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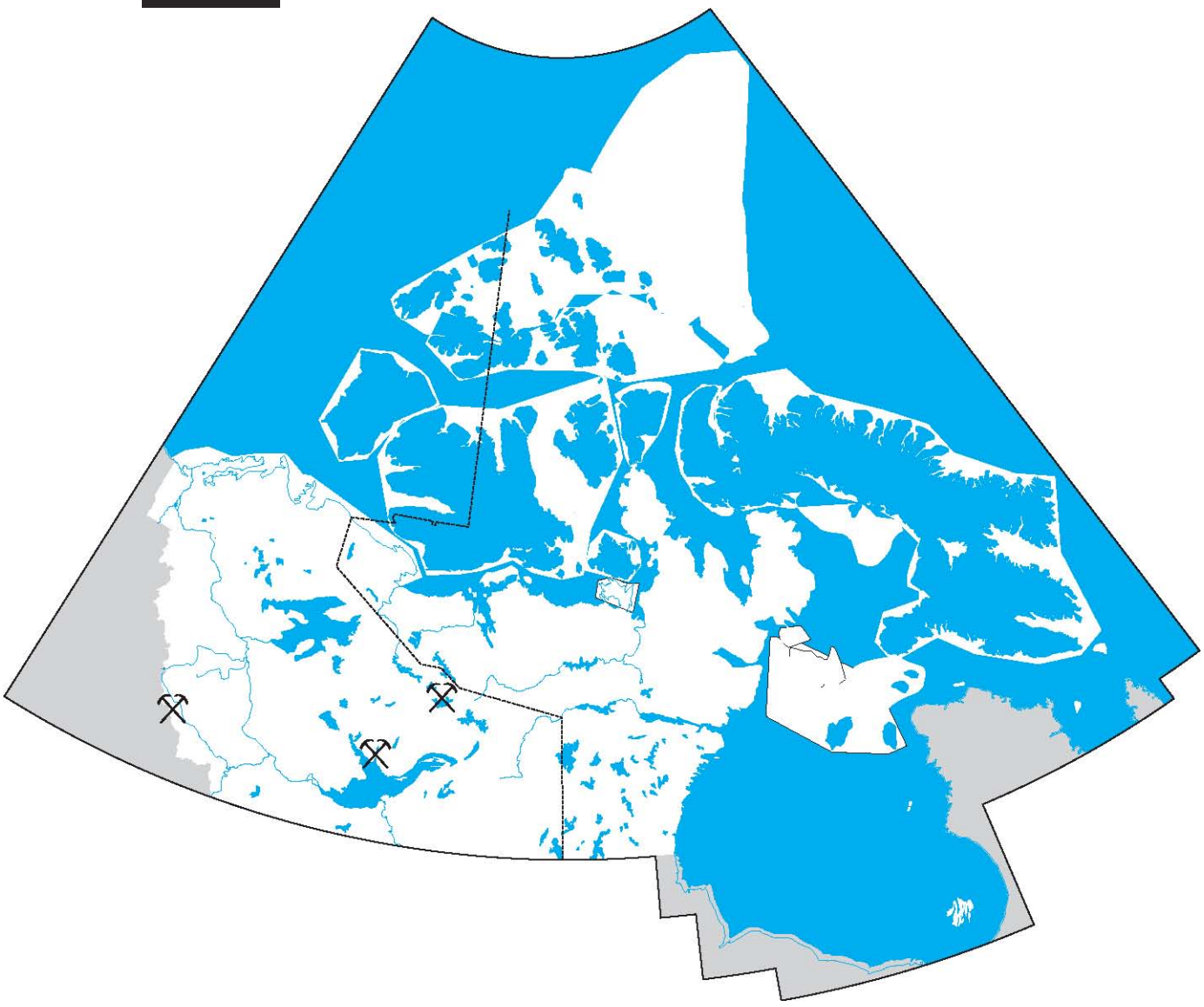

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GOLD IN THE YELLOWKNIFE GREENSTONE BELT, NORTHWEST TERRITORIES: RESULTS OF THE EXTECH III MULTIDISCIPLINARY RESEARCH PROJECT

poster

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The Yellowknife EXploration science and TECHnology (EXTECH) initiative, a cooperative program involving the Government of the Northwest Territories (GNWT), Natural Resources Canada - Geological Survey of Canada (GSC), the Department of Indian and Northern Development (DIAND), and private industry partners initiated a four year multidisciplinary, multi-agency geoscience program in April 1999 focused on the Yellowknife area. Its main objective was to address the declining gold reserves through the development of new ideas and technologies. This partnership program included: detailed mineral deposits studies; regional geological research; and, development of a comprehensive digital geoscience knowledge base.

The results of the Yellowknife EXTECH III project will be published by the Mineral Deposits Division (MDD) of the GAC as an MDD Special Volume.

A total of 26 papers has been submitted for the volume which is organized into themes of: Historical Background; Regional Geology; Mineral Deposits and Regional Metallogenic Studies; Surficial Geology and Exploration Geochemistry;Geophysical Approach to Gold Exploration in the Yellowknife Area; and Data Integration and Guides to Exploration.

The publication will also include a DVD containing: 1) digital files of appendices and tables; 2) a compilation of georeferenced geoscience data for the Yellowknife greenstone belt in a 2-D GIS database; and 3) over 50,000 drill holes from the Con and Giant mines compiled in a 3-D GIS database.

Some of the key results include: 1) The compilation of information from over 50,000 drill holes at the two mines, integrated mine workings and lithochemical samples, utilizing 3-D GIS modeling undertaken collaboratively with mine geologists, has identified a number of drill targets for future exploration; 2) Metamorphic mapping has resulted in a comprehensive definition of the metamorphic isograds and their location for the main part of the Yellowknife greenstone belt and provides useful constraints on genetic modeling; 3) New geochronological data from both Re-Os and U-Pb zircon dating with the addition of bedrock geochemistry has helped clarify the Au mineralization timing, redefined the belt stratigraphy as well as allowing for the identification of a major crustal break; 4) The refinement of the Quaternary geology and testing of new approaches to till sampling in conjunction with biogeochemistry has allowed for more efficient kimberlite indicator mineral and gold grain surveys and resulted in the discovery of two new kimberlites; 5) Detailed surface and downhole geophysical surveys combined with laboratory studies on physical properties of the deposit lithologies has allowed for the refinement of the geophysical signatures of the orebodies and accompanying sulphide mineralization; 6) The compilation of the history of mining in the Yellowknife Greenstone Belt and its economic impact

has contributed to a better understanding of the potential socio-economic implications of future mines and exploration projects in the north.

This volume is expected to be completed by March 2005.

NWT PROSPECTING COURSES AND COMMUNITY GEOSCIENCE OUTREACH ACTIVITIES

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talk

The Government of the Northwest Territories, through the Minerals, Oil and Gas Division, Resources, Wildlife and Economic Development (RWED), provides educational 40-hour courses to NWT residents on prospecting, basic geology and mineral exploration methods. Requests for the prospecting course come from NWT communities and are taught in the community at local learning centres, community hall or band office. The community-driven request system and a local sign-up list helps to ensure that a decent turnout level is achieved and the course is truly wanted by the community.

Three prospecting courses are taught per year and a balance is maintained at that level. A waiting list is established on a first come basis.

Since 1998, 19 courses and workshops have been taught in the Northwest Territories.

Courses were completed in the communities of Norman Wells, Tulita, Deline, Fort Good Hope, followed by Fort McPherson, Aklavik, Wrigley, Tuktoyaktuk, Sachs Harbour, Paulatuk, WhaTi, Jean Marie River, Fort Liard and Yellowknife. From these courses emerge a number of candidates who apply for the RWED-funded and -operated NWT Prospector's Grubstake Program to explore and prospect in their local areas. The program offsets costs for sample assays and geochemical expenses, travel expenses into remote areas for the purpose of prospecting and basic prospecting supplies. About two dozen prospectors apply for this assistance per year, generally half are newly trained applicants and the others are more experienced prospectors. Our program is advertised on our website at http://www.rwed.gov.nt.ca/RWED/mog/minerals/minerals.htm

Geology, rocks and minerals talks are given in the local high schools and elementary schools while instructors are in the communities teaching the adult prospecting course. Open houses for community members are also arranged.

Individual requests for advice on the interpretation of geochemical results, and the identification of rock, mineral and fossil samples sent in from residents across the NWT are carried out throughout the year.

A wide variety of educational community outreach activities are carried out each year and are based on community requests or built around their unique geology and needs. Some of these include:

a) NWT Youth Prospecting School (piloted in 1999 with 14 students representing several NWT communities).
b) Norman Wells Fossil Hunt-Paleontology lectures and field trips for the public, a combination of geoscience outreach and tourism-building (1999-2003).
c) Skills Canada workshops, local and regional science fairs, museum programs, EdGeo Teachers Workshop, talks and hikes for Aurora College teachers program and various school groups and other public organizations.

As a result of this work, many partnerships have been built between the Minerals, Oil and Gas Division, RWED and other private organizations, schools, museums, municipal and federal government departments. Some of these include NWT and Nunavut Chamber of Mines, DIAND, C.S. Lord/ NWT Geoscience Office, Aurora College and Learning Centres in NWT Communities, NWT elementary and public schools, band offices, federal departments NRCAN, Skills Canada, and territorial government Departments such as Education, Culture and Employment.

Outreach activities are most effective when a community shows a need and becomes an active participant in the program being developed. Establishing a mutually best time to hold the course or program is critical in having a successful outcome. Listening and meeting the needs of the participants and community under varying situations is also of importance. Maintaining programs when they are successful and changing outreach activities to meet the requests as they change are best methods of providing relevant and useful geoscience outreach activities in the north.

ORIGIN OF DIAMONDS FROM THE K252, K91 AND K11 KIMBERLITES, BUFFALO HEAD HILLS, ALBERTA, CANADA

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talk

Over 2000 diamonds recovered from 3 kimberlite pipes (K11, K91 and K252) during exploration in the Buffalo Head Hills kimberlite field in northern Alberta, by the Ashton/Encana/Pure Gold joint venture, were examined in this study. The diamonds show a large abundance of secondary forms, the majority having resorbed octahedral (i.e. tetrahexahedroidal) morphology. Sharp-edged octahedra, octahedral aggregates, macles (twins) and fragments are also observed. The diamonds are mainly colorless, although yellow and brown stones are present in this population. Overall, the diamonds are clear and transparent. Tetrahexahedroidal surfaces show extensive hillock patterns (elongate, positive relief features), whereas residual octahedral faces exhibit an abundance of negative trigons (triangular etch pits). Plastic deformation is present but not noticeably abundant.

Fourier Transform Infra-red (FTIR) analyses of nitrogen content and aggregation on a subset of 160 samples indicate that approximately 25% of the diamonds have nitrogen contents below detection (ca. 10 ppm) and thus may be classified as Type II. The remainder has nitrogen concentration ranging from 10 ppm to >3000 ppm. Nitrogen aggregation is variable and ranges from IaA (i.e. >90% of nitrogen occurs in pairs) to IaB (i.e. >90% of nitrogen occurs in groups of four atoms surrounding a vacancy), with higher aggregation states being more abundant in this dataset (IaA < IaAB < IaB). Type IaA diamonds have a restricted range in nitrogen concentration around ~1000 ppm. Type IaAB and IaB diamonds span the entire range of nitrogen concentrations with Type IaB diamonds showing both the lowest and highest concentrations observed. Apart from possible but yet un-quantified effects of plastic deformation, nitrogen aggregation is controlled by three factors: (i) nitrogen concentration, (ii) residence temperature and (iii) residence time. The observation that Type IaB diamonds from our sample extend to very low nitrogen contents, compared with a large database of African, South American and northern Canadian diamond populations thus implies that mantle residence occurred at temperatures well above those usually observed for diamonds world-wide. This suggests a deep, possibly sublithospheric origin. Type IaA and IaAB diamonds with higher nitrogen contents resided at shallower depths in the mantle and maybe indicative of a younger diamond-forming event.

Sixty of the 160 diamonds were analysed for C-isotopes. A bimodal $\delta^{13}C$ distribution with peaks at -5‰ and -15‰ was observed for diamonds from all three kimberlite pipes. Approximately half of the diamonds are isotopically light ($\delta^{13}C$ < -10 ‰), suggesting a predominantly eclogitic paragenesis.

The few available inclusions show the presence of both the eclogitic and peridotitic paragenesis. Pyrope garnet and olivine inclusions in diamonds characterize the peridotitic paragenesis from these pipes. The occurrence of omphacitic pyroxene and almandine-rich garnet inclusions in diamonds from the K252 pipe are characteristic of the eclogitic paragenesis. A predominance of the eclogitic suite has only been observed in a few but economically extremely valuable diamond deposits worldwide (e.g. Premier, Jwaneng and Orapa).

BEYOND THE PIPELINE: 100 YEARS OF GEOSCIENTIFIC INVESTIGATION TELLS US WHERE TO GO FROM HERE

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talk

Completion of the Mackenzie Valley pipeline is a historical event in par with the construction of the great Canadian railways that opened the west. Likewise, the pipeline will open the North, and in more than one ways, some good and some bad. On the positive front, it is sure to make the sedimentary basins of Northern Canada more attractive to exploration. High commodity prices will help drive exploration in basins, or parts of basins that have been largely ignored in the past. Which basins will be investigated first will depend on the volume and quality of geoscientific knowledge accumulated over the past 100 years, and where scientific investigation will take place

over the near future. Unfortunately, geoscientific gaps and needs are usually addressed on an anecdotal basis, too often tainted by the personal agenda and political expediencies of various proponents, with little or no regard for the huge volume of knowledge accumulated before. In collaboration with the Northwest, Yukon and Nunavut governments, the Geological Survey of Canada has conducted a new type of scientific gap analysis, one that is based, as faithfully as possible, on the accumulated knowledge in the academic literature and government reports. What came out of our study is that very few northern basins, or even parts of these basins, can be dubbed as mature in terms of scientific maturity. Many areas lack the most basic understanding of their three-dimensional architecture, while the petroleum system of most of them remain a mystery. While some areas have been revisited over and over again, others have been left unattended in spite of good outcrops and available subsurface data. The series of maps generated through this project (Northern Basins Initiative) captures the many gaps in the sedimentary basins of the NWT and neighbouring Yukon and Nunavut territories. These maps, which show and analyse the density, breadth, quality and trends of scientific investigation, provide a true and honest snap-shot of geoscientific gaps at the dawn of a new exploration area.

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

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3. Canadian Hydrographic Service, Burlington, ON

talk

The Geological Survey of Canada in collaboration with the Canadian Arctic Shelf Exchange Study (CASES), the University of New Brunswick, the Canadian Hydrographic Service and Devon Canada Corp. conducted a seabed-mapping program of the Beaufort Sea from the Canadian Coast Guard ships NAHIDIK and AMUNDSEN June-September 2004. Conventional bottom sediment corers, sidescan sonar, subbottom profilers and new multibeam sonar technologies were used to investigate environmental and geotechnical issues related to offshore hydrocarbon exploration and transportation. These issues included seabed scouring by ice keels, seabed ecosystems, gas seeps, mud volcanoes, abandoned artificial islands and seafloor foundation conditions.

An extreme 3 m deep ice scour was tracked for a significant distance of 24 km across the seabed from 42 to 37 m water depth. The abundance and diversity of bottom dwelling fauna increases significantly in water depths greater than 50 m – bathymetry beyond the zone of active seabed scouring by ice keels. Gas vents observed in 2001 and 2003 were destroyed by ice scouring processes or partially infilled with fluvial sediments in 2004. A high concentration of ninety-seven mud volcanoes was observed along a 16 km track in the Mackenzie Bay area. Abandoned artificial islands have been eroded by wave and current action to more than 4 m below sea surface over the past 20 years. Sediment cores indicate the seabed subsurface consists of

disturbed surficial silty clays overlying more cohesive silty clays at depth. Normal sediment property profiles with depth below seabed in the disturbed layer are significantly scattered by the reworking action of ice keels. Sediment slumping observed on the upper slope probably occurred several thousand years ago.

SLAVE BEDROCK COMPILATION

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talk

Efforts are underway to systematically compile existing bedrock geology information for the Slave craton into a common GIS-based platform. As several previous compilations do exist and are available in the public domain, any new compilation effort is only useful if it is able to go well beyond previous compilations in terms of accuracy, completeness, and detail.

Broken down by 250,000 NTS sheet, we started in the northern part of the craton with map tiles 76M, L, E, F, and G. We have assembled all basic background information:
-topography
-digital elevation
-regional aeromagnetic data in several formats (total field, vertical gradient, tilt, etc.)
-Armstrong's compilation of industry aeromagnetic data
-and gravity data

A selection of existing geological maps, starting with A-Series GSC maps, is being converted to digital products and brought into the compilation, where they are merged with existing digital maps and recoded to a common legend. In the process, inconsistencies along map boundaries are resolved.

Digital elevation data and magnetic data are used to compile layers of topographic and magnetic lineaments. The latter provides the basis for a comprehensive analysis of mafic dyke swarms in the craton and other magnetic linears such as banded iron formations. Geochron data from the on-line database are checked for correct locations and linked to the map.

Results thus far tentatively support a single volcanic assemblage from Anialik River to Back River, development of which was initiated at ca. 2705 Ma with bimodal volcanism and subvolcanic intrusions. Rare inherited zircons indicate a precursor history as old as 2711 Ma. Typical ages for younger rhyolite complexes are 2696-2690 Ma, coeval with the main phase of the Anialik River Intrusive Complex. Youngest volcanic ages are ca. 2670 Ma. This volcanic substrate is overlain by 'Burwash-age' greywacke turbidites with youngest detrital zircons with ages of ca. 2672 and 2664 Ma. In the High Lake greenstone belt, these rocks are overlain by a younger 2620-2610 Ma volcanic assemblage.

On-going work to refine the stratigraphy of the Yellowknife greenstone belt has yielded several new results (see also abstract and poster by Davis et al.). The youngest magmatic event of the

Kam Group, the Kam Point gabbro sill, has a preliminary age of ca. 2697 Ma, indicating late stage sill intrusion in a developing volcanic rift. This age slightly post-dates youngest felsic rocks and epiclastic sediments at the top of the Kam Group, in accordance with field relationships. The massive porphyry facies of the Townsite Formation is dated at ca. 2709 Ma, eliminating earlier age inconsistencies. The 'type locality' of the Banting Group rocks at the top of the Giant Section, reinterpreted to belong to the Kam Group based on structural and geochemical evidence, is indeed confirmed to be of Kam age with a preliminary but somewhat imprecise age of 2698 Ma. Hence, there is no stratigraphic connection between Kam and Banting groups proper in the main part of the Yellowknife greenstone belt, opening up the way for major strike-slip displacement on the Yellowknife River Fault Zone, as proposed earlier on structural grounds.

THE EVOLUTION OF GRANITOIDS IN THE WECHO RIVER AREA: WHERE IS THE BASEMENT?

talk

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The main intrusive phases recognized in the Wecho River area include four granitoid suites and an enderbite to mafic granulite unit. Geochemical and geochronological samples of these rocks were taken to better define the evolution of the granitoid suites and to help determine the role of Mesoarchean basement. Results of analyses from the northern portion of the map area are summarized below.

The youngest granitoid is a K-feldspar phenocrystic monzogranite. This unit has distinctive major element chemistry, containing the highest wt. % Fe2O3, MgO, Al2O3, and K2O and the lowest SiO2 (65-73 wt.%) of all the granitoid suites. It is slightly peraluminous and rare earth element diagrams show consistent enrichment in light rare earth elements relative to heavy rare earth elements, along with negative Eu anomalies. Incompatible element diagrams show depletions in Ba, Nb and Ti. Spatially associated with the monzogranite is a peraluminous, equigranular biotite-muscovite granite that has high SiO2 (73-75 wt.%) and low CaO, Fe2O3, Al2O3, and MgO compared to other suites. This granite shows extreme enrichment in light rare earth elements relative to heavy rare earth elements.

Medium-grained, equigranular granite to granodiorite, associated with migmatitic rocks in the Armi Lake supracrustal belt, is peraluminous and shows a slight negative Eu anomaly. Metaluminous enderbite to mafic granulite, found as small isolated enclaves in the northern portion of the map area, has distinctive petrographical and geochemical characteristics with low SiO2 (53 wt.%) and high Fe2O3 (12 wt.%) and MgO (3.6 wt.%). Compared to other suites, this unit shows relatively flat incompatible element trends with minor Ba enrichment.

The oldest unit is well-foliated biotite-magnetite granite to tonalite with K-feldspar stringers and mafic enclaves. This granitoid has low Fe2O3 and high CaO, Na2O and SiO2. A sample of this suite was taken from the northern most part of the map area for U-Pb geochronology. The sample yielded a monazite age of ca. 2600 Ma, which is interpreted as the crystallization age of the suite. Unaltered zircons with no core-rim structures gave ages between 2855 and 2970 Ma, within the realm of the Central Slave Basement Complex (see Buse et al., this volume). The inherited zircons suggest that basement underlies the northernmost part of the Wecho River area.

A Sm-Nd isotopic study is underway to further explore the extent of basement underlying the Wecho River area. Future geochemical and geochronological work also includes characterization of granitoids from the southern portion of the study area and a comparative analysis of the Nardin gneiss (Central Slave Basement Complex).

AN UPDATE ON THE GEOLOGY AND GEOCHRONOLOGY OF THE WECHO RIVER AREA

poster

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Regional bedrock mapping over the past two years in the Wecho River area has identified a complex, previously unrecognized low- to high-grade supracrustal domain in the southwestern Slave craton. This supracrustal domain is extensively intruded by pre-, syn, and late-tectonic granitoids. U-Pb zircon and monazite geochronology and major- and trace-element, and radiogenic isotope geochemistry have been employed to help delineate the extent of Mesoarchean basement underlying the study area and to better understand the petrogenesis of the major crust forming granitoids. This study presents preliminary geochronological ages from four samples that were collected and analyzed from the northern part of the study area, mapped in 2003.

The granitoids in the northern part of the study area are classified as five distinct units based on physical properties and crosscutting relationships. These include K-feldspar phenocrystic granite, biotite-muscovite granite, biotite granodiorite, charno-enderbite to enderbite (orthopyroxene-bearing granodiorite to tonalite), and well-foliated biotite-magnetite granite to granodiorite. The granitoids intrude supracrustal rocks that are at mid- to upper-amphibolite-grade in the south (Armi Lake belt) and at upper-amphibolite-grade in the north.

The K-feldspar phenocrystic granite crosscuts all other Archean rocks types in the study area and yielded a U-Pb monazite age of 2575 Ma. The equigranular biotite granodiorite intrudes the Armi Lake belt and yielded a U-Pb monazite age of 2580 Ma, interpreted as the crystallization age of the pluton. Two U-Pb zircon ages of 2590±2.3 Ma and 2580 Ma were yielded from the enderbite located in the northwest portion of the study area. The 2590±2.3 Ma age is interpreted as the minimum age of crystallization and the younger 2580 Ma age as a later metamorphic

growth. A well-foliated to gneissic granodiorite occurs the northernmost part of the study area and yielded a monazite age of 2600.6±2 Ma, determined as the crystallization age of the rock. Zircons in this sample were unaltered with no core-rim structures and yielded ages between 2855 Ma and 2970 Ma. These zircons are interpreted as inherited from Central Slave Basement Complex believed to underlie parts of the Wecho River area.

The southern part of the study area, mapped in 2004, is underlain by a number of granitoids that were not identified in the north. To help distinguish the different granitic suites and examine the evolution of the southern study area in comparison to north, three geochronological samples (2 granitoids and one turbidite) were collected and are currently being analyzed.

MINERAL CLAIMS MAPPING IN THE DIGITAL AGE: AN IMPROVED BASE WITH HIGH-RESOLUTION IMAGERY AND CANMATRIX

poster

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This poster presentation introduces new paper and digital mapping products and services provided for the Mining Recorder's Office. INAC is now using NRCan's CanMatrix product and LandSat7 orthoimagery as a more accurate base map for mineral claim mapping and as an alternative base for map visualization on the web.

Depending on the area of interest, three improved base map layers are available. LandSat7 imagery is available or in production for almost all of the NWT and Nunavut, with only a handful of exceptions on Ellesmere Island. CanMatrix data, a scanned image of a 1:50,000 NTS map, is available for about 90% of the north. National Topographic DataBase vector data at the 1:50,000 scale is available for almost the entire mainland, but is very limited in the Arctic Islands.

Mineral claim maps are created using the best available base maps, alone or in combination, for the area of interest. Files are created in Adobe PDF format using the MapBook extension for ArcGIS. Map production processes and data editing processes have been updated to take advantage of the geodatabase and ArcGIS.

SIDViewer Online remains as a public window to INAC's spatial information. New functionality has been added to the interface to simplify display of relevant data, and print selected information. INAC staff will have access to an internal version of SIDViewer Online that will incorporate the new base mapping. This version of SIDViewer will also be available for use by clients at the Mining Recorder's Office.

The changes INAC has made in technology and processes as a part of the effort to improve base mapping will open up new avenues for further enhancements to the services and products available to INAC's clients.

poster

BASE MAPS IN THE DIGITAL AGE: COOPERATIVELY IMPLEMENTING A GEODATABASE

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Managing the volume of data required to create more accurate base maps for the Northwest Territories and Nunavut required a change from INAC's existing file-based data management methods. The implementation of a geodatabase, stored in an Oracle database and accessed with ESRI's ArcSDE application server, has made it possible to store hundreds of gigabytes of images and make them easily available to GIS applications. All of INAC's base map data, vector and raster-based, is now stored in a single database and each layer is available in manner that is seamless to the application.

Implementing the geodatabase proceeded in three major phases: designing the database, processing the data, and loading the data. First, the database was designed to allow each dataset to be managed separately as required. Further work such as adding topology will be done as our experience and expertise increases. Second, thousands of files were downloaded from NRCan, and then processed. INAC obtained all available National Topographic DataBase files at the 1:250,000K scale and the 1:50,000K scale, and all CanMatrix files at the 1:50,000K scale. Landsat7 imagery was purchased and the hundreds of CD's have arrived. Mosaicked LandSat7 data was obtained from the NWT Geomatics Centre. Third, methods and infrastructure were developed to load all of this data.

Four departments in two governments have worked together to complete this project. At the beginning of this project, GNWT's Department of Resources, Wildlife, and Economic Development (RWED) recognized the similarities between the work being done by INAC and RWED's work with the NWT Geomatics Centre. RWED brought the two groups together to begin discussing coordinated development of geodatabases. Environment Canada and INAC both wanted to obtain complete CanMatrix data, and worked together to download the thousands of images required. In addition, the CanMatrix data required extensive processing before loading to the geodatabase. The NWT Geomatics Centre and INAC collaborated to process these images into a single data layer. Also, INAC and the NWT Geomatics Centre have continued to keep each other informed of their approaches to storing data in a geodatabase, with the intent of easing the future integration of the data. Further cooperation is anticipated as both governments work to make digital data accessible to northerners.

