Currently, claims over the area are held by Tyler Resources Inc. and Navigator Exploration Corporation, who are reassessing its overall potential for diamondiferous kimberlite, volcanic massive sulphide, and lode gold mineralization (Armstrong and Hopkins, 1999).

Three weeks of detailed (1:30,000) mapping of the Aylmer Lake dome was carried out this past field season as part of the Walmsley Lake Project (see MacLachlan et al., this volume). Volcanic rocks are distributed in an upright, outward-steepening dome that records coherent stratigraphy with no recognized structural repetition. Granitoid rocks in the core of the dome appear to be intrusive into the lowermost flows, and interlayering of sedimentary rocks at the top of the dome supports a conformable upper contact. Mapping delineated a basal pillowed to massive succession of mafic volcanic rocks between 0.5-1km thick, intruded by gabbro sills up to 200m thick and traceable for 5km along strike. These flows are overlain by a 150-700m thinly bedded succession, possibly tuffaceous in origin, that range from intermediate at the base of the section, to felsic at the top. Except for a breccia unit in the northwestern corner of the dome, characterized by intermediate (dacitic?) angular blocks in a mafic matrix, the tuff succession appears distal in origin. The upper felsic section is capped by a gossanous unit up to 50m thick, characterized by poorly to moderately-banded, two-amphibole, pyrrhotite-rich sediments, interbedded locally with pelitic material. This unit is interpreted as a silicate-sulphide facies iron formation. Clastic sedimentary rocks typical of greywacke turbidites of the Slave Province overlie the volcanic dome.

Airborne aeromagnetic and EM data, provided by Navigator Exploration Corporation, show excellent correlations with stratigraphy, and will serve as a useful mapping tool for extrapolating geology through areas of poor outcrop. Better stratigraphic resolution combined with petrological studies will allow for more critical assessment of the economic potential of intravolcanic magnetic/conductive units for volcanic massive sulphide and the capping iron formation for lode gold styles of mineralization.

Folinsbee, R.E.1950: Geological Survey of Canada, Paper 50-4, scale 1:126,720.
Armstrong, K., and Hopkins, R. 1999: GEM Property, NWT Assessment Report #084225.

U-PB GEOCHRONOLOGY OF SUBPHANEROZOIC BASEMENT OF THE SOUTHWEST NORTHWEST TERRITORIES: A PRELIMINARY REPORT

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Basement domains in the southwest NWT are assigned to Wopmay Orogen, based largely on the extrapolation of the magnetic signatures of the exposed Wopmay Orogen more than 400 km south into the covered basement west of Great Slave Lake. In order to ground truth this correlation and provide age constraints for the recently recorded SNORCLE seismic reflection line, we examined the composition and age of drill core and cuttings in this region from over 100 wells known to penetrate basement. From this set 10 samples of core and cuttings were selected for U-Pb geochronology using the SHRIMP II ion microprobe at GSC Ottawa. Aeromagnetic data were used as the base for geophysical subdivision and samples were collected from each of the major domains which, comprise from east to west, the informal Hay River terrane, Great Bear Magmatic Zone, Hottah terrane, Fort Simpson terrane and Nahanni terrane.

The Hay River terrane lies along the southwest shore of Great Slave Lake and to our surprise gave an age of 1838 Ma, making it the youngest rock in the region. Wells in Great Bear Magmatic Zone returned cuttings of rhyolite and intrusive rock that gave U-Pb ages of 1873-1862 Ma - nearly identical to dates from the older portion (pre-folding plutons) of the exposed magmatic rocks near Great Bear Lake. In contrast to the exposed shield, Hottah terrane (>1914 Ma) has a different range of distinctly younger ages in the subsurface, ranging from 1875-1854 Ma, very similar to ages considered typical of GBMZ. Collectively the Hottah terrane is cut by a suite of northwest-trending positive linear aeromagnetic anomalies that resemble a dyke swarm. The magnetic linears are characteristic of the Hottah terrane throughout the southern NWT and northeastern British Columbia. Fortuitously, several drill core and cuttings of fine to medium grained diabase confirm the dyke interpretation. The Fort Simpson terrane comprises plutonic rocks dated at 1845 -1853 Ma. The Nahanni terrane coincides closely with the zero-edge of a westward thickening wedge of Precambrian sedimentary rocks and thus, from the petroleum perspective, represents a fundamentally different kind of subPhanerozoic basement.

The geochronology offers some new ideas and poses some new questions on the interpretation of the SNORCLE reflection line and tectonic models for southern Wopmay orogen. It confirms that non-reflective sequences seen above reflective "Hottah terrane" on the SNORCLE line are magmatic arc rocks. It indicates that a broad region (300 km across strike) of southern Wopmay orogen was affected by magmatism more or less synchronously (1872-1845 Ma). This suggests either a single (and seemingly unlikely) subduction system or a series of subduction zones. The latter option contrasts with the reflection profile that shows a single, east-dipping subduction zone. We suggest that this is a late stage feature of the Fort Simpson-Hottah collision rather than a feature related to the Great Bear Magmatic zone and allied subduction-generated magmatic rocks.

RESULTS FROM BEDROCK MAPPING IN THE COMMITTEE BAY BELT, LAUGHLAND LAKE AREA (NTS 56K) CENTRAL MAINLAND, NUNAVUT

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The Committee Bay Belt, Laughland Lake map area (NTS 56K), is underlain by NE-trending rocks of the Archean Prince Albert Group, flanked to the N and W by paragneisses and associated peraluminous and metaluminous granitoids, and to the S and E by metaluminous granitoids. The Group comprises dominant metasedimentary rocks including semipelite, psammite, iron formation and quartzite with less abundant metavolcanic sequences incorporating predominant, spectacular, spinifex-textured komatiites, and uncommon pillowed to massive basalts and intermediate to felsic volcaniclastic rocks. The metamorphic grade in the main supracrustal belt is upper greenschist facies, but W and N the grade increases to amphibolite facies with consequent development of metasedimentary diatexites and paragneisses with accompanying peraluminous melt lenses. Cogenetic intrusive units range from rare gabbro through common quartz diorite and diorite, abundant tonalite to granodiorite and rare granite that crop out S, E and NW of a central, approximately oval plutonic body of tonalite (VTT) which is interpreted to be younger than the supracrustal belts.

