Calgary Mineral Exploration Group 11th Annual

Calgary Mining Forum

&

Alberta Geological Survey

Minerals Section Open House

Alberta Energy and Utilities Board

Alberta Geological Survey

"New Searches and the Western Frontier"

April 24 and 25, 2002

Ramada Hotel – Downtown
708 Eighth Avenue S.W.
Calgary AB T2P 1H2

The Calgary Mineral Exploration Group Society is pleased to present the annual Calgary Mining Forum, including the Alberta Geological Survey's Minerals Section Open House.

The Calgary Mining Forum is Alberta's meeting place for people involved in mineral exploration in Alberta, in Canada, and throughout the World. During the two days talks, posters, and trade show exhibits from industry, government, and academia will be presented.

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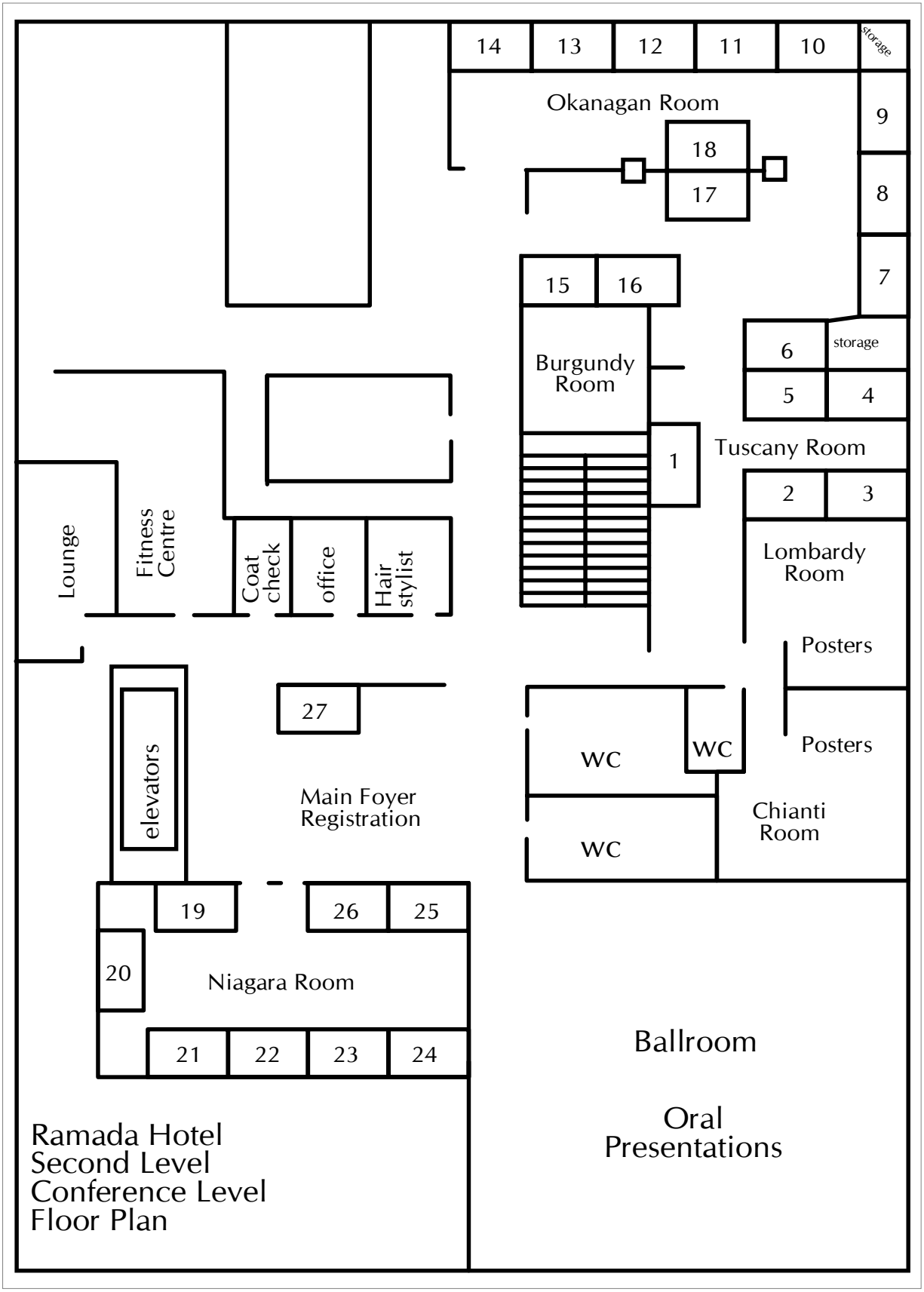
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Chianti Room
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Niagara Room
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Ballroom
Oral Presentations
Ramada Hotel
Second Level
Conference Level
Floor Plan

TRADE SHOW

Okanagan and Tuscany Rooms

1. Prospectors and Developers Association of Canada
2. Portfolio Strategies Corporation
3. Department of Indian and Northern Affairs, Geology Division
4. Mineral Information Maps
5. Western Petrochemicals Corp.
6. Geoanalytical Laboratories Saskatchewan Research Council
7. Loring Laboratories Ltd.
8. Shear Minerals/APEX Geoscience
9. Associated Mining Consultants Ltd.
10. Terracon Geotechnique Ltd.
11. Eagle Plains Resources
12. Troymin Resources Ltd.
13. Alberta Geological Survey
14. Alberta Geological Survey
15. Jacques Whitford Associates
16. Activation Labs
17. Marum Resources Ltd.
18. Layne Christenson

Niagara Room

19. Fugro Airborne Surveys Corp.
20. Yorkton Securities
21. TOR Geoscience Corp.
22. Northern Empire
23. Kensington Resources
24. Commerce Resources
25. Tiberon Resources Ltd.
26. Canadian Royalties

Main Foyer

27. Deakin Equipment

PROGRAM OF EVENTS

Tuesday April 23

5:00 p.m.-8:00 p.m. **Registration and Exhibitor's Reception,** ***Conference Level***

Wednesday April 24

8:00 a.m.–7:00 p.m. **Registration,** ***Conference Level, Second Floor***

8:00 a.m.–9:00 p.m. **Trade Show:** ***Okanagan and Niagara Rooms, Conference Level,***
Poster Session: ***Chianti and Lombardy Rooms, Conference Level***

8:30 – 8:40 a.m. **Opening Remarks: Paul Hawkins, Co-Chair, Calgary Mining Forum**
"The Eleventh Annual Calgary Mining Forum"

8:40 – 12:00 noon **Session One**
Session Chairman: **Paul Hawkins, Paul A. Hawkins & Associates Ltd.**

12:00 – 1:20 p.m. **Lunch Break** ***(Lunch is presented in the Okanagan Room)***

1:20 – 5:25 p.m. **Session Two**
Session Chairman: **Alex Knox, AWK Consulting**

5:45 – 9:00 p.m. **President's Reception,** ***Sponsored by Alex Knox, President, Calgary Mineral Exploration Group Society, Conference Level, Second Floor***

Thursday April 24

8:00 a.m. –2:00 p.m. **Registration,** ***Conference Level, Second Floor***

8:00 a.m. – 3:00 p.m. **Trade Show:** ***Okanagan and Niagara Rooms, Conference Level***
Poster Session: ***Chianti and Lombardy Rooms, Conference Level***

8:45 – 12:00 noon **Session Three**
Session Chairman: **Reg Olson, Alberta Geological Survey**

12:00 – 1:00 p.m. ***Lunch Break (Lunch is presented in the Okanagan Room)***

1:00 – 4:40 p.m. **Session Four**
Session Chairman: **Mark Fenton, Alberta Geological Survey**

4:40 p.m. **Closing remarks**

Lunch is provided for Full Registrants
in the Okanagan Room on Wednesday and Thursday.
Coffee Breaks are scheduled at appropriate times in the foyer.

SPEAKERS PROGRAM

Wednesday Morning, 24 April 2002

Session Chairman: Paul Hawkins, Paul A. Hawkins & Associates Ltd.

8:30 - 8:40 **Opening Remarks: The Eleventh Annual Calgary Mining Forum,**
Paul Hawkins, Forum Co-Chair

8:40 – 9:05 **Overview of Alberta Diamond Exploration**
Michael Dufresne, Apex Geoscience

9:05 – 9:30 **Petrogenetic Considerations for Alberta Kimberlites**
Roy Eccles, Alberta Geological Survey

9:30 – 9:55 Coffee Break

9:55 – 10:20 **The Buffalo Head Hills Kimberlite Province: An Exploration Update**
Dave Skelton, Ashton Mining of Canada Inc.

10:20 – 10:40 **Diamond Properties**
Pamela Strand, Shear Minerals

10:40 – 11:00 **Diamond Properties**
Rick Boulay, Marum Resources

11:00 – 11:20 **Fort à La Corne, Saskatchewan**
Brent Jellicoe, Kensington Resources Ltd.

11:20 – 11:40 **Coronation Gulf Diamond Play**
John Robins, Northern Empire Minerals

11:40 – 12:00 **Nui Phao Tungsten Property, Vietnam**
Jim Stemler, Tiberon Minerals

12:00 – 1:20 **Lunch in Okanagan Room, Exhibit Hall**

Wednesday Afternoon, 24 April 2002:

Session Chairman: Alex Knox, AWK Consulting

1:20 – 1:45 **Geology and Exploration Update: Diamondiferous Kimberlites of Central Saskatchewan,**
Lynn Kelley and Shawn Harvey [Gary Delaney*]
Saskatchewan Geol. Survey, Saskatchewan Energy and Mines

1:45 – 2:10 **Coronation Gulf Diamond Play**
Donna Schreiner, DIAND, NWT Geology Division

2:10 – 2:35 **NWT Activities Overview 2001**
Allan Turner,DIAND, NWT Geology Division

2:35 – 3:00 **Mineral Exploration Activity in Saskatchewan: Trends and Opportunities**
Gary Delaney, Saskatchewan Geological Survey, Sask. Energy and Mines

3:00 – 3:20 **Coffee Break**

3:20 – 3:45 **The Future of Exploration and Mining in Canada**
Gerald Harper, Prospectors & Developers Association of Canada

3:45 – 4:10 **Explorers Position Themselves for a "New Era" in British Columbia**
Tom G. Schroeter, BC Geological Survey

4:10 – 4:35 **Mesozoic Arc Magmatism and Related Metallogeny in Central and Northern Intermontane Belt**
Larry Diakow, BC Geological Survey

4:35 – 5:00 **Harrison Gold Property, British Columbia**
Chuck Downie, Eagle Plains Resources Ltd.

5:00 – 5:25 **2001 Exploration Results on Commerce Resource's FIR Carbonatite: A Potential Source of Tantalum and Niobium**
Alex Knox[1]* and Jody Dahrouge[2]
[1]AWK Consulting [2]Dahrouge Geological Consulting Ltd.

5:45– 9:00 **President's Reception**
Okanagan Room

**denotes speaker*

Thursday Morning, 25 April 2002

Session Chairman: Reg Olson, Alberta Geological Survey

8:45 – 9:10: **Opening Remarks: Alberta Geological Survey Open House**
Reg Olson, Alberta Geological Survey

9:10 – 9:35 **Bedrock Topography, Drift Thickness and Subcrop Geology of the Peerless Lake area, NTS 84B: An Update**
John G. Pawlowicz* and Mark Fenton, Alberta Geological Survey

9:35 – 10:00 **One Guy's Perspective on Junior Mining in 2002**
Art Ettlinger, Yorkton Securities

10:00 – 10:25 **Borehole Geophysics as an Aid to Kimberlite Exploration in the Canadian Prairie Region**
Paul Bauman* and Richard Kellett, Komex International Ltd.

10:25 – 10:45 **Coffee Break**

10:45 – 11:10 **Late Wisconsin Ice Flow History in the Peerless Lake Area (NTS 84B): Implications for Exploration**
Roger C. Paulen*, Mark Fenton, John G. Pawlowicz, Alberta Geological Survey

11:10 – 11:35 **Sand and Gravel Geology: A Key to Exploration and Development of Mineral Aggregate Resources**
W.A.D. Edwards* and H. D. Budney, Alberta Geological Survey

11:35 – 12:00 **The RADARSAT-1 Mapping Program in Northern Alberta**
Eric Grunsky, Alberta Geological Survey

12:00 – 1:00 **Lunch in Exhibit Hall**

**denotes speaker*

Thursday Afternoon, 25 April 2002

Session Chairman: Mark Fenton, Alberta Geological Survey

1:00 – 1:25 **The Athabasca Uranium Deposits – A General Overview**
Ken Wheatley, COGEMA Resources Inc.