SPRING DISTRIBUTION AND GEOCHEMISTRY IN THE SOUTH NAHANNI RIVER BASIN

poster

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2. University of Calgary, Calgary, AB

The mineral and thermal springs in the South Nahanni River Basin are being studied as part of a Mineral and Energy Resource Assessment for the expansion of the Nahanni National Park Reserve, NWT. The distribution and trace element geochemistry of springs are being examined as a potential means to identify mineral deposits within the expansion area. Additionally, the spring systems will be examined as potential analogs for the shallow crustal circulation systems of ore formation models.

Twenty springs have been sampled to date, with temperatures ranging between 0.8 and 51.2 °C. Electrical conductivity ranged between 0.1 - 2650 μS, pH ranged from 3.8 to 7.6. Sulfide concentrations were generally less than 5 ppm in all springs sampled. Dissolved oxygen values were found between 0.1 – 10.5 mg/L. Most springs had total dissolved gas pressure percent saturation over 100%. Lab analysis results are being performed on the dissolved components, including trace elements, major cations and anions, $\delta^{18}O$, $\delta^{2}H$, $\delta^{34}S$ of sulphates and sulfides, $\delta^{13}C$ of inorganic carbon. Dissolved gas and free gas compositions and isotopes ($\delta^{13}C$ and $\delta^{2}H$) are also being determined, as well as travertines precipitated from the springs ($\delta^{13}C$ and $\delta^{34}S$). Silica-geothermometry, solubility and mass-flux calculations are going to be performed in order to create a simple analogy of the formation of potential ore-deposits. Results will also be compared to local geology maps and known rock geochemistry of the area.

APPLYING INTERNET MAP SERVER TECHNOLOGY TO DATA DISSEMINATION AND KNOWLEDGE SHARING AT THE ALBERTA GEOLOGICAL SURVEY

poster

Chao, D.K.
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Geoscientists at the Alberta Geological Survey have been sharing their knowledge and results on their geological studies with the public through published reports, journals and maps. However, the release of digital datasets for the studies was not common as there was no affordable tool for the public to examine or process them. With the recent advance of computer technology, affordable software and Internet, demands on digital datasets have been steadily increasing. These technologies also enable AGS to publish datasets and databases on CD-Rom while Internet Map Server (IMS) or web-based GIS is used for publishing selected GIS datasets.

AGS has published more than 20 GIS datasets, organized in five themes, using the IMS technology. Each theme is a separate web-based GIS page. These themes are Geology of Alberta, Hydrogeology/Water Well Chemistry, RadarSat-1 Data Holdings, Sand and Gravel, and

CO_2 Sources and Basin Suitability. Users can query and print these datasets as map layers. Most of them are downloadable as complete GIS dataset or selected records.

The Geology of Alberta IMS contains ten layers of geological datasets. These datasets are bedrock geology of Alberta, surficial geology, bedrock topography, drifts thickness, structural lineaments, industrial minerals occurrences, metallic minerals occurrences, drill hole locations of the Athabasca Basin region, oil and gas distributions and the outline of airborne survey.

The Hydrogeology/Water Well Chemistry IMS focuses on the distributions of water well locations containing shallow coal aquifer water chemistry in Alberta Plains Region for CBM development, and water well locations with coal within the perforated completion interval and screened completion interval. Other supporting geological datasets include bedrock geology and selected outcrop boundaries.

The RadarSat-1 Data Holdings IMS includes an inventory of orthorectified and processed RadarSat-1 imageries – S1 and S7 Ascending and Descending and Principal Component 1 to 4. These imageries are available for purchase by scene at AGS or for download as mosaics by NTS tiles in Geotiff format.

The Sand and Gravel IMS concentrates on aggregate deposits in Alberta. Information on the deposit includes percentage, volume and total thickness of sand and gravel and deposit size in hectares. There is also a sand and gravel calculator for users to re-calculate the deposit size based on different sand and gravel percentages.

The CO_2 Sources and Basin Suitability IMS datasets cover the entire Western Canada Sedimentary Basin. They include distribution of CO_2 sources categorized by industries and urban locations, major crude oil and natural gas pipeline network, Western Canada Sedimentary Basin boundary and geological regions suitable for CO_2 storage. Users can query any dataset by their geographic extent and/or attributes. The resulting records are downloadable in ASCII format.

Several more themes are in the works and will be available in the future. They are coal bed methane potential of Alberta, oil and gas pools distributions that are suitable for Enhanced Oil Recovery (EOR), and aquifer characterizations and CO_2 capacity calculations of Viking and Keg River units of the Western Canada Sedimentary Basin.

Samples and detailed discussion of each theme will be presented on poster display.

DIAMOND EXPLORATION PROJECTS ON THE SLAVE CRATON, NWT GGL DIAMOND CORP

Chartier, T.[1], Hrkac, C.[2], and Hrkac, R.[2]
1. Consulting Geologist
2. GGL Diamond Corp.

talk

GGL Diamond Corp. (GGL) has been exploring for diamonds in the NWT since 1992. Prior to 1992, the company was engaged in the exploration for gold and still holds advanced gold properties in British Columbia and Nevada. GGL currently holds over 400,000 acres in three separate project areas within the Slave craton of the Northwest Territories. They are the Doyle Lake, CH, and Fishback Projects.

The Doyle Lake Project consists of 30 claims (LA 1-30) totaling 52,688 acres and is the most advanced property in the company's portfolio. The property is located in the southeastern Slave, contiguous to and south of the AK claims (Gahcho Kue diamond project) that are being explored through a joint venture between Mountain Province and De Beers Canada Exploration Inc. (De Beers).

The Doyle Lake project has been explored under a joint venture with De Beers since 1995 and contains one kimberlite, the Doyle Sill. The Doyle Sill is a diamond bearing, shallow dipping kimberlite body averaging 2 metres in thickness. A drilling program on the Doyle Sill conducted in 2003 extended the strike length to 2.0 kilometres. Results of this program returned 161 microdiamonds from 84.5 kilograms of kimberlite.

In July 2004, the joint venture (De Beers 60%, GGL 40% carried interest) holds 15,000 acres, while GGL controls 100% interest in 36,000 acres including the diamondiferous Doyle Sill.

GGL retains 100% interest in its CH and Fishback projects. The CH Project, consisting of 308,000 acres is located 40 kilometres southwest of the Ekati Diamond Mine and 40 kilometres west of Diavik Diamond Mine. The CH Project contains ten separate diamond properties of which the Zip-de, Starfish, Seahorse, Courageous and MacKay are the most advanced. Three kimberlites, Adams, Shasta, and Rainier, were discovered by GGL in 2001 on the Seahorse Property. No microdiamonds were recovered. Top priority geophysical targets with kimberlitic indicator mineral support have been identified and will be drill tested in 2005.

The Fishback Project is located in the southern Slave, 70 kilometres northeast of Yellowknife. In 2000, GGL identified the "Big Hole" target, a steep sided, 75 metre deep depression beneath a lake, approximately 60 to100 hectares in size. Kimberlite indicator minerals have been found down-ice from the lake and lake bottom sediments collected from the depression returned kimberlite trace and rare earth elements.

The "Big Hole" lies within a magnetically quiet zone and a 32 hectare EM anomaly has been identified in the southern portion of the "Big Hole". Modeling of this EM data reveals approximately 25 metres of lake bottom sediments and a basement conductor, indicative of a kimberlite body 900-1000 metres in width. Ground gravity over this target has identified a gravity low correlating to the EM anomaly.

An inclined drill hole collared from land was drilled into the "Big Hole" in July 2004. The hole was terminated at 846 metres after it began to drift away from the projected azimuth. An unusual, 70 centimetre thick microbrecciated carbonate-rich dyke was intersected at 775 metres. The contacts of this unit are sharp and the dyke has been interpreted to be injected into the country rocks by a magmatic intrusive event. The EM and gravity targets will be drill tested by vertical drill holes in early 2005.

UPDATE ON THE KNIFE LAKE KIMBERLITE AND INULIK DIAMOND PROPERTY, CORONATION DIAMOND DISTRICT, NUNAVUT RHONDA CORPORATION

Chartier, T. and Hodder, S.

talk

During the mid-1990's, Rhonda Corporation (Rhonda) acquired large tracts of land in the Coronation Diamond District, to explore for base metals with joint venture partner, Noranda Mining. By 2000, all but approximately 80,000 acres were allowed to lapse and the claims were returned to Rhonda.

Rhonda entered the diamond exploration business with the discovery of the Knife kimberlite in the spring of 2000. It was drilled by DeBeers Canada Exploration Inc. (DeBeers). A formal joint venture agreement was signed for a single claim, Tree 1, with DeBeers in July 2003. Upon signing, De Beers had earned a 51% interest in the Knife Property but will have the option to earn an additional 19% interest to hold a 70% interest in the Tree 1 by spending $10 million by 2008 and carrying Rhonda's 30% interest to production.

During 2000-01 DeBeers collected just under 1600 metres of kimberlite from nine core drill holes. Detailed logging of the core identified at least five pyroclastic kimberlite phases which make up the 6.5 hectare Knife kimberlite. Three volumetrically significant phases of kimberlite are: mantle xenolith pyroclastic kimberlite (MXPK), grey pyroclastic kimberlite (GPK), and brown pyroclastic kimberlite (BPK). All five kimberlite phases are diamondiferous but the three main units have all produced coarse diamonds greater than 1.0 mm.

A composite summary of microdiamonds recovered by caustic dissolution from the 2000-01 drilling has produced 1383 diamonds (greater than 74 microns) from 1683.62 kilograms of kimberlite. Of these 1383 diamonds, 15 stones are greater than 1.0 mm and of these 15 stones, 6 are greater than 2.0 mm.

A 7524 kilogram sample was processed for macrodiamonds by dense media separation (DMS) and returned 18 stones or 0.82 carats. The largest stone recovered from this work is a 0.220 carat stone found in the MXPK.

In late March 2004, DeBeers conducted a ground gravity survey followed by an eleven-hole core-drilling program. The ground gravity results show a kimberlite body measuring 350 metres

east-west by 350 metres north-south and covering an area of 6.5 hectares. Approximately 15.1 tonnes of kimberlite were collected during this program and microdiamond results are pending.

Rhonda's Inulik property consists of 42 claims and covers 33,000 hectares (81,557 acres) adjacent to the Tree 1 claim that hosts the Knife kimberlite. The property has been explored by Rhonda and most recently with joint venture partner, Teck Cominco Limited (Teck Cominco). A drilling program conducted in 2003 intersected several hypabyssal dyke or sheet like bodies varying between a few centimetres to 24.4 metres (drill length). No microdiamonds were recovered from these intersections.

Teck Cominco spent approximately $1.5M on the Inulik property and focused their work on 10 claims in the southeastern portion of the property. In August 2004, the Participation Agreement signed by Teck Cominco and Rhonda in July 2002 was terminated, returning the claims to Rhonda. Rhonda now retains 100% interest in the project and plans to continue to explore the property.

WORLD MINERAL GEOSCIENCE DATABASES

Chorlton, L.B., Laramée, R.M., and Sinclair, W.D.
Geological Survey of Canada, Ottawa, ON

talk

The World Mineral Geoscience Database Project (WMGDP), Geological Survey of Canada (GSC), was initiated to provide high quality data sets of global scope to describe major mineral deposits. Boosted with joint GSC-industry funding for eight years of intermittent bulk compilation by deposit specialists, the databases document over 6000 major porphyry, lode Au, Ni-Cu-PGE-Cr, sediment-hosted Cu, Sedex, MVT, uranium, and Fe-oxide-Cu-Au deposits. WMGDP databases document relatively well-known deposits using publicly available data sources, and are meant to complement deposit-occurrence-showing databases housed by state/provincial or national government agencies. They were designed to capture in succinct terms the most significant geological parameters: commodities, mineralization styles, host rocks, related igneous rocks, ages, metallic/alteration signatures, mineralogy, coincident features, and tectonic setting, and to marshal this information for a valuable global perspective on the nature, distribution, and footprints of the major deposit types.

GSC geologists have been compiling databases of Canadian mineral deposits for decades, starting with card files which evolved through mainframe to networked PC information systems, and finally to individual databases on the desktop. Once geologists were able to use databases on their own personal computers, subsets of the database were extracted for commodity specialists, resulting ultimately in disparate user-specific spreadsheets. The sediment-hosted copper file was expanded by copper specialist, R.V. Kirkham, to include deposits outside Canada. Published in the Generalized Geology of the World and Linked Databases (1995), it sparked the precursor to this project (World Map Project) that included compilations for other deposit types. The WMGDP then unified the structure and content of these individual databases and created a rigorous, efficient referencing system. Its relational database management schema

allows the parameters of diverse types of deposits to be accommodated realistically, allows complex relationships between different database entities, e.g., references and deposit descriptions, to be managed efficiently, and can be extended for other subject matter. A user-friendly data entry interface to manage keys and linkages, and enable internally consistent terminology using drop-down picklists with values that compilers were initially allowed to create and define, simplifies this system for compilers. Greater inter-database language consistency was imposed in consultation with compilers as the project progressed.

Databases have since been transferred to a central server for improved integrity, version control, and user-friendly Internet access. Key to maintaining the new database system will be the Internet query application that enables users to filter data, and download user-defined or predesigned spreadsheets, geospatial data, and web pages. A browser-based version, which includes a web map server, will provide another attractive mode for public access. Critical errors are noticed mainly by experts working with the data; therefore, a broad geological clientele will be encouraged to access the data freely and to report problems. Immediate efforts will update Canadian deposits and apply tractable Canadian standard terminology for stratigraphy, geologic provinces, and age.

LAND USE PLANNING IN THE DEH CHO TERRITORY

Cizek, P.
Deh Cho First Nations Representative, Deh Cho Land Use Planning Committee

talk

Land use planning outlines what types of activities should occur, where they should take place, and the terms and conditions necessary to guide land use decisions over time. The Deh Cho Land Use Planning Committee was formally established in February 2002 under the authority of the Deh Cho Interim Measures Agreement. The purpose of the land use plan is to promote the social, environmental, cultural and economic well being of residents and communities in the Deh Cho territory, having regard to the interests of all Canadians. The Plan shall provide for the conservation, development and utilization of the land, waters and other resources in the Deh Cho territory.

The presentation will briefly review the Committee's planning process and progress, then explain the role of the land use plan in the regulatory system.

THE LATE ACHAEAN OROGENIC GOLD SETTING IN THE EASTERN KAMINAK GREENSTONE BELT

Cormier, J. and Duke, N.
Department of Earth Sciences, University of Western Ontario, London, ON

talk

The easternmost Kaminak Lake to Pork Peninsula segment of the Ennadai-Kaminak granite greenstone terrane forms the core of a near stable Neoarchean cratonic nucleus. The only Hudsonian tectonothermal overprint in the immediate area relates to an 1850 Ma high-grade metamorphic paragneiss/migmatite complex exposed north of Kaminak Lake. A signature of its short-lived 2700-2695 Ma primitive volcanic arc assemblage is a local occurrence of synvolcanic tonalite plutons and prolific gabbroic sills throughout the volcanic succession. The main stage for emplacement of orogenic granodiorite batholiths occurred between 2690 and 2685 Ma. This syndates upright folding of the arc assemblage and culminated in regional ash-flow tuff eruption from multiple felsic centers at 2680 Ma. Intrusion of high-level strongly-zoned hornblende diorite porphyry plugs over megacrystic granite stocks between 2675-2665 Ma occurred at several of the preserved felsic centers including Quartzite Lake, Fat Lake, East Lake, Big Lake, Gill Lake and Wilson Bay. The small porphyry plugs either host or are spatially associated with the most viable of the known gold targets.

The Kaminak Nepheline Syenite-Ijolite-Carbonatite Complex represents a late 2660 Ma alkaline igneous phase that also accounts for widespread lamprophyric dyking. The age of matrix zircon in restricted occurrences of polymictic granite cobble conglomerate is coeval with this late stage of alkaline intrusive activity. Both the lamprophyre dykes and polymictic conglomerates are overprinted by late dextral shearing. These shears are in turn crosscut by undeformed 2450 Ma Kaminak diabase dykes, clearly indicating that shearing occurred in the terminal stages of the late Achaean orogenic setting. The anastomosing shear systems are instrumental in preserving structurally bound outliers of the ash-tuff blanket. The regional felsic volcanism, isolated porphyry intrusions and late alkaline magmatism with coeval polymictic conglomerate deposition, together with terminal dextral shearing, identifies an orogenic environment analogous to that of the structural breaks which are the key control for gold camps occurring in the southern Abitibi greenstone belt of the Superior Province.

The temporal link of high-level porphyry plugs to deeper-seated megacrystic granite stocks with well-developed thermal aureoles and ties to retrograde shear systems define the crustal continuum that is immediately involved in gold concentration. Ar/Ar dating of hornblende has demonstrated that amphibolite facies aureoles developed marginal to orogenic plutons were still above blocking temperatures between 2640 and 2620 Ma. It is therefore likely that this time interval approximates the active stage of dextral shearing and the associated gold concentration. Devolatilization of the orogenic infrastructure was key in the fluidization of post-peak metamorphic chlorite-carbonate-sericite-pyrite altered shear systems. The porphyry plugs provided foci for high-level fluid escape. As a result of the reactivation of the Kaminak breaks in early Proterozoic rifting and subsequent collisional tectonics, the preserved infolds of the Hurwitz, the Kaminak and Whiterock synclines, mask gold mineralized Neoarchean breaks, and this accounts for most gold prospects occurring proximal to preserved enclaves of the Hurwitz.

EXPERIENTIAL SCIENCE

Daniel, S.
Coordinator Mathematics, Science and Secondary Education, Department of Education, Culture and Employment, Yellowknife, NT

talk

The Department of Education, Culture and Employment is currently developing a new pathway for high school science education called Experiential Science. These three ecology courses, offered at the grade 10, 11 and 12 levels respectively, are designed to engage students in hands on learning while applying scientific knowledge, processes and protocols in a context based learning environment. The program of studies is designed to appeal to a wide variety of students by allowing each student to engage their own learning style. The ability to focus and express one's own learning style is inherent in experiential and context-based education and leads to greater student success. The curriculum for Experiential Science integrates western science and Aboriginal knowledge through field study experiences and applications. Each course has a unique ecological focus: grade 10 - Arctic and Subarctic Terrestrial Systems; grade 11 - Arctic and Subarctic Marine Systems; and grade 12 - Arctic and Subarctic Freshwater Systems. A balance between classroom and field investigations allow students to learn in a dynamic environment which fosters a better understanding of ecological and scientific principles through the direct study of the northern environment.

PROGRESS ON INTEGRATED SYSTEMS FOR GEOLOGICAL MAP, STRATIGRAPHIC, PALEONTOLOGICAL AND GEOCHRONOLOGICAL DATABASES AT THE GEOLOGICAL SURVEY OF CANADA

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

talk

As part of the Earth Science Sector Programme "Consolidating Canada's Geoscience Knowledge", several interlinked, theme-based data systems are being developed to improve the management and delivery of geoscience information for the Geological Survey of Canada (GSC). Collectively they form the nucleus of a national geoscience data repository. For each theme (geological maps, geological names, paleontology and geochronology) a data model is being adopted or developed, a physical database implemented, and user interfaces for data input, organizing and output written for use within the GSC. An essential design element for each user interface is the ability to draw on and connect information between each theme based on controlled terminology.

Web sites have been deployed or prototyped for Geochronology and Stratigraphic data, and paleontological and geological map metadata. Progress on all aspects of the project will be illustrated.

MEADOWBANK GOLD PROJECT, NUNAVUT
AN UPDATE ON 2004 ACTIVITIES

Davidson, G.
Cumberland Resources Ltd., Vancouver, BC

talk

The Meadowbank Gold Project (100% Cumberland Resources Ltd.), located 70 kilometres north of the Hamlet of Baker Lake, Nunavut, was one of the most active advanced gold projects in North America in 2004. The 2004 exploration program, budgeted at $6.4 million, consisted of over 18,000 metres of diamond drilling in a two-phased program focused on both increased resource definition and expansion of the existing deposits, along with exploration for new resources within the 25 kilometre gold trend.

The phase one program was dominantly ice based and directed at expansion and increased definition of the Vault and Goose Island Deposits. Drilling was required in these areas to convert inferred resources into measured and indicated categories in support of ongoing feasibility studies. The Goose Island Deposit received 3315 m of drilling in 28 holes. The drilling at Goose Island successfully expanded the deposit to both the north and south and included numerous high-grade intersections, including: 119.46 g/t over 4.89 m, 97.61 g/t over 4.28 m and 12.72 g/t over 11.25 m. Drilling at the Vault Deposit consisted of 4791 m in 30 holes. The drill program at Vault successfully expanded the potential open pit to the northeast with near surface intersections such as 5.75 g/t over 11.30 m, 6.02 g/t over 6.01 m and 3.17 g/t over 13.01 m.

An initial test of the Crown Prospect, located approximately two kilometres northeast of Vault, was also conducted during the ice-based program. The Crown area received 1293 metres of diamond drilling in nine holes. The remainder of the phase one program focused on assessing possible strike extensions of the Vault Deposit to the southwest and drill testing of the area between Goose Island and the Third Portage Deposit.

The second phase of drilling was conducted between July and September on land-based targets. The phase two program included 1150 m of drilling, in eight holes, directed at expansion of the PDF Deposit. The remainder of the drilling was focused on new exploration targets. Revised resource estimates are currently underway incorporating the results of the 2004 drill program.

The Meadowbank project is host to the third largest undeveloped gold resource in Canada. In the first quarter of 2004, the Company reported the following resource profile for the Meadowbank project:

Meadowbank Project Resources – Q1/2004**

Resource Category	***Tonnes***	Grade (g/t)	Ounces Gold
Measured and Indicated	21,685,000	4.3	2,998,000
Inferred	5,700,000	4.3	788,000

**Resource estimates were prepared in conformance with the requirements sent out in National Instrument 43-101 by AMEC independent qualified persons as defined by NI 43-101.

The Company is currently evaluating the feasibility of developing an open pit gold mine with a forecast production rate of approximately 250,000 ounces per year for approximately ten years. The permitting process for the project has been initiated and an Environmental Impact Statement (EIS) is being prepared for submittal for a "Part 5" review with the Nunavut Impact Review Board (NIRB).

NEW GEOCHRONOLOGICAL RESULTS FROM THE SLAVE PROVINCE MINERALS AND GEOSCIENCE COMPILATION AND SYNTHESIS PROJECT, GSC NORTHERN RESOURCES PROGRAM

Davis, W.J.[1], Bleeker, W.[1], Hulbert, L.[1], and Jackson, V.[2]
1. Geological Survey of Canada, Ottawa, ON
2. Northwest Territories Geoscience Office, Yellowknife, NT

talk

Geochronological work has been carried out on three subprojects that contribute to ongoing regional geologic and metallogenic synthesis in the Slave Province.

New dating in the Yellowknife greenstone belt was focused on several key units in the Kam Group to resolve stratigraphic questions. A preliminary zircon age of ~2709 Ma is reported for a massive volcanic unit of the Townsite Formation. This age is conformable with ages of ~2712 Ma and ~2704 Ma for underlying and overlying units respectively, and resolves a stratigraphic inconsistency of a previously reported, ~2685 Ma age for a similar massive porphyry unit in the Townsite Formation. Sandstone within the Townsite Formation contains zircon with syn-volcanic ages consistent with its stratigraphic position, and no evidence of zircon derived from the Mesoarchean Central Slave Basement Complex. An age of 2698 +8/-7 Ma for a quartz-feldspar porphyritic tuff at the top of the Giant section confirms that this unit is Kam Group. Detrital zircons from an epiclastic sandstone near the top of the Kam contain zircons as young as 2699 Ma, similar to the age of felsic volcanic rocks in the section. The Kam Point gabbro sill, yields two slightly discordant baddeleyite analyses of ~2697 Ma, and represents a syn-volcanic mafic intrusion. The Quyta-Bell granite, north of Yellowknife, is dated at 2713 ± 2 (zircon and titanite), and represents a large volume felsic pluton generated at the time of Kam Group volcanism, most likely the result of crustal melting due to heating by mafic intrusions. Increasing proportions of epiclastic sediments in the upper Kam Group most likely sourced from these felsic centers.

Additional work has been carried out on dating detrital zircons from conglomerate units of the Jackson Lake and Beaulieau River formations. High precision TIMS analyses confirm that both sedimentary units post-date ~2.605 Ga, but the data are not yet sufficient to confirm a ~2.58 Ga component suggested by SHRIMP studies of the Beaulieau River Formation. Further work is planned to test this.

New U-Pb ages for Paleoproterozoic mafic intrusions from the Booth River complex, NE of Contwoyto Lake yield ages of 2026 ± 1 Ma and 2025 ± 1 Ma. A U-Pb baddeleyite age of 1870.3 ± 1.2 Ma was obtained from a sample of the Mara River sheets (correlated with Morel Sills) from the sill at the base of the Kilohigok basin.

USE OF MMI GEOCHEMISTRY TO DETECT KIMBERLITES UNDER GLACIAL COVER

talk

de Souza, H.
Diamond Exploration Services Group, SGS Lakefield, Lakefield, ON

The aim in this presentation is to describe how the Mobile Metal Ion (MMI) process has been used to successfully identify blind mineralization, and specifically kimberlites, under glacial overburden as occurs over much of the shields areas in Canada.

The extreme heterogeneity characteristic of overburden in glaciated terrains has generally presented a major challenge to the successful application of purely geochemical methods for the detection of blind mineral deposits. However, new methods developed in the last decade have demonstrated that mobile ions present in surface soils can be used to detect blind mineralization, even in areas of thick overburden. In a departure from existing methodology, samples are collected in the A horizon and at a constant depth along a traverse. Weak partial extractions are key to successful extraction of the mobile metal ion population; the problem of controlling post-extraction re-adsorption phenomena is addressed by use of strong ligands in the extracting solutions. The mobile metal ion signal is generally at the part per billion level or lower requiring use of sensitive ICP-MS instruments for analysis. The successful application of the MMI process over the Cross Lake VMS deposit conducted under the auspices of the CAMIRO Deep Penetrating Geochemistry program has validated this approach. In this presentation, discussion of the MMI-D leach developed to extract mobile elements that might be anomalous over kimberlites will be discussed, along with relevant case studies.

These case studies demonstrate that mobile metal anomalies can be detected directly over kimberlites and that the MMI process is an effective tool in exploring for mineral deposits under cover.

SYNOPTIC MINERAL POTENTIAL MAPPING OF THE GWICH'IN AND SAHTU SETTLEMENT AREAS, NWT FOR REGIONAL LAND-USE PLANNING

poster

Eddy, B.
GSI – Geosystems Integration, Ottawa, ON

A synoptic (1:1,000,000) mineral potential map of the Gwitch'in and Sahtu Settlement Areas of the NWT reveals various degrees of potential for a number of deposit types, including MVT Pb-Zn, Skarn, and SEDEX among others. The analysis and mapping methodology used includes a fuzzy logic method for mapping geological favourability using digital geology, combined with a GSC-Ratings scheme for ranking mineral showings data. One of the benefits realized through using this methodology is that 'uncertainty' is indicated along with areas of inferred mineral potential. Overall ratings are presented using a regional ecosystems framework to allow more effective communication and planning among diverse stakeholders and communities.