The southern margin of the map sheet corresponds to the NE trace of the E-W trending Amer shear zone, represented by moderately N dipping, highly flattened metasedimentary rocks that structurally overlie a broad compositional range of granitoid rocks. There the Amer shear zone is characterized by a number of protomylonitic strands developed in both the granitoid and supracrustal rocks. The northern edge of the VTT incorporates, in the NW, moderately S dipping, L>S tectonized peraluminous and metaluminous granites containing supracrustal remnants. In the NE, a series of S-dipping panels of interspersed granodiorite and m-scale layered metasedimentary rocks are cut by E-W trending, steeply-dipping, mylonite zones, termed the Walker Lake shear zone. The latter is characterized by a shallowly-plunging extension lineation interpreted in terms of late horizontal movement. Far NW of the VTT is an intrusive complex of foliated augen granodiorites with rare metasedimentary xenoliths, all cut by an array of equigranular, biotite+magnetite monzogranite. To the immediate E and NE of the VTT, a narrow N-trending supracrustal belt is cut by numerous N-trending shear zones exposed as talc-chlorite schists. In 100 m scale boudins exposed therein, komatiitic flows and internal stratigraphic sequences are well preserved. Intruding the eastern side of the N-trending belt is a series of granitoid rocks exhibiting widespread NE-SW trending gneissic texture arising from transposition of a net-vein complex. The granitoids and the adjacent supracrustal belt are cut by an anorthosite body and all are cut by foliated and non foliated metaluminous monzogranite. The map area is interpreted to represent a large, sigmoidal, crustal scale structure (ca. 70 km wide) geometrically resembling a C-S type configuration, wherein structural elements are accentuated, and rotate into, the bounding, E-W trending shear zones. This deformation occurred late D2 (or D3?) much of which we consider is Proterozoic.

ARCHEAN GRANITE GREENSTONE BELTS OF THE HEARNE DOMAIN,WESTERN CHURCHILL PROVINCE, NUNAVUT: A PETROCHEMICAL CASE FOR INTRAOCEANIC SUPRASUBDUCTION ZONE EXTENSION?[1]

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The Kaminak-Tavani, Rankin Inlet and MacQuoid greenstone belts of Hearne domain, Western Churchill Province are dominated by tholeiitic basalts but contain subordinate calc-alkaline basalts and andesites. On the basis of their incompatible element profiles, these record four distinct types of basaltic to andesitic volcanism. In volumetric order these are: *MORB-like* rocks (flat spiderdiagrams); *Arc-like*, Th and LREE-enriched basalts; *OIB-like* basalts to basaltic andesites (convex-upwards spiderdiagrams) and; *BABB-like* rocks (low abundances, flat spiderdiagrams). Geochemical varieties generally do not form discrete packages and can be intimately interlayered on the outcrop, but more commonly, km-scale. Widespread, commonly thin felsic to intermediate rocks, include abundant tuffs and rare flow-banded and autobrecciated rhyolites. These comprise three distinct types: 1) rocks having fractionated spiderdiagrams (comparable to TTG granitoids), 2) those having less fractionated spiderdiagrams (strong HFSE and Eu anomalies) and 3) rhyolites exhibiting flat spiderdiagrams with negative Eu troughs comparable to "Type-3" rhyolites of the Superior Province. ϵNd_t values for all volcanic rocks of these belts range from +4.6 to -1.0, although the majority correspond to the value of depleted mantle (DM) of the time (ϵNd DM at t=2680 =+2.3 ± 0.5: ϵNd average volcanic rock=+2.2, n=63). The felsic rocks yield T_{DM} values of 2640-2750 Ma, and corresponding ϵNd_t values of +1.6 to +2.9, implying derivation from a predominantly NeoArchean source. Volcanic rocks exhibiting negative ϵNd values are rare and include calc alkaline basalts or basaltic andesites. In conjunction with geochronological data, this suggests that contamination occurred in the basaltic mantle source via subduction processes rather than through direct crustal assimilation during ascent.

Although many recent investigations of Archean greenstone belts have ascribed a major role for the accretion of oceanic plateaux in their development, data for the Hearne do not support this proposal. Felsic to intermediate tuffs (rare in oceanic plateaux) were erupted throughout the development of the supracrustal sequences of the Hearne and are interlayered with all observed types of mafic to intermediate rocks. Moreover, siliciclastic and chemical sedimentary rocks (BIF) are widespread, whereas ultramafic rocks are rare, features in contrast with the essentially mafic-to- ultramafic, volcanic dominated oceanic plateaux. Distinct fault and/or unconformity bounded breaks between thick sequences of tholeiitic basalts and calc-alkaline basalt-andesite-rhyolite packages are not observed.

In contrast, the "infant arc" scenario provides a setting wherein a series of lithospheric processes link, yielding a penecontemporaneous, broad swath of juvenile oceanic crust exhibiting a complex geological, and petrochemically diverse history. The geochemical and Nd isotopic data for the Hearne, in conjunction with the corresponding geochronological data, lend further credence to the proposal that lithospheric processes generating infant arc stages in the W Pacific may have operated during the Archean.

AN OVERVIEW OF THE CANADA-NUNAVUT GEOSCIENCE OFFICE AND ITS PROGRAM

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The Canada-Nunavut Geoscience Office (C-NGO), a partnership between the Government of Nunavut's Department of Sustainable Development, DIAND and the Geological Survey of Canada, was officially opened 14 months ago. Our mandate is to provide accessible geoscience information and expertise in Nunavut to support informed decision making, sustainable development, education and training, as well as outreach and capacity building. Over the past year, a diverse geoscience program has been designed and staffed to respond to Nunavut's prioritized needs. An inaugural season of field investigations has been successfully completed, as outlined below.

A new multi-year regional integrated project is examining the bedrock and surficial geology of the Committee Bay area northeast of Baker Lake. Bedrock mapping of the Archean greenstone belts of the Prince Albert Group and surrounding metaplutonic rocks was completed over most of NTS 56K; a series of 4 1:100,000-scale maps will be released this winter. Thematic investigations of iron formation-hosted Au, geochemistry and isotopic composition of the volcanic stratigraphy, as well as the structural, metamorphic and geochronological evolution of the region were initiated by graduate students. Investigations of the regional stratigraphy of surficial materials, as well as ice flow dynamics and implications for mineral exploration are underway. In partnership with the GSC, and funded through the Targeted Geoscience Initiative, acquisition of high-resolution aeromagnetic data commenced in July, and direct involvement of GSC staff in field and supporting laboratory activities has begun.

In collaboration with various Ottawa-based GSC divisions, the C-NGO has begun a new three-year integrated project on the northern margin of the Trans-Hudson Orogen on central Baffin Island. Bedrock mapping of a Paleoproterozoic Piling Group contiental margin sequence on the southern flank of the Archean Rae craton was completed over much of NTS 37A and 37D, and new 1:100,000-scale maps will be released early in 2001. A number of thematic investigations, including teleseismic, gamma-ray, and 3-D GIS modelling studies were begun by GSC staff as an integral part of the project. Graduate theses will investigate a wide variety of geochemical, isotopic, economic, geochronological, sedimentological, metamorphic and structural aspects of the area.