1:25 – 1:50 **Carbonate-Hosted Pb-Zn (MVT) in Northern Alberta - Real Potential?**
R.J. Rice*, D. Pana, B.E. Buschkuehle, R. Eccles, J. Adams, E. Grunsky
Alberta Geological Survey

1:50 – 2:15 **Structural Control on MVT Deposits in Carbonate Sequences of the Western Canada Sedimentary Basin**
Dinu Pana, Alberta Geological Survey

2:15 – 2:40 **Potential for Carbonate-Hosted MVT Deposits in Northern Alberta and Southern Northwest Territories – A Targeted Geoscience Initiative**
Peter K. Hannigan, Geological Survey of Canada

2:40 – 3:00 **Coffee Break**

3:00 – 3:25 **Reflectance Spectra of Carbonate Alteration, Pine Point, NWT**
W.A. Turner*[1], A. Laamrani[2]; B. Rivard[2]
[1]C.S. Lord Northern Geoscience Centre, Box 1500, Yellowknife, NT X1A 2R3
[2]Earth and Atmospheric Sciences, University of Alberta

3:25 – 3:50 **EXTECH IV Athabasca Uranium Multidisciplinary Study: The Power of Partnership**
C.W. Jefferson*[1], G. Delaney[2], R.A. Olson[3], D. Thomas[4] and P. Portella[5]
[1]Geological Survey of Canada [2]Saskatchewan Energy and Mines
[3]Alberta Geological Survey [4]Cameco Corporation [5]COGEMA Resources Inc

3:50 – 4:15 **Sequence Stratigraphy: An Alternate Approach to Correlating and Subdividing Strata in the Athabasca Basin, Northern Saskatchewan**
Brent Collier*, S. Bernier and D.G.F. Long,
Dept. of Earth Sciences, Laurentian University

4:15 – 4:40 **Summary of the Extech IV Athabasca Uranium study, Sub-project 3, Bitumens, Hydrocarbons, Fluids, and Diagenesis**
N. S. F. Wilson, Geological Survey of Canada

4:40 – 4:50 **Closing Remarks**
Alex Knox, President, MEG

**denotes speaker*

POSTER SESSION

Chianti and Lombardi Rooms

Poster 1. **The RADARSAT-1 Mapping Program in Northern Alberta**
E. Grunsky, Alberta Geological Survey

Poster 2. **Preliminary Surficial Geology of the Peerless Lake Area (NTS 84B)**
R.C. Paulen, Alberta Geological Survey

Poster 3. **Pasquia Hills Kerogen Shale Prospect, Hudson Bay, Saskatchewan**
D. Nikols, R. Hardy, and J.D. Campbell, Western Petrochemicals Corp.

Poster 4. **Bedrock Topography, Drift Thickness and Subcrop Geology of the Peerless Lake Area, NTS 84B: an Update**
John Pawlowicz and Mark Fenton, Alberta Geological Survey

Poster 5. **Geochemical Surveys in Support of Diamond Exploration in Northern Alberta**
G.J. Prior, R.A. Olson, M.M. Fenton, J.G. Pawlowicz, and E.C. Grunsky
Alberta Geological Survey

Poster 6. **Use of Digital Equipment to Collect Quaternary Field Data: Giving the Palm a Hand**, Mark M. Fenton, J.A. Weiss, Z. Amer, J.G. Pawlowicz, E.J. Waters
Alberta Geological Survey

Poster 7. **Update on Athabasca Stratigraphy, Mineralogy, Geochemistry, and Sub-Athabasca Geology in the Pointe Brule Area, Alberta**
Dave Quirt Saskatchewan Research Council

Poster 8. **2001 Mining and Exploration Activity –Northeast-Central British Columbia**
Bob Lane, Ken MacDonald and Brian M^{c}Grath, BC Geological Survey Branch

Poster 9. **Porphyry Copper-Gold Mineralization in Northeast-Central British Columbia**
Bob Lane, Ken MacDonald and Brian M^{c}Grath, BC Geological Survey Branch

Poster 10. **Combining Remote Sensing Techniques to Explore for Lead and Zinc: Pine Point, a case study,** S. Schwarz, NWT Centre for Remote Sensing, H. Falck, C.S. Lord Northern Geoscience Centre, H. Epp, NWT Centre for Remote Sensing, and V. Singroy, Canadian Centre for Remote Sensing

Poster 11. **Integrating Geological, Geochemical and Geophysical Data Using CAD and GIS in Mineral Exploration Projects**
Daniel Beauchamp, D.A. Beauchamp Consulting

Poster 12. **Hydrodynamic Study of the Middle Devonian of the Great Slave Plain of the Northwest Territories,** E.P. Janicki, Government of the Northwest Territories

Poster 13. **EXTECH IV Athabasca Uranium Multidisciplinary Study: The Power of Partnership,** C.W. Jefferson, Geological Survey of Canada

Poster 14. **Lithostratigraphy and mineralogy in the Eastern Athabasca Basin, northern Saskatchewan – What we learned in Year 2 of EXTECH IV** C.W. Jefferson, Geological Survey of Canada, J.B. Percival, Geological Survey of Canada, S. Bernier, Laurentian University, C. Cutts, COGEMA Resources, G. Drever, Cameco Corp., D. Jiricka, Cameco Corp., D. Long, Laurentian University, S. M^{c}Hardy, Cameco Corp., D. Quirt, Saskatchewan Research Council, P. Ramaekers, MF Resources, K. Wasyliuk[4], Cameco Corp., and G.M. Yeo, Saskatchewan Energy and Mines

Poster 15. **Adelante Minerals – A Mexican Sullivan?**
Nick Gass, Gass and Associates Exploration

Poster 16. **The Stratigraphy and Structure of a Representative Klippe of the Bravo Lake Formation, Piling Group, Central Baffin Island, Nunavut,** J.R. Stacey and D.R.M. Pattison Dept. of Geology, U. of Calgary

Poster 17. **Alberta's Metallic and Industrial Minerals Activity**
Brian Hudson, Alberta Energy

Poster 18. **Surficial Geology and Drift Thickness EXTECH IV, Alberta Portion Athabasca Basin: Preliminary Report,** Fenton, M.M., Pawlowicz, J.G., Grunsky, E., Alberta Geological Survey *(abstract on poster)*

Talks

Posters

TECHNICAL PRESENTATIONS

ABSTRACTS

Arranged in alphabetical order by first author

Borehole Geophysics as an Aid to Kimberlite Exploration in the Canadian Prairie Region

Paul Bauman* and Richard Kellett,
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Over the next ten years, Canada is predicted to rank third in the world in sale value among diamond exporting nations. While economic kimberlites have only been proven to exist in the Precambrian Canadian Shield of the Northwest Territories, the discovery of the first kimberlites in Central Saskatchewan was announced in 1988. Since then, approximately 150 kimberlites have been discovered in the prairie provinces of Manitoba, Saskatchewan and Alberta, with a significant percentage of these being diamond bearing. Because most of this Prairie Region is covered by a till blanket which may exceed 100 m in thickness, airborne, and to a lesser extent ground based geophysics, have played an important role in identifying drilling targets. Very limited physical properties data exists regarding kimberlites in the Prairie Provinces (Mwenifumbo et al., 1996).

This paper examines various suites of logs from a number of kimberlite fields in the Western Canadian Sedimentary Basin. It is shown that while the physical properties of kimberlite can vary widely, even within a single borehole or pipe, borehole geophysical logs do effectively distinguish kimberlite from the host rock. Ranges of physical properties, including magnetic susceptibility and formation resistivity, can be identified and used in forward magnetic and geoelectrical modelling. Airborne data can thus be modelled with greater confidence, while the effectiveness of various ground-based techniques can be predicted in advance of field programs. In addition, logging programs have been useful in identifying kimberlitic material that may have been bypassed in the drilling program, in locating off-hole bodies, and in sterilizing prospects identified from incorrectly modelled surface magnetic data.

Sequence Stratigraphy: An Alternate Approach to Correlating and Subdividing Strata in the Athabasca Basin, Northern Saskatchewan

Brent Collier*, S. Bernier and D.G.F. Long
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brent_collier@sympatico.ca

Strata of the Manitou Falls, Lazenby Lake, and Wolverine Point formations have been studied in 11 cores along a 15 km N-NW transect at Shea Creek, south of the Carswell structure. Numerous fine-scale cycles can be recognized based on trends in maximum grain size. Most of the 680m sequence at Shea Creek may represent two 3rd order cycles: 1) MFa as part of the lower cycle and 2) MFb(?)-WP comprising the upper cycle. In some cores these are unconformably overlain by a remnant of the Locker Lake Formation (<10m) which represents part of a third 3rd order sequence. The sequence can be further divided into a number of 4th order cycles: the Manitou Falls MFa (170m), the MFb(?)+c+d cycle (187m), the LzL-WPa1 cycle (172m), and WPa2 cycle (151m). A number of 5th order cycles can also be recognized.

Existing models suggest that sandy-silty fluvial systems flowed approximately east to west across the basin, with locally significant northerly transport of coarser clastic units. By dividing units into distinct sequences, it may be possible to develop more precise correlations across the basin despite poor outcrop, a marked decrease in maximum grain size and a depletion of conglomerate in western sections. This may be especially important in the Manitou Falls Formation, due to a major decrease in the relative abundance of coarser material in down-stream settings. A relatively fine-grained unit dominated by plane-lamination or low-angle crossbeds is located at the top of the 4th order MFa cycle, up to 30m in thickness. This unit may correlate with the SB layer identified in the eastern part of the Athabasca Basin at the same stratigraphic level. If this correlation is valid the overlying strata, which resembles MFc lithofacies in the eastern parts of the Athabasca basin, may be a distal facies equivalent of the MFb member. This would suggest that strata equivalent to unit MFc on the eastern side of the basin may be thin to absent at Shea Creek. Such correlations will only work if Manitou Falls strata at Shea Creek are part of the same fluvial sub-system. This needs to be tested using paleocurrent measurements in inclined cores.

Sequences preserved in the Manitou Falls Formation may be driven by Milankovitch processes. In the Athabasca Basin, boundaries have been placed at the base of apparent upward-fining units because of lack of recognizable unconformities. The limited changes of both maximum and mean grain-sizes means that cycles, if present, are difficult to identify. Paleoclimate indicators may be the best markers for sequences, unfortunately desiccation marks are exceptionally rare and evaporates are not present. Nodules in parts of MFa may represent soil pisolites or a form of armoured mud ball; these hypotheses are being tested by petrographic work. The nodules occur at different stratigraphic levels, are present only within mudstone units and cannot be correlated between cores.

Mineral Exploration Activity in Saskatchewan: Trends and Opportunities

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In 2001, total Saskatchewan mineral exploration expenditures were forecasted to be about $29.2 million similar to actual expenditures of $28.2 million in 2000. These estimates revealed that diamond exploration, mostly focused in central Saskatchewan, was expected to double from the previous year to $8.56 million. Activity in most other sectors including uranium was forecasted to decrease. North of Lake Athabasca, a new focus of grass roots exploration was rare earth elements (REE) and tantalum.

At the close of calendar 2001, 3463 dispositions covering 2.5 million hectares (ha) were under disposition for metallic minerals. An additional 917 dispositions covering 357,000 ha were under disposition for industrial minerals.

For 2002, initial indications suggest that mineral exploration will generally be at a similar level and focus compared to 2001. Dynamics influencing this activity include a continued strong interest in diamonds and renewed interest in gold and base metals.

In addition to being the world's largest miner of uranium and potash, Saskatchewan produces base metals, gold, coal sodium sulfate, salt clay, silica sand and other minerals. There is a high potential for new economic discoveries of many of these commodities, as well as for others, including platinum group metals, diamonds and rare metals. Significant parts of the province, particularly the northern Precambrian shield, are underexplored. Integrated, partnered focused geoscience research is profiling the exploration attractiveness of and focusing mineral exploration in some of these areas.

Harrison Gold Property, British Columbia

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Eagle Plains Resources Ltd. Harrison Gold property (also known as ABO / RN) is located 130 km east of Vancouver and consists of 83 mineral claim units within the New Westminster Mining District. Access to the property is easily facilitated by a paved road connecting Harrison Village, approximately 4.5 km southwest, to the property boundary, from which point a network of 4 wheel drive gravel logging roads affords access to most of the claim areas. The property has excellent access to infrastructure including hydroelectric power and rail-service located within 3 kilometres of property boundaries.

The property was originally staked as the RN claim in 1972. From 1972 to 1983, intermittent surface and underground high grade mining produced 643 tonnes of ore from the Portal zone, from which 30,443 grams (979 ounces) of gold was produced along with a small amount of copper. Recovered grade from the mining was 47.4 grams/tonne gold or 1.38 ounces/ton. From 1982 until 2000 the property was under option to a number of junior and senior mining companies including Abo Oil Inc. (later Abo Resources Ltd.), Kerr Addison Mines Ltd., Bema International Resources Inc., (now Bema Gold Corp.),

Pacific Comox Resources Ltd, and Global Gold Inc. The property remained in good standing from 1974 – 2000, with almost 7 million dollars spent on exploration and development. The property was identified by Eagle Plains Resources staff through research, and was staked within hours of its forfeiture.