FROM DIGITAL DATA TO DIGITAL KNOWLEDGE: MAPPING MINERAL POTENTIAL IN THE NWT WITH DIGITAL GEOLOGY AND NORMIN MINERAL SHOWINGS DATA

Eddy, B.
GSI – Geosystems Integration, Ottawa, ON

talk

The significant increase in digital geoscience data provides a foundation for new ways of delivering information for a variety of purposes and users. In this presentation, we demonstrate how digital geological maps and mineral showings data are used to generate synoptic level mineral potential maps (1:1,000,000) for large areas across the NWT. These maps are being used for regional land-use decisions, economic development planning, and implementing the protected areas strategy, but may also in some ways highlight potential exploration target areas.

Presenting results in presentation styles that are easily understood by diverse stakeholders, without compromise to the complexity of the geological information presents a number of challenges. Addressing these challenges signifies a shift in what we believe to be an emergence of 'digital knowledge' from 'digital data'. The mutual relationship between data and knowledge is explored for consideration in ongoing digital geoscience information system development and downstream use.

CONNECTING UNIVERSITIES TO NORTHERN RESEARCH AND EDUCATIONAL NEEDS

England, J.
Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB

talk

The Northern Chair program at the University of Alberta began July 1, 2002. To date, the Chair program has made substantial progress in pursuing the four goals originally identified by NSERC: research, training of HQP's, communication, and northern partnerships. My northern partners (five in total) include: Nunavut Research Institute (NRI, Iqaluit); Canada-Nunavut Geoscience Office (C-NGO, Iqaluit); Aurora Research Institute (ARI, Inuvik); Canadian CircumpolarInstitute (CCI, U of A); and Campbell Scientific Canada (Edmonton).

At a Northern Chair workshop held in Edmonton (January 2003), all the northern partners and scientific collaborators gathered to discuss the four major goals. In response to concerns raised by the northern partners, we proposed the establishment of Northern Student Internships that was subsequently implemented by NSERC (with 10 positions made available during the spring of 2004). The intent of the student internships was to provide direct involvement of graduate students in northern communities *in lieu* of the standard Teaching Assistantships (TA's) normally held at their home universities. The benefit of this was intended both for the expanded experience of the graduate student concerning a wide range of northern issues (from research to culture), and for the northern partners whose teaching capacity would be diversified, thereby augmenting programs for northern students. The synergy between the graduate student and

northern students would also encourage involvement of northerners in their research projects, facilitating mentorship. In response to this program, one of my PhD students (Chantel Nixon) applied for and was awarded an internship that was taken up in Iqaluit in late August 2004, extending through to the end of the year. The northern partners include Dr. Ted Little at C-NGO and Jason Carpenter, Environmental Technology Program (ETP), Nunavut Arctic College. NSERC contributes $10k per student. An additional $2k was contributed by the V-P Research (U of A) while my Department (Graduate Chair) supported the graduate student's request to be off-campus for the fall term 2004.

With respect to northern partnerships, enormous political, cultural, societal and economic processes are at play in the three northern territories. Northern educators are also painfully aware of the impact of economic development that often provides lucrative alternatives to education that overwhelm the best of intentions/aspirations to keep people in existing programs. Opportunities and the need for northern outreach remain enormous. However, more resources need to be invested in basic linkages and infrastructure if meaningful bridges are to be built between northern agencies, colleges and southern universities. We are at a very early stage and current resources applied to these goals remain modest. NSERC and SSHRC should be encouraged to establish an annual allotment of 50 student internships. Other forms of outreach must also be established to provide northern students with opportunities to participate in field research and gain field training. For example, two students from Sachs Harbour currently enrolled in the Natural Resources Technology Program, Aurora College, Inuvik, have agreed to join my research party on N. Banks Island in 2005 and will substantially contribute to fulfilling aspirations for the recruitment of northern students into the field program. These may be small steps but they are crucial to secure.

DEVELOPMENT OF A DIGITAL ELEVATION MODEL FROM AERIAL PHOTOGRAPHY

Epp, H.
NWT Centre for Geomatics, Resources, Wildlife & Economic Development, Government of the Northwest Territories, Yellowknife, NT

talk

Existing Mackenzie Delta area mapping is inadequate to meet oil and gas development and resource management needs of government agencies, industry, and land claim organizations. Important uses of aerial photography, mapping, and Digital Elevation Model (DEM) information include: documentation of surface features for wide-ranging photo-interpretation, environmental impact assessments, engineering design, management of land, water, habitat, wildlife, and other resources, and monitoring of change.

To improve the quality and accuracy within the Mackenzie Delta and Valley colour aerial photography was obtained during the summer of 2004 at a scale of 1:30000. Digital Elevation Data (DEM) will be created from the photography through the standard photogrammetric method or the more recent softcopy method. Photogrammetry began with analog plotters, moved to

analytical workstations, and the hard copy stereo photo pairs are now being replaced with digital softcopy representations of a stereo pair.

A detailed description of how digital elevation contours and raster data are derived from the photography using the photogrammetric and softcopy methods will be outlined.

A Digital Elevation Model (DEM) will provide essential topographic information for engineering design construction and operation of all future development projects, assessment and monitoring of environmental impacts, and management of area environmental, wildlife, and cultural resources. This information is crucial for development in the low relief area of the delta.

WHEN MERGERS MAKE SENSE: THE NEW PEREGRINE DIAMONDS LTD.

Ettlinger, A.[1], Pell, J.[1], and Carter, A.[2]
1. Dunsmuir Ventures Ltd., Vancouver, BC
2. Peregrine Diamonds Ltd., Vancouver, BC

talk

In July 2004 Peregrine Diamonds Ltd. and Dunsmuir Ventures Ltd. announced plans to merge. Upon completion of this merger early in 2005, the new Peregrine Diamonds Ltd. will be based on three key pillars of strength in mineral exploration: 1) a strong property portfolio, 2) a skilled experienced management team 3) a proven ability to finance during both the highs and lows of our sector. Supporting this team approach is an alliance with BHP Billiton Diamonds Inc., the world's largest mining company.

In its search for Canada's next diamond mine, the new Peregrine Diamonds will have two large land positions within the Slave Craton and in the Western Churchill diamond district of Nunavut. In addition to using all the common exploration tools, Peregrine also has a competitive advantage through the exclusive use of 40,000 line-kms per year of BHP Billiton's revolutionary and highly sophisticated Falcon™ airborne gravity gradiometer systems.

In the Lac de Gras area, Peregrine owns a 38.475% interest in the WO Project which contains the diamondiferous DO-27 kimberlite, and has an option to earn an additional 16% by completing a 200 tonne bulk sample. DO-27 is one of the larger kimberlites in the Slave, with a surface area estimated at between 10 and 16 hectares. It is a multiphase system, with at least two pyroclastic events and a hypabyssal phase. In 1994, a bulk sample was collected from a restricted area at the edge of the DO-27 pipe, which may not have been representative of the whole body. Plans are in progress to test the higher-grade central portion of the pipe by means of a large diameter reverse circulation drilling program on ice in early 2005. Community consultations are underway and a permit for this bulk sample has been submitted to the Mackenzie Valley Land and Water Board.

Elsewhere in the Lac de Gras area, high resolution Fugro DIGHEM surveys have been completed over most of the company's Lac de Gras West and Lac de Gras East projects with follow up prospecting of high priority anomalies initiated this summer. These two projects, along with the WO Project contain ten known kimberlites and cover more than 117,000 hectares

immediately to the south of Ekati and Diavik. Falcon™ surveys were also flown on the company's Thistlewaite (TW) Property in the Western Slave and on the Indian Mountain (IM) Property in the South-Central Slave. Regional and anomaly specific till sampling and prospecting was completed on both properties this summer. These new data, combined with previous geophysics, will be used to plan future programs.

In the Western Churchill Province, the company has four properties covering 1.94 million hectares. Over 1700 till samples were collected from these areas in 2004. The more advanced property, Nanuq, contains two well-developed kimberlite indicator mineral trains displaying diamond stability field chemistry. Limited drilling in early 2004 at the head of one train did not intersect kimberlite. An additional 500 till samples were collected this summer and with this tighter geochemical coverage and a recently completed Falcon™ survey covering the two trains, the company expects to have a better understanding of the kimberlite source areas prior to drilling in 2005.

New companies are borne on the Venture Exchange on a continual basis. At Peregrine, we realize that only through good property acquisitions, competent corporate governance, a thorough geologic understanding of our targets and strong shareholder support can we maximise our chances of success. Our exploration drilling and bulk sampling programs in 2005 will give us the opportunity to accomplish this.

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

Falck, H.[1], Kirkham, G.[2], and Pierce, K.[1]
1. Northwest Territories Geoscience Office, Yellowknife, NT
2. Kirkham Geosystems, Vancouver, BC

poster

The Cantung Mine represents one of the most important concentrations of tungsten on earth. The mine was the western world's largest tungsten producer during its operation from 1962 to 1985. In the two years prior to its recent closure it was the source of nearly 10% of the global tungsten production. An improved understanding of the deposit combined with new methods of examining the geometry of the mineral resource is an important tool for identifying exploration targets.

The Cantung deposit contained 4.2 million metric tons of high grade ore (>1.6% WO_3) that developed in a package of folded and overturned limestones above a Cretaceous (ca. 96.6 ± 1.2 Ma) granite intrusion. The geometry of the overturned fold, intersecting faults and intrusions have challenged previous exploration efforts but the re-opening of the mine (2001-2003) offered an excellent opportunity to examine this world-class skarn deposit using current modeling techniques.

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 not apparent in the standard two-dimensional level plans, cross-sections and long-sections. The objective of the project is to create a complete, integrated model of the mine, combining geology, assays, topography, surface features and underground workings. 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. 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 in unexplored or under-explored areas.

MERA AND THE PROPOSED NAHANNI NATIONAL PARK RESERVE EXPANSION

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2. Geological Survey of Canada, Ottawa, ON

poster

The Mineral and Energy Resource Assessment (MERA) was established in 1980 to ensure an inventory of non-renewable resource potential before creation of new national parks north of 60˚. These assessments are conducted for areas where the Federal Government administers the resources and they follow the published MERA Terms of Reference viewable at http://nrcan.gc.ca/mms/poli/mera_e.htm or http://nrcan.gc.ca/mms/poli/mera_f.htm A MERA is conducted by neutral federal government agencies and the results are publicly reviewed before finalization. The report contributes unbiased, science-based information on non-renewable resource potential in areas proposed for national parks, allowing governments make informed and balanced land use decisions.

The region being assessed is defined by the Greater Nahanni Ecosystem with a surface area of >35,000 km^2. The South Nahanni River crosses the eastern Selwyn Mountains and southern Mackenzie Mountains which expose mainly sedimentary rocks, including: Neoproterozoic (about 800 Ma) to Late Cretaceous (about 100 Ma) platformal to shale basin sedimentary strata. The sedimentary rocks were intruded by minor Devonian (350 Ma) granitoid rocks and deformed into folds and thrust faults during the Jurassic (~170 Ma) to Cretaceous collision of an island arc with western North America. Crustal melting during this collision produced major Cretaceous granitoid batholiths in the Selwyn and westernmost Mackenzie Mountains. Subsequent compressive and right-lateral strike slip adjustments continued throughout the Tertiary (~40 Ma) to the present. This complex history included the formation of diverse resource types including zinc-lead-silver (Sedex type), lead-zinc-silver (Skarn type), lead-zinc (Mississippi Valley type-MVT), gold (Placer and Lode type), emeralds and other gemstones, lithium and rare elements (in pegmatites), oil, gas and coal.

The initial phase of the project involves the compilation and integration of geoscience data from government assessment files and published scientific reports including bedrock geologic maps, geophysics, geochemistry, remote-sensed data, petroleum plays and mineral deposit data. Where possible, industry input as “expert knowledge” and datasets will be incorporated. This compilation is necessary to determine the geologic characteristics of existing resource types and identify information gaps.

The project also has four field components:

The Geology and Mineral Deposit Study will involve visiting major mineral showings to verify reported information and to determine the geologic controls affecting the formation of this deposit type.

A Regional Stream Sediment Geochemistry Survey will collect samples at a density of 1/13 km^2 following the NGR methodology in areas without previous surveys and re-analyze existing collections to a uniform standard. A minus 80 mesh fraction is prepared from the sediments and analysed for more than 60 elements using a combination of ICP, INA and specific techniques.

The Spring Water Geochemistry Sampling involves a series of onsite measurements (pH, conductivity, eH, O_2, H_2S) as well as collection of samples for lab analyses (major ions, trace metals, stable isotopes for ^{2}H and ^{18}O in water, ^{34}S and ^{18}O in dissolved SO^{4}, ^{34}S in H_2S, ^{13}C in bicarbonate, ^{11}B, and Sr). In addition, diluted samples are collected for measurement of dissolved Si to aid in aqueous geothermometry.

A set of three Regional Geophysics Surveys will be conducted, as no public data sets are available. The recorded parameters include total field magnetics, and gamma ray spectral determinations of total radioactivity, potassium, uranium and thorium allowing regional and local definition of bedrock and surficial geology, spectral geochemistry and structures.

THE SELWYN PROJECT – A STATUS REPORT

Fischer, B.
Northwest Territories Geoscience Office, Yellowknife, NT

poster

The Northwest Territories Geoscience Office (NTGO) has begun planning a multi-disciplinary investigation of the Selwyn Basin area of the Cordillera. The purpose of the project will be to better understand the region's depositional and tectonic histories, and to assess its mineral potential more fully.

Under preliminary consideration are the NWT parts of the area between 62-65 degrees N and 126-132 degrees W. This area is underlain by deep water sedimentary rocks of the Selwyn Basin of late Proterozoic to mid-Devonian age; contemporaneous and locally interstratified shallow water carbonates of the Mackenzie Platform to the NE; and younger, primarily clastic assemblages up to Cretaceous age. Early Cretaceous folding about NW axes was followed in the mid-Cretaceous by granitic plutonism which generated the Selwyn Plutonic Suite. The region is prospective for a variety of deposit types, including stratiform Pb-Zn (Ba-Ag); stratabound Zn-Pb(-Cu-Ag); stratiform Cu; polymetallic veins; tungsten, gold, copper, and gem beryl in skarns; and Li and REE in pegmatites.

In spite of this promising mineral potential, the geology of the region is poorly known. Existing bedrock geology maps are reconnaissance scale, and regional geochemical, aeromagnetic and

radiometric data are completely lacking over most of the area. As a starting point for project planning, existing maps and data are being compiled, and collection of new geochemical and geophysical data are underway or planned. Together, these datasets will help to define specific questions that the Selwyn Project will undertake to address.

In 2004, NTGO conducted a regional stream water and sediment geochemical survey in close collaboration with the Geological Survey of Canada (GSC). Sediment and water samples were collected from 942 sites in NTS maps sheets 105P and 105O/NE, mostly from primary streams. These data will aid in assessing metals distribution and targeting areas of potential economic interest for future mapping.

A scheduled 4500 line-km gamma-ray and magnetometer survey in the Sekwi Range (part of NTS 105P) was cancelled due to logistical and weather problems. The planned survey block extends NE from the Mactung deposit, across Cretaceous plutons and tightly folded strata of the Selwyn Basin and Mackenzie Platform. If funding becomes available next fiscal year, the survey will be carried out in early summer 2005, and will be administered by the GSC.

Compilation of existing data includes vectorization in GIS format of bedrock geology maps for seven 1:250,000 scale NTS map sheets (105I, 105P, 106A, 106B, 96D, 95M, and 95L). These data, in conjunction with new regional geochemical data, radiometric and magnetic data to be acquired next year, and other data including Landsat TM, air photos, and mineral showings, will be analysed and interpreted to define the geographic extents and thematic focus of new field-based studies.

NON-RENEWABLE RESOURCE ASSESSMENTS-UPDATE

Gal, L.P. and Lariviere, J.M.
Northwest Territories Geoscience Office, Yellowknife, NT

poster

The Northwest Territories Geoscience Office is active in non-renewable resource assessments (NRA) as part of the NWT Protected Areas Strategy (PAS; Sahoyúé - §ehdacho and Edehzhie candidate protected areas), and land use planning efforts (Gwich'in Settlement Area).

NRA Phase II fieldwork at Sahoyúé - §ehdacho candidate protected areas was completed in 2003, and results will soon be released as an NWT Open File. Fieldwork focused on geochemical sampling including stream sediments, heavy mineral concentrate samples (HMC), stream waters, and bedrock samples.

The NRA Phase I report for Edehzhie candidate protected area was released in early 2004 (NWT Open File 2004-01). Phase II fieldwork was started in 2003 in the western quarter of Edehzhie. Sampling consisted of 261 stream sediment samples, 104 HMC samples, 258 routine water samples, and 53 anion water samples. Results of this geochemical survey are expected to be released in late 2004 as a joint GSC-NWT Open File.

The NRA Phase I report for three Gwich'in conservation zones (identified in the Gwich'in Land Use Plan) is nearly complete, and an Open File release is expected late this year. Phase II fieldwork in the Richardson Mountains was carried out in the summer of 2003. Sampling consisted of 280 stream sediments and routine water samples, 127 HMC, and 59 anion water samples. A joint GSC-NWT Open File release is expected late in 2004.

Phase II fieldwork in the Travaillant Lake area was completed in the summer of 2004. Sampling consisted of 76 stream sediments and water samples, and 37 HMC samples. Results of this survey are pending.

In support of the NWT PAS Five Year Plan to identify areas of ecological importance in the Mackenzie Valley region, mineral and petroleum potential mapping projects were initiated in 2004. See posters by Lariviere and Eddy, and Gal.

MAPPING OIL AND GAS POTENTIAL IN SAHTU AND GWICH'IN SETTLEMENT AREAS

poster

Gal, L.P.
Northwest Territories Geoscience Office, Yellowknife, NT

The Northwest Territories Geoscience Office is carrying out non-renewable resource potential mapping in support of the NWT Protected Areas Strategy Five Year Action Plan. This mapping is being done in the Mackenzie Valley region, in concert with ecological mapping, in order to better identify potential protected areas representative of eco-regions.

This oil and gas potential mapping study is coarse-scale, comparative, qualitative, and knowledge-based. The basis of the methodology is the identification of conceptual and established exploration plays, primarily from existing literature. The plays are represented and mapped by the known subsurface extent of possible reservoir rock. In effect, the reservoir is a proxy for the complete petroleum system(s). The methodology used is similar to that of Gal and Jones (2003) in the Deh Cho region.

Play maps are developed as polygons and overlain in a GIS environment. The overlap of play polygons, and whether those plays are established or conceptual, is the basis for the methodology. In simple terms, an area with three conceptual plays is more favourable than an area with only one conceptual play, all other factors being equal.

Two plays are established in the Sahtu Settlement area and six are conceptual. In the Gwich'in Settlement area, two of 11 plays are established.

The basal Cambrian clastic play includes natural gas resources in the Colville Hills (e.g., Tedji Lake, Bele and Tweed). A play fairway (modified from Canadian Gas Potential Committee, 2001) is used to represent the established play, while the balance (the full extent of subsurface Mount Clark Formation) is considered conceptual, given the increased geological risks.

Middle Devonian Kee Scarp limestone (Ramparts play) hosts the oil pool at Norman Wells. A fairway (after Williams, 1985) includes known and possible Kee Scarp reef development, favourable sealing conditions and thick source rock packages, and essentially unexplored areas. The balance of Ramparts Formation subcrop is a conceptual play as the unit includes dominantly non-reefal facies, may be very shallow, and lack an overlying seal.

In the southern Mackenzie Delta, Dixon et al. (1994) identified two plays in the Paleozoic and Mesozoic, north of the Eskimo Lakes Fault Zone; these extend into the Gwich'in Settlement area. These are grouped together for simplicity because the play area is essentially the same, and the entire area is deemed to have very high potential. Discovered pools associated with the South Delta Mesozoic/Paleozoic play occur outside the Gwich'in, and include the Parsons Lake field, one of the anchor fields of the planned pipeline (Mackenzie Gas Project).

The areas with the highest potential for hydrocarbons in the Gwich'in and Sahtu are in the Mackenzie Plain, the Keele Arch area of Colville Hills, and the southern end of Mackenzie Delta. This is due to the number of possible plays in these areas and, in the case of the Keele Arch, a favourable established play fairway.

DEVELOPMENT OF THE NICO GOLD-COBALT-BISMUTH DEPOSIT

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

talk

NICO is a poly-metallic deposit with gold, cobalt and bismuth co-products, located 160 km 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, 20 km east of the property.

NICO is a hydrothermal replacement deposit of the "Iron Oxide-Hosted class", more commonly referred to as "Olympic Dam-type". Metals are contained in three, 40-50 degree dipping stratabound lenses of ironstone, with individual lenses up to 70 metres in thickness. They are hosted in brecciated, potassium- and iron-altered sedimentary rocks of the Proterozoic Treasure Island Group beneath an angular unconformity with felsic volcanic rocks of the Faber Group. NICO contains a total global drill indicated mineral resource of 98 million tonnes. The mineable portion varies in accordance with different metal price assumptions and mining methods. At US$375/ounce gold, $US15/pound cobalt, and US$3.25/pound bismuth the mineable resource is 28.3 million tonnes using a combined underground and open pit mining development scenario.

MICON International Limited is preparing a bankable feasibility study assessing the economics of the NICO deposit at a planned 3,000 tonnes of ore/day (1 million tonnes/year) production rate. Half of the mill feed would be sourced from underground stopes using "blasthole with delayed cemented rock fill" mining methods from a decline ramp using trackless equipment. An open pit with truck and shovel equipment would supply the remaining mill feed and waste to backfill the underground workings. Ore would be processed in a flotation concentrator built at the site to

produce gold-cobalt and gold-bismuth concentrates. The gold-bismuth concentrate would be sold to smelters in Canada, Asia and Europe. Gold-cobalt concentrates conversely, would be processed in an autoclave at the site with cobalt cathode precipitated by electrowinning after purification with ozone. Cyanidation of the autoclave residue recovers gold as dore. A camp would be built to accommodate employees working at the site on a rotational basis.

A preliminary estimate of capital required to construct the mine is approximately $120 million. Attractive rates of return (IRR) in excess of 40% were determined in an earlier scoping study. The current bankable feasibility study is expected to be complete in the first quarter of 2005 and, subject to financing and receipt of applicable permits, the deposit could be in production in 2007. A bulk sample is planned in 2005.

A GIS MINERAL OCCURRENCE DATABASE IN SUPPORT OF A METALLOGENIC STUDY OF THE SLAVE PROVINCE

Hall, B.V., Peter, J.M., and Bonham-Carter, G.F.
Mineral Resources Division, Geological Survey of Canada, Ottawa, ON

talk

It is estimated that around one billion dollars worth of mining company exploration data resides in the assessment report archives in the Indian and Northern Affairs Canada (INAC) offices at Iqaluit and Yellowknife. As part of the Slave Province Minerals Geoscience Compilation and Synthesis project during the past year, personnel from the Geological Survey of Canada (GSC), in partnership with INAC, have been collecting and tabulating mineral deposit data from these assessment report archives. Two hundred fifty six attributed columns for each mineral occurrence and encompassing each of the following is tabulated in a spreadsheet format: 1) geographic location, 2) major commodities, 3) ore mineralogy, 4) trace element compositions of mineralization, 5) gangue mineralogy, 6) alteration assemblages, 7) external morphology, 8) internal structure, 9) mineral textures, 10) structural style, 11) structural orientation, 12) post mineralization deforming structures, 13) stratigraphic position, 14) spatial relationship to intrusive bodies, 15) relative and absolute age determinations, 16) geophysical response, 17) surficial geochemical response, 18) best assay values, 19) best drill hole intersections, 20) tonnage and grade, 21) exploration history, and 22) references. These attributes are then portrayed and analyzed using the GIS software package ArcGIS® to determine any spatial relationships between the mineral occurrences and structures, stratigraphic position and/or intrusive bodies using the latest geological and topographic maps and Landsat imagery.

The Beechey Lake (76G) 1: 250,000 scale map sheet is now completed and will be the first to be released as an open file report. From this map sheet, information from 289 mineral occurrences and/or anomalous geophysical or geochemical responses has been tabulated. Two hundred forty one of the mineral occurrences list gold as the first commodity, 12 list copper, and three each list uranium and zinc. In terms of mineral deposit types, iron formation-hosted gold deposits represent 175 occurrences, of which the George Lake and Goose Lake Districts are the most economically significant in terms of grade and tonnage. Second in abundance are turbidite-hosted gold

occurrences (n=27), which are also present in the George Lake and Goose Lake Gold Districts, followed closely by the lode gold quartz vein occurrences (n=25), which are most prevalent in Fidler and Regan lakes area in the southeastern portion of the map sheet. Most of the gold occurrences are in the turbiditic sequences of the Beechey Lake Group, and in particular the iron formations. A preliminary interpretation of the data suggests that the iron formation hosted-gold and turbidite hosted-gold occurrences can be divided into subgroups: 1) those having an apparent spatial relationship to the intrusive bodies of the Regan Lake Plutonic suite, and 2) those occupying a northwesterly trending, curvilinear trend that appears to be associated with the Komatik Break. The bimodal volcanic-associated massive sulphide (VMS) occurrences (n=16) are generally restricted to the felsic to intermediate pyroclastic sequences of the Hackett River, and to a lesser degree the Back River Groups. Notable examples of this class of occurrence include the Musk and Yava deposits, both of which are hosted by the Ignerit Formation of the Hackett River Group.

MINERAL POTENTIAL MAPPING – AN OVERVIEW WITH EXAMPLES

talk

Harris, J.R.
Geological Survey of Canada, Ottawa, ON

Mineral potential mapping is a process which uses multi-criteria from an exploration model (i.e. gold, VMS) to produce a map that shows areas favourable for exploration in a given geographic area. Inherently, this emulates the exploration process by starting with an exploration model (i.e.mesothermal gold, VMS etc), extracting key components (predictors) from the model and integrating these components into a map which shows areas with potentially higher exploration potential. However, there are many different ways of producing such a map ranging from a light-table approach where transparent maps are overlaid in order to ascertain spatial relationships between the various predictors to use of sophisticated software packages that facilitate the data integration process.

Geographic Information systems (GIS) in concert with spatial modeling software packages provide useful tools for producing a mineral potential map. This talk highlights the methodology behind the creation of a mineral potential map and reviews different methods, both data- and knowledge-driven, for producing such a map. In addition different methods for evaluating the reliability of a potential map are presented. A number of free and commercial spatial modeling packages are introduced and discussed. Examples to illustrate various concepts are drawn from gold studies in the Red Lake and Swayze greenstone belts in Ontario as well as from a kimberlite modeling project conducted in the Slave province of the NWT.

REMOTE PREDICTIVE MAPPING (RPM) – AN OVERVIEW WITH EXAMPLES

talk

Harris, J.R. and Desnoyers, D.
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 (μm 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 techniques 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 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 RPM 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.