An investigation of the Zn potential of Paleozoic sedimentary rocks in the Arctic Islands in the vicinity of the Polaris Mine was begun this summer, involving field mapping, structural and stratigraphic studies. This work will be combined with geochronological and isotopic studies, to build on existing Industry data sets to create a better understanding of the nature and age of mineralizing fluids, and the structures that controlled their movement. This will aid identification of areas that are most likely to contain significant new resources and encourage both companies and local prospectors to undertake new exploration activity within the framework of an improved geological model. Increased partnership with GSC-Calgary is planned for the coming field season.

In collaboration with staff of GSC's Terrain Sciences Division and the Climate Change Action Fund, we have developed a poster for the general public that explains some of the effects of climatic change that are relevant to Nunavut.

MAKING THE TRANSITION: THE STATUS OF DIAND'S NUNAVUT REGIONAL OFFICE

Sharp, J. M.,
DIAND Nunavut Regional Office

Prior to the creation of Nunavut in 1999, the Department of Indian Affairs and Northern Development managed its eastern Arctic responsibilities from its regional office in Yellowknife, NWT. Since April 1, 1999, the Yellowknife office has continued to administer these responsibilities while a new regional office is established in Iqaluit. Management of Nunavut-related programs and services will be transferred to the Iqaluit regional office when it becomes fully operational in April 2001.

The Operations Directorate will compose a large part of the Iqaluit office. The directorate will consist of five sections - Water Management, Environment and Contaminants, Mining/Lands, Mineral Resources, and the District Office. The District Office is fully staffed and functional, with Resource Management Officers located in Sub-District Offices in Rankin Inlet and Kugluktuk. As of November, managers have been hired for the other sections and most of the remaining staff are expected to be hired by the end of December.

Topics to be discussed will include the location of DIAND offices in Nunavut, as well as an introduction to the staff and duties of the five sections within the Operations Directorate.

GEOLOGIC SETTING OF THE MEADOWBANK IRON FORMATION-HOSTED GOLD DEPOSITS

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Geologic investigations were undertaken at the Meadowbank deposits to help determine the controls on gold mineralization. This included detailed mapping of the surface geology and logging of drill core. Follow-up work will include petrography, lithogeochemistry and geochronology to further constrain the processes and timing. A detailed understanding of these deposits are important to provide the geologic framework to evaluate the exploration potential of the Prince Albert Group to the north.

The host rocks to the Meadowbank gold deposits are felsic to intermediate volcaniclastic rocks and interbedded iron formation. The stratigraphic sequence is polydeformed with four phases of deformation recognized regionally, two of which have substantially modified the geometry of the deposit stratigraphy. The initial significant phase of deformation is a progressive transposition of the strata with tight to isoclinal folding which culminated in low angle high strain zones, localized along lithologic contacts. This progressive deformation event appears to have controlled the distribution of gold mineralization. Overprinting NE-SW plunging, upright, folds further modified the geometry of the mineralized body.

Although deformed, there are large sections of intact stratigraphy at the Meadowbank deposits which is well-represented in drill core. These relationships indicate that quartzite and quartz pebble conglomerate overlie an ultramafic interval, possibly of volcanic origin. Underlying the ultramafic volcanic rocks is a bimodal sequence of felsic to intermediate volcaniclastic rocks that were likely sourced from the adjacent felsic flow/intrusion. Felsic volcaniclastic beds, and lesser mafic tuff, were deposited intermittently which interrupted the deposition of magnetite-chert iron formation, suggesting that chemical sedimentation was coeval with bimodal volcanism.

TIMING OF GOLD MINERALISATION IN THE GIANT AND CON GOLD DEPOSITS, YELLOWKNIFE, CANADA.

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The Giant and Con gold deposits are hosted in a series of brittle-ductile deformation zones that cut the stratigraphy of the Yellowknife Bay formation, Kam Group (2.72-2.7 Ga.), Yellowknife Greenstone belt. The Giant and Con deposits have experienced a similar structural history (D1 to D3) and contain several similar phases of gold mineralisation. Giant and the upper portions of the Con deposit are dominated by refractory gold hosted in quartz-ankerite-paragonite schist and white laminated quartz veins, that formed during the development of an S1 foliation, which is restricted to zones of syn-D1 alteration (Siddorn & Cruden, 2000). The lower portion of the Con deposit is dominated by syn-D2, free-milling gold mineralisation hosted in quartz veins (Siddorn & Cruden, 2000).

Recent regional and underground mapping suggests that D2 in both deposits can be correlated with the regional D2 event (post-2.64-62 Ga Defeat magmatism, syn-2.58 Ga Prosperous magmatism, Davis & Bleeker, 1999). Armstrong (1997) recognised that emplacement of a lamprophyre dyke in the Con deposit occurred towards the end of peak metamorphism (Defeat related, 2.64-2.62 Ga.). This dyke contains an S2 foliation and is altered and cut by a gold-bearing quartz vein, suggesting that its emplacement was pre-D2, post-Defeat magmatism. Armstrong (1997) also recognised the presence of amphibolite schists with a possible S2 foliation in the Con deposit, suggesting that S2 may have started to form at the end of peak metamorphism. This is supported by observations in the Trapper Lake deformation zone, north-west of the Giant deposit, which contains an amphibolite grade S2 foliation that is locally retrograded to greenschist facies.

The Con deposit also contains a distinctive tourmaline breccia associated with pre-D2 ore bodies. The breccia is cut by S2 and contains clasts of sericite, quartz-carbonate, and gold-bearing quartz. Fragments of this distinctive tourmaline breccia appear to occur as clasts within the Jackson Lake Fm.. The Jackson Lake Fm. is cut by S2 and is believed to have been deposited after D1 (Martel et al., 2000). Therefore, the Jackson Lake Fm was deposited after syn-D1 refractory mineralisation, but before syn-D2 free-milling mineralisation.

Deformation-intrusive relationships are displayed in Defeat age Western granodiorite plutons and dykes to the west of the Giant and Con deposits. In the Rod claims, a series of NE striking, moderately dipping deformation zones (similar to the Con and Campbell zones) cut the Western granodiorite and contain free-milling gold. These zones display similar D2 (reverse-dextral shear) kinematics to the Campbell zone, Con deposit, suggesting that they formed during D2.

Close to the Giant deposit and the Western granodiorite-Kam Group contact, a unique timing history is displayed in the Brock fold. Here, an S1 fabric contained within possibly gold-related quartz-mica and garnetiferous tan alteration, is cut by an 8a porphyritic gabbro dyke, and by granitic dykes that emanate from the Western granodiorite. Subsequently all lithologies were folded about an axial planar S2 foliation to form a tight F2 fold that plunges moderately SW, with an associated L2 lineation. Current indications suggest that the area was metamorphosed to amphibolite grade after D1 and its associated alteration to form the garnet bearing assemblages. This was most likely due to the contact metamorphic effect of the Western granodiorite, which is therefore post-D1 but pre-D2.