The Harrison Gold property is underlain by a stratigraphic succession of sedimentary and volcanic rocks of the Cretaceous Brokenback Hill Formation and Peninsula Formation (Fire Lake Group) bounded on the east by the major Harrison Lake shear zone or fault, and intruded by various phases of the Tertiary granodiorite of the "Hicks Lake batholith".

Gold mineralization occurs mainly as free visible flakes within quartz veins (approaching a weak stockwork system). The mineralized quartz veins are confined to quartz diorite intrusive bodies including the Jenner, Portal, Hill and Lake stocks, or their immediate periphery. Gold mineralization is not known to occur more than 2 to 3 metres outside the quartz diorite intrusives. Gold also occurs in association with open-space sulphide-fillings within a hydrothermally altered breccia pipe (Breccia zone). Accessory minerals include copper, silver, lead, zinc, molybdenum, tungsten and bismuth.

Past work including mapping, soil sampling, ground-based geophysics and diamond drilling focused mainly on the northern part of the property. The Harrison gold property has been explored by 149 drill holes totalling approximately 16,500 metres, (54,000 feet), resulting in the determination of geological resources of at least 3.5 million tonnes grading 3.2 to 4.1 grams per tonne gold, (or 360,000 to 461,000 ounces in situ) in two deposits, the Jenner deposit and the smaller Portal deposit.

The gold is contained in mineralogically simple quartz stockworks from which acceptable gravity and flotation concentrates can be obtained.

Eagle Plains Resources has acquired all of the data from the past work programs and has initiated a comprehensive geological compilation including re-evaluation of existing reserve calculations and metallurgical studies. Eagle Plains completed an airborne geophysical survey over the entire property area in October 2001. A number of exploration targets remain untested including stockwork, vein and/or skarn mineralization, gold soil geochemical anomalies, and geophysical anomalies, as well as extensions of existing resources.

Overview of Alberta Diamond Exploration

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Northern Alberta has seen a significant amount of exploration for diamonds in the last 5 years. This exploration has resulted in the discovery of a number of kimberlite pipes. To date, at least 46 kimberlites or related intrusions have been discovered in three discreet clusters by the Ashton-AEC-Pure Gold joint venture, the New Blue Ribbon-Montello joint venture and DeBeers. At least 26 of the kimberlites discovered to date have yielded diamonds.

In contrast to the Lac de Gras kimberlite pipes, most of the northern Alberta pipes are quite large and potentially complex bodies, in some cases up to 15 to 20 ha in aerial extent due to the preservation of the upper crater facies and associated pyroclastic aprons in whole or in part. Thus, the potential is high for northern Alberta kimberlite pipes to yield substantial tonnages, which could impact favourably on the economics of any discoveries.

Minibulk sample results released during 2001 by Ashton-AEC-Pure Gold for the recently discovered K252 kimberlite at 55 cpht have given the first substantial indication that some of the Alberta kimberlites may have excellent potential to host a population of commercial-sized diamonds at grades approaching the threshold of being economic. This recent discovery by Ashton of an a non-magnetic strongly diamondiferous kimberlite along with new diamond discoveries in the Coronation Gulf area of Nunuvut and the Otish Mountains area of Northern Quebec have helped to spark renewed staking and exploration across northern Alberta.

The rate of discovery of new kimberlites in northern Alberta has slowed due to several factors including a lack of capital because of market conditions but also due to the fact that many of the easy to recognize primary magnetic anomalies have been drilled. Future kimberlite discoveries will rely more and more on the use of diamond indicator mineral sampling in combination with other exploration techniques such as soil and biogeochemical sampling, high resolution magnetic surveys, electromagnetic surveys and, possibly, gravity surveys. A recently completed government compilation includes analyses for more than 15,000 possible diamond indicator minerals across Alberta including several interesting geochemical and geographic trends. Based upon the recovery of favourable diamond indicator minerals in other areas of northern Alberta, the potential for discovery of further diamondiferous kimberlites in new clusters outside of the known clusters of kimberlites is high.

As well as Ashton, a new more educated group of explorers including BHP Billiton, Shear, Marum, New Blue Ribbon as well as a number of smaller companies are putting past information to work. Diamond indicator minerals recovered during exploration in areas such as Calling Lake, Cold Lake, the Chinchaga, the Birch Mountains, the Caribou Mountains and the Edmonton region are strongly suggestive that local kimberlites exist in these areas.

Despite the complex glacial history in some of these areas, certain diamond indicator minerals recovered to date including subcalcic G10 pyrope garnets, high chromium chromites, high chromium picroilmenites, sodium rich eclogitic garnets and omphacitic clinopyroxenes indicate that the potential is high for the discovery of local, near surface, diamondiferous kimberlites.

The exploration for diamondiferous kimberlites in Alberta is still at an early stage. The potential is still considered high for the discovery of an economically important diamond deposit with systematic exploration and sufficient capital expenditures.

Sand and Gravel Geology: A Key to Exploration and Development of Mineral Aggregate Resources

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In Alberta mineral aggregate is produced almost exclusively from sand and gravel: ~2 billion tonnes over the last 50 years. In the next fifty years Alberta will need another 3 to 5 billion tonnes of mineral aggregate. Mineral aggregate is big business and an essential commodity. Sand and gravel is easy to find but finding enough economic supply to maintain Alberta's infrastructure and ensuring these sources are recognized and protected for future development is not a simple task. The AGS uses an exploration plan based on the geological knowledge and understanding of the Alberta setting gained from mapping ~4500 deposits over the last 25 years.

Sand and gravel deposits in Alberta range from ~50 million years old to Recent. They include Recent alluvial (35% of all deposits), preglacial fluvial (6%), glaciofluvial (50%) and eolian (7%) deposits. Eolian dune deposits are easily identified by their distinctive landforms and sedimentology and are quite consistent in character.

The preglacial fluvial formations developed as terrace-like features that record the erosion of the plains during continental uplift and before Laurentide glaciation. The oldest preglacial deposits were uplifted for the longest period and became isolated remnants occupying topographic highs. Progressively younger deposits occur at decreasing elevations. The youngest preglacial deposits are found in bedrock channels below surrounding plains level. Our exploration strategy for the identification of preglacial formations includes comparison of elevation and location against a stratigraphic model, identification of rock types in the gravel fraction and the relationship of the formation to bedrock.

A great variety of glaciofluvial features are found in Alberta, the most common being outwash plain, meltwater channel and kame deposits. All these deposits are ice-frontal or proglacial in nature and their distribution is based on the late Laurentide or Cordilleran glacial history of the region. Our exploration strategy for the identification of glaciofluvial deposits includes landform analysis through air photo interpretation, identification of rock types and investigation of the sedimentology.

Alluvial formations include in-channel and valley side deposits. Most major Alberta rivers incised into the plains bedrock after glacial retreat and left terrace deposits of sand and gravel along the valley sides. Point bar and channel bar gravel deposits are also found in many active rivers. Our exploration strategy for the identification of terrace deposits includes landform analysis through air photo interpretation, comparison of grain size analyses from several deposits and terrace levels and comparison of elevation and location of the terrace segment against a stratigraphic model built for the specific river.

Potential for Carbonate-Hosted MVT Deposits in Northern Alberta and Southern NWT – A Targeted Geoscience Initiative

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A joint project was initiated in 2001 investigating the regional potential for carbonate-hosted lead-zinc or Mississippi Valley-type (MVT) deposits across a considerable area of northern Alberta and southern Northwest Territories. This two-year project was jointly conceived by the Geological Survey of Canada, the C. S. Lord Northern Geoscience Centre and the Alberta Geological Survey and is partly funded by GSC's Targeted Geoscience Initiative.

The primary goal of the project is to delineate the distribution and describe the origin of known carbonate-hosted lead-zinc deposits in the project area, represented primarily by the world-class Pine Point deposit, and to investigate the potential for undiscovered occurrences of MVT mineralization elsewhere in the area. By characterizing the geochemistry of each occurrence and relating their mineralization to the regional stratigraphy and structure, a better understanding of the petrogenesis of the MVT occurrences and their relation to the Pine Point deposit is achievable.

The integrated geological investigation that will be utilized in this project will examine the relationship between stratabound Pb-Zn mineralization and its regional stratigraphic framework and will better characterize the structural features critical for fluid migration and ore deposition.

While a great deal of work has been done on the Pine Point district, new scientific approaches can build on the existing data sets and revitalize the district for further mineral exploration. Data gathered from hydrocarbon exploration will be integrated with existing data at Pine Point. The team will use satellite imagery, seismic sections, aeromagnetic and gravity interpretations, borehole geophysical information, and core samples, to: 1) establish the structural, stratigraphic, diagenetic, and geochemical conditions along the M^{c}Donald fault system at Pine Point, and 2) examine faults of similar trends for indications of migration of mineralizing fluids. Those faults exhibiting similar structural, diagenetic and geochemical characteristics as those at Pine Point would likely be considered as primary exploration targets.

Dissolution, dolomitization, recrystallization and brecciation are common host-rock characteristics in MVT deposits. Clay mineral alteration patterns and anomalous reflectance patterns in organic matter are recognized in other carbonate-hosted lead-zinc deposits in the world and these potential alteration patterns will be examined.

MVT deposits exhibit some characteristics similar to hydrocarbon accumulations in that fluids involved in the formation of the host dolostones migrate in a similar manner- from source beds through permeable strata into various physical or chemical traps. Diagenetic alteration such as dolomitization produces secondary porosity, an important consideration in both petroleum reservoirs and Mississippi Valley-type deposits. MVT deposits usually exhibit an association with organic matter, principally bitumen. Hydrothermal dolomite, recognized as an important exploration play-

type in the oil and gas industry in the Western Canada Sedimentary Basin, is common in MVT deposits. Brines found in fluid inclusions of minerals in MVT deposits are similar to those found in petroleum exploration boreholes in sedimentary basins.

By the end of the project, substantial progress will have been achieved in attempting to answer the following questions: 1) What are the source and nature of dolomitizing and mineralizing fluids? 2) What pathways did the fluids take and what is the regional extent of the fluids?, and 3) What were the interactions between fluids and rocks through which they flowed that led to ore localization?

Geology and Exploration Update: Diamondiferous Kimberlites of Central Saskatchewan

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The discovery of two rootless, ice-rafted blocks of kimberlite at Sturgeon Lake, Saskatchewan in 1988 led to an unprecedented staking rush and high level of exploration activity for diamonds. Peak exploration expenditures of $11 million were recorded in 1994. Exploration activity tapered off to a low of about $1 million in 1998, but rebounded dramatically in the last few years to more than $8 million in 2001.

To date more than 70 kimberlites have been discovered in central Saskatchewan. The aerial footprints of the kimberlites range from 3 to nearly 200 hectares, and estimated masses range from 3 million to more than 600 million tonnes. Many of the larger kimberlites appear to be multi-lobe composite bodies, coalesced from multiple eruptive centres. Many of the kimberlites are macro-diamond bearing. With an aggregate mass approaching 10 billion tonnes, the central Saskatchewan kimberlite field is said to be one of the largest in the world.

The kimberlites intruded through the Sask Craton, an Archean crustal element mantled by Paleoproterozoic crust. Kimberlite volcanism was contemporaneous with mid-Cretaceous sedimentation along the northeastern shore of the Cretaceous seaway. In general, the kimberlites are flat lying. Positive relief preserved on the upper surface of some of the kimberlite bodies suggests rapid sediment burial. The stratabound bodies are underlain by Cretaceous sedimentary rocks and overlain by Cretaceous rocks and Pleistocene glacial drift that together, average 100m in thickness. The gross form of the kimberlites has been characterized as pancake-shaped to emphasize the contrast with the classic carrot shape of kimberlites exploited in other parts of the world.

Petrographic study indicates that most of the kimberlites are well-preserved volcaniclastic rocks (crater facies) including lapilli tuff; pyroclastic; and resedimented kimberlite. Identification of the volcanic feeder was somewhat problematic until late 2000, when Shore Gold Inc. reported that vertical hole Star 020 intersected 539.4 metres of kimberlite and was terminated in kimberlite at 627 metres below surface. The lower parts of the drill core contained diatreme facies kimberlite with abundant large mantle-derived xenoliths.

The most advanced projects are those of the Fort à la Corne (FALC) joint venture (DeBeers Canada Exploration 42.25%, Kensington Resources 42.25%, Cameco 5.5%, and UEM 10% carried), which holds ground covering 63 drill-confirmed kimberlites; and the Star Kimberlite (Shore Gold Inc 100%). In 2001, the FALC joint venture carried out a $4.8 million exploration program focused on two kimberlites, 141/140 and 150, that were identified in previous exploration as high-priority targets. A grade estimate of 19 cpht and stone value estimate of $153 to $179 per carat for kimberlite 141 was released following the 2000 program. The partners completed 16 additional NQ core holes and 10 large-diameter reverse circulation holes in the 3rd quarter of 2001. Results from that program are pending.
Shore Gold holds the Star Kimberlite, a complex, multi-eruptive body with an estimated mass in

excess of 500 million tonnes. The most recently published grade estimates for the Star body was 36.6 cpht, but no stone valuations have been published. In 2001, Shore completed seven NQ core holes and one large diameter reverse circulation hole. Results from this work are also pending.