KIMBERLITE EXPLORATION USING A CAPACITIVELY-COUPLED RESISTIVITY SYSTEM

poster

Hildes, D.
Aurora Geosciences Ltd., Whitehorse, YT

The electrical conductivity of kimberlite is typically higher than the usual granitic country rock of the Slave Craton. This contrast is the basis for several geophysical techniques used in kimberlite exploration, the most usual being multicoil helicopter-borne EM and ground horizontal loop EM surveys, both frequency-domain EM systems. Both airborne and ground time-domain EM surveys have also been used. Capacitively-coupled resistivity surveys are most effective in predominantly resistive terrains and therefore appear ideally suited for diamond exploration in the NWT but are nevertheless less common than EM surveys.

The Geometrics Ohm Mapper is a capacitively-coupled resistivity system and, as in a standard galvanic resistivity survey, multiple dipole separations give apparent conductivity at various depths, usually displayed as a pseudosection and computer-based inversions output a true resistivity cross section consistent with the data. This helps resolve a critical question in all conductivity surveys of whether the anomaly persists at depth. This paper presents Ohm Mapper data collected over both known kimberlites and false-positive targets. The results show the Ohm Mapper to be a useful geophysical tool for kimberlite exploration and the resistivity cross sections assist in the discrimination between barren and kimberlitic targets.

TYPICAL DAM DESIGNS IN PERMAFROST

Holubec, I.
I. Holubec Consulting Inc., Oakville, ON

talk

Design and construction of dams in permafrost is considerably more complex than in non-permafrost regions, as is demonstrated by the much larger number of problems and failures of dams in permafrost regions. This is due to the presence of ice in the foundations, temperature dependency of the design and the importance of the construction schedule.

Design and construction of dams in Russia and Canada from the 1940's to the present date have produced a number of designs appropriate for permafrost. The selection of an appropriate design for a dam is dependent on the mean annual air temperature of the site, height of the dam and the available construction schedule. A review of dam case histories in Russia and Canada leads to group the favourite designs into five typical designs summarized in this presentation. These are:

a) Small dams with liners and frozen core and foundations used for water reservoirs. Constructed in the summer/fall and allowed to freeze during the following winter. (e.g. Lupin, Pond Inlet).

b) Frozen curtain dams that are constructed during the summer and cause its core to freeze naturally by air pipes or active freezing. (Russia and Diavik water retention dam).

c) Frozen core dams where the frozen central core is developed by placing and freezing layers of saturated material during the cold months of winter. (Raglan, Kubaka and Ekati).

d) Lined rockfill dams on frozen foundations where the frozen foundations are created/maintained by either construction scheduling or thermosyphons. (Diavik and Ekati).

e) Large hydro dams that are designed as traditional dams in non-permafrost regions with seepage control measures. (Vilyuy, Snare Rapids and Wareham).

Brief presentation of the design concepts and the performance of these five typical dam designs will be presented.

SOIL COVERS OVER REACTIVE TAILINGS IN PERMAFROST; PRESENT KNOWLEDGE

Holubec, I.
I. Holubec Consulting Inc., Oakville, ON

talk

Many operating mines in the Canadian permafrost region have adopted, or are considering, encapsulating reactive tailings in permafrost. Since a layer of the ground near the surface in permafrost thaws every summer, it is necessary to place a layer of material (cover) over the tailings that will contain within it the seasonally annual thawed zone, active layer, and thereby prevent thawing of the tailings near the surface.

The presentation summarizes four recent case histories from cover test pads constructed over reactive tailings in continuous permafrost that provide information on parameters that govern the design of a cover to maintain the tailings frozen. Case histories from Nanisivik, Raglan, Lupin and Rankin Inlet represent different tailings operations; cover design approaches and physical and climate conditions.

Presently encapsulating in permafrost is viable in continuous permafrost that is prevalent above the tree line. However, global warming is occurring with considerable temperature increases in the Canadian Western Arctic. The presentation addresses key permafrost temperature information related to permafrost encapsulation design and provides temperature-warming trends at selected mine locations. The question is how should global warming be addressed in the design of soil covers in permafrost.

Mines considering proposing to encapsulate tailings in permafrost will need to consider what impact global warming will have on their design.

LITHOGEOCHEMISTRY AND ALTERATION OF HOST ROCKS AT THE HIGH LAKE VMS DEPOSITS, NUVAVUT

Houle, M.Y.[1] and Olivo, G.R.[2]
1. TeckCominco Ltd., Vancouver, BC
2. Department of Geological Sciences and Engineering, Queen's University, Kingston, ON

talk

The High Lake massive sulfide deposits are hosted by volcanic rocks of the High Lake greenstone belt, in the Slave Province, approximately 550 kilometres Northeast of Yellowknife in Nunavut, Canada.

Detailed lithogeochemical and petrographic studies were carried out on two volcanogenic massive sulfide deposits in the High Lake greenstone belt; the High Lake A-B Zone, and at the recently discovered West Zone.

Host rocks of the sulfides consist of FII calc-alkaline dacite to rhyolite with $La_{(n)}/Yb_{(n)}$= 4-10, and REE contents approximately 10 to 100 times that of C1-Chondrite. The supracrustal rocks have been subjected to greenschist metamorphic grade conditions with higher grade metamorphic aureoles documented peripheral to late felsic plutons. The structural geology is complex at High Lake with at least three fabrics and phases of deformation recognized. These structural complexities have largely obliterated the paleo-topographic and synvolcanic setting in the environs of the massive sulfide bodies.

Immobile-incompatible elements (Al-Zr) were used to monitor igneous fractionation trends in least altered samples and to identify precursor compositions in the altered samples. Although TiO2, Al2O3 Zr, Y and REE are considered largely immobile in VMS systems, considerable mobility in Y is documented in stringer-zones at the AB zones and immediately below massive sulfide lenses at the West Zone. Material additions/depletions were calculated for altered rocks and are largely attributed to sea-floor related massive sulfide forming processes. In general, footwall alteration comprises up to 50% addition of MgO, Fe_2O_3 (and sulfides), and depletions of alkalies (CaO, Na_2O, SiO_2, and K_2O). These gains and losses of major elements are related to the breakdown of feldspars in hydrothermal up-flow zones. By contrast, hanging-wall alteration comprises moderate to strong SiO_2, and locally K_2O addition directly above and within massive sulfide bodies. This general pattern holds at both the High Lake AB and West Zone deposits.

The geochemical data suggest the High Lake AB zones are hosted in a silicic volcanic centre characterized by SiO_2~ 70-75%. By contrast, the West Zone deposits appear to be hosted in a much larger, but less silicic volcanic centre with SiO_2 values between 68 and 70% and with a higher proportion of andesitic host rocks than at the AB zone. The host rock geochemistry and precious metal content of the VMS deposits at High Lake are very similar to those at Sturgeon Lake, Myra Falls and in some of the Noranda deposits. The tectonic environment envisioned for the High Lake area is an intra-oceanic back arc basin.

Drilling by Wolfden Resources Ltd. continues to add significantly to the West Zone deposit. The exploration potential is considered excellent both along strike and at depth.

PERMAFROST AND GEOHAZARD CONSIDERATIONS – MACKENZIE VALLEY PIPELINE

Isherwood, A.
BGC Engineering, Calgary, AB

talk

The geotechnical conditions along the proposed pipeline route will influence the design and subsequent operational performance of the pipeline. Glacial history, climate, drainage and tectonics all influence the distribution of the permafrost and the various soil types. The geological conditions along the route are described, along with the associated geohazards.

CONSTRAINTS ON HYDROCARBON SOURCE ROCK MATURATION IN THE KEELE TECTONIC ZONE SOUTH OF TULITA, NWT, FROM MULTI-KINETIC APATITE FISSION TRACK THERMOCHRONOLOGY, VITRINITE REFLECTANCE AND THERMAL MODELLING

talk

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Apatite mineral separates from sandstone of the Devonian Imperial Formation in the Northrock et al. East MacKay I-77 well were analysed for fission track (FT) age and length parameters. Two FT age populations with different thermal annealing properties were recovered. Also, thermal maturity (%Ro, Rock-Eval® pyrolysis) was measured on Cretaceous and Paleozoic drill cuttings samples from this well and used to constrain eroded sediment thicknesses and paleogeothermal gradients. The study well is near the MacKay Range, approximately 80 km southeast of Norman Wells, within the Keele Tectonic Zone, a region characterized by multiple phases of anomalous subsidence and uplift during the Phanerozoic. In the study area, an Upper Cretaceous to Tertiary foreland basin succession rests unconformably on Devonian strata. This major unconformity displays a discontinuous increase in thermal maturity (0.55 to 0.75 %Ro); it developed during pre- and post- Albian time and represents approximately 270 My of missing geological record. FT age and ^{252}Cf-irradiated length grains were analysed using an electron microprobe and were examined microscopically to estimate average track etch-pit size in order to constrain FT annealing kinetic parameters. 0.125 atoms per formula unit (apfu) Cl (0.45 wt% Cl) separates two FT age populations: 90 ± 6.1 Ma (silt to fine sand size grains) and 222 ± 22.5 Ma (silt size grains). Cl ranges from 0-0.63 apfu (0-2.25 wt%) for 171 lengths and 0-0.59 apfu (0-1.72 wt%) for 34 age grains. Geologically-constrained inverse modelling, incorporating a multi-kinetic annealing scheme, and temperature, %Ro and stratigraphic constraints, yields Monte Carlo solutions that delimit time-temperature ranges for pre-Albian, Albian and post-Albian heating events.

Model results for East MacKay I-77 imply that maximum temperatures for hydrocarbon generation from Paleozoic source rocks occurred during the early to middle Mesozoic prior to the development of Laramide structures. The majority of FT thermal histories have maximum temperatures of 124 ± 10°C between Middle Triassic to Early Jurassic, <75°C during the Albian, and 97 ± 9°C during Paleocene to Early Eocene. The Cretaceous-Cenozoic thermal history was modelled using a simple burial history with a constant geothermal gradient similar to the present value (32°C/km); variable early Mesozoic geothermal gradients (31-42°C/km) and burial thicknesses fit the measured %Ro data. Shale compaction is continuous across the Devonian-Cretaceous unconformity, implying that maximum burial occurred during the Cenozoic and that the early Mesozoic geothermal gradient was higher than present. Although East MacKay I-77 has an unfavourable thermal history for hydrocarbon accumulation within Laramide structures, organic-rich Paleozoic shales retain significant hydrocarbon potential. Deeper Laramide burial elsewhere in the region could have thermally reactivated Paleozoic source rocks or matured Cretaceous source rocks but further work is needed to determine this.

SOUTH WOPMAY BEDROCK MAPPING PROJECT AND INTEGRATED STUDIES: PRELIMINARY RESULTS FROM THE 2004 FIELD SEASON

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The South Wopmay bedrock-mapping project is a study of the Paleoproterozoic rocks of Wopmay Orogen that onlap the Archean Slave craton in the region between Indin Lake and the community of Gameti, Northwest Territories.

Preliminary results from 2004 1:100 000 scale mapping, presented below, will be integrated with detailed geochemical and geochronological studies of the diverse magmatic phases in order to better constrain the evolution of the southern Wopmay Orogen. Additionally, in 2004, the bedrock-mapping project coordinated with a magnetotelluric transect (see Spratt, this volume) and the placement of two teleseismic stations by a POLARIS crew. These geophysical programs aim to characterize both the deep crustal and lithospheric architecture that characterize the southern Wopmay Orogen and the western Slave craton and hence delineate, at depth, the westernmost extent of Archean rocks within Wopmay Orogen.

Wopmay Orogen is dissected by the crustal-scale Wopmay fault zone. Previous studies in the northern part of the orogen have suggested that, west of the fault zone, rocks of the Great Bear magmatic zone (GBMZ) interacted with the cryptic ca. 2.0-2.4 Ga Hottah Terrane, while the package of rocks to the east interacted with Archean Slave basement. In the study area, the Wopmay fault zone is a ~300 meter wide zone of ultramylonite, hornblende-bearing augen granite gneiss, and post-mylonitic quartz stockwork. Both the age of movement and predominant sense of motion along the fault are poorly constrained. A ca. 0.78 Ga Hottah diabase dyke/sill clearly crosses the fault zone, however aplite dykes known to crosscut the mylonitic fabrics that define the fault zone in the study area may better constrain the age of mylonite formation.

West of Wopmay fault zone, are the biotite-magnetite ± hornblende-bearing rocks of GBMZ. Within these rocks are felsic gneisses and magnetite-rich, arkosic silt- and sandstones of the Treasure Lake Group and rhyolitic to dacitic porphyry, which is tentatively associated with volcanic rocks of the Faber Group.

East of Wopmay fault zone, rocks of the Slave craton include biotite- and cordierite–bearing metagreywacke-mudstones of the Yellowknife Supergroup that have been intruded by coarse-grained biotite granite (Eau Claire pluton). Paleoproterozoic rocks of the Snare Group comprise predominantly greenschist- (or lower) grade quartz pebble conglomerate, arenite, siltstone, mudstone, limestone, and locally stromatolitic dolomite. Typically, siltstones and mudstones are highly folded, locally recording two generations of folding. Magmatic rocks underlie the greater majority of the eastern area and are subdivided into 4 main units. The two-mica-bearing Mattberry granite contains a penetrative foliation, which is crossed by deformed and metamorphosed mafic dykes. Age relationships between Mattberry granite and the Snare Group rocks are generally equivocal, but locally unconformable contacts are preserved, implying that the granite may be Archean. The remaining intrusive phases are variably foliated biotite ± hornblende-bearing rocks of diverse compositions that are considered to post-date the Mattberry granite. These magmatic phases are not seen to contact the Snare Group rocks.

NORTHWEST TERRITORIES FORMATION TOPS PROJECT

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talk

A need was seen to create a cohesive publicly available set of formation tops for the Northwest Territories. The Targeted Geoscience Initiative II (TGI 2), funded by Natural Resources Canada, and undertaken by the Northwest Territories Geoscience Office (NTGO), has provided initial funding for the work. Formation tops are simply the drill depth to the top of recognized lithostratigraphic units. They are usually "picked" from wireline logs, but sometimes from drill cuttings or core.

At the present time the public can access formation tops for the NWT in the Schedule of Wells (schedule) published by the National Energy Board of Canada. However this set of tops has not been revised in over ten years. A bigger problem is that the tops have been picked in different periods extending over eight decades of exploration using the stratigraphic nomenclature accepted at that time. Much of the nomenclature from previous eras of exploration was borrowed from the closest region in Alberta or British Colombia; these formational names often have only limited applicability in the NWT. This project aims to unify and simplify the nomenclature that is most appropriate for each region in the NWT.

Another goal is to provide the tops in a spreadsheet format so that users can simply print out or import it into commercial geological databases/mapping packages. With the data in electronic form it can be readily updated and revised as new wells are drilled and stratigraphic thinking evolves.

Picks from several authors at the Geological Survey Canada (GSC-Calgary) have been relied upon as a basis for many NTGO picks. The stratigraphic nomenclature used by the GSC is based upon the most detailed and up-to-date surface and subsurface work available and has largely been accepted by NTGO.

The process for picking tops started with consulting the stratigraphic literature for the most suitable nomenclature. Tops were indicated on hardcopy wireline logs for each individual location based upon litho-stratigraphic variations in log response. These were compared and contrasted with other sets of formation tops, both publicly and commercially available. Drill cuttings were studied in many cases to verify lithologies. Correlations of tops with existing wells were used to pick tops for more recently drilled wells. Regional cross-sections were drawn, where necessary, to understand changes in lithology and facies across the regions.

Extra attention has been given to picking the thickness of unconsolidated surficial deposits and depth to Precambrian basement. New applications for knowledge of the thickness of glacial overburden are becoming apparent, and basement elevation is critical for understanding the succeeding stratigraphic succession.

HYDROCARBON POOLS OF THE TROUT PLAIN, NORTHWEST TERRITORIES

poster

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The Trout Plain comprises the southwestern portion of the Great Slave Plain exploration region. It is directly north of northeastern British Columbia and extends to approximately latitude 61º. Gas reserves are estimated at 1016 10^6m^3 (36 Bcf) for seven gas discoveries made over the period 1959 to 1989. Other discoveries have recently been made, but the data will remain confidential pending aboriginal land claim settlements.

Much of the exploration effort in the Trout Plain has been focused on drilling along the edge of the Arrowhead Salient, which lies along the northern margin of the Middle Devonian Slave Point Formation carbonate platform. One discovery has been in channel sandstones of the Early Cretaceous. Trapping is interpreted to be mainly stratigraphic; enhanced porosity in carbonates along the platform edge is sealed by adjacent shale basins.

Volumetric reserve estimates for the initial seven gas discoveries were derived using non-confidential, publicly available data contained in well files, drill cuttings, core and other sources. Pools have been assumed to occupy a standard gas spacing unit of 259 hectares. Three of the seven discoveries are profiled on this poster.

Shell et al Arrowhead B41-6040-12245 was drilled in 1989 and has gas reserves estimated at 22.6 10^6m^3 (0.8 Bcf) in the Early Cretaceous Chinkeh Formation sandstone. This is the lone discovery, so far, of a clastic Cretaceous reservoir on the Arrowhead Salient or further east on the Great Slave Plain. It was drilled on the basis of an interpreted channel incised into the Paleozoic surface and infilled with basal Cretaceous sands. The main pay zone consists of six metres of fine to medium-grained, massive quartz arenite. The overlying Garbutt Formation shales provide the vertical seal while tight carbonates and shales of the Mississippian Flett Formation provide lateral trapping.

Suncor Netla C07-6050-12245 was drilled in 1961 and is the largest of the original Trout Plain discoveries with gas reserves estimated at 570 10^6m^3 (20 Bcf) in the Slave Point Formation. The reservoir occurs in a 14-metre thick zone of light grey, medium-grained siliceous limestone (mudstone and wackestone). Visible porosity appears low in drill cuttings across the pay zone but a large component of microporosity is suggested by the chalky texture. The sonic log shows very high porosity.

HB Pan Am South Island River M41-6010-12100 is located along the eastern edge of the Arrowhead Salient close to the British Columbia border. It has gas reserves of 62 10^6m^3 (2.2 Bcf) in the Slave Point Formation. The pay zone of roughly six metres is at the top of a section of approximately 100 metres of medium to coarsely crystalline, white dolomite (Presqu'ile dolomite), which in places is fractured and vuggy. Porosity varies, with a high of 11%, and an average of 5.5%.

MACKENZIE MAPPING PROGRAM FOR NORTHERN OIL & GAS DEVELOPMENT

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The Mackenzie Delta region and Mackenzie Valley are experiencing significant gas exploration activity in anticipation of the completion of gasfield development and construction of a natural gas pipeline from the delta to the existing pipeline network in Alberta by 2010. Engineering design for oilfield facilities and pipelines, environmental impact assessments for specific facilities as well as overall development, monitoring the environment for impacts and change, inventories of resources (forests, granular resources, wildlife habitat and species, etc), and general management of area resources, are all seriously constrained by the age and accuracy of maps and remote sensing information currently available. Regional baseline photography dates back to the 1950s and '60s, existing 1:50,000 and 1:250,00 scale maps based on this information have contour intervals of 10 m and 500 feet respectively, and current satellite data is limited by +/- 5-7 m vertical and 15X15 m horizontal resolution (for Landsat 7). This baseline mapping was deemed inadequate for requirements of northern oil and gas development by a November 2003 workshop of government, land claims, environmental groups, and industry representatives, which recommended a program to improve base mapping to augment anticipated industry-specific information.

DIAND, with Natural Resources Canada and Environment Canada, initiated a federal government effort in 2004, in partnership with GNWT, Inuvialuit, Gwich'in, and oil & gas industry representatives, to address the deficiencies in baseline mapping over the next two to three years. The program has been partially funded as part of the Northern Oil and Gas Program announced in the federal February 2004 budget.

In summer 2004, Natural Resources Canada collaborated by completing a Differential Geographical Position Survey (DGPS) update of the regional geodetic control network to provide improved ground control for new aerial photography. New 1:30,000 scale colour stereo aerial photography was obtained in late summer and fall for the entire delta region (approx 3000 photos), and a 16 km wide corridor along Mackenzie Gas Pipeline route to the Alberta border (another 1500 photos). A major contracting exercise is being initiated for production of new mapping and a Digital Elevation Model (DEM) with 1 m vertical accuracy and contouring, as well as colour photomosaic of the entire area, etc. The estimated cost of this stage of the program is approximately $2M. As only part of this funding is in place, partners are beings sought from other government agencies, environmental groups, and industry. Program products noted above, as well as raw DGPS control data, will be housed at the GNWT Centre for Geomatics, where it will be accessible via Internet at no cost, or provided via various storage media at minimal charge (i.e. cost of hard drive(s), etc).

A NEW DISCOVERY OF GOLD IN THE PROTEROZOIC BRAVO IRON FORMATION, BAFFIN ISLAND

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poster

Numerous high-grade gold showings have been discovered in iron formation near the southern margin of the Proterozoic Piling Group on Central Baffin Island at the north end of the Trans Hudson Orogen. The silicate facies Bravo Iron Formation extends discontinuously over a known 140 kilometres strike length within the mafic Bravo Lake Group.

The 3-10 metre thick chemical iron formation occurs near the middle of the Bravo sediments. Sulphides are mainly pyrrhotite with pyrite, arsenopyrite, variable magnetite and minor traces of chalcopyrite.

Anomalous gold is ubiquitous throughout the iron formation. 2500 prospecting samples have been taken from this formation; virtually all contain gold values ranging from several tens to over 100,000 ppb Au. Free or coarse gold has been noted with garnet and quartz veins, occasionally with amphibole. Arsenic may be concentrated with high gold values or may be entirely absent.

Three phases of deformation appear to be present, including an early soft folding event, which thickens the unit.

To date, many prospects and zones with gold values exceeding one gram gold per tonne have been located. Three prospects in the western section have low values to 1-3 gm/T Au. In eastern parts of the district, numerous gold prospects carry gold values with assays ranging from 10 to over 100 gm/T Au. The most advanced are Malrok and Ridge Lake, where detailed channel sampling and initial drilling have been completed. Malrok consists of a continuous arcuate zone totalling over a 1.3 kilometre strike extent. Values up to 15.1 gm/T Au over 3 metres in drill core and 210 gm/T Au over 0.6 metres in channel samples are reported. High gold values in channels ranging from 10 to over 100 gm/T Au have been obtained over the 3.5 kilometre Ridge Lake zone. Drilling was completed in 2004; assays are not yet reported.

Just east of Ridge Lake, the Peninsula Prospect contains gold values up to 8.3 gm/T Au over a 3 kilometre strike extent. Detailed mapping here by DIAND geologist Andrea Mills shows the iron formation to comprises discrete iron formation beds 100 to 1000 metres long.

Prospecting late in the season of 2004 discovered a 12 kilometre arsenic rich extension of the Bravo Iron Formation immediately east of Peninsula. Assays for several hundred samples are awaited.

In the far east an 8 kilometre long outlier of Bravo Lake hosts the new Durette Gold Showing which carries 10 to 46 g/T Au values, scattered iron formation with arsenopyrite contains values of 1.0 – 10 gm/T Au.

The Bravo Iron Formation is considered to originate in an extensive sea floor venting system at the margin of a basin. Gold in association with silica, iron, arsenic and other volatiles emanated from sea floor vents during a period of minimal volcanism and clastic deposition. As clastic sedimentation re-commenced late in the venting, some gold and volatiles continued upward into hanging wall sediments until the vents ceased production.

HACKETT RIVER PROJECT REVIEW AND NEW DEVELOPMENTS

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poster

Sabina Resources' Hackett River base metal property, under option from Teck Cominco Metals, is located approximately 480 km (300 miles) northeast of Yellowknife within the Kitikmeot region of Nunavut. The property is located near a proposed road leading to a deep-water port site on Bathurst Inlet.

Previous exploration work on the Hackett River property by Cominco, Etruscan and others has outlined five massive sulphide deposits. They are the Main West, Main East, East Cleaver, Boot and Finger Lake zones. The Knob Hill zone is thought to connect with the East Cleaver deposit at depth. The five deposits are located along a six-kilometer long portion of prospective stratigraphy in the central part of the property. All of the deposits are open at depth. The sulphide deposits are located near the transition from felsic volcanics to overlying sediments.

The Main West, Main East, Boot and Finger Lake deposits are located at the top of a steeply southward facing stratigraphic sequence. The East Cleaver Lake deposit and the nearby Knob Hill deposit occur within an overturned anticline called the Anne Lake – East Cleaver Lake synform. The Anne Lake – East Cleaver Lake synform plunges moderately to the west and dips steeply to the south. The elongate East Cleaver deposit is located along the fold axis and plunges to the west with the enclosing stratigraphy. The Knob Hill deposit is located on the north limb of the Anne Lake – East Cleaver synform and dips moderately steeply to the south.

Copper-rich stringer-veinlet zones of mineralization locally underlie several of the massive sulphide deposits. Alteration associated with the copper-rich stringer-veinlet zones consists of pophyroblastic sillimanite – sericite or "spotted rock". Massive sulphide zones occur stratigraphically above the copper – rich stringer-veinlet zones or to one side of the massive sulphide body. Massive sulphides are also locally interlayered with carbonate and/or calc-silicate lenses. Massive sulphide mineralization consists of coarse-grained pyrite, pyrrhotite, sphalerite, chalcopyrite and galena. Several high-grade gold and silver drill intercepts at East Cleaver are associated with 1 – 2% arsenopyrite and calc-silicate alteration.

Sabina Resources' 2004 drill program discovered significant extensions to the Main West, East Cleaver – Knob Hill, and Boot Lake deposits at depth and laterally. The drill program also better defined the grade distribution of base and precious metals within the deposits.

Several regional geophysical targets were also drill tested however no significant mineralization was encountered. Drilling of several regional coincident gravity/conductor geophysical targets intersected a fairly thick (~50 m) carbonate (calcite and/or dolomite) layer that appears to be a regional stratigraphic marker horizon.

LOWER CRUSTAL XENOLITHS FROM THE DIAVIK MINE – A PRELIMINARY EXAMINATION OF PRESSURE-TEMPERATURE CONDITIONS

poster

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As part of comprehensive study of xenoliths from the A-154 south kimberlite pipe (Diavik Diamond Mine, NT), we have begun an investigation of xenoliths in this pipe believed to be of lower crustal origin. These samples are distinguished from crustal xenoliths derived from country rocks of the current erosional level by the presence of garnet, and from abundant eclogite xenoliths of mantle origin by the presence of plagioclase. Four xenoliths of this type have been identified to date in A-154, all of which are broadly basaltic in composition.

The lower crustal xenoliths are dominated by clinopyroxene (cpx), garnet and plagioclase. Orthopyroxene is present in one sample and rutile in another. Hydrous minerals such as hornblende or biotite are either absent or only present in trace amounts. The mineralogical features noted above would categorize these rocks as high-pressure mafic granulites, which is similar to the characteristics of the most abundant type of crustal xenolith reported from other pipes in the Slave Province and worldwide (Rudnick, 1992; Davis et al., 2003).

Detailed investigation of mineral compositions by electron microprobe has thus far only been conducted for one sample. Garnet, plagioclase and cpx in this sample show little compositional zoning except for core to rim increases in the Ca and Fe content of garnet, and decreases in the Ca content of plagioclase. Such zoning patterns are characteristic of rocks that have experienced a period of isobaric cooling from peak metamorphic temperature. An estimate of peak metamorphic conditions was obtained using mineral core compositions and TWQ multi-equilibrium thermobarometry (Berman, 1991). The garnet-cpx geothermometer yields a temperature of 850°C, which must be regarded as a minimum estimate of peak temperature because of the possibility of Fe-Mg re-equilibration in garnet and cpx during cooling. Pressure estimates for this sample vary with geobarometer. The garnet-cpx-plag-qtz geobarometer yields a maximum pressure estimate of 13 kbar (at 850°C), and the garnet-rutile-plagioclase-ilmenite-quartz geobarometer yields a minimum pressure estimate of 10.5 kbar. These P-T estimates are at the upper end of the range of pressures and temperatures reported by Davis et al. (2003) for other lower crustal xenoliths recovered from Slave Province diatremes.

Future work will focus on obtaining quantitative P-T estimates for all lower crustal xenolith samples from A-154 and on constraining the timing of peak metamorphism in this segment of Slave Province lower crust.

UTILIZATION OF DRIFT EXPLORATION TECHNIQUES TO CONSTRAIN KIMBERLITE INDICATOR DISPERSAL TRAIN SOURCES, CREDIT LAKE PROPERTY, NT

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talk

Arctic Star Diamond Corporation optioned the Credit Lake property from Kennecott Canada Exploration in June 2004. The property is located in a relatively mature diamond province, approximately 50 km west of Diavik and 40 km west-southwest of Ekati. A considerable amount of till sampling and geophysical work was done prior to Arctic Star's tenure. This previous work identified four distinct kimberlite indicator mineral (KIM) dispersal trains on the property. However, no kimberlite has yet been identified on the property. Arctic Star commenced a till sampling and geophysical program in the summer of 2004 to locate the source of these KIM dispersal trains.

The first measure of success for Arctic Star's exploration program is demonstrating that the indicator dispersal trains originate from sources located on the property. One set of approaches to demonstrating an on-property source relies on analysis of till indicator mineral and geochemical composition, till lithology, and glacial landform mapping. While these approaches cannot conclusively demonstrate the presence of kimberlite – only drilling results can – they can demonstrate the high probability that one or more of the indicator trains originate on the property and direct further geophysical and drilling efforts.

The first approach relies on examination of till fine-fraction geochemistry and pebble lithology to determine a mean transport length of till-forming material. Examination of regional compositional trends reflecting bedrock composition allows characterization of a regional till 'mixing model' from which a mean transport length can be determined. Knowledge of the mean transport length, in turn, allows for more refined estimates of the distance to source of anomalous till KIM concentrations. Work on till compositional data is ongoing, however preliminary results indicate low mean transport lengths of till-forming material and a high probability of on-property sources of the KIM dispersal trains.

A second approach attempts to disprove the hypothesis that till composition on the property reflects a significant transport distance of till-forming material, or inheritance of the KIM dispersal trains from older drift. To date, work has confirmed the preservation of one paleo ice-flow direction in till on the property (ice-flow to 310°). The KIM indicator dispersal trains are correspondingly characterized by sharp edges. No exotic lithologies have been identified in till. No drumlins or other landforms that may indicate the preservation of thick and/or older relict drift have been identified on the property. These observations all indicate that the KIM dispersal trains formed during the last stage of glaciation, are composed of locally derived material, and are not composed of material remobilized from older drift.

Initial results of the summer 2004 exploration program support the hypothesis that identified KIM dispersal trains originate on the Credit Lake property. New indicator mineral data in particular is resolving wider trains into individual trains originating from multiple sources.

PROGRESS REPORT ON PRODUCTION OF BASIC GEOSPATIAL INFORMATION IN THE TERRITORIES

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talk

The Earth Science Sector's program (ESS) through Geomatics for Northern Development Program, Geomatics for Sustainable Development of Natural Resources Program and the Connecting Canadian Program is working hard to ensure that basic topographic information is made available to people of the North.

The presentation illustrates the challenge that we all face in the North regarding access to basic geospatial information and the way we can best answer it. The presentation also illustrates what is being done and the progress that is made. The goal of the presentation is also to get feedback from participants about the different on going initiatives.

The different products (e.g. National Topographic Database (NTDB), Digital Elevation Models (DEM), and Landsat-7 Ortho-Images) and their characteristics will be explained and production indexes will show the progress made during the last years. The different processes to upgrade the NTDB will be also examined. Finally, an update on the GeoBase Portal will also be provided.

GEOLOGY OF THE SNOWBIRD LAKE AREA AND IMPLICATIONS FOR THE SNOWBIRD TECTONIC ZONE

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talk & poster

The Snowbird Lake mapping project is located in the southeastern corner of the Northwest Territories, adjacent to the Nunavut and Saskatchewan borders. It is a multidisciplinary study initiated by the NWT Geoscience Office in collaboration with the Western Churchill Metallogeny Project of the Geological Survey of Canada. The study area covers the Selwyn lozenge, the central of three lozenges entrained in crustal-scale shear zones. These shear zones partly define the Snowbird Tectonic Zone, which is thought to represent the boundary between the Rae and Hearne Domains of the Churchill Province. Components of the study include remote predictive mapping, bedrock mapping, geochemistry and geochronology, surficial mapping, aeromagnetic survey, and esker and till sampling.

The Selwyn lozenge consist mainly of granulite-grade orthogneiss (orthopyroxene + clinopyroxene + garnet ± magnetite-bearing), upper amphibolite- to granulite-grade metasedimentary rocks (garnet + biotite + sillimanite ± melt ± cordierite(?)-bearing) and lesser amounts of mafic volcanic rocks (clinopyroxene + orthopyroxene + garnet-bearing), and previously unrecognized sequences of banded iron formation (BIF). The eastern margin of the

Selwyn Lozenge is marked by the Striding mylonite zone, which juxtaposes the Selwyn Lozenge with a highly strained, granulite-grade plutonic panel. This panel consists of Chipman tonalite (ca. 3.0 Ga) and spatially related Chipman dykes (ca. 1.9 Ga) that were previously mapped as mixed metavolcanic and metasedimentary rocks. The presence of high-grade orthogneiss (Chipman tonalite and dykes) east of the Striding mylonite zone indicate that the zone itself does not define the boundary between the Rae and Hearne domains as previously suggested.

A change from granulite/upper amphibolite-grade orthogneiss to greenschist-grade supracrustal rocks (Hearne Domain) is located along an unexposed curvilinear, geophysically defined structure 20 kilometres east of the Striding mylonite zone. This structure appears to define the western extent of greenschist-grade rocks of the Hearne Domain within the study area. Based on geometrical and lithological similarities with the Athabasca mylonite triangle, this structure is interpreted to represent the northern continuation of the Legs Lake shear zone in Saskatchewan. The Legs Lake shear zone juxtaposes high-pressure granulite rocks with low-pressure amphibolite rocks of the Hearne Domain.

Proterozoic rocks include a sequence of limestone and dolostone, granitic plutons, and northwesterly oriented Mackenzie diabase dykes. The extent of rocks previously assigned to the Proterozoic Hurwitz Group is questioned and a sequence of volcanic rocks (and associated BIF) has been sampled for geochronology to test if they are Archean.

The structural history of the rocks in the lozenge is complex; the earliest structures preserved are a composite gneissosity (Sgn)/foliation (S1) with a moderate dip and a northwesterly oriented enveloping surface, along with recumbent, isoclinal folds (F1). D1 structures are folded by northeast-southwest trending folds (F2) with an axial planar foliation (S2), producing large-scale fold interference patterns (F1/F2). A mylonitic fabric concentrated along northeast to easterly oriented shear zones, overprints the Chipman dykes. This fabric is interpreted to be correlative with the northeast oriented fabric observed across the study area.

COMMITTEE BAY PROJECT – EXPANDING GOLD DISCOVERY IN NUNAVUT

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talk

The Committee Bay Greenstone Belt located north of Baker Lake, Nunavut extends over 300 km and is one of the largest unexplored greenstone belts in North America. The belt is comprised of poly deformed Archean supracrustal rocks including, iron formation, komatiite, quartzite and minor mafic and felsic volcanics. Gold mineralization occurs along the entire length of the belt and to date the most significant known occurrences are hosted in iron formation and localized shear zones.

In 2004 Committee Bay Resources and joint venture partner Gold Field Exploration completed a C$7.9 million exploration program. A total of 7,100 m in exploration drilling has been completed with emphasis on the definition and expansion of the Three Bluffs deposit to a

resource stage. Drilling this summer has significantly expanded the high grade zone at Three Bluffs to a strike length in excess of one kilometer and to a depth of 300 m. These holes (including intersections of 4.55 g/t Au over 78.37 m including 16.54 g/t Au over 13.00 m, 15.67 g/t Au over 9.68 m, 13.62 g/t Au over 8.84 m including 20.65 g/t au over 3.94 m, and 16.69 g/t Au over 5.00 m) in combination with previous drilling reinforce the assumption that the widest, high grade zones extend from surface along a shallow 20^0 to 30^0 plunge direction to the northeast below a diorite sill.

Original banded oxide and silicate iron formation at Three Bluffs are sulphidized, silicified and disrupted by hydrothermal fluids. Weakly affected iron formation shows sporadic replacement of chert bands. More advanced stages of alteration are characterized by progressive replacement of magnetite bands by amphibole minerals such as grunerite and actinolite. The most advanced alteration involves the sulphidation of amphiboles and garnet by pyrrhotite and lesser pyrite. The highly disrupted mineralized zones are often accompanied by grey translucent quartz that is likely related to silica flooding. Those zones with the most intense silica flooding or silicification are often accompanied by the presence of visible gold.

Silicification and/or grey quartz veining appear to concentrate in structures along the contact of iron formation and dacite a conformable volcanic rock. This contact can be traced for well over 5 km along strike in outcrop and drill holes.

Elsewhere surface exploration has identified new targets that vary in style from shear-hosted gold (Castle Rock), silver-gold bearing breccias (Kinn Silver), iron formation hosted (Shamrock), intrusive-related (Burro) to multi-stage stockwork veining (Raven). This presentation will give a brief review of the geology and structure of the Committee Bay area with emphasis on describing the supracrustal rocks that are important hosts for gold mineralization. It will document the drilling success at Three Bluffs and elaborate on the geology, mineralization and resource estimate. Other prospects reflecting the variety of deposit types will be briefly described and placed in geologic context.

THE LENA WEST PROJECT: 2004 UPDATE

McLean, C. and Clarke, D.
Diamondex Resources, Vancouver, BC

talk

The Lena West Project is an exciting area in Canada for the discovery of a new kimberlite province. A two-week reconnaissance-sampling program in 2002 returned abundant anomalous kimberlite indicator mineral (KIMs) concentrations. Further sampling during 2003 returned numerous KIM's with a significant portion of G10 pyropes and a number of diamonds. Airborne and ground magnetic surveys conducted in 2003 and 2004 have identified many distinct kimberlite like anomalies. The 2004 exploration program also included ground geophysics, auger drilling, diamond drilling and fluvial sediment sampling. The Property is comprised of 139 Prospecting Permits encompassing 6.15 million acres, centred approximately 200 kilometres southeast of Inuvik and 300 kilometres north of Norman Wells.

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 found in this part of the Interior Platform are underlain by an Archean craton of similar aerial extent as the Slave Structural Province. The distribution, morphology and chemistry of the recovered indicator minerals in 2002 hinted at the discovery of a new kimberlite province, which itself may contain several kimberlite clusters.

In the summer of 2003, the Lena West Property saw the completion of a 63,800-line km detailed airborne magnetics survey and the collection of 1,053 Heavy Mineral Concentrate (HMC) samples. The 2003 stream sediment sampling campaign returned anomalous concentrations of pyrope-garnet grains of lherzolitic and harzburgitic periodite provenance (with a significant portion of G10s), a total of 5 diamonds ranging from 0.5mm to 1.5mm in their longest dimension, as well as kimberlitic ilmenite grains with chemistries indicative of favourable diamond preservation conditions. Morphological studies of the recovered KIMs indicate the presence of both primary and secondary sources with a subset of grains indicating close proximity to primary source areas.

In the spring of 2004 the remainder of the airborne magnetics survey was flown and numerous geophysical anomalies were identified. At least two distinct clusters of 20-30 high priority anomalies are present. Twenty priority targets were followed-up with detailed ground magnetic surveys. An auger-drilling program was conducted to recover subsurface sediment samples above identified mag anomalies for kimberlite indicator mineral analysis. Targets sampled by the auger-drilling program have been processed and analysis of the resulting heavy mineral concentrate is currently underway. Diamond drilling is currently testing high priority targets. A total of 1,107 regional and follow-up fluvial sediment samples were taken with the intent to identify the source of the anomalous indicator mineral concentrations discovered in samples from the 2003 program.

Observation of the 2004 HMC for KIMs continues as does the processing of the new airborne data set. This new data will help focus the locations of sources in the areas already identified as having high-grade diamond potential. Prior to the second quarter of 2005, it is expected that auger and diamond drilling will have recommenced on the highest priority targets. By this time all important indicator minerals will be microprobed and their morphologies characterized.

GARNET XENOCRYSTS FROM THE DIAVIK MINE – COMPOSITION, PARAGENESIS AND COLOR

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1. University of Alberta, Earth and Atmospheric Sciences, Edmonton, AB
2. Diavik Diamond Mines Inc., Yellowknife, NT

talk

Mantle xenoliths from the A-154 South kimberlite pipe (Diavik Diamond Mine, NWT) are largely eclogitic in paragenesis, suggesting that either sampling efficiency or abundance of eclogite at depth exceeds that of peridotite. However, the low abundance of peridotitic xenoliths

may also relate to preferential weathering and disaggregation. To test the relative abundance of eclogitic and peridotitic mantle material sampled by the ascending kimberlite we studied xenocrystic garnets ranging in size between two to five millimeters recovered from coarse heavy media concentrate.

Over 10,000 garnets were divided into groups according to their color. From 15 initial groupings 88 garnets have been analyzed for major and minor elements using an electron microprobe (WDS). Trace and ultra-trace element analysis of 60 garnets using LA-ICPMS is currently in progress.

Plotting the garnet color groupings in the standard Ca-Cr plot shows that orange (light to dark) and reddish-orange colors are restricted to Cr_2O_3 contents of ≤1 wt%, corresponding to the eclogite/peridotite division in this diagram (e.g. Grütter et al., 2004). Reddish-orange garnets have CaO contents of <4 wt%, whereas orange garnets range from 3.9-12 wt%. The reddish-orange garnets also show a restricted range in Mg-number (76-84) compared to the orange garnets (40-82). This suggests that the reddish-orange garnets probably reflect orthopyroxene bearing, websteritic sources, while pure orange shades characterize normal eclogitic garnets. In the peridotitic field a color transgression is observed with increasing Cr_2O_3 content for garnets plotting along the low-Ca side of the lherzolitic (G9) field. The colors change from orangey-red with Cr_2O_3 contents of 1.5-2.5 wt% to light red with Cr_2O_3 contents of 2-4 wt%. The orangey-red group is overlapped by G9 garnets with reddish-pink and light pink colors, which have Cr_2O_3 between 2-5.5 wt%. Dark pink garnets are observed towards higher chromium contents (5-9.5 wt% Cr_2O_3). The varying shades of pink plot on both sides along the lherzolite-harzburgite (G9/G10) division, the reddish shades are restricted to the lherzolitic field. Purple colors characteristic of pyrope garnets with elevated knorringite component ($Mg_3Cr_2Si_3O_{12}$), plot at Cr_2O_3 contents exceeding 5 wt%. No systematic variation in the intensity of purple coloration (light to dark purple) with Ca content was observed, light and dark purples occur both in the G10 and G9 fields. The light and dark purple groupings contained four garnets with included diamond. Finally, a group of deep red garnets was observed, these are Ca saturated with 4-8 wt% Cr_2O_3, and overlap with the pink-purple groupings. These deep red garnets appear to fall into two groups, one group plots along the lherzolite/harzburgite division (G9), while the second group extends into the wehrlite (G12) field and appears to be characterized by elevated Fe^{3+}/Fe^{2+} ratios.

Eclogitic/websteritic and peridotitic garnets are sufficiently distinct in color to permit assignment of the >10000 garnets in our sample to one of the two suites based solely on color. Contrary to the xenolith data, the concentrate garnet population shows the relative abundance of peridotitic garnets (ca. 70%) exceeds that of eclogitic garnets (ca. 30%). Considering that garnet is at least 10 times more abundant in eclogite (ca. 50 %) than in cratonic peridotites (usually < 5%) A-154 contains a mantle sample that is probably over 95% derived from peridotitic sources.

QUATERNARY GEOLOGICAL WORK IN THE WESTERN CHURCHILL PROVINCE: AN UPDATE OF RECENT AND UPCOMING COMPILATIONS

poster

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With multiple new prospects for diamond exploration emerging in north-central Canada, the compilation, synthesis and release of existing surficial geology maps, reports and data files for the western Churchill Province of the Canadian Shield is paramount. The development of Quaternary geoscience knowledge in this region represents a key component of the Western Churchill Metallogeny Project (WCMP) – part of the Geological Survey of Canada's Northern Resources Development Program. The WCMP is a 3-year multi-agency, multidisciplinary project that aims to compile and synthesize geoscience knowledge of the western Churchill Province spanning northern Alberta, Saskatchewan, Manitoba, southeastern Northwest Territories and central mainland Nunavut. The goal is increased mineral exploration in the north, with its associated benefits to northerners and northern communities.

This poster shows a location map of existing Quaternary compilations over the western Churchill Province and surrounding areas, including surficial geology maps at various scales, till composition data, GSC publications and other government reports, and a selection of scientific papers. An up to date reference list of recent Quaternary publications is provided on the project's web page (http://nrd.nrcan.gc.ca/nrd_t2/index_e.aspx?articleid=309). This list comprises publications for northern Manitoba, northern Saskatchewan, central Kivalliq, western Committee Bay, Melville Peninsula, Somerset Island, Boothia Peninsula, Prince of Wales Island, and Baffin Island. The poster presents a preview 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. Areas of recent and future field projects by the participating agencies are also shown.

QUATERNARY MAPPING IN THE SCHULTZ LAKE (NTS 66A) AND WAGER BAY AREAS (NTS 56G): A HISTORY OF SHIFTING ICE FLOW AND CONTRASTING GLACIAL LANDSCAPES BENEATH THE KEEWATIN ICE DIVIDE

talk

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Quaternary framework mapping was conducted in June-July 2004 in the Schultz Lake and Wager Bay areas, two areas of active mineral exploration for which the glacial record is poorly understood. Field work included surficial mapping, reconnaissance till sampling, stratigraphic

studies and ice flow indicator surveys. More than 100 till samples were collected for geochemical, gold and kimberlite indicator mineral analysis. These results, together with the interpretation of the glacial history, will provide a regional framework for mineral exploration, particularly for diamonds. The work is under the Western Churchill Metallogeny Project, which is part of the Geological Survey of Canada's Northern Resources Development Program (http://nrd.nrcan.gc.ca).

Although both areas lay beneath the Keewatin Ice Divide during the last glaciation, the ice flow directions and sequences, the nature of the surficial deposits, and the resulting effects on glacial transport are remarkably different. These contrasts result from differences in bedrock geology, topography, ice dynamics, and ice margin configurations. In the Schultz Lake area, the glacial erosional and depositional record is very well preserved, particularly west of the Thelon River where Proterozoic Dubawnt Supergroup rocks and derived glacial sediments are exposed. Evidence for multiple flows are found in the form of preserved faceted and striated surfaces, palimpsest streamlined landforms, multiple-till sections, and contrasting surface till colors and pebble lithologies. Although an old southeastward flow was recorded across most of the map area, the dominant flows are north-northwestward to northwestward. The surface till composition reflects a predominant southeastern provenance (NW flow) except near Pitz Lake, where evidence for a mixed provenance is suggested (both NW and SE). A late but major westward ice-streaming event is recorded in southern areas. In the Wager Bay map area, glacially polished surfaces and streamlined landforms are generally well preserved in northern areas, where the dominant flow is to the NNW, with late flows into Wager Bay from both the north and south shores. In the southern part of the area, striations are more poorly preserved and the landscape reflects extensive meltwater erosion and deposition. Dominant flows in the south shifted between southward and southeastward. An east-west belt 10-20 km wide bisects the central part of the map area, mainly within the uplands south of Wager Bay. It comprises outcrops that are glacially faceted and striated in opposite directions (both north and south), areas with poorly defined striae or immature roches moutonnées, and areas with no striae but remnants of regolith.

Major shifts in glacial directions across the entire Schultz Lake map, multiple-till stratigraphy, and well-developed polished surfaces and streamlined glacial landforms suggest a mobile, wet-based ice sheet at Schultz Lake, and a shifting ice divide. In contrast, the location of the ice divide at Wager Bay seems to have been fairly stable, and the generally poor development of a glacial landscape suggest that ice in the Wager Bay area could have been cold-based prior to deglaciation.

NUNAVUT EXPLORATION OVERVIEW - 2004

Mills, A.
Indian and Northern Affairs Canada, Iqaluit, Nunavut

talk

This year saw an unprecedented number of applications for prospecting permits, resulting in the largest area of Crown Land to be held by proponents in the history of Nunavut. A total of 1522 prospecting permits encompassing 64,009,105 acres were granted by the Mining Recorder's Office. This brings the total area of Nunavut covered by permit to 82,598,674 acres, or 106,608,010 acres including claims. Not surprisingly, the main driving force behind this rush is diamond exploration. Precious and base metal exploration are still strong in Nunavut, due in part to the increase in market prices. Other commodities such as iron, coal and gemstones are also being sought.

Diamond exploration was conducted across the Territory this year, with significant new discoveries on the Boothia, Melville, and Brodeur peninsulas as well as in the Rankin Inlet area. Diamonds North, in partnership with BHP Billiton, discovered kimberlite float on their Amaruk Property, south of Kugaruuk (southern Boothia Peninsula). Stornoway and partners BHP Billiton and Hunter Exploration Group discovered new kimberlite on their Aviat Project on the Melville Peninsula. Strongbow Exploration and partner BHP Billiton report new kimberlite on Wales Island, just west of the Melville Peninsula. Twin Mining reports new kimberlite fragments, inferred to indicate a new pipe northeast of their Freightrain kimberlite. North of Rankin Inlet, Shear Minerals discovered new kimberlites on their Churchill Property. Diamonds North and Teck Cominco have selected numerous drill targets to collect samples from kimberlitic bodies on Victoria Island. Finally, the Coronation Gulf area remains a hive of activity with companies such as Tahera, Rhonda, Ashton, DeBeers, International Samuel, Strongbow, Stornoway, Hunter, Kennecott, Diamondex and Allyn all exploring their respective properties in the region.

Advanced gold projects include Cumberland Resources' Meadowbank Project and Miramar Mining Corporation's Hope Bay Project, both currently in the regulatory process. Meadowbank is the third largest undeveloped gold resource in Canada, with nearly three million ounces of gold. Miramar's Hope Bay and Back River projects have a combined net resource of 6.6 million ounces of gold. Other active gold projects include the Committee Bay Project, a joint venture between Committee Bay Resources and Gold Fields Exploration Ltd., Wolfden Resources' Ulu Gold Property, and Commander Resources' Qimmiq Project.

New and exciting exploration in Nunavut encompasses a variety of commodities, aside from gold and diamonds. Wolfden continues to advance their 100% owned High Lake Cu-Zn project, ~175 km east-southeast of Kugluktuk. Sabina Resources Ltd. reported impressive drill intersections from their Hackett River Zn-Pb-Cu-Ag-Au Property. About 50 km southeast, Expatriate Resources Ltd. is exploring the Yava VMS deposit. Also in this area, Strongbow has confirmed high base and precious metal values from the company's Au-Ag-Cu-Zn-Pb Musk property. Starfield Resources conducted geophysics and drilling to develop their magmatic sulphide Ni-Cu-PGM Ferguson Lake Project in southern Nunavut. Baffinland Iron Mines Corp. worked on the Mary River iron deposits on north central Baffin Island. Gem-quality sapphire with exceptional blue colour is the focus of an exciting gemstone play near Kimmirut, where

True North Gems Inc. conducted mini-bulk sampling on their Beluga Sapphire occurrence. Finally, James Bay energy Inc. is exploring for coal at their Strand Fiord Project on Axel Heiberg Islandin the High Arctic.

ENHANCING GEOSCIENCE KNOWLEDGE IN NORTHERN CANADIAN COMMUNITIES

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

talk

The many small and medium-sized communities that are dotted across Canada's northern landscape rely to a great extent on natural resources for their economic well-being. The key to increased prosperity lies in building capacity so that the communities can participate meaningfully in resource-based development. The Northern Resources Development (NRD) Program of the Geological Survey of Canada launched a new project in 2003-2004 to enhance the understanding of geoscience in Canada's northern communities. The project, entitled "Geoscience Experience for Northern Communities" (GENCOM), is active across northern Canada, working in cooperation with other NRD projects to assist communities in developing the geoscience knowledge necessary to make informed decisions on resource development and land-use planning. The project is providing readily understandable geoscience information to northern communities through community and school-based programs and is engaged with literally dozens of partners in developing science outreach materials of general and local interest. The nature of the outreach in different projects and regions is tailored to the nature of the project and the needs of the communities.

Some new Geoscape posters are under development, notably for northern Saskatchewan and the Northwest Territories. However, this well-tried poster format has been modified for smaller communities into a booklet-style document that challenges the community to answer five key questions: Where does our water come from? Where does our energy come from? What local Earth resources do we depend on? Where does our garbage go? Where does our sewage go? Some projects are being conducted in collaboration with science centres that provide service to northern communities including The Exploration Place in Prince George B.C. and the Odyssium in Edmonton. This means that products developed will have a much longer life in the community than the specific scientific projects.

The project is also developing attractive fact sheets that deal with Canadian resources. The sheets are developed in a hierarchy with a long-term view to establishing them on a web site. At the high end of the hierarchy are sheets that deal with the topics: mineral resources, energy resources, industrial minerals and gemstones. The middle of the hierarchy has topics in more detail such as base-metals, coal, carving stone, and diamonds, while the bottom of the hierarchy is populated with northern-based stories like the Polaris mine, northern pipelines and Yellowknife gold. Another feature of the project is the development of focused workshops for

teachers in northern communities and visits to schools in the same communities. The long-term goals of the project are northern communities with better geoscience knowledge and more individual residents of northern communities who feel inspired to pursue geoscience-related careers.

GEOLOGY OF THE SOUTHERN WECHO RIVER AREA, ARCHEAN SLAVE PROVINCE, NWT

Ootes, L.
Northwest Territories Geoscience Office, Yellowknife, NT

talk

The Wecho River area is located ~100 kilometres north of Yellowknife, NT, and is the foci of a two-year bedrock mapping project. Presented here are the preliminary results of mapping from the 2004 field season, which was undertaken in the southern part of the study area (the northern part of the area was completed in 2003). To compliment 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 study area (by S. Buse, Carleton University, Ottawa, ON).

Previous bedrock maps show the southern part of the Wecho River area to be underlain by undifferentiated Archean metasedimentary (including minor mafic volcanic) and granitoid rocks. This study was able to further delineate the supracrustal rocks, as well as sub-divide the granitoids into at least eight end-members based on their physical attributes. These units include, but are not limited to, phenocrystic granite, biotite-granite, two-mica granite, biotite-magnetite granite, hornblende (± magnetite) granite, hornblende granodiorite to tonalite, quartz monzodiorite to diorite, and syn-tectonic 'dirty' granite, which contains variable amounts of sedimentary enclaves.

The supracrustal rocks include greywacke-mudstone turbidites with minor intercalated mafic volcanic rocks. The metamorphic grade of the turbidites increases northeastward across the map area from greenschist (biotite facies) to upper-amphibolite (sillimanite + K-feldspar-in). The supracrustal sequence is discontinuous due to intrusion by young granitoids, and offset along a >10 kilometre-scale Proterozoic fault, leaving the turbidites as two distinct belts in the southwestern Slave Province; the Russell-Snare-Cowan-Mosher belt and the Wheeler-Germaine-Armi belt.

In the southwestern portion of the study area, at Mosher Lake, occurs a north trending package of mafic volcanic pillowed flows with gneissic margins that rests within the turbidites. During D_1, the turbidites underwent isoclinal folding, but the volcanic horizon is interpreted to have flattened and stretched. Syn-plutonic D_2 folding has left turbidite beds in the Russell-Snare-Cowan-Mosher areas as augen-like structures that wrap the syn-tectonic plutons; the more rigid volcanic pile at Mosher Lake was preserved as a lenticular body. This lenticular body is interpreted as a relict marker unit within the turbidites; stratigraphically underlying this volcanic belt to the east, the turbidites are homogenous, economically sterile greywacke-mudstones, overlying this volcanic belt to the west, the turbidites have interbedded, economically

prospective silicate and sulphide iron formations, including known gold showings, as well as felsic volcanic rocks (*ca.* 2658 Ma).

In the vicinity of Wheeler and Germaine lakes, the turbidite package contains a package of silicate/sulphide iron formation with known gold showings. The metamorphic grade of these rocks is above the sillimanite-in isograd, and in many localities there is evidence for in-situ partial melting. North of both Wheeler and Germaine lakes, the turbidites are at upper-amphibolite grade and occur as sillimanite-, or garnet-bearing psammites that are extensively injected by younger granitoids and sillimanite ± iolite bearing metatexites to diatexites. This greatly amplifies the known extent of the turbidites and shows there is a general increase in metamorphic grade from southwest to northeast in the southwestern Slave Province.

GAS HYDRATES – CANADA LEADS RESEARCH TOWARDS A CLEANER ENERGY OPTION FOR THE FUTURE

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2. Geological Survey of Canada Pacific, Victoria, B.C.

talk

Gas hydrates are crystalline substances composed of water and natural gas molecules, in which a solid water-lattice accommodates gas molecules in a cage-like, clathrate structure. Most natural gas hydrate deposits consist primarily of methane occurring in association with permafrost and in marine environments. Gas hydrates represent a potentially vast unconventional energy resource, with world wide estimates suggesting that they contain more energy than all conventional hydrocarbon resources combined. Although detailed scientific and engineering knowledge about gas hydrates is lacking, their potential relevance is far reaching. The most concentrated deposits yet known in the world occur in the Canadian Arctic. If the technologies for recovery can be developed, gas hydrates almost will dramatically increase the natural gas supply in North America. In addition to the obvious economic benefits to Canada, the increased utilization of clean burning natural gas has substantial implications for the reduction in greenhouse gas emissions. Gas hydrates also offer an attractive possible option for the disposal of carbon dioxide generated by combustion of hydrocarbon fuels, through long-term sequestration in geologic reservoirs.

The realisation of the economic potential of gas hydrates requires ground breaking development of science and technology. The Earth Sciences Sector of Natural Resources Canada began a new program to study gas hydrates in 2003. The program includes three projects; a northern project aimed to further investigation of gas hydrate occurrences in the Mackenzie Delta, southern Beaufort Sea and Arctic Islands, a marine program to study gas hydrates in the Pacific and Atlantic margins and a research and development project to undertake fundamental laboratory and modeling work. Highlights of the ESS program include the 2002 Mallik gas hydrate production research well project which conducted the first modern production testing of gas hydrates. With leadership from NRCan and Japan this project included 9 participant organizations from six countries. This talk will review the geology and distribution of gas hydrates in Canada and provide a brief highlight of recent activities.

ICE-MOVEMENT HISTORY AND DRIFT PROSPECTING IN THE DARBY LAKE (NTS 56N) AND ARROWSMITH RIVER (NTS 56O NORTH) AREAS, CENTRAL MAINLAND NUNAVUT

talk

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The Canada-Nunavut Geoscience Office initiated an ice-movement mapping and reconnaissance-scale drift prospecting program within the Darby Lake (NTS56N) and Arrowsmith River (NTS56O north) map areas as part of the Boothia Peninsula Integrated Geoscience project, a component of the Targeted Geoscience Initiative (TGI2). Preliminary results indicate at least 3 phases of ice-movement. In the Darby Lake area, most large-scale landforms (e.g. roche moutonées) suggest an early, dominant ice-flow to the northeast, likely by the Laurentide Ice Sheet at the last glacial maximum (LGM). Similar but fewer of these landforms occur in the Arrowsmith River area. Subsequent phases of ice-flow in the Darby Lake area suggest ice flow to the north-northwest, however, in the Arrowsmith River area this second phase of movement was to the north-northeast. The final phase involved north-northeast movement in the Darby Lake area, but varied in the Arrowsmith River area from north-northeast to northeast. The region is inferred to have been affected by the coalescence of ice from two ice divides: the north-south M'Clintock Divide (purported to have been located west of the Boothia Peninsula), and the north-east oriented Keewatin Divide (located somewhere between Baker Lake and Wager Bay). During the LGM, eastward flowing ice from the M'Clintock Divide crossed the Boothia Peninsula where it intercepted north-westward flowing ice from the Keewatin Ice Divide. Over time, Keewatin ice-flow dominated and forced M'Clintock flow north-westward. During the final deglaciation phase, disintegration of Keewatin ice allowed the eastward flowing M'Clintock ice to deflect Keewatin ice to the northeast. There is little evidence of ice flow toward Chantrey Inlet during deglaciation; most evidence suggests ice-flow was toward Committee Bay during the final phase of deglaciation.

A reconnaissance-scale drift prospecting survey resulted in the collection of 3 kg and 10 kg till samples from 70 sites in the Darby Lake area, and 23 sites in the Arrowsmith River area. Spacing of sample sites ranges from 2 to 30 km, with an average spacing of 20 km. In areas of greater metal prospectivity (e.g. komatiites and other supracrustal rocks) samples were collected at a closer spacing, and down-ice from the last paleo ice-flow direction. The 3 kg till samples will be analyzed for: Au by fire assay and ICP-MS; carbonates; and texture. The 10 kg till samples will be analyzed for: Au counts; MMSIMs; pebble lithology. Heavy mineral separates will be archived. Results of the drift prospecting survey and till analysis will be presented in a GSC Open File.

THE ORIGIN OF DIABASE DYKES IN THE LAC DU SAUVAGE – LAC DE GRAS AREA, NWT

poster

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Proterozoic mafic magmatism in the form of diabase dykes, sheets, sills and flood basalts is prevalent in all Archean cratons but is particularly abundant in the Slave craton (e.g. LeCheminant and Heaman, 1989; Heaman et al., 1992; LeCheminant and van Breemen, 1994; Lecheminant et al., 1997; Harlan et al., 2003; Atkinson, 2004). At least nine periods of Proterozoic mafic magmatism are currently recognized in the Slave craton: 1) 2.23 Ga Malley (NE trend), 2) 2.21 Ga Mackay (ENE trend), 3) 2.19 Ga Dogrib (ENE trend), 4) 2.02-2.03 Ga Lac de Gras (NNE trend) and 2.04 Ga Hearne (NE trend), 5) 1.88 Ga Indin (NNE trend), 6) 1.83 Ga Sparrow (SE trend), 7) 1.27 Ga Mackenzie (ESE trend), 8) 0.78 Ga Gunbarrel (NE trend) and 9) 0.72 Ga Franklin (E to S trend). In the Lac du Sauvage - Lac de Gras area, several of these dyke swarms are exposed. As part of a larger study to determine the origin of Proterozoic mafic magmatism, a number of these mafic dyke swarms were sampled during a 2-week period of bedrock-mapping in the central Slave Province. The map area straddles NTS sheets 76D/09 and 76C/12 in the Lac du Sauvage – Lac de Gras region. A total of 33 diabase dyke samples were collected and 5 distinct dyke orientations were recognized corresponding to events 1, 2, 4, 7 above plus a set of "305^{o}-trending" dykes.

A detailed petrographic and geochemical study of all five dyke swarms will be conducted and will compliment published research (e.g. LeCheminant et al., 1997). In addition, geochronology of the '305º' dyke swarm and a study of dyke emplacement patterns will be conducted on oriented chill margin samples. The geochemical composition of a single Lac de Gras dyke sampled in six locations over ~15 km and emplacement characteristics will be investigated to assess along strike chemical variations. The ultimate goal of this research is to provide constraints on the origin and tectonic setting of this mafic magmatism.

TABLET PC-BASED DATA CAPTURE AND ATTRIBUTION OF GEOLOGICAL FEATURES USING CUSTOM ARCMAP TOOLS

talk

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Custom tools were developed at the Geological Survey of Canada in Ottawa to facilitate digitizing features on paper maps using ESRI's ArcMap software.

Traditionally, this conversion process involves tracing geological features onto several mylar overlays. Using registration tics, the mylars are then scanned, georeferenced and the linework are vectorized. Disadvantages of this method include inaccurate registration of features between mylars, and the raster to vector conversion usually results in errors that need to cleaned to create topologically sound data. This data cleaning is very time consuming.

In our Tablet-PC based method, a scanned georeferenced image of a paper map is used as a backdrop for on-screen sketching and simultaneous attribution of features using custom ArcMap tools. These tools include a LayerAttributer tool, for coding point, line and polygon features, and DigSym, a tool for capturing oriented point features like geological structures. These tools accurately capture on screen sketches into attributed shapefiles or feature classes in personal geodatabases. The attribute values for each feature type are user-defined and stored in an XML document. Within the LayerAttributer and DigSym tools, their associated XML files are used to populate drop-down picklists in ArcMap. Once a feature is drawn as an ink-sketch, it is converted to a vector feature and automatically coded with the attribute value selected in the picklist.

Digital conversion of paper geological maps is a tedious and time-consuming process. The benefits of using ink technology (Windows XP Tablet Edition) and a Tablet PC are the speed and ease with which lines and points are captured. Tablet PC's are more ergonomic than a traditional workstation set-up because they allow the user to sit in a comfortable sketching position. The paper source map is much more useful stored as a digital georeferenced image that can be used as a digital layer with the newly captured geological data and any future interpretations of that data. Finally, the Layer Attributer and DigSym tools enable features to be automatically attributed as they are drawn. The standard symbolization tool in ArcMap allows the user to see what information has been captured and check the attribution graphically.

DISASSEMBLING A TECTONIC PUZZLE: TOWARDS A REVISED SUBDIVISION OF THE WESTERN CHURCHILL PROVINCE

talk

Pehrsson, S. and the Western Churchill Metallogeny Project working group

The western Churchill Province (WCP) is one of the largest yet most poorly known cratons of the Canadian Shield. First regionally explored as part of the Geological Survey's helicopter reconnaissance programs of the 1950's and 1960's, it was defined by Stockwell (1962) as a province of Archean and Paleoproterozoic domains that had been severely deformed and metamorphosed during the Hudsonian (Trans-Hudsonian) orogeny. Targeted regional mapping continued through the 1970's and 1980's and culminated with preliminary subdivisions (Heywood and Schau, 1978; Eade, 1985; Lewry et al., 1985), which recognized a NE-SW trending limit of 'Hudsonian' reworking stretching from Chesterfield Inlet to Lake Athabasca. Hoffman's 1990 subdivision of the Churchill established the Archean Rae and Hearne Provinces, separated by the Snowbird tectonic zone (STZ). This major geophysical feature has been interpreted both as a Paleoproterozoic suture (Gibb and Walcott, 1982; Hoffman, 1990; Ross et al., 1991) and an intracontinental accommodation fault (Hanmer et al., 1995).

Ongoing and recent studies have established new subdivisions of the existing provinces and multiple phases of Paleoproterozoic reworking. The Archean Rae domain is characterized by major crust formation events in the 2.75-2.58 Ga range, but with widespread U-Pb and Sm-Nd isotopic evidence for incorporation, assimilation or erosion of 3.4-2.85 Ga crust. Zircon inheritance and Tdm patterns on pre-2.6 Ga rocks suggest a crustal age zonation perpendicular to the NE-trending regional structure grain. This zonation, along with evidence that the pre-Trans

Hudsonian structural trends were also NW-SE, supports subdivision of the central Rae into distinct northeastern and southwestern domains. The southwestern domain is further differentiated by virtue of older and presently more widespread Mesoarchean crust, a lack of Archean komatiite-quartzite sequences, and a regional 1.9 Ga high pressure metamorphic reworking. The western Rae is characterized by Paleo- to Mesoarchean Queen Maud and Taltson basement blocks, which are apparently separated from the central Rae blocks by major shear zones.

The Archean Hearne domain has been subdivided into the northwestern and central Hearne subdomains on the basis of crust formation ages, crustal contamination and tectonothermal reworking. Isotopic data from supracrustal and plutonic rocks again suggest a crustal age zonation, with evidence for older crust involvement in the genesis of the northwestern and southern Hearne, but little or no evidence for older crust in the central Hearne. Whether the Rae, northwestern Hearne, and central Hearne have been intact since the Archean (as a telescoped continent-transitional margin--oceanic domain) or the central Hearne was accreted in the Paleoproterozoic (possibly as a microcontinent of Superior Province vintage) remains to be tested.

The WCP's long history of Paleoproterozoic reworking between 2.5-1.8 Ga owes much to its situation in an upper plate setting between two major, but markedly different Paleoproterozoic orogens. Crustal thickening, attendant metamorphism and/or magmatism characterized two early domainal reworking events at 2.55-2.5 and ca. 2.3 Ga, possibly related to collisional orogenesis. The 1.99-1.93 Ga Taltson-Thelon orogen produced a comparatively narrow tectonothermal overprint on the western margin of the Rae, with focused magmatism and limited supracrustal basin formation. Trans-Hudsonian, 1.88-1.80 Ga reworking, in all its manifestations, extends 1000's across strike and was associated with abundant magmatism and sediment accumulation in a variety of foredeep to foreland-related settings. This broader overprint appears to reflect stronger plate coupling induced by shallower subduction during the Trans-Hudson orogeny.

RETROSPECTIVE OF DIAMOND EXPLORATION AT THE HARDY LAKE PROPERTY, LAC DE GRAS REGION, NORTHWEST TERRITORIES, CANADA

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2. Scott Smith Petrology, Vancouver, BC
3. Majescor Resources, Montreal, QC

talk

Twenty-four kimberlites were discovered on the Hardy Lake property since 1992 using sediment sampling, till geochemistry, geophysics and drilling.

The classical heavy mineral anomaly obtained from till samples on this property is characterized by short linear trains 100 to 200 m wide, two to three km in length, aligned parallel to the NNW and WNW ice directions.

The mineral dispersion trains at Hardy Lake property are controlled by the following factors: (i) Type of kimberlite (e.g. crater facies, hypabyssal kimberlites) (ii) Abundance and grain size of indicators in the kimberlite and in the till cover (iii) The size of the intrusion and its topographical location (e.g. on lakes, on land) (iv) Glacial history and type of glacial sediments sampled.

The entire property has been covered using detailed airborne magnetic and electromagnetic (EM) surveys at 75 m and 100 m line spacing. Targets selected from the airborne surveys were followed-up using ground geophysical surveys (mag, HLEM). Ground gravity and ground penetrating radar (GPR) techniques have also been used to follow-up targets not resolved by the other geophysical methods.

The twenty-four Hardy Lake kimberlites can be subdivided into two major groups with distinct geophysical signatures.

The hypabyssal kimberlites generally have strong magnetic low signatures without electromagnetic responses. This type of kimberlite occurs as small pipes or sheet-like bodies (0.1 to 0.4 ha) and is composed of macrocrystic and sparsely macrocrystic magmatic kimberlite (HK).

The Crater Facies kimberlites can have a neutral, very weak low or high magnetic signature with electromagnetic response. The crater facies kimberlites are pipes and are relatively larger than the hypabyssal kimberlites (0.3 to 4.0 ha). The crater facies kimberlites are composed mainly of resedimented volcaniclastic kimberlite (RVK) with minor pyroclastic kimberlite (PK) and hypabyssal kimberlite facies (HK).

From the 19 intrusives tested for micro diamonds 17 returned positive results. Drill core samples from other three occurrences discovered in 2003 are currently being tested for micro diamonds by Majescor.

At Hardy Lake property, systematic changes in the major and trace element mineral chemistry of the kimberlites suggests that the kimberlites in the south portion of the property have sampled deeper lithosphere inside the diamond stability field.

The potential to find new kimberlites in the property is still significant based on the presence of several unexplained mineralogical /geophysical targets.

The largest pipe discovered on the property (Jack Pine kimberlite 4.0 ha) and other selected kimberlites of interest also require further investigation to better evaluate their diamondiferous potential.

UPDATE ON THE SLAVE PROVINCE MINERALS AND GEOSCIENCE COMPILATION AND SYNTHESIS PROJECT

poster

Peter, J.[1], Hall, B.[1], Bleeker, W.[1], Lynds, T.[1], Kerr, D.[1], Davis, B.[1], Ernst, R.[1], Buchan, K.[1], Hulbert, L.[1], Thomas, M.[1], Peterson, T.[1], Wright, D.[1], Anglin, L.[2], Knight, R.[1], Falck, H.[3], and Slave Province Minerals and Geoscience Compilation and Synthesis Project Team
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The "Slave Province Minerals and Geoscience Compilation and Synthesis" project is progressing through strong collaboration with federal and territorial governments. The goal is 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. Compilation work is progressing in the following areas: 1) bedrock geology (W. Bleeker), which is providing existing information in a 2) GIS database (T. Lynds), commencing in the north (sheets 76M, L, E, F, and G) (see Bleeker, 2004—this volume). This exercise is being conducted in concert with other compilations, and this multi-facetted approach has already shown to be effective in providing new insights into the history of the Slave Province (see Davis et al., 2004—this volume); 3) geochemistry, geochronology, and paleomagnetism of mafic dyke swarms (R. Ernst, K. Buchan) which is also obtaining new age and paleomagnetic data with the aim of interpreting the Proterozoic breakup history of the Slave province and extending the distribution of known dyke swarms; 4) geophysics (M. Thomas); 5) geochronology (B. Davis), which also includes new ages (see Davis et al.—this volume); 6) granitoid intrusion geochemistry (T. Peterson); 7) petrophysical properties (M. Salisbury); 8) surficial geochemistry and geology (D. Kerr) — a GSC Open File of till geochemical data will be published early next year, and the glacial striae data compilation is in progress; 9) mineral deposits (J. Peter, B. Hall) is progressing, with the first sheet completed (see Hall et al., 2004—this volume), and several others nearing completion; 10) EXTECH III results volume (L. Anglin, D. Wright, H. Falck; see Anglin et al., this volume) production is on target for publication mid next year. A nickel-copper-PGE deposit potential study conducted as part of the Slave project (L. Hulbert) has resulted in three new geological maps in GIS format of the Booth River Complex and the enclosing Kilohigok Basin: Booth River North (1:20 K), Booth River South (1:20 K) and the Kilohigok Basin(1:250 K) that also have accompanying geophysical, DEM, LandSat 7 imagery and airphoto mosaics. Geochemical analyses and tracer isotope studies are in progress. Detailed electron microprobe investigations, bulk compositions, and assays show that the Fe-Ti oxide-rich layered sequence is moderately fractionated, with the adjacent marginal zone being less fractionated and consequently a better target for Ni-Cu-PGE exploration. A new 1:50 K geological map of the Muskox intrusion, its "feeder dyke" and associated Ni-Cu-PGE mineralization, and a geochemical and Nd-Sr-Pb isotope investigation of the Franklin sills along the Coronation Gulf demonstrates that these intrusions have experienced little crustal contamination and are poor targets for Norilsk-type deposits. This work corroborates earlier findings suggesting that the extremely contaminated Franklin ultramafic-gabbro sills on Victoria Island are favorable exploration targets. Additional information on the Slave Province Minerals and Geoscience Compilation and Synthesis Project can be found on the following web site (R. Knight): http://nrd.nrcan.gc.ca/slavecomp/

POCKET PC'S AND FIELD DATA COLLECTION: A 2004 UPDATE

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poster

In an effort to increase efficiency and lessen the workload on field geologists, Compaq's iPAQ Pocket PC (PPC) running ESRI's ArcPad software was adopted as a tool in 2001 to collect digital field data in the NWT. Since that summer, the NWT Geoscience Office (NTGO) has kept current with advancements in the system, which has evolved on both the software and hardware fronts.

Initially, the ArcPad software used simple forms for data input. Since then, software developments such as the Application Builder have considerably improved the functionality of data collection. With this program, code can now be integrated with the forms to reduce the time needed to enter data; this can include defining defaults, incrementing values, and "remembering" the last value entered.

Hardware enhancement has involved not only faster processors, larger RAM capacities, and increased battery efficiencies; but also the addition of Secure Digital (SD) and Flash Cards that now come standard on the PPC. These high-capacity memory cards can be loaded with several georeferenced image datasets (e.g., air photographs, regional magnetic data, satellite images, existing geology maps, and mineral showings), which are viewable within ArcPad. The addition of the memory card slots to the PPC has also dramatically increased the available accessories, such as a GPS or camera that can be added to the mapping tool. The PPC's major limiting factor, however, remains the capability of the CPU. But file size management, such as compressing and/or trimming images and feature datasets, and limiting the number of files open at one time in ArcPad makes this manageable.

Advancements in humanware have also progressed to the point where the level of user comfort generates input in which the base schema is easily customized. The regular involvement of the user works as part of an iterative process meant to fine-tune the tool to suit each mapper's specific project area and needs.

The PPC has proven to be a valuable regional mapping tool. In addition to data collection, it can serve as a navigational aid when linked to a GPS, and it allows access to a number of spatial datasets on the outcrop. However, the geological applications are not limited to regional mapping. ArcPad and the PPC are well tailored for the collection of point spatial data, and other applications could include stream sediment, soil, till, or rock sampling.

THE APLITIC DYKES OF THE CANTUNG MINE: PETROGRAPHY, GEOCHEMISTRY, AND RELATIONSHIP TO THE E ZONE OREBODY

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talk

The Cantung Mine, located in the Mackenzie Mountains of the Northwest Territories, is a world class W-Cu-Bi-Au skarn deposit. The pyrrhotite-scheelite-chalcopyrite skarn is underlain by a flat-topped mid-Cretaceous monzogranite stock that intruded a folded argillite-carbonate sequence at a depth of 6.6-12.7 kilometres. Abundant aplitic dykes that are less than a metre thick and have an irregular geometry, crosscut the underlying intrusion and country rocks along pre-existing fractures, and are concentrated near the orebody and the upper margin of the main intrusion.

The aplites display a variety of grain sizes, textures, age relationships and have both steep and shallow attitudes. These characteristics may reflect cyclicity within the local stress regime during the injection of the dykes. Dykes that follow orientations similar to those of the major, low-displacement, normal faults at Cantung exhibit higher degrees of strain indicating that the faults were still active during and after the injection of the aplites.

Geochemical analyses have demonstrated that the aplites have fractionated to an extreme degree with respect to the underlying pluton. A large magma body crystallizing slowly at depth, with a highly fractionated, residual melt may be the source of the aplites and metal-enriched mineralizing fluids.

A variety of overprinting alteration styles have modified the dykes, from relatively unaltered with local albitization, to potassic, to calcic, and to sericitic, reflecting an overall decrease in the temperature of the late fluids. Only the aplites that have undergone calcic (+/- sericitic) metasomatism are observed to be in direct contact with mineralized host rocks, and these are the only aplites that contain abundant scheelite, either pervasively or along fractures. The calcium enrichment in these aplites may be due to a fluid gradient between a crystallizing aplite and a separate fluid phase enriched in incompatible elements, volatiles, and ore metals interacting with the calcareous country rocks. Therefore, the recognition of dykes that have undergone calcic metasomatism may be important in delineating former fluid pathways and may aid in future exploration at the mine and in similar deposits.

UNIVERSITY OF ALBERTA - NWT GEOSCIENCE FIELD SCHOOL: HANDS-ON TRAINING FOR THE NEXT GENERATION OF GEOLOGISTS

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2. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB

talk

Enrollment trends in earth science departments across Canada over the last decade record a decline in undergraduates in geology programs that, if continued, will create a critical shortfall of geologists in a decade's time. In contrast to this trend, demand for qualified geologists is high: global demand for base metals is increasing, energy supply is high on governments' agendas both federally and at the provincial/territorial levels, and here in the North, exploration activity is a cornerstone of the economy. Additionally, demographics within geological surveys and universities across Canada reflect an aging population that will see a significant portion retire over the next 10-15 years. One way to attract and retain students to fill these gaps is to provide hands-on training and to engage them in field-based studies that will capture their interest and provide opportunities for independent research.

For the past two summers, the University of Alberta's Earth and Atmospheric Science Deptartment (EAS) in partnership with the NWT Geoscience Office (NTGO) has run a two-week field-based bedrock mapping course in the Slave Province. The course is offered to six 4th-year undergraduates, and provides them with experience in field data collection and compilation, as well as exposing them to the logistical realities of field work in the North. To date, the course has been based in a different area each summer, where the geologic setting is known, but existing bedrock maps need upgrading. The advantage of this approach is that the mapping project makes a real contribution to NWT's knowledge base, rather than being solely a "cookbook" mapping exercise for academic credit.

Area selection and logistics for the course are coordinated by NTGO. In 2003, the class was based out of an NTGO camp on Germaine Lake in the southwestern Slave Province, and was an add-on to an ongoing government bedrock mapping project. In 2004, Diavik Diamond Mines Inc. generously provided their exploration camp on Lac du Sauvage as a base for the course. Grading for the course is based on both performance in the field, and on a final report submitted during the fall term. In addition to the field course, each year a number of students have undertaken undergraduate theses on various aspects of the geology ranging from metamorphic petrology to U-Pb analyses of baddeleyite. These studies are a spin-off benefit for NTGO and its clients, as they add to the publicly-available information base on NWT's geology.

This field school is, to our knowledge, unique in Canada and adds a dimension to EAS's curriculum that would be difficult without the partnership of NTGO. The benefit is mutual, as it provides an opportunity for NTGO to identify excellent candidates for future graduate studies and/or employment. Our long-term intent is to continue to offer the course in much the same way, providing new map areas and unknown challenges to each class.

Diavik Diamond Mines Inc. and Aber Diamonds are thanked for their support for the 2004 field school.

NEW INSIGHTS INTO THE GEOLOGY OF THE LAC DU SAUVAGE AREA, NWT

poster

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In late August/early September 2004, fourth-year undergraduate students from University of Alberta's Department of Earth and Atmospheric Sciences undertook a 2-week bedrock mapping course in the central Slave Province. The map area straddles NTS sheets 76D/09 and 76C/12 in the Lac du Sauvage – Lac de Gras region, and is underlain by steeply-dipping metagreywackes of the Yellowknife Supergroup, intruded by late Archean granitoid rocks and cut by diabase dykes. Extensive till cover masks contacts and makes cross cutting relations difficult to determine. Publicly-available georeferenced images of industry aeromagnetic maps were available to aid with mapping, although it was found that the signal from diabase dykes overwhelmed other bedrock responses, rendering the images of little value in interpreting bedrock geology.

Metamorphic minerals in pelitic beds include biotite, cordierite, andalusite ± sillimanite ± muscovite, indicating mid-amphibolite facies conditions. A number of outcrops preserve both strongly flattened (plan view) and near-euhedral porphyroblasts of the same mineral, and andalusite was observed both as cores within and rims on cordierite. These observations together suggest two generations of porphyroblast growth, possibly resulting from multiple pulses of heat during granite emplacement. Fabrics in the metagreywackes include bedding (S_0), an early foliation preserved as inclusion trails within porphyroblasts (S_1), and a foliation defined by micas and flattening of porphyroblasts (S_2). The latter is associated with steeply, and variably, plunging isoclinal folds.

Although the most recent compilation map subdivides late Archean monzogranites into two units (a Kspar-phyric biotite monzogranite and an equigranular two-mica monzogranite), outcrop-to-outcrop variations in composition and texture within the study area did not support these subdivisions. Consequently, we have grouped all monzogranites into a single map unit that includes these two phases, and documented spatial variations in accessory mineral assemblages (biotite, muscovite, apatite, tourmaline, sillimanite) and texture (porphyritic vs. equigranular). The monzogranite, while generally massive in hand sample, contains a pervasive, undulating, sub-horizontal fracture foliation spaced 10 cm to several m's in outcrop. Locally, a penetrative foliation is present as well, defined by aligned biotite ± muscovite, or less commonly, biotite-rich schlieren. The two phases of monzogranite define flat-lying sills that parallel the fracture foliation, and in the Duchess Lake area, variations in composition correspond to elevation, with Kspar-phyric monzogranite occurring in topographic lows, and a two-mica phase defining hilltops. Given that these phases define interlayered, subhorizontal sheets exposed in an area with extensive till cover, it is easy to understand why subdivisions on the existing map do not stand up at a more detailed map scale.

Two additional, but volumetrically minor granitoid units in the area include a strongly foliated biotite tonalite and a leucocratic biotite granodiorite. The granodiorite occurs as minor sills within the monzogranite, while the tonalite appears to define a narrow lens which parallels the

steep foliation in the metagreywackes. Based on its strain state, the tonalite is interpreted as the oldest intrusive unit.

Diabase dykes with five distinct orientations were mapped and sampled in the study area. These rocks are the focus of a petrologic study by M. Patterson (this volume).

GEOSCIENCE EDUCATION IN NUNAVUT – PARTNERS AT WORK

Riveros, C.P.
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talk

Mineral resource development has great potential for the long-term economic development and sustainability of Nunavut. Therefore, government and public institutions are working together to increase public appreciation for geoscience and other sciences throughout the territory to ensure that Inuit are ready to benefit from that huge development potential, and several initiatives have been undertaken. The Department of Education is developing science school curricula using principles of Inuit traditional knowledge and geoscience. A regional school operation coordinates a Science Educators Community, a non-profit group that has been delivering programs to youth in the Kivalliq region since 1992. Programs include regional science fairs, Kivalliq science awards, SET Challenge as part of the National Science and Technology week, and science/culture camps. Since 2001 the Department of Economic Development and Transportation has delivered the High School Math and Science Awards Program. That department has also partnered with the Prospectors and Developers Association of Canada to deliver Geoscience Teacher Workshops. The recently formed Nunavut Science Outreach Network sponsored by the department aims to make science a more relevant and positive experience for Nunavummiut and to act as a "one-stop-shop" for science public information in Nunavut. The department also offers an Introductory Prospector Course that aims to develop Nunavut's grassroots exploration capacity by building on Inuit's innate wisdom of the land. Since 1999, approximately four hundred prospectors have graduated from the course, from which many have staked claims and several have negotiated deals with companies. Since 2002, Nunavut Tunngavik Inc. has offered programs that focus on subsurface Inuit Owned Land evaluation. The Inuit Earth Sciences Student Assistance Program has helped hire eleven high school students as field assistants. Six prospectors were hired through the Inuit Prospectors Assistance Program and a carver through the Inuit Carving Stone Development Program to evaluate carving stone potential. Through the Inuit and University Geoscience Partnership Program, five undergraduate and two graduate students from the University of Waterloo have been hired to conduct fieldwork. The Department of Indian and Northern Affairs Canada sponsors an annual Northern Mining Week promoting the public's exploration of their surrounding landscape and the role of mining and minerals in everyday life. Initiated in 2003, the Nunavut Mine Training Partnership represents industry, federal and territorial governments and Inuit regional training bodies. The group coordinates, develops, and delivers training to address the employment needs of the mineral industry in Nunavut. Through these initiatives, schools, government departments, Inuit organizations and community groups are working together to increase Inuit involvement in geoscience and ensure Inuit participation in this fast growing economy.

EMERALD, RUBY, SAPPHIRE EXPLORATION IN CANADA AND GREENLAND 2004

talk

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Emerald was discovered at Regal Ridge in the Finlayson district of the Yukon Territory in August 1998 by geologist Bill Wengzynowski. Regal Ridge is a metamorphic-hydrothermal emerald deposit. Emerald occurs widely within a swarm of aplite dikes and quartz-tourmaline-scheelite veins which cut mineralized chlorite schist of the Devonian age, Fire Lake formation. Emerald is found at the surface on Regal Ridge over an area measuring 1500 meters by 400 meters, across an elevation range of 200 meters. A second occurrence, now measuring 300 meters by 100 meters, and located one kilometer to the southwest, was discovered in 2004 on Howdy Ridge. Both emerald occurrences flank a Cretaceous-age, two-mica granite, roughly 500 meters above the intrusive contact.

Core drilling completed in 2004 by True North Gems on their 21 square kilometer property elevates the total test of the emerald deposit to 73 holes for 4552 meters. Emerald has been intercepted in drill core. Soil sampling completed in 2004 now brings the total to 3000 samples. Emeralds are coincident with strong, stacked anomalies in Cu, W, Be, Sn, and F. The same elements are strongly enriched within the emerald host-rock intercepted in core. Mini-bulk sampling in 2004 totalled 642 tonnes from the surface, recovering 26.097 kilograms of total beryl. In all, 2589 tonnes have been mini-bulk sampled.

The Beluga sapphire deposit, in the Kimmirut district of Nunavut Territory, was discovered in November 2002 by prospectors Nowdla and Seemeega Aqpik. Sapphire occurs as a late-metamorphic hydrothermal replacement in blocks of metapelite within marble melange. Six outcrops of gem-quality sapphire have been located on True North's 9.9 square kilometer property. In 2004, True North Gems collected a 5 tonne mini-bulk sample at the main sapphire showing, extracting a continuous mineralized block measuring 2.3 x 2.4 x 0.4 meters. Geologic mapping indicates the sapphire-rich zone has a very shallow dip to the northwest, and is continuous at the surface for a minimum distance of 30 meters on strike by 3 meters in width by at least 1 meter in thickness. Float surrounding the exposure expands the overall target dimensions to 70 x 25 x 2 meters.

Rubies at the Siggartartulik deposit in Greenland occur as metasomatic replacements in the Upper Leuco-Gabbro unit of the Fiskenaesset anorthosite complex, a layered intrusive body of Archean age (2.86 G.a.). Rubies are found adjacent to a network of anorthite - quartz pegmatites, which formed during regional, retrograde amphibolite metamorphism. Pegmatites, and metasomatic alteration are exposed intermittently along a 1.2 kilometer strike length of favorable prospective contact between the anorthosite and amphibolite. In 2004, True North Gems investigated six ruby occurrences, originally discovered in the 1950's, on their 104 square kilometer property at Fiskenaesset. The four cutting sites comprising the 3-tonne mini-bulk sample at Siggartartulik test the ruby mineralization along a continuous strike length of 120 meters.

CANADIAN GEOSCIENCE KNOWLEDGE NETWORK

poster

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The Canadian Geoscience Knowledge Network (CGKN) is a cooperative network of federal, provincial and territorial geoscience agencies aimed at providing Canadian geoscience information via the Internet. The CGKN works towards the establishment of common standards and tools to enable access to geoscience data.

CGKN.net is the portal for access to geoscience data and knowledge across Canada. The website provides an extensive on-line catalogue of maps, publications, data and reports produced by CGKN participating agencies.

For more information about CGKN, contact us at info@CGKN.net or visit http://CGKN.net

RESULTS OF BEDROCK MAPPING OF THE DARBY LAKE (NTS 56N) - ARROWSMITH RIVER (NTS 56O NORTH) MAP SHEETS: NEW CONSTRAINTS ON THE REGIONAL GEOLOGY OF THE CENTRAL RAE DOMAIN, NUNAVUT

talk

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The Darby Lake and Arrowsmith River areas, ESE of Chantrey Inlet in north central Nunavut, lie immediately north of the recent Committee Bay Geoscience Project area. Mapping in 2004 provides scientific continuity and a seamless link with the forthcoming Boothia Peninsula Project in areas north of 68° latitude. Similarly, concurrent independent research utilizing a number of NW-trending helicopter transects will attempt to link the current map area westward, up to 300 km into the Queen Maud Block.

Regional, 1:250 000 scale bedrock mapping permits subdivision of the study-area into three NE-striking lithotectonic domains: a NW tonalite domain; a central gneissic monzogranite domain and; a SE foliated biotite monzogranite domain. The NW domain is dominated by biotite±hornblende tonalite, grading locally to granodiorite. Preserved supracrustal keels and associated rafts/xenoliths contain the assemblage biotite±garnet±andalusite±cordierite in metasedimentary rocks and actinolite-chlorite schists in the mafic volcanic rocks. Thin (<3 m) sulphidic silicate facies Fe formation occurring in semipelite, and associated with mafic volcanics and spinifex-textured komatiites, were noted. Stratigraphically and possibly structurally overlying is the elongate, ENE-trending syncline of the Chantrey Group, a sequence of predominantly clastic metasedimentary rocks inferred to be Paleoproterozoic in age.

The central domain is dominated by a range of granodiorite to monzogranite, which both intrude and contain sparse tonalite, abundant screens, rafts and schlieren of biotite±sillimanite±garnet

bearing metasedimentary rocks and co-spatial metatexites to diatexites. Roughly coincident with regional aeromagnetic and bouguer gravity highs is a suite of biotite±garnet potassium feldspar megacrystic granodiorites that have been observed to grade laterally into biotite±orthopyroxene±garnet charnockites.

The SE domain contains dispersed remnants of supracrustal rocks intruded by biotite monzogranite and megacrystic biotite monzogranite. The supracrustal sequences are dominated by psammite and semipelite, rarely at amphibolite grade. Massive to weakly foliated biotite-magnetite monzogranite, occurring as sheets and dykes along the southern margin of the central domain correspond to discreet magnetic highs and are inferred to be Paleoproterozoic in age (ca. 1820 Ma).

Excluding greenschist facies supracrustal rocks in the far north and NW, rock-types and preserved structural elements are inferred to be generally correlative with the higher grade assemblages observed in all the Committee Bay map sheets. Although a few unambiguous D1 (>2350 Ma) structures were observed, the main regional, tight to isoclinal F2 folds in supracrustal rocks, and varying to rare open F2 folds in the intervening granitoids, are likely Paleoproterozoic in age. The three domains outline a NW-SE variation across the map area whereby the lower granulite facies charnockitic granitoids occur in the central domain and appear along the central SW-NE axis of the map area. These charnockitic granitoids likely represent a mid-crustal structural culmination axial to the trace of large-scale Paleoproterozoic folds of the crust.

NWT GEOSCIENCE OFFICE COMMUNITY OUTREACH PROGRAM: COMMUNITY MAPPING PROJECT

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The NWT Geoscience office has an active Outreach program that provides geological information sessions to local schools, communities and interest groups. Geologists participate in educational initiatives ranging from science fairs, Skills Canada workshops, rock walks and Mining week activities and project geologists are encouraged to speak to community members about their field programs. As well, for the past two years, two field-based educational programs were delivered by the NWT Geoscience Office – one at a university level field school, the other, a community mapping project.

The Community Mapping Project for 2004 took place in Gameti, NWT as a joint venture with the Gameti First Nation band. The purpose of the mapping program is to foster an interest in geology on a local level within the community as well as familiarize people with the nature of work done when bedrock mapping. The end product is a poster that focuses on the geology, landforms, historic sites and other areas of interest described by the community. This poster is designed for the community, about the community – in an effort to encourage a general increase in interest in geology as well as providing an educational tool for teachers.

Consultations with the band office and community members are an integral part of the program. The band itself hired the geological assistants and guide to work on the project. Open houses were held in the community during the mapping project to share the information being gathered and people were encouraged to bring their questions forward and add their knowledge to the project. These sessions also provided an opportunity for people to ask questions on exploration/mining and mineral resources.

The project involved teaching basic geological mapping skills, rock and mineral identification, compass traverse, sample collection, GPS usage, digital photography, GIS basics to two local assistants, as well as identifying landforms and glacial features. As part of the fieldwork, 3 days were spent installing a teleseismic station as the team worked with a POLARIS (Canadian geophysical research consortium) crew.

The information poster consists of a geologic map, descriptive notes and photographs assembled in consultation with Gameti community members. This winter the completed poster will be delivered to the community at an information session and talks will be arranged at the school for the students and teachers. The poster and information on the mapping program is posted on the NTGO website. Graphics, text and html files related to the project will be supplied to Gameti for their website.

By providing hands on experience it is hoped that this will foster an interest in careers in science and technology. The increased knowledge of some of the aspects of geology, mineral resources and the exploration/mining business can serve as background information in making land use decisions.

BENEFITS AND CHALLENGES IN COMPARING MINERAL OCCURRENCES FROM THE NORTHWEST TERRITORIES WITH MINERAL OCCURRENCES FROM THE REST OF CANADA

Smyth, C.P.
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talk

Mineral occurrences around the world are compared for many beneficial reasons, amongst them being (a) to learn about the mineral occurrences being compared, (b) to learn about the areas in which they occur, and (c) to recognize classifications of mineral occurrences or mineral occurrence regions that are useful for exploration, exploitation, and remediation purposes.

Challenges in comparing mineral occurrences arise from many sources, amongst them being (a) variations in the field experience of those documenting mineral occurrences, (b) variations in the digital or paper framework within which the documentation is expressed, (c) variability in the terminology used in different descriptions or systems, and (d) variable levels of development of mineral occurrences, which range from no development to many years of mining.

The Northwest Territories NORMIN mineral occurrences database currently holds 4515 records in a high quality carefully designed Oracle database. It is made accessible to the public through two sophisticated, yet easy to operate, Internet interfaces - one text-based, and one map-based.

It is nevertheless a time-consuming task to use the database for the purposes described above, particularly when they involve expertise or experience derived from outside the Northwest Territories. For example, a geologist with experience working on the Brook Pond deposit in Newfoundland may wish to examine all mineral occurrences in the NWT which are similar to Brook Pond. This would entail a number of iterations through the NORMIN query interface, which would yield lists of mineral occurrences needing to be ranked in terms of their similarity to Brook Pond before the better matches are evaluated in detail.

Because such comparisons are so time-consuming under current circumstances, they are not carried out very frequently, and, as a result, their benefits are enjoyed neither by the NWT, nor by geologists or companies working in, or considering working in, the NWT.

Work has therefore begun on the transformation of parts of the NORMIN database into a format and terminology which is interoperable with mineral occurrences from British Columbia, Newfoundland, New Brunswick and a number of other regions inside and outside Canada – as well as with mineral deposit models from a number of respected geological institutions.

Challenges of this work include (a) the mapping of controlled but non-standardised terminology to terms taken from internationally recognized standards for terminology – which can be automated, (b) the extraction and mapping of terms from free-format data fields – which is not cost-effectively automated, and therefore carried out by a geologist, and (c) the selection of which mineral occurrence attributes should be included in the transformation, and which can reasonably be left for later retrieval from the (non-standard) source database.

KIMBERLITE TRENDS AT THE SURFACE AND AT DEPTH

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2. BHP-Billiton Diamonds Inc., Kelowna, BC

talk

Although the focus of much study as the host rock for diamonds, the emplacement mechanisms and structure of kimberlite deposits remains only poorly perceived. Recent application of geochronological and seismic techniques to the Lac De Gras kimberlite field that is home to the world's newest diamond mines in NW Canada revealed unexpected correlation in structural trends. The best fitting patterns for the variation in SKS splitting delay times for the Lac de Gras teleseismic stations are consistently those of two horizontal layers. The fast axis of each lower layer trends 045-050º and delay times are 0.9-1.0 seconds. Upper layers show greater variability; beneath the Ekati Diamond Mine, the fast axis trends 012º with a delay time of 0.45 seconds. At depths of about 120 km, the radial component of receiver functions from this same station has

maximum amplitude at 285-290º and the transverse component at about 320º; together these indicate a horizontal symmetry axis for hexagonal anisotropy at 108/288º and an associated fast axis at 018/198º. The 120 km depth is the top or bottom of the mantle layer containing this anisotropy; the large maximum amplitudes observed suggest it is here the bottom of the upper layer. Precise ages of over 40 kimberlites in the Lac de Gras field are constrained using standard Rb/Sr and U/Pb isotopic dating techniques correlated with a local geomagnetic polarity timescale indicate that one kimberlite group erupted from 75 to 64 Ma along a generally east-west (100-110°) trend. Another 58.9±1.2 Ma group has a similar trend, whereas younger 55.4±0.5, 53.2±0.3 and 47.5±0.5 Ma clusters show tighter grouping along northeast (37-45º) trends. The inferred age and direction of trends at both the surface and at >120 km depth suggests that kimberlites erupt along fractures controlled by continental stress fields related to global plate motions. This provides important clues about where to search for additional diamond deposits, but also about past plate motions.

SLAVE2BEAR PROJECT: A MAGNETOTELLURIC TRANSECT FROM THE SLAVE CRATON TO THE BEAR PROVINCE ACROSS THE WOPMAY OROGEN

talk

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A magnetotelluric (MT) project was initiated in July, 2004, as a contribution to C.S. Lord's Western Slave Study. The first phase (July, 2004) comprised float-plane deployed MT instrumentation at a total of 21 locations along an approx. 300-km-long WNW-ESE profile from the south-central Slave craton to the Bear Province crossing the Wopmay Orogen. Broadband MT (BBMT) data were recorded, over two night intervals, at all sites yielding regional-scale information about the resistivity structure of the crust and uppermost mantle. At six sites spaced equally along the profile an attempt was made to try to record long period MT (LMT) data using equipment installed for the whole month of July. However, ambient curious wildlife, especially at one site, resulted in recovery of useable data at only five of them. To date processing is almost complete of the BBMT data, but some minor problems due to strange equipment function still need to be resolved. Nevertheless, from these BBMT data we are able to derive a preliminary regional-scale two-dimensional (2-D) model of the crust and uppermost mantle. The features in this model that we consider robust, in that they are unlikely to change after completion of processing and modelling, are the following:

1) The upper mantle at depths of 80-140 km beneath the eastern part of the profile under the Slave craton does exhibit reduced resistivities (approx. 1000 ohm.metres), but is almost two orders of magnitude less conducting then the anomalous region observed beneath Lac de Gras and named the Central Slave Mantle Conductor by Jones et al. (2001, 2003). Thus we conclude that the CSMC does not extend into the western Slave.

2) There is significant upper crustal conductivity observed at sites in the middle of the profile. This anomaly is within the conjectured boundaries of the Slave craton, and not within the Wopmay Orogen.

3) The bulk of the crust within the Wopmay Orogen is anomalously resistive, compared to Paleoproterozoic orogens worldwide. The lowermost crust displays reduced resistivities of 1000s ohm.metres.

4) Other than these features, the mantle lithosphere is highly resistive, with resistivities of tens of thousands of ohm.metres, consistent with Ol-Opx-Cpx mineral assemblages without any interconnected conducting phase.

DIAMONDS FROM THE CRISTAL AND GENESIS VOLCANICS, WAWA AREA, ONTARIO

talk

Stachel, T.[1], Blackburn, L.[1], Kurszlaukis, S.[2], Barton, E.[3], and Walker, E.C.[4]
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3. De Beers Geoscience Centre, Southdale, South Africa
4. Petrologic Inc, Lakefield, ON

The Wawa area of Ontario holds some of the oldest diamond deposits in the world, with comparable ages only being observed for the diamondiferous gold-bearing sediments of the Witwatersrand Basin in South Africa (3.0-2.8 Ga). We studied diamonds from two outcrops of mantle-derived ultramafic volcanics (Genesis and Cristal) on the Festival property of Pele Mountain Resources. U-Pb dating of zircons from Genesis indicates an emplacement age of 2744 ±43 Ma. The absolute age of the ultramafic rocks at Cristal is unknown but from field relationships emplacement prior to Genesis is evident.

The diamonds from the two occurrences are dramatically different. At Genesis, where 57 diamonds in the size range 1.7-0.3 mm were studied, the crystals are almost exclusively cubes, including some fragmented, twinned and moderately resorbed cubes. The cube faces are often slightly concave ("reentrant cubes") and may display fine textured tetragons. About 5% of the Genesis diamonds show extensive dodecahedral resorption, 10% classify as irregular crystals. Most (about 2/3) of the cubes contain clouds, the fully transparent stones are dominated by browns of variable intensity followed by colorless and, in the case of one diamond, yellow coloration. Nitrogen concentrations range from below detection (i.e. <10 ppm) to 600 atomic ppm. Nitrogen aggregation, measured as the relative percentage of nitrogen in the fully aggregated B-center, is very low (0 to 11 %B). Because of such poor nitrogen aggregation, Type IaA cube diamonds in kimberlite pipes elsewhere are often interpreted to reflect a late stage of diamond formation penecontemporaneous to emplacement.

From Cristal we examined a total of 270 diamonds ranging from 3.0-0.5 mm in size and selected 45 diamonds for further analytical studies. Morphologically the diamonds from Cristal range from un-resorbed octahedra to highly resorbed dodecahedra. Overall, octahedral and mildly resorbed octahedral diamonds dominate. About 25% of the samples from Cristal are irregular crystals (mainly broken diamonds, some aggregates and highly irregular shapes), macles (octahedral twins) are common (ca. 15%) and about 5% of the diamonds have minor {100}

faces, i.e. represent cubo-octahedral growth. Half the diamonds are colorless, the rest covers a range from very light to intense brown coloration. Nitrogen contents range from <10-560 ppm, but with only one exception nitrogen is ≤170 ppm. Nitrogen aggregation varies between 0-97% B-centre. A cluster of diamonds with low nitrogen contents but high aggregation states implies high mantle residence temperatures (approximately 1250-1300ºC), suggesting the diamond sources for Cristal extended to unusually great depth. Thirty four mineral inclusions were recovered from Cristal diamonds, the majority being colorless (olivine), plus some pyrope garnet and Mg-chromite. This inclusion paragenesis indicates a "normal" lithospheric peridotitic source. A high chromium signature (8-14 wt% Cr_2O_3) of the pyrope garnet inclusions also implies typical, depleted lithospheric sources. However, the garnet inclusions contain a small majorite component which is further evidence for formation at unusually high pressures (ca. 8 GPa). Accordingly, the primary volcanic host rocks of the Wawa diamond deposits cannot be related to the younger Wawa lamprophyres emplaced during and after of the Kenoran orogeny, but must belong to a more primitive suite of rocks capable of sampling diamondiferous lithosphere to a depth of at least 250 km.

YELLOWKNIFE GEOSCIENCE FORUM 2004 EXPLORATION UPDATE: CHURCHILL DIAMOND PROJECT, NUNAVUT

talk

Strand, P.[1], Thomas, E.[2], and Woad, G.[3]
1. Shear Minerals Ltd., Edmonton, AB
2. Stornoway Diamond Corp., Vancouver, BC
3. BHP Billiton Diamonds Inc., Vancouver, BC

The 8.5-million acre Churchill Diamond Project contains the newly emerging Churchill kimberlite district that was discovered in 2003 by Shear Minerals Ltd., Stornoway Diamond Corp. and BHP Billiton Diamonds Inc. During the 2004 summer field season the JV partners discovered another 6 new kimberlites bringing the total kimberlite discoveries on the property to 22 bodies.

To fast track this project the JV partners have put in place an aggressive multi disciplined program that is designed to locate the hard-rock source of high diamond potential indicator minerals recovered from till samples on the property.

Geographically the Churchill Diamond Property is located between the communities of Rankin Inlet and Chesterfield Inlet in the Kivalliq region of Nunavut, where exploration is facilitated using barge and rail access. Geologically the project is located within 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 where as systematic exploration for diamond bearing intrusives within the area has been limited to the last couple of years. During the mid 1990's narrow kimberlite dykes (192-214 Ma) intersected while drilling at the Meliadine gold deposit and the highly diamondiferous Parker Lake (Akluilak) dyke (1832 Ma), which was discovered by the GSC, and is 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 in 2003, and the GSC reported numerous kimberlite float occurrences throughout the Meliadine trend. These occurrences suggest that multiple kimberlitic sources of differing ages exist in and around the Churchill Diamond Property.

Since 2001, more than 2,700 microprobe confirmed diamond indicator mineral grains have been recovered from 738 till samples. Indicator minerals recovered include pyrope garnets, eclogitic garnets, chromites, ilmenites, chrome-diopsides and olivines. To date about 27% of all pyrope garnets are G10 sub-calcic pyropes from 183 samples and plot to the left of the 85% line defined by Gurney (1984). These samples are largely contained within four corridors approximately 15 km wide.

In addition to this the JV partners have isolated four main "*corridors*" of indicator minerals containing high diamond potential G10 pyropes. Using detailed airborne and ground based magnetic and EM data; regional and localized till sampling; and glacial interpretation and surface mapping the partners have now constructed a large data base to assist in prioritizing targets for drill testing within these "*corridors*" in 2004-2005.

This summer over 30 priority geophysical targets within the "*corridors"* were slated for potential drill testing between early fall 2004 and the spring of 2005. To date 11 targets have been tested and this has resulted in the discovery of 6 new kimberlitic occurrences as previously mentioned.

Between now and commencement of the new drilling season in the spring of 2005 the priority drill target list will be continuously updated as more data is returned from the laboratories and as the geophysical data is further processed and scrutinized.

The joint venture has put in place an aggressive $10 million budget for the 2004 season as part of a multi-year program aimed at discovering the source of the property's outstanding indicator mineral chemistry.

GEOLOGICAL COMPILATION OF THE SLAVE CRATON: PROGRESS REPORT

poster

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Stubley Geoscience Ltd., Cochrane, AB

This poster presents a progress snapshot of an ongoing project to compile the bedrock geology of the Archean Slave craton and parts of adjacent Proterozoic orogens, with final publication anticipated in April 2005. The interpretive compilation integrates data from variously-sourced geology maps with modern satellite and aeromagnetic data that was generally unavailable to the original mappers, and has resulted in generation of new data and reinterpretation of geological relationships. The compilation is maintained within ArcView GIS 3.2a, and is amenable to integration with other GIS platforms. All data is projected to Universal Transverse Mercator

Zone 12 using North American Datum 1983. The accuracy of geological relationships reflects the accuracy of the source data, and many areas are valid at scales of 1:30,000 to 1:50,000.

Bedrock types have been classified into 41 units with pan-Slave applicability, including 26 units for Archean rocks; approximately 9000 polygons (averaging ~ 27 km^2 for Archean rocks) have been individually assigned descriptive attributes. Linear features include faults, diabase dykes, and topographical lineaments, which together offer significant advances in the understanding of the Slave's crustal fracture systems. More than 8000 fault segments averaging about 6 km in length have been extracted from bedrock maps and interpreted from remotely-sensed imagery. Nearly 23,000 diabase dyke segments (mapped and inferred; averaging about 3 - 4 km in length) have numerical strike and length attributes, and are further classified by "swarm" name if appropriate. Point data includes kimberlite locations and U-Pb geochronological sample sites, each with abbreviated descriptions and citation information. Polygons delineating the areal extents of all data sources, with full citation details, form integral components of the database.

THE PRAIRIE CREEK CHALLENGE

Taylor, A.B.
Canadian Zinc Corporation, Vancouver, BC

talk

The Prairie Creek Property, 100% owned by Canadian Zinc Corporation (CZN-TSX), contains a significant mineral resource of lead, zinc, silver and copper and additional mineral potential on the property remains excellent. This presentation will review the geology of the deposit and provide an update on recent activities and future programs.

Located in the southern Mackenzie Mountains of the Northwest Territories, the Prairie Creek mine contains over $100 million of mine site infrastructure including a mill, office complex, shops, accommodations, mobile equipment and extensive underground workings.

Three distinct styles of base metal mineralization have been discovered on the property; Mississippi Valley-type cavity style (MVT), Vein-type (V) and Stratabound-type (SB).

MVT-type Zn-Pb mineralization is exposed in the northern portion of the property, hosted within a marginal carbonate sequence of the Root River Formation occurring within local biohermal reefs.

The V and SB-types occur within the Prairie Creek embayment feature, an ancient sedimentary basin, within a Siluro-Ordovician carbonate sequence. Presently 90% of the mineral resource reports to V-type where Pb-Zn-Ag-Cu is hosted in a crosscutting, steeply dipping, north trending fault structure which is axial planar to a doubly plunging regional anticline. Vein mineralization consists of sphalerite-galena-tetrahedrite-pyrite in a quartz-carbonate matrix cutting Ordovician age dolostones and graphitic shales of the Whittaker and Road River Formations.

The balance of the mineral resource occurs as SB-type massive sulphides, recently discovered proximal to and at depth to V-type mineralization. SB-type consists of sphalerite-pyrite-galena replacing, in substantial thicknesses, the local dolostone host. This style of deposit is found, so far, exclusively within the Upper Whittaker Formation dolostones. The close physical proximity of the V and SB-types may indicate a similar genetic origin however there are some significant differences in their nature.

The presence of similar stratigraphy and structure elsewhere on the property indicates a very prospective exploration corridor of over 16 kilometers in length. Numerous additional vein exposures are known to occur throughout the property and this in combination with Stratabound mineralization, which has been drill located in multiple zones south of the minesite, demonstrate the excellent potential for discovering additional resources. Discovery of additional mineral deposits will further compliment the already substantial mineral resource base established at the minesite.

The company continues surface diamond drilling exploration and evaluation of the main zone to further delineate the resource. Further work also continues on environmental studies, site rehabilitation, milling and engineering research along with community affairs. Regulatory Permitting continues to be a challenge and remains one of the largest consumer of the companys' time. The company is entering into its' sixth environmental assessment relating to six consecutive land use exploration permit applications.

The location of the Prairie Creek mineral deposit creates numerous challenges, however a mine is where you find it, Prairie Creek mine remains a unique opportunity.

FOLDING IN THE MACKENZIE MOUNTAINS: A NEW PARADIGM

Taylor, J.R.
Canadian Natural Resources Limited

talk

Superimposed folds are refolded folds; folds whose fold axes, or axial surfaces, have been themselves folded by younger folds. Superimposed folding is recognized in the Paleozoic sedimentary strata exposed in the Mackenzie Mountains of the Yukon and Northwest Territories.

In the Mackenzies, three types of interference patterns or hinge migration refolds may form depending on the geometry of the first generation folds, F_1, and on the convergent angle of later F_2 folds as they cross F_1 fold axes. Interference patterns are the outcrop configurations produced by the refolding of non-coaxial folds. Hinge migration is the mechanism of fold interference where folds cross at an oblique angle or are parallel or coaxial as described in the French Alps and in paraffin model experiments by Odonne & Vialon (1987).

Three cases are examined from exposures at Caribou, Merrill and Whittaker structures. F_1 folds are broad open folds that allow 'Type 1 - Dome and Basin' patterns to form when the planar F_1 fold limbs are cut at approximately 75-90 degrees by a series of later, low amplitude, closely

spaced F_2 folds. When F_2 fold axes intersect earlier F_1 fold axes at an oblique angle, less than 60 degrees, the resulting 'Type 0 - Oblique' fold interference gives rise to hinge migration accompanied by transverse movement along tear faults. When F_2 and F_1 fold axes are parallel, only a single fold axis direction is observed in outcrop and F_1 folds may become F_2 folds by 'Type 0 – Coaxial' hinge migration. In the cases where the fold axes cross at an oblique angle or are parallel, structural relicts of F_1 folds or F_1 fold segments may be preserved.

The contrast in style and orientation of the two generations of folds, although not absolute, may be clues to correlating structures. Orientation of bedding, fold axes and cleavage, if present, may or may not be diagnostic. Hinge migration means that the orientation of folds may not be used directly for correlating structures. Some classic interference patterns can be present in the same time as hinge migration. The transition from one type of interference structure to another is not sudden. In the Mackenzie Mountains the change in incidence angle of the F_2 folds compared to the F_1 fold axial trend is gradual from the 60-90 degree angle at the Caribou Syncline, through less than 60 degrees at the Merrill Anticline to coaxial at the Whittaker Anticline.

An interpretation, using the concepts of superimposed folding, may identify those structures which are F_1 folds or are F_2 successors to F_1 folds which may have been available to trap and hold hydrocarbons generated from the Mississippian - Devonian shale source rocks which expelled hydrocarbons during the period from the Permian to the Jurassic. Late F_2 folds that postdate Mississippian - Devonian sourced hydrocarbon migration and do not involve refolds of preexisting F_1 folds may have formed too late and in the wrong positions to trap hydrocarbons.

NSERC RESEARCH PARTNERSHIPS PROGRAMS AND THE GEOSCIENCES

poster

Thériault, R.J.
Natural Sciences and Engineering Research Council, Ottawa, ON

NSERC invests in people, discovery and innovation through its Scholarships and Fellowships, Discovery Grants and Research Partnerships Programs respectively to build a strong Canadian economy and to improve the quality of life of all Canadians. It supports research in universities and colleges, research training of scientists and engineers and research-based innovation. The Council promotes excellence in intellectual activity in both the generation and use of new knowledge, and it works to provide the largest possible number of Canadians with leading-edge knowledge and skills to help Canada flourish in the 21st century.

Through its Research Partnerships Programs (RPP), NSERC helps Canadian companies compete in today's economy by jointly funding collaborative R&D projects with scientists and engineers in universities across the country. NSERC funding for the RPP in 2003-2004 amounted to $152M, and represented 20% of the Council's total budget of $759M. The RPP include Collaborative Research and Development (CRD) Grants, Industrial Research Chairs (IRC), Strategic Projects Grants (SPG), Research Partnership Agreements (RPA) Grants with federal government laboratories, Research Networks Grants, and Idea to Innovation (I2I) Grants.

NSERC RPP support for research in the geosciences and related areas is accomplished mostly through the CRD, IRC and the SPG programs. The CRD grants provide support for well-defined projects undertaken by university researchers and their private-sector partners. Direct costs of CRD projects are shared by the industrial partner(s) and NSERC. The SPG fund early-stage project research in target areas of national importance and in emerging areas that are of potential significance to Canada, and that may lead to breakthrough discoveries. The SPG projects involve one or more academic researchers with one or more non-academic (private or public) organizations that can apply the results. The IRC are intended to build university strengths to achieve the critical mass required for major research endeavours of interest to industry; and/or assist in the development of research efforts in fields that have not yet been developed in Canadian universities but for which there is an important industrial need. Chair holders are distinguished senior researchers, promising junior researchers or outstanding R&D professionals with non-academic backgrounds.

NSERC RPP funding for research in the geoscience-related disciplines in 2003-2004 totaled $7.47M. The fields most actively supported by the RPP are geology, geochemistry and geophysics; hydrology and related disciplines; and mining, oil and gas and fuel energy technology. RPP funding in 2003-2004 in support of geology, geochemistry and geophysics-related activities amounted to $3.3M. Support for research in hydrology during this period totaled $1.7M. Research directly related to mining, oil and gas, and fuel energy received $3.6M in RPP funding in 2003-2004. Since 1994, total RPP funding for research in these fields has amounted to $73.8M.

NEW KIMBERLITE DISCOVERIES AT AVIAT AND WALES ISLAND ON THE MELVILLE PENNINSULA, NUNAVUT

Thomas, E.[1], Woad, G.[2], and Armstrong, K.[3]
1. Stornoway Diamonds Inc., Vancouver, BC
2.BHP Billiton Diamonds Inc., Vancouver, BC
3. Strongbow Exploration Inc., Vancouver, BC

talk

Stornoway is currently participating in five separate joint ventures on the Melville Peninsula of eastern Nunvaut, holding varying interests in more than 12.5 million acres. Exploration properties include the **Aviat Project**, as well as the **Fury, Sarcpa** and **Gem** properties, **Kingora**, the **Alexis** Joint Venture and **Wales Island**. Exploration programs were completed on each of these properties in 2004 under a total exploration budget of approximately $12 million. The company has been involved in the discovery of eight kimberlites so far, including the AV-1 kimberlite, which has returned a sample grade of 0.88 carats per tonne (>0.85 mm) from 7.4 tonnes processed.

The 2004 summer program on the 5.5 million acre **Aviat** property (Stornoway 70%, BHP Billiton Diamonds Inc. 20%, Hunter Exploration Group 10%) began in early August and focused on the Tremblay Corridor both up and down ice of the diamondiferous AV-1 and AV-2 kimberlites discovered in 2003. To date, the company has identified a total of five

geographically distinct kimberlite occurrences from drilling and a sixth occurrence has been inferred from heavy concentrations of boulders found at surface. The new kimberlite occurrences: AV1a, AV-3, AV-4 and AV-5 display characteristics similar to AV-1 and AV-2 and appear to be dominated by macrocrystic, hypabyssal type I kimberlite. Indicator mineral and diamond analysis is underway. Kimberlitic indicator minerals (KIM's) are common throughout the trend and are evident at all six occurrences described above. The Tremblay Corridor extends for more than 75 km, varies between 3 and 8 km in width and contains numerous KIM anomalies identified from the 2003 till sampling program and over 100 kimberlite float occurrences identified from prospecting in 2004. Partial microprobe results received to date confirm the overall high diamond prospectivity of the region. A total of 330 till samples analysed to date have returned probe confirmed kimberlitic grains, including samples with high proportions of G10 garnets suggestive of possible provenance from diamondiferous source bodies. While most of the encouraging mineral chemistry is associated with the Tremblay Corridor, additional promising results have been returned from regional samples located elsewhere within the project area. Results of comprehensive 2004 till sampling and geophysical surveys will be used to guide the 2005 exploration program.

Stornoway, Strongbow Exploration Incorporated and BHP Billiton Diamonds Inc. each hold a 33.3% interest in the 284,547 acre **Wales Island Project**, located on Wales Island in Committee Bay, southwest of Stornoway's Aviat project and north of BHPB's Qilalugaq Project at Repulse Bay. Aeromagnetic surveying completed over the property earlier in the year identified a number of priority targets, three of which were drill tested in late August 2004. Two of the three targets were explained by the intersection of kimberlitic intrusive rock, the third target could not be adequately tested due to time constraints and remains unexplained. Petrographic study and indicator mineral analysis will be undertaken on the drill core in the coming weeks. The primary goal of the limited 2004 reconnaissance program was to simply establish the presence of kimberlitic intrusives on Wales Island. A larger, more comprehensive exploration program will be planned for 2005.

WEB-BASED DELIVERY OF GEOSCIENCE DATA

Viljoen, D.

talk

Organizations that provide geoscience data and information have used the Internet to facilitate the discovery, evaluation, and download of data for more than 10 years. In the early days, web-based data delivery consisted of static HTML representations of database tables and links to digital map files (GIS data). Currently, organizations can choose from a wide variety of solutions including server-side scripting languages, Web Services, and Internet Mapping Services (IMS).

With server-side scripting solutions such as Active Server Pages (ASP), ColdFusion, and PHP, the client web browser makes a request that is translated into a database query. The resulting dataset is returned to the client as HTML. This means that the data (e.g. geochronology ages) and the presentation (font-size, table formatting) are returned to the client in the same HTML response. If, for example, the client wants to extract the data from the HTML for their own

needs, the data has to be parsed from HTML formatting tags (e.g. <TABLE>, <TR>, <TD>, <FONT>, etc.). One of the main goals of the Extensible Markup Language (XML) is to describe data and to focus on what the data is (e.g. <AGE>, <AUTHOR>, etc.). HTML and XML have complementary purposes: HTML is for displaying information while XML is for describing information. Since XML provides a framework for describing data, it is ideal for providing geoscience data and information over the Internet.

Beyond describing data, XML also provides the framework for defining and interacting with Web Services and Internet Mapping Services. With Web Services, clients are able to create applications that request data and use the content of the response for their own requirements such as populating HTML tables in web pages or inserting new records in their databases. Some Internet Mapping Services use XML to define the content of the map and IMS requests/responses.

The performance of Web Services or IMS depends on how much data needs to be processed and extracted from the databases or spatial data files to respond to a request. Performance becomes complicated when a request involves accessing multiple databases across different organizations. In this case, the pros and cons of distributed versus replicated databases should be considered.

With examples taken from the Geological Survey of Canada and other geoscience data providers, this talk will review the evolution of web-based data delivery, Web Services, Internet Map Services, and the role of XML in these technologies. It will review some of the challenges in creating Internet Map Services that perform well and the importance of considering both distributed databases and database replication as provincial and federal geoscience data providers improve access to their databases.

MIRAMAR PROGRESS REPORT -- HOPE BAY AND BACK RIVER PROJECTS, NUNAVUT

Wakeford, J.
Miramar Mining Corporation, Vancouver, BC

talk

In 2004 Miramar continued their aggressive gold exploration programs in the Hope Bay Belt and added a significant new gold project in the Back River area. The combined projects place Miramar as Northern Canada's largest gold explorer, drilling more than 55,000 m of core in 2004 on multiple projects and total exploration expenditures for 2004 totalling in excess of $25 million.

On the exploration front, Miramar had an outstanding year in 2004, with tremendous results from its Hope Bay and Back River projects. Hope Bay project highlights for 2004 include extension of the Boston property mineralization to vertical depths below 1000 m and excellent drill results and expansion of the resource at Naartok. Also, Miramar obtained exciting new results from the Goose Lake property at Back River.

Significant advances were made in the understanding of the geological models and the nature of the mineralization at both Naartok and Boston deposits.

On the development front, Miramar encountered delays in permitting the development of the small, high grade Doris North project at Hope Bay which is now three years into the permitting process.

Miramar's objective is to build an intermediate gold production profile through the sequential development of its Arctic gold assets. The planned goals in the implementation of this strategy include: 1) Development of a mine at Doris North to commence production as expeditiously as possible, generating cash flow to pay for the mining infrastructure and to fund the continued exploration and development of the Hope Bay belt; 2) Demonstrate the potential of the upper portions of the Boston deposit to support an extended operating life; 3) Determine the potential for an expanded production scenario through the development of a large scale mining operation at Madrid; 4) Advance the Back River project to identify further production opportunities; and 5) Continue the exploration programs at Hope Bay to expand the known deposits, such as Boston to depth and Madrid, and to discover new deposits to support a sustained intermediate production profile, while conducting grassroots exploration in cooperation with strategic partners.

Miramar's goal is to have one infrastructure centre for the entire Hope Bay belt, minimizing the capital requirements and optimizing the return on future development areas.

DAMOTI LAKE GOLD PROJECT UPDATE

Walford, P.[1] and Covello, L.[2]
1. Anaconda Gold Corp., Toronto, ON
2. Aurora Geosciences Ltd., Yellowknife, NT

talk

The Damoti project is located in the North West Territories approximately 170 km north west of Yellowknife. The property is held by Doublestar Resources Inc. Anaconda Gold Corporation is currently earning a majority interest and has now completed two drilling programs.

The gold is found in iron formations on the property that are both sediment and volcanic hosted. Gold has been found in these iron formations with the best values occurring with pyrite, pyrrhotite and chlorite. The focus of the recent drilling has been the Horseshoe Zone where past drilling has identified several high grade gold zones. Some of these zones have been drifted on from a decline on the 25 metre and 40 metre levels.

Andaconda Gold Corp. in conjunction with Double Star Resources is evaluating the potential for small scale, high grade mining on the property. Recent drilling is focused on improving and increasing resources within range of the existing ramp. Metallurgical work is part of this phase of the evaluation.

AIRBORNE LIDAR IN THE MACKENZIE DELTA, BEAUFORT SEA REGION

talk

Whalen, D. and Solomon, S.
Geological Survey of Canada, Dartmouth, NS

The Mackenzie River delta is an extensive wetland ecosystem that is important habitat for migratory waterfowl and is the location of increasing human activities ranging from subsistence hunting to oil and gas development. Management of the competing uses demands the best possible information about the physical environment. Historically, delta regions have been mapped using conventional air photogrammetry and air photo analysis which provide relatively coarse topographic information at the 1:50 000 scale. However, more than 10 000 sq km of the delta are less than 15 m elevation, so that there is virtually no regional data on the morphology of these critical lowlands. With the recent upsurge in hydrocarbon exploration and pipeline investigations, the oil industry has begun to apply new airborne mapping techniques to the delta and adjacent areas. Airborne LiDAR (Light Detection and Ranging) technology employs an eye-safe downward-directed laser and precise positioning in order to acquire high-resolution elevation and intensity (strength of the returned laser signal) information. These data are used by the industry to develop highly detailed digital elevation models in support of their activities. Natural Resources Canada is also interested in the application of LiDAR to improve our understanding of coastal dynamics and storm surge flooding in the region.

Imperial Oil has provided a 30 sq km, cleaned LiDAR dataset in the vicinity of the proposed Taglu development for scientific purposes. Elevation and intensity were examined in order to evaluate its potential to map morphological and vegetation features. Using applications provided within GIS software, high-resolution (1-2 m cell size) raster models were generated for both attributes. Elevations (re: CGVD28) in the area range from slightly below 0 m in the river channels to a maximum of 14 m over remnants of tundra uplands. The elevation data appear to have a vertical resolution of 0.1-0.2 m allowing the identification of low-centred ice wedge polygons by virtue of their raised outer rims. River levees, point bars, scroll bars and other fluvial features are also easily identified and their elevations and slopes can therefore be quantified on a regional basis for the first time. It has long been known that vegetation on the delta is very sensitive to flooding frequency and therefore to elevation. Comparisons between elevation and intensity data revealed that intensity values co-varied with elevation at elevations of less than 2 m. Comparison with vegetation classes based on Landsat revealed that there is some correlation between vegetation class and intensity and elevation although similar intensity/elevation values can often be attributed to more than one vegetation class. Preliminary observations also suggest that the intensity values may give clues to the relative water saturation level in a specific area or terrain type. During the past summer LiDAR was acquired over extensive areas of the delta and adjacent regions where more validation data are available. These data as well as data from the communities of Tuktoyaktuk and Aklavik and the summer whaling camp at Shingle Point will be analyzed in support of flooding potential, coastal hazard mitigation and disaster management planning.

HIGH-GRADE QUARTZ-SCHEELITE VEINS IN THE CANTUNG MINE, NORTHWEST TERRITORIES: A LATE MAGMATIC-HYDROTHERMAL EVENT

poster

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The Cantung Mine, Northwest Territories, is a large (>4.2 Mt), high-grade (>1.6 wt. % WO_3) skarn that developed in Lower Cambrian limestones when intruded by a Late Cretaceous monzogranite stock. Quartz veins crosscutting skarn in the open-pit orebody are scheelite-rich, containing up to 3.7 wt. % WO_3. Newly excavated portions of the underground E-zone orebody have revealed numerous small aplite dykes, which are associated with a marked increase in W ore grades. In some cases, vertical aplite dykes extend upward to become quartz veins, similar to those exposed in the overlying open pit. A fluid inclusion and trace element study was undertaken to document the P-T-X conditions of quartz vein formation and elucidate the relationship between high-grade quartz-scheelite veins in the open pit, underground skarn-related quartz veins, and aplite dykes.

Analysis of >500 fluid inclusions from quartz and scheelite in veins, and in aplite revealed two main fluid types: a H_2O-CO_2-CH_4-NaCl fluid, found as primary and pseudosecondary inclusions and thought to represent the ore fluid and; a H_2O-NaCl-$CaCl_2$ brine, found as pseudosecondary and secondary inclusions. The primary CO_2-bearing fluids have XCO_2 values of 0.05 to 0.25, XCH_4 values up to 0.05, and total densities ranging from 0.75 to 1.02 g/cm^3. They have homogenization temperatures (T_h values) of 220 to 400^{o}C and their salinities range from 0.2-8.2 wt. % equiv. NaCl. The brine inclusions have T_h values of 200 to 400^{o}C, salinities of 1.7 to 10.4 wt. % equiv. NaCl, and vary in density from 0.60 to 0.95 g/cm^3. The tungsten-rich, quartz veins in the open-pit have fluid inclusions with higher salinities, XCO_2 values, and T_h values than fluids in barren quartz veins emplaced during intial skarn formation. The quartz-scheelite veins likely formed at temperatures of ~400 to 500^{o}C and pressures of ~2 to 3 kbar, in agreement with recent estimates from F-OH apatite-biotite thermometry of the skarn ore.

Aplite-associated quartz veins have fluid inclusions with similar fluid properties to those in the tungsten-rich veins in the open pit. Tungsten concentrations of the high-grade, open-pit veins correlate with Bi, Mo, Sn, and Au concentrations, which indicates a magmatic component to the late stage fluids. The quartz-scheelite veins in the open pit are not simply the result of skarn-ore fluids ascending along fractures, but instead represent a later magmatic-hydrothermal event, possibly related to aplite intrusion.

Ongoing oxygen isotope studies of skarn-related quartz veins and late stage high-grade quartz veins in the open pit will allow us to isotopically characterize the fluids responsible for skarn ore and quartz-scheelite vein mineralization. Comparison of these values with the $\delta^{18}O$ values of aplites will permit us to evaluate the genetic relationship between aplites and tungsten-rich quartz veins.

THE ECONOMICS OF DIAMOND PROJECTS IN THE CANADIAN ARCTIC

talk

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A hypothetical economic model has been developed for diamond projects in the Canadian Arctic using data from recent exploration and mining projects. The model reflects economic conditions as it applies to the diamond mining industry in the Canadian Arctic at the present time. It captures the pre-production expenditures, production data, and post-production costs. The economic profitability indicators derived from the model are what the mining companies could envisage from a similar diamond project in the real world. In addition, the model provides the sharing profile of the mineral wealth between corporate and governments sectors, reflected by the Effective Tax Rate (ETR) including the royalty payment and corporate income tax. Furthermore, it provides the exploration companies with guidance as to the minimum size and/or in-situ value per tonne requirements of targets being sought in order to ensure economic success and probable exploration and development expenditures. The model shows that, on average, diamond projects in the Canadian Arctic are expensive to explore for and develop, but are economically robust.

MARY RIVER IRON ORE DEPOSITS, NORTH BAFFIN ISLAND, NU

talk

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Baffinland Iron Mines Corporation, Toronto, ON

Discovered in 1962 by Murray Watts and Ron Sheardown, the Mary River Iron Ore Deposits are somewhat unique examples of Algoma type iron formation. The deposits are located approximately 160 kilometres south of the Hamlet of Pond Inlet along a major structural discontinuity that extends northwest approximately 100 kilometres from Angajurjualak Lake to Milne Inlet.

Initial field work in the mid-1960's outlined five exposed deposits (No. 1, 2, 3, 3A and 4) of high grade hematite-magnetite mineralization within an extensive zone of banded iron formation. Deposits No. 1 through 3A occur within a 30 square kilometre area while the deposit No 4 is situated some 25 kilometres to the northwest. An indicated resource was calculated for Deposit No 1 that totalled 143.7 million tonnes grading 67.3% Fe, 1.4% SiO2 and 0.12% S. Within the deposit was a low sulphur zone totalling 108.4 million tonnes at a grade 68.4% Fe, 0.8% SiO2 and 0.03% S.

Advanced exploration work in 2004 focussed on expanding and improving resource definition and acquiring representative mineralised material for analytical testing of iron ore to ISO standards. These include reduction, decrepitation, degradation and other physical and chemical tests that determine how an iron ore behaves in the blast furnace, which remains the primary

method of creating pig iron and steel. A total of 2,813 metres of large diameter core was drilled in 15 holes in 2004 bringing the total diamond drilling on the Mary River deposits to 6,132 metres in 45 holes.

Results are highly encouraging due firstly to the expanded thicknesses of hematite in Deposit No. 1 as the drill program stepped significantly down dip from the previous drilling. The previous drilling had been restricted to a maximum vertical depth of only about 160 metres from the surface outcrop on the ridge line while this year's drilling, at times, probed Deposit No. 1 at depths more than twice as deep as previous drilling. Drilling has also more than doubled the strike extent of the previous drilling on Deposit No. 1 from approximately 1.2 kilometres to more than 2.8 kilometres. In addition, the first hole ever drilled on any of the other four deposits in the Mary River camp. A 122 metre hole that ended in mineralization with a 106 metre intercept of specular hematite was drilled in Deposit No. 2, located about 2.5 kilometres east of Deposit No. 1.