Evidence to date suggests that D1 in the Giant and Con deposits occurred pre-Defeat magmatism (2.64-62 Ga.) and was coeval with the formation of refractory and early free-milling ore bodies. D2 appears to have started in the Yellowknife Greenstone belt towards the end of Defeat-related metamorphism (post 2.62 Ga., syn 2.58 Ga.), and was synchronous with the formation of most free-milling ore bodies. At the greenstone belt scale, D1 is responsible for tilting of the Kam group strata and the formation of discrete, mineralised brittle-ductile faults, now represented by early alteration and refractory gold in the Giant and Con deposits. Since D1 predates Defeat age magmatism, early rotation and deformation of the Kam group strata cannot be related to intrusion of the Western granodiorite. D2 is responsible for the pervasive strain within the Yellowknife greenstone belt and affects all supracrustal rocks, including the Jackson lake Fm. It appears to have started during cooling of the Western granodiorite and is responsible for the geometric modification (Giant) and reactivation (Con) of D1 brittle-ductile fault zones and for the emplacement of free-milling gold quartz veins in both deposits.

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SURFICIAL GEOLOGY INVESTIGATIONS OF LA BICHE RIVER MAP SHEET (NTS 95C), SOUTHEAST YUKON AND SOUTHWEST NORTHWEST TERRITORIES

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This research is part of the Central Forelands NATMAP project and involves detailed investigations of the glacial geomorphology, stratigraphy, geochronology and drift geochemistry. It also focuses on documenting the nature and distribution of landslides and other mass movements within the region, noting areas of potential hazard in aid of risk assessment for future development.

The La Biche River map area lies mostly within the Liard Plateau, and is bounded to the west by the Hyland Plateau, and to the north and east by the La Biche and Kotaneelee ranges of the Mackenzie Mountains. The eastern landscape is characterized by north-south trending ridges (up to 2400 m asl) and valleys (maximum relief is ~1200 m), while to the west the landscape is more gently rolling. Valleys are heavily wooded while ridges are covered by a thick moss-lichen carpet and dwarf birch.

The western map area is largely covered by till veneer derived from glaciers that flowed eastward from the northeast dome of the Cordilleran Ice Sheet during the last glaciation. There are extensive bedrock fluting fields in this region that indicate at least two major phases of flow (ENE and NNE). Mapping of glacial striations and tracing the distribution of granite erratics reveals that the eastern map area was overrun by Laurentide (continental) ice during the last glaciation. Granite erratics have been found up to 1620 m on the La Biche Range, and as far west as the confluence of the Whitefish and Beaver rivers. This represents a considerably greater vertical and westward extension of Laurentide ice than previously identified. Thick Laurentide till, however, is only found in the upper parts of the valley east of the Kotaneelee Range, and along the southern Beaver River. In the western map area, glaciolacustrine deposits are extensive. However, despite widespread evidence of extensive proglacial lakes within the eastern regional valleys during deglaciation, the valleys themselves have been largely swept clean of Quaternary fill by deglacial rivers. These rivers eroded a series of peneplanes into bedrock, leaving a coarse boulder lag in the valley bottom within which the modern underfit rivers flow.

Mass movements are widespread throughout the map area. Extensive shale deposits in the western part of the map sheet appear highly susceptible to failure, and have lead to the development of large slumps (km scale). Also in the western regions, localized accumulations of till and widespread clay-rich, glaciolacustrine deposits (which were also found to be ice-rich in places), have produced extensive debris flows and slumps. Along the ridges and valleys of the eastern part of the map sheet mass movements are mostly triggered by failure of Mattson Formation sandstone along steeply dipping bedding planes, which in places have activated larger failures, and flow, of the overlying unconsolidated material. Mass wasting in the region also includes extensive smaller scale features relating to periglacial and nival activity.

A YEAR IN THE LIFE OF THE NWT PROTECTED AREAS STRATEGY

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PAS Secretariat

The NWT Protected Areas Strategy (PAS) was approved by the federal and territorial governments in 1999 and is currently being implemented across the Northwest Territories. Communities and regional organizations are developing proposals to protect their special natural and cultural places.

This presentation will describe the PAS planning process and what some of the challenges and rewards are of this unique approach to establishing protected areas.

AN EXPLORATION REVIEW OF TAHERA CORPORATION CORE PROPERTIES

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Tahera Corporation

Tahera Corporation core properties are located in the Canadian arctic approximately 400 km north north-east of Yellowknife, just north of Echo Bay's Lupin mine, and straddle the border between the NWT and Nunavut Territories. They consist of three claim groups designated as Burnside, Contwoyto and Jericho, totalling 496,611 acres. Four kimberlites have been discovered to date, and are named JD-01 (Jericho), JD-02, JD-03 and Contwoyto-1. All are diamondiferous with grades ranging from 0.2 carat/ton to a high of 1.29 carat/ton found in the central lobe of the JD-01 kimberlite. At this point, JD-01 remains the only economic kimberlite body. A feasibility study concluded production of 3 million carats over an eight-year mine life. Barring any major delay in the permitting process, mine construction is scheduled to begin during the winter of 2002.

Tahera Corporation was formed through the 1998 merger of Lytton Minerals Ltd. and New Indigo Resources. The history of the exploration that resulted in the discovery of Tahera's kimberlite bodies started with the staking rush, which followed the discovery of the Point Lake diamondiferous kimberlite by Dia Met/BHP. At its peak, Lytton and its various partners controlled over 11 million acres extending from the shores of the Coronation Gulf in the north to a claim block east of the Dia Met/BHP ground in the south. Canamera Geological Ltd carried out Lytton's exploration. Ranch Lake kimberlite, presently within the Kennecott/Tahera JV, was the first discovery and was drilled in March of 1993. The next kimberlite discovery was JD-01 drilled in February 1995, and was closely followed by JD-02 located approximately 350 meters to the north north-west. The JD-03 kimberlite was discovered in August of 1996, and the last kimberlite, named Contwoyto-1, was discovered in October of 1998.

The primary exploration tools utilised by Tahera Corporation are the collection of heavy mineral till samples to identify kimberlite indicator mineral anomalies. This is followed by geophysical surveys, mapping and ground truthing. Since glacial processes control the distribution of these heavy mineral indicators, mapping of quaternary features is instrumental in working back to the source kimberlite.

Initial airborne geophysical coverage applied by Canamera exploration was 250 metre flight line spaced fixed wing Geoterrex magnetic and time domain electromagnetic surveys. The line spacing provided by the survey was too large for the size of most kimberlites. Tahera's core properties were re-flown with 50 metre spaced magnetic and frequency domain electromagnetic surveys totalling 33,971 line km.

Potential for the discovery of new diamondiferous kimberlites is significant due to the unexplained heavy mineral trains composed of indicator minerals which suggest their kimberlitic host sampled the diamond stability field. This is further complemented by new strategic till sampling conducted property wide, and the recent enhancement of geophysical methods. Future exploration will focus on discovering the source of these trains, and the definition of new trains from localised anomalies.