Mesozoic Arc Magmatism and Related Metallogeny in Central and Northern Intermontane Belt, British Columbia

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Mesozoic subduction-related magmatic arc intrusions and cogenetic volcanic sequences comprising much of the Intermontane Belt have historically been an important source of both copper and gold from porphyry and epithermal style deposits. Analysis of more than one hundred published U/Pb and $^{40}Ar/^{39}Ar$ isotopic dates that supplement regional geological mapping studies conducted over the past decade help to define spatial changes in the position of arc magmatism and distribution of associated mineral deposits.

Virtually all copper and gold porphyry deposits in Stikine terrane correspond with the distribution of calc-alkaline and fewer alkaline intrusions emplaced as early as 210 Ma; however, most range in age between 200 and 195 Ma. Temporally associated subaerial volcanic sequences may contain epithermal Au-Ag mineralization. For example, in the Toodoggone mining district, situated along the northeastern boundary of the Stikine Terrane, Cu-Au porphyry deposits including Kemess South and Kemess North are related to a suite of earliest Jurassic calc-alkaline granodiorite stocks. Farther north in the district, contemporary, genetically-related near-paleosurface epithermal Au-Ag systems owe their preservation to syn-volcanic structures and younger, regionally extensive assemblages of successor basin sedimentary deposits.

After 190 Ma there is a profound reduction in the magnitude of Jurassic magmatism, characterized by widely spaced arc segments that are comprised of contemporaneous plutons and volcanic rocks. These define linear magmatic tracts that, in time, generally diminish in length and progressively change location. Despite the longevity of arc magmatism between 190 and 175 Ma there is a dearth of mineral deposits formed during this interval.

The Eskay Creek deposit is an extraordinarily precious metal-rich volcanogenic massive sulphide deposit hosted by a circa 174 Ma subaqueous, bimodal volcanic-sedimentary succession proximal to syn-volcanic rhyolite domes. Elsewhere in western Stikine Terrane, age equivalent felsic volcanic and sedimentary rocks are widely distributed and record the terminal depositional event of Jurassic arcs. Regional consistency in the character of host rocks and environment of deposition for Eskay Creek type deposits appear to be aerially restricted to northwestern Stikinia. However, in central Stikine Terrane broadly similar stratigraphy requires further evaluation for VMS potential.

Preliminary Petrogenetic Considerations for Alberta Kimberlite

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The main objective of the Alberta Kimberlite Petrogenesis project is to sample Alberta diatreme rocks and report on their physical (e.g., textural classification), and geochemical (e.g., major and trace element) characteristics.

Eighty-three samples from the Mountain Lake, Buffalo Head Hills and Birch Mountains areas were analyzed for major and trace element geochemistry. The results have allowed for the selection of five pipes for detailed petrography and radiogenic isotopes. To place these data in context, the physical and geochemical characteristics will be compared between diatreme fields in Alberta and with data from occurrences of kimberlite worldwide.

The Mountain Lake diatreme is a hybrid rock with geochemical affinities to basanite (olivine potassic basalt), the Sweet Grass olivine minette, Montana alnöite and melilitite. Compared to northern Alberta kimberlite (Buffalo Head Hills and Birch Mountains), the Mountain Lake diatreme contains higher SiO_2, Al_2O_3, Na_2O, K_2O, Na_2O/K_2O, Ga, Rb and peralkalinity index, and lower MgO, Nb, LREE, and Sr. Mountain Lake is therefore classified as a high potassic alkali ultramafic rock.

Diatremes in the Buffalo Head Hills and Birch Mountains have textures and geochemical properties that are similar to kimberlite worldwide. Of the two areas, the Buffalo Head Hills kimberlites contain the highest MgO, Cr, and Ni, the lowest Al_2O_3, SiO_2, V, Y, Pb, Sr and Ga values, and have chemistry similar to that of primitive kimberlite in the Northwest Territories. The isotopic signature of selected samples from the Buffalo Head Hills are similar to Group I kimberlite suggestive of a source similar to those from which many oceanic island basalts (OIB) are produced.

In addition, a high proportion of the Buffalo Head Hills kimberlites are diamondiferous. The Buffalo Head Hills cluster may therefore be classified as the more primitive kimberlite magma in this dataset.

In contrast, the Birch Mountains kimberlites are more evolved, with lower SiO_2, Ni and MgO and higher Fe_2O_3, TiO_2, Nb, V, Sc, Zr, Hf, Y, Ba, Rb, light rare-earth elements (LREE), Ga and Pb. Their isotopic signature are characterized by variably higher $^{87}Sr/^{86}Sr$ and lower $^{143}Nd/^{144}Nd$ content. The data indicate that the Buffalo Head Hills and Birch Mountains pipes must originate from compositionally distinct sources.

The RADARSAT-1 Mapping Program in Northern Alberta

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The surficial geology of northern Alberta is largely unmapped. As part of a regional mapping strategy, the Alberta Geological Survey (AGS) acquired multi-beam RADARSAT-1 satellite imagery to assist in identifying features associated with geomorphology, geologic structure and surficial processes.

During October to December 1999 a total of 280 scenes of RADARSAT-1 Standard Beam modes S1 (incidence angle 20-27º) and S7 (incidence angle 45-49º) were captured for both ascending and descending passes. Standard Beam Mode 1 (S1) is useful for identifying surface features in areas of low or gently rolling relief. Standard Beam Mode 7 (S7) is commonly used for surface feature identification in areas of high relief. Autumn was chosen in order to minimize the effect of deciduous vegetation and winter snow. The imagery was orthorectified and filtered using a Gaussian smoothing technique. The resulting images reveal distinctive features, which assist in the discrimination of surface topography, geologic structure, drainage patterns, vegetation character and density.

A correlation matrix, derived from the four images, provides information on the relationships and interactions of each beam mode and look direction. The method of principal components analysis (PCA) was applied to the correlation matrix. The resulting components yield imagery that highlights geomorphology, geologic structure, variation in vegetation and a measure of moisture balance in the study area.

In general terms, the first component highlights differences between the effects of the two incidence angles which can be related to differences in volume scatter, surface roughness and moisture content. The second component highlights distinctions based on both look direction and incidence angle differences. Features that are enhanced by these interactions include differences in the openness of the forest canopy that discriminated between grasslands, open (deciduous) and closed (conifer) forest cover. The third component is characterized by the difference between the ascending/descending look directions of the S1 beam mode. The imagery of the third component clearly shows features associated with geologic structure and geomorphology. The fourth component shows features that are the least correlated and the imagery depicts features associated with drainage.

A regional composite has been assembled that covers the northern part of the province, north of 55 degrees north latitude. To date, several areas have been studied. Comparison of the features identified in the imagery with features known from existing maps and field visits confirm the usefulness of the imagery as a regional surficial terrain mapping tool.

Worldwide Financing and Exploration Trends: A Canadian Perspective

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Based on an annual PDAC survey of Canadian junior company spending patterns, combined with several other databases, a detailed picture of the worldwide financing and exploration trends of Canadian companies has been developed, covering the complete business cycle of the 1990s.

Detailed analysis reveals the nature of the recovery that took place during the early part of the decade and the combination of factors involved in the downturn that started in 1997. Potential future trends in financing and exploration are discussed, based on information current to the year 2000, and an analysis is given of cyclical and secular forces presently affecting the mineral industry.

EXTECH IV Athabasca Uranium Multidisciplinary Study: The Power of Partnership

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EXTECH IV (EXploration science and TECHnology initiative) aims to (1) enhance the 4-dimensional geoscience knowledge base of the 1.7 billion year-old Athabasca Basin and (2) to develop new exploration methods for deep uranium deposits that are located at or near its basal unconformity with basement gneisses, thereby sustaining and enhancing the environmentally sound development of this mature mining camp. Integrated, multiparameter geophysical - geological studies focus on a high-resolution seismic reflection survey that transects the world's largest super-high grade uranium deposit at M^{c}Arthur River. Linked borehole geophysics, organic geochemistry, stratigraphy, basement structure, airborne and ground geophysics, clay mineralogy and Quaternary studies span the basin. A responsive partnership among Cameco, COGEMA, NSERC, the geological surveys of Alberta and Canada, Saskatchewan Energy and Mines, and the universities of Alberta, Laurentian, Regina and Saskatoon brings leadership, expertise and resources to resolve capacity gaps. In year 2 of 3, EXTECH IV expanded from 11 to 14 sub-projects with > 80 scientists, and total resources increased from $4.5 to 6.5 million.

EXTECH IV is on track with all sub-projects reporting at a November 26 workshop and provincial Open Houses, as follows: 1) Regional and high-resolution seismic: downhole seismic models and preliminary images of stratigraphic breaks and unconformity; 2) Multiparameter Borehole Geophysics: direct logging of stratigraphic markers, alteration zones and radiogenic heat production; 3) Bitumens and Hydrocarbons: Precambrian oil was generated, migrated, and may be related to U mineralization; 4)& 4a) Stratigraphy-Sedimentology: detailed sections show growth faulting, paleo-topographic controls on stratigraphy; quantitative logs give a dependable framework, new 1:1,000,000 map eliminates border fault between Saskatchewan and Alberta; 5)& 5a) Basement Structure: detailed structural study documents direct relationship between U-mineralization and late reverse fault increments; regional study of western basement is resolving Saskatchewan-Alberta correlations; 6) Gamma Ray Geophysics: newly reformatted and levelled ternary compilation revealed previously unrecognized regional basement structure; 7) Mineralogy: preliminary data plots linked to physical stratigraphic sections discriminate primary from alteration minerals; 8)&8a) Coordination and Database: web site is up at ; GIS database is extensively populated; workshops and field trips are facilitating knowledge sharing, new partnerships added; 9) Audiomagnetotellurics: transect indicates conductive structures at depths of 500m and deeper; 10) High-Resolution Gravity: transect filled a gap in the national database, established new local base stations, and identified local gravity anomalies; 11) Geochronology: new standards are being used for uraninite and xenotime dating by SHRIMP (sensitive high resolution ion microprobe).

2001 Exploration Results on Commerce Resource's FIR Carbonatite: A Potential Source of Tantalum and Niobium

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The Fir property contains one of several carbonatite bodies that are part of the Blue River Project of Commerce Resources Corp. The carbonatites are between 20 and 40 km north of Blue River, B.C., along the main line of the CNR and adjacent to Highway 5. Active logging at and near the Verity Carbonatite provides additional infrastructure.

Within the Blue River area the carbonatites generally form sill-like bodies that are hosted by gneissic metasedimentary rocks of the Horsethief Creek Group. The Fir Carbonatite consists of two contemporaneously emplaced sills with nearly identical petrological, geochemical properties, but different Nb/Ta mineralogies. The host gneisses have a general strike of north and dip 10° to 15° east. Although outcrop exposure is poor, the Fir Carbonatite has been traced at surface over an area of about 350 m by 450 m. Drilling indicates that the average combined thickness is about 40 m. Drilling to date has established that the Fir Carbonatites constitute a very large resource of tantalum, niobium and phosphate. The occurrence is open to the north, south and east.

The economic significance of the Fir Carbonatite was first recognized during the early 1980's when it was discovered by surface prospecting. Recent exploration by Commerce Resources Corp. (including six holes drilled in 2001) has confirmed the Fir Carbonatite as having great potential for large tonnages with highly anomalous concentrations of tantalum and niobium.

The Fir Carbonatite is almost exclusively beforsite (dolomite carbonatite) and consists predominately of ferroan dolomite with accessory apatite and dark-green amphibole. Both outcrops and drill core display primary igneous layering with bands richer and poorer in non-carbonate minerals. Fenitized country rock associated with the carbonatite appears limited to narrow intervals, such as up to 1 m thick amphibole-rich layers and pods.

At Fir, the tantalum and niobium are found in two distinct minerals, pyrochlore $(Ca,Na)_2(Ta,Nb)_2O_6(OH,F)$ and ferrocolumbite $Fe(Ta,Nb)_2O_6$. Tantalum may substitute for niobium in both of these minerals, up to 12% in pyrochlore and up to 3% in ferrocolumbite Variable Nb/Ta ratios found in the core assay data probably reflect different mineralogical ratios. The pyrochlore seems to occur in two habits, as euhedral to subhedral octahedrons and as anhedral, porous masses.

Recent beneficiation test work indicates that by using simple gravity concentration techniques, approximately 80% of the contained tantalum and niobium can be recovered to a concentrate at the Fir Carbonatite. For the Fir Carbonatite, the cleaner gravity concentrate contained 44.24% combined Ta_2O_5 and Nb_2O_5 (4.16% and 40.09% respectively).

Structural Control on MVT Deposits in Carbonate Sequences of the Western Canada Sedimentary Basin

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Field investigations of the Devonian carbonate stratigraphy and deformation pattern in the Interior Plains of northern Alberta corroborated with existing data on MVT deposits and prospects in the Rocky Mountains fold-and-thrust belt and on the Pine Point MVT district indicate that the MVT mineralization in carbonate sequences of the Western Canada Sedimentary Basin is epigenetic. All MVT occurrences are confined to a halo of late hydrothermal dolomitization invariably related to fractures or fault zones.

Hydrothermal ore fluids were hotter than what could be reasonably obtained from burial or advecting basin fluids. Consequently, huge volumes of highly saline fluids invoked by basinal fluid flow genetic models are not critical factors for the MVT mineralization. Tectonically induced, secondary porosity of carbonate rocks appears to be the main trap for ore-bearing fluids. The occurrence of highly porous reefs is a favourable geologic feature for the development of MVT, but not a critical factor.

Cambrian and Devonian platformal carbonate sequences of the WCSB developed on the ancestral passive margin of North America are the primary hosts of MVT deposits and prospects. For the portion of the WCSB carbonate stratigraphy involved in Mesozoic orogenies, routinely invoked basinal fluid flow models for MVT deposits are irrelevant. MVT deposits and prospects in the Rocky Mountains fold-and-thrust belt are unequivocally related to the Laramide orogeny and/or to post-orogenic collapse.

The MVT mineralization in Paleozoic carbonate sequences involved in the Mesozoic foreland basin is related to zones of recurrent strain in the Precambrian basement. Pine Point district is structurally controlled from continental to deposit scale. It is located along the transcrustal Great Slave Lake Shear Zone with the individual deposits within the district distributed in linear trends above basement fault scarps.

Saline water from successive basins may have repeatedly infiltrated a recurrent fault zone, extracted and transported metals in an open system low- to medium-grade metamorphic environment; focused within linear zones of strained/permeable basement the metal-bearing waters were released and reacted with the carbonate caps at the site of ore deposition, from prospect or mine to district scale. The likely driving forces for fluid flow may have been a combination of topography, thermal convection, and hydraulic pumping.

Based on the inferred genetic relationships between zones of recurrent strain in the basement and overlying carbonate stratigraphy, several exploration target areas for MVT are identified in northeastern Alberta.

Late Wisconsin Ice Flow History in the Peerless Lake Area (NTS 84B): Implications for Exploration

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The Peerless Lake area has been subjected to several Quaternary studies by the Alberta Geological Survey (AGS) since 1992. As part of a multi-year program initiative, the AGS conducted a surficial mapping program in 2001-2002. The impetus for this recent study is the discovery of 36 kimberlite pipes in the Buffalo Head Hills & Loon River Lowlands. Quaternary studies in the Peerless Lake region have important implications for mineral exploration using drift prospecting.

Special attention was paid to the various ice-flow indicators in the region. Ice flow history and flow directions in northern Alberta are generally interpreted exclusively from streamlined surface landforms. However, it must be stressed that these landforms only represent the final chapter of a long story of ice movement during the Late Wisconsin.

The sparse occurrences of outcrop and the complete lack of preserved striae on the soft clastic bedrock prevent any preliminary interpretations on early and regional glacial flow patterns. Pebble fabric measurements conducted on surface tills generally parallel the regional landforms. Widespread deposition of englacial debris in the form of thick hummocky stagnant-ice terrain also masks regional ice flow indicators.

An interpretation of ice flow history and directions in the Peerless Lake area is determined from streamlined landforms, glacial thrust ridges and pebble fabric measurements. Early glacial flow was likely dictated by topography but as ice sheet thickness increased during the glacial maximum (ca. 18,000 years B.P.), ice was unimpeded by local topography, and generally flowed to the southwest.

Flutings scoured into the bedrock on the Buffalo Head Hills and a well-preserved crag and tail landform at the K5 kimberlite outcrop parallel this regional ice flow interpretation. Flutings and linear landforms on the northeastern flank of the Peerless Highlands indicate a south-southeasterly ice flow.

This suggests that late-stage ice was deflected due to topographic control of the thinning ice sheet. A rare boulder pavement was also discovered at the Red Earth airport. Striae measured from the planed tops of the boulders indicate that the surface till in the Loon River Lowlands was deposited by ice flowing southward (188°). During early deglaciation, glacial lakes submerged several areas as the northward-retreating ice blocked meltwater drainage. Beautifully preserved flutings in the southeast suggest that southwestwardly flowing ice re-advanced into a large glaciolacustrine lake that occupied the Wabasca River lowland to the northeast.

Bedrock Topography, Drift Thickness and Subcrop Geology of the Peerless Lake area, NTS 84B: An Update

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Drift studies are part of the Alberta Geological Survey's (AGS) initiative to complete Quaternary mapping of Northern Alberta at 1:250,000 scale. Final bedrock topography and drift thickness maps are presented for the Peerless Lake area. Also the poster will include results of geochemical, kimberlite indicator, pollen and hydrocarbon analyses from till and bedrock core samples.

The Peerless Lake area is located in north-central Alberta between 56° and 57°N, and 114° and 116°W. The main physiographic features are the Buffalo Head Hills to the west and the Peerless Lake highland to the east separated by a broad north-south trending lowland occupied by the Loon River. The subcropping bedrock consists of Upper Cretaceous aged sandstone and shale that have been intruded by at least 36 kimberlites. Glacial sediments cover the bedrock throughout the entire region, ranging in thickness from 1 to over 200 m.

Areas of thickest drift are in the north-south buried channel through the Loon River Lowland and another deeply buried channel trending from Wabasca in the southeast towards Lubicon Lake in the west. The drift in these channels contains thick interbeds of till, glaciofluvial and glaciolacustrine sediments. Drift thickness is generally much thinner on the Buffalo Head Hills, and absent on some of the kimberlites that outcrop in this area. The highlands in the Peerless Lake and south central regions are covered by a more extensive accumulation of drift of about 100 m thick.

In 2001 two rotary core holes were drilled to collect samples from the thick drift in the lowlands to the north and south of the community of Red Earth. Presently only a low correlation can be established between holes, but some distinct stratigraphic units can be identified in individual holes. Picks from pre-existing oil well logs show a major vertical offset in beds of the Base of Fish Scales and Pelican formations in the area corresponding to the northern portion of the Loon River Lowland.

Palynological analysis of two bedrock samples produced a younger than expected age from the top of the Buffalo Head Hills and an older than expected age from the bedrock in the Loon River Lowland. The Buffalo Head Hills sample located at 56.83301°N and 115.94270°W returned a Late Campanian age (~75my) indicating a stratigraphic position of the mid Wapiti Formation. The second sample located at 56.82908°N and 115.24630°W, from a core of the top of the bedrock near the base of the channel in the Loon River Lowland yielded a Late Albian age (~100 my), putting it at the contact of the Joli Fou and Pelican Formations.

Hydrocarbon analysis from two overburden core samples indicated the presence of severely biodegraded petrogenic hydrocarbons similar to Lower Cretaceous oil sands in northern Alberta. The shallower sample in till was different in that it also contained traces of biogenic hydrocarbons, suggesting sources derived from recent higher land plant material.

Carbonate-Hosted Pb-Zn (MVT) in northern Alberta - real potential?

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Pb-Zn geochemical anomalies and occurrences of possible MVT type mineralization are known from bedrock and core in parts of the Middle and Upper Devonian carbonate sequence of northern Alberta. The most encouraging report is of 3.1 % Zn over 21 m (with 0.05% Pb), including 5.1 % Zn over 11 m, in well 16-34-118-21 W5 at 1279 to 1301 m from the Middle Devonian Keg River Formation near the Great Slave Lake Shear Zone in northwest Alberta.

In bedrock, historically a galena occurrence has been reported in the Middle Devonian Methy Formation (Keg River equivalent) near Whitemud Falls, Clearwater River east of Ft. M^{c}Murray. Also from bedrock, a value of 0.1% Zn was obtained by Gulf Minerals in 1977 from the Upper Devonian Grosmont Formation, Vermilion Chutes, Peace River. Pb-Zn mineralization is also known to exist in Middle Devonian carbonates underlying the oil sands in the Ft. M^{c}Murray region.

Multidisciplinary fieldwork conducted in Ft. M^{c}Murray and Ft. Vermilion regions during the summer of 2001 lead to the definition of prospective areas for MVT mineralization.

Structural work indicates that:

1) NE-SW trending shear zones known from the Precambrian shield in northeast Alberta could continue in the basement beneath Wood Buffalo National Park and into the Vermilion Chutes area and be affecting the overlying Upper Devonian Mikkwa and Grosmont Formations of this region;

2) E-W faulting in the Mikkwa Formation on Harper Creek west of Wood Buffalo National Park could represent a sub-parallel fault set to that suggested for Vermilion Chutes reinforcing the likelihood of regional fault systems traversing the park and

3) 3) N-S and NE-SW trending faults are present in the Middle Devonian Methy Formation, Whitemud Falls, Clearwater River close to the historic galena occurrence mentioned above.

Sedimentologic work identified both increased porosity from host-rock dissolution and saddle dolomite in the partially reefal Methy Formation, Whitemud Falls and also partially reefal Grosmont Formation, Vermilion Chutes. The Grosmont Formation also displayed hydrocarbon staining. Diagenetic features such as these are known to be associated with MVT mineralization.

Core studies planned for the summer of 2002 may also reveal additional prospective regions for MVT mineralization in northern Alberta.

Coronation Gulf Diamond Play

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Abstract not available

Explorers Position Themselves for a "New Era" in British Columbia

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The new Government in British Columbia demonstrated its commitment to mining by improving and harmonizing the 20% BC Exploration Tax Credit with the Federal Exploration Investment Tax Credit. BC now has one of the most attractive exploration incentive programs in Canada for 2002 exploration. Explorers have been dusting off their files on British Columbia, conducting property examinations and acquiring ground.

Field-related exploration spending for 2001 is estimated at $32 million, while total exploration and deposit appraisal spending is estimated at $48 million. Included in this total are 57 projects with budgets in excess of $100,000. Mine site exploration spending accounted for 40% of total expenditures and was dominated by programs at the following metal (Eskay Creek, Kemess, Myra Falls) and coal mines (Line Creek, Fording Coal). The total value of solid mineral production is estimated at $2.9 billion.

Other key indicators of renewed exploration interest in British Columbia showed improvement: drilling, on over 80 projects in 2001, was up by 13%; and the number of forfeited claims decreased by 15%. Claim staking continued to be up from the late 1990s by more than 50% and the number of new Free Miners Certificates issued remained steady.

MINING AND DEVELOPMENT

Production at Barrick Gold's Eskay Creek massive sulphide, high-grade deposit in northern British Columbia was 320 784 oz. gold and 14.45 million oz. silver. Nearly 35,000 meters of exploration drilling was completed at the mine site and in the immediate vicinity.

The Kemess South mine operated by Northgate Exploration continued to improve mining, milling and transportation operations. It is forecast to produce 257 000 ounces of gold and 31 700 tonnes of copper.

At the Boliden-Westmin (Canada) Myra Falls VMS deposit on Vancouver Island, exploration drilling focused primarily on testing the Price and Lynx deposits. Production was suspended in December due to low metal prices. Work continues on advancing the decline, however, exploration ceased and the mine is currently for sale.

Teck Cominco Ltd.'s Sullivan sedex zinc-lead-silver mine closed on December 21, 2001. Over the past century, the mine produced some 8 million tonnes of zinc, 9 million tonnes of lead and more than 285 million ounces of silver for a total value to the British Columbia economy of more than $20 billion at today's prices.

Clean coal production in the province is expected to total about 26.6 million tonnes, with a projected value of about $1.6 billion, or roughly 35% of total solid mineral production. Pine Valley Coal has a permit for a trial cargo of 100,000 tonnes from its Willow Creek project in the Northeast Coalfield, and shipped and sold 36,000 tonnes during 2001. T'Sable River Coal conducted a modest drilling program in preparation for a large drilling and underground development program on its T'Sable River project on Vancouver Island in 2002. Western Canadian Coal has entered the provincial Environmental Assessment process for a project approval certificate for its Wolverine EB open-pit mine in the northeast. Other targets receiving attention in the Northeast Coalfield are the Perry Creek underground property and the Burnt River and Brazion open-pit properties. Compliance Coal extracted a 10,000 tonne bulk sample from its Tulameen project in the Interior.

There are more than 40 industrial mines and quarries in British Columbia and at least 20 major sites where upgrading these raw materials into value-added products takes place. Significantly there are increasing exports of crushed stone and natural aggregate to urban centres along the west coast of the United States. Another important development was the startup of the Ashcroft basalt quarry and related roofing-granule plant. The November 2000 spike in tantalum prices attracted attention to a variety of high technology minerals in the province.

ADVANCED AND GRASSROOTS EXPLORATION

The main focus for exploration during the past year was polymetallic massive sulphide (28%), porphyry (28%), and coal (22%) deposits, and a number of new discoveries were made.

Northgate's discovery of significant additional resources at the Kemess North deposit, 6 kilometres north of the mine, has not only provided the potential to extend the mine life but has also led to a revitalization of exploration in the entire Toodoggone camp.

Sultan Minerals tested its recently discovered Gold Mountain zone on its Kena intrusion-related gold project near Nelson. Assays to date, and preliminary petrographic and metallurgical studies, suggest potential for a large tonnage, possibly heap-leachable nonrefractory gold deposit. In addition, there is potential for bonanza-grade gold zones internal to the lower grade areas.

Drilling on the Lorraine property, northwest of Germansen Landing, indicates the extent of the porphyry/iron-oxide copper gold mineralization may be much larger than previously believed; three discrete zones traced along a 1.4-kilometer strike length may coalesce and continue to depth.

DRC Resources completed 26 drill holes to test the deep mineralization beneath and adjacent to the southwest end of the Afton porphyry copper-gold-silver-palladium deposit. The potential for development of an underground block-caving operation was investigated. An updated mineral resource study will be undertaken in 2002.

Pacific Booker re-drilled the Morrison porphyry copper-gold deposit on 60-metre centres and to depths of 300 meters. An improved resource estimate is expected in late 2002.

Drilling by International Wayside on its Cariboo Gold Quartz mesothermal gold project in the Wells-Barkerville camp tested the newly discovered Bonanza Ledge zone(s) over a minimum 1- kilometre strike length, and other auriferous pyrite replacement targets to the northwest along the Wells Trend.

Drilling on the RDN prospect, 40 kilometres north of the Eskay Creek mine, by Newmont confirmed the close similarity to an Eskay Creek setting, including stratigraphy and anomalous geochemical signatures.

The most active area for PGE exploration was a belt of ultramafic rocks located on the east side of Harrison Lake that extends over 75 kilometres northwesterly from Hope. Also within this belt, Leader Mining discovered a large magnesium-rich ultramafic intrusive body on the Cogburn property. It carried out a drilling program and a preliminary metallurgical and engineering study, targeting its magnesium metal potential.

The largest increase in exploration expenditures during 2001 occurred in the coal sector, and included testing the potential for coalbed methane. On Vancouver Island, Priority Ventures acquired coal licenses and freehold gas rights to the Dove Creek property, and drilled three deep holes in 2001.

Crystal Graphite excavated a 10,000-tonne bulk sample on its Black Crystal graphite property, near Nelson. To date, the company reports that 20,400 tonnes of graphitic material, with an estimated grade of 3% graphite, have been made available as plant feed, of which 2000 tonnes have been processed at its Koch Creek pilot plant.

Commerce Resources drilled its Verity and Fir carbonatite deposits near Blue River, testing their tantalum, niobium and phosphate contents.

Cantec Ventures excavated trenches to bedrock on the Firestorm opal property, west of Burns Lake. Trial marketing is planned to determine the value of the gems.

GOVERNMENT INITIATIVES

The British Columbia refundable Mining Exploration Tax Credit (20%) and a provincially harmonized new federal Exploration Investment Tax Credit Program for flow-through share investors in August 2001 are expected to lead to increased investment and exploration activity in 2002. Combined, the two programs can result in an equivalent 139% tax reduction, one of the best incentive programs in Canada.

The Geological Survey Branch carried out a wide range of activities throughout the province, designed to improve the exploration databases and to assist in stimulating exploration. Much of the Survey's extensive geoscience information is available on the Ministry's website at: www.em.gov.bc.ca/geology.

The Buffalo Head Hills Kimberlite Province: An Exploration Update

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In the Buffalo Head Hills region of north-central Alberta, intensive exploration conducted by Ashton, and its joint venture partners Alberta Energy Company and Pure Gold Resources, has resulted in the discovery of 36 kimberlites. Exploration efforts have been focused on detecting kimberlites through geophysical techniques rather than drift prospecting for indicator minerals due to the marked physical property contrasts between the kimberlites and the host Cretaceous sediments. Magnetic and electromagnetic methods have been the primary geophysical tools, however gravity and seismic surveys are also effective in identifying kimberlite bodies.

Kimberlite emplacement in the region is spatially associated with the Peace River Arch, a significant east-northeast-trending structure that extends from the British Columbia-Alberta border to northeastern Alberta. The kimberlites in the Buffalo Head Hills area vary considerably with respect to size and geometry. Kimberlite outcrops were identified in four locations while in other areas overburden depths of up to 127 metres were encountered during drilling. Size estimates based on geophysical modeling range from one to 47 hectares. All but one of the kimberlites are classified as crater facies; most of them can be described as volcaniclastic olivine-rich kimberlites with varying amounts of lapilli and xenoliths. The indicator mineral suite is dominated by olivine and includes chromite, peridotitic and eclogitic pyrope garnets, and rare picroilmenite. Diamond was recovered from 24 of the kimberlites. Six of the diamondiferous kimberlites where samples of at least one ton! ne of material have been extracted returned estimated diamond contents of between 3.5 and 55 carats per hundred tonnes.

Recent work has focused on the K252 kimberlite where an estimated diamond content of 55 carats per hundred tonnes was returned from a 22.8 tonne sample. The body was identified as an airborne time domain electromagnetic anomaly in 2000. Subsequent drilling in early 2001 intersected kimberlite with two distinct phases: an upper volcaniclastic phase and a lower breccia unit. To date a total of 20 drill holes have constrained the size of the body to approximately two hectares. Gravity work completed in the winter of 2002 appears to correlate well with the drill indicated results. The K252 data is currently being evaluated to determine if further work is warranted.

NWT Activities Overview 2001

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Diamonds continued to dominate mining and mineral exploration activities in the Northwest Territories in 2001. Development of the mine infrastructure for the Diavik project, jointly owned by Diavik Diamond Mines Ltd. (60%) and Aber Diamond Corporation (40%), is slated to start production in the first half of 2003. De Beers Mining Ltd. filed an environmental review in late February 2002 for the Snap Lake project. Mine construction is projected to begin in 2004, with production commencing in late 2005. De Beers Canada Exploration Inc., in joint venture with Mountain Province Diamonds Inc., further bulk sampled the Hearne and 5034 pipes on the AK claims near Kennady Lake. Other successful diamond exploration programs included drilling at MZ Lake, also on the AK claims, and at Aylmer Lake West, while work completed on King and Carat properties await the results of caustic fusion analysis.

In 2001, high platinum group elements and tantalum prices fueled drilling on the Rutledge Lake claims, as well as grassroots exploration on a number of smaller programs. Base and precious metal projects were also advanced, with the drilling of the Prairie Creek, Hart, CL, and North projects. In addition, flotation metallurgical tests were conducted on ore from the Nico (Co-Au-Bi) deposit.

There were three operating mines in the Northwest Territories during 2001: the Ekati mine; and the Con and Giant mines. The Ekati mine, 80% owned by BHP Billiton World Exploration Inc., reached a record year with production of ~2.5 million carats, valued at US $165 per carat. The combined gold production of the Con and Giant mines was 129,607 ounces, at a cash cost of US $256 per ounce. On January 21, 2002, crushing of ore commenced at the Cantung mine, 100% owned by North American Tungsten Corporation Ltd., bringing the fourth mine in the Northwest Territories on line.

C.S. Lord Northern Geoscience Centre (CSLNGC), a collaborative geoscience program between DIAND and the NWT Government, advanced numerous projects during 2001. These include: 1) two bedrock mapping programs in the Slave Geological Province, which incorporate geochronological, metamorphic, geochemical, and surficial studies; 2) the Yellowknife EXTECH project, examining the stratigraphic, structural, and metamorphic controls of gold deposition in the Yellowknife gold camp; 3) petrographic and geochemical studies of alkaline rocks in the Slave Province, and diamond specific compilations, including magnetic, drill hole, and selected geoscience data for the Slave Province; 4) basement structure map, and potentiometric and salinity maps of the Devonian formation fluids in the Great Slave plain of the Interior Platform; 5) Protected Areas Strategy mineral and petroleum resource appraisals of the Sahyoue and Edacho areas at Great Bear Lake; 6) the CSLNGC component of the collaborative MVT study with the AGS and GSC-Calgary, including studies of Westmin and Cominco core at the Pine Point minesite, hyperspectral studies of alteration phases from the North Trend, a Westmin drill hole compilation, and remote sensing studies in the Southern Great Slave plains.

Reflectance Spectra of Carbonate Alteration, Pine Point, NWT

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C.S. Lord Northern Geoscience Centre (CSLNGC) is collaborating with the Earth Observation Systems Laboratory (EOSL), University of Alberta to research the use of reflectance spectroscopy to differentiate hydrothermally altered and unaltered carbonate facies in the Pine Point mining district. This study is part of a collaborative Targeted Geoscience Initiative (TGI) between CSLNGC, the Geological Survey of Canada, and the Alberta Geological Survey, assessing the potential for Mississippi Valley-type (MVT) deposits in Northern Alberta and Southern Northwest Territories.

Reflectance spectroscopy, which employs the visible (VIS) and near-infrared (NIR) portion of the spectrum (0.35 to 2.55 μm), is a rapid, inexpensive, and nondestructive technique to assess mineralogy. Reflectance spectra (brightness as a function of wavelength) are excellent for detecting electronic transitions in minerals (e.g., iron oxides, Fe^{2+}-bearing minerals), and vibrational absorptions by lighter elements (e.g., OH, SO_4, CO_3).

The study uses core from two transects (54000 and 48000) that were drilled by Cominco, across the northern section of the North Trend, Pine Point mining district.

Work conducted since the 2001 field season addressed the following two objectives: 1) to use the G1 facies of the Buffalo River Formation as a marker horizon for the potential detection of distal clay alteration resulting from hydrothermal alteration; and 2) to examine the reflectance spectra signatures for the altered and unaltered carbonate facies of the Pine Point Formation.

Scanning Electron Microscope analysis of the lower argillaceous G1 facies indicate that detrital smectite is present in all samples analysed. Authigenic illite was identified in only one sample, taken directly from a brecciated zone crosscut by dolomite veins. The quantity of illite in this sample is very low and was not detected in reflectance spectra. It is concluded that clay alteration haloes are not easily identifiable on a regional scale in the Pine Point area, as clay alteration variations are not observed distal to the ore bodies.

Four distinct carbonate alteration types are constrained to specific facies in the Pine Point, Sulphur Point, and Windy Point Formations in the North Trend. These alteration types are: white dolomite, blue-grey dolomite, white calcite, and blue-grey calcite. The four alteration types are unique in their reflectance spectra signatures. Research attempting to isolate the unaltered signatures of the Pine Point, Windy Point, and Sulphur Point Formations is ongoing. Reflectance spectra characterization of altered and unaltered carbonate rocks will have important implications for the potential use of airborne or spaceborne imaging spectroscopy for exploration of MVT deposits in the North.

The Athabasca Uranium Deposits - a general overview

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The uranium deposits located within the Mesoproterozoic Athabasca Basin of northern Saskatchewan, and to a lesser extent Alberta, are the highest-grade deposits in the world. Most of the deposits are located along the eastern boundary of the basin. Other deposits have been located at Cluff Lake in the western part of the basin, and numerous sub-economic intersections have been identified throughout.

The Athabasca sandstones overlie both Archean and Paleoproterozoic lithologies of several different domains. To date, the most prolific is the Wollaston domain that underlies the eastern part of the basin. This domain consists of meta-pelites, psammites, calc-silicates and meta-quartzites. The most important lithology is a graphitic pelitic gneiss near the bottom of the sequence, typically proximal to Archean granites and granite gneisses. These rocks have undergone upper amphibolite to granulite facies metamorphism, and have survived several periods of deformation.

Around 1700 Ma, extensional tectonics allowed the development of the Athabasca Basin which was filled with up to several kilometres of sandstone. Several periods of adjustment followed, and, at about 1300 Ma, an orogenic event heated the formational fluids to approximately 200ºC. These fluids migrated through the basin and, due to their corrosive and oxidizing nature, mobilized uranium and other metals. These metals were then deposited in areas of reduction; typically immediately above or within the graphitic pelitic gneisses where a stationary redox reaction was taking place. It is assumed that a reduced fluid emanated from the graphitic zone; possibly due to a reactivation of an existing structure, or to the oxidized metals being precipitated by reductive materials such as the graphite.

There are numerous geological characteristics associated with these deposits, such as variations in clay types, silicification/desilicification of the sandstone and basement lithologies, halos of increased metal content and post-Athabasca tectonics. These characteristics vary slightly between deposits, and add to the complexity of locating unconformity-type deposits.

Summary of the Extech IV Athabasca Uranium study
Sub-project 3, Bitumens, Hydrocarbons, Fluids, and Diagenesis

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This subproject focuses on the origin and possible role that hydrocarbons may have played during formation of Athabasca uranium deposits. The aim of this component of the larger Extech project is to evaluate the 1) origin of bitumens/hydrocarbons associated with uranium mineralization; 2) role/influence of bitumen/hydrocarbons on uranium mineralization; and 3) possibility of a petroleum system (source, migration, entrapment, preservation/destruction) in the Athabasca Basin.

During 2001 samples were collected from M^{c}Arthur River, Cluff Lake, and Maybelle River (NE Alberta). A detailed petrographic study (including reflected and transmitted light microscopy) is underway and is focused on determining the paragenesis of the samples collected including ore, organic, and inorganic phases. This is being integrated with organic-inorganic geochemical studies that aim to define the source of the organic materials and evaluate the role of organic matter in the mineralization process. Other techniques (i.e. fluid inclusion studies) will also be employed to solve questions pertaining to the subproject goals.

We present preliminary field, petrographic, and geochemical data that suggest that Douglas Formation may have sourced hydrocarbons that migrated towards the basement. Current research aims to refine this interpretation, and qualify and quantify the role of organic matter in the genesis of the deposits.

POSTER PRESENTATIONS

ABSTRACTS

Arranged in alphabetical order by first author

Integrating Geological, Geochemical and Geophysical Data
Using CAD and GIS in Mineral Exploration Projects

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Computer applications such as CAD (Computer-Aided Drafting) and GIS (Geographic Information System) can be used to process and to present mineral exploration data to produce maps useful in the interpretation of information in mineral exploration, and in oil and gas projects. Although CAD is now commonly used, GIS has yet to make serious inroads into the industry.

A GIS can be thought of as an "intelligent CAD" that allows for the integration of geological, geochemical and geophysical data from spreadsheets, databases, maps, and graphics into maps for exploration projects. This system makes for superior and more thorough interpretation of the information for geologists and explorationists, and makes improved presentations for investors and regulatory agencies.

Some advantages of a GIS over a manual or CAD approach are as follows:

- Easier formatting of data e.g. geochemical anomalies by symbol size or colour, or both;
- Data recorded in different coordinate systems combined into one map e.g. lat-long and UTM;
- GPS, geochemical and geophysical data can be imported, contoured and overlain onto geology;
- Highly accurate maps can be prepared at any scale on virtually any printer and in presentations;
- Data can be modified, updated and recoded, and easily combined with CAD data;
- Capability of evaluation using fuzzy logic.

Data presented in this poster shows brief summaries of some of my current projects:

- Landsat imagery showing kimberlite locations in the Coronation Gulf Area, Nunavut;
- Property locations plotted over an aeromagnetic survey in Otish Mountains, Québec;
- Probability graphs of geochemical stream sediment data from eastern Yukon;
- Reinterpretation of whole rock geochemistry from granitic plutons in the Yukon;
- Geochemical interpretation of stream sediment data in southern British Columbia;
- Fault patterns over topography, and over basement and surface geology in parts of Alberta.

Using statistical software and a GIS to combine various types of data an explorationist can now interpret the mineral potential of properties more effectively and make better presentations to prospective clients and investors.

Use of Digital Equipment to Collect Quaternary Field Data: Giving the Palm a Hand

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Last spring in MEG 2001 the AGS Team presented on the use of Palm IIIs to collect field data. Last summer this approach was enhanced by an increased selection of software available on the Palm and a greater variety of other hardware and software.

The Palm software now included an improved surficial geology data form and four new/draft forms for recording information on geochemical samples (till, soil, peat and vegetation). In addition to the "regular" GPS units and digital cameras new equipment tested included a field printer, capable of handling up to tabloid size paper, and conductivity and pH meters.

The printer allowed up-to-date printing of site coverage maps for all field crews (using data downloaded, the previous evening, from the Palm and GPS to an Access database, and mapped with ArcView GIS). Daily access maps were also provided to each crew by selecting the appropriate segment of a Landsat 7 satellite image. The resolution available on these images allows the location of new trails, well sites and roads produced during the previous winters drilling or lumbering activities.

The digital cameras (Nikon 990 CoolPix) were used for a variety of planned and unplanned tasks. They were used to take most of the field pictures, although we did not succeed in talking quality images out of a helicopter; the plexiglass confused the light and range finding meters in the camera. The only good pictures were taken by holding the entire camera outside the helicopter window. These cameras were also used to make, at the end of each day, a digital back up of each page of the field notebooks used to supplement the data recorded on the Palms. When the original digital Landsat 7 image became unusable the Nikon also photographed a "replacement" image from a clean paper plot.

Conductivity and pH meters were used to make preliminary tests of wetland waters to help distinguish the various types such as bogs and fens. These data also proved useful in calibrating the various wetland "colours" shown on the Landsat 7 imagery. The draft geochem forms proved useful but will need a few revisions such as including upgrading the colour selections (these were made up by a person used to working in the USA and as a result lacked colours typical of the Boreal Forest) and the incorporation of a comments section.

Adelante Minerals – A Mexican Sullivan?

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This prospect came to light in 1999 with anomalous gold assays from "old Indian mines" in the mountains of western Mexico. Satellite imagery and aerial photography revealed an aulacogen (failed rift) 'morphed' into a 120 sq. km graben comprised of six major, high angled E-W faults with extensive breccias.

A granitic stock intrudes the S-E mountains, resulting in quartz veins and a variously mineralized halo. Lacustrine deposits of an old lagoon mask the faults between the mountains and an ancient 45 sq. km tidal bay. The bay is the result of the emptying of a rhyolite magma chamber and its subsequent collapse along the old graben faults. Sea water percolating down the faults would form 'smokers' on the floor of the bay which are believed to have deposited base metals in the fault breccias similar to the Sullivan model.

Slow refilling of the magma chamber raised the floor of the bay exposing the iron rich mineralization to oxidation. Massive amounts of the gossan material were distributed around the bay by tidal currents. Continued uplift resulted in the bay becoming a low dome. Eroded and slumped breccia exhibit some possible mud volcano structures, and float boulders reveal a zoned probable hydrothermal replacement ore: 1.6% Zn, 0.96% Pb, 0.5% Cu, 0.676 oz/T Au, & 2.74 oz/T Ag ($380/t ore).

Working in Mexico is not the problematic undertaking that it once was. There are reasonably passable roads and even a small air strip. We require backing in the order of $100,000- $150,000 to undertake a MAG/EM aerial survey to delineate the ore deposits and project strategic land selection. We are also in a position to expedite an assertive exploration program under very reasonable terms, to an interested exploration company.

The RADARSAT-1 Mapping Program in Northern Alberta

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The surficial geology of northern Alberta is largely unmapped. As part of a regional mapping strategy, the Alberta Geological Survey (AGS) acquired multi-beam RADARSAT-1 satellite imagery to assist in identifying features associated with geomorphology, geologic structure and surficial processes.

During October to December 1999 a total of 280 scenes of RADARSAT-1 Standard Beam modes S1 (incidence angle 20-27º) and S7 (incidence angle 45-49º) were captured for both ascending and descending passes. Standard Beam Mode 1 (S1) is useful for identifying surface features in areas of low or gently rolling relief. Standard Beam Mode 7 (S7) is commonly used for surface feature identification in areas of high relief. Autumn was chosen in order to minimize the effect of deciduous vegetation and winter snow. The imagery was orthorectified and filtered using a Gaussian smoothing technique. The resulting images reveal distinctive features, which assist in the discrimination of surface topography, geologic structure, drainage patterns, vegetation character and density.

A correlation matrix, derived from the four images, provides information on the relationships and interactions of each beam mode and look direction. The method of principal components analysis (PCA) was applied to the correlation matrix. The resulting components yield imagery that highlights geomorphology, geologic structure, variation in vegetation and a measure of moisture balance in the study area.

In general terms, the first component highlights differences between the effects of the two incidence angles which can be related to differences in volume scatter, surface roughness and moisture content. The second component highlights distinctions based on both look direction and incidence angle differences. Features that are enhanced by these interactions include differences in the openness of the forest canopy that discriminated between grasslands, open (deciduous) and closed (conifer) forest cover. The third component is characterized by the difference between the ascending/descending look directions of the S1 beam mode. The imagery of the third component clearly shows features associated with geologic structure and geomorphology. The fourth component shows features that are the least correlated and the imagery depicts features associated with drainage.

A regional composite has been assembled that covers the northern part of the province, north of 55 degrees north latitude. To date, several areas have been studied. Comparison of the features identified in the imagery with features known from existing maps and field visits confirm the usefulness of the imagery as a regional surficial terrain mapping tool.

Alberta's Metallic and Industrial Minerals

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Abstract not available

Hydrodynamic study of the Middle Devonian of the Great Slave Plain of the Northwest Territories

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This study of hydrodynamic conditions in middle Devonian formations (Slave Point, Keg River, Sulphur Point, Pine Point) is part of a broader project researching Mississippi-Valley-Type mineralization as found at Pine Point, Northwest Territories. Present-day formation water flow direction may relate to the paths that mineralizing fluids took. Possible regional pathways of migrating hydrocarbons, and where they may have preferentially become trapped, are also suggested by the direction of formation water flow.

Important structural and stratigraphic features that likely influence the current flow of formation water within the middle Devonian include the deep-seated block faulting of the Cameron Hills, the Tathlina Arch, the Hay River fault Zone and the eastward thinning of the Phanerozoic section.

Data from drill stem tests and fluid analyses was used to construct a pressure elevation chart. The results show that all middle Devonian formations are essentially part of one aquifer system. Most data points line up very closely to an average water gradient of .47psi/foot, which is indicative of moderately saline formation water in a normally pressured basin (where the rock framework supports itself).

A potentiometric map shows that flow is primarily in the direction of Precambrian outcrop to the northeast. Widely spaced contours over most of the area indicate slow formation fluid flow and uniform permeability for the gross middle Devonian section. An area of somewhat lower potential exists in the vicinity of the Cameron Hills. Potential again increases somewhat to the east. Downdip flow (dip is generally to the southwest) from east to west may have helped to trap the hydrocarbons found in that area. Localized deviations from regional formation-fluid flow direction possibly resulted from abrupt structural dislocations that originate in the basement and propagated through the Devonian section.

The continuity of formation pressures among middle Devonian formations is evidence that mineralizing fluids could pass from one formation to another. Faults and other structural features, however, likely work significant localized changes in the potentiometric surface. These same localized variations in flow direction may have influenced the paths of mineralizing fluids.

EXTECH IV Athabasca Uranium Multidisciplinary Study: The Power of Partnership

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EXTECH IV (EXploration science and TECHnology initiative) aims to (1) enhance the 4-dimensional geoscience knowledge base of the 1.7 billion year-old Athabasca Basin and (2) to develop new exploration methods for deep uranium deposits that are located at or near its basal unconformity with basement gneisses, thereby sustaining and enhancing the environmentally sound development of this mature mining camp. Integrated, multiparameter geophysical - geological studies focus on a high-resolution seismic reflection survey that transects the world's largest super-high grade uranium deposit at M^{c}Arthur River. Linked borehole geophysics, organic geochemistry, stratigraphy, basement structure, airborne and ground geophysics, clay mineralogy and Quaternary studies span the basin. A responsive partnership among Cameco, COGEMA, NSERC, the geological surveys of Alberta and Canada, Saskatchewan Energy and Mines, and the universities of Alberta, Laurentian, Regina and Saskatoon brings leadership, expertise and resources to resolve capacity gaps. In year 2 of 3, EXTECH IV expanded from 11 to 14 sub-projects with > 80 scientists, and total resources increased from $4.5 to 6.5 million.

EXTECH IV is on track with all sub-projects reporting at a November 26 workshop and provincial Open Houses, as follows: 1) Regional and high-resolution seismic: downhole seismic models and preliminary images of stratigraphic breaks and unconformity; 2) Multiparameter Borehole Geophysics: direct logging of stratigraphic markers, alteration zones and radiogenic heat production; 3) Bitumens and Hydrocarbons: Precambrian oil was generated, migrated, and may be related to U mineralization; 4)& 4a) Stratigraphy-Sedimentology: detailed sections show growth faulting, paleo-topographic controls on stratigraphy; quantitative logs give a dependable framework, new 1:1,000,000 map eliminates border fault between Saskatchewan and Alberta; 5)& 5a) Basement Structure: detailed structural study documents direct relationship between U-mineralization and late reverse fault increments; regional study of western basement is resolving Saskatchewan-Alberta correlations; 6) Gamma Ray Geophysics: newly reformatted and levelled ternary compilation revealed previously unrecognized regional basement structure; 7) Mineralogy: preliminary data plots linked to physical stratigraphic sections discriminate primary from alteration minerals; 8)&8a) Coordination and Database: web site is up at ; GIS database is extensively populated; workshops and field trips are facilitating knowledge sharing, new partnerships added; 9) Audiomagnetotellurics: transect indicates conductive structures at depths of 500m and deeper; 10) High-Resolution Gravity: transect filled a gap in the national database, established new local base stations, and identified local gravity anomalies; 11) Geochronology: new standards are being used for uraninite and xenotime dating by SHRIMP (sensitive high resolution ion microprobe).

Lithostratigraphy and mineralogy in the Eastern Athabasca Basin, northern Saskatchewan – What we learned in Year 2 of EXTECH IV

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Thirty-six new drill logs have more than doubled the database for the stratigraphy sub-project of EXTECH IV in the Manitou Falls Formation (MF) of the eastern Athabasca Basin. Sets of 19 to 23 sedimentological, diagenetic and structural parameters were logged in on a metre-by-metre basis in drill core related to a number of key studies that are reported here and at previous EXTECH IV presentations: a NW-trending multiparameter geophysical traverse across the world class McArthur River uranium mine, a sub-parallel transect in the Wheeler River area, transects in the Hawkrock River, Dawn Lake - La Rocque Lake and Close Lake areas, and detailed sedimentologic studies at Key Lake, Cigar Lake and McClean Lake.

Four members and many subunits of MF are consistently delimited throughout the 40 x 80 km McArthur-Wheeler area and document similar growth of synsedimentary faults that affected sedimentation during deposition of members a to d. At McArthur River area the growth fault is spatially associated with the P2 structure that is defined by post-lithification brittle offsets of the sandstone-basement unconformity, and has related splay faults, mineralogical alteration zones and uranium deposits.

Detailed structural and stratigraphic studies in the Key and McClean lake open pits record episodic movement on similar faults and their association with ~40 m deep, steep-walled paleo-valleys that preserve onlapping stratigraphy and minor paleo-talus deposits near ridges of basement meta-quartzite. Similar similar paleo-valleys are inferred in the McArthur-Wheeler area and are likely present under other parts of the Athabasca Basin related to basement structures. Overall, thicker stratigraphic sections provide the best data on growth faults whereas open pits provide the best data on paleovalleys and fault structure.

Preliminary north-south regional transects confirm that lateral facies changes related to the Ahenakew and Moosonees deposystems limit our ability to generate a coherent lithostratigraphic model for the entire eastern Athabasca Basin, although such models and Sequence analysis work within deposystems. The application of Sequence Stratigraphy may help to understand variations within and between deposystems throughout the Athabasca Basin.

Preliminary analysis of clay mineralogy by PIMA with initial XRD verification confirms this methodology as being suitable for tracking diagenetic zonation, and to construct a 3-D diagenetic map of the Athabasca Basin with respect to the MF lithostratigraphic framework. These many

advances have quantitatively defined lithostratigraphy and helped interpret the sedimentological and physical-mineralogical properties of the MF in the eastern Athabasca Basin, as a direct aid to exploration as well as to help calibrate a variety of exploration geophysical technologies under development in EXTECH IV. Such studies in the western Athabasca Basin show similar promise.

2001 Mining and Exploration Activity - Northeast-Central British Columbia

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Mineral exploration activity in the Northeast-Central region increased marginally in 2001. Exploration expenditures were up by approximately $0.8 million to an estimated $7.2 million and the amount of diamond drilling jumped by roughly 13,000 metres to 49,500 metres. The number of major exploration projects increased from 12 to 14.

Large drill programs at several porphyry copper-gold prospects generated very encouraging assay results and led to the expansion of mineral resources at the Kemess North deposit and reserves at the Springer zone at the Mount Polley mine. Activity in the Peace River Coalfields was up considerably over last year. There was one development project, Willow Creek, and five exploration projects where significant rotary and core drilling took place.

The year 2001 was a turbulent one for mining companies. Depressed metal prices resulted in closure of the Mount Polley copper-gold mine. However, the Kemess gold-copper mine continued to improve its operating efficiency by increasing both throughput and metal recoveries. There was a revival in the coal mining sector province-wide because of the recovery in world coal markets. The Bullmoose metallurgical coal mine benefited from the improved prices and was on pace for record production.

Porphyry Copper-Gold Mineralization in Northeast-Central British Columbia

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Gold-enriched porphyry copper deposits contain the largest reserves of copper and close to 50% of the gold reserves in British Columbia. Calcalkalic and alkalic porphyry copper-gold deposits occur in Late Triassic to Early Jurassic volcanic arc terranes that comprise Quesnellia and Stikinia. Two compilations summarize available data for all known and/or suspected porphyry occurrences within 1) part of the Quesnel Terrane centred on the Nation Lakes area, north of Fort St. James, and 2) in the Toodoggone region of the northern Omineca Mountains.

In the Nation Lakes area, Minfile provides capsule descriptions for 63 porphyry and porphyry-related occurrences. Nelson and Bellefontaine (1996) summarized the geologic setting of many of the alkalic intrusions associated with these deposits. Forty-five of these are categorized as alkalic porphyry Au-Cu occurrences. They are typically small, high-level to subvolcanic, contain densely plagioclase-phyric and have well developed potassic-propylitic-pyritic alteration haloes.

The most well-known deposit in the region is Mt. Milligan. It is an alkalic porphyry Au-Cu system that was discovered in 1987 (Faulkner et al., 1989), and currently has drill indicated reserves of 299 million tonnes grading 0.45 g/t Au and 0.22% Cu (Sketchley et al., 1995). The Mt. Milligan deposit is part of a larger cluster of porphyry and porphyry-related mineralization and alteration centers in the Phillips Lakes area located southeast of the prospective Hogem batholith (host to numerous porphyry Au-Cu occurrences including the Lorraine deposit).

In the Toodoggone region, MinFile lists 35 occurrences that are known to be or suspected to be porphyries. Twenty-four of these, including the Kemess South, Kemess North and Pine deposits, are categorized as calcalkalic porphyry Cu±Mo±Au systems. Porphyry mineralization in the Toodoggone region is spatially and genetically associated with the Early Jurassic Black Lake intrusive suite and their co-magmatic volcanic piles (i.e. the Toodoggone Formation). Porphyry mineralization has also developed in the older Takla Group volcanics.

Generally, important gold values occur only in porphyries in volcanic settings or with high-level porphyry intrusions (M^{c}Millan and Panteleyev, 1988). One of these is the Maple Leaf stock that hosts the Kemess South orebody (Rebagliati et al., 1995).

The MapPlace website of the British Columbia Ministry of Energy of Mines (www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/Default.htm) contains map-based digital data and tools that enable one to conduct desktop research. The website includes broad-scale geology, tectonic assemblages, aeromagnetic geophysical coverage, satellite imagery, regional geochemistry data and links to the Minfile and Assessment Report databases.

Pasquia Hills Kerogen Shale Prospect, Hudson Bay, SK

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The first major core-drilling project in the Pasquia Hills oil shales (First and Second White Specks interval) since the 1960's began in February 2002.

Fifteen holes were spaced over three townships near the community of Hudson Bay, Saskatchewan. All holes were cored from the top of bedrock to final depth, terminating in the Lower Colorado Shales. Geophysical logs including spectral gamma, neutron density and resistivity were run in each hole. Core was split over its entire length using a diamond saw and visually described. Continuous Samples were taken over the entire White Specks interval. Composites were made of material with similar organic carbon content by grouping serial constituents.

Petrophysical analysis was combined with Rock-Eval total organic carbon and various shale oil yield measures in an effort to characterize the resource. A series of other assay and analytical measurements, petrography, micropaleontology, and sedimentological studies are currently underway.

Preliminary Surficial Geology of the Peerless Lake Area (NTS 84B)

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As part of a multi-year program initiative, the Minerals Section of the Alberta Geological Survey (AGS) is focusing on the surficial geological mapping and Quaternary stratigraphy of northern Alberta. Peerless Lake (NTS 84B) is the second region to be mapped under AGS's Quaternary mapping initiative. This map sheet includes up to 34 kimberlite pipes that were recently discovered in the Buffalo Head Hills area. Quaternary studies in the Peerless Lake region have important implications for mineral exploration using drift prospecting.

The physiography of the map-area is dominated by the Buffalo Head Hills to the west and the Peerless Highlands to the east, which are separated by the Loon River Lowlands. The highlands are characterized by extensive areas of stagnant ice terrain dissected by multiple meltwater channels and organic terrain interspersed with glaciolacustrine and glaciofluvial sediments occupy the lowlands. Drift thickness is variable, from <3 m in the Buffalo Head Hills to >200 m in the Loon River Lowlands.

Outcrops of kimberlite (e.g. K5 and K6) occur in the Buffalo Head Hills forming small prominent knobs above the surrounding stagnant ice terrain. On the Buffalo Head Hills, areas of thin (<2 m) till overlie sandstone and shale bedrock were discovered. The occurrence of these outcrops were previously unknown and palynological analysis shows that the bedrock is an outlier of Wapiti Formation sandstone of Late Campanian age. This is considerably younger than the mapped Smoky Group. Additionally, thin veneers of preglacial (Tertiary?) quartzite gravels discontinuously overlie the bedrock on these areas of shallow drift cover.

An extensive esker and ice-contact meltwater complex was observed in the southwest corner of the map-area. Other notable glaciofluvial features include the Trout River meltwater channel, which occurs near the western edge of the Peerless Highlands, and a kame complex adjacent to Gods Lake. These are excellent sources of aggregate in a region that has limited aggregate resources.

Indications of ice flow history and directions have been mapped exclusively from streamlined landforms. Flutings and linear landforms on the northeastern flank of the Peerless Highlands indicate a south-southeasterly ice flow. This suggests that late-stage ice was deflected due to topographic control of the thinning ice sheet.

Bedrock Topography, Drift Thickness and Subcrop Geology of the Peerless Lake area, NTS 84B: An Update

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Drift studies are part of the Alberta Geological Survey's (AGS) initiative to complete Quaternary mapping of Northern Alberta at 1:250,000 scale. Final bedrock topography and drift thickness maps are presented for the Peerless Lake area. Also the poster will include results of geochemical, kimberlite indicator, pollen and hydrocarbon analyses from till and bedrock core samples.

The Peerless Lake area is located in north-central Alberta between 56° and 57°N, and 114° and 116°W. The main physiographic features are the Buffalo Head Hills to the west and the Peerless Lake highland to the east separated by a broad north-south trending lowland occupied by the Loon River. The subcropping bedrock consists of Upper Cretaceous aged sandstone and shale that have been intruded by at least 36 kimberlites. Glacial sediments cover the bedrock throughout the entire region, ranging in thickness from 1 to over 200 m.

Areas of thickest drift are in the north-south buried channel through the Loon River Lowland and another deeply buried channel trending from Wabasca in the southeast towards Lubicon Lake in the west. The drift in these channels contains thick interbeds of till, glaciofluvial and glaciolacustrine sediments. Drift thickness is generally much thinner on the Buffalo Head Hills, and absent on some of the kimberlites that outcrop in this area. The highlands in the Peerless Lake and south central regions are covered by a more extensive accumulation of drift of about 100 m thick.

In 2001 two rotary core holes were drilled to collect samples from the thick drift in the lowlands to the north and south of the community of Red Earth. Presently only a low correlation can be established between holes, but some distinct stratigraphic units can be identified in individual holes. Picks from pre-existing oil well logs show a major vertical offset in beds of the Base of Fish Scales and Pelican formations in the area corresponding to the northern portion of the Loon River Lowland.

Palynological analysis of two bedrock samples produced a younger than expected age from the top of the Buffalo Head Hills and an older than expected age from the bedrock in the Loon River Lowland. The Buffalo Head Hills sample located at 56.83301°N and 115.94270°W returned a Late Campanian age (~75my) indicating a stratigraphic position of the mid Wapiti Formation. The second sample located at 56.82908°N and 115.24630°W, from a core of the top of the bedrock near the base of the channel in the Loon River Lowland yielded a Late Albian age (~100 my), putting it at the contact of the Joli Fou and Pelican Formations.

Hydrocarbon analysis from two overburden core samples indicated the presence of severely biodegraded petrogenic hydrocarbons similar to Lower Cretaceous oil sands in northern Alberta. The shallower sample in till was different in that it also contained traces of biogenic hydrocarbons, suggesting sources derived from recent higher land plant material.

Geochemical Surveys in Support of Diamond Exploration in Northern Alberta

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Geochemical and mineralogical investigations of till in northern Alberta by the Alberta Geological Survey have been ongoing since 1992. The till sampling program was undertaken, in part, to provide regional till data for use by diamond exploration companies.

The Alberta Geological Survey initiated extensive geochemical investigations of other sampling media, including spruce trees, A-horizon soil, B-horizon soil, peat and sub-peat clay, in 2000. These programs consisted primarily of orientation surveys completed in areas of known kimberlites in the Buffalo Head Hills and Birch Mountains. These programs have identified anomalies associated with kimberlite in till, A-horizon soil, B-horizon soil, spruce twigs and spruce needles.

Update on Athabasca Stratigraphy, Mineralogy, Geochemistry, and Sub-Athabasca Geