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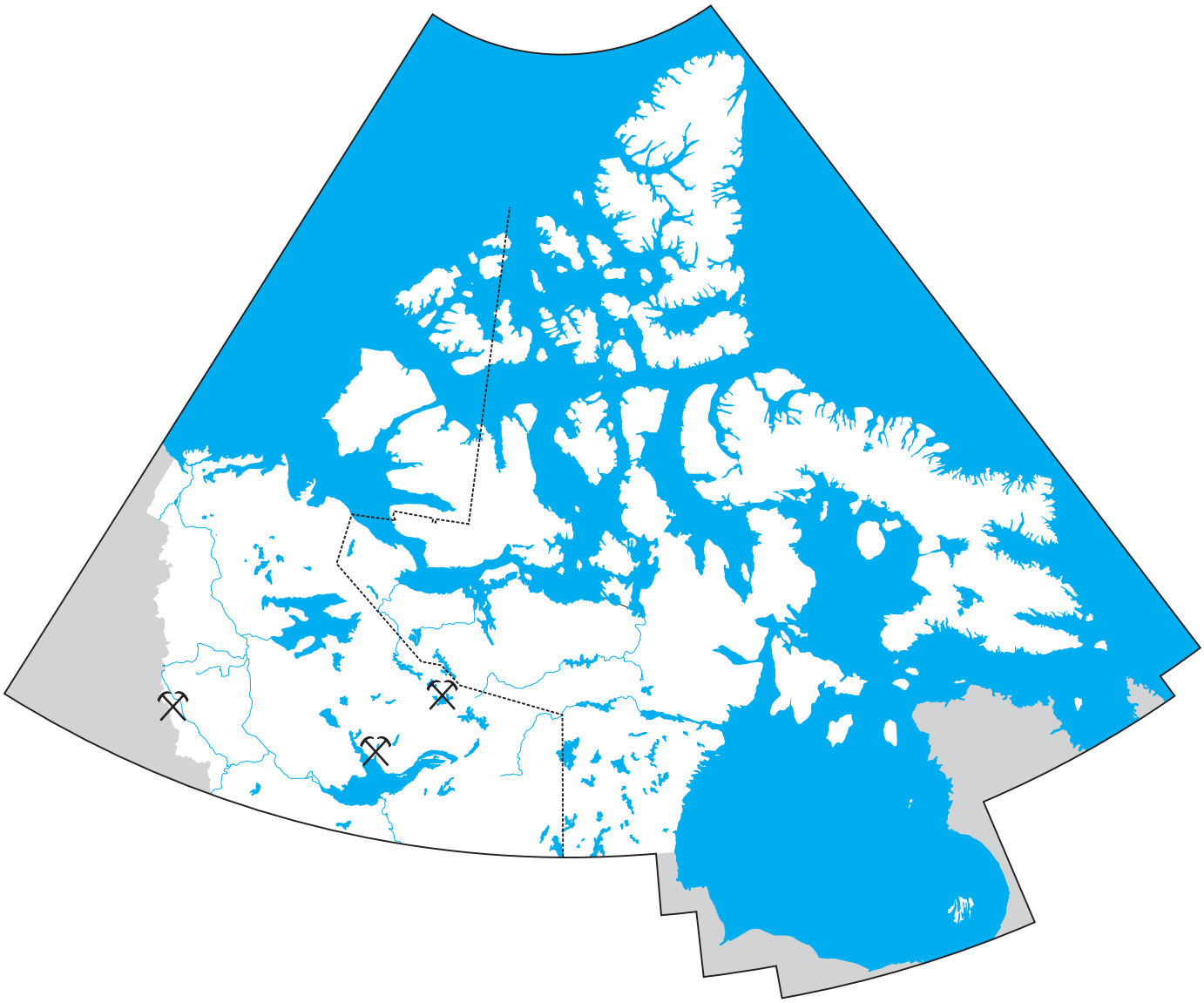

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REGIONAL DISTRIBUTION OF KIMBERLITE INDICATOR MINERALS, SLAVE CRATON, NORTHWEST TERRITORIES AND NUNAVUT, CANADA

Armstrong, J.P.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Since 1991 over 350 kimberlites have been discovered in the Archean Slave Craton (190 000 km^2), northern Canada. Exploration for kimberlites has relied heavily on the application and use of indicator mineral sampling with glacial till the preferred sample medium. Compiled kimberlite indicator mineral (KIM) results, based on exploration programs conducted by industry, may be used to better understand the nature of down-ice dispersion and the relative abundances of the various kimberlite indicator minerals.

Each particular kimberlite field is identifiable by KIM till anomalies that are resolvable on the scale of the Slave Craton. Individual kimberlite clusters and fields shed particular suites of KIMs and the dispersion trains display variable features. On an individual basis, most indicator trains have a pencil rather than a fan-shaped dispersion pattern with down ice dispersion distances up to 80 kilometres or more. The young (47-55 Ma) Lac de Gras field (~ 200 kimberites) hosts volumetrically significant volcaniclastic to re-worked volcaniclastic kimberlite that has shed prodigious quantities of KIMs. Older kimberlite fields are dominated by hypabyssal to diatreme facies kimberlite and are characterized by lower overall abundances of indicator minerals potentially consistent with longer erosional histories.

MINERALOGY OF CALCITE AND CALCITE-DOLOMITE SOLID SOLUTION-BEARING HYPABYSSAL KIMBERLITES FROM THE LAC DE GRAS KIMBERLITE FIELD, CENTRAL SLAVE CRATON, NORTHWEST TERRITORIES, CANADA

Armstrong, J.P.[1], Wilson, M.[2], Barnett, R.L.[3], Nowicki, T.[4], and Kjarsgaard, B.A.[5]
1. C.S. Lord Northern Geoscience Centre, Yellowknife, NT
2. Memorial University, St. Johns, NL
3. RL Barnett Geological Consulting Inc., London, ON
4. Mineral Services, Vancouver, BC
5. Geological Survey of Canada, Ottawa, ON

A suite of eight fresh, Late Cretaceous to Eocene, hypabyssal kimberlites from the Lac de Gras field were studied in order to understand better carbonate paragenesis. Samples studied demonstrate excellent preservation of textures and primary mineralogy and are archetypal of Group 1 kimberlite. Five kimberlite localities are identified as calcite-bearing based on the presence of high Sr-Ba calcite as phenocrysts, microphenocrysts and in segregations. Three kimberlite localities are identified as dolomite-bearing based on the presence of mixed calcite-dolomite segregations containing oscillatory and banded textures of calcite-dolomite solid solution and dolomite (+/- magnesite).

A data set of over 350 microprobe analyses of carbonates and 400 combined analyses of olivine, monticellite, spinel and phlogopite, in conjunction with XRD and detailed petrography form the base for this study. Sr-Ba calcite are characterized by high XCa (>0.95) and are enriched in Sr (4,900 - 11,100 ppm) and Ba (3,200 - 14,200 ppm). The calcite-dolomite and dolomite-magnesite solid solution compositions span the XCa range from 0.42 to 0.95, and typically have Sr and Ba contents of ~ 1,000 - 4,000 ppm. Monticellites have low Fe/(Mg+Fe) ratios that distinguish them from monticellite from hypabyssal intrusions elsewhere in the central Slave. Spinel data shows a trend of decreasing Cr/(Cr+Al) at constant mg#, consistent with Trend 1 spinel. Chemical and petrographic differences are noted for spinel from calcite and calcite-dolomite bearing samples. Phlogopite analyses fall within recognized fields for macrocrystic, phenocrystic and groundmass micas.

The carbonate, silicate and oxide mineral compositions suggest that the origin of the calcite-bearing versus dolomite-bearing kimberlites studied is related to subtle differences in parent magma composition, in particular, the CO_2/H_2O ratio. The formation of the carbonates reflects the latter part of a protracted magmatic crystallization sequence, in which Sr-Ba calcite precipitates from an evolved kimberlite melt. Subsequently, calcite-dolomite solid solution and dolomite are precipitated from localized, Mg-rich carbonate fluids at relatively high temperatures (higher than serpentine stability).

PRELIMINARY EXPLORATION RESULTS FOR INUIT OWNED LANDS OF THE WEST KITIKMEOT

Armstrong, K.A.
Strongbow Resources Inc., Vancouver, BC

In March 2003, Strongbow Resources Inc. and Nunavut Tunngavik Incorporated (NTI) entered into an agreement under which Strongbow may explore more than 600,000 ha of Inuit Owned Lands in 28 non-contiguous parcels within the West Kitikmeot region of Nunavut (the NTI properties). The NTI properties are located within the northern part of the Archean Slave and Proterozoic Bear structural provinces of the Canadian Shield. When initially selecting Inuit Owned Lands as part of the Nunavut Land Claims Agreement, NTI retained a geological consulting firm to assist in the identification of areas considered to be prospective for mineral exploration in both the short and long terms. In particular, their mandate was to select ground with potential for gold and base metal mineralization. As a result, the NTI properties cover prospective greenstone belts and related supracrustal rocks adjacent to 5 gold and 7 base metal deposits. In many cases the local stratigraphy hosting mineralization associated with these deposits extends onto the NTI properties, however most of these areas have seen limited to no exploration over the last 10-20 years.

Strongbow's preliminary work on the NTI properties in 2003 concentrated on a compilation of existing geoscience data, flying fixed wing airborne magnetic surveys, and field investigations. A small summer field program included limited bedrock mapping in the vicinity of two gold showings as well as prospecting and ground verification of other showings in the Anialik,

Napaktulik and central High Lake volcanic belts. The Anialik belt is of particular interest as it is notably underexplored when compared to other volcanic belts in the Slave province (e.g. Yellowknife and Hope Bay volcanic belts). A total of approximately 66 drill holes have been reported in the entire Anialik belt - with the majority (48) testing a single target in the Run Lake area. Over 25 gold and base metal showings are known within the belt, including the Fox gold showing discovered by Strongbow in 2003. The sources of several mineralized boulders discovered by previous workers within the belt have yet to be identified.

In addition to gold and base metals, large parts of the NTI properties are also considered prospective for diamonds, with approximately 18% of the total property area lying within 20km of a known kimberlite. An initial review of public diamond exploration data for the West Kitikmeot region indicates that, although a majority of the NTI properties do not appear to have been subjected to systematic till sampling, several areas do contain distinct kimberlite indicator mineral anomalies. Most prominent of these is located in the centre of parcel CO-44 where a cluster of positive samples extends in a broadly northwest trending fashion, roughly parallel to the regional ice direction, and includes individual samples reportedly containing up to 150 kimberlite indicator mineral grains. One hundred and two till samples were collected from CO-44 in 2003 in an effort to better define this mineral train. An additional 147 samples were collected from other parcels in the NTI properties to test for kimberlite indicator minerals.

ORIGIN OF DIABASE DYKES IN THE GERMAINE LAKE AREA, NWT

Atkinson, B.R., Heaman, L.M., and Chacko, T.
Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB

As part of a B.Sc. thesis project, samples from twenty diabase dykes were collected in the vicinity of Germaine Lake, southwestern Slave Province, NWT. Preliminary assessment of these dykes based largely on orientations has yielded four main groups of interest. Group I consists of six dykes, five of which range in orientation from 030° to 045°, similar to the 2.23Ga Malley dyke trend in the central Slave. A sixth member of this group, has a variable orientation along strike of 020° to 060°, although the overall orientation is 030°. Group II consists of six dykes, with an orientation range of 150° to 170°. This orientation is characteristic of the 1.27Ga Mackenzie dyke swarm, although previous dyke compilations do not indicate the presence of Mackenzie dykes in this region. The three members of Group III have a consistent 020 trend, which is characteristic of the 2.030-2.033Ga Lac de Gras dykes of the central Slave and Indin dykes in this region. The two samples of Group IV both have a 060° trend. There is the possibility of other dyke trends (120° and 095°) in the area but at present there is only one dyke from each of these orientations. Initial petrographic work shows varying degrees of alteration, from samples with relatively fresh clinopyroxene and olivine (020° orientation), to complete replacement of the clinopyroxene by chlorite +/- amphibole and sericite alteration of the plagioclase (samples of 160° orientation). A section of a 095° dyke was also extremely altered, but showed a unique characteristic of abundant small equigranular oxide crystals distributed uniformly throughout the section and corresponds to magnetic dykes in the field, as opposed to large aggregates of oxides seen in the other sections studied to date. In the less altered samples

ophitic texture between the clinopyroxene and plagioclase is common. Samples of the chill margins of four dykes from Groups I and II were collected in the hopes of determining primary chemical compositions of the dyke magmas. An interesting section across the contact with the monzogranite country rock of sample BA241A (030° trend), shows nicely preserved flow texture defined by the alignment of plagioclase and rare clinopyroxene microphenocrysts in a glassy matrix, the orientation of this section indicates that the flow was likely vertical. An important finding of the initial petrographic work was the identification of baddeleyite grains in at least four of the dykes. These grains were recognized using backscatter electron imaging on the electron microprobe. Future research on these dykes will involve comprehensive petrographic work, mineral chemistry, whole rock geochemistry, and U-Th-Pb chemical age dating with the hopes of elucidating the Proterozoic mafic magmatic history in this part of the Slave Province.

THE LITTLE NAHANNI PEGMATITE GROUP - WHAT CAN IT TELL US?

Barnes, E.M.[1], Groat, L.A.[1], Kontak, D.J.[2], Marshall, D.[3], and Falck, H.[4]
1. University of British Columbia, Vancouver, BC
2. Nova Scotia Department of Natural Resources
3. Simon Fraser University
4. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Recent observations of the textural and mineralogical variations found in the Little Nahanni Pegmatite Group, Northwest Territories, suggest that data from this well-exposed system could make a significant contribution towards understanding pegmatite formation.

This laterally extensive, rare-element pegmatite dyke swarm covers 5 x 11 km, and provides up to 300 m of vertical pegmatite exposure, as it cuts a cirqued ridge above tree-line (~1500 m). This exceptional exposure adds a three-dimensional aspect to the study, rarely encountered on this scale, providing an excellent opportunity to study the environment of pegmatite formation. The dykes show textural discontinuity, commonly restricted to the decimetre to metre-scale, of classic pegmatitic textures (line-rock, comb layering etc), suggesting a dynamic environment, presumably reflecting pressure variations during initial dyke formation.

Observations from one dyke with considerable vertical exposure, underline the potential for studying fluid/melt evolution. At low elevations (at the base of a cirque) the dyke contains spodumene, lepidolite, muscovite, potassium feldspar, quartz, albite, garnet, tourmaline, Nb-Ta oxides, fluorite and phosphate minerals, while at 300 m higher elevation the dyke shows a decreased mineralogical diversity, with only rare garnet, fluorite and phosphate minerals, and a higher abundance of quartz. Miarolitic cavities are also in evidence at higher elevations, commonly displaying bladed calcite. Whether the bladed calcite is associated with a proximal system of quartz veins and country rock brecciation, will be investigated.

Initial work for this study will combine detailed petrographic studies (including analysis by cathodoluminescence) with fluid inclusion and isotopic analysis to investigate the formation and

fluid evolution of the LNPG. In addition, mapping and sampling for geochemical and geochronological analyses will assist in the regional tectonic and magmatic study.

MAPPING LOWER CRUSTAL AGE DOMAINS UTILIZING LAM ICP-MS U-PB DATING OF INHERITED ZIRCONS: A NEW DIAMOND EXPLORATION TOOL?

Bennett, V.[1], Jackson, V.[2], Rivers, T.[1], Tubrett, M.[1], and Relf, C.[2]
1. Department of Earth Sciences, Memorial University of Newfoundland, St Johns, NL
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

U-Pb age dating by laser ablation microprobe inductively coupled plasma mass spectrometry (LAM ICP-MS) has advanced rapidly over the past decade from a reconnaissance tool to a versatile, high spatial resolution, high precision age-dating technique. Correspondingly, the scope of applications has considerably broadened. Initial applications of the LAM ICP-MS U-Pb dating technique were limited to measuring $^{207}Pb/^{206}Pb$ ages of detrital zircon populations. More recent developments, however, have made the determination of precise crystallization and metamorphic $^{207}Pb/^{206}Pb$, $^{206}Pb/^{238}U$ and $^{207}Pb/^{235}U$ zircon ages, either from separates or *in situ* in thin section, a cost-effective and routine analytical procedure. Perhaps the most significant advance has been the increase in spatial resolution of the laser, such that a volume approximately 5-10 μm wide, 100 μm long and 8-12 μm in depth can be analyzed with relative ease. Spatial resolution of this order enables zircon inheritance to be documented.

Here we present the results of an inherited zircon study of metaluminous magmas that were generated from late Archean lower crust below the Snare River Terrane (SRT), southwestern Slave Province. Specifically, we have documented three main stages of lower crustal evolution from inherited zircon populations within metaluminous magmas that involve: (i) formation of a *'temporally homogeneous'* lower crust (ca. 2674 Ma); (ii) development of a *heterogeneous* lower crust comprised of multiple age components due to protracted magmatism and deformation from ca. 2674 to 2600 Ma; and (iii) loss of several inherited lower crustal zircon components as a result of post-orogenic collapse from ca. 2600 to 2585 Ma.

This study clearly demonstrates the ability of the LAM ICP-MS technique to image lower crustal age domains with high precision, which, in this case, has resulted in a robust reconstruction of the tectonomagmatic evolution of the SRT. Such a technique has potential for applications in regional reconnaissance, particularly in geological provinces where the ages of lower crustal magma source regions are poorly constrained. One such province is the Paleoproterozoic Bear Province, adjacent to the Slave Craton, where magmatic rocks are widespread. In the absence of deep seismic reflection data, a fundamental question with respect to the crustal architecture of the Province involves determining the extent of Archean basement below the Proterozoic rocks. If the presence of Archean basement could be demonstrated through the systematic study of inherited zircons, this would provide a first-order constraint on the crustal architecture, which would have significant implications for diamond exploration in the region. In light of the recent discoveries of alluvial diamonds along the Mackenzie Valley drainages, north of Norman Wells, the question of the source region is now paramount. Were they sourced from diamondiferous

kimberlites in the Slave Province or does the Bear Province also have an Archean basement which might render it prospective for diamond-bearing kimberlites?

BEAUFORT SEA SEABED GEOENVIRONMENTAL AND GEOTECHNICAL RESEARCH RELATED TO OFFSHORE HYDROCARBON DEVELOPMENT

Blasco, S.
Geological Survey of Canada Atlantic, Bedford Institute of Oceanography, Dartmouth, NS

The Geological Survey of Canada is conducting a seabed geology research program to investigate environmental and geotechnical issues related to renewed interest in offshore hydrocarbon exploration and transportation in the Beaufort Sea. The research is being conducted in collaboration with the Canadian Hydrographic Service, the Department of Fisheries and Oceans Freshwater Institute, Devon Canada, the Monterey Bay Aquarium Research Institute, the Canadian Museum of Nature and the Inuvialuit Joint Secretariat. New multibeam sonar technology is being used to generate digital georeferenced maps of the seabed to study seabed ice scouring by sea-ice pressure ridge keels, benthic ecosystems, gas seeps, subsea pingo-like-features and abandoned artificial islands. Seabed subbottom profile data and sediment samples are being acquired to characterize the physical and engineering properties of surficial marine clays. These data can be used for seabed foundation stability assessment, seabed classification for benthic habitat mapping and to ground-truth multibeam base maps. Borehole and seismic data collected in the 1970-80's are being analyzed and re-interpreted to determine the origin and engineering implications of subsea ice-bearing permafrost.

Initial results are yielding new insights into geological processes active on the seabed. Extreme ice scours as deep as 3.8m and up to 654m wide have occurred over the past 13 years. An extreme 42m deep ice keel cut a 1m deep scour into the seabed in 41m of water. Multibeam base maps clearly define the detailed topography of the seabed and allow for the classification of the seabed for more focused biological sampling and the discrimination of benthic habitats for marine protected area assessments. Actively venting gas seeps were mapped at two separate locations on the shelf. Geochemical sample analyses revealed the observed escaping gas was almost pure methane. Seabed features described historically as submarine pingos are much larger than their terrestrial counterparts and are probably mud volcanoes. Almost pure methane gas has also been observed actively venting from these features. Waves, currents and sea ice have eroded abandoned exploration drilling islands constructed in the 1970's and 80's. Island elevations have been reduced from above sea surface to several metres below and island shape has changed from circular to an elongated morphology over the past 15-25 years. The abandoned artificial islands are now hazards to navigation, could be re-occupied and may be potential sources of granular materials in the future. Marine clays that compose the seabed have been significantly reworked by the action of ice keels over geological time to depths of 1 to 3 m. This reworking process may alter their engineering properties and affect their performance as a foundation material. Ice-bearing sediments that exist to depths of 700m below seabed were generated by the cyclic accumulation of glaciofluvial outwash deposited in terrestrially dominated environments with successive glaciations over time.

A PRECISE AGE FOR THE DUCK LAKE SILL AND ITS RELEVANCE FOR FITTING THE SLAVE IN A GLOBAL ARCHEAN CONTEXT

Bleeker, W.[1] and Kamo, S.[2]
1. Geological Survey of Canada, Continental Geoscience Division, Ottawa, ON
2. Jack Satterly Geochronology Laboratory, Department of Geology, University of Toronto, Toronto, ON

The Duck Lake Intrusive Sheet (Gibbins, 1987), or "Duck Lake sill", is a prominent, shallow-dipping, mafic intrusion in folded Burwash Formation strata to the east of Yellowknife Bay. It can be followed from the Yellowknife River to Duck Lake, in places forming a prominent west-facing escarpment. Similar mafic intrusive rocks may extend further south to Ruth Island. Crude columnar jointing and a weak parting in basal mafic-ultramafic rocks, as well as the dip of the upper contact, indicate that the sill is dipping shallowly to the east at about 05° to 35°.

The outcrop location of the sill along the Ingraham Trail and its moderate easterly dip suggest that the intrusion can be projected into the subsurface as the "Y1" bright reflector on the SNORCLE seismic reflection profile (Cook et al., 1999). Indeed, impedance contrasts between the gabbroic rocks of the sill and surrounding metaturbidites are among the highest measured between rock units along the SNORCLE profile. The "Y1" reflector corresponds to a positive seismic velocity anomaly (D. Snyer, pers. comm.), further strengthening correlation with the Duck Lake sill rather than with a putative shallow dipping fault for which there is no independent evidence (cf. Cook et al., 1999). This case study prompts the question whether some other bright reflections on the SNORCLE profile may also represent mafic intrusions.

The sill is differentiated with a melanocratic gabbro base and a leucogabbro upper zone (see also Gibbins, 1987, and references therein). Interstitial quartz is present in the leucogabbro along the upper contact of the sill and is also present in fine-grained granophyric intergrowths between larger pyroxene and plagioclase crystals. Abundant brown baddeleyite and lesser amounts of skeletal zircon were recovered from this coarse-grained leucogabbro near the upper contact of the sill.

Two zircon and four baddeleyite single crystals were analyzed. A best-fit line through all the data points yields an upper intercept age of 2186+4/-2 Ma (probability of fit: 2%). This age suggests a temporal relationship with the ca. 2188 Ma Dogrib dyke swarm (Lecheminant et al., 1997). However, a closer inspection of the data suggests that the Duck Lake sill may be somewhat younger and that its age is best estimated by the weighted mean $^{207}Pb/^{206}Pb$ age of the five, near-concordant data points (4 baddeleyites and 1 zircon) at 2181$\pm$2 Ma (MSWD: 3.4). The latter age estimate includes two abraded, concordant, baddeleyite analyses with a weighted mean age 2180.0$\pm$1.1 (MSWD: 0.35).

The preferred age of the Duck Lake sill (2181$\pm$2 Ma) is similar to, or indistinguishable from, the age of several alkaline complexes in the southwestern Slave, e.g. at Blatchford Lake, Big Spruce Lake, and Squalus Lake. The Squalus Lake intrusion, in particular, has been dated at 2181$\pm$2 Ma (M. Villeneuve, unpubl. Data). The 2181$\pm$2 Ma Duck Lake sill, the somewhat older ca. 2188 Ma Dogrib dyke swarm, and the alkaline complexes probably relate to the progressive break-out of

the Slave craton from its parental landmass, the late Archean Sclavia supercraton (Bleeker, 2003). In general, multiple precisely-dated mafic dyke swarms and short-lived magmatic events provide a "bar code" (i.e., in the sense of a time line punctuated by precisely-dated events) that characterize fragments of ancient crust such as the Slave craton (e.g., Bleeker, 2003). Establishing such "bar codes" for each of the ca. 35 cratonic fragments around the globe, combined with high-precision paleomagnetic data, is the most efficient way to identify correlations among the preserved Archean cratons.

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THE INCREASING PROFITABILITY OF GOLD PROJECTS IN THE NORTHWEST TERRITORIES - THERE'S MONEY TO BE MADE OUT THERE

Bullen, W. and Zhang, J.
Minerals, Oil & Gas, Department of Resources, Wildlife and Economic Development,
Government of the Northwest Territories, Yellowknife, NT

Exploration expenditures on gold projects in the Northwest Territories (NWT) decreased from around $30 million annually in 1997 and 1998 to around $1.5 million in 2001 and 2002. Economic models of gold projects, based on past and current producers in the NWT, indicate that the viability of gold projects in the territories decreased steadily from 1997 to 2001, becoming uneconomic for the first time in 1999 (assuming a threshold internal rate of return of 15%). Over the last two years, however, the economics of the model gold project improved significantly, with the project becoming viable in 2002, and even more so in 2003.

For example, in 1997 the gold project had a net present value (NPV) and internal rate of return (IRR) of $104 million and 18.5% respectively. The economic criteria decreased to $47 million and 12.8% respectively in 2001. However, the figures increased to $91 million and 16.6% in 2002. Significantly, the NPV and IRR of the model gold project in 2003 closely approximate those of the model gold project in 1997, when exploration expenditures were in the $10's of millions.

The economic viability of gold projects in the NWT is affected primarily by two factors, assuming fixed costs, namely the gold price in US dollars and the exchange rate. Between 1997 and 2001, the gold price decreased from an average of $US330 per ounce to $US270 per ounce. Over the same period, the Canadian dollar weakened against the US dollar but to a lesser extent,

causing the model gold project to slip below the economic threshold. In mid-2001, however, the gold price began improving while the Canadian dollar continued to fall resulting, in 2002, in a marked improvement in the economics of the gold project. The economics continued to improve into 2003 as the gold price strengthened more rapidly than the Canadian dollar.

Recent projections suggest that the US dollar is still overvalued relative to other major currencies, particularly the Euro, and that further weakening can be expected. The gold price in US dollars is, therefore, likely to retain its current strength or even increase. If trends over the last two years are maintained, changes in the $US/$Cdn exchange rate will not totally offset increases in the gold price. For this reason, new gold projects in the NWT will likely remain economically robust into the foreseeable future.

The current low expenditure on gold exploration in the NWT has serious implications for the future of gold mining in the territory. The question that needs to be asked, particularly given the results of the recent modeling work, is why are current expenditures so low. Possible reasons include:
The perception that gold is overvalued, particularly in relation to the $US/$Cdn exchange rate.
The potentially greater returns from diamond projects.
A lack of awareness of the economics of gold projects in the NWT.

GRANITES OF THE WECHO RIVER AREA: A PRELIMINARY PETROLOGIC STUDY

Buse, S.[1], Cousens, B.[1], and Ootes, L.[2]
1. Ottawa-Carleton Geoscience Centre, Carleton University, Ottawa, ON
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The Wecho River area is located approximately 100 kilometres north of Yellowknife, NT, and is underlain by numerous granitoid rocks. This study (part of an M.Sc. project by S.B.) is aimed at defining the age and geochemical characteristics of the granitic suites in the study area. Samples collected in the 2003 field season will be used for major-, trace-element, and isotope geochemistry in order to better constrain the origin, petrogenesis, and tectonic evolution of the Wecho River area. In this contribution, we are presenting results from mapping along with a preliminary petrographic investigation.

Three granitic suites, that are primarily I-type granites to granodiorites, were identified during the 2003 field season. The youngest suite is a K-feldspar phenocrystic granite that occurs throughout the map area. The Carlsbad-twinned phenocrysts are from 1 to 4 centimetres long and 0.25 to 1.5 centimetres wide. Generally, the phenocrysts are randomly oriented, but locally they are aligned and together with biotite, form a weak foliation. The groundmass is composed of euhedral to subhedral biotite + plagioclase + quartz + K-feldspar ± muscovite ± magnetite. This granite contains rare mafic and granodioritic enclaves. Locally, an equigranular, muscovite-bearing granite is spatially, but perhaps not genetically, associated with the K-feldspar phenocrystic granite.

The second suite is an equigranular, medium-grained granodiorite that is locally magnetic and contains fine-grained, magnetite-bearing amphibolite enclaves and aggregates, or knots, of biotite. The groundmass is composed of anhedral to subhedral plagioclase + quartz + K-feldspar + biotite. The granodiorite has a moderate to strong foliation that is defined by biotite and flattened quartz.

Mafic enclaves, which occur within the 'second suite', were also sampled at several locations for geochemical analysis. The enclaves range in size from several centimetres to tens of metres and are commonly massive, although a few examples contain minor layering. They are composed of fine-grained hornblende + biotite + plagioclase + magnetite.

The third granitoid suite is also an equigranular granodiorite, but quartzofeldspathic minerals are generally subhedral to euhedral. Biotite defines a weak foliation in this granodiorite, but it is less abundant than in the 'second suite' granodiorite. The granodiorite contains few enclaves, and these are amphibolite (volcanic derived?) and metasedimentary rocks.

To compliment the Wecho River area study, two granitoid samples were collected for geochemistry and geochronology from east of the Wecho area, near the Nardin Lake complex. The first of these samples is a strongly deformed granodiorite to tonalite gneiss with abundant biotite, flattened quartz, and mafic enclaves. Highly deformed mafic dykes transect this gneiss, indicating it may be part of the Central Slave Basement Complex. The second of these samples is a weakly magnetic, moderately foliated, equigranular granodiorite that locally contains hornblende and is physically similar to the 'second suite' in the Wecho River area (see above) as well as the Defeat Plutonic Suite at Yellowknife.

COMPARISON BETWEEN SELECTIVE EXTRACTION, CONVENTIONAL TILL AND HUMUS GEOCHEMICAL SURVEYS OVER KNOWN MINERALIZATION AT MELIADINE AND HOPE BAY

Carpenter, R.[1] and Sherlock, R.[2]
1. Indian and Northern Affairs Canada, Iqaluit, NU
2. Canada-Nunavut Geoscience Office, Iqaluit, NU

Selective extraction geochemical methods (i.e. MMI-B and TerraSol) provide an effective exploration tool in covered areas and their usefulness has been demonstrated for a number of mineral deposit types in various terrains. However, the effectiveness of these techniques in permafrost or barrenland regions is unknown. This study gives the results of an orientation survey using different sampling media and analytical technique over four known lode-gold deposits in Quaternary glaciated and permafrost-dominated terranes of Nunavut; Hope Bay (Doris and Naartok deposits) and West Meliadine (F-Zone and Tiriganiaq deposits).

MMI-B and TerraSol selective extraction techniques were used as well as conventional INAA analyses of till and humus. Sampling techniques were followed according to laboratory instructions. For example, TerraSol samples were collected from the most consistent material

available and were placed in cloth or poly-weave sample bags as per recommendations by Activation Laboratories. In contrast, MMI-B samples were collected in Ziploc bags at consistent depth, usually 15-20 centimetres and sent to XRAL Laboratories. INAA and humus samples were analysed by Activation Laboratories. All four geochemical techniques were employed at each sample site. In all cases the mineralized zones were covered by several metres of glacial till (Meliadine) or marine clay (Hope Bay).

Orientation lines were directed perpendicular to the strike of gold mineralization. In order to ensure sufficient background material was collected, total line length varied from 565 to 675 metres. Sample separation ranged from 10 to 50 metres and the closest spaced sampling occurred directly over known mineralization. The width of mineralization ranges from a few metres up to 20 metres and typical drill intersections have >10.0 g/t Au over these widths.

No detectable gold anomalies were observed in MMI-B, TerraSol or till samples from either of the gold deposits at Hope Bay, however single point humus anomalies are spatially associated with both Naartok and Doris. In contrast, results at West Meliadine are more complex. For example, at Tiriganiaq, glacial dispersion is evident in the till data and gold anomalies terminate up-ice of mineralization. TerraSol data mimics these results, but no MMI-B gold anomalies were observed. A speculative humus gold anomaly also occurs above Tiriganiaq. All four geochemical techniques detected the F-Zone orebody, yielding significant gold anomalies directly above mineralization. Complete results including trace element results in spreadsheet form are available from the Mineral Resources Directorate of Indian and Northern Affairs Canada in Iqaluit.

GOLD DEPOSITS IN THE DORIS NORTH AREA, HOPE BAY VOLCANIC BELT, NUNAVUT

Carpenter, R.[1], Quang, C[1], Sherlock, R.[2], Kleespies, P.[3], and McLeod, R.[3]

1. Indian and Northern Affairs Canada, Iqaluit, NU
2. Canada-Nunavut Geoscience Office, Iqaluit, NU
3. Miramar Mining Corp, Vancouver, BC

Significant discoveries of gold mineralization have been made in the Hope Bay volcanic belt over the past decade, including the Boston, Doris and Madrid group of deposits. The Doris North area has been a focus of recent exploration activity and is currently undergoing a feasibility study conducted by owner Miramar Mining Corp. An updated resource calculation for the Doris North area is 458,200 tonnes grading 22.0 g/t Au, yielding a total indicated and inferred resource of 323,900 ounces of gold (Miramar Mining Corp, press release, September 10, 2002). Infill drilling at Doris North has provided an excellent opportunity to study critical deposit-scale features that are important to mine development and exploration.

Gold mineralization at Doris North is associated with quartz veins accompanied by variably thick hydrothermal alteration envelopes. Three approximately north-south trending and near vertically dipping, gold-bearing quartz vein systems are known in the Doris North area. From

west to east these zones are: West Valley Wall veins, Central vein and Lakeshore vein. The relatively flat-lying and shallowly north-plunging Hinge Zone occurs where the Lakeshore and Central veins merge, resulting in a shallowly north-plunging "fish-hook" geometry. The West Valley Wall zone mineralization is hosted by strongly magnetic massive basalt, and is associated with a series of narrow (<30 centimetre) and discontinuous quartz veins clustered over 1-2 metres width. The Central vein is 70 metres east of the West Valley Wall veins at the westerly contact between vesicular-amygdaloidal basalt and gabbro. Surface exposures of the Central vein consist of a main 30 centimetre-wide north-south striking, vertically dipping quartz vein directly at the basalt and gabbro contact. The Lakeshore vein is 30 metres east of the Central vein, outcropping on the northwest shore of Doris Lake at the westerly contact between gabbro and amygdaloidal Fe tholeiite pillow basalt. This steeply west-dipping vein averages 4-5 metres in width and locally approaches 8 metres.

Gold mineralization is accompanied by pervasive hydrothermal alteration of basaltic and gabbroic wall rocks. Alteration zones flank quartz vein systems and alteration intensity decreases away from mineralized zones. In general, alteration intensity and quartz vein density correlate. Alteration assemblages are quartz, sericite, paragonite, iron-carbonate and pyrite, proximal to quartz veining and chlorite, calcite distal to quartz veins.

GEOLOGY OF THE INUK GOLD OCCURRENCE, COMMITTEE BAY GREENSTONE BELT, NUNAVUT

Carpenter, R.[1], McDonald, D.[2], L'Heureux, R.[3], and Turner, A.[3]
1. Indian and Northern Affairs Canada, Iqaluit, NU
2. Committee Bay Resources Ltd, Vancouver, BC
3. Apex Geoscience Ltd, Edmonton, AB

The Inuk gold occurrence is a banded-iron-formation (BIF) hosted gold deposit located in the northeast portion of the Committee Bay greenstone belt. This several kilometre wide belt extends for several hundred kilometres is comprised of greenschist to amphibolite facies ultramafic to mafic volcanic rocks inter-bedded with BIF, greywacke and quartzite. Some significant drill intercepts at Inuk are 16.04 g/t Au over 12.60m, which includes a 1.50m interval grading 69.20 g/t Au (Committee Bay Resources press release September 2nd, 2003).

Gold mineralization is associated with silicate and sulphide alteration minerals that overprint BIF host rocks. Least altered oxide facies BIF is comprised of alternating mm to cm bands of magnetite and chert. On outcrop and drill core surfaces, chert is normally pale white in colour, in contrast, hydrothermally altered chert (silicification / recrystallization) has a glassy grey to black colour. BIF sequences can be several tens of metres thick and are variably folded, ranging from metre scale open folds to tight, near isoclinal folds normally parallel to the axial plane of the Inuk fold structure. Despite the well-preserved nature of the BIF's no conclusive evidence for sedimentary structures were observed.

Progressive hydrothermal alteration of oxide facies BIF is indicated by replacement of original magnetite bands by grunerite and actinolite. Extensively altered BIF portions show near complete silicate replacement. Subsequent sulphidation of these silicate-rich layers by pyrrhotite, pyrite and minor arsenopyrite is associated with the main phase of gold mineralization. For the most part, gold and associated alteration minerals occur as variably thick, vertical and near horizontal "haloes" related to axial planar shears within the Inuk fold structure. Silicate-rich hornfelsed BIF marginal to monzonite intrusive bodies can also act as favourable hosts for sulphidation processes.

UPDATE ON THE NWT BIODIVERSITY ACTION PLAN

Carrière, S.
Wildlife and Fisheries, Department of Resources, Wildlife and Economic Development, Yellowknife, NT

In November 1995, Cabinet approved the Canadian Biodiversity Strategy, which was ratified and signed by the then Minister of Renewable Resources. Upon signing, the Government of the NWT agreed to make every effort to implement the Strategy in the NWT, in particular by preparing a Biodiversity Action Plan.

Starting in 2002, the Department of Resources, Wildlife and Economic Development (RWED) prepared to report on biodiversity-related actions in a way that reflected what all people and organizations are doing within the NWT, not just what government was doing. RWED sent open invitations to governments, organizations, and groups that might be interested in being part of a NWT Biodiversity Team. So far, the following are members of the Team: Aurora College, Canadian Parks and Wilderness Society, Environment Canada, Dene Nation, Department of Fisheries and Oceans, Ducks Unlimited Canada, Forest Management, RWED, Gwich'in Renewable Resource Board, Indian and Northern Affairs Canada, Parks and Protected Areas, RWED, Parks Canada, Western Field Unit, Parks Canada, Nahanni National Park, Sahtu Renewable Resources Board, Wildlife and Fisheries, RWED, Wildlife Management Advisory Council (NWT), World Wildlife Fund, and Department of Transportation, GNWT (observer), Canadian Museum of Nature (observer), Con Mine (observer). Participation in the NWT Biodiversity Team always remains open.

The NWT Biodiversity Action Plan aims to review each goal of the Canadian Biodiversity Strategy from the context of NWT, to list current activities and to plan for the future.

The Biodiversity Team would like to provide an update on their efforts. The Team will soon produce an Internet-based searchable list of NWT-based activities and initiatives that are related to biodiversity. That list can be used to quickly find and compare what we are already accomplishing to what the priorities may be over the next few years. The Team will also publish this list in a printed report to be released this winter. More updates can be found at: www.nwtwildlife.rwed.gov.nt.ca/Biodiversity/biodiversity_action_plan.htm.

ENHANCED NATURAL DEGRADATION OF CYANIDE AND RELATED COMPOUNDS IN AN ABANDONED TAILINGS LAKE USING MONO-AMMONIUM PHOSPHATE (MAP)

Chapman J.[1], Coedy W.[2], Mudder T.[3], Botz M.[4], and Melo O.[5]
1. SRK Consulting Inc., Vancouver, BC
2. Colomac Site Remediation, Contaminated Sites Office/ DIAND, Yellowknife, NT
3. Times Ltd., Sheridan, Wyoming
4. Elbow Creek Engineering Inc., Joliet, Montana
5. Contaminated Sites, Yellowknife, NT

Gold was recovered at the Colomac Mine, located about 220 km northeast of Yellowknife NT, from an open pit mine using conventional cyanide vat leaching and carbon adsorption. Since the tailings containment area (TCA) had been permitted as a zero discharge facility, water treatment with cyanide destruction was not implemented during operations. At cessation of operations, elevated concentrations of cyanide, metals, and other compounds remained in both the tailings porewater and the Tailings Lake. This abandoned site has been under care and maintenance, managed by the Department of Indian Affairs and Northern Development (DIAND) since 1999, while a remediation plan is being developed and implemented. During this period, natural degradation of cyanide, the related compounds of ammonia, nitrate, and thiocyanate, and metals has been observed to occur within the Tailings Lake. Laboratory testing indicated the natural biological processes and populations within the tailings lake were nutrient limited and could be enhanced through the addition of phosphate. During the spring of 2002 granular Mono-ammonium Phosphate (MAP) was distributed on the ice surface. The MAP, added to achieve a target phosphorus concentration of 1 mg/L as P, was transported to site in solid form over the temporary winter road. The lake chemistry and biological processes were monitored regularly throughout the summer to assess the effect of nutrient addition on natural degradation of cyanide and related compounds. Over the summer months of 2002, dramatic reductions in cyanide and the related compounds of ammonia, nitrate, and thiocyanate and some metals were noted.

Another application of MAP was added to the ice in May 2003 to increase the residual phosphate concentration and further enhance removal of ammonia.

In this paper, the logistical aspects of MAP addition to the tailings lake and the water quality monitoring program are discussed as well as the fate of the compounds of concern, including the mechanisms of removal and reaction kinetics.

THE LENA WEST PROJECT: AN UPDATE

Clarke, D.
Diamondex Resources, Vancouver, BC

The Lena West Project area is comprised of 139 Prospecting Permits encompassing 6.15 million acres of diamond prospective territory, centred approximately 200 kilometres southeast of Inuvik

and 300 kilometres north of Norman Wells. Diamondex applied for these permits following a reconnaissance stream sediment-sampling program conducted in August and September of 2002 returned anomalous and wide spread kimberlite indicator mineral concentrations.

The 2002 sampling program was designed to test theories concerning the potential for the region to host diamondiferous kimberlites, based on observations made by the Company's consultant and technical advisor, Dr. Nikolai Pokhilenko. Dr. Pokhilenko proposed that the Phanerozoic and Proterozoic sediments of this part of the Interior Platform are underlain by an Archon of similar aerial extent as the Slave Structural Province. Based on his interpretation of Late Paleocene and Pliocene river drainage and Quaternary ice movement from this region, Dr. Pokhilenko speculated that kimberlitic indicator minerals recovered from this area would be largely of local provenance. As such, the region's potential for hosting primary diamond deposits would be confirmed through the recovery of mantle root kimberlite indicator mineral (KIM) chemistries. Over a two-week period in August and September of 2002, widely spaced heavy mineral concentrate (HMC) samples from the area's streams (sample density less than 1 per 1,000 km^2) yielded significant amounts of pyrope garnet, picroilmenite, and to a lesser extent, chromite. The distribution, morphology and chemistry of the recovered indicator minerals hinted at the discovery of a new kimberlite province, which itself may contain several kimberlite clusters.

The primary goals of the 2003 Lena West exploration program were to confirm the presence of superior KIM chemistry and locate their potentially diamondiferous sources. In all, 1,053 stream samples were collected within and around the Lena West prospecting permits. In addition, Fugro was contracted to fly a total of 63,800 line kilometers of horizontal gradient magnetic survey over the northern and central portion of the permits. The remaining area of the permits will be surveyed early in 2004 using the same line-spacing of 300 m. The majority of the HMC samples were collected by three separate crews, which used rafts to float down the individual river drainages, panning samples at suitable trap sites. A great advantage of being able to pan the concentrates at the collection sites was the immediate recognition of anomalous KIM concentrations. When positive samples were located, a helicopter supported sampling crew would follow-up the immediate area with a more concentrated sampling of the area's tributaries.

Highlights from this past season include the collection of relatively large purple pyrope garnets (up to 3 mm) and the recovery of two diamonds with their longest dimensions measuring 0.6 and 0.8 mm.

Picking of the HMC for KIM continues as does the processing of the airborne data set. Prior to the second quarter of 2004, it is expected that all the important indicator minerals will be microprobed and their morphologies characterized. This will work will help Diamondex's explorationists link the best KIM chemistry with the highest priority geophysical targets. While the work conducted in the Lena West area must still be considered to be in the early reconnaissance stage, the Company is hopeful that promising drill targets will be tested in 2004.

PLUTONIC AND PORPHYRY ENVIRONMENTS OF LODE GOLD MINERALIZATION IN THE EASTERN KAMINAK GREENSTONE BELT, WHALE COVE AREA, NUNAVUT

Cormier, J.[1], Johnson, W.[2], and Duke, N.[1]
1. Department of Earth Sciences, University of Western Ontario, London, ON
2. Nunavut Tunngavik Incorporated, Cambridge Bay, NU

The eastern extremity of the Kaminak Greenstone Belt bordering on Hudson Bay is best known for its widespread lode gold occurrences. These prospects range in setting from deep belt-marginal plutonic amphibolite facies conditions to shallow greenschist facies porphyry environments preserved in the belt core. Gold prospects are noticeably absent in bordering gneissic terranes, confirming that crustal depth was an important control on their genesis. The best lode gold potential relates to quartz vein systems occurring along extensive syn-intrusion shear systems focused at the regional amphibolite to greenschist transition and on the high-level porphyry intrusive centers.

The regional amphibolite to greenschist transition tracks from the north terminus of Mistake Bay through the Whale Cove Airport to bisect Pork Peninsula. The numerous gold prospects west of Mistake Bay and on Pork Peninsula are prime examples of gold concentration along this metamorphic front. West of Mistake Bay, a major anastomosing carbonated shear system with limited quartz veining separates southerly amphibolite facies volcanics rimming the Tavanni granite stock from a northerly greenschist panel of mixed variolitic flows, flow breccia, and volcanoclastics - all intruded by small porphyry plugs. Volcanic stratigraphy on Pork Peninsula includes a basal amphibolite facies pillow basalt-gabbro sill-interflow iron formation (BIF) association overlying an agmatitic plutonic infrastructure exposed on Igloo Point. The amphibolite to greenschist isograd approximates the top contact of this volcanic assemblage and overlying coarsely pillowed and locally variolitic flows. A high strain domain persists for approximately 100m across strike and is injected by a variety of quartz-feldspar porphyry dykes. The most encouraging prospects explored to date west of Mistake Bay and on Pork Peninsula are hosted by strongly sulphidized BIF occurring at the outermost limit of amphibolitic recrystallization.

The most economically significant lode gold mineralization, however, has been outlined by exploration focused on high-level porphyry complexes (Fat Lake, Big Lake, Wilson Bay). These deposits occur as nodes on regional shear systems developed within greenschist facies volcaniclastics preserved in the core of the Kaminak belt. The shears are characterized by sericite-ankerite-pyrite alteration which intensifies proximal to and pervasively overprints early quartz feldspar porphyry of intrusive origin. The best zones of gold mineralization occur along contacts between peripheral quartz-feldspar porphyry and central plagioclase-hornblende porphyry plugs. The quartz-feldpsar porphyries are likely early manifestations of the 2660 Ma granite magmatism that characterizes the Kaminak belt. The late ferrodiorite/gabbro plugs intruded into quartz-feldspar porphyry while shear-related deformation/alteration was still active, and must therefore be of somewhat similar age. The gold concentrated due to fluid ponding at igneous nodes along active deformation fronts within the shallow levels of the Kaminak belt during the regional metamorphic overprint which culminated in widespread granitic magmatism. Given that tectonic slivers of Hurwitz quartzite are occasionally preserved along the mineralized

shear systems it is possible that Neoarchean gold may be locally remobilized by fault reactivation during the Hudsonian.

LINKING GEOLOGICAL MAP, STRATIGRAPHIC, PALEONTOLOGICAL AND GEOCHRONOLOGICAL DATABASES: A PART OF CONSOLIDATING CANADA'S GEOSCIENCE KNOWLEDGE

Davenport, P.H.
Geological Survey of Canada, Calgary, AB

Geological maps (and now 3D geospatial presentations) continue to be a prime format for conveying geological information. Bringing maps into GIS allows their display at various resolutions, but because each map is a conceptual model of an area, with a unique legend scheme, collectively they form an inconsistent mosaic unless additional steps are taken to make them interoperable. Scalable, interoperable map databases for bedrock and surficial geology are being developed under a new program at the Geological Survey of Canada (GSC) "Consolidating Canada's Geoscience Knowledge". Databases for geochronology and paleontology, important contributors to the fourth dimension of geological models, are also being developed and linked to the map databases. They are intended in the first place to improve information management at the GSC for the specialists in these fields. By linking them to the map databases, new information such as a radiometric date will more directly influence age of the unit in the map database, and all related units.

Stratigraphy is the key in these linkages. A database of Canadian stratigraphic nomenclature is being assembled from published lexicons and an extensive unpublished card file index compiled at the GSC. This will be made available as a work in progress through the Canadian Geoscience Knowledge Network web site (www.CGKN.net) to both inform, and to solicit input to address missing, obsolete or incorrect information.

For bedrock geological maps, the usual requirements for interoperability include the ability to query and/or classify by age, map unit name, lithology, and combinations thereof. The variable usage of chronostratigraphic names can be addressed by calibrating them according to a geological time scale, and basing the queries on numeric age. Queries based on map unit names are hampered by the widespread use of informal names, and the problems of associating detailed map units with regional and national map legends. The national stratigraphic database will help manage the plethora of detailed map unit names, and with the map database will allow these more general legends to be applied to the detailed units.

The way rocks are named, and the detail of the lithological descriptions of map units are even more variable, and furthermore rock names cannot be placed into natural hierarchies. One solution is to employ keywords for the lithological characteristics that are implicit in a rock name, together with its qualifiers, and the general context of the map. These keywords are based on simple properties (e.g. genetic process, composition, environment of formation, etc.). Being simple classifiers, each set can be organized hierarchically. Keywords also assist in making

geological maps more usable for applications beyond geoscience, as they facilitate the creation of different thematic maps from a geological map database to address more general queries, e.g. to make a map of acid rain sensitivity.

PLANNING THE DEVELOPMENT OF MEADOWBANK - KIVALLIQ'S FIRST GOLD MINE

Davidson, G.I.
Project Manager, Exploration, Cumberland Resources Ltd., Vancouver, BC

Cumberland Resources is a Vancouver-based mineral exploration and development company that holds a 100% interest in the Meadowbank gold project which is situated about 70 km north of Baker Lake in Nunavut. This project is in the final stages of a feasibility study that should be completed in late 2003 or early 2004. Assuming a positive production decision, construction will commence in 2005 with mining commencing in late 2006 or early 2007. The previously completed pre-feasibility study indicated capital costs of US$123 million. Once in production, Meadowbank will become one of the highest output gold mines in Canada with a mining rate of 4,700 tpd which would generate an annual production of 246,000 oz. gold with an estimated open pit mine life of ten years.

The Environmental Review process has also been initiated for the Meadowbank project. The Review process is designed to fully assess all the environmental impacts of building, operating and closing the operations at Meadowbank. This complex approval process involves federal, territorial, regional and local regulatory agencies.

Since Cumberland Resources commenced exploration at Meadowbank in 1995, the Hamlet of Baker Lake and the Kivalliq region have been the beneficiaries of increased employment, training and business opportunities. Cumberland Resources is committed to responsible and sustainable development in the Kivalliq region and will strive to maximize the benefits of the project.

Gordon Davidson, a professional geologist, has been instrumental in the advancement of the Meadowbank gold project as gold resources expanded from an estimated 200,000 ounces in 1995 to more than 3,500,000 ounces of gold as currently defined.

Mr. Davidson was Project Manager of the Meadowbank Project from 1995 to 1997, and after pursuing other opportunities with both exploration and logistical companies returned to Cumberland in 2002. In 2003, he was appointed Project Manager, Exploration.

Prior to joining Cumberland, Gordon amassed 20 years of experience largely in the Northwest Territories, Nunavut and Labrador. This work ranged from project generation through grass roots exploration to detailed pre-feasibility studies with a variety of companies.

NATIONAL GEOCHEMICAL RECONNAISSANCE: DRAINAGE GEOCHEMICAL SURVEYS IN NWT

Day, S.J.A.[1], Friske, P.W.B.[1], Lariviere, J.L.[2], McNeil, R.J.[1], and McCurdy, M.W.[1]
1. Geological Survey of Canada, Ottawa, ON
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The National Geochemical Reconnaissance (NGR) programme is Canada's geochemical drainage survey programme. NGR consists of three main components: conducting regional geochemical drainage surveys; selective re-analysis of archived samples; and related orientation, methodology development, follow-up and interpretive studies. To date, over 80,000 streams and over 100,000 lakes have been sampled covering more than 2.6 million square kilometres of Canada's landmass. Originally undertaken primarily to assist mineral exploration, NGR data today have many applications. From mineral exploration, to mineral potential evaluation, to geological mapping, to environmental base-line data studies, these geochemical data have proven valuable far beyond the initial survey cost.

A series of five lake sediment surveys and two stream sediment surveys comprise the NGR coverage in the current Northwest Territories. These lake sediment surveys were conducted in the mid to late 1970's and contain sediment data for 3,746 sites. The two stream surveys were conducted in 1981 and 1994 respectively and contain sediment and water data for 1,592 sites. In total, the seven surveys represent less than 7% of the NWT surface area.

In conjunction with the C.S. Lord Northern Geoscience Centre (CSLNGC), two new stream sediment and water surveys were conducted in the summer of 2003. Data generated from these surveys will serve as the basis for mineral potential evaluations of portions of the Richardson Mountains and the Horn Plateau (Edéhzhie). Sediment and water data for 540 sites will be published in two joint GSC / CSLNGC Open Files in the summer of 2004.

REMOTE PREDICTIVE MAPPING - A "NEW" TOOL FOR NORTHERN RESOURCE DEVELOPMENT

Desnoyers, D.W. and Harris, J.R.
Natural Resources Canada, Geological Survey of Canada, Ottawa, ON

Exposed geology represents a random two-dimensional view of a time series of 4-dimensional geological processes. "Mapping" is the process of combining observations at all scales (um to Km) to unravel the sequence of events throughout geological time. In a terrestrial setting this process involves establishing an inventory of direct and indirect lithological, structural, geochronological and geochemical observations, often mixing systematic and opportunistic data acquisition, and then integrating these data into an internally self-consistent model of terrestrial evolution.

Natural Resources Canada; faced with an immense landmass, a demand for sustainable resource development and ever increasing costs of operation in the north, is actively investigating a variety of proven and evolving techniques to change the way we "map". These include the use of cost effective optical and radar technology for preliminary reconnaissance followed by airborne geophysics, and other airborne remote sensing techniques. The results, combined with any other available data for the particular region under study, would be a first order predictive map. This predictive map would focus the resulting ground follow-up by identifying the areas that have the potential to provide the most information. Subsequent field mapping or "ground-truthing" and other more traditional activities involving physical specimens such as geochronology, geochemistry and petrology etc. would result in a traditional geoscience "map" of the area. This map or more precisely the sum total of the data that this map represents can then be used as a predictor for similar (typically adjacent) areas thus expanding the influence of the field mapping.

The goal is to develop the expertise and a toolkit of techniques to allow us to "map" more effectively and efficiently in a wide variety of situations. Examples from a number of proposed and on-going northern geoscience projects will be discussed.

ALTERATION AROUND THE POLARIS MINE, CENTRAL ARCTIC ISLANDS, NUNAVUT

Dewing, K.[1], Sharp, R.J.[2], Turner, E.C.[3], Héroux, Y.[4], Chagnon, A.[4]
1. Geological Survey of Canada, Calgary, AB
2. Geological Consultant, Calgary, AB
3. Canada-Nunavut Geoscience Office, Iqaluit, NU
4. INRS-Géoressources, Sainte-Foy, QC

The alteration halo around most Mississippi Valley-type deposits is narrow, making this deposit type a difficult exploration target. The alteration around Polaris Mine on Little Cornwallis Island, Nunavut is no exception - apparently unaltered limestone occurs within 20 m of ore. There are seven useful vectors towards mineralization around Polaris, however. These are listed in order of increasing extent away from the ore body:
i) Anomalous induced polarization response is restricted to within the 300 m by 800 m areal extent of mineable ore.
ii) Development of collapse and crackle breccias plus thinning of the host Thumb Mountain Formation, along with collapse of the overlying shale units is most pronounced over the ore body and decreases to zero at the limit of dolomitization. The Thumb Mountain Formation is thinned by 50% in the ore body.
iii) Dolomitization of the host Thumb Mountain Formation is variable in extent away from the mineable ore, ranging from 20 to 125 m on the down-dip east side, to 550 m on the up-dip west side, and up to 250 m along strike. Dolomite is both replacive and sparry, has low iron content and fluid inclusion homogenization temperatures around 100 C and inclusion salinity of 35 wt % NaCl eq. Trace Pb and Zn are present throughout the dolomitized area.

iv) A large (2.2 milligal) residual gravity anomaly is roughly co-incident with the dolomitized halo.
v) Three anomalous clay mineral assemblages occur around Polaris, replacing the original, sedimentary clay mineral assemblages: 1) a well-crystallized, pure illite assemblage occurs over the ore body; 2) a coarse kaolinite assemblage is present as large vermicules in pores within dolostone. The coarse kaolinite assemblage is restricted to the dolomitized zone; 3) a fine kaolinite assemblage occurs in limestone of the Thumb Mountain Formation for up to 1 km away from the ore body.
vi) The level of thermal maturity as determined by the reflectance of zooclasts is 1.3% Ro Vi. eq. (vitrinite reflectance equivalent) in shales above the ore body, or nearly twice as high as the expected background Ro Vi. eq. value (0.73%) that would be due to burial diagenesis alone. Elevated reflectance values occur for up to 1 km south of the edge of the ore body. Interestingly, Ro Vi. eq. values decrease in the mineralized zone, in contrast with the expected increase of Ro with depth. The Ro reaches values as low as 0.55% in the ore body.
vii) Vein and disseminated barite occurs within 10 km of the ore body. Barite has d34S values range from +35 to +60 per mil.

HIGH LAKE VMS PROPERTY, NUNAVUT, CANADA

Downie, I.F.
Wolfden Resources Inc., Thunder Bay, ON

The Wolfden Resources High Lake property is located in the Kitikmeot region of Nunavut, Canada approximately 550km north-northeast of Yellowknife, NWT. The property lies approximately 45km south of the Coronation Gulf, a potential location for a deep-water Arctic Ocean port. The closest population center is Kugluktuk (Coppermine), located 175km west-northwest of the property.

The property lies within the High Lake greenstone belt, in the northern part of the Slave Structural Province. The High Lake belt varies from 5 to 30km in width and extends 140km south from the Coronation Gulf. Felsic volcanic rocks dominate over mafic throughout the belt, which is in contrast to other Slave Province greenstone belts.

The central part of the property is underlain by north-trending Archean aged (2.69 - 2.60 Ga) basaltic to rhyolitic flows and fragmental volcanics. Intercalated with the rhyolitic volcanics and at their eastern contact with andesitic rocks, are numerous carbonate-rich exhalite lenses. Argillites and greywacke underlie the easternmost part of the property and are exposed by the Kennarctic River. A large mass of Late Archean plutonic rocks intrude the supracrustal units in the western part of the property. Northerly trending Proterozoic diabase dikes of the MacKenzie dike swarm intrude all units. Several prominent northwest and north-south trending brittle faults, including the regionally significant High Lake fault, indicate variable amounts of displacement of granitoid and volcanic units prior to the emplacement of the diabase dikes.

Partially drill tested stratiform and stringer sulphide mineralization typical of Volcanogenic Massive Sulphide deposits occur at High Lake as discrete north and northeast trending bodies at the A / B, D, E, West, North, and South zones.

The High Lake deposits were first discovered in the mid 1950's though airborne reconnaissance prospecting by Kennarctic explorations. 52 diamond drill holes totaling 7149m were completed during 1956 and 1957. The property was then dormant until 1991, when Kennecott Canada, in conjunction with Aber Resources, began a second round of exploration which included 63 diamond drill-holes and led to a drill-indicated resource for the A, B, and D zones of 5.3 million tonnes averaging 4.05% Copper, 2.36% Zinc, 1.76 g/t Gold and 31.73 g/t Silver.

Wolfden Resources, after acquiring a 100% interest in the property from Kennecott and Aber, began exploration on the property in 2001. In total, nearly 100 drill holes have been completed on the property by Wolfden. Work in the 2001 and 2002 programs concentrated on infill and extension drilling on the A/B and D Zones, while in 2003, the program focused on regional exploration following the completion of a regional airborne geophysical survey. This effort resulted in the discovery of the West Zone during the summer of 2003; a poly-metallic deposit located approximately 1400 meters west of the A/B and D Zones. Ongoing drilling continues the process of extending the high grade mineralization of the West Zone that has been intersected over a strike length of 400 meters and to depths of 425 meters where it remains open. The discovery of the West Zone highlights the potential of the High Lake greenstone belt and has significantly increased the size of the total resource at High Lake.

Future work will continue to drill define the West Zone and will test priority anomalies identified from the 2002 airborne geophysical survey.

2003 FIELD RESULTS OF THE COLLABORATIVE NTI/UWO GEOSCIENCE PROGRAMS IN THE EASTERN KAMINAK AND THE BELCHER ISLANDS, NUNAVUT

Duke, N.[1], Johnson, W.[2], Jamieson, D.[3], and Wyllie, R.[2]
1. Dept. of Earth Sciences, Univ. of Western Ontario, London, ON
2. Nunavut Tunngavik Incorporated, Cambridge Bay, NU
3. D.R.J. GEOCON Ltd., Peterborough, ON

Two mineral potential assessment programs were carried out over the course of the 2003 field season. During July, crews mobilized by Cape Islander craft out of Whale Cove to camps in Mistake Bay and Pork Peninsula achieved regional coverage of the gold-rich eastern extremity of the Neoarchean Kaminak Greenstone Belt. During August, crews mobilized by freighter canoes out of Sanikiluaq achieved regional coverage of widespread copper prospects in the Belcher Islands segment of the Paleoproterozoic TransHudson orogen.

The eastern extremity of the Kaminak Greenstone Belt comprises a synclinorial succession with a basal ocean floor pillow basalt- gabbro sill- interflow sedimentary series, a medial primitive

intermediate-to-felsic arc assemblage, and an upper proximal-to-distal metaturbidite cover sequence. High grade gneisses rimming the belt border on amphibolite grade volcanics enveloping granite plutons, while the core is characterized by high-level porphyry centers intruding into greenschist facies volcanics and sediments. The basal volcanic series has modest Ni-Cu-PGE and Cu-Zn massive sulphide potential associated with ultramafic sills and interflow sedimentary units respectively, and oxide iron formations are well developed at the upper volcanic/sediment contact. However, the region is best known for its widespread lode gold occurrences. Bordering gneisses are devoid of known gold prospects, while isolated gold-bearing veins are widespread within the belt. The best lode gold targets are vein systems within major shears focusing along the amphibolite to greenschist transition (e.g., at Mistake Bay and Pork Peninsula) and on high-level porphyry intrusive centers within core greenschists (e.g. the Fat Lake, Big Lake, and Wilson Bay complexes). The Kaminak belt is moderately block faulted due to Paleoproterozoic extension relating to deposition of the Hurwitz Supergroup, and Hudsonian compression resulted in slivers of Hurwitz quartzite being locally preserved along reactivated strands of gold mineralized Neoarchean shear systems.

The Belcher Islands expose the eastern hinge of the TransHudson Orogen. Trangressive shallow marine stromatolitic dolomite-variegated argillite cyles dominate the lower stratigraphy and sandwich a prominent plagioclase porphyritic flood basalt. Regressive cross-bedded quartzite occurs just below the Kipalu Iron Formation and this regional marker caps the continental margin sedimentary succession. Overlying pillow basalt-pyritic black argillite/chert of oceanic provenance forms resistant ridges on islands and clearly outlines anticlinal fold closures. The uppermost unit exposed is recessive concretionated greywacke (the origin of the widespread "omars") occupying the cores of synclinal folds underlying inlets between the bordering island ridges of pillow basalt. The Kipalu Iron Formation, signifying the rift-to-drift transition within the stratigraphic column, is a vast Fe-Mn resource and its pyritic argillite cap may have unproven SEDEX potential. The widespread Cu occurrences are supergene in origin, relating to open space quartz veins that follow east-west fracture sets, postdating Hudsonian folding, within volcanic units. Soapstone occurrences related to gabbro sills intruding impure dolomite between the volcanic members provide the carvers of Sanikiluaq with a superior polishing product, and the community with a thriving business.

DYNAMICALLY DECOUPLED REGIONAL AND THERMAL METAMORPHIC OVERPRINTS IN THE DISCOVERY AREA: THE GOLD CONNECTION

Duke N.[1], Gochnauer, K.[2], Webb, D.[3], and DuPre, D.[4]
1. Dept.of Earth Sciences, Univ. of Western Ontario, London, ON
2. Indian and Northern Affairs Canada, Yellowknife, NT
3. Tyhee Development Corp., Vancouver, BC
4. D.G. DuPre and Associates Inc., Delta, BC

The timing relationships of regional and thermal metamorphic overprints have proven difficult to decipher in plutonic settings. In the Discovery area, the regional east-west trending cordierite isograd crosscuts the north-south oriented D_2 structural grain at a high angle south of Giauque

Lake, protrudes southerly, enveloping the Discovery-Ormsby "thermal corridor," and then strikes northerly from the south end of the Ormsby lithon through Maguire and Eclipse lakes to intersect the Nicholas Lake lineament bounding the south margin of the Nardin Front. Andalusite, garnet, and hedenbergite can occur along quartz veins exterior to this isograd. Interior to the cordierite facies overprint, cordierite aligned on the regional S_2 foliation is both texturally mantled by "hopper"andalusite in equilibrium with paragonitic muscovite and retrograded to phengite-chlorite-quartz. Modal andalusite increases towards tourmaline-bearing granite pegmatite dykes which postdate S_2 peripheral to sillimanite facies paragneiss and agmatitic breccia, respectively bounding the Nardin and MaCrae River plutonic complexes. Buoyancy driven uplift of plutonic infrastructures is signified by domainal D_3 reactivation of S_2/S_0 where steep mylonitic shear systems developed within superjacent metasediments.

The sinistral jog in the regional cordierite isograd at Discovery is accommodated by brittle/ductile attenuation on such faults as the eastern Ormsby, central Digger, and western Discovery strands, and these bound zones of gold concentration. This high strain domain was strongly fluidized during regional folding, accounting for the Discovery Vein developing as a saddle reef on the nose of the main steeply north-plunging F_2-anticline. It continued to be chemically reactive during thermal overprinting, accounting for gold concentration on shallow south-dipping, east-west striking sheeted D_3 joint sets in the Orsmby Zone. The gold system clearly ties regional and thermal metamorphic overprints, signifying that the regional cordierite facies overprint is the precondition for continued high temperature-lower pressure andalusite growth and associated hydrothermal retrogression. Rapid isothermal decompression of the geopressurized near vertical shear system produced shallow-dipping extensional vein sets. The close relative timing of regional and thermal overprints is best constrained by detailed paragenetic studies of the gold mineralization.

The granoblastic textures and local glomerocrsytic andalusite-staurolite porphyroblasts which characterize metasediments bordering on the Discovery and Ormsby lithons of volcanic substrate are manifestations of the late thermal overprint. The high grade Discovery Vein is sandwiched between inner andalusite-rich and outer cordieritic metasediments and has an associated grossular-hedenbergite-biotite-sulphide selvage. Hornblende gneiss, formed by high strain deformation of underlying pillow basalt, shows the effects of CO_2-flooding in bands of polygonal calcite-quartz intergrown with radiating Fe-cummingtonite. Both hornblende and Fe-cummingtonite show selective replacement by a well foliated biotite-pyrrhotite-apatite-monazite assemblage carrying low grade (<5 g/t) gold. Idioblastic to zenoblastic almandine preferentially overgrows foliated biotite-pyrrhotite marginal to sheeted quartz veins. Late chlorite-zoisite is commonly associated with arsenopyrite in zones of highest gold (>10 g/t) tenor. The gold is concentrated in early ductile-D_2, mylonitic-D_2/D_3, and late brittle-D_3 structural traps from fluid shed at the thermal front of amphibolitic recrystallization. The simplest geotectonic explanation for rapid dynamic decoupling of regional and thermal metamorphic overprints is that D_2 transpression culminated in D_3 buoyancy.

STABILITY OF FROZEN AND THAWING SLOPES IN THE MACKENZIE VALLEY, N.W.T.

Dyke, L.D.
Geological Survey of Canada, Ottawa, ON

Extensive ice-rich Quaternary sediments and the pronounced loss of strength when these materials thaw make the Mackenzie valley a landslide-prone region. Locally, landslides are common, particularly in the high banks where the Mackenzie River and major tributaries have cut into glacial lake sediments. At such sites, failure through frozen sediment takes place and can result in up to 200 m of bank crest retreat. Other slope failures locally common are active layer detachments and retrogressive flows. These are shallower but can also occur repeatedly and are possible at just about any location on ice-rich ground. Although climate warming is a potential cause, other processes are probably more effective as landslide triggers. Thus, toe erosion, forest fires, and saline pore water all contribute as destabilizing factors. Major advances in the stability analysis of thawing slopes were made in the early 1970's. Ice lensing and layering, severe burning of surface vegetation on slopes rich in subsurface ice, and high rates of slope loading by toe erosion are conditions and processes which promote the failure of frozen or thawing slopes, based on conventional slope stability analyses. Although these analyses may not be highly accurate, they indicate that slope stability in permafrost regions may be very sensitive to environmental factors in addition to thawing of homogeneous frozen soils.

HIGH RESOLUTION SATELLITE IMAGERY FOR NORTHERN DEVELOPMENT AND MONITORING

Epp, H.
NWT Centre for Geomatics, Yellowknife, NT

Since 1995, a number if high resolution satellites have been launched which are providing data from 5.8 to less than 1metre resolution in panchromatic as well multispectral mode. This type of data has become invaluable for a wide range of commercial, government and customer applications. Data of sub-meter resolution enables the user, through photogrammetric processing, to produce orthorectified imagery and first generation basemaps, plan and monitor engineering project, forestry and fire management, riparian corridor mapping, change detection, transportation analysis, asset management, environmental planning, crime mapping and analysis, storm water management, public safety and disaster management and airport management and planning. These are only a few of the many applications that this type of data can be used for. The presentation will focus on data from three of the main commercial satellites and their applications in the Northwest Territories. Details on sensors, bands, spatial and spectral resolutions and applications of the IRS-1D, IKONOS, and QUICKBIRD will be provided.

EMERALD EXPLORATION IN THE NORTHERN CORDILLERA, NWT AND YUKON: APPLICATION OF A PORTABLE GAMMA RAY SPECTROMETER

Falck, H.[1], Neufeld, H.L.[2], Groat, L.A.[2], and Shives, R.[3]
1. C.S.Lord Northern Geoscience Centre, Yellowknife, NT
2. University of British Columbia, Vancouver, BC
3. Geological Survey of Canada Ottawa, ON

Emerald is a highly-prized gemstone that has sparked a great deal of excitement in the north. The two known showings of the coloured gemstones, Regal Ridge, Yukon and Lened, NWT provide an excellent opportunity to study these elusive deposits. Whereas other deposits types offer a number of characteristics that may be recognized using geochemical surveys and airborne electromagnetic techniques, emerald deposits are more challenging and have only been providential discoveries in Canada.

The Lened showing is located 50 km north of Tungsten NWT, east of the Yukon/NWT border. The emeralds are hosted in a small, 40 × 15 m, skarn-altered limestone lens cut by at least 35 significant quartz veins, many of which contain green beryl. Skarn development appears to have been controlled by a fault that forms the contact between pyritic black shales and the skarn host, comprised of rhythmically bedded limestone. The quartz veins are 2-30 cm wide, extend perpendicularly from the fault zone across the skarn, and pinch out in the limestone. The green beryl is concentrated in the quartz-calcite vein immediately adjacent to the wallrock. The veins are surrounded by a 5-10 cm retrograde alteration zone defined by a halo of pale mica.

The Regal Ridge showing in the Finlayson Lake district of southeastern Yukon, occurs in complexly deformed metavolcanic rocks of the Yukon-Tanana Terrane, near their contact with a peraluminous mid-Cretaceous biotite (± muscovite) quartz monzonite. Emeralds are found in a continuum, from the quartz monzonite to quartz-rich, tourmaline-bearing granitic pegmatite and aplite, to quartz-tourmaline (± calcite) veins and their associated alteration halos within the metavolcanic rocks. The veins are often enveloped by a mass of fine, dark tourmaline crystals, locally associated with minor amounts of scheelite. Disseminated sulfides, mainly pyrrhotite and chalcopyrite, give the sericitic to biotitic alteration a gossanous appearance coincident with the tourmaline zone.

An Exploranium GR-256 gamma-ray spectrometer was used to conduct reconnaissance surveys at both showings. Readings were collected across the host rocks, alteration halos and emerald-bearing rocks, in conjunction with geochemical and petrographic sampling. When calibrated, the unit sorts the gamma-ray energies for each reading into a 256-channel spectrum, and can provide real-time estimates of the concentrations of the three most abundant, naturally occurring radioactive elements: K, U, and Th from roughly a cubic meter of rock.

Survey results indicate that the quartz veins hosting emeralds at both showings did not have strong definitive signatures, but there was a strong spatial association between radiometric anomalies and aplitic dykes at Regal Ridge, and the fault zone that acted as a potential fluid passageway at the Lened showing. This demonstrates the utility of the ground GRS method for

identifying favourable conduits and suggests that detailed airborne GRS could be used to delineate similar gem-related conduits at property and regional scales throughout the Selwyn Mountains.

OIL AND GAS IN YUKON

Freeman, R.
Oil and Gas Management Branch, Government of Yukon, Whitehorse, YT

Seven of the eight oil and gas regions of Yukon occur in the portion of the territory lying northeast of the Tintina Fault. They are the North Coast, Old Crow Basin, Kandik Basin, Eagle Plain, Bonnet Plume Basin, Peel Plateau and Liard Plateau. In this area, Paleozoic deposition of thick platformal and basinal sediments occurred on the relatively stable North American margin. The remaining oil and gas region, the Whitehorse Trough, is an intermontane basin south of the Tintina Fault.

Assessments of Yukon's conventional oil and gas resources have been completed with the Geological Survey of Canada Calgary (GSC (Calgary)), using the PETRIMES methodology. Generally, the territory is gas-prone with some oil potential. Recent updates of assessments for the Eagle Plain, Peel Plateau, Whitehorse Trough and Liard Plateau have resulted in significant increases in the estimated natural gas potential. Working in partnership with industry and using recently acquired seismic, a potential of over six trillion cubic feet (Tcf) was calculated for the Eagle Plain, over three times the original estimate. The northern Yukon has a potential for approximately 20 Tcf of natural gas and 900 million barrels (MMbbls) of oil.

Coalbed methane is another important potential resource in the Yukon, especially within the Bonnet Plume Basin. A coalbed methane resource assessment and related coal database for the territory was recently completed in partnership with the GSC (Calgary).

The Oil and Gas Management Branch has entered and seeks new partnerships and collaborations to collect additional petroleum geoscientific data and to help further define and delineate the petroleum resources of Yukon. A recent collaboration with the GSC (Ottawa) has resulted in the acquisition of high resolution aeromagnetic data over portions of the Peel Plateau, Bonnet Plume and Eagle Plain.

OIL AND GAS POTENTIAL OF THE PEEL PLATEAU, YUKON TERRITORY

Freeman, R.
Oil and Gas Management Branch, Government of Yukon, Whitehorse, YT

The Peel Plateau and Plain area lies at the northwestern extension of the Western Canadian Sedimentary Basin. Yukon portions of the Peel region are bound by the Mackenzie Mountains

to the south and the Richardson Mountains to the west. The Peel region is underlain by approximately 4.5 km of Lower Cambrian to Upper Cretaceous strata that overlie Proterozoic basement. Strata comprise thick Paleozoic platformal and basinal sediments deposited on the relatively stable North American margin, overlain by Mesozoic foreland deposits.

Exploration conducted largely during the 1960's and 1970's resulted in the acquisition of over 2000 km of reflection seismic data in the Yukon portion of the Peel region. During this time, nineteen exploratory wells were drilled in the region. None of these wells has established economic reserves or production, but there have been several gas shows. All shows have been recorded within the Paleozoic succession. Many of the well locations were not identified using seismic data suggesting that the lack of success is not indicative of the region's potential.

Nine plays have been identified within 3 structural and stratigraphic belts the Yukon portion of the Peel region. These belts are separated by large structural elements including the Trevor Fault and the eastern limit of Cordilleran deformation. West of the Trevor Fault, two plays having negligible potential have been defined. This region, west of the fault, is dominated by Upper Paleozoic successions comprising the east-verging Cordilleran Fold and Thrust Belt. East of the Trevor Fault and west of the extent of deformation, in a region underlain by the Paleozoic and Cretaceous platform to basin facies transition, three plays have been identified. East of the extent of the Cordilleran deformation to the inter-territorial border, where the area consists largely of undeformed Paleozoic carbonate rocks, five plays have been identified. The eastern most assessment region is the most prospective for hydrocarbons in the Yukon portion of the Peel.

Depositional and tectonic histories of the Peel Plateau and Plain, coupled with recorded shows, suggest that the region is gas prone. Assessment of this region suggests there is significant potential for natural gas, with a summed mean play potential of approximately 3 Tcf or 83 x 109 m^3 initial raw gas-in-place in 88 pools.

RESULTS OF THE 2003 EXPLORATION SEASON AT REGAL RIDGE – DOES THE MODEL WORK?

Gaboury, B.
True North Gems, Vancouver, BC

For the 2002 field season, it was determined that a method was required to overcome the effects of an “emerald nugget effect” in diamond drilling for reserve estimation at Regal Ridge. In 2002 it was recognized that marked geochemical and mineralogical changes in the wallrock were associated with emerald mineralization. These changes and the characterization of emerald mineralizing fluids by fluid inclusion studies, led to the development of a genetic model.

In the 2003 exploration season, a detailed wholerock geochemical sampling program was employed in conjunction with a field mineralogical screening to determine the emerald-bearing potential of individual veins at Regal Ridge.

EVALUATION OF OIL AND GAS POTENTIAL IN THE DEH CHO TERRITORY

Gal, L.P. and Jones, A.L.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Oil and gas potential in the Deh Cho territory was qualitatively assessed for the Deh Cho Land Use Planning Committee's (DCLUPC) planning purposes. The report is now available to the public as NWT Open File 2003-03.

The Deh Cho territory includes parts of two major geological provinces: the Cordillera and the Interior Platform. The Cordillera encompasses dominantly Paleozoic and Mesozoic rocks that were uplifted, faulted, folded and generally deformed during the Columbian/Laramide orogeny (Late Cretaceous to Early Tertiary). The Interior Platform comprises gently dipping, largely undeformed sedimentary rocks. The pre-Cretaceous sedimentary rocks of both provinces were deposited in marine conditions on the margin of the ancestral North American continent. The Cretaceous sedimentary rocks were partly derived from erosion of the newly uplifted mountains, and deposited under both marine and non-marine conditions.

To date, some 443 hydrocarbon wells had been drilled in Deh Cho territory. Current production in Deh Cho territory consists of natural gas from the Fort Liard region and gas with oil from Cameron Hills. Several other significant discoveries have been made that have not been developed.

This study of petroleum potential focused on the definition and mapping of hydrocarbon plays. The plays are defined mainly on the basis of stratigraphic intervals (potential reservoirs). Potential reservoir rocks in the subsurface include sandstones (especially Cretaceous and Mississippian), dolostones (particularly Devonian) and limestones. A wide variety of stratigraphic and structural traps occur in the subsurface of the Deh Cho territory; these are mainly related to basement features, stratigraphic facies, subcrop limits, and Laramide folds.

Twenty plays were identified: nine established (with known discoveries) and 11 conceptual (geologically possible, some with associated hydrocarbon occurrences). A polygon map of relative petroleum potential was created by overlaying play areas and summing the number of established and conceptual plays in a given area. Rankings of low to very high potential were made according to play number and type criteria.

The area with the highest potential for hydrocarbons lies across the south and includes the Liard Plateau and the Great Slave Plain. In the Great Slave Plain, significant plays are associated with the Middle Devonian carbonate barrier complex, and northeast trending reactivated basement faults. There are additional plays throughout the Paleozoic and Mesozoic successions. In the Liard Plateau and adjacent Great Slave Plain, Laramide structures are important in forming structural traps in a setting analogous to the Foothills plays of northeastern British Columbia and Alberta. The northern part of the Great Slave Plain has less potential as the Middle Devonian carbonate barrier complex gives way to a shale basin, but opportunities exist in Lower Paleozoic rocks. The Great Bear and Mackenzie plains have geology similar to Great Slave Plain, and have much of the same potential, but are even less explored. The Mackenzie Mountains,

Franklin Mountains, and Selwyn Fold Belt have the lowest relative potential for containing hydrocarbons.

A COMPARISON OF THE DEEP LUPIN AND MCPHERSON BANDED IRON FORMATION-HOSTED LODE GOLD SYSTEMS, NUNAVUT

Geusebroek, P.A. and Duke, N.A.
Department of Earth Sciences, University of Western Ontario, London, ON

Existing research on the Lupin banded iron formation (BIF)-hosted lode gold deposit dates from the mid-1980's and these early studies focused on the surface and shallow levels of the mine. Significantly, the regional cordierite isograd, exposed at surface about 0.5 km north of the mine, was intersected at the 550m level, and underground workings now provide access to the 1570m level. As well, a new McPherson zone, with gold concentrated in a subsidiary BIF unit occurring about 60 meters stratigraphically below the Lupin BIF, was discovered during routine underground exploration in 1997. Together, the deep Lupin and McPherson domains of gold mineralization show substantial differences with respect to the shallow Lupin ores as were documented in previous studies.

With increasing depth, the Lupin Dome becomes more open folded, the degree of sulphidization becomes less pervasive, and the north-south oriented S3 foliation becomes less penetrative. The wall rocks become more coarsely recrystallized and garnet-rich at the BIF-greywacke interface. Crosscutting quartz veins generally show more restrictive vein halo alteration with more apparent calc-silication. However, as near surface, at depth the gold mineralization still relates to the degree of pyrrhotite replacement of silicate-facies BIF bands and to late retrograde hydrothermal chlorite-arsenopyrite overprinting vein margins. The McPherson BIF unit is not as Fe-silicate rich as the Lupin BIF. Hedenbergite and grossular garnet replace McPherson BIF well away from any discernable quartz veins, suggesting a more skarn-like mode of host rock replacement. Pyrrhotite and arsenopyrite distribution also show much broader distribution in the McPherson BIF unit, and arsenopyrite is much more ubiquitously present.

It is hypothesized that the global gold system at Lupin operated at peak thermal metamorphic conditions. Dilatant structures related to the development of the Lupin Dome were fluidized well above and well below the cordierite isograd, i.e. the same mineralizing system connected the mid-greenschist to amphibolite facies thermal gradient (between 350-550°C) in the aureole that developed above the Contwoyto Lake pluton, dated at 2685 Ma. Continuity of the overall system is suggested by the subtle decrease in Au:Ag ratios (0.86-0.81) with depth, which may be related to increased preservation of loellingite with refractory gold content. Collapse of the thermal gradient was accompanied by retrograde hydrothermal fluid incursion that remobilized primary gold, associated with prograde pyrrhotite replacement of the Lupin and McPherson silicate BIF units, to the fronts of the retrograde chlorite-arsenopyrite vein halos. As demonstrated by the McPherson zone, the late secondary overprint becomes more calc-silicate dominated and skarn-like at depth.

THE NICO GOLD-COBALT-BISMUTH DEPOSIT - AN UPDATE ON DEVELOPMENT USING AN UNDERGROUND AND OPEN PIT MINING APPROACH

Goad, R.E., Mulligan, D.L., and Neale, K.L.
Fortune Minerals Limited, London, ON

NICO is a gold deposit with significant cobalt and bismuth co-products, located 160km northwest of the City of Yellowknife, Northwest Territories, Canada. The project is currently accessed from the government winter road to the communities of Wha Ti and Rae Lakes. A proposed new road will provide all-weather access to the site. Power is available from the Snare hydro complex, 20km east of the property. A plant in Yellowknife can treat sulphide concentrates produced from the deposit with minor modifications.

NICO is a hydrothermal replacement deposit of the "Iron Oxide-Hosted class", more commonly referred to as "Olympic Dam-type". The metals of economic interest are primarily contained in three, 40-50 degree dipping stratabound lenses of ironstone, each up to 70 metres in thickness. They are hosted in brecciated, potassium- and iron-altered sedimentary rocks of the Proterozoic Snare Group beneath an angular unconformity with felsic volcanic rocks of the Faber Group. The mineral resource inventory contains in excess of 70 million tonnes from which approximately 20 million tonnes are mineable at current metal prices.

Fortune Minerals completed a scoping study in 2002 assessing a predominantly underground mining development scenario, focused on early access to the gold-rich, high-grade core of the deposit. The mining method contemplated was "Blasthole with Delayed Cemented Rock-Fill" using trackless equipment from a decline ramp. Supplemental mill feed would be sourced from two open pits at the deposit ends. Ores would be processed in a flotation concentrator built at the site to produce gold-cobalt and gold-bismuth concentrates for sale or subsequent processing to higher value products. The study indicates that NICO can generate an attractive rate of return at conservative base case metal prices, increasing to more than 40% at current prices at a net present value of greater than $100 million. A program of 35 new drill holes was recommended to expand selected areas of the deposit before proceeding to feasibility studies.

Results of drilling in 2003 exceeded expectations with numerous high-grade gold, cobalt and bismuth intersections. Environmental baseline studies, hydrogeology and geotechnical studies were also upgraded for feasibility work. Further metallurgy is in progress to optimize recoveries in high-grade parts of the deposit and will be followed by pilot plant verification of the autoclave process and production of higher-value cobalt products. Feasibility studies are planned for completion in the second quarter of 2004. Assuming positive results from the feasibility study, construction could begin in the latter part of 2004 with production in 2005 or 2006.

NEW TECHNOLOGY FOR DEEP EARTH IMAGING - APPLICATIONS FOR EXTENDING POTENTIAL MINE LIFE: TITAN 24 DEMONSTRATION PROJECT - SUMMARY OF RESULTS OF DEEP EARTH IMAGING AT FALCONBRIDGE KIDD CREEK MINE, GOLDCORP RED LAKE MINE, FNX MINING AND TRIBUTE MINERALS

Gordon, R.
Quantec Geoscience Ltd., Toronto, ON

New technology and processes are available today that can assist the mining and exploration community with their efforts to yield discovery and increase reserves.

The Titan 24 system provides multi-parameter mapping information to depths of 500-800 metres and deeper resistivity information to depths of 1-2km. The talk will highlight some recent results from demonstrations of this new technology in Ontario. Specifically the Titan 24 system results from four active and favourable geologic regions within the province are reviewed. The Confederation lake belt, Red Lake, Timmins area and the Sudbury contact will be reviewed.

The demonstrations show that a thorough investigation of the 3d subsurface volume yields the most informed decisions for earth scientists. Drill targeting can be more focused and geologically favourable ground that has been previously explored with more traditional means may be worth considering as high potential areas for new exploration.

MINERALOGY AND GEOCHEMISTRY OF THE TRUE BLUE PROPERTY, SOUTHERN YUKON

Groat, L.A.[1], Wengzynowski, W.[2], Barnes, E.M.[1], Rohtert, W., Turner, D.[2], and Eaton, D.W.[2]
1. University of British Columbia, Vancouver, BC
2. Archer Cathro & Associates (1981) Limited, Vancouver, BC

The True Blue property is located northeast of Whitehorse and south of Ross River in south-central Yukon. Blue beryl was discovered on the property in 1976 and aquamarine (blue gem beryl) in 2003. The beryl occurs in a swarm of closely-spaced quartz ± siderite ± fluorite ± tourmaline veinlets that cut a Mississippian-age (320 Ma) syenite stock. The veins, which occupy a dense network of orthogonal tension gashes, are 0.5 to 20 cm thick and locally comprise up to 30% of the rock. The veins have sharp, parallel wall-rock contacts and display coarse-granular crystal growth of gem-quality beryl radiating from nucleation points, and in some cases replacing tourmaline. Over 100 individual beryl showings have been discovered in a zone measuring 600 (100 m in outcrop at the surface over an elevation range of 100 m. The vein zone is developed near the upper contact of the syenite intrusive body with Lower Paleozoic pelitic and carbonate country rocks. The syenite is sodic in composition and contains high concentrations of rare earth elements.

Much of the aquamarine is an unusual cobalt-blue colour. Electron microprobe analyses show high concentrations of Na (to 2.51 wt.% Na_2O), Mg (to 3.27 wt.% MgO), and Fe (to 5.81 wt.% FeO). The dark-blue colour is most likely due to the presence of Fe^{2+} cations in the channels in the crystal structure.

Previous discoveries of gem beryl in northwestern Canada include the Lened (western Northwest Territories) and Regal Ridge (southern Yukon) emerald properties. This most recent discovery confirms that the region is (locally) rich in Be and that the potential exists for more gem beryl mineralization.

CYCLES IN CARIBOU ABUNDANCE AND THE CURRENT TREND IN THE SIZE OF THE BATHURST HERD OF BARREN-GROUND CARIBOU

Gunn, A.
Wildlife and Fisheries, Department of Resources, Wildlife and Economic Development, Yellowknife, NT

Barren-ground caribou herds typically cycle in size over decades. The most variable aspect of the cycles is the time when the numbers are low. Among the major herds of barren-ground caribou in the NWT and Nunavut is the Bathurst herd. The herd calves west of Bathurst Inlet and post-calving migration and the summer ranges cover the central Slave Geological Province. A census of breeding cows on the calving ground in June 2003 revealed that the Bathurst herd peaked in size in the mid-1980s and between 1986 and 2003, the size of the herd declined from 470 000 to 186 000. As a herd declines, enhanced monitoring is essential to ensure that factors do not accelerate a decline or slow down the recovery of the herd. Changes in herd size also have implications for thresholds for cumulative effects and, as well, change the ecological conditions for other species on the central barrens such as wolves, wolverine and grizzly bears.

THE GWICH'IN LAND USE PLAN AND THE REGULATORY SYSTEM NANH'GEENJIT GWITR'IT T'IGWAA'IN WORKING FOR THE LAND GWICH'IN LAND USE PLAN

Hamre, K.L.
Board Member, Gwich'in Land Use Planning Board

After 20 years of work, a Land Use Plan for the Gwich'in Settlement Area was approved on August 7, 2003. The approval of the Land Use Plan by the Gwich'in Tribal Council, the GNWT and the Federal Government means this Plan is now legally binding. All land users must comply with the Plan.

The Gwich'in Settlement Area (GSA) includes the communities of Inuvik, Aklavik, Fort MacPherson and Tsiigehtchic, the watershed of the Arctic Red River, and a portion of the Mackenzie River and its' delta. The GSA is approximately 56,935 km^2.

The Land Use Plan is based on three management zones:
1) conservation zones,
2) special management zones and
3) general use zones.

Conservation zones are the most restrictive, with little other than traditional activities allowed. These zones have legal latitude /longitude boundaries established (available through the Gwich'in Land Use Planning Board office).

Within special management zones, land users must comply with special conditions specific to each of the 16 zones, as well as all standard regulations of the regulatory agencies.

Land use in the general use zones is governed only by standard regulatory agency regulations.

All land users are encouraged to consult the Plan prior to making application for land use, to ensure they are in compliance with the Plan. The Planning Board staff will assist. All applications through the regulatory agencies such as the Gwich'in Land and Water Board or the Gwich'in Land and Resources Department of the Gwich'in Tribal Council, will require that applications are in conformance with the Plan.

If an application is not in compliance, an exception or amendment to the Plan may be requested through the Planning Board.

contact information for Gwich'in Land Use Planning Board:
www.gwichinplanning.nt.ca
Phone: (867) 777-7936
or Toll Free in the NWT: 1-888-450-4443

INUIT TRADITIONAL KNOWLEDGE AS A LAND-USE PLANNING TOOL - THE NAONAIYAOTIT TRADITIONAL KNOWLEDGE PROJECT

Hanks, C.[1], Banci, V.[2], Spicker, R.[3], and Evalik, C.[4]
1. BHP-Billiton Diamonds Inc., Yellowknife, NT
2. Banci Consulting, Maple Ridge, BC
3. Rescan Environmental Services Ltd., Vancouver, BC
4. Kitikmeot Inuit Association, Cambridge Bay, NU

Under the Nunavut Land Claim and associated legislation, mining companies are required to consult with communities and to consider Traditional Knowledge (TK) in their developments. Aboriginal and Inuit peoples have stressed that they have a key role to play in environmental

assessments and that TK should be considered in all phases of a development. While the term "traditional knowledge" has been a key buzzword for a decade, there is still little understanding of what kinds of information TK comprises, and there are few effective ways for industry or Aboriginal peoples to access and implement TK in a timely fashion.

The Naonaiyaotit Traditional Knowledge Project (NTKP) is a Geographic Information System (GIS) database of the knowledge of the Inuit of the western Kitikmeot within the Slave Geologic Province. This long-term project was initiated in 1996, in response to a need for baseline information to assess potential effects of the BHP-Billiton Ekati(tm) mine, the first diamond mine in Canada. From that initial impetus, the NTKP has developed into a land-use planning tool that will provide the Inuit with a means of responding to land-use applications and integrating TK into environmental assessments throughout their area of historical and current use.

Structured interviews were used to obtain detailed information from 51 Inuit consultants on wildlife, habitat and land use. Interviewees represented a cross-section of elders and knowledgeable current land users. Spatial (map-based) and textual information from these interviews can currently be retrieved through the GIS and efforts are underway to include the Inuinaktun audio portion of the interviews. As other TK projects in the NWT and Nunavut are using similar methods, information is complimentary and sharing of data is facilitated.

The NTKP contains detailed information on wildlife, fish and human land use. These observations span a century and cover an area that extends from Lac de Gras in the south to the Arctic Ocean in the north. The NTKP will allow the Inuit to provide input into potential developments beginning at the preliminary screening stage. Early intervention can be used to identify and hopefully mitigate potential conflicts with wildlife, habitat and heritage sites. Issues can be addressed before proponents have invested in advanced project design, at which stage changes are more often more difficult and expensive. Knowledge derived from NTKP can be used to suggest ways of avoiding impacts by identifying the best locations for camps, roads and other infrastructure, identify data gaps, and be instrumental when designing and conducting baseline studies.

The NTKP GIS database contains proprietary data and belongs to the Inuit beneficiaries of the western Kitikmeot, as represented by the Kitikmeot Inuit Association (KIA). A series of edited reports in English is being developed for project sponsors and public use.

EXISTING OPERATIONS AND ENVIRONMENTAL ASSESSMENTS - THE COURTS ADDRESS "GRANDFATHERING" UNDER THE MACKENZIE VALLEY RESOURCE MANAGEMENT ACT

Hardin, M.J.
General Counsel and Corporate Secretary,
Ashton Mining of Canada Inc., North Vancouver, BC

The coming into force of the *Mackenzie Valley Resource Management Act* on December 22, 1998 marked the beginning of a new era in the regulation of mineral exploration, mine development and mining operations in the Northwest Territories. With full implementation, the MVRMA has brought about profound changes to the regulatory regime originally established in the early 1970's under the *Territorial Lands Act* and the *Northern Inland Waters Act*, and subsequently expanded by the Environmental Assessment and Review Guidelines Order, the *Northwest Territories Waters Act* and the *Canadian Environmental Assessment Act*.

Implementation of a new comprehensive statutory regime presents numerous challenges. In the case of the MVRMA, they include the potentially complex legal question of how to apply the new requirements to the applications, permits, licences and operations that already existed when the new legislation came into force. Part 7 of the Act is intended to deal with this, including the extent to which existing operations are "grandfathered" and therefore exempt from the noteworthy environmental assessment requirements established under Part 5.

The relevant provision of the MVRMA, Section 157.1, has now been interpreted by both the Supreme Court of the N.W.T. and the Court of Appeal. The two judgments where handed down when the North American Tungsten Corporation Ltd. asked the courts to review the decision of the Mackenzie Valley Land and Water Board to require the company to conduct an environmental assessment. The environmental assessment related to the North American Tungsten's application, in early 2002, to renew the water licence necessary to continue operations at its tungsten mine near the N.W.T.-Yukon boundary. The mine's first water licence was granted in 1975 and had been renewed several times during the intervening period.

In November 2002, the Supreme Court of the N.W.T. agreed with the decision of the Land and Water Board and endorsed the company's obligation to conduct an environmental assessment. But in May 2003, the N.W.T. Court of Appeal took the opposite view, and determined that the MVRMA exempted North American Tungsten from this requirement. As a result, a Part 5 environmental assessment administered by the Mackenzie Valley Environmental Impact Review Board was not required before the Land and Water Board could reach a decision on the renewal of the water licence.

This presentation will discuss the legal issues that were decided in this case, their significance to the ongoing administration of the MVRMA and their potential application to other statutory regimes.

MAPPING LITHOLOGY IN CANADA'S HIGH ARCTIC: APPLICATION OF HYPERSPECTRAL DATA

Harris, J.R.[1], Rogge, D.[2], Hitchcock, R.[3], Ijewliw, O.[1], and Wright, D.[1]
1. Geological Survey of Canada
2. University of Alberta
3. Canada Centre for Remote Sensing

A test site in southern Baffin Island, Canada, has been established to study the applications of hyperspectral data to lithological mapping as part of the Remote Predictive Mapping (RPM) project which forms part of the new ESS Northern Resources Development Program. Good bedrock exposure and the lack of continuous vegetation cover in the Arctic provide an ideal environment for the application of hyperspectral remote sensing. Airborne PROBE hyperspectral data has been collected over the study site in the summer of 2001.

Two processing methods are investigated for extracting endmembers from the data that represent lithological and compositional variations in the largely Archean metasediments, tonalities, quartzites and metagabbros. These methods include selection of endmembers from MNF processed data and end member determination using an iterative error analysis technique.

Both processing methods presented in this study are successful at delineating different lithologies within the study area even though rocks are highly weathered and variably covered by lichen. Method 1 (MNF processing) may be the preferred method when using hyperspectral data to map mixed Archean rocks typified by metamorphosed granitoid, mafic intrusive and sedimentary rocks comprising pelites and psammites (but not carbonates).

A METHOD FOR DETECTING GLACIAL DISPERSAL TRAINS IN TILL GEOCHEMICAL DATA

Harris, J.R. and Bonham-Carter, G.F.
Geological Survey of Canada, Ottawa, ON

A new algorithm for identifying potential glacial dispersal trains in till geochemical data is introduced. The algorithm, referred to as the dispersal train identification algorithm (*DTIA*), requires a set of user input parameters used for simulating dispersal train characteristics. The algorithm employs a succession of wedge-shaped search regions (each one shaped like an isosceles triangle with the search point at the principal vertex) to 'look' in user-specified directions from a set of search points that may be mineral prospects, geochemical anomalies in rock or a homogeneous grid of points. The values of the till sample points occurring within the wedge are analyzed as candidates for a dispersal train using a series of criteria. The geologist specifies the length and angle of the wedge, where the length reflects the distance of down-ice dispersion and the angle is used to model a ribbon or fan-shaped dispersal train. For each search position *DTIA* calculates the average of the values within the wedge (*pmed*) the difference between wedge average and the local average (*diff*), and fits an exponential model to the within-

wedge points (geochemical value as a function of distance from the search point). Candidate search points for the heads of dispersal trains are selected based on high values of *pmed* and *diff*, as well as best fit lines (fitted to the natural logarithms of geochemical values) that show high negative slopes (*b*), significant values of a test statistic for the slope magnitude (*ts*), and large negative correlation coefficients (*R*). The slope statistic, *ts*, is particularly useful in identifying candidate trains, but care must be taken to eliminate situations where the closest sample point is relatively far from the search point.

DTIA is tested on three datasets; simulated data in which dispersal trains are embedded in various levels of background noise, a dataset in Cape Breton where documented till dispersal trains exist and in the Swayze greenstone belt where no documented trains are known. The effects of varying the input parameters (e.g. length and angle and direction of wedge) are studied as well as different search strategies with the objective of identifying the most appropriate parameters for successfully identifying points that represent the heads (or source zones) of potential till dispersal trains.

The algorithm works satisfactorily with the simulated data, and performs well with the data from Cape Breton. The results are particularly sensitive to both direction of search and the wedge angle, as demonstrated by plots of *ts* versus these two parameters, for known trains, using mines as search points. Application to the Swayze data reveals candidate trains whose directions are consistent with glacial transport directions known from data on glacial striations. Although this method shows promise as a data exploration tool, more work is needed to improve the algorithm and to test it under a greater range of conditions.

A NEW BEDROCK GEOLOGY MAP OF THE NARES STRAIT REGION, NORTHERN NUNAVUT AND NORTHWEST GREENLAND; LARGE UNTESTED STRUCTURES IN THE CENOZOIC BASINS OF NORTHERN BAFFIN BAY AND KANE BASIN

Harrison, J.C.
Geological Survey of Canada, Calgary, AB

Onshore and offshore bedrock geological features of the Nares Strait region have been compiled on a new map at a scale of 1:1,000,000. The map includes onshore map units and structure of Nunavut in Arctic Canada from northern Baffin Island to northern Ellesmere Island and, on the Greenland side, from the Thule area to Nansen Land and the Lincoln Sea. Sources include published maps of the Geological Survey of Denmark and Greenland (GEUS) and the Geological Survey of Canada (GSC). Also introduced are draft maps of northeast Ellesmere Island. These are currently in preparation as a result of co-ordinated field work from 1998 to 2000 by staff of the German Federal Institute for Geosciences and Natural Resources (BGR) and GSC. Offshore geology is drawn from the interpretation of geophysical data, most notably petroleum industry reflection profiles, and government reflection and refraction seismic and aeromagnetic data including new marine and airborne surveys produced in 2001 as a result of co-operative work involving GSC, BGR, the Danish Lithosphere Centre and the Canadian Coast Guard.

Major features of the map area include 1) the Canada-Greenland shield subdivided into Archean gneissic terranes, high grade Paleoproterozoic supracrustal belts with marble, and Paleoproterozoic plutonic igneous suites, 2) mid-Proterozoic sedimentary basins and related post-orogenic craton cover of Thule and Borden basins, 3) mid-Proterozoic through lower Paleozoic rocks of Pearya, a composite terrane on northern Ellesmere Island accreted to ancestral North America in the mid-Silurian, 4) Neoproterozoic (Vendian) to Devonian strata of the Franklinian succession, 5) Carboniferous to Paleogene strata of Sverdrup Basin deposited on the erosional roots of the Upper Devonian-Lower Carboniferous Ellesmerian orogenic belt, 6) Cretaceous through Neogene strata located in fault-bounded small basins that record the depositional history of Baffin Bay rifting and spreading, and contemporaneous strike slip faulting and thrusting in the Eurekan Orogen adjacent to Nares Strait, and 7) mafic dykes, sills and volcanics including those belonging to the Melville Bugt (ca. 1650 Ma), Franklin-Thule (ca.720 Ma), Sverdrup Basin (ca. 90-120 Ma), and Kap Washington (ca. 65 Ma) events.

Offshore bedrock map units include 1) granitoid basement rocks 2) moderate velocity stratified successions assigned to either the mid-Proterozoic (Borden-Thule) or lower Paleozoic (Franklinian) packages, 3) refraction-identified oceanic crust (tectonized serpentinite?) that underlies the abyssal plain of northern Baffin Bay; 4) Cretaceous-Neogene rift-fill and rift-cover sequences with low velocity and subdued magnetic signature (up to 12 km thick in Baffin Bay), and 5) magnetically anomalous basin-fill in Nares Strait, correlated with upper Paleocene volcaniclastic sandstones exposed on northeastern Ellesmere Island.

Significant elements of the offshore include geological features that preclude the existence of the Wegener Fault in Nares Strait, and more than 20 major untested structural culminations developed in Cenozoic strata on the north Baffin shelf. Several untested structures are more than 50 km in length.

AN ONLINE SEARCHABLE MAP INDEX OF BEDROCK GEOLOGY MAPS PRODUCED BY THE GEOLOGICAL SURVEY OF CANADA

Harrison, J.C., Lemay, D., and Lai, G.
Geological Survey of Canada, Calgary, AB

The Geological Survey of Canada has produced over 3150 bedrock geology maps since its' inception, and more than 2085 since 1945. An additional 197 bedrock maps are known to be in preparation. Nevertheless, lack of access to an easily useable map-based index has been a long-standing point of frustration for all users of these GSC map products. Industry clients, sales staff and librarians do not know which maps are current for any specific region of the country. GSC research staff have trouble discovering what has been done (or is being done) by their colleagues and predecessors. Managers are largely dependent on their research staff for identifying thematic and geographic gaps in mapping coverage. To rectify this problem and to allow better public and in-house access to the GSC map collection, an online searchable GIS-based map index has been developed of the current, archival and "in prep" bedrock geology maps. The

index allows the user to search for maps using a scaleable map index and other user-defined criteria, including scale, vintage and map product line (i.e. A-series, Preliminary or Open File). The map indices allow the user to display the national, regional or local coverage of GSC bedrock geology maps using any combination of the search criteria superimposed on a base that includes shorelines and major rivers, political boundaries and the labelled 1:50,000 and 1:250,000 scale NTS map grids.

The second part of this effort is an assessment performed on the GSC collection of more than 1500 current bedrock geology maps. The assessment draws on the components of each map including:
1) the base map (GIS, digital plot file, formal draft, or hand-drafted print),
2) the geology layer (percentage of drift cover, percentage of unmapped areas, onshore, offshore, subsurface and metamorphic isograd mapping),
3) unit description (number of map units and varieties, thematic emphasis, and utilized time scales),
4) linework (number of geological contact types, dyke sets, fault and fold varieties),
5) measured point data (bedding, flow indicators, linear and planar kinematic elements, and glacial point data),
6) recorded point data (outcrop identification, number of field stations, location of fossil and mineral localities, exploratory wells, and measured sections)
7) accessory illustrations (stratigraphic and geological relations diagrams, and cross-sections), and
8) nature of supplemental text (attached or separate) and references.

The assessment criteria are designed to provide the user with local, regional and national perspectives on the state of bedrock geological mapping as performed by the GSC. In order to obtain a truly national understanding of the state of bedrock geological mapping in Canada it will be necessary to perform similar assessments on the provincial and territorial map collections.

THE PROFESSIONAL ADVANTAGE

Henderson, L.
Association of Professional Engineers, Geologists, and Geophysicists Geoscientists of the Northwest Territories and Nunavut (NAPEGG)

Everyday in the Northwest Territories and Nunavut geoscientists play an exciting and pivotal role in exploring for and developing mineral, oil and gas resources; protecting groundwater, developing infrastructure plans, cleaning up contamination and finding safe locations for hazardous wastes. This work directly concerns the safeguarding of public welfare, life, health, property and economic interests.

The Association of Professional Engineers, Geologists, and Geophysicists of the Northwest Territories and Nunavut (NAPEGG) was established by an Act of the Legislature of the NWT:

to regulate the practices of professional engineering, geology and geophysics and to govern the professions in accordance with this Act and the by-laws, and to establish and maintain standards of knowledge, skill, care and professional ethics among its members and licensees, in order that the interests of the public may be served and protected.

Geoscientists in some cases do not see the need, benefit, and value of professional registration with an association such as NAPEGG. Professionals in the NWT are required to follow a set code of ethics that expects honest, fair and ethical behaviour from all members. This presentation will help to explain the need for registration and more importantly will highlight the benefits and the value to individuals, companies, and industry as a whole, to act in a professional manner.

INTRODUCTION TO THE NORTH BAFFIN QUATERNARY MAPPING AND TILL GEOCHEMISTRY PROGRAMME

Holme, P. and Little, E.
Canada-Nunavut Geoscience Office, Iqaluit, NU

The Canada-Nunavut Geoscience Office, in collaboration with the Geological Survey of Canada and the Polar Continental Shelf Project, has begun a new three-year geoscience initiative to evaluate the economic potential of northern Baffin Island. The emphasis of the initiative will be on surficial geology mapping of the NTS 37E, F, G and H mapsheets, with complementary detailed bedrock mapping of key localities, with the intent of reducing exploration risk in the region.

The 2003 field season focussed on the 37G mapsheet, about 75 km northwest of the Barnes Ice Cap. Specific objectives included the production of two 1:100k-scale surficial geology maps (37G-east and west), evaluation of ice-movement chronology and glacial history of the region and a reconnaissance till geochemical survey.

Data collected include: 763 description stops, 207 paleo-ice flow measurements, 156 till geochemistry samples, and 23 cosmogenic exposure age samples. Preliminary findings suggest that the area's glacial history is complex, with evidence for over-riding by both warm- and cold-based ice during the Last Glacial Maximum. The provenance and sequence of over-riding ice masses and their basal thermal states will be determined only after synthesis of field data and more detailed airphoto analysis.

BENEFITS OF INTEGRATED SEISMIC AND GRAVITY EXPLORATION: AN EXAMPLE FROM NORMAN WELLS, NWT

Isaac, J.H. and Lawton, D.C.
Fold-Fault Research Project, University of Calgary, Calgary, AB

Interpretation of a 16-km gravity survey acquired across the Norman Range, near Norman Wells, NWT, was integrated with geological and reflection seismic data to determine the most likely structural model for the subsurface. Previous geological work led to the development of three contrasting structural models for this area:
(1) A low angle thrust fault in the Upper Cambrian Saline River Formation causing repetition of dense Palaeozoic dolomites and anhydrites, with no involvement of sub-Saline River sediments.
(2) A high-angle reverse fault thrusting Proterozoic sediments into the core of the Norman Range.
(3) A vertical block fault model with a horst of Proterozoic rocks coring the Norman Range, with no horizontal shortening.

The gravity data show a positive Bouguer anomaly, indicative of denser rocks, across the core of the Norman Range. To determine which of the three structural models was most likely to give this observed gravity response, we first modified them to reflect the local geology then modelled the theoretical gravity response for each one with a two-dimensional gravity modelling computer program. Control for the interpretation of the data was provided by the surface geology, density measurements from hand specimens and well logs, stratigraphic thicknesses from well data and some existing seismic data. We modelled the theoretical Bouguer anomaly for each case, perturbing each model to get as good a match as possible between the modelled and observed data, assuming that the formation densities remain constant along the section and the structure is two-dimensional. We obtained a good match for the first model with the Bouguer anomaly being caused by repetition of dense Palaeozoic dolomites and anhydrites. The other two models required a high density of 2.84×10^3 kg/m^3 for the uplifted Proterozoic sediments in the core of the Norman Range in order to fit the observed gravity data. Such a high density, that of a dolomite lithology, is considered unreasonable for the thick Neoproterozoic sequence of predominantly quartzites and mudrocks thought to underlie the Palaeozoic in this area.

After resolving from the gravity modelling that the first model is most likely to represent the structure of the Norman Range, we used this model to assist effectively in the construction of a velocity model for depth migration of an 8-km seismic line, which was acquired near the location of the gravity survey. This was in an area where outcropping carbonates cause problems in both data acquisition and processing. The processed seismic line supports the thin-skinned detachment model because there is evidence for thrust faulting and deep reflections show no significant structure.

Integration of the gravity and seismic data with geological information provides the most robust interpretation of both data sets and supports a thin-skinned deformational model for the Norman Range with a décollement in Upper Cambrian salt strata of the Saline River Formation.

QUANTITATIVE ANALYSIS OF HYDROCARBON SYSTEMS OF THE BEAUFORT-MACKENZIE BASIN - A PROGRESS REPORT

Issler, D.R., Snowdon, L.R., McNeil, D.H., and Chen, Z.
Natural Resources Canada, Geological Survey of Canada, Calgary, AB

Renewed hydrocarbon exploration in the Beaufort-Mackenzie Basin is being driven by favourable economic and political circumstances and concern for future North American energy supplies. Previous exploration has resulted in numerous major hydrocarbon discoveries (mainly gas) and this bodes well for future exploration success. A basic structural/stratigraphic framework exists for the region but many key exploration questions concerning source rocks, thermal history and controls on hydrocarbon generation, migration and accumulation remain unanswered. A major GSC project has been initiated to address these fundamental questions in order to promote efficient hydrocarbon exploration in this costly and environmentally sensitive region. Past exploration has yielded a wealth of core material and well data that provide an excellent foundation for our quantitative analysis of hydrocarbon systems. The study area is challenging because, in addition to the typical problems associated with deltaic systems (extensive recycling of sediments, fossils and organic matter; rapid deposition with associated low thermal maturity, high heating rates and overpressure), there have been extreme variations in surface temperature with associated permafrost development and gas hydrate accumulation. To deal with these complexities, we are employing geochemical, geophysical, petrophysical, petrological, biostratigraphic and thermochronological methods to constrain the geometry, physical and chemical properties, and thermal evolution of the sediments and organic matter within the basin.

Currently we are compiling major databases of new and existing well and sample data that will be used in the preparation of cross sections and maps and in the interpretation and modelling of hydrocarbon systems using in-house and commercial software. Quality control is a major issue, and where possible, objective criteria have been established to rank data so that only the best data are used for interpretation and modelling. Example data sets include temperature, pressure, organic geochemical properties, permafrost thickness, sediment compaction, thermal conductivity, biostratigraphic and palynological zonations, apatite fission track parameters and thermal maturity. In addition to data compilation and sample analysis, we have had to undertake some basic research and methods development to deal with problems encountered along the way. These include the characterization of newly identified organic molecular compounds, the development of an alternate thermal maturity scheme (foraminifera colouration index) and the incorporation of multi-kinetic annealing behaviour in apatite fission track thermal models. Some of the key outputs of the study will be plots, cross sections and maps showing revised structure and stratigraphy and the distributions of geothermal gradient, permafrost thickness, overpressure, thermal maturity, reservoir characteristics and hydrocarbon potential. We are working closely with petroleum companies to ensure that exploration decisions are based on the most up-to-date information and interpretations. In addition, government and local community decision-makers will find these results to be essential for effective planning purposes.

THE SNARE RIVER MAPPING PROJECT: DIGITAL ATLAS UPDATE

Jackson, V.A. and Irwin, D.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Systematic 1:50 000 scale mapping of the Snare River area was initiated in 1998 and completed in 2002. In 2003, a preliminary compilation map of the geology of the area was published in AutoCAD R14 format, leading to the initiation of a digital geological atlas as the final publication.

Production of the digital atlas will involve conversion of the current AutoCAD R14 map into Arcview 3.x format. Databases from Fieldlog 3.0 will be imported into Arcview 3.x format and form the backbone of a relational spatial database of field data. The Snare River digital geological atlas will include an Arcview 3.x project file to open the geologic map with selected polygon, line, and point data layers. The primary layers will comprise lithology and structure and geochemistry, geochronology, sample, and station locations. The atlas will also incorporate data such as links to petrographic, geochemical and geochronological analytical results, publicly available airborne magnetic surveys, selected photographs, cross-sections, figures, and descriptive text. Also included will be a printable map in Adobe Reader format, a report and reference to a number of reports and thesis studies that were carried out in conjunction with the Snare River mapping project.

The final product will be available on CD ROM as a C.S. Lord Northern Geoscience Centre Open File with an anticipated release in the spring of 2004.

DIAMOND INDICATOR MINERAL CHEMISTRY IN RELATION TO DIAMOND POTENTIAL - THE BRODEUR PENINSULA KIMBERLITE PROVINCE VS. SOMERSET ISLAND

Jago, B.C.[1], Davis, D.[2], and Derbuch, H.[3]
1. SGS Lakefield Research, Lakefield, ON
2. Dalmin Corporation
3. Twin Mining Corporation, Toronto, ON

Garnet, spinel and Cr-diopside mineral chemistry are compared for three of Twin Mining's kimberlite bodies in the Brodeur Peninsula Kimberlite Province and six bodies from the Somerset Island Kimberlite Province and comments made regarding diamond potential.

The Brodeur Peninsula and Somerset Island kimberlite provinces were originally discovered in the 1970's when approximately 10 bodies were discovered on Somerset Island and a single body (?) on the Brodeur Peninsula following extensive stream sediment sampling, remote sensing and prospecting programs. Since then, several additional bodies have been discovered on Somerset Island and a variety of dykes and pipes have been discovered on Baffin Island particularly in the late 1990's, up to the present.

The expansion of the Brodeur Peninsula Kimberlite Province followed the restaking of the Zulu Pipe by a prospecting consortium headed by Fred Tatarnic and its subsequent option to Twin Mining in the year 2000. Results of Tatarnic's resampling of outcropping kimberlite for microdiamond and diamond indicator minerals and their panning of a 0.768 carat stone from residual soil were considered encouraging enough by Twin Mining to option the property. Twin considerably expanded Tatarnic's land holdings from three original claims covering 7,128 acres to a present day total of 537 claims covering 1,262,079 acres (5,107 km^2).

Somerset Island garnet and chromite mineral chemistry shows that sub-calcic harzburgitic garnet (G10) is extremely rare as is diamond inclusion chromite. Garnet populations are dominated by lherzolitic garnet (G9) with lesser garnet megacrysts (G1) and rare crustal garnet (G5). Cr-rich spinels are rare but a small population (<1-2%) is compositionally similar to chromite inclusions in diamond.

In contrast, mineral concentrates produced from a variety of sample sites representing three to six kimberlite bodies on Twin Mining's Freightrain claim group all contain sub-calcic harzburgitic garnet (up to 20%) and have substantial diamond inclusion chromite populations (35-60%) although high-pressure eclogitic garnet (G3, G4 and G6) are relatively rare (<1-2%)

The contrast in garnet and chromite mineral chemistry and its positive implications for diamond prospectivity are reflected in contrasting geothermal arrays produced by single clinopyroxene geothermobarometry (Nimis and Taylor 2000). The geotherm array calculated using Cr-diopside derived from garnet lherzolite for several Brodeur kimberlites parallels the 35-mW/m^2 conductive geotherm of Polack and Chapman (1977) and is rooted in the diamond stability field whereas the pressure/temperature array calculated from Somerset Island Cr-diopsides is at a much higher geothermal gradient (53 mW/m^2) and rooted in the graphite stability field. The Somerset Island array calculated from single Cr-diopsides is very similar to that calculated from four-phase peridotite assemblages (Jago and Mitchell 1986) as both arrays are rooted in the graphite stability field and show an apparent "inflection" to higher temperatures.

The contrast in mineral chemistry is borne out in microdiamond and bulk sample results. Kjarsgaard and Levinson (2002) and Armstrong (person. Comm.) report that Somerset Island kimberlites are largely barren or very low grade whereas the Brodeur kimberlites have substantial microdiamond populations and have produced already more than 50 carats of gem-quality diamonds at modelled grades of up to 50 cpht in bulk samples.

DIAMOND GRADE AND QUALITY IN RELATION TO MINERAL CHEMISTRY OF TWIN MINING'S JACKSON INLET FREIGHTRAIN KIMBERLITE, BRODEUR PENINSULA, NUNAVUT, CANADA

Jago, B.C.[1], Lindsay, J.[2], De Belder, D.[3], and Davis, D.W.[4]
1. SGS Lakefield Research, Lakefield, ON
2. AMEC E & C Services Limited
3. Diamond Trading N.V.
4. Dalmin Corporation

Mineral chemistry, diamond grade and quality are correlated to different degrees for 248.3 t of vent-facies kimberlite extracted from five excavations in bedrock (JI-1, 77.2 t centrally located; JI-3, 73.9 t 100 m northeast; JI-4, 42.1 t 75 m to the southwest; and JI-5 23.7 t, Ji-5S 2.5, JI-6, 28.9 t, 85 m to the southeast) on the Freightrain pipe in a series of sampling campaigns since mid-2000.

Diamond inclusion chromite (Fipke et al. 1995) is abundant at all sites (average 49.2%) whereas sub-calcic harzburgitic garnet (Gurney 1985) is generally high (average 19.7%) except for JI-1, which yielded 9.0%. High-pressure, Na-rich (>0.07 wt. % Na_2O) eclogitic garnet varies from 0% to 10.8% of the eclogitic garnet population. Diamond size distribution modeling predicts estimated total diamond content grades of 50 cpht for JI-1 and JI-4, 20 cpht for JI-3, 30 cpht for JI-6 and 10 cpht for JI-5 and JI-5s, based on a bottom cut-off of 0.85 mm square mesh sieve. Among diamonds from these samples, there appears to be an even distribution of the higher quality stones across the large size range, with a strong higher quality bias in the larger sizes. Conversely, there appears to be a bias to lower quality in the sizes smaller than 0.05 carats.

HYDROCARBON POOLS OF THE COLVILLE HILLS, NORTHWEST TERRITORIES

Janicki, E.P.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The Colville Hills exploration region occupies a semi-circular area north of Great Bear Lake and offers some of the best tested but undeveloped gas resources in northern Canada. The National Energy Board of Canada estimates (50% probability level) a resource of 11933 10^6 m^3 (420 Bcf) for three gas discoveries made in the 1980's.

Interest has been recently renewed in this region with the prospect of a Mackenzie Valley pipeline passing within economic tie-in distance. Several wells were drilled and new seismic was shot in 2003; these data are confidential at this time. More wells are planned for 2004.

Volumetric reserve estimates for the 1980's discoveries were derived using non-confidential data contained in well files, drill cuttings, core and other sources. Pool sizes are largely based upon previous seismic interpretations done by the original operating companies.

The Bele discovery is located on a gentle anticline with a pool extent of 7840 hectares and gas reserves estimated at 2323 10^6m^3 (82 Bcf) in the Cambrian Mount Clark Formation. Mount Clark reservoir rock at Bele is comprised of fine-grained, well-consolidated quartz arenite with an average porosity of 11%.

The Tedji discovery has an area of 3681 hectares with gas reserves of 882 10^6m^3 (31 Bcf) in Mount Clark sandstone. A fining-upwards sand lens, developed in a near shore environment, provides reservoir rock with 14% porosity. The gas is trapped in an anticlinal structure interpreted as a product of strike-slip adjustments of crustal scale Proterozoic faults.

The Tweed discovery has gas reserves of 3347 10^6m^3 (118 Bcf) in the Mount Clark (pool size 8272 hectares) and 104 10^6m^3 (3.7 Bcf) in Cambrian Mount Cap sandstones (pool size 1685 hectares). The Mount Clark pay zone is a fine-grained quartz arenite with porosity of 11%; Mount Cap pay consists of two dolomitic siltstone beds each with an average porosity of 10%. Gas is trapped in an anticline ten's of kilometres long and recognizable at surface.

GOOD BASIC GEOSPATIAL INFORMATION, A FOUNDATION FOR GOOD DIGITAL GEOSCIENCE

Jolicoeur, P.
Geomatics for Northern Development, Centre for Topographic Information of Sherbrooke
Natural Resources Canada, Sherbrooke, QC

As development of the North increases, the need for good basic geospatial information also increases. It is believed that the lack of such information may be a barrier to economic development. The federal government and particularly NRCan have a clear role to play in providing such information. The Earth Science Sector's program (ESS) Geomatics for Northern Development is dedicated to answering this need. This obviously is to be done in consultation with its clients/stakeholders.

Since priority has been put on answering the North's needs (around 2 years ago), extensive work has been done. This presentation shows what is being done to better answer the needs and gets feedback from participants.

The Northwest Territories have already full coverage of National Topographic Database (NTDB) data at the 1:250,000 scale. There is no data at a larger scale for a huge part of the territory. This information however does not answer today's needs. New technology (GPS) requires precise and accurate information in all fields (environmental, gas/ petroleum industry, mines, governments). It is now crucial to answer these needs.

Generally it is agreed that the NTDB at the 1:50,000 scale is much more appropriate and should be made available on a short-term period. Right now, over 50% of the coverage is not completed for NWT.

In an effort to respond to identified needs, ESS is undergoing extensive work at the 1:50,000 scale. The main goal is to accelerate the basic NTDB data coverage for the NWT, improve this information with planimetric correction and update its content with Landsat 7 ortho-imagery. There is also ongoing production of Landsat7 ortho-imagery for a National coverage, DEM production for a National coverage and National road network updating.

MINERAL CLAIMS MAPPING IN THE DIGITAL AGE - TOWARD AN IMPROVED BASE WITH HIGH-RESOLUTION IMAGERY AND A SDE-POWERED GEODATABASE

Juniper, J.
Indian and Northern Affairs Canada, NT Region, Yellowknife, NT

The NWT Region of the Department of Indian Affairs and Northern Development (INAC) records, maintains, administers and manages a large amount of information pursuant to various pieces of legislation related to federal surface and subsurface rights across the entire Northwest Territories (NWT) and Nunavut. The Land Administration Division of the Operations Directorate records and maintains all federal land use permits, land leases, quarry permits, agreements for sale, parks, reserves, preserves and withdrawals. The division also records and maintains historical and existing land and land use records. The Mining Recorder's Office of the Mineral and Petroleum Resources Directorate records, maintains, administers, and manages all federal subsurface rights in the Northwest Territories, including mineral leases, permits, mineral claims, and mineral staking.

DIAND has historically provided clients with information services to ensure compliance with the Canadian Mining Regulations and the disposition of Federal Lands. Over the past several years, demand for digital information in addition to hard copy maps, including web-delivered data and on-line map viewing has increased dramatically. In order to meet the public's service expectations and to fulfill the department's business functions and legal mandate, it is imperative that the digital base data and the products created with this data are available at an appropriate scale and as accurate and precise as possible.

This presentation focuses on the identification of some of the unique challenges facing the INAC - NT Region Information Management in their efforts to provide the Mining Recorder's Office and the mining industry with a viable paper and digital mapping products and services. Specifically, it focuses on the potential for LandSat7 ortho-imagery as a more accurate base map for mineral claim mapping and as an alternative base for map visualization on the web. It also introduces a project plan for addressing the functional challenges through the implementation of an ArcSDE-powered geodatabase and the redevelopment of SidViewer with ArcGIS 8.x technology.

THREE DIMENSIONAL COMPUTER MODELING OF A TUNGSTEN SKARN, CANTUNG, NWT

Kirkham, G.[1], Falck, H.[2], and Tenney, D.[3]
1. Kirkham Geosystems, Vancouver, BC
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT
3. North American Tungsten Ltd., Tungsten, NT

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

The Cantung Mine is an unusually large (4.2 million metric tons of ore) and high-grade deposit (>1.6% WO_3) that developed in a package of folded and overturned limestones above a Cretaceous granite intrusion (95 Ma). Cantung was the western world's largest tungsten producer during its operation from 1962 to 1985 and currently is the source of nearly 10% of global tungsten production. It was placed into care and maintenance in 1986 when commodity prices fell, but its re-opening offers an excellent opportunity to examine a world-class skarn deposit using current modeling techniques.

The objective of the project is to create a complete, integrated model of the mine combining geology, assays, topography, surface features and underground workings. It is hoped that this new 3D view of the mine and surrounding areas will improve the understanding of the formation of these interesting deposits and act as a guide for unexplored or under-explored areas.

HOPE BAY PROJECT - CANADA'S PREMIER UNDEVELOPED GREENSTONE GOLD BELT, NUNAVUT TERRITORY, CANADA

Kleespies, P. and Lindsay, D.
Miramar Mining Corporation, Vancouver, BC

The Hope Bay project is one of the most prospective undeveloped greenstone belts in Canada and contains a number of significant gold deposits hosted in a typical Archean greenstone belt. The deposits occur in several geologic settings, including shear hosted, lode and breccia associated, and these types are illustrative of the diverse potential of the belt. Intensive exploration conducted by Miramar, including more than 140,000m of drilling in the period 2000-2003 has significantly advanced the understanding of the geology of these deposits, while regional exploration has identified a number of additional targets.

The Hope Bay greenstone belt extends over 80km in a north-south direction and is between 7 and 20km wide. The belt comprises mafic meta-volcanic and meta-sedimentary rocks that are bound by Archean granite intrusives and gneisses. The greenstone package has been deformed during multiple events and is transected by major north-south trending shear zones that appear to exert a significant control on the occurrence of mineralisation. Three major mineralized districts have been identified to date, each of which is host to several gold deposits.

Doris is typical of the "Archean lode" deposit style and consists of a steeply dipping, 4km long quartz vein system in folded and metamorphosed pillow basalts. At Doris North, the veins are folded to create a high-grade anticlinal hinge zone which hosts significant, high grade, near surface resources. Miramar has commenced permitting and anticipates bringing this area into production in 2005.

Boston is located near the southern end of the belt and is characteristic of "Shear hosted" gold deposit type. It is associated with a flexure in the Hope Bay structural break. Gold is associated with sulphide mineralization, which forms in clots within the veins and as a halo in the wall rock around the veins. Drilling in 2003 has more than doubled the depth extent of this deposit and radically changed the geologic interpretation of the area.

At Madrid drilling in 2001-03 defined a major structure, the Deformation Zone (DEFZ), which is comprised of highly deformed quartz-dolomite and porphyry, over a strike length of more than 11km. Exploration drilling has identified numerous gold deposits and occurrences along this trend in 2001-03. Styles of mineralization are variable and include disseminated, stockwork and breccia style gold mineralization in altered mafic volcanics and in brecciated, silicified and sulphidized mafic to ultramafic volcanics with intercalated argillite. Exploration in 2003 has significantly expanded the known gold mineralization, and advanced Miramars understanding of the controls on mineralization in the area.

Numerous other exploration targets remain to be tested on the Hope Bay belt in a variety of geologic settings.

The poster will highlight the geology and mineralization of the Hope Bay belt; provide an insight into the latest exploration results and review the development progress for the project.

ARE RISK-BASED ASSESSMENTS PROVIDING THE ANSWERS NEEDED TO UNDERSTAND AND EFFECTIVELY MANAGE HEALTH AND ENVIRONMENTAL RISKS IN NORTHERN ENVIRONMENTS?

Koppe, B.[1], Morison, S.[2], and Brown, G.[1]
1. Environmental Toxicologist, Cantox Environmental Inc., Calgary, AB
2. Gartner Lee Limited

Decision-making regarding resource management decisions such as mine reclamation can be challenging. Despite significant progress to date, more pressure is being exerted for more

extensive and complete cleanup of contaminated sites, frequently to "background" conditions. Meanwhile, it is unclear whether significant advances in public health and environmental quality are realized through the extra expenditures that are required.

Well developed methods are currently available and in wide use throughout Canada and the U.S. for assessing the potential risks of chemical contaminants on public health and environmental quality. These approaches will need to be modified to account for and incorporate the unique (and sensitive) human and ecological characteristics found in northern Canada. While it will be possible to adapt the risk assessment to northern conditions, a certain amount of skepticism about the benefits of risk assessment is known to exist, as certain members of the public and some regulators feel it is sometimes used as justification for not fully remediating contaminated sites. The message that we will deliver in this talk is that much of the skepticism regarding the risk-based approach arises from lack of information, lack of understanding and/or oftentimes, lack of trust in the results. This is despite the use of highly conservative scientific approaches for estimating the health risks from chemical contaminants.

The presentation will include brief case studies that will illustrate the advantages and disadvantages of risk-based decision making compared to the conventional approach of remediating sites to meet generic soil and groundwater quality criteria.

SOAPSTONE OCCURRENCES ON TUKARAK ISLAND: A PRODUCT OF PLUME TECTONICS ON THE EAST MARGIN OF THE TRANSHUDSON OROGEN, BELCHER ISLANDS, NUNAVUT

Laarman, J.[1], Johnson, W.[2], and Duke, N.[1]
1. Dept. of Earth Sciences, Univ. of Western Ontario, London, ON
2. Nunavut Tunngavik Incorporated, Cambridge Bay, NU

The community of Sanikiluaq on the Belcher Islands is well known as a major soapstone carving center, and its product is highly valued for the fineness of grain and high polishing standards. These features owe much to the uniqueness of the raw materials available at this locale. Where most soapstone is sourced in serpentinization of ultramafic igneous rocks, the source on the Belcher Islands is talc-altered impure dolomite occurring marginal to regionally extensive gabbro sills. The Belcher soapstone derives from the hydrothermal alteration of sedimentary rocks rather than having an igneous rock parentage.

The primary soapstone quarries in the region are located on Tukarak Island. Tukarak is cored by a central anticline that exposes shallow-dipping Belcher Island stratigraphy. The lower exposed section is dominated by transgressive stromatolitic dolomite/red-green argillite couplets which are interrupted by a thick unit of plagioclase-porphyritic flood basalt. This rifted continental margin succession is capped by the Kipalu Iron Formation which is in turn overlain by a major unit of pillow basalt of oceanic provenance. Sills relating to continental breakup intrude the sedimentary succession well below the Kipalu. The lowermost plagioclase-poor "picritic gabbro," which intrudes impure stromatolitic dolomite/argillite between the major volcanic

members, has local "massive soapstone" developed in impure dolomite along its immediate interior contact. Its outer contact, in contrast, is characterized by friable talc schist, indicating that the sill formed a deformation barrier during regional folding. Strain was partitioned to its upper outer contact while a strain shadow prevailed along its lower inside limb. Accordingly, the thermal aureole is strongly telescoped to a few meters above but is well preserved below, as demonstrated by bleaching of orange-weathering dolomite to brown, buff, grey, and white within about 50 meters of the sill contact.

High quality massive soapstone is confined to the immediate gabbro contact. The best soapstone quarries occur where there are irregularities, such as where the sill ramps upward in stratigraphy, where feeder dykes occur below, or where there are multiple sill injections, suggesting that these were thermal nodes for enhanced hydrothermal activity. Significantly, the affiliated gabbro is itself pervasively hydrated, and shows a weak tectonic fabric, indicating that it intruded an active structure involved in basin collapse and also became a physical barrier for escaping formational brines. Assuming that intrusion coincided with the drowning of the shelf margin at the switch from the deposition of the oxidative Kipalu Iron Formation to reduced black argillite/chert interlayered with the pillow basalt cover, the gabbro was emplaced within about 1.5 kilometers of the ambient sediment/sea water interface. The talc development relates to subsolidus convective hydrothermal cooling between 1000° and 300°C of both the sill and its thermally baked margins. Structural overprinting relates to tight folding during closure of the TransHudson Orogen by the Hudsonian Event at 1850Ma; and this deformation destroyed all massive talc except for pockets preserved within local strain shadows.

THE AKLAVIK RANGE: MULTIPHASE DEFORMATION IN THE NORTHERN RICHARDSON MOUNTAINS, MACKENZIE DELTA REGION

Lane, L.S.
Geological Survey of Canada, Calgary, AB

Two structural domains are documented by new detailed bedrock mapping in the Aklavik Range map area (107B/4). A western low-strain domain, located between the Donna River Fault zone (DRFZ) and the Cache Creek uplift, preserves open doubly-plunging folds that are dismembered by predominantly local-scale faults. An eastern high-strain zone coincides with the DRFZ and the Aklavik Range itself. Within this zone, both folds and faults are dominated by northwest structural trends. Whereas the folds in the low-strain domain have wavelengths on the order of 10 km, structures in the high strain domain typically are spaced less than one kilometre apart.

The low-strain domain is dominated by the Martin Creek anticline and syncline, gentle folds trending 010° with limbs dipping less than 30°. The anticline extends across the entire map area but has not been previously identified. The syncline terminates southward and is replaced by a second syncline offset en echelon to the east. The folds are markedly doubly plunging, producing a dome and basin geometry. Faults are common, but only three exceed 10 km in mapped length. Faults have steep dips but variable strikes and are best developed in the brittle sandstone-dominant units (Bug Creek and Parsons groups). They dissipate in the thick shale

successions (Husky and Mount Goodenough formations). Local structures indicate an evolution consisting of early east-west shortening followed by later north-south shortening accompanied by east-west extension.

The Donna River Fault is a splay diverging northward from the Richardson-Trevor-Eskimo Lakes fault system. It projects beneath the Mackenzie Delta to define the eastern margin of the Tununuk High, which is the downplunge projection of the Cache Creek uplift. The fault, where exposed, is a subvertical, throughgoing structure striking 010°, accompanied by a zone of brecciation up to 300 m wide. The Aklavik Range is a local structural culmination comprising competent Paleozoic and Jura-Cretaceous strata east of the Donna River Fault, juxtaposed against Early Cretaceous shale and sandstone on the west. Most faults within the Aklavik Range have steep dips; however, three low-angle east-directed thrust faults are mapped. The Donna River Fault zone preserves evidence of multiple episodes of displacement since Jurassic time. Inferred Jura-Cretaceous rift-related activation has been completely overprinted by Tertiary convergent and dextral strike-slip deformation. However, multiple sets of fault striations are rarely preserved in this zone. The orientations of subsidiary folds and faults, and penetrative fabrics within the DRFZ both indicate dextral strike-slip; whereas the low angle thrust faults and significant uplift of the Aklavik Range both indicate important convergence.

OVERVIEW OF STRUCTURAL INHERITANCE IN THE LIARD BASIN REGION

Lane, L.S. and Fallas, K.M.
Geological Survey of Canada, Calgary, AB

The recently completed Central Foreland NATMAP Project has produced a suite of new maps and GIS datasets through two parts of the Cordilleran foothills in the Liard Basin region. The two areas straddle the Liard Line, a Late Proterozoic discontinuity interpreted as a crustal-scale transfer fault active during Late Proterozoic rifting of western Laurentia.

Bedrock mapping, combined with subsurface and potential field studies, has revealed some of the controls on structural variation both within and between transects. Within the northern transect, detailed mapping has clarified the geometry of apparently sinuous structural trends, as being due to interference between northwest and northeast trends. These interference patterns probably result from the influence of early Paleozoic facies transitions combined with a weak regional decollement.

Between transects, the scale and orientation of structures, and the thickness and preservation of stratigraphic units differ. Although the surface structures are detached on the Late Devonian Besa River Formation throughout the project area, structures in the north are ten times larger. Also, the deformation front extends some 150 km farther east, and the surface thermal maturity in the north is less than half that farther south. The factor controlling these differences is the mechanical stratigraphy. The northern transect is underlain by a thick Carboniferous succession of limestone and sandstone (Flett and Mattson formations) that is not present in the south. The Mattson attains a thickness of up to 1400 m, whereas the stratigraphy in the southern transect is

not dominated by a single competent unit but consists of a succession of thinner units. These stratigraphic thickness and facies trends as well as abrupt changes in structural trends reflect the tectonic inheritance of Proterozoic and Late Paleozoic structures.

NON-RENEWABLE RESOURCE ASSESSMENTS-UPDATE

Lariviere, J.L. and Gal, L.P.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The C.S. Lord Northern Geoscience Centre is active in non-renewable resource assessments (NRA) as part of the NWT Protected Areas Strategy (PAS; Sahyoue-Edacho and Edehzhie candidate protected areas), and land use planning efforts (Gwich'in settlement area and Deh Cho claim area). An update on NRA activities and results in 2003 is presented.

NRA Phase II fieldwork to evaluate the Sahyoue-Edacho candidate protected areas focused on Edacho in 2003. Forty-eight silt samples and 14 heavy mineral concentrate (HMC) samples were collected from streams draining Edacho. Twenty-nine water samples were also collected, along with seven bedrock outcrop samples.

Stream sediment samples and lithogeochemical data are being studied but do not reveal any significant metal anomalies. HMC and water chemistry results are pending.

Black shale outcrops were observed along the west side of the peninsula. These are correlated with similar rocks at Sahyoue, which were determined to be Turonian (Late Cretaceous) in age, and equivalent to Slater River Formation. Samples submitted for pyrolysis and measurement of total organic carbon (TOC) were determined to be potentially rich, although immature hydrocarbon source rocks (TOC=16-20%, S_2=57.4-112.7, T_{max}=402-407). They may have potential as oil shales. At Douglas Bay, coal beds are correlated with similar exposures at Sahyoue that were palynologically dated as Paleocene. The coal at Sahyoue is sub-bituminous grade.

The NRA Phase I report for Edehzhie is in final review and should be released as an NWT Open File by late 2003. Phase II fieldwork consisted of geochemical sampling covering the western 1/4 of the candidate protected area, including the Willowlake River and the Bulmer Lake area. Sampling consisted of 261 stream sediment samples at a sample density of approximately 1 per 13 km^2 and 104 HMC samples at an approximate sample density of 1 per 25 km^2. Fifty-three anion water samples and 258 routine water samples were also collected. Results of this survey are pending.

A Phase I NRA report is underway for three Gwich'in Conservation zones and Phase II fieldwork in the Richardson Mountains (Rat, Husky, Black Mountain and James Creek/Vittrekwa River conservation zones) was carried out in summer 2003. Sampling consisted of 280 stream sediment samples at a sample density of approximately 1 per 13 km^2 and 127 HMC (approximate density of 1 per 25 km^2). Fifty-nine anion water samples and 280 routine water

samples were also collected. Results of this survey are pending. Fieldwork in the Travaillant Lake conservation zone is expected to take place in the summer of 2004.

Mineral and petroleum potential evaluation studies were carried out for the Deh Cho Land Use Planning Committee (DCLUPC) in early 2003 for incorporation in their land use planning exercises. The mineral potential mapping report has been submitted to the DCLUPC as a final draft version. The report is in the critical review stage of the NWT Open File process and should be released in late 2003. The petroleum potential study by L. Gal and A. Jones has been released as C.S. Lord Northern Geoscience Centre NWT Open File 2003-03.

MINERAL POTENTIAL MAPPING OF THE DEH CHO TERRITORY, NORTHWEST TERRITORIES

Lariviere, J.M.[1], Eddy, B.G.[2], and Udell, A.[3]
1. C.S. Lord Northern Geoscience Centre, Yellowknife, NT
2. GSI-GeoSystems Integration, Ottawa, ON
3. Victory Point FX, Yellowknife, NT

This mineral potential evaluation was requested by Deh Cho Land Use Planning Committee (DCLUPC). It is information to be considered as part of the decision making process on regional land-use planning. The C. S. Lord Northern Geoscience Centre (C.S. Lord) was contracted to deliver the mineral potential evaluation for the Deh Cho territory in the form of a series of Mineral Potential Maps. Based on the large geographic extent of the area, combined with time and data constraints, a knowledge-driven mineral potential mapping approach has been taken. In combination with the Geologic Survey of Canada's ranking scheme, a set of Mineral Potential Maps has been produced showing geological favourability and ranking of Resource Assessment Domains (Domains) for nine significant mineral deposit-types.

The nine mineral deposit-types considered were selected from a list of twenty types thought to have the potential to occur in the Deh Cho territory. These deposit-types were selected from an initial list of eighty-two mineral deposit-types and sub-types identified in the Geology of Canadian Mineral Deposit-types (Eckstrand et al, 1996). Of the nine considered in this study, the results show significant potential for:

Sedimentary exhalitive sulphides (SEDEX) zinc-lead;
Sediment-hosted stratiform copper;
Mississippi Valley-type lead-zinc;
Vein copper;
Skarn deposits (emerald, gold, tungsten, copper, and lead-zinc);
and to a lesser extent:
Stratiform iron, and granite pegmatite (tantalum, cesium and lithium).

The most significant potential occurs in the western part of the study area, within the Cordilleran geologic province. Specifically, within the Deh Cho boundary, six Domains (11, 18, 20, 21, 23,

and 33) are ranked high to very high mineral potential for a number of deposit-types. It is within these specific domains that the potential for discovery of new mineral deposits is most likely. The general conclusion is that the Deh Cho shows at least some mineral potential (if not for one type, then another) in all locations. There is no area within the Deh Cho territory that can be said to have no potential or very low potential.

Although the potential in the western portion is relatively higher than the central and eastern portions, it must be understood that new discoveries, data, and knowledge about the study area continue to emerge. As a result of these new data and knowledge acquisitions, re-evaluation of the mineral potential may result in a high potential for some commodities in regions that were previously ranked relatively low in this study, or not assessed at all (eg. Diamonds).

Eckstrand et al., 1996: GSC, Geology of Canada, no. 8, p. 1-7 (*also* GSA, The Geology of North America, v. P-1).

GEOSCIENCE DATA MANAGEMENT AND GIS AT THE YUKON GEOLOGICAL SURVEY - DIGITAL MAPPING FROM THE FIELD TO THE INTERNET

Lipovsky, P.S. and Stuart, A.
Yukon Geological Survey, Department of Energy, Mines and Resources, Yukon Government, Whitehorse, YT

The collection, management and publication of geological data have rapidly become dominated by digital techniques. Large amounts of digital data are now being produced, demanding efficient methods of storage, analysis and final presentation. The Yukon Geological Survey (YGS) is addressing these increasing digital demands at all stages of the geological mapping process, including field data collection, map production, and distribution of the final products. The YGS has developed a set of tools that facilitate digital data capture in the field and efficient production of geological maps using standard drafting and GIS software (AutoCAD, ArcView and ArcGIS). Digital data is ultimately released to the public in many forms including interactive CD-ROM's and an internet mapping server (IMS) website from which Yukon-wide geoscience data can be browsed and downloaded.

DIGITAL DATA MANAGEMENT AND MAP PRODUCTION FOR THE FIELD GEOLOGIST USING YUKON GEOLOGICAL SURVEY'S GEOFIELD

Lipovsky, P.S., Colpron, M., and Pigage, L.C.
Yukon Geological Survey, Department of Energy, Mines and Resources, Yukon Government, Whitehorse, YT

Today's geological world has rapidly become dominated by digital techniques, demanding efficient methods for digital data capture, storage, analysis and final presentation of geological

information. GeoFIELD is a data management system developed by the Yukon Geological Survey (YGS) to facilitate digital data capture and efficient production of geological maps while in the field. GeoFIELD is an enhanced Microsoft Access 2000 database that interacts with AutoCAD Map 2000 using Visual Basic for Applications programming to allow digitizing and plotting of station locations and structural data. GeoFIELD's database structure was modeled after the GSC's FieldLOG and the system offers similar functionality to meet the needs of the YGS staff. The Microsoft Access platform offers a user-friendly interface from which field data can easily be entered, browsed and updated. It also offers the ability to build complex database queries, generate reports, and customize the database structure. Extensive picklists are easily customizable and ensure consistency and quality control during data entry. GeoFIELD can be used effectively with a handheld device and as well as with common GIS applications such as ArcView 3.x and ArcGIS 8.x. The use of GeoFIELD at the YGS has allowed large scale regional mapping programs to achieve the collection and processing of raw field data to the production of publicly released digital interactive maps within a six month period.

GEOCHEMICAL AND ND ISOTOPIC SIGNATURE OF MAFIC AND ULTRAMAFIC MAGMATISM IN THE ARCHEAN PRINCE ALBERT GROUP, COMMITTEE BAY GREENSTONE BELT, CENTRAL MAINLAND NUNAVUT, CANADA

MacHattie, T.G.[1], Heaman, L.[1], Creaser, R.A.[1], Skulski, T.[2], and Sandeman, H.A.[3]
1. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB
2. Geological Survey of Canada, Ottawa, ON
3. Canada-Nunavut Geoscience Office, Iqaluit, NU

The ca. 2.7 Ga Prince Albert Group (PAG) occupies a 650 km long, northeast trending corridor of the Rae province in mainland Nunavut. Mafic and ultramafic rocks dominate the volcanic successions in the group with comparatively rare intermediate to felsic volcanic/volcaniclastic(s). The lower PAG stratigraphy is floored by a basal sequence of basalt (locally pillowed), komatiitic basalt and gabbro overlain by an extensive horizon of peridotitic komatiite and lesser komatiitic basalt and basalt. U/Pb zircon ages of felsic and intermediate crystal-lapilli tuffs within the basalt pile range between 2732+8/-2 and 2729.8±1.2 Ma respectively, the latter located at the top of the basalt horizon immediately below koamtiite. The lower age limit to "basalt dominated" volcanism is identical to a U/Pb zircon age of 2729.7±0.9 Ma determined on a crystal-lapilli tuff within the komatiite horizon. Currently the upper age limit to main komatiite horizon is constrained by a 2718±2 Ma crosscutting granodiorite, and the youngest detrital zircon in overlying orthoquartzite (2722±11Ma).

Within both the basalt and komatiite horizons crustally contaminated samples can be identified. Contamination is recognized by high, but variable Th/NbN (primitive mantle normalized) (>1 to >>1) and variable LREE-enrichment. The formation of contaminated basalts and komatiitic basalts can be successfully modeled by coupled assimilation/fractional crystallization processes (AFC=20-35%) from a komatiitic parental magma. Contaminated komatiite contains 1-3% upper continental crust. The variable fractionation of Th, Nb and the LREE is due to heterogeneity in the crustal composition added (eg. upper vs. lower). The Nd isotopic

compositions of the contaminated basalts are distinctly juvenile, ranging between +2.0 to +2.8 (n=5), indicating that the crustal contaminant was relatively recently extracted from the depleted mantle.

Uncontaminated komatiite (Ce/SmN = 0.39-1.06) can be divided into two groups based initial Nd isotopic compositions, group 1 (n=6) are more depleted having εNd (2730) between +3.4 to +4.3 while group 2 are lower, ranging between +2.0 to +2.8 (n=11). The major and trace element geochemistry of komatiite cannot distinguish between the two groups. Uncontaminated basalt displays a very wide spectrum of trace element compositions, from LREE-depleted to moderately-, to strongly-enriched basalts (Ce/SmN = 0.60-2.13). The Nd isotopic composition of these basalts is similar to the group 2 komatiite having εNd (2730) between +1.7 and +2.9 (n=6).

The narrow range in 143Nd/144Nd(2730) of group 2 komatiite and uncontaminated basalts (0.509180-0.509241) is accompanied by a relatively wide range in 147Sm/144Nd (0.1167-0.2718) resulting in a well correlated (17 point) Sm-Nd isochron that yields an age of 2727±29 Ma. This age is in very good agreement with the U/Pb zircon ages of intercalated intermediate and felsic volcanics (above). The geochemical and isotopic data indicate that komatiite and basalt were sourced from a long-term depleted mantle reservoir having an average εNd (2730) = +2.3±0.3, and that the extreme fractionation of the Sm/Nd (and other incompatible elements) occurred during melt generation processes in the mantle.

A NEW LOOK AT BOVIE STRUCTURE AND ITS REGIONAL CONTEXT

MacLean, B.C.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Bovie Structure is a curvilinear feature, over 200 km long, extending in a northerly direction from northeast British Columbia into southern Northwest Territories near 123° west longitude. Over part of its length it manifests itself at surface as the doubly plunging Bovie anticline, a prominent feature that crosses the NWT - BC border. A study sponsored by the Central Forelands NATMAP project incorporated reflection seismic and aeromagnetic data. When combined with 3-D GIS mapping and digital elevation model displays, it reveals how Bovie Structure changes along strike and how it is best developed at Bovie anticline. This anticline underwent two stages of development. The first stage was one of basement uplift, possibly coincident with establishment of the Celibeta High, sometime after deposition of the Mississippian Mattson Formation but prior to the Cretaceous. The second stage occurred during the Laramide Orogeny when a shallow detachment fault severed a portion of the older uplifted block carrying it eastward and upwards. The interpretation presented here incorporates two phases of contractional tectonics and thus generates several new hydrocarbon plays not considered in the traditional extensional model.

THE SUB-PHANEROZOIC BASEMENT SURFACE UNDER THE SOUTHERN NORTHWEST TERRITORIES AND ITS INFLUENCE ON OVERLYING STRATA

MacLean, B.C.[1] and Morrow, D.W.[2]
1. C.S. Lord Northern Geoscience Centre, Yellowknife, NT
2. Geological Survey of Canada, Calgary, AB

The sub-Phanerozoic basement surface under the southern NWT has been mapped using reflection seismic and well data as a contribution to the NWT - Alberta - GSC joint MVT project. The basement surface is seen to dip gently southwest and to be broken by numerous faults that are small in terms of both throw and extent. Seismic control is often insufficient to confidently define fault strike. However, extensive features such as the Cordova Embayment area, Celibeta High and the Bovie trend are easily seen and provide some guidance as to fault directions. Comparison with aeromagnetic patterns, middle Devonian stratigraphy, and surface drainage patterns provide suggestions of NE and SW regional trends but these must remain speculative until more data are available.

GEOGRAPHICAL INFORMATION SYSTEMS AS A TOOL FOR DATA INTEGRATION AND MAPPING

Mair, N.
NWT Centre for Geomatics, Yellowknife, NT

Geographical Information Systems (GIS) are able to easily integrate data from a variety of sources. High resolution satellite imagery, aerial photography, cadastral information, and pipeline and road coordinates are but a few of the many sources of spatial data that a GIS can incorporate into a single map product. A map product composed from such a wide spectrum of data or the analytical output derived from those data, can be a significant aid in the management of decision making, consultations and other such uses. In poster format, this display provides a number of map compositions created at the NWT Centre for Remote Sensing highlighting data integration and display used for real world applications in the NWT.

GEOTHERMOMETRY AND FLUID INCLUSION STUDIES OF THE E-ZONE BIOTITE SKARN, CANTUNG MINE, TUNGSTEN, NWT

Marshall, D.[1], Falck, H.[2], Mann, B.[3], Kirkham, G.[4], and Mortensen, J.[5]
1. Simon Fraser University, Burnaby, BC
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT
3. North American Tungsten, Tungsten NT
4. Kirkham Geosystems Ltd., Vancouver, BC
5. University of British Columbia, Vancouver, BC

The E-Zone at North American Tungsten's CanTung Mine at Tungsten, NWT is comprised of a typical exoskarn profile in the Sekwi and Vampire formations surrounding an Upper Cretaceous (~91 Ma) two-mica pluton. Skarn assemblages range from garnet-diopside at the upper end through pyroxene-pyrrhotite and amphibole-pyrrhotite to biotite-pyrrhotite. Scheelite is the dominant tungsten-bearing phase and occurs generally with pyrrhotite and is hosted within the locally-named Ore Limestone unit.

The biotite skarn, a biotite-rich phase of the biotite-pyrrhotite skarn, consists primarily of fluorine-bearing biotite, minor quartz veins, sulphides and lesser amounts of fluorapatite and the rare earth epidote allanite. Petrographic studies are consistent with contemporaneous precipitation of the biotite, pyrrhotite, fluorapatite and sulphides. Electron microprobe analyses of F and OH contents of coexisting biotite and fluorapatite are consistent with maximum precipitation temperatures in the range of 550 °C.

Cathode luminescence and back-scattered imaging via a scanning electron microscope reveals growth zones in the fluorapatite and allanite. Zoning in the fluorapatite is visible to a lesser extent petrographically as defined by an inclusion-rich core and a fluid inclusion-poor outer rim. Preliminary fluid inclusion work, the work of Mathieson and Clark (1984) and Zaw and Clark (1977) reveal that the fluid inclusions range in composition from liquid-rich brine inclusions to CO_2-bearing brine inclusions with varying proportions of vapour.

The entire sphalerite dataset for coexisting pyrrhotite, sphalerite and pyrite from Mathieson and Clark (1984) and Zaw and Clark (1977) is consistent with formational pressures in the range of 1 to 2 kilobars using the sphalerite geobarometer of Toulmin et al. (1991). Intersection of the fluid inclusions isochores with these pressure constraints indicates that the brine fluid inclusions were probably trapped in a one-phase field, but the CO_2-bearing brine inclusions may have been the product of phase-separation at the pressures and temperatures of skarn formation. The slightly increased pressures for skarn formation are also consistent with the lack of a meteoric signature in the stable isotope data. The higher pressures suggest that skarn formation may have occurred at depths on the order of 3 to 6 km and the evidence of boiling in the system suggests a slight modification to the existing model of skarn formation at Tungsten.

Mathieson and Clark, 1987 Econ. Geol., 79, 883-901
Toulmin et al., 1991, Am. Min., 76, 1038-1051
Zaw and Clark, 1977 GAC/MAC Abstracts, 2, 57

GEOLOGY AND DEFORMATION HISTORY OF THE FERGUSON LAKE CU-NI-CO-PGE DEPOSIT, YATHKYED GREENSTONE BELT, WESTERN CHURCHILL PROVINCE, NUNAVUT

Martel, E. and Nicholson, J.

During the summer of 2003 mapping was conducted in the western portion of the western Churchill Province, Nunavut, around the Ferguson Lake Cu-Ni-Co-PGE deposit owned by Starfield Resources. The project, funded by the Canada-Nunavut Geoscience Office in association with Starfield Resources, has been initiated in order to better understand the geology and deformation history of the Ferguson Lake area and to put the Cu-Ni-Co-PGE deposit into a regional perspective. Ongoing support through geochemical and geochronological studies will further benefit the project.

Both gneissic metavolcanic and metasedimentary rocks, widely intruded by granitoid sheets, have been recognized in the study area. The area was intruded by tonalitic to granodioritic sheets and plutons. A number of younger syenite plutons outcrop on the map area, and are tentatively assigned to the Proterozoic Martell Syenite Suite that has been previously mapped in the region. The layer of massive sulphide is hosted in hornblendite, which is interpreted here to be an Archean ultramafic sill.

At least three generations of ductile deformation (G1, G2 and G3) are recognized in the study area, based on fold and foliation overprinting relationships. The earliest fabric is defined by gneissic layering (Sgn), and affected most of the rocks in the map area. Whether this gneissosity formed during the early stages of G1 or prior to it is uncertain. A foliation developed parallel to the gneissosity is interpreted to have formed during G1. G1 also produced strongly developed, shallow plunging L1 lineations (stretching and mineral). Large-scale recumbent folding of the gneissosity, with east-west fold hinges is also a result of G1. The G1 fabrics have been folded by upright, doubly plunging F2 folds with an S2 axial planar foliation. The variation in orientation of F2 fold hinges is interpreted as a result of interference with pre-existing folding (F1). D3 produced open, moderately north or south plunging F3 folds with no associated foliation or lineation. G3 was followed by the generation of ductile to brittle structures. A conjugate set of discrete shear zones is common throughout the map area, and indicates a north-northwest-east-southeast compression component after the main folding event (F2). Brittle faults are generally oriented northwest and generally show sinistral displacement.

Regional scale mapping around the deposit indicates that the massive sulphide horizon, as well as the hornblendite host, are deformed along with the stratigraphy. The horizon is found within the north-dipping limb of an F2 fold. Further mapping along the western extension of the massive sulphide horizon is essential to constrain the geometry of the deposit.

THE STRATIGRAPHIC MAKE UP OF THE KIPALU IRON FORMATION: BRIDGING THE RIFT/DRIFT UNCONFORMITY IN THE EASTERN TRANSHUDSON OROGEN, BELCHER ISLANDS, NUNAVUT

Masters, J.[1], Johnson, W.[2], and Duke, N.[1]
1. Department of Earth Sciences, University of Western Ontario, London, ON
2. Nunavut Tunngavik Incorporated, Cambridge Bay, NU

The Kipalu Iron Formation is exposed on the Belcher Islands segment of the Circum-Superior TransHudson Orogen. It occupies the same stratigraphic position as other major Superior-type iron formations occurring in the Labrador Trough and in the Great Lakes Region of the Penokean Fold Belt. In all cases these major iron formations overlie passive margin quartzite-carbonate successions and are overlain by deep marine black shale-volcanic strata of oceanic provenance. Affiliated gabbro sills (2250-2100 Ma) suggest that these iron formations occupy a significant time interval at the rift-to-drift unconformity in the evolutionary history of the Paleoproterozoic TransHudson geotectonic cycle

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The overall Belcher Islands stratigraphy comprises lower transgressive stromatolitic dolomite-variegated red-green argillite couplets, interrupted by a major plagioclase-porphyritic flood basalt unit. The succession is capped by the approximately 100-150m thick Kipalu Iron Formation. It is immediately underlain by regressive cross-bedded quartzite, and immediately overlain by pillow lavas with minor interlayered black chert. Detailed stratigraphic sections were constructed and sampling carried out across the Belcher Islands, from Fairweather Harbour on northern Innetalling Island and on northern Tukarak Island in the east, through Haig Inlet on central Flaherty Island, to southern Kugong Island in the west. In general, the bottom 25m consists of fissile to blocky, drab brown-green Fe-Mn argillite conformably overlying cross-bedded quartzite. The overlying 25m interval of blocky black- weathering Fe-Mn argillite has abundant interlayered decimeter-scale cherry-red chert beds. This lower section is capped by 10-25m with massive bands of magnetite- hematite, with locally associated layers of blue-black Mn-carbonate. The upper 25-50m are dominated by blocky Fe-Mn argillite, with minor interlayers of Fe-carbonate, while lenses of ferruginous cross-bedded quartzite and bands of chert occur near the top. The unit is capped by 0-50m of platey black pyritic argillite which is intruded by multiple gabbro sills and is interlayered with the lowest flows of the overlying pillow basalt.

A subtle change within the Kipalu stratigraphy indicates that the deep marine incursion occurred from west to east. At Haig Inlet and Fairweather Harbour, the redox boundary is knife sharp, whereas on western Flaherty there is more transitional grey chert separating red-green chert-argillite from the overlying black platey argillite. The Kipalu transgression documents the drowning of the continental margin at the onset of seafloor spreading within the internides of the TransHudson Orogen. Exposure of the Belcher Islands segment of this margin suggests that a regional geanticlinal basement arch is developed along the paleo shelf/slope hingeline. The major magnetite-hematite concentrations occur on central Flahery Island, and the most persistent and thickest Mn-carbonate units were observed at the south end of Kugong Island. The widespread occurrence of high-valency Fe-Mn oxide-carbonate bands within the Kipalu Iron

Formation suggests an unusually oxidative depositional setting, perhaps accounted for by the thick succession of underlying stromatolitic dolomite.

THE GEOLOGY AND MINERALOGY OF THE ANURI KIMBERLITE, NUNAVUT, CANADA

Masun, K.M., Doyle, B.J., Ball, S., and Walker, S.
Kennecott Canada Exploration Inc., Vancouver, BC

The 613 Ma Anuri kimberlite comprises two steep-sided eruptive pipes that coalesce at the present surface. The pipes are infilled predominantly with volcaniclastic kimberlite (VK) and hypabyssal kimberlite (HK) occurring at depth in the eastern lobe. The VK comprises altered fragmental breccia that is composed of a variety of crustal, mantle and cognate components. It can be divided into four subtypes: lithic breccia, mud-rich volcaniclastic kimberlite, autolithic volcaniclastic kimberlite breccia, and heterolithic volcaniclastic kimberlite breccia. HK occurs as a competent, dark gray macrocrystic rock characterized by high magnetic susceptibility and density. Mineralogically, the VK is composed of altered olivine and mantle-derived pyrope garnet, clinopyroxene, chrome spinel, lesser ilmenite and rare eclogitic garnet. HK is comprised of abundant macrocrystal olivine and common chrome spinel. Typical kimberlite indicator minerals such as pyrope and ilmenite are absent. Clinopyroxene and eclogitic garnets are rare. Compositional trends of primary spinel and mica are consistent with archetypal kimberlites in both volcaniclastic and hypabyssal rock types.

The texturally contrasting types of kimberlite represent separate phases, which must have been emplaced by different processes. Features such as the proportion, type and alteration of cognate and crustal-derived xenoliths and the nature of the inter-clast matrix of the volcaniclastic and hypabyssal rock, support different modes of emplacement. Evidence indicates that the Anuri pipes were formed by two or more phases of kimberlite intruding and excavating the country rock and infilling the volcanic edifice with syn- and post-eruptive volcaniclastic infill. The country rock that once occupied the excavated crater was expelled and accumulated, together with kimberlite ejecta, as extra-crater deposits. As the locus of explosive fragmentation descended, the pipe was progressively deepened, combining juvenile magmatic fragments with slumping material from extra-crater deposits and material deposited within the crater. This resulted in the development of a massive, poorly sorted volcanic pile. There is no definitive evidence of in situ primary pyroclastic kimberlite preserved within the volcaniclastic deposits, but pyroclastic activity likely contributes to the infill of the pipes. The HK is thought to have intruded prior to VK as a separate phase of kimberlite, ascending to high stratigraphic levels and possibly breaching the surface.

COMMITTEE BAY PROJECT - THE EMERGING STORY

McDonald, D.
Vice President Exploration, Committee Bay Resources Ltd, Edmonton, AB

The Committee Bay Greenstone Belt extends over 300km and is one of the largest unexplored greenstone belts in North America with excellent gold and diamond potential. Committee Bay Resources Limited holds over 500,000 acres of land with prospective geology in the Committee Bay area southwest of Melville Peninsula, Nunavut.

Committee Bay is a typical Archean greenstone belt comparable to the Yellowknife, Red Lake, Kirkland Lake and other prolific gold belts. The belt comprises a sequence of metavolcanic and metasedimentary rocks of Archean age (the Prince Albert Group) and surrounded by granitoid gneisses. The belt has been deformed during multiple events and is transected by major northeast and east-west trending shear zones that appear to exert a significant control on the occurrence of mineralization, particularly where major flexures are apparent and coincide with iron formations.

Regional mapping of the belt by the Geological Survey of Canada in 1961 and 1967 by Heywood and 1972 and 1973 by Schau helped to advance exploration for base metals by a number of companies in the 1970's. Between 1992 and 2001 APEX Geoscience Ltd. and predecessor companies performed reconnaissance and detailed exploration for gold within the Committee Bay region including ground and airborne geophysical surveying and diamond drilling. Recognizing the exploration potential of the belt the Geological Survey of Canada through the Canada-Nunavut Geoscience Office has performed a Targeted Geoscience Initiative geological mapping and data collection from 1999 to 2002.

Committee Bay Resources Ltd was established in 2002 to concentrate on exploration in the Committee Bay belt. Gold Fields Limited, through a subsidiary, has an option to earn a 55 % interest in the property by spending US$5.0 million over the next four years and is funding all gold exploration on the Committee Bay Project. Committee Bay Resources Ltd. is the operator and carried out a C$1.8 million exploration program for 2003.

This summer's drilling resulted in: 1) the discovery of high-grade gold-bearing quartz veins with silicification and sulphidation at Three Bluffs, and 2) the continuation of high-grade gold mineralization in the hinge area of the iron formation at Inuk. Gold mineralization at Three Bluffs is identified in iron formation and adjacent sediments and has been traced by drilling for over 700m. Original banded oxide and silicate iron formation is disrupted as fluids cut through the rock. Banded magnetite and amphiboles are replaced by pyrrhotite and lesser pyrite and arsenopyrite and silicification intensifies. Mineralization and related alteration are progressively more intense to the northeast where the most recent drilling occurred. These results continue to build on the potential of the Three Bluffs area, where multiple gold occurrences have been identified on surface in several parallel zones over a strike length of at least 6 km.

An aggressive mapping and sampling program was implemented to prioritize gold targets over the 300 km long greenstone belt. Ongoing generative exploration concentrated on seven high

priority gold targets recently identified by time domain electromagnetic airborne surveys. Follow-up mapping and sampling have defined several gold-bearing zones within sulphide-bearing iron formation and shears. During the program over 500 rock grab samples were collected and have yielded a number of new targets. The company has also undertaken a program of regional diamond exploration within the belt.

WASTE ROCK MANAGEMENT AT THE DIAVIK DIAMOND MINE

McDonald, G.
Diavik Diamond Mines, Yellowknife, NT

Over the life of the Diavik Diamond Mine, some 250 Mt of country rock will be mined to access 107 M carats of diamonds. The mined rock will be placed in north and south rock piles. During the environmental assessment and regulatory permitting of the mine, it was recognized that while more than 85% of the country rock that would be mined was granite with little or no potential to leach metals, an estimated 15% of the rock that was biotite schist, had potential to leach metals. The scientific community had a wide range of views on the expected behavior of the country rock piles given the specific conditions of climate, geology, hydrology and geochemistry. This uncertainty, combined with Diavik's location, has resulted in an aggressive approach to managing waste rock. The presentation describes the implementation of the plan over the last year, successes and challenges, as well as the financial and human resource requirements.

QUATERNARY GEOLOGICAL WORK IN THE WESTERN CHURCHILL PROVINCE: RECENT AND FUTURE COMPILATIONS

McMartin, I.[1], Campbell, J.E.[2], Dredge, L.A.[1], Dyke, A.S.[1], and Little, E.C.[3]
1. Geological Survey of Canada, Ottawa, ON
2. Saskatchewan Industry and Resources, Northern Geological Survey, Regina, SK
3. Canada-Nunavut Geoscience Office, Iqaluit, NU

Compilation, synthesis, and release of extant data through maps and reports on the Quaternary history of the Western Churchill Province is crucial at this time as multiple new prospective areas for diamond exploration are now emerging in north-central Canada. The development of Quaternary Geoscience Knowledge in this region represents a key component of the Western Churchill Metallogeny Project (WCMP), which is part of GSC's Northern Resources Development Program. The WCMP is a collaborative effort between the Northwest Territories, Nunavut, Saskatchewan, Manitoba, Alberta and the GSC. New regional framework surficial mapping also forms an integral part of the project. The emphasis of the new field work is in three areas: SW Western Churchill (NE Saskatchewan), central Western Churchill (Kivalliq and Kitikmeot Regions), and NE Western Churchill (Baffin Region).

This poster first provides a location map and a list of recent Quaternary compilations over the Western Churchill Province, including surficial geology maps at various scales, till composition data, GSC publications and other government reports, and a selection of scientific papers. The poster also gives an overview of up-coming compilations that will be assembled mainly as part of the WCMP, such as surficial geology maps, ice flow maps and till composition datasets, and shows areas of recent and future field projects by the participating agencies.

THE APPLICATION OF TILL COMPOSITION TO MINERAL EXPLORATION IN THE COMMITTEE BAY AREA, CENTRAL MAINLAND, NUNAVUT

McMartin, I.[1], Little, E.C.[2], Utting, D.J.[3], Ozyer, C.A.[4], and Ferbey, T.[5]
1. Geological Survey of Canada, Ottawa, ON
2. Canada-Nunavut Geoscience Office, Iqaluit, NU
3. Department of Earth Sciences, Simon Fraser University, Burnaby, BC
4. Department of Earth Sciences, University of Western Ontario, London, ON
5. British Columbia Ministry of Energy and Mines, Victoria, BC

A regional-scale drift prospecting survey incorporating ice-movement indicator mapping, clast provenance, heavy-mineral, and till geochemical studies was carried out in the Archean Committee Bay supracrustal belt as part of the Targeted Geoscience Initiative (TGI)[a]. Archean supracrustal rocks of the Prince Albert Group, prospective for many different deposit types, are extensively covered by Quaternary sediments of the last glaciation, therefore drift prospecting represents an essential tool for mineral exploration.

An understanding of the ice flow history is fundamental to drift prospecting in order to resolve sediment transport directions and interpret dispersal patterns observed in the compositional analyses of glacial deposits. The Committee Bay area is situated near the axis of the Keewatin Ice Divide and the ice flow record is complex. Three main phases of regional ice movement were identified. The oldest phase is characterized by a northward movement tentatively associated with the Last Glacial Maximum (Phase I). During the early deglaciation, Keewatin Sector ice was redirected towards large water bodies on either side of the study area (paleo-Committee Bay and Chantrey Inlet). This resulted in a northeastward flow in the northeastern part of the study area, and a northwestward flow in the southwest (Phase II). As retreat of the ice margin continued inland to the ENE trending Chantrey Moraine system, the orienting influence of open waters decreased and the flow shifted to a north-northwesterly direction (Phase III).

Surface till composition suggests that the regional northerly flow (Phase I) is the predominant direction of glacial transport in the area. Re-entrainment by later flows appears to be minimal, or coincidental for the areas located south of the Chantrey Moraine system. Till has a predominant local component and the low content of greenstone clasts reflects ice flow perpendicular to the narrow supracrustal belt, which is dominated by poorly exposed metasedimentary rocks. In areas where ultramafic rocks are well exposed, regional scale dispersal trains (e.g. Cr, Co, Ni) reflect northward glacial transport of geochemically distinct bedrock sources (i.e. komatiites). Factoring-out the elevated elemental values associated with komatiites by using elemental ratio

maps (e.g. Ni/Mg, Ni/Cr) can be useful to distinguish between metals related to Ni-sulphide mineralization and those associated with high background concentrations in the supracrustal rocks. Gold dispersal trains from known mineralization are short (<1.5 km) and associated grains are mainly pristine or modified in shape whilst background concentrations of 0 to 2 reshaped gold grains/10 kg till sample are present southeast (up-ice) of the belt. Anomalies identified through drift prospecting methods may indicate potential for unrecognized mineralized source rocks. Many are within areas covered by thick drift and may not have been identified by bedrock or geophysical mapping.

a McMartin, I., Utting, D.J., Little, E.C., Ozyer, C.A., Ferbey, T. (2003). Complete results from the Committee Bay Drift Prospecting Survey, central Nunavut (NTS 56 K, 56 J-North, 56 O-South and 56 P), Geological Survey of Canada, Open File 4493.

NUNAVUT EXPLORATION SUMMARY - 2003

Mills, A. and Carpenter, R.
Indian and Northern Affairs Canada, Iqaluit, NU

Although 2003 saw the closure of Nunavut's only mine; the Lupin gold mine, two gold projects, Cumberland Resources Ltd's Meadowbank project and Miramar Mining Corp's Doris North project, as well as Tahera Corp's Jericho diamond project are currently in the environmental assessment process. Exploration activity in Nunavut during 2003 was primarily for diamonds and gold. Extensive diamond exploration in the eastern Arctic led to the discovery of over 30 kimberlites near Rankin Inlet by Shear Minerals Ltd (Churchill project) and Cumberland Resources Ltd (East Meliadine project). Also, Stornaway Ventures Ltd confirmed that the AV-1 kimberlite discovered in 2002 on Melville Peninsula contains diamonds, and they also discovered a new kimberlite occurrence 4 km from the original, justifying their significant increase in land tenure. One of the main highlights of this year's exploration on the Brodeur Peninsula, west of Arctic Bay, is the discovery of kimberlite fragments between the Freightrain and Cargo-1 kimberlites by Twin Mining Ltd. DeBeers Canada Exploration Inc, BHP-Billiton, Dunsmuir Ventures Ltd and Kennecott Canada Exploration Inc also conducted extensive diamond exploration programs in the eastern Arctic. New kimberlites were also discovered on Victoria Island, west of Cambridge Bay by Diamonds North Resources Ltd, and progress has continued in the Coronation diamond district by a number of companies including Ashton Mining of Canada, Hunter Exploration and Navigator Exploration Corp.

Impressive gold values were attained at several new showings within the Committee Bay greenstone belt, northeast of Baker Lake by Committee Bay Resources Ltd. New drilling on other known gold deposits has resulted in the expansion of several gold resources in that region. Drilling in the Madrid area of the Hope Bay belt by Miramar Mining Corp resulted in the upgrading of the Suluk deposit and excellent drilling results were obtained in deep drilling at the Boston deposit. Continued exploration at Meadowbank by Cumberland Resources Ltd resulted in new and favourable resource calculations at the Vault and PDF deposits. Comaplex Minerals Corp and their partner Placer Dome Inc continued drilling at their Noomut River project and

Comaplex also purchased WMC Resources Ltd interest in West Meliadine and resumed drilling. Sampling on Commander Resources Ltd's project on Baffin Island also yielded encouraging gold results.

Exploration by Wolfden Resources Ltd at their High Lake project resulted in the discovery of two new zones. The West Zone is a Cu-Ag-Au-Zn discovery and a second, gold-rich discovery was made near the previously known AB zone. Ni-Cu-PGE exploration continued at Ferguson Lake by Starfield Resources Ltd and Muskox Minerals Corp and their partner Anglo American Ltd were active at the Muskox Intrusion.

In addition to the Bathurst Port and Road project, cash has been raised for the pre-feasibility study of the proposed 1200 km long road from northern Manitoba through Kivalliq region of Nunavut. These potential projects could result in significant advancement in Nunavut's infrastructure.

PLANNING FOR THE MANAGEMENT OF ARSENIC WASTES AT GIANT MINE

Mitchell, B.
Giant Mine Remediation Project, Indian and Northern Affairs Canada, Yellowknife, NT

After almost 50 years of gold production, approximately 237,000 tonnes of arsenic trioxide dust, a by-product from roasting of gold bearing aresenopyrite ore, is now stored underground in bedrock at Giant Mine. The dust is stored in five mined-out stopes and ten specially constructed chambers that are no more than 76m below surface. In late 1999, when Giant Mine's owner went bankrupt, and the mine was transferred through the Department of Indian Affairs and Northern Development (DIAND) to the current owner, DIAND assumed responsibility for preparing a Project Description suitable for environmental assessment on an acceptable management alternative for the stored arsenic trioxide dust. An independent Technical Advisor was immediately contracted to develop a plan for the long-term management of the arsenic trioxide dust. The Technical Advisor is a team of experts led by SRK Consulting Inc.

After reviewing a large number of possible technologies at a public workshop, and based on the results of scientific, engineering and risk assessment studies carried out over the past three years, the Technical Advisor recommended two arsenic trioxide management alternatives for further consideration by DIAND and the community. The Technical Advisor has identified what it believes to be the best *in situ* ("leave underground") arsenic management alternative and the best *ex situ* ("take it out") alternative for safeguarding the area's ground and surface water from unsafe levels of arsenic. As an additional review process, an Independent Peer Review Panel has thoroughly reviewed the work of the Technical Advisor.

The recommended *in situ* alternative entails isolating the arsenic trioxide dust in its current location by artificially creating a frozen block around the underground storage areas. In contrast, the *ex situ* option would remove the dust from the underground storage areas, encase it in cement and permanently store it on surface in a secure landfill. Neither alternative is a quick fix, walk-

away solution - both demand long-term water treatment and monitoring of the mine site. The arsenic trioxide dust management alternative that is ultimately adopted will become part of an overall abandonment and restoration plan for the site that will address both surface and underground issues.

THE INUIT OWNED LANDS INFORMATION SYSTEM

Morrison, K.
Nunavut Tunngavik, Cambridge Bay, NU

The Inuit Owned Lands Information System (IOLIS) is NTI's online GIS. Accessed via Netscape Navigator or Microsoft Internet Explorer, which require free downloaded plugins to properly access the site, the system provides users with a single source of information on Inuit Owned Lands parcels in Nunavut where Inuit have the mineral rights.

Background layers for the GIS use the National Topographic Database, National Atlas Base, and Landsat 7 and/or Ikonos satellite imagery (where available). Existing layers in place now include kimberlites, mineral showings, the C-NGO base geological data, existing and proposed infrastructure, protected areas, mineral tenure, Regional Inuit Association and Nunavut Planning Commission boundaries and Inuit Owned Lands Parcels.

Of particular use to the exploration and mining industry are reports on the IOL Parcels which provide information on archeological sites, ecological information, wildlife and fishing, local use and other such information of which the exploration industry must be aware.

Additional features planned to be implemented include the ability to download exploration reports filed with NTI on selected areas and more map layers and information as it is acquired.

THE MACKENZIE CORRIDOR PROJECT AND THE GEOLOGICAL ATLAS OF THE NORTHERN CANADIAN MAINLAND SEDIMENTARY BASIN

Morrow, D.W.
Geological Survey of Canada, Calgary, AB

The need for a "one stop" summary of geoscience information for the Mainland part of the Northwest Territories has become pressing as construction of the Mackenzie Valley Pipeline draws closer. The proposed "Geological Atlas of the Northern Canadian Mainland Sedimentary Basin" is intended to provide this type of information summary. It is part of a three-year Earth Sciences Sector (ESS) project entitled "The Mackenzie Corridor: Access to Northern Resources" under the Northern Resources Development Program (NRD) of ESS-NRCAN. The governments of the Yukon Territory, represented by the Yukon Oil and Gas Resources Branch, and of the Northwest Territories, represented by the C.S. Lord Geoscience Centre are project collaborators.

This atlas will provide a "window" of accessibility into geoscience information for small and medium size resource exploration companies and will also help local communities and native groups in making informed decisions concerning resource development and land management. The area covered extends between the two other major geological atlas compilations of western Canada - the Western Canadian Sedimentary Basin Atlas of the Canadian Society of Petroleum Geologists and the Mackenzie-Beaufort Atlas of the Geological Survey of Canada, both of which have been acknowledged to be of inestimable value to industry.

The atlas region extends northward from 60°N latitude to the Arctic coast and westward from 110°W to 141°W longitude in Northern Yukon Territory, or to the Tintina Trench in the south-central part of the Yukon Territory. Tintina Trench is a major tectonic feature that separates the in-place sedimentary sequence of North America from accreted terranes. This atlas will incorporate aspects of the geology, mineral and hydrocarbon resources of the entire Phanerozoic and Neoproterozoic sedimentary sequence that lies within this region, as well as at least nominal geoscience information coverage for accreted terranes.

Like its well-known southern counterpart, the Western Canada Sedimentary Basin Atlas, this atlas will be divided into a series of Theme Chapters and of Time Slice Chapters. Theme Chapters focus on specific topics, such as an initial chapter dealing with "Resources, Transportation and Pipelines". The "Resources, Transportation and Pipelines" theme chapter includes the delineation of discrete petroleum exploration areas, or "exploration basins (industry terminology)" that are derived in part from the former Northern Basins Initiative project. These are loosely defined regions that display a commonality of stratigraphy and/or structural development and sedimentary basin development. This has led to the development of distinctly different types of exploration "play types" in different "exploration basins". For example, exploration basins in the Interior Plain, such as in the Great Slave Plain basin emphasizes stratigraphic play types, whereas in the deformed belt, such as the Franklin Mountains, emphasis is on structural plays. Time Slice Chapters deal with the sedimentary sequence in segments that are subdivided by their age. Examples nearing initial publication include the "Upper Cretaceous and Tertiary" and "Jurassic and Lower Cretaceous" chapters.

A NEW APPROACH TO INDEXING WOLVERINE ABUNDANCE ON THE SLAVE GEOLOGICAL PROVINCE

Mulders, R.[1], Paetkau, D.[2], d'Entremont, M.[3], Gau R. [4], and Cluff, D.[1]
1. Wildlife and Fisheries Division, Resources, Wildlife and Economic Development, Yellowknife, NT
2. Wildlife Genetics International, Nelson, BC
3. Jacques Whitford Environment Ltd., Yellowknife, NT

The Government of the Northwest Territories has designated wolverine (*Gulo gulo*) as "secure" in the NWT, while the Government of Nunavut has designated this species as "sensitive". Habitat disturbance and the cumulative level of wolverine mortality by northern hunters, outfitters and the mining industry, may negatively impact wolverine distribution and abundance

on the central barrens. This is a concern given uncertainties in their demographics and population viability assessement.

Wildlife managers currently lack a cost effective and quantifiable method to index wolverine abundance across the Slave Geological Province. Measuring wolverine abundance improves our ability to monitor and assess sustainable levels of harvest. Snow track surveys are often conducted under challenging and variable environmental conditions, and are susceptible to observer bias and other errors that are difficult to assess. In April 2003, the GNWT initiated a research project to test techniques to snag hair from wolverines as an alternate method of indexing wolverine abundance on the tundra. Hair samples can be used to identify individual wolverines, since hair follicles contain DNA.

Four baited hair-snagging prototypes were tested within 50 km of a research camp at Daring Lake, NWT. We deployed 200 bait stations along 50 transects covering an area of 1,500 km^2. One unit of each hair snagging design was deployed along each 3 km transect, positioned 1 km apart. Hair-snagging devices were deployed for a 2-week period (~2,700 trap-nights). Field-testing was conducted in early April to facilitate travel by snowmobile. Wolverine hair was obtained at over 60% of the stations, and one station design in particular holds promise for future use. Non-target species included arctic fox, red fox, and snowshoe hare. Preliminary genetic analysis suggests that 20 individual wolverines left hair at the snagging stations.

GEOSCIENCE EXPERIENCE FOR NORTHERN COMMUNITIES

Nowlan, G.S.
Geological Survey of Canada, Calgary, AB

Geoscience Experience for Northern Communities (GENCOM) is the title of a new project within the Geological Survey of Canada's Northern Resources Development Program. It was launched in 2003 with the goal of providing readily understandable geoscience information to northern communities through community and school-based programs.

The project is developing partnerships with communities to:
assist communities in garnering the necessary knowledge to make decisions on resource development and land-use planning
encourage northerners to pursue careers in geoscience-related fields through field employment and school enrichment programs
develop posters and information sheets for use in the community and across the north
provide workshops for teachers in northern communities on earth sciences: rocks, minerals, fossils, resources, landscape.

This project is especially active in areas where the Geological Survey of Canada is conducting field-based projects but it is also interested in assisting any northern communities. One example of work underway is a workshop for teachers in Yellowknife to be presented at the Yellowknife Educators Conference at Sir John Franklin School on 27 November 2003. This is designed for

teachers of the Grade 3 Rocks and Minerals and Grade 7 Planet Earth elements of the curriculum. A second example is a Geoscape Poster planned for Dawson in Yukon. Geoscape posters already exist for many Canadian cities and regions including Vancouver, Victoria, Calgary, southern Saskatchewan, Whitehorse, and Quebec (see www.geoscape.nrcan.gc.ca). These posters highlight earth hazards (e.g. landslides, floods, earthquakes and volcanoes) and earth resources (groundwater, minerals, energy) for specific communities or regions. A third example is a major outreach project planned for northern British Columbia that will be conducted jointly with regional school teachers and Exploration Place in Prince George. The project comprises the preparation of a northern B.C. Geoscape Poster that will also be tied to a travelling box of resources for teachers, exhibits in the Exploration Place, field trips designed for individual towns and workshops for teachers.

The project is also preparing one-page fact sheets on various topics related to northern resources. The subjects for pages planned so far include: carving stone, tar sands, diamonds, pipelines, Yellowknife gold, the Polaris mine, oil and gas in the Arctic Islands, aggregate resources and the overall exploration process. These one-pagers will be designed so that they can also be posted on a web site or used as panels in Geoscape Posters.

GENCOM has initiated contact with several northern communities, including Yellowknife, Norman Wells, Tulita, Inuvik, and Fort McPherson in the NWT, Dawson in Yukon and Baker Lake in Nunavut. Several other communities in the northern parts of British Columbia and Alberta have also been contacted directly. Other contacts will be made as field work on the scientific projects in the Northern Resources Development Project develops.

COMMUNICATING GEOSCIENCE KNOWLEDGE TO CANADIANS: A CRITICAL ISSUE FOR THE NORTH

Nowlan, G.S.
Geological Survey of Canada, Calgary, AB

Whether Canadians know it or not, basic geoscience knowledge is necessary for making informed decisions about resource development, environmental issues and land-use planning. This is particularly true in northern Canada that is experiencing new resource development and population growth. The challenge for geoscientists is to communicate these issues to Canadians in an understandable manner. News stories about geoscience are commonly related to bad news stories, like global climate change, contaminated water, landslides, earthquakes or a burst tailings pond dam. There is a need to provide background information that will be of value to communities in their decision-making related to development, land-use and the environment.

There are two fundamental geoscience messages that we can deliver to Canadians. The first is that everything we wear, drive, live in, use, eat and drink every day comes from the Earth. This is not news to those who have been living off the land for generations, but as society becomes more mechanized and technologically complex, some of the fundamental truth of this statement gets blurred. Related messages are that Earth resources are precious and we should conserve

them, that suitable Earth resources do not occur everywhere, that Earth resources are limited, and that geoscientists do highly sophisticated work to identify new resources.

The second fundamental message that we can communicate to Canadians is that Earth processes affect their lives in real and immediate ways. Extensions of this message are that we cannot change Earth processes, that we must adapt to them, and that we can live in harmony with Earth processes if we choose to. We can build better buildings to withstand earthquakes or permafrost conditions, we can avoid building in the likely paths of landslides, we can be careful about building structures in flood plains; we can exercise caution on the amount of greenhouse gases we emit to avoid exacerbating climate change. Nevertheless Earth processes may catch us unawares, when, for example, a long dormant volcano stirs to life or when the next asteroid impacts our planet.

Effective communication of these messages to Canadians empowers them to make responsible decisions at the community level. Therefore, they are best transmitted in a local context. In any given community there are at least three distinct groups of people to reach. Each has a different time frame for effectiveness of outreach. For example, politicians and decision-makers have a relatively short time in office that demands frequent contact. The main body of the community represents a medium term investment, but it may be such a diverse group that it constitutes the most challenging objective. Finally, a solid long term investment can be derived by providing outreach to students and teachers in education systems.

A new project of the Geological Survey of Canada entitled *Geoscience Experience in Northern Communities (GENCOM)* is beginning to address communication of geoscience issues in northern communities. It is doing so in partnership with many agencies and through consultation with northerners. It is based on ensuring geoscience outreach to communities, especially where new scientific and technological developments are taking place.

PRELIMINARY MAPPING RESULTS FROM THE WECHO RIVER AREA: NO LONGER A HOMOGENOUS GRANITOID TERRANE IN THE SOUTHWESTERN SLAVE PROVINCE, NWT

Ootes, L.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The Wecho River area is located ~100 kilometres north of Yellowknife, NT. The area is targeted for a two-year mapping project covering the eastern 1/3 of NTS 85O. Presented here are the preliminary results of mapping from the 2003 field season, which was undertaken in the northern part of the study area (NTS 85O/09-10, 15-16). To complement mapping, the project is supporting an M.Sc. thesis study that is applying major-, trace-element, and isotope geochemistry to unravel the evolution of granitoid rocks in the Wecho River area (by S. Buse, Carleton University, Ottawa, ON).

Pre-1950's maps show that the northern part of the Wecho River area is underlain by undifferentiated Archean granitoid rocks. Results from 2003 mapping show that the area is complex and partly underlain by supracrustal rocks.

Two distinct granitoid units dominate the map area. The youngest and most extensive granite is commonly K-feldspar phenocrystic, has variable amounts of muscovite and biotite, is weakly foliated (defined by biotite and K-feldspar phenocrysts), contains xenoliths of granodiorite and amphibolite- to granulite-grade intrusive (e.g., enderbite) and supracrustal rocks (e.g., diatexite). The older and less extensive granitoid is a granite-granodiorite that is weakly to moderately magnetic, moderately to highly deformed (containing flattened quartz), and contains variable amounts of mafic xenoliths (in part granulite-grade).

Granulite-grade rocks occur throughout the northern part of the map area as remnants within the granitoids and include those of plutonic origin (e.g., orthopyroxene bearing enderbite and jotunite) and those of supracrustal origin (e.g., sedimentary metatexite, high-grade silicate facies iron formation, and mafic migmatite, presumably of a volcanic protolith).

In the southeastern portion of the map area (85O/09) there is an ~200 km^2 package of greywacke-mudstone turbidites with minor amounts of mafic rocks and horizons of silicate facies iron formation (garnet $\pm$ magnetite $\pm$ amphibole). It is proposed herein to refer to this supracrustal package as the Armi Lake belt. The turbidites in the Armi Lake belt have been metamorphosed from mid-amphibolite- (biotite $\pm$ sillimanite $\pm$ garnet) to granulite-grade (garnet + cordierite + K-feldspar $\pm$ sillimanite). The main foliation is northeast striking and is locally folded (commonly gently plunging) and crenulated about an axial planar biotite cleavage that is also northeast striking.

South of the map area are the lower- to mid-amphibolite-grade Wheeler Lake turbidites with numerous horizons of gold-bearing silicate iron formation. Results from this study suggest that the Armi Lake belt is the continuation of the Wheeler Lake turbidites, but have been separated by Proterozoic sinistral faults. An additional working hypothesis is that the supracrustal remnants in the Wecho River area and the neighbouring Snare River area represent a once continuous supracrustal package across the southwestern Slave Province. This package, preserved as high-grade erosional remnants within a complex terrain of granitoid rocks, is distinguished from the Burwash Formation north and east of Yellowknife by the characteristic presence of silicate facies iron formation. Limited age data from detrital zircons suggest the iron formation-bearing turbidite package may be younger than the Burwash Formation; this question is being addressed with further U-Pb analyses.

ANCIENT ARCHEAN CRUST IN THE WESTERN CHURCHILL PROVINCE: A REVIEW OF THE DIRECT AND INDIRECT EVIDENCE

Pehrsson, S.J., Peterson, T., Davis, W.J., Sandeman, H., Skulski, T., van Breemen, O., Hartlaub, R., Wodicka, N., Hanmer, S., and Cousens, B.

Understanding the lithospheric architecture of cratons is an important component in the formulation of regional diamond exploration models. In particular, the distribution and role of Mesoarchean crust in the development and stabilization of dominantly Neoarchean cratons, and its significance for diamond prospectivity is a subject of considerable interest. For example, the spatial relationship of the Slave diamondiferous kimberlites to underlying Mesoarchean lithosphere is well documented. An emerging new area of diamond exploration focus is the Western Churchill Province (WCP), a larger and poorer known Archean geologic province that has had a significantly different and more protracted thermotectonic history than that of the Slave. In this talk, we review the current state of understanding of geologic domains in the Western Churchill Province and distribution of pre-2.8 Ga crust.

Utilizing first order lithotectonic criteria stemming from recent Western Churchill NATMAP, Targeted Geoscience, and Saskatchewan Industry and Resources initiatives, and integrating a variety of direct (crystallization age) and indirect (zircon inheritance, isotopic signature) evidence, the WCP can be subdivided into several major domains and associated subdomains. The Rae domain, extending from Baffin Island to Saskatchewan, and situated east of the Taltson-Thelon magmatic zone, is characterized by 2.74-2.68 Ga greenstone belts with a distinct association of komatiite-quartzite and iron-formation. Rae greenstone belts are locally deposited on pre-2.8 Ga sialic crust and show evidence throughout the domain for contamination by 2.8-3.8 Ga crust. Existing datasets hint at involvement of oldest crust (3.0-3.8 Ga) southwest of Thelon basin, whereas to the northeast the domain locally contains, or interacted with crust of generally ca. 2.8-3.0 Ga.

The second major domain of the WCP, the Hearne, extends from Northern Saskatchewan and Manitoba to Hudson's Bay in Nunavut. The Hearne domain is separated from the Rae by the Snowbird Tectonic Zone (STZ), and in its northern part, west of Hudson Bay, is subdivided into two subdomains. The northwestern Hearne subdomain borders the STZ and is characterized by Archean greenstone belts with local evidence for interaction with Mesoarchean crust, and a polyphase thermotectonic history indicating major high grade events/reworking at 2.5 and 1.9 Ga. In contrast, the lower metamorphic grade central Hearne subdomain contains juvenile, possible oceanic, ca. 2.72-2.68 Ga greenstone belts, preserves a NeoArchean cooling history, and was unaffected by the earliest Paleoproterozic thermotectonic events. The central Hearne Archean rocks show little or no evidence of interaction with Mesoarchean crust, whereas the northwestern Hearne domain locally preserves evidence of Mesoarchean crust. Evidence for a southern Hearne subdomain south of the central Hearne comes from the scattered occurrence of >2.8 Ga gneisses, Tdm ages and inherited zircons in both Archean and Paleoproterozoic magmatic rocks.

Boundaries between these domains and subdomains are in some cases not precisely located and are incompletely understood, although most boundary zones record a significant

Paleoproterozoic history. The extent to which the widespread Paleoproterozoic orogenesis played a role in exposing/juxtaposing older crustal blocks is just beginning to be explored.

THE TEHERY-WAGER BAY REMOTE PREDICTIVE MAP: A NEW CONCEPT FOR RECONNAISSANCE REGIONAL MAPPING

Pehrsson, S.J., Panagapko, D., Harris, J., Pilkington, M., and Currie, M.

One of the challenges facing explorationists is the lack of modern geoscience data in large portions of Canada's north, particularly in parts of the Western Churchill Province (WCP). As part of the GSC's Northern Resources Development Program, the Western Churchill Metallogeny and Remote Predictive Mapping projects have developed a new data product that is geared to stimulate exploration through dissemination of hitherto unavailable geoscience information.

This poster presents that steps involved in creating a pilot 'remote predictive map' CD. The pilot study area, situated in the Rae domain of the WCP, is presently part of a region of active mineral exploration and has not been mapped systematically since the GSC's major helicopter reconnaissance projects of the 1960's and 70's. It has been recognized that although a geological map at 1:250,000 scale cannot be meaningfully produced from the bedrock field data, the published 1:1,000,000 scale maps resulting from the early work do not reflect the variety of lithologic units originally observed. In many instances, even point locales of certain units can be of interest to the exploration community.

The data contained in the CD represent a compilation of all up-to-date geological, mineral occurrence, geophysical and remotely sensed data for the Tehery Lake-Wager area (NTS 56B/C/F/G). These data were integrated and reviewed through a multi-stage process, and an interpreted geology figure-map was created. Initially a legend of units for the bedrock database was devised based on a) unit descriptions in the individual scientist's archived field notes and b) subsequent petrographic descriptions by A.N. LeCheminant in the 1980's. Seventeen basic units were recognized and are described in a geologic summary on the CD. The basic units were plotted on a georeferenced base map and a broad map unit subdivision was created, based in part on geology/associations in adjoining, more recently mapped areas. Basic database units were combined where appropriate into larger map units for the final geology figure. Lastly, the map unit distribution was then compared to processed magnetic, gravity, landsat and radiometric maps for consistency and to extend units if possible into areas of less data.

A first order result of the process is the recognition that large areas of unsubdivided supracrustal belts can now be reasonably predictively subdivided into likely Archean and Paleoproterozoic sequences and a major Paleoproterozoic crustal break can be recognized. Targeted fieldwork in 2004 will be aimed at testing the veracity/success of the predictive map approach.

THE WESTERN CHURCHILL METALLOGENY PROJECT: FROM MELVILLE TO URANIUM CITY, A NEW LOOK AT THE LARGEST UNDER-EXPLORED CRATON IN THE CANADIAN SHIELD

Pehrsson, S.J. and the Western Churchill Project team

The Western Churchill Metallogeny project is a three-year, multidisciplinary and multi-agency initiative to understand the nature, distribution and context of mineral resources in the Western Churchill Province (WCP). One of the largest geologic provinces of the Canadian Shield, spanning Nunavut, the Northwest Territories, northern Saskatchewan and Manitoba and NE Alberta, the WCP has huge mineral potential and is presently site of active exploration for lode gold, diamonds, Ni-Cu-PGEs and polymetallic Sedex deposits.

The project aims to increase investment in northern resource exploration by developing a comprehensive metallogeny and bedrock compilation-synthesis of the WCP and conducting targeted quaternary studies to characterize the Keewatin Ice Divide, a feature which hampers drift prospecting for gold and diamonds in the area due to its complicated ice flow history. The compilation and synthesis will be regional and trans-jurisdictional in scope, recognizing that prospective sequences and tectonic features cross provincial/territorial boundaries. An initial phase will centre on the Central and Northwestern Hearne domain of Nunavut, focus of the recent Western Churchill NATMAP. Phase 2 will encompass the northern part of the Rae domain in Nunavut and NWT, while the third and final phase will encompass the southern Hearne and Rae of all five provinces/territories, including the Athabasca EXTECH IV area. Activities will include development and analysis of a digital mineral assessment database, compilation and publication of new 1:250,000 and 1:1,000,000 scale bedrock and metallogeny maps, and expert and layperson mineral potential maps. Quaternary studies will produce new surficial geology, till geochemistry and regional ice flow maps, along with an integrated assessment of quaternary history between Nunavut and northern Saskatchewan.

Emphasis will be on interim product release, including new 'remote predictive maps' based on integration of archival data in reconnaissance areas with modern geophysical datasets. Targeted acquisition of new geochronologic, tracer isotope, thermobarometric and lithogeochemical data along a transect from Committee Bay to northern Manitoba will provide the first ever complete cross section of the WCP and the Rae/Hearne domain boundary. Additional acquisition will be focused in the south-central part of the province at the junction between NWT, Nunavut, Saskatchewan and Manitoba, site of ongoing and new Provincial/Territorial mapping initiatives. Outreach and community understanding will be facilitated through the GENCOM outreach project of the Northern Resource Development Program and participation in ongoing provincial/territorial and NGO geoscience education/outreach initiatives.

THE NANUQ DIAMOND PROJECT, WESTERN CHURCHILL PROVINCE: POISED FOR DISCOVERY

Pell, J.
Dunsmuir Ventures Ltd., Vancouver, BC

Dunsmuir Ventures' Nanuq and Nanuq South diamond projects cover in excess of 1.4 million acres south of Wager Bay, in the Rae domain of the Western Churchill Province, Nunavut. The property covers the intersection of the east-west Wager Bay shear zone with the Keewatin Arch, a long-lived major crustal uplift. The newly discovered diamondiferous kimberlites at Rankin Inlet and on Melville Peninsula also occur along this arch.

The properties are underlain by presumed Archean quartz-feldspar-biotite ortho- and paragneisses, intruded by Early Proterozoic (circa 1.8 Ga) calc-alkaline granitic rocks. Supracrustal rocks occur throughout the region, generally as discontinuous lenses; however, in the central part of the property, south of the Wager Bay shear zone, an unmapped greenstone belt can be traced on government aeromagnetic maps for at least 70 km. It contains quartzites, semipelites, amphibolitic metavolcanics, silicate-facies iron formation and metamorphosed ultramafic rocks (peridotites and/or komatiites) and is interpreted as being correlative with Archean Prince Albert and Woodburn Lake Group rocks.

The Nanuq properties are located close to the inferred location of the Keewatin Ice divide. Detailed geomorphological studies and boulder tracing indicate that the main ice movement was from northwest to southeast in the north and in a more east-southeasterly direction in the south. Late north-to-south and east-west ice movement is locally documented by glacial striae, but appears to have minimal effect on the overall dispersal patterns. Boulder displacements and studies of magnetite content of tills suggest that glacial transport distances were limited; boulder trains are rarely longer than 600 m and clear magnetite dispersion trains are on the order of 4 to 6 kms only.

Kimberlite indicator mineral (KIM) sampling by BHP Billiton Diamonds Inc. as part of a regional reconnaissance program detected the presence of KIMs in the Nanuq area. Additional work by Dunsmuir outlined a distinct KIM train in excess of 35 km long and up to 6 km wide, with anomalous concentrations of KIMs in other areas of the property. Pyrope garnets (G9's and G10's), diamond inclusion field (DI) eclogitic garnets and DI chromites were confirmed by microprobe analyses. These results prompted the acquisition of the properties by Dunsmuir in early 2003.

In 2003, Dunsmuir collected an additional 730 till samples. Partial results have been obtained and suggest that the main Nanuq KIM train is comprised of a number of smaller, closely spaced to overlapping dispersal trains emanating from a number of sources. The presence of multiple sources within the main Nanuq indicator train would account for its length of over 35 kilometres when other evidence suggests shorter glacial transport.

A 12,000 line-kilometre aeromagnetic survey of part of the Nanuq property was recently completed and geophysical anomalies, both magnetic highs and lows, have been identified.

Those with down ice indicator mineral support will be chosen for ground geophysical follow-up and based on the results, targets will be selected for a spring 2004 drill program. Dunsmuir is optimistic that this will lead to the discovery of a new kimberlite cluster on the Nanuq property.

SLAVE PROVINCE MINERALS AND GEOSCIENCE COMPILATION AND SYNTHESIS PROJECT

Peter, J., Bleeker, W., Hulbert, L., W., Kerr, D., Ernst, R., Knight, R., Wright, D., Anglin, L., and Slave Province Minerals and Geoscience Compilation and Synthesis Project Team
Geological Survey of Canada, Ottawa, ON

In collaboration with federal and territorial governments, native corporations, industry and academic partners, the Geological Survey of Canada (GSC) has initiated the "Slave Province Minerals and Geoscience Compilation and Synthesis" project to provide an accessible and up-to-date compilation and synthesis of all publicly available geoscience data, including mineral deposits, for the Slave geologic province under the Northern Resource Development Program. The mineral potential of the Slave province is very high, and informed management will be instrumental to the economic development of Nunavut and the Northwest Territories.

Key components and responsible persons are: project leader (J. Peter), bedrock geology (compilation and synthesis of existing maps, production of new maps; W. Bleeker), uranium-lead geochronology (database for existing data, and new analyses; B. Davis), surficial geology and geochemistry (ice flow directions, till geochemistry, gold grain counts, kimberlite indicator minerals, soil profiles, biogeochemistry; D. Kerr), mineral deposits compilation and synthesis (J. Peter), kimberlites and diamonds (B. Kjarsgaard), nickel-copper-PGE deposits (fieldwork on Booth River Complex and Franklin Sills, mafic and ultramafic intrusion geochemistry; L. Hulbert), EXTECH III results volume publication (L. Anglin and D. Wright), outreach (R. Knight), GIS (T. Lynds), mafic dykes (database, compilation map, geochemistry, geochronology, and paleomagnetism; R. Ernst), geophysics (M. Thomas, A. Menzel-Jones), petrophysics (M. Salisbury), mineral potential (G. Bonham-Carter, D. Wright). The project will build on previous bedrock geological compilation efforts (e.g., Hoffman and Hall, 1993) by bringing in new datasets (e.g., bedrock geology maps, U-Pb ages, tracer isotopes, distribution of ancient crust) acquired over the last decade. This will involve the redrawing of 40 to 50 NTS 250,000 map sheets with a harmonized legend. It will deliver a comprehensive, multi-parameter, multi-layered GIS database that will be available digitally, as well as a dedicated scientific volume (EXTECH III) and synthesis and primary data papers. Outreach work will be conducted through linkages with another GSC project and the Nunavut Earth Science Outreach Network, which will transfer this information and its potential uses to the communities within the area so that they can make informed land use decisions.

All available geoscience information relevant to mineral exploration and development from government and industry assessment and private files is being compiled into a GIS database layer. Data and knowledge gap assessment will be undertaken to guide highly targeted new analyses (e.g., lithogeochemical compositions, U-Pb geochronology and Lu-Hf tracer isotopes)

of existing archived samples. A salient goal will be the synthesis of existing knowledge and the refinement or formulation of metallogenic and tectonic models. Gaps that require field investigation will be used for decision-making regarding future work. All geoscience information will be disseminated via CD-ROM, paper maps, scientific publications, oral and poster presentations at national and international geoscience meetings and the internet. The products and information will assist in resource exploration, development, and land-use planning decisions.

CRUSTAL INHERITANCE AND LITHOTECTONIC DOMAINS IN THE CHURCHILL PROVINCE

Peterson, T.[1], Pehrsson, S.[1], Skulski, T.[1], Sandeman, H.[2], van Breemen, O.[1], Davis, W.[1], Hartlaub, R.[3], Wodicka, N.[1], and Cousens, B.[4]

1. Continental Geoscience Division, Natural Resources Canada
2. Canada-Nunavut Geoscience Office, Iqaluit, NU
3. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB
4. Department of Earth and Planetary Science, Carleton University, Ottawa, ON

We are compiling a database of radiogenic isotope data and U-Pb ages for rocks throughout the Churchill Province, and initiating additional measurements in targeted areas, for the purpose of further delineating its lithotectonic domains. Domain boundaries may constrain exploration strategies for mineral deposits, and tectonostratigraphic models of crustal evolution. The sample suite is dominated by Archean greenstones and related silicic rocks (ca. 2700 Ma), Archean diorite-to-granite (ca. 2600 Ma), and Proterozoic granitoids, silicic lavas, and minette dykes and lavas (ca. 1850-1740 Ma). Here, we focus on Sm-Nd and zircon dating results.

The Rae and Hearne domains are currently divided on the basis of styles of mafic volcanism and contrasts in lithosphere conductivity profiles. Further subdivisions are now based on the presence of pre-2.8 Ga crust; 1.9 Ga high-pressure metamorphism; and 2.6 Ga granitoid plutonism. Proterozoic igneous provinces appear not to be influenced by Archean domains, but are defined in part by different structural levels and 1.9-1.7 Ga tectonometamorphic histories.

Neoarchean granitoids and volcanic rocks (ca. 2.7 Ga) of the Hearne domain are characterised predominantly by juvenile εNd values averaging +2.3, and TDM values for felsic volcanic and granitoid rocks ranging from 2.58-2.99 Ga. Clear examples of reworking of Mesoarchean crust are within the Angikuni greenstone belt and the Cross Bay complex (MacQuoid belt), where TDM ranges from 2.68-3.10 Ga and 2.68-3.20 Ga respectively. In general, the 2.6 Ga igneous suite, with average εNd of about +0.8, has a significant juvenile component and is not a sensitive isotopic tracer for older crust.

In the Rae domain, basement plutonic/orthogneissic rocks with Mesoarchean ages are known from northern Saskatchewan and the Woodburn Lake area. Model ages greater than 3.0 Ga are obtained from gneisses and Archean intrusions in northern Saskatchewan and southern NWT,

near the Thelon tectonic zone, in the Queen Maud block, and the Eqe Bay area of Baffin Island. Older TDMs >3.5 Ga are restricted to northern Saskatchewan.

Proterozoic igneous rocks all show substantial crustal inheritance, or derivation from metasomatized mantle, with little or no discernible juvenile component. Inherited zircon cores in some Proterozoic granitoids (Hudson suite, ca. 1.83 Ga) yield ages ranging from ca. 3.0 Ga to 2.6 Ga; ages less than 2.8 Ga correlate well with igneous ages in wall rocks. εNd ranges from about -13 to -5, with TDM 2.5 Ga-3.2 Ga. The older model ages and inherited zircon ages in the Hudson suite are confined to a belt south of the Ennedai-Kaminak greenstone belts, which appears to extend into the Hearne domain of northeastern Saskatchewan. Widely dispersed inherited zircon ages of ca. 2.5 Ga may indicate that a metamorphic event of this age, previously detected in the northern Hearne domain, is more regional in extent. Several minettes of the Dubawnt Lake area, adjacent to probable pre-2.7 Ga crust, also have older model ages, but TDM near 3.0 Ga is also noted in isolated minettes elsewhere, such as in the diamondiferous Akluilak minette. This may reflect a source component in ancient lithospheric mantle or lower crust.

GIS COMPILATION OF THE WOPMAY OROGEN SOUTH OF 65°N

Pierce, K.L. and Turner, W.A.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The C.S. Lord Northern Geoscience Centre initiated a GIS data compilation, as a preliminary phase to a potential regional mapping project, in the Wopmay Orogen (south of 65°N latitude). The project area was mapped regionally by the Geological Survey of Canada (GSC) between the 1930s and 1970s. Industry exploration during the 1960s and 1970s in the southern Great Bear magmatic zone (southern Wopmay Orogen) led to the discovery of polymetallic iron oxide deposits in the Mazenod Lake area. Textural similarities between these Proterozoic deposits and that of the billion tonne Olympic Dam deposit, located in south Australia, indicated a need for detailed mapping. Between 1987 and 1996, the GSC carried-out property-scale mapping, including geochemical and geochronological surveys, in the southern Great Bear magmatic zone.

The compilation is managed in ArcView GIS 3.x format and includes:
- scanned and georeferenced (previously released) GSC maps;
- digitized polygon and line data for 1:250 000 scale maps, with associated .dbf file containing lithological information from the original maps;
- digitized polygon and line data, with associated .dbf file of original lithology, for detailed maps of various scales (including the Hottah Lake, Bode Lake, DeVries Lake, Mazenod Lake and Lou Lake areas);
- lithogeochemical point data compiled from assessment reports and government releases, and a regional geochemical survey of water and lake sediments.
- host rock geochronology;
- geophysical data composed of an airborne magnetic image for the area south of 65°N latitude and gamma ray spectrometry imagery south of 64°N.

Work will continue on the compilation to also include mineral showings data, for an expected spring 2004 open report release.

THE APLITIC DYKES OF THE CANTUNG MINE, NWT: IMPLICATIONS FOR MINERALIZATION PROCESSES AND EXPLORATION

Rasmussen, K.
Department of Geology and Geophysics, University of Calgary, Calgary, AB

The CanTung mine, located in the MacKenzie Mountains of the southwestern Northwest Territories, is the largest producer of tungsten in the western world and one of the world's highest grade scheelite deposits (1.6% WO_3), with minor Cu, Bi, and Au. Two ore zones have been outlined and mined: the Open Pit (1962-1974) and the underground E-zone (1974-1986 and 2002-present). Both ore bodies occur as a scheelite-bearing, pyrrhotite-rich skarn that formed on the upper limb and in the hinge zone, respectively, of an overturned anticline. The mineralization occurs in the Ore Limestone, a coarsely-crystalline banded marble unit within a sequence consisting of argillite, limestone, and dolostone. The skarn is spatially and genetically related to two adjacent mid-Cretaceous (91.6 +/- 2.6 Ma) stocks of metaluminous to mildly peraluminous biotite monzogranitic composition. A series of aplitic dikes crosscut the granitic stocks and the mineralized skarn. The abundance of the aplitic dikes and their relationship to ore mineralization suggests that if not having a genetic role in the formation of the ore deposit, they have intruded along the permeability network (faults, joints, etc.) and may be used as indicators of mineralization.

In order to better understand the role of the dike rocks, a small mapping and sampling project of a representative portion of the mine, was undertaken in the summer of 2003. The project was focused around field relationships between the dikes, host rocks, and mineralization. This project included a survey throughout the currently active mine workings mine to measure the orientation of aplitic dikes and to identify potentially significant structural trends. A petrographic study of the dikes, to determine the mineralogy, texture, and extent of fractionation and hydrothermal alteration, is in progress. Following petrographic examination of the dike rocks, a selected suite of samples will be the focus of a detailed multi-element geochemical study to discern any petrogenetic relations between the genesis of the W-Cu-Bi-Au mineralization and the granitic intrusions and the dike rocks.

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

Reinson, G.[1] and Drummond, K.[2]
1. Reinson Consultants Ltd., Calgary, AB
2. Drummond Consulting, Calgary, AB

The Northwest Territories and Yukon Territory can be divided into 13 exploration regions based on physiographic and geological controls and the regions compared with respect to discovered resources and overall ultimate potential.

The discovered oil resources of 1,016 MMbbl in the Mackenzie Delta/Beaufort Sea region are almost 4 times that discovered in the other 12 exploration regions combined (314 MMbbl). Most of the mainland oil resource is found in the Mackenzie Plain region (302 MMbbl reflecting the Norman Wells field). The discovered marketable gas resources in the Mackenzie Delta/Beaufort Sea exploration region (9 Tcf) are more than 4 times the combined volume discovered in the other exploration regions (1.9 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. These numbers are estimated at 5.4 Bbbl oil and 50 Tcf gas, as compared to 0.4 Bbbl oil and 18 Tcf gas for the mainland exploration regions. Liard Plateau (4.1 Tcf), Peel Plain (2.9 Tcf), Southern Territories (1.8 Tcf), Colville Hills (3.4 Tcf) and Mackenzie Plain (1.4 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 hydrocarbon potential. The Liard Plateau region is highly prospective for large volumes of natural gas. The Southern Territories, Mackenzie Plain, Colville Hills and, in particular, Peel Plain, are exploration regions also considered to be favorable with respect to exploring for, and discovering, viable economic reserves of natural gas.

NWT BEDROCK MAPPING FIELD SCHOOL: APPLICATION OF ESRI'S ARCPAD SOFTWARE

Relf, C. and Irwin, D.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

For two weeks in late August/early September 2003, the C.S. Lord Northern Geoscience Centre hosted a field school for senior undergraduate students from the University of Alberta's Department of Earth and Atmospheric Sciences. The primary goals of the course were two-fold: to provide an opportunity for students to gain first-hand bedrock mapping experience, including collecting and manipulating field data and creating a comprehensive map; and to fill a gap in the NWT's bedrock mapping coverage. At the end of the course, a database of point data (rock descriptions, mineral assemblages, structural measurements, samples, photographs) and line data

(traverses, contacts, linear features) had been populated in ArcView 3.x format. Lithological units and their associated attributes were also defined. The data were brought back to the university for compilation into a bedrock geology map, which will be released through the Centre, and will represent a contribution to the Wecho River mapping project (see Ootes, this volume).

This field school represents a deviation from most undergraduate field courses, as the geology of the study area was not well known. The mapping exercise therefore represented a real (albeit relatively small) mapping project. The tool used to generate the database was Compaq's IPAQ Pocket PC loaded with ESRI Arcpad 6.01. Data entry forms, created by Irwin and modified from the Geological Survey of Canada's FieldLog database, are user-friendly and required minimal training, allowing students to enter data on the outcrop directly into ESRI shapefiles. Data collected during the day were simply downloaded nightly into an ArcView 3.x project that grew as mapping progressed. A paper map with hand-plotted geology contacts evolved concurrently with the digital version, and following the field work, contacts were quickly digitized and descriptive notes imported into the ArcView 3.x project.

The database generated in the field served to track samples and photographs collected in support of three B.Sc. thesis projects, which were defined and undertaken as spin-offs from the mapping course. The ability to generate a "real-time" or "living" digital database meant that the students were able to learn the iterative nature of geologic mapping within a very short timeframe.

This pilot project proved very successful in its first year, and it is hoped that the course can continue to be offered. Given the short timeframe available to generate the map, the ability to collect ArcView-compatible data in the field was a key factor in the course's success.

FUTURE PLANS FOR BEDROCK MAPPING IN THE NORTHWEST TERRITORIES: NEW FRONTIERS FOR 2004 TO 2009

Relf, C., Falck, H., Goff, S., Jackson, V., and Turner, A.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

Over the past two decades, bedrock mapping coverage of the Slave Province has progressed significantly, and while the geology of some areas are still poorly understood, a much clearer picture of the evolution of this Archean craton now exists. In contrast, knowledge gaps outside of the Slave craton remain largely unaddressed. To this end, in the summer of 2003, field reconnaissance was carried out in three areas of the NWT to aid in planning for future bedrock mapping projects: the Kasba Lake area (NTS 65D), southern Wopmay Orogen (NTS 85N, 86B and 86C), and the Selwyn Basin (NTS 105I and 105P). These areas have not been mapped since the 1940's, and although they are considered to have significant mineral potential, they remain under-explored.

The Snowbird Tectonic Zone transects the Kasba Lake area, separating greenstones of the Hearne Province from mixed gneisses of the Rae Province. Recent studies in the Churchill

Province in Nunavut and northern Saskatchewan have provided insights into the geological complexities and mineral potential that can be expected in the Kasba Lake area. A bedrock mapping project integrated with petrologic, surficial and mineral occurrence data is being planned for the summer of 2004. As a first step, a regional airborne magnetic survey is being flown over the area this winter, to aid in correlating bedrock geology through extensive areas of poor outcrop.

The southern Wopmay Orogen (south of 65º latitude) is targeted for systematic regional mapping and integrated studies. In 2004, it is anticipated that a three- to four-year project will be initiated in the form of an east-west transect covering parts of the Great Bear Magmatic Zone, the Internal Zone and the Foreland/Hinterland. In addition to regional bedrock mapping, the project will focus on delineating Slave basement, providing sound geochronology, and identifying the stratigraphic, structural, and petrologic settings of the various mineral deposit types within the transect. The Geological Survey of Canada (GSC) and the Dublin Institute for Advanced Studies will be collecting teleseismic and magnetotelluric data, respectively, along the transect corridor eastward to Grizzle Bear Lake (west-central Slave Province). These data will complement the field-based studies and contribute to our understanding of the structure of the deep crust and lithospheric mantle beneath the western Slave Province and overlying Wopmay Orogen.

Finally, planning will begin for upgrading existing maps of the Selwyn Basin. As aeromagnetic and regional geochemical data are currently lacking for most of the area, the first step will be to collect new regional data to aid in evaluating mineral potential and to support future bedrock mapping. The proposed expansion of Nahanni Park may provide an opportunity to collaborate with the GSC, as it is anticipated that a Mineral and Energy Resource Assessment will be undertaken on adjacent ground over the next few years.

METAMORPHISM OF GRAYWACKES AND SILICATE IRON FORMATION AT GERMAINE LAKE, NWT

Scheel, J.E.[1], McCallum, N.G.[1], Chacko, T.[1], and Relf, C.[2]
1. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

As part of a 4th-year undergraduate mapping course jointly run by the C.S. Lord Northern Geoscience Centre and the University of Alberta, we have undertaken a study of metamorphosed graywackes and silicate iron formations from the vicinity of Germaine Lake in the southwestern Slave Province. The ultimate goal of the project is to document the pressure-temperature conditions of metamorphism across the mapping area and to determine the ages of the major metamorphic events.

This poster presents the initial findings of the study, focusing on typical mineral assemblages in the two rock types. The metagraywackes comprise two bulk compositions, semi-pelites and psammites. In the southwestern part of the map area, the characteristic mineral assemblage in the semi-pelites is sil-bt±crd-qtz-plag. Primary muscovite is rare or absent, reflecting the

potassium-poor nature of the graywacke protolith. Sillimanite and biotite, which define the dominant metamorphic fabric, are aligned axial planar to the F2 folds in the region. Psammites at the same grade typically contain bt±crd-qtz-plag. Garnet is locally abundant in the psammites, presumably because of local increases in Fe/Mg ratio or Mn content. Cordierite, where present in the semi-pelites and psammites, is aligned in the regional metamorphic fabric and commonly altered to sericite. Metamorphic grade increases toward the northern and eastern parts of the field area, as indicated by appearance of cm-scale layers and pods of granitic composition material in the semi-pelites. We interpret this leucocratic material to represent crystallized melt. The melts are probably generated in two ways; in-situ partial melting of semi-pelites, and injections of melt from adjacent granitic plutons. Indeed, the regional correspondence of the melt-in isograd and granitic plutons suggests that the intrusion of these magmas may have supplied some or perhaps most of the heat necessary for metamorphism. This idea remains to be tested through age dating of the plutons and the metamorphism. The mineral assemblage in these higher-grade semi-pelites is sil-bt±crd±grt-plag-qtz. Cordierite in these rocks is less altered than at lower grade and in places of the gemmy-blue, iolite variety. Cross-cutting the metamorphic fabric in both higher and lower grade areas are quartz veins and granitic dykes, which locally contain one or more of garnet, tourmaline, iolite, and pink andalusite intergrown with, or mantled by sillimanite. Dating of monazite or zircon in these veins and dykes would provide a minimum age constraint on the regional metamorphism. The silicate iron formations occur as discontinuous layers within the supracrustal package, rarely extending for more than 10-20 m along strike. The distinctive feature of this spectacular lithology is the presence of abundant blood-red garnets, which in places make up 40-60% of the rock. Accompanying garnet is quartz and amphibole, which, depending on bulk composition, is either of a calcic variety (e.g., hornblende), or an amphibole in the Fe-Mg grunerite-cummingtonite series. No higher-grade minerals such as orthopyroxene, pigeonite or fayalite have yet been identified.

Future work will focus on obtaining quantitative P-T estimates from mineral assemblages suitable for thermobarometry, and on obtaining chemical age dates of monazite using the electron microprobe.

C.S. LORD GEOSCIENCE CENTRE OUTREACH: HOLMAN COMMUNITY MAPPING PROJECT

Schreiner, D.R.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The C.S. Lord Northern Geoscience Centre provides geological information sessions to local schools, communities and interest groups, participates in education initiatives such as science fairs, and coordinates rock walks and talks during Mining Week. Until recently, these outreach activities were carried out mainly in response to demand, which has been increasing over the past several years as awareness of geoscience and its importance to our daily lives increases. This past spring, the Centre made a decision to coordinate outreach activities more formally, and to undertake a component of pro-active outreach.

One of the pro-active projects under the Outreach Program is the Holman Community Mapping Project. The purpose of the project is to foster an interest in geology on a local level within the community by looking at landforms, local historical sites and even the relationship of flora to rock types. The project consisted of initial community consultations on the planned activities, followed by two weeks of fieldwork in early August examining the geology surrounding Holman.

To increase community participation, field assistants were hired directly from the community, and local people were encouraged to look over the maps, photos and samples collected on a daily basis, to ask questions on areas of interest, to bring rocks for identification, and to suggest areas of geologic/topographic/cultural interest for the field team to examine. An open house to discuss the project was held prior to the mapping team leaving the community and another will be held this winter when the finished poster is presented to the community.

Encouraging an interest in geoscience will hopefully not only increase awareness of the local geology and landscape, but will also encourage young people to consider science as part of their past and future.

COMPILATION AND INTEGRATION OF GIS AND REMOTE SENSING DATA: PINE POINT AREA, SOUTHERN NWT

Schwarz, S.
Indian and Northern Affairs Canada, NT Region, Yellowknife, NT

As part of the Mississippi Valley-type Targeted Geoscience Initiative, this work concentrated on the use of GIS and remote sensing techniques to identify large-scale geological structures, which may have been used as conduits controlling the distribution of lead-zinc at the Pine Point Mississippi Valley-type (MVT) deposit in southern NWT. The geology of the study area includes Phanerozoic strata, overlain by a thick sequence of overburden. As a result, most of these structures cannot be identified by conventional mapping techniques.

A multi-layered ArcView-based Geographic Information System (GIS) has been created to integrate, manage, and analyze the geospatial data collected and compiled during this project. This data includes geological maps, linear structural elements, well locations, Landsat-7 and Radarsat satellite imagery, contoured basement well data, airborne magnetic and gravity data, interpreted linear features from airborne data, and a three-dimensional model of contoured basement well data. All data in the database is in NAD83 Zone 11 projection, and FGDC (Federal Geographic Data Committee) compliant metadata is included for each data layer with attributes.

In the Tathlina study area a three dimensional model of the basement was created using contoured basement well data. As most rocks in the study area (limestone, dolomite, shale and sandstone) have a relatively uniform magnetic and physical densities, the variations in the magnetic field strength and the gravity may be attributed to differences in the basement rocks.

The net effect of the cover sequences is to "blur" the small-scale variations such that only large-scale variations are apparent. In effect, the geophysics allows us to see through the cover sequences and provide a means of portraying the topographic relief of the buried basement structures. Additionally, fault traces digitized from geological maps and lineaments interpreted from structure contours were draped on the basement model. Some troughs and crests in the three-dimensional model of basement structure appear to coincide with mapped fault structures and interpreted linear features from structure contours, magnetic and gravity data. Gas and oil occurrences are moderately focused along interpreted linear.

As with many GIS projects, the compilation of the database is by far the most time consuming part of the project. Combining all of the available data within GIS has permitted the analysis and modeling of the various datasets, leading to observations that could not be recognized if the data were examined independently.

AN OVERVIEW OF THE GSC'S NORTHERN RESOURCES DEVELOPMENT PROGRAM

Scott, D.J.
Geological Survey of Canada, Ottawa, ON

Many northern communities have few economic development options other than responsible development of their natural resources. In many parts of the north, the present state of the geoscience knowledge base is not sufficiently developed to support the exploration for, and discovery of, new resources that are required to strengthen local economies. Consequently, an improved understanding of the geological framework of the north is required to stimulate new private sector investment, and facilitate opportunities to northerners. In addition, in order to maximize the benefit to communities, the capacity of their citizens to participate in these opportunities must be improved to through an increased understanding of the exploration sector, and development of marketable skills.

The Northern Resources Development Program comprises 14 projects operating across northern Canada (northern parts of seven provinces as well as the three territories). The Program will:
1) create and effectively market new, comprehensive, regional mineral and energy geoscience products (regional databases, maps, reports) to stimulate private sector investment in exploration and development in areas of high geological potential;
2) contribute to the building of the knowledge, skills and capacities needed by northerners to meaningfully guide and participate in this development by working with communities and agencies responsible for economic development, and;
3) contribute to the creation of employment opportunities in the communities of the North, which comprise dominantly Aboriginal Canadians, by ensuring that northerners who wish to participate and exploration companies seeking northerners are connected.

In addition to working with our partners in territorial and provincial geological surveys, universities across Canada, and the exploration industry, we are forging new connections to communities and economic development groups across the north.

VOLCANIC STRATIGRAPHY AND STRUCTURAL GEOLOGY OF THE BOSTON AREA, HOPE BAY VOLCANIC BELT, NUNAVUT

Sherlock, R.L.[1] and Carter, G.[2]
1. Canada-Nunavut Geoscience Office, Iqaluit, NU
2. Miramar Mining Corp., North Vancouver, BC

The Hope Bay volcanic belt is a mafic volcanic dominated Archean greenstone belt, in the northeast portion of the Slave Structural Province in western Nunavut. The Boston gold deposit, located in the southern portion of the Hope Bay belt, is the largest of the known gold deposits in the belt with a resource of about 1.5 million ounces of gold. The oldest rocks seen in the Boston area are pillow basalts that host the Boston gold deposit. Stratigraphically overlying these basalts are a succession of sedimentary rocks that vary from quartzose feldspathic wacke to argillite. In the upper portions of the succession these sedimentary rocks are interlayered with intermediate to felsic volcanic sandstones to conglomerates (ca. 2686 Ma). Amygdaloidal pillowed flows overlie the sedimentary rocks, which are in turn overlain by felsic volcanic rocks (ca. 2662 Ma) and argillite. The belt is flanked to the east by late- to post-volcanic tonalite to granodiorite (ca. 2649 Ma) and to the west by late ca. 2600 Ma granites.

The strata in the Boston area are folded about a large south plunging synformal anticline, cored by the pillowed mafic flows that host the Boston deposit. Asymmetric folds on the east limb of the main anticline have structurally thickened the sedimentary rocks. Gold mineralization is associated with a complex anastomosing high strain zone that is developed roughly axial planar to the main anticline and tentatively interpreted as the latest expression of D_2 strain. Associated with the high strain zone is a strong south-plunging stretching lineation, subparallel to the plunge of the anticline fold axis. Accompanying the gold mineralization in the mafic volcanic rocks, is a proximal iron-carbonate, quartz and sericite (± paragonite) alteration assemblage that grades out into a chlorite-calcite distal alteration assemblage. Overprinting the main (D_2) structural elements are a series of cross-folds (F_3). This folding event has produced a large embayment of supracrustal rocks into the tonalite-granodiorite on the eastern side on the volcanic belt and also deforms the gold mineralization and associated alteration at the Boston deposit.

Overall the timing of gold mineralization at Boston is grossly similar to what has been proposed for the northern portion of the belt, at the Doris deposit and in the Madrid area; although the mechanism for gold emplacement is unique in the three areas.

Regionally, the Windy felsic volcanic rocks are recognized throughout the volcanic belt and have a consistent age of ca. 2686 Ma. These rocks tend to be mainly intermediate volcanic sandstones to conglomerates. The stratigraphy that hosts the Windy felsic rocks varies along strike throughout the belt, from a dominantly volcanic environment in the north to a mainly

sedimentary environment in the south. The variation in stratigraphic association, the consistent age, and the variations in the volcanic lithofacies suggests that these rocks may represent a belt scale hiatus in deposition and mark the contact between and upper and lower volcanic cycles.

MERGING SATELLITE TELEMETRY, GIS AND DIGITAL IMAGERY FOR WILDLIFE MANAGEMENT

Slack, T. and Wright, W.
Resources, Wildlife, and Economic Development, Government of the Northwest Territories, Yellowknife, NT

Wildlife Management, DRWED, Inuvik, is developing the capacity to address complex ecological questions using a variety of spatial analytical tools. The three keystones of our work are wildlife satellite telemetry, satellite imagery and GIS.

During the last few years satellite telemetry technology has developed rapidly. With the transition from VHF to satellite wildlife radio collars, there has been an exponential increase in the amount and accuracy of location data obtained. The new generation of large mammal GPS collars can be programmed to obtain a large number of locations per day that have an accuracy of $\leq$12m.

Satellite imaging technology has improved and the cost of acquiring has decreased making this technology more accessible. The diversity of images available (Ikonos, IRS, Modis, etc) has increase with the deployment of the new generation of satellites. High resolution imaging sensors offer more detail and with this more analytical challenges. Landsat images cost significantly less, have more bands and are of higher resolution. The numbers of users and the types of analyses possible have increased because images cost less and license agreements are more liberal. This technology is being used by Wildlife Management to produce vegetation/potential habitat maps in the Inuvik Region.

Lastly, the advances in GIS software and digital data have allowed more types of data to be included in the analysis. As a result the physical and biological properties of the environment that influence wildlife can be examined concurrently to assess more complex relationships. Examples of data that are commonly used include digital elevation (and derivatives), vegetation/habitat, harvest, ice and snow data in addition to NRCAN basedata. In addition to better data, advances in software have made it easier to analyze larger datasets, to include more variables, and to undertake more sophisticated statistical analyses.

The products generated are used to help make more informed wildlife management decisions, to help people in the communities more easily understand wildlife movements, distribution and habitat relationships, and can be used in advanced cumulative effects modelling.

TOWARD A MANTLE STRATIGRAPHY BENEATH THE CENTRAL SLAVE CRATON

Snyder, D.B.[1] and Lockhart, G.D.[2]
1. Geological Survey of Canada, Ottawa, ON
2. BHP Billiton Diamonds Inc., Kelowna, BC

Four independent sources of information are now available about mantle layers within the Slave craton: xenolith suites, conductivity profiles, seismic discontinuity and velocity maps, and trend analysis of coeval kimberlite eruptions using precise age dating. Detailed xenolith petrological analysis is generally available at only four locations: the Drybones, Jericho/Anuri, Diavik/Ekati, and Gahcho Kue kimberlite clusters. Although each area has distinct mantle stratigraphy, one general trend is that the central Slave has a depleted (harzburgite) uppermost mantle and increasing metasomatism in lherzolitic peridotites with greater (150-250 km) depths (Kopylova & Caro, J. Petrology, in press). Magnetotelluric soundings were made over a considerable part of the craton and are remarkable for the very strong conductor observed beneath the Lac de Gras area at 80 120 km depth (Jones et al., Geology, 29, 423-426, 2001). Teleseismic studies can reveal major discontinuities in physical properties of the mantle. Beneath the central Slave these discontinuities are consistently observed at depths of 37-39 km (the Moho), 48-51 km, 88-108 km, 138-150 km, and 180-190 km; the latter three are not simple (1-D) increases or decreases in bulk density and seismic velocity with depth and probably involve anisotropic (3-D) structures. Teleseismic anisotropy studies provide additional information about large-scale fabric in the mantle and reveal two distinct layers beneath Ekati; a shallow one with a 010° trend and a deeper one with a 051° trend. The correlation of these trends with azimuths where phase reversals are observed on the deepest three discontinuities suggests that the shallow fabric occurs at 90-145 km, the deeper layer below 150 km. Similar results are observed in the Siberian craton. If the highly depleted layer represents former Archean oceanic mantle (Davis et al., Lithos, in press), then it could readily contain enough strongly aligned olivine to produce the observed anisotropy.

Correlating Natural Remanent Magnetization (NRM) of 40 Lac de Gras kimberlites with isotopically dated kimberlite ages has produced a refined time scale for the eruption of these kimberlites and revealed eruption clusters with easterly and northeasterly alignments. Economic clusters erupted at 55, 53 Ma and 48 Ma have trends distinct from mapped fractures and regional dyke swarms. Their trends at 037-045° are intriguing close to those measured in the lower mantle lithosphere by the teleseismic studies, yet distinct from the uppermost mantle trends. One possible explanation is primary control of both features by the regional (North American scale) stress field; the principal horizontal stress today occurs at about 045-055° in the central Slave, and has probably adone so since about 55.5 Ma.

EXPLORATION UPDATE: CHURCHILL DIAMOND PROJECT, NUNAVUT CANADA'S NEWEST KIMBERLITE PROVINCE

Strand, P.
Shear Minerals Ltd., Edmonton, AB

The Churchill Diamond Project represents Canada's newest kimberlite province discovery made by Shear Minerals Ltd. and partners Stornoway Diamond Corp. and BHP Billiton. Over the past two months, eighteen new kimberlite pipes have been drilled at the Churchill Property. The project comprises in excess of 2.0 million acres near the communities of Rankin Inlet and Chesterfield Inlet in the Kivalliq region of Nunavut, where logistics facilitate exploration with barge and rail access. The partnership acquired the ground after two years of regional exploration that recovered positive diamond indicator minerals suggesting multiple local kimberlite sources.

The Churchill Diamond Property is located in the Churchill Province cratonic rocks and is underlain by the Archean Rankin Inlet group. Past exploration in the region has been largely for gold and base metals; systematic exploration for diamond bearing intrusives within the area has been limited. Narrow kimberlite dykes (192-214Ma) were intersected during drilling at the Meliadine gold deposit. Approximately 120 km to the northwest is the highly diamondiferous Parker Lake (Akluilak) dyke (1832 Ma) that is now believed to be associated with the magmatic event responsible for the Christopher Island Formation. In 2003, Cumberland and Comaplex announced the discovery of 11 new kimberlites, and the GSC reported numerous kimberlite float occurrences through the Meliadine trend. These occurrences are evidence that multiple kimberlitic sources of different ages exist in the Churchill Diamond Property region.

During 2001 and 2002, 145 microprobe confirmed diamond indicator mineral grains from 183 till samples and two kimberlite float occurrences were discovered. Indicator minerals include pyrope garnets, eclogitic garnets, chromites, ilmenites, chrome-diopsides and olivines. About 46% of all pyrope garnets are G10 subcalcic pyropes that plot to the left of the 85% line defined by Gurney (1984). Indicator mineral results defined several corridors of interest on the property that were followed up in 2003 by collecting >1,800 till samples that include regional, target specific and dispersal train studies.

During 2002, a high resolution airborne magnetic survey totaling 16,307 line km identified 226 priority targets. In 2003 an additional 22,639 line km was flown, resulting in more than 100 additional high priority targets including a cluster of 29 magnetic lows. Geophysical evidence suggests that a kimberlite cluster of more than 100 pipes is present at the Churchill Diamond Property.

The 2003 exploration program was defined to test whether kimberlites were present on the property as well as test the size of the potential kimberlite cluster. Ground geophysics was completed over 58 priority geophysical targets of which 29 were selected for drill testing. In June, the first drill program commenced. In total 31 holes were drilled and resulted in the discovery of 18 kimberlite pipes at the Churchill Diamond Property. The cluster of kimberlite pipes occurs over a spatially large area measuring 60 km by 50 km. The kimberlites occur as

magnetic highs and lows, with some correlating EM signatures. To date, six of eleven kimberlites have proved diamond bearing with the highest count from the Quamalak-1 Kimberlite where 156.8 kg returned 8 diamonds with the three largest diamonds measuring 0.6 x 0.56 x 0.48 mm; 0.48 x 0.40 x 0.36 mm; and 0.24 x 0.40 x 0.30 mm.

The 2004 exploration program will be assisted and guided by pending results from a larger database of till samples collected this year. This will help to better refine and geochemically support the selection of drill targets for 2004. The exploration will be focused on tracking down the source of the high-confidence diamond indicator mineral chemistry recovered to date. Subsequently, exploration at the Churchill Diamond Property in 2004 will include drilling, till sampling, prospecting, geophysics (ground and airborne) including EM, quaternary and environmental baseline work.

The Churchill Diamond Project is in the very early days of what is going to be an aggressive multi-phase, multi-discipline exploration program. In the first season of drilling a new diamond bearing kimberlite province has been established. The results from the Churchill Diamond Property are comparable with the early stage exploration of the prolific Slave Craton that hosts Canada's two producing diamond mines.

OZIEXPLORER, A LOW COST, SIMPLE MAPPING AND GPS PROGRAMMING TOOL

Taylor, D.
NWT Centre for Geomatics, Yellowknife, NT

Interested in getting started with digital methods but not ready to spend thousands of dollars on a GIS system and the related training? Or, do you use a GPS for fieldwork and want to make use of the track logs or waypoints? If so then, you want this program.

OziExplorer is a low cost simple mapping tool primarily used with a GPS. An Australian who wanted to know where he was while driving in the outback invented it. He designed it to program a GPS and to display the results on a map. If you have a computer, GPS and cable to connect the two then you have almost everything you need to get started. For less than $CDN 200 and a fast internet connection you can get the rest.

It makes all GPS communications easy. It has applications on its own or in conjunction with other GIS programs such as ArcView. I have used this program for aerial survey planning and data recording for search and rescue and wildlife surveying.

I have found three different applications areas for it. Use OziExplorer to create, display, upload and download waypoints, track logs and routes to a GPS. Use it to view and print maps of your trip plan (route), your travels (track log) and your sample sites (waypoints). Finally, without a GPS, use it as a map atlas and view satellite imagery, air photos, NTS 1:250,000 or 1:50,000 scale maps or almost any map that you can scan.

I will show you many applications of this program and examples of data that you can get. Free base maps can be downloaded from various government web sites, specifically from our web site http://nwtcrs.rwed-hq.gov.nt.ca.

POINTED MOUNTAIN GAS FIELD: MIDDLE DEVONIAN, HYDROTHERMAL DOLOMITE NAHANNI FORMATION

Taylor, J.R., Seeley, T.P., Moore, D., and Mitchell, K.I.
Canadian Forest Oil Ltd., Calgary, AB

Slightly sour (H_2S 0.55%), acid (CO_2 11%) and hot (formation temperature 310° F (154° C)) natural gas has been produced from the fractured hangingwall Middle Devonian Nahanni dolomite (depth 13,500 feet (4115m)) at Pointed Mountain, Northwest Territories. A total of 315 BCF (8,874 10^6m^3) of Nahanni gas has been produced in the years 1972-2001.

Nahanni dolomitization has occurred in two stages, an initial recrystalization to a gray fine-grained dolomite and a secondary, coarse grained, sparry, white dolomite introduced into the formation by hydrothermal fluids. This secondary hydrothermal dolomite crosscuts bedding, infills vugs, fractures and is associated with brecciation of the earlier gray fine-grained dolomite beds. This textural association of a fine-grained, gray, matrix dolomite and the precipitation of white sparry saddle dolomite into fractures, breccias and pore space is seen in the Pointed Mountain cores. High initial gas rates in some wells are partly due to intersecting, open fracture permeability.

The discovery well, P-53-60-30-123-45, was drilled in 1966 to a well depth of 4370.5m (14,339 feet). 1082.7 feet (330m) of Nahanni, Headless and Arnica were penetrated before faulting to Horn River shale. The K-45-60-30-123-45 well was drilled in 1968. The P-53 and the K-45 wells were the best wells in the field and together produced (September 1972 to December 1998) 257.4 BCF or 82% of the produced gas reserves. Patterns of gas production and timing of water influx up the flanks of the thrust sheet trap are mapped. The possibility of additional pockets of unproduced Nahanni gas is speculated on.

LITTLE BEAR AREA (NORMAN WELLS): HYDROCARBON PROSPECTS NORTHWEST TERRITORIES

Taylor, J.R., Mitchell, K.I., and Winter, G.
Canadian Forest Oil Ltd., Calgary, AB

The Little Bear area is located 55km southeast of Norman Wells. Exploration Licences (EL) 412 and 421 are prospective for both gas and oil. The Enbridge oil pipeline to Zama, Alberta is located just east of EL 421. The same pipeline right-of-way is planned for the Mackenzie Valley natural gas pipeline. Modern 2D seismic was shot in the late 1990s and a number of stacked

potential hydrocarbon traps have been mapped. New information on geochemistry, timing of hydrocarbon migration and basin interpretation contained in several GSC published and open file reports tend to enhance prospectivity.

A drill ready, multi-zone, shallow (600m), exploratory oil play in the Cretaceous Slater River Formation sandstones has potential and nearby pipeline access. A deeper (3500m) sub-salt Cambrian deltaic sandstone updip pinch out on the Keele Arch has the potential for very large (TCF+) natural gas reserves. The Cambrian has established gas discoveries in the Colville area northeast of Norman Wells. The Cambrian section at Little Bear is much thicker and the structural timing as a pre-Laramide "early structure" means that it could be a timely (in more than one sense) exploration target in advance of the Mackenzie valley gas pipeline construction. Secondary gas potential is present in the Devonian Hume and Arnica Carbonates and in the sub-Cambrian Proterozoic Dolomites.

POSTER 1: 1:250 000 SCALE BEDROCK GEOLOGY COMPILATION OF THE MACQUOID LAKE (NTS 55M)- GIBSON LAKE (NTS 55N)-CHESTERFIELD INLET (NTS 55O) AREA, KIVALLIQ REGION, NUANVUT, CANADA

POSTER 2: 1:250 000 SCALE BEDROCK GEOLOGY COMPILATION OF THE KAMINAK LAKE (NTS 55L)- TAVANI (NTS 55K)-MARBLE ISLAND (NTS 55J)- PARTS OF FERGUSON LAKE (NTS 65I) AREA, KIVALLIQ REGION, NUANVUT, CANADA

Tella, S., Berman, R.G., Davis, W.J., Peterson, T.D., Paul, D., Panagapko, D., Juneau, S., and the Western Churchill Metallogeny Project (WCMP) Team
Geological Survey of Canada, Ottawa, ON

The bedrock geology compilations for selected portions of the northern and central Hearne subdomains reflect work in progress. These interim displays are compiled from published maps and reports, and highlight the types of geological data sets to be included in a major bedrock geology compilation work that is being undertaken by the Geological Survey of Canada under the auspices of the Western Churchill Metallogeny Project (WCMP), Northern Resources Development Program (2003-07). The WCMP area in Nunavut extends from 60° to 68°N and from 90°-102°W, and includes adjoining parts of NWT, Saskatchewan, and Manitoba. One of the objectives of the WCMP is to publish an integrated, geological and metallogenic synthesis of the region in digital format, in order to provide a tectonostratigraphic framework for mineral exploration strategies. The region hosts several economic mineral prospects - volcanic-associated massive sulphide, magmatic Ni-Cu, iron-formation-hosted Au, diamonds, and carving-stone.

The area covered in poster 1 (parts of northern Hearne) 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 ca. 2720-2655 Ma, amphibolite facies juvenile mafic, intermediate, and felsic volcanic rocks and associated ca. 2784-2655 Ma plutonic

rocks; 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 from the supracrustal 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 magmatic events. The region experienced tectonometamorphic events at ca. 2.55-2.5, 1.9, 1.83, and 1.75 Ga.

The region covered in poster 2 (parts of central Hearne) is underlain by the central and eastern segments of the Rankin-Ennadai granite-greenstone belt and by Paleoproterozoic continental clastic sequences (e.g., Hurwitz Group) and ca. 1830 Ma granitoid plutons. Geochronological data indicate formation of the Archean crust between 2711-2667 Ma. The oldest volcanic rocks (2711-2691 Ma) consist of mixed tholeiitic and calc-alkaline mafic and felsic, submarine to subaerial volcanic rocks and associated plutons. Younger volcanic rocks and associated calc-alkaline intrusions yield ages between 2686-2679 Ma. A regional, penetrative deformation and metamorphism occurred during the latter stages of a plutonic event at ca. 2680 Ma. Detrital zircon geochronology indicate that the Archean metasedimentary rocks and associated iron formation were deposited after 2681 Ma followed by ca. 2666 Ma post-tectonic granite, ca. 2659 Ma carbonatite, and deposition of post-2660 Ma, possible "Timiskiming-type" conglomerates. Development of the Rankin-Ennadai belt in an extensional, oceanic supra-subduction environment is suggested.

VOLCANIC STRATIGRAPHIC CONTROL OF GOLD MINERALIZATION OCCURRING AT THE MADRID BEND IN THE HOPE BAY DEFORMATION ZONE, NUNAVUT

Therriault, R.G.[1], Kleespies, P.[2], and Duke, N.A.[1]
1. Dept. of Earth Sciences, University of Western Ontario, London, ON
2. Hope Bay Joint Venture, North Vancouver, BC

In the central Madrid segment of the Hope Bay Greenstone Belt, north-south trending volcanic stratigraphy consists of variably flattened and altered volcanic units subdivided on the basis of physical characteristics and lithogeochemical signatures. Dark green high Fe-Ti basalt flows typically exhibit stronger D_2 strain and more chlorite-calcite alteration than adjacent lighter green "normal" tholeiites. In the Suluk area these two packages are separated by a 100m wide north-trending, steep westerly-dipping linear of strong deformation and quartz-ankerite-sericite alteration (the Hope Bay Deformation Zone; HBDZ). Three lithologies have been identified within the HBDZ by means of visual examination and geochemistry. These include enclaves of basalt, lenses of argillite and quartz-feldspar porphyry bodies dated at 2698.7 +6.7/-3.7 Ma. At the north end of Patch Lake the HBDZ swings westward cutting through stratigraphy toward the

Naartok deposit and is lost in an overlying felsic volcanic package exposed on the eastern shore of Windy Lake. These felsic volcanic rocks are of the same age as the quartz-feldspar porphyry intruding the deformation zone. Along this east-west trending segment the hangingwall stratigraphy departs from north-south, becoming progressively northeast in orientation as volcanic units are dragged into the shallow north-dipping zone of deformation.

Although the HBDZ is not itself mineralized, it is spatially related to several promising gold prospects in the Madrid area, indicating that it acted as the major conduit for gold-bearing fluids from depth. Gold mineralization is primarily hosted within high Fe-Ti basalts located in the footwall of the deformation zone at Suluk, and in the hangingwall in the Naartok area. Mineralization is concentrated in quartz + ankerite veins and stockworks, however, bordering Fe-Ti-Cr-Ni enriched wall-rock also hosts significant gold. Auriferous zones are invariably accompanied by sulphidization in the form of pyrite ± chalcopyrite, pyrrhotite and arsenopyrite. Associated wall rock alteration is characterized by an assemblage of quartz + ankerite + sericite ± paragonite and fuschite. Several generations of veining have been identified, two of which may contain gold. Early deformed grey quartz + ankerite ± albite veins and stockworks are the primary host to gold. Occurrence of gold in weakly deformed quartz + coarse ankerite ± hematite veins and vein breccias that crosscut the earlier set is evidence for late remobilization. Mineralized zones typically occur along lithological contacts and proximal to interflow argillite lenses. Dilation between lithologies of contrasting rheology created fluid pathways and trapped gold-bearing fluids. The strong gold association with Fe-Ti basalts indicates gold precipitation was dominantly controlled by the stratigraphic position of the high Fe-Ti volcanic units that proved most amenable to sulphidization.

GRAVITY AND MAGNETIC SIGNATURES OF THE MUSKOX LAYERED INTRUSION, NORTHWESTERN CANADIAN SHIELD

Thomas, M.D.
Geological Survey of Canada, Natural Resources Canada, Ottawa, ON

The 65 km long, north-trending 1270 Ma Muskox layered mafic-ultramafic intrusion in the northwest Canadian Shield has a maximum width and thickness of about 10 km and 2200 m, respectively, near its northern extremity. It narrows to roughly 200 metres at its south end, and then continues further south as a narrow dyke. Northward continuation of the intrusion beneath basaltic volcanics of the Coppermine River Group is suggested by the presence of prominent linear gravity and magnetic highs.

The intrusion comprises marginal peridotites lying above the inward-dipping contacts, and an overlying, flat-lying igneous stratigraphy dominated by dunites and peridotites (lower and mid levels) and gabbros (higher levels). Geological evidence indicates that the intrusion is funnel-shaped in cross-section along its length. Gravity and magnetic anomalies associated with the intrusion provide an independent means of examining the third dimension of the intrusion. A conspicuous linear magnetic high runs along the intrusion, locally branching into two or three separate features, and extends approximately 20 km northward across overlying, gently dipping

sedimentary and volcanic sequences of the Coppermine River Group, suggesting continuity of the intrusion at depth in this direction. Magnetite produced by serpentinization of ultramafic units is the probable principal source of this magnetic anomaly. The gravity signature is less uniform. A distinct gravity high is observed only over the northern part of the intrusion, where high-density gabbros are exposed. This continues northward following the path of the magnetic high, but extends some 50 km farther north. Most of the intrusion is associated with only a weak positive gravity signature or no gravity response. This, also, reflects serpentinization affecting olivine-rich ultramafic rocks of the intrusion. In the southern part, dominated by dunite, densities have been reduced from ~3.00 g/cm^3 to values as low as or lower than those of adjacent country rocks (2.71 g/cm^3).

Gravity modelling, more pragmatically applied in the northern part of the intrusion, suggests that the intrusion increases in width from about 10 to 19 km, maintaining a funnel-like geometry in the east, but becoming slab-like (~750 m maximum thickness) in the west. Small satellite mafic-ultramafic bodies within overlying dolomite and sandstone provide convincing evidence for the western extension. In the gravity model, the position of the eastern keel is displaced roughly 2 km from the position portrayed in the geological model, and gabbroic layers are thicker and are gently synformal, as opposed to being flat-lying. A caveat is that serpentinized portions of the intrusion, having low densities, may be invisible to the gravity modelling. Problematically, the match between the magnetic signature of the gravity model and the observed magnetic signature is extremely poor. It is apparent that the sharp peaks of the magnetic profile cannot be generated by gently dipping units. Successful modelling of magnetic profiles crossing the southern part of the intrusion, where dips are steeper and a presumed vertical feeder zone is closer to the surface, support this conclusion. The reconciliation of gravity and magnetic models for the intrusion is examined and debated.

NORTHWEST TERRITORIES GEOLOGY FIELD SCHOOL: A NEW INITIATIVE BY THE C.S. LORD NORTHERN GEOSCIENCE CENTRE AND THE UNIVERSITY OF ALBERTA: MAPPING AT GERMAINE LAKE, SLAVE PROVINCE, NWT

Tremblay, M.[1], Relf, C.[2], Atkinson, B.[1], Chacko, T.[1], Heaman, L.[1], McCallum, N.[1], Ootes, L.[2], Scheel, E.[1], Trommelen, M.[1], and White, D.[2]
1. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB
2. C.S. Lord Northern Geoscience Centre, Yellowknife, NT

In late August/early September 2003, the C.S. Lord Northern Geoscience Centre and the Department of Earth and Atmospheric Sciences at the University of Alberta jointly ran a field-based bedrock mapping course in the NWT. The course was developed for fourth year undergraduate students and involved two weeks of bedrock mapping in the Wheeler Basin (Germaine Lake area, southwestern Slave Province). The primary goals of the course were to provide hands-on bedrock mapping experience to five senior undergraduate students, while filling an existing gap in the NWT's knowledge base.

To minimize field costs, fieldwork was piggy-backed onto the end of the field season for the Wecho River bedrock mapping project (see Ootes, this volume). Two members of the Wecho mapping crew (Ootes and White) participated as instructors; this provided a regional geologic context for students, and will ensure seamless integration of the Germaine Lake geology map into the final Wecho River compilation. Systematic bedrock mapping was carried out by the students, who will generate a geology map and report for release through the C.S. Lord Centre by late spring 2004.

Mapping revealed a previously-undocumented package of finely layered mafic to intermediate rocks of presumed volcanic affinity within a thick package of multiply-folded greywackes. These greywackes preserve a progressive transition from sillimanite-bearing pelites and psammites to extensively melted migmatites northward, eastward and southward from the center of the basin. Fabric orientations across the transition suggest the area is hot-side-up towards the north and east, which is atypical in the Slave Province and will need to be addressed by further mapping in 2004. Plutonic rocks in the map area were subdivided into three units based on composition, texture, and relationship to the peak metamorphic fabric in the host rocks. Three orientations of Proterozoic diabase dykes were distinguished, and data on ice flow direction (straie, roches moutinees, etc.) were collected.

The University offered the course for credit, and students were evaluated both on their performance in the field and for a final deliverable. Tremblay will be generating a digital map, legend and GIS-compatible database of the field data collected, while the other students are producing written reports. In addition to these contributions, three of the five students have undertaken honours undergraduate thesis work on aspects of the Germaine Lake geology. Scheel is carrying out petrographic analyses of metamorphic assemblages across the area (Scheel et al., this volume); McCallum is comparing mineral assemblages of iron formations from the map area with those elsewhere in the southwestern Slave Province (McCallum et al., this volume); and Atkinson is studying the petrogenesis of Proterozoic diabase dykes in the area (Atkinson et al., this volume).

OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NORTHWEST TERRITORIES: A 2003 UPDATE

Tupone, J.
DIAND Petroleum Development and Benefits, Yellowknife, NT

This presentation will give a brief overview of:
-The oil and gas regulatory regime in the Northwest Territories;
-Oil and gas rights issuances in the Northwest Territories since the mid-1990's;
-Oil and gas exploration activity with respect to number of wells drilled and seismic programs undertaken; and
-What we expect to see for exploration activity this winter.

FLUIDS ASSOCIATED WITH PB-ZN MINERALIZATION IN THE PINE POINT MINING CAMP AREA

Turner, W.A.
C.S. Lord Northern Geoscience Centre, Yellowknife, NT

The C.S. Lord Northern Geoscience Centre examined the fluids responsible for ore and gangue mineral precipitation from selected localities to the south and west of Great Slave Lake, southern Northwest Territories. This study is part of a collaborative Targeted Geoscience Initiative between C.S. Lord Northern Geoscience Centre, Geological Survey of Canada, and Alberta Geological Survey that is assessing the potential for further undiscovered Mississippi Valley-type (MVT) lead-zinc ore bodies in northern Alberta and southern Northwest Territories. The fluid study described herein comprised one component of the MVT project.

The primary goal of this study was to constrain the trapping temperatures and salinities of fluids associated with the ore and gangue minerals. To accomplish this goal non-destructive microthermometric analyses of fluid inclusions were conducted. The study area ranges from the Little Buffalo River in the east to Heart Lake in the west and from Falaise Lake in the north to Escarpment Lake in the south. The fluid microthermometric studies identified two fluid types: Type 1 and 2. Type 1 fluid was observed in sphalerite and dolomite, and is a moderately low temperature (respective ave. 86 and 100°C), high salinity calcic brine (ave. 25 to 27 wt. % $CaCl_2$-NaCl), that was directly involved in the processes that deposited the metals. The composition of Type 1 fluid shows very little variation in the mean hydrohalite and ice melting temperatures over the area (~8,500 km^2) covered by the study. Type 2 fluid, observed in calcite and celestite, also has a low average homogenization temperature (85°C), however is less saline (ave. ~9 wt. % $CaCl_2$-NaCl) and has higher NaCl to $CaCl_2$ ratios than Type 1, and was not involved in metal deposition. These data suggest that a distinctly different fluid was responsible for the deposition of sphalerite and dolomite from that of calcite and celestite. This interpretation is consistent with the observed mineral paragenesis where white calcite and celestite were precipitated later than the hydrothermal dolomite and sulphide mineralization.

Although a distinct difference was observed in the compositions of Type 1 and 2 fluids, discrimination of the two fluid types on the basis of homogenization temperature was not possible. The similarities in the relatively low homogenization temperatures may however indicate that both fluid types were trapped at relatively shallow (and potentially similar) conditions. This further suggests that the fluid conditions remained comparatively similar during the multiple events of hydrothermal mineral deposition; supportive evidence that the area in the vicinity of the Pine Point mining camp did not undergo significant tectonic instability during and after ore mineralization.

GIANT DEEP-WATER SEEP MOUNDS ENCLOSED BY BASINAL CARBONATE STRATA: IMPLICATIONS FOR BASE-METAL MINERALIZATION IN THE MESOPROTEROZOIC BORDEN BASIN

Turner, E.C.
Canada-Nunavut Geoscience Office, Iqaluit, NU

Large (>200 m thick; >4 km width), hitherto unrecognised dolostone mounds are present within basinal rocks of the Mesoproterozoic Society Cliffs Formation, Borden Basin (ca. 1.2 Ga), Nunavut. Of the aulacogenic basin's three grabens, the largest and most economically important is the Milne Inlet Graben, host to the Nanisivik Zn/Pb deposit and numerous other base metal showings. The graben is characterised by repeatedly reactivated faults along which basin opening was accommodated; many are associated with sulphide mineralisation.

Carbonate mounds form dramatic cliffs in the northwestern part of the graben, and are present in core from Nanisivik. Mound growth initiated during deposition of the deep-water upper Arctic Bay Formation shale, and terminated at some time before development of the upper Society Cliffs carbonate ramp. On mound flanks, mound-derived debrites resulted from extensive erosion after growth. Mounds remained topographically pronounced after growth ceased, in some cases protruding up into Victor Bay Formation shale. Mounds are concentrated where syndepositional faults are especially numerous, as in the Nanisivik area.

Massive white mound-core dolostone is devoid of layering, and generally lacks internal structure; faintly clotted fabrics are common, and cement-rimmed thromboids and stromatactis-like textures are rare. Uppermost parts of mounds are characterized by karstic solution-collapse pipes and veinlets occluded by isopachous, medium crystalline dolomite; mound tops are veneered by intraclastic or oncolitic rudstone, overlain by Victor Bay Formation.

The mounds do not resemble any of the bioherms hitherto described from the Borden Basin, and lack the stromatolitic framework that is ubiquitous in Proterozoic photic-zone reefs. Their deep-water location, lack of paleogeographic or substrate controls, concentration in an area of unusually dense synsedimentary faults, lack of stromatolitic framework, and locally linear plan shape suggest that mound carbonate precipitated as a result of cold-seep fluids emerging on the sea-floor from synsedimentary faults. The presence of coarse-grained, immature, angular terrigenous material near basin-controlling faults elsewhere in the same stratigraphic interval attests to ongoing tectonic activity coeval with mound growth.

It is not surprising that an actively rifting basin should contain highly active fluid systems concentrated at structural weaknesses. This phenomenon has important implications for base-metal prospectivity. (1) The subsurface activity of voluminous, syndepositional fluid-circulating systems suggests that the entire Arctic Bay to Victor Bay succession could have sedex potential: the basin's ongoing tectonic activity might have resulted in a succession of fluid-flow events. Although fluid exhaled during early Society Cliffs time yielded mineralisation in the form of carbonate mounds, fluids vented at other times might have had metalliferous compositions. (2) The western mound cluster corresponds to a high spatial concentration of early faults, and to the best-developed Zn-Pb mineralisation; this area might be the most susceptible to fluid movement

and sulphide mineralisation. (3) The most impressive mineralisation, including the Nanisivik deposit, appears to be located on flanks of subtle domes that may be compactional features centred over mounds. Domes, overlain by impermeable shale, might have acted both as hydrocarbon traps and focal points for metalliferous fluids conducted through nearby, permeable faults.

UPDATE ON THE DEVELOPMENT OF THE DISCOVERY AND NICHOLAS LAKE MINES

Webb, D.R.[1] and Dupre, D.G.[2]
1. Tyhee Development Corp., Vancouver, BC
2. D.G. Dupre and Associates, Vancouver, BC

Tyhee Development Corp released a two-part resource estimate on its wholly owned Yellowknife Gold Project in August 2003. The Company is evaluating two resource scenarios at the Ormsby Zone - both of which could be developed independently or together. One case involves a large tonnage bulk-mineable resource while the other involves a higher-grade selectively mineable resource.

The tabular mineralized sheets of the Ormsby Zone are characterized by quartz veins and associated alteration within Achaean mafic metavolcanic rocks. Alteration includes post-deformational garnet development within chloritized selvages cross-cutting a pyrrhotite bearing, strongly lineated amphibolatized mafic massive, pillowed and fragmental rocks. The central part of the zone exhibits more intense mineralization and higher gold grades.

The central part of the Ormsby Zone hosts a measured and indicated resource of 54.6 million tonnes grading 1.06 gpt gold and an inferred resource of 42.8 million tonnes grading 1.01 gpt gold using a 0.5 gpt cut-off. The higher grade resource which is, in part, within the large tonnage resource hosts a measured and indicated 1,347,000 tonnes grading 11.07 gpt gold and an inferred resource of 1,130,000 tonnes grading 10.01 gpt gold using a 1.5 metre minimum width and a 5 gpt cut-off.

The company completed 15 diamond drill holes on their in 2003. The first phase of drilling succeeded in extending the mineralization of the Ormsby Zone to the north, east and west. Intersections included broad low-grade sections (e.g. NDM 232 intersected 1.43 gpt gold (1.22 gpt cut to 100 gpt) over 193.5 metres) as well as higher grade but shorter sections (e.g. 11.64 gpt gold over 9.5 metres in NDM 232 and 2,658 gpt gold over 0.15 metres in NDM 236).

A second phase of diamond drilling targeted a second volcanic lithon that had previously returned broad zones of low-grade mineralization (e.g. NDM 107 intersected 1.48 gpt gold over 27.3 metres) and 12.10 gpt gold over 1.5 metres). Results are pending.

PROSPECTING ON NORTHERN BAFFIN: A STRATIGRAPHIC AND STRUCTURAL FRAMEWORK OF THE ARCHEAN MARY RIVER GROUP AND ITS POTENTIAL ECONOMIC MINERAL PROSPECTS

Young, M., Gertzbein, P., Berniolles, F., and Sandeman, H.

New mapping (parts of NTS 37 G) has established a preliminary stratigraphic and structural framework for the supracrustal rocks of the Archean Mary River Group on Northern Baffin Island. The supracrustal rocks consist of interbedded basalt, quartzite, komatiite, Algoma-type iron formation, psammite, overlain by quartzite, psammite and intermediate volcanic rocks. Ultramafic sills intrude the lower part of the sequence. Three generations of structures are recognized in the supracrustal rocks: early (Archean?) L>S fabrics (D1) including bedding-parallel S1 foliations and tight to isoclinal F1 folds; superposed (Paleoproterozoic?) east-striking upright folds (F2) with an associated moderately developed axial planar foliation which decreases in intensity to the north; and conjugate, northwest- and northeast-trending crenulation cleavages (S3). Superposition of F2 folds on F1 in the southern part of the map area resulted in a dome and basin interference pattern, whereas in the west-central area F1 and F2 folds are nearly coaxial producing Type 3 interference patterns. In the northern part of the map sheet, weakly developed F2 folds produce open, undulating S1 surfaces, but do not affect the orientation of L1. Regions of intervening plutonic rocks typically carry a shallowly east to southeast-plunging L1 lineation and are structurally less complex, as a result of their initial isotropic characteristics and lower degree of accumulated finite strain. Newly identified potential economic mineral prospects in this map sheet include sulphidized (up to 30% py, +/- cpy, +/- aspy) iron formation; disseminated and fracture-filling sulphides in ultramafic intrusions; galena and sphalerite mineralization in dolomite of the Bylot Supergroup; and carving stone.