THE FORT LIARD GAS PROJECT

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In the first quarter of 1999 Chevron Canada Resources and partners drilled a successful gas well, Chevron et al Liard K-29, approximately 29 km north of the community of Ft. Liard, NWT, Canada. The well encountered gas within vuggy and fractured Middle Devonian Manetoe Dolomite reservoir at a depth of approximately 2500m. The well has greater than 450 m of gross gas pay and has been on production since May 2000 at rates between 50-75 mmcf/d. A second well (M-25) drilled into the same pool late 1999, is expected to come on stream at similar rates in November of 2000.

1:100 000 SCALE BEDROCK GEOLOGY COMPILATION MAP OF THE MACQUOID LAKE GIBSON LAKE-AKUNAK BAY AREA (PARTS OF 55M AND 55N), KIVALLIQ REGION, NUNAVUT[1]

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GSC A-Series Map xxxx A: (Anticipated Release: early 2001)

The map, which covers a portion of the northern Hearne domain, presents results of bedrock mapping undertaken during 1996, 1998, and 1999, and integrates more recent data from topical studies on geochronology, petrology, and metamorphism. The objectives of the mapping were to evaluate the nature of tectonothermal reworking of the Archean lithologies during the Paleoproterozoic and to provide an improved tectonostratigraphic framework for mineral exploration. The region hosts several economic mineral prospects -- volcanic-associated massive sulphide, magmatic Ni-Cu, iron-formation-hosted Au, diamonds, and carvingstone. Detailed accounts of bedrock geology, structure, metamorphism, petrology, and geochronology are given in the marginal notes and references therein.

The map area is broadly divided into three lithological and structural subdomains: 1) the MacQuoid homocline comprised of northwest-dipping belts principally composed of Archean amphibolite facies sedimentary rocks and gneissic tonalite, structurally overlain by 2) a volcanic belt comprised of amphibolite facies juvenile mafic, intermediate, and felsic volcanic rocks (with ages of ca. 2655 Ma to ca. 2720) and associated plutonic rocks (ca. 2656 to 2685 Ma); and 3) the ca. 2700 Ma Cross Bay plutonic complex comprised of polydeformed and metamorphosed Archean tonalite gneiss, diorite and gabbro that structurally overlies the MacQuoid homocline. The volcanic rocks are predominantly tholeiitic basalts to basaltic andesites. U-Pb isotopic studies on zircon, titanite, and monazite from the suprcrustal and granitoid rocks suggest that the Cross Bay complex was deformed at ca. 2695 Ma before the onset of ca. 2680 Ma volcanism in the MacQuoid homocline, and highlight a complex Archean and Paleoproterozoic tectono-magmatic evolution. The Big lake shear zone (Blsz), which coincides with the southern margin of the Cross Bay plutonic complex, is a north-dipping zone of straight gneisses/mylonites predominantly derived from granitoid protoliths. Metamorphosed and deformed ca. 2190 Ma mafic dykes, and variably deformed ca. 1830 Ma granite and co-magmatic lamprophyre dyke-swarms represent Paleoproterozoic tectonothermal and magmatic events.

At least four deformation events affected the supracrustal units within the MacQuoid homocline and the volcanic belt. D1-D2 are considered to be late Archean events. Younger Paleoproterozoic tectonothermal events deform the ca. 2190 Ma mafic dykes.

The region underwent multiple metamorphic events that range from greenschist to granulite facies. The main Archean metamorphism occurred between ca. 2500-2560 Ma, and ranged from ~5.1 kbar - 660° C in the southwest to ~9 kbar - 770° C in granulite facies rocks of the Chesterfield Inlet area to the northeast. A high pressure metamorphic event at ca. 1900 Ma ranged from ~10 kbar-675° C in the southwest to > 12 kbar north of Chesterfield Inlet. Widespread greenschist to lower amphibolite facies metamorphism accompanied emplacement of the suite of ca. 1830 Ma granite plutons at ~15 km depth.

METAMORPHISM AND THE ORIGIN OF GOLD DEPOSITS IN THE YELLOWKNIFE GREENSTONE BELT, PHASE 2 - NEW DATA AND FIRST APPLICATIONS

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Metamorphism is a key component of the particular combination of geological circumstances that produced the Con and Giant gold deposits in the Yellowknife Greenstone Belt (YGB). This study of the metamorphism of the whole belt has begun to fill gaps in the metamorphic data base, to eliminate discrepancies between isograd patterns defined by previous workers, and to compare metamorphic settings and P-T histories of mineralized and unmineralized segments of the YGB. Results of petrography, limited microprobe and SEM analysis, and field work advance knowledge of the gold deposits by providing new constraints on the depth and timing of deformation, plutonism, alteration, and gold mineralization and on the thermal evolution of the belt.

Phase II field work revealed that foliations formed during metamorphism occur intermittently from one end of the YGB to the other. At six localities, the structures are cut by younger granitoids (Western Plutonic Complex) that are themselves deformed. Regional trends of the foliations are cut by Boyle's (1961) amphibolite facies isograd, considered by most workers to be a contact effect of Defeat Suite plutons. New petrographic evidence indicates that Defeat Suite plutons have been metamorphosed under greenschist facies conditions. It follows that regional metamorphism and deformation began before and continued after intrusion of the Defeat Suite. In this context, contact metamorphism adjacent to the plutons is a relatively short, locally high grade event that interrupted a much longer low grade regional metamorphism. Soon after crystallization of the granitoids, low grade regional metamorphic conditions were re-established throughout the belt and imposed on Defeat Suite plutons.

Phase II petrography and field observations support the hypothesis that the Jackson Lake Formation, the youngest supracrustal unit in the YGB, was deposited unconformably on top of adjacent volcanic rocks before the onset of compressional deformation and regional metamorphism (~2670 Ma, Henderson, 1985). The young ages obtained from the Jackson Lake Formation metaconglomerate (Davis and Bleeker, 1999) are presumed to be products of the metamorphic event rather than the maximum age of deposition.

Most of the gold mined to date came from high strain zones that are dominated by chlorite-carbonate-white mica schists and phyllites. These auriferous zones cut across lithologic contacts, contact metamorphic amphibolite facies rocks at Con, regional upper greenschist facies rocks at Giant, and, locally, regional foliation trends. The carbonate-rich rocks are commonly considered to have formed at lower temperature than the assemblages in adjacent, less-deformed greenstones and amphibolites. In fact, the transformation from amphibolite facies and upper greenschist facies assemblages to lower greenschist facies carbonate-chlorite assemblages could be produced by CO2 -rich fluids at or near peak metamorphic conditions.

The high strain zones may have had a history of fluid flow under a range of P-T conditions before development of Siddorn's D1 (Siddorn and Cruden, 2000). Henderson (1978) suggested that the zones were initiated by faulting during formation of the volcanic pile. Evidence of synmetamorphic rotation and flattening of the belt before intrusion of Defeat suite (this study) raises the possibility that deformation in the high strain zones began when regional metamorphic grade was low. Foliated/lineated amphibolites at Con (Armstrong, 1997) and elsewhere along the length of the belt (this study) indicate deformation continued at high metamorphic grade. Once formed, such prominent structural discontinuities would persist through a range of metamorphic conditions and have a dramatic effect on the geometry of fluid flow.

Recent experimental evidence (Loucks and Mavrogenes, 1999) supports the assertion by Hodgson et al. (1993) that ninety per cent of gold mined from metamorphic terranes around the world was deposited at pressures of one to three kilobars (3.5-10.5 km depth) and temperatures of 250-450 °C (Gold Deposition Zone, Thompson, 2000). Estimates of peak metamorphic pressures and temperatures, the coexistence of epidote and hornblende across a wide swath in the belt (Boyle, 1961; McDonald et al., 1993), and experimental data indicating epidote-hornblende is only stable at pressures above 3.3 kilobars (Spear, 1993) suggest that much of the belt may have been too deep and/or too hot for gold to be deposited during peak metamorphic conditions. Given that volcanic rocks were deposited on the earth's surface and returned there as metamorphic rocks after orogenesis ceased, however, the belt must have passed through the Gold Deposition Zone twice, once on the way down and again on the way back to the surface. In their GAC poster, Falck and Kerswill (2000) describe two gold mineralization events, one bracketed by ages of 2664 and 2620 Ma and the other younger than 2596 or 2589 Ma.

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ARCHAEOLOGICAL INVESTIGATIONS OF WINTER ACCESS ROUTES AND MINERAL EXPLORATION AREAS IN SLAVE GEOLOGICAL PROVINCE, NT

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Archaeological research by Jacques Whitford Environment Limited over the past two years on winter access routes to mineral exploration areas, and field inventories around mineral exploration areas, has resulted in the discovery of over 225 archaeological sites dating back over at least the past 2500 years. Site densities have been found to be as high as 0.5 sites/km² around the De Beers Canada Exploration Inc. (formerly Monopros) exploration area at Gahcho Kué (Kennady Lake). Site distribution on or close to the 220 km of winter access route corridors investigated for Winspear Diamonds Inc. between MacKay Lake and Snap Lake, and for De Beers from MacKay Lake to Gahcho Kué, is 1 site/1.25 km. Sites have been found widely distributed across the landscape on a range of landforms, but are frequently clustered in specific locations. Of these, elevated, level terraces and knolls and eskers appear to be the most favoured sites for human land use activities, often adjacent to a water body. Of the sites found, many would be at some risk of disturbance from related development activities such as winter access route construction and use, preparation and use of field camps during access route construction and use, and extraction of aggregate from eskers for road traction, without appropriate mitigation.

Legislation and guidelines in the Northwest Territories, as well as the results of the Gahcho Kué and Snap Lake projects, suggest that mineral exploration and winter access route construction are activities that should be preceded by careful screening, archaeological overview assessment, field inventory, and impact assessment, and inclusion of archaeological considerations early in the project planning process. For example, De Beers has undertaken overview assessments of several of their recent grassroots projects in the Northwest Territories and Nunavut; the overview reports contain information on known archaeological sites, a prediction of site potential, and procedures for field exploration crews on recognizing, avoiding, and reporting new sites. Sharing of this information with local communities during the public consultation process can result in additional site locations becoming known, thus enhancing heritage conservation. Participation in field investigations by representatives of affected aboriginal communities can greatly enhance the experience of all team members and leads to positive feedback to the communities on the developers' and regulators' commitment to environmental conservation.

IS THERE A DEEP EXTENSION TO THE GIANT GOLD DEPOSIT?

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Preliminary interpretation of lithogeochemical and isotopic analyses of wallrock and quartz vein samples collected from drill core and surface across the southern most part of the Giant deposit suggests that mineralized zones may exist at depth below "A" shaft and that these zones differ from those mined elsewhere in the mine. Wallrock alteration, indicated by major and trace element analyses of ~75 wallrock samples, suggests that fluids forming the mineralized zones mined in the A1 and B2 open pits migrated up a west-dipping rather than an east-dipping fluid pathway found in the rest of the mine. Such a west-dipping structure would be comparable to those in the Con Mine, located immediately on the other side of a paleospastically restored West Bay Fault. These alteration halos extend to depths of 1 kilometre, well below the 200 m depth of workings in the "A" shaft part the mine and may compare favorably with similar alteration halos around mineralized veins in the deepest part of the Campbell shear system. Fluid migration along a west-dipping pathway appears to be consistent with the orientation of large gold-bearing sheeted veins hosted in sheared volcanic rocks that occur on surface in the open pits. The existence of similar veins at depth is indicated by long quartz veins intercepts in foliated rocks in archived core from deep diamond drill holes that explored the area beneath "A" shaft.

The paucity of drill holes between the Townsite and West Bay Faults suggests that this area has not been fully tested for the existence of free-milling ore like that found at depth in the Con and most other mesothermal gold deposits. Further exploration in this area may be warranted to establish if deep free-milling ore exists in this part of the Giant Mine.

LITHOGEOCHEMISTRY OF WALLROCKS IN THE CON GOLD DEPOSIT: PROJECT STATUS REPORT

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2 Miramar Con Mine Ltd., Yellowknife, N.W.T.

A lithogeochemical cross-section and long-section are being constructed for the Con Mine by compiling, evaluating, and re-interpreting the existing data as well as by the collection and analysis of wallrock and vein samples away from mineralized shear zones. Results to date indicate that there are lithogeochemical anomalies that coincide with and extend into the hanging wall of the mineralized shear zones. Hanging wall alteration on the 2300 Level of the mine may be attributable to: (1) fluids leaking up out of the shear zone; (2) the emplacement of younger dikes; or (3) fluids migrating up out of the sediments located just east of the shear zone.

Whole rock geochemical data gathered from the mine office is being used to construct the long-section because samples were collected primarily from the shears zones. Potentially useable data identified includes results from >1,000 samples collected by Myers (1973-1977), 25 samples collected by Webb (1983), 82 samples collected by Webb (1987), 60 samples collected by Strand (1993), and 390 samples collected by Madiesky (1996). Recognized problems with the data include: (1) the largest data set appears to only be available in hand-written documents; (2) the location of many samples within the mine, including those collected as recently as 1996, are poorly documented with locations frequently recorded only on maps or long-sections; (3) some old computerized data may no longer be accessible.

A lithogeochemical cross-section of the Con Mine is being constructed along mine section 20,000 north. Wallrock and veins samples have been collected approximately every 500' on surface (between 8,500 and 13,500 E), the 2300 Level (between 8,800 and 13,300 E) and the 4900 Level (between 10,000 and 13,000 E). Results from these samples are being integrated with the existing data from the Campbell shear zone to generate a thick section across the deposit. This section will in turn be used to answer questions about the origin of the Con Mine deposits.

PORPHYRY-RELATED COBALT-COPPER-GOLD MINERALIZATION IN THE GREAT BEAR LAKE AREA OF THE NORTHERN GREAT BEAR MAGMATIC ZONE, NWT

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Exploration activities in the northern portion of the Great Bear Magmatic Zone (GBMZ) commenced in the late 1920's with the identification of cobalt and copper as secondary weathering stains on Proterozoic rocks at Port Radium. Subsequent discoveries led to the extraction of radium, uranium and silver ores from several deposits over the next half century. Exploration activity declined following closure of the mines in the Port Radium and Camsell River districts in the early to mid 1980's. However, a review of the region in the mid to late 1980's by Central Electricity Generating Board Exploration of Canada Ltd. ("CEGB"), utilizing an alteration model established by Hildebrand was successful in identifying uranium mineralization on the Longtom Property, 50 km to the south of the Camsell River District.

Recent work by Tyhee Development Corp and others in the Port Radium, Camsell River and Longtom (Zebulon) districts within the Great Bear Magmatic Zone has identified polymetallic mineralization associated with the alteration assemblages CEGB used to identify uranium mineralization at Longtom Property. Tyhee's new polymetallic discovery is located 3 km south of Cameron Bay on the east side of Great Bear Lake. It hosts significant cobalt-copper-gold mineralization with sporadic bismuth and silver in an alteration halo peripheral to the Contact Lake Intrusion. This well documented, subvolcanic syenite to monzonite (+/- quartz) sill-like body intrudes and may be comagmatic with porphyritic andesites of the Echo Bay Formation, Labine Group (ca 1,920 - 1,870 +/- Ma).

Previous workers noted that alteration is best developed along the upper contact of the intrusions, and forms extensive halos consisting of proximal albite, intermediate magnetite-actinolite-apatite and distal sulphide replacements. Potentially economic concentrations of copper, cobalt and gold are zoned and occur within all phases of the alteration as discrete veins, pods and disseminations over a minimum 1,000 meter by 130 meter area. Preliminary petrographic studies indicate that native copper, arsenopyrite, glaucodot and chalcopyrite are the principal sulphide minerals associated with high Co, Cu and Au values. They are intimately intergrown with tourmaline and quartz, and K-feldspar, chlorite, quartz, carbonate and epidote are common alteration minerals in the immediate host rocks. Assays of surface samples indicate Co values of up to 0.62 wt %, Cu values up to 1.75 wt % and gold values up to 4.7g/t. Continuous chip samples have returned values up to 23 meters of 0.11% Co, 0.26% Cu, and 0.14 gpt Au.

To date, exploration of the Tyhee property has consisted of preliminary surface reconnaissance work, however, previous mapping has traced the favourable alteration and/or mineralization extending for more than 18 km of strike length. A number of similarities with other large Proterozoic iron oxide associated copper-gold and polymetallic deposits elsewhere in the world are documented.

WESTERN CHURCHILL NATMAP PROJECT: SOURCES OF INFORMATION AND DATA

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The NATMAP (National Mapping Program) was designed to facilitate multi-disciplinary and multi-agency collaborations to solve geological problems. Such a program often spawns projects with a large number of participants, typically scattered throughout the country, and necessitates efficient dissemination of information and distribution of digital data. For the Western Churchill NATMAP project, the dissemination of information has utilized annual meetings, project workshops, email and the Internet. See the Web page: http://www.nrcan.gc.ca/~shanmer/Churchill.html for the latest information about the Western Churchill NATMAP project.

When several agencies are involved, the availability of data is varied due to differences in publication policy. Currently, there is no place (real or cyberspace) for one-stop shopping for government digital data. However, projects typically build their own digital geoscience database using GIS technology and details on the distribution of digital data in the project area, and its source are provided to project participants and other interested clients, often via the Internet. In the case of the Western Churchill NATMAP project, an archive of the extents and source of digital data is maintained on the Web at:

http://gis.nrcan.gc.ca/natmap/wcn/wcn_gis.html. In order to facilitate distribution of the digital data archive, a CD-ROM of data was produced in 1998 (Wilkinson, 1998), with another due in December 2000 (Wilkinson and Brown, 2000). Complete CD-ROM contents can be found on the aforementioned Web page.

The Canadian Geoscience Knowledge Network (CGKN) is currently being developed. Coordinated by the National Geological Surveys Committee, a key goal of CGKN is the development and adoption of standards and policies for digital data that should facilitate the discovery and access to geoscience data and knowledge. Visit the following Web site: http://cgkn.net/ for more information.

Wilkinson, L. 1998. GSC Open File D3683.
Wilkinson, L. and Brown, N. 2000. Geological Survey of Canada Open File DXXXX.

WOODBURN LAKE GROUP: STRUCTURAL GEOMETRY OF THE MEADOWBANK DEPOSIT AREA -IMPLICATIONS FOR GENESIS OF A MAJOR GOLD DEPOSIT IN THE WESTERN CHURCHILL PROVINCE

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The potentially world-class Meadowbank gold deposit occurs within a sequence of Archean supracrustal rocks dominated by intermediate volcaniclastic rocks with interlayered iron-formation, pelitic and ultramafic schists, and quartzite. The deposit is hosted largely by iron formation but gold also occurs within volcanogenic interbeds. It contains multiple styles of sulphide mineralization that can be grouped according to their relationship to four main phases of penetrative, regional deformation.

The earliest D_1 structures comprise S_1 foliations, L_1 stretching lineations, and shallowly-plunging, inclined F_1 isoclinal folds. The S_1 foliation, defined by greenschist-facies mineral assemblages, can be the dominant foliation observed in outcrop. Pre-D_2 gold and sulfides (pyrrhotite, locally pyrite and rarely arsenopyrite) are concentrated within S_1, and along F_1 limbs, with or without magnetite. Sulfides are also found within or adjacent to quartz veins deformed in S_1, and veins that cut S_1 but are deformed by D_2. D_1 deformation was ongoing by ca. 2.62 Ga, the age of the oldest Archean granite overprinted by S_1[1]. Concentration of sulfides and gold along S_1 implies that the earliest stages of mineralization had commenced before or during intrusion of the granites.

D_2 structures comprise S_2 foliations, L_2 mineral and intersection lineations, F_2 tight to isoclinal folds and minor reverse faults. S_2 varies from a schistosity or crenulation cleavage to a transposition foliation that obliterates bedding and S_1. It is defined by greenschist-facies mineral assemblages but is consistently overgrown by moderate-temperature metamorphic porphyroblasts including biotite, garnet and amphibole. F_2 folds at all scales are shallowly doubly-plunging and form a northwest-vergent fold set with moderately southeast-dipping axial surfaces. Syn-D_2 pyrrhotite ± pyrite and minor arsenopyrite are aligned along S_2 crenulation cleavages that are axial planar to minor F_2 folds. The maximum age for D_2 is 2599 Ma, the age of the youngest granite with S_2 foliation, and the lower limit is 1835 ± 1 Ma, the age of an undeformed crosscutting pegmatite dyke[1].

D_3 structures consist of open to close, shallowly-plunging F_3 folds with an associated L_3 crenulation lineation. Chevron to similar-style F_3 folds of S_2 and L_2, have wavelengths on the order of decimetres to centimetres. F_3 folds define a consistently southeast-verging minor fold set with shallowly northwest-dipping (< 30°) axial surfaces.

D_1 through D_3 structures are folded about a map-scale, south-plunging F_4 synform, centred on the North Portage area. D_4 structures include upright, open to tight F_4 folds, local steep S_4 crenulation cleavage, and related L_4 crenulation lineation. F_4 folds are moderately to shallowly-plunging, with north-northeast trending, steeply dipping (> 60°) axial surfaces. Grunerite, amphibole and biotite porphyroblasts, which overgrow S_2, are locally crenulated or wrapped by S_4 Syn-D_4 coarse pyrite ± pyrrhotite is associated with local quartz-carbonate veins that occur along the axial planes of F_4 folds. D_4 only locally remobilized pre-existing gold, as D_4 veins are barren where S_1 and S_2 foliations are gold-poor.

Present evidence suggests gold and sulphides were present prior to D_2 deformation with significant deposition and/or remobilization during D_2 deformation. Minor remobilization of sulphides is also associated with D_4 deformation. The ambiguity associated with the absolute age of D_2 makes it difficult to determine whether the primary gold mineralization is Archean or Proterozoic.

References:

[1] Pehrsson, S., et al., 2000. Extended abstract in GeoCanada 2000, Calgary, AB

YELLOWKNIFE EXTECH 2D GIS DATA COMPILATION

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The objective of the 2D GIS data compilation component of the EXTECH project is to develop of a single comprehensive digital geoscience database for the Yellowknife EXTECH study area that will provide researchers with common, relevant and current information related to their projects. Having a central data repository will allow users to access the data more quickly and easily resulting in more time to do research. Compiling data collected during the project as well as existing data will make it easier for scientists to gain a better understanding of spatial relationships through data integration techniques using all the data. Coordination of all spatial data collection to be included in the GIS database through a single group will help maintain standard data structures and formats.

A GIS database of spatial geoscience data, covering the aerial extents of the Yellowknife Greenstone Belt (YGB), has been built using ArcView GIS. Both historical data and data collected during the course of the project are being compiled. Data layers include regional airborne radiometrics, bedrock geology compiled at 1:100000, surficial geology, mineral deposits, geochemistry, Landsat TM imagery, geochronology and topographic data. Other data will be added as it becomes available. The data has been registered to a common projection and is in industry standard file formats suitable for use in other GIS systems. Meta data is included for each data layer.

Two sub-projects are being carried out as part of the GIS project to facilitate dissemination and use the data by EXTECH participants and researchers interested in the YGB: 1) The data is being compiled and will be released on a CD. The CD will include a data viewer that will allow users to investigate the data without having access to a GIS system. It is expected that the CD will be released by February 2001. 2) An application is also being developed for viewing the data on the WEB using map server technology (ArcIMS). This application will allow users to view, query and overlay different data layers from the EXTECH database on the WEB. This project is expected to be completed by March 31, 2001.

BASEMENT/COVER RELATIONSHIPS, UNCONFORMITIES AND DEPOSITIONAL CYCLES OF THE WOODBURN LAKE GROUP, WESTERN CHURCHILL PROVINCE, NUNAVUT

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The Rae province north of Baker Lake records 150 million years of Neoarchean bimodal volcanism, sedimentation and granitic plutonism within significantly older crust. The oldest known rocks belong to a Mesoarchean basement complex north of Half Way Hills consisting of 2.87 Ga foliated granodiorite which intrudes banded mafic and felsic gneisses of unknown antiquity. Komatiite-mafic volcanic rocks and associated felsic volcanic rocks of the Woodburn Lake (WLg) and Ketyet River (KRg) groups comprise three cycles or an age spectrum of compositionally bimodal magmas erupted from 2.74 to 2.71 Ga. The volcanic rocks are interlayered with iron-formation, volcaniclastic rocks and volcanogenic wackes. At Half Way Hills, mafic volcanic rocks and 2.74 Ga felsic rocks structurally underlie 2.87 Ga foliated granodiorite basement. The contact is a modified unconformity, based on the presence of mafic feeder(?) dykes in basement rock and low strain enclaves in which mafic rock is in contact with strongly foliated granodiorite. North and south of the Meadowbank River, 2.72 and 2.71 Ga felsic volcanic rocks are associated with komatiite flows. The bimodal volcanic suite and the underlying basement rocks support a continental setting with mantle-derived ultramafic-mafic magmatism accompanied by crustal rifting.

The 2.74-2.71 Ga volcanic rocks are unconformably or disconformably overlain by a dominantly sedimentary package which includes orthoquartzite, polymict and oligomict conglomerate, slate and greywacke. Gabbroic sills in orthoquartzite have the composition of tholeiitic basalt. The ages of detrital zircons in the clastic rocks are consistent with input from Mesoarchean basement and Neoarchean volcanic rocks. Minimum depositional ages for clastic rocks have generally been poorly constrained by granitic intrusions to >2.62 Ga, permitting the inference that the clastic rocks, including orthoquartzites, are genetically related to bimodal volcanism in a continental rift setting. This inference is now challenged by new data. South of the Meadowbank River, quartz-Kfeldspar porphyritic tuff is interlayered with quartzite and slate near the top(?) of the quartzite section. The presence of embayed quartz phenocrysts and crystal clasts in clastic rocks adjacent to the tuff supports a depositional relationship between the units. Similar Kfeldspar-quartz porphyritic tuff is interlayered with iron-formation and wackes north of the Meadowbank iron-formation-hosted gold deposit. Samples from both tuffs give indistinguishable U-Pb zircon ages of 2.63 Ga. The data imply that the depositional age of quartzite at Meadowbank River is 2.63 Ga, and that it is part of a separate sedimentary-volcanic package that is ca. 80 m.y. younger than the bimodal komatiite-felsic volcanic suite, and just ca. 5-10 m.y. older than the onset of voluminous granitic plutonism.

The revised stratigraphic relationships could have important implications for the Meadowbank gold deposit. The contact between quartzite/conglomerate and iron-formation/ultramafic rocks intersected in drill core locally resembles an unconformity (or disconformity), and the auriferous iron-formation seemingly belongs to the older bimodal volcanic assemblage. However, the age of the immediate host rocks and the relative significance of syngenetic, structural and metamorphic controls on the mineralization are yet to be established.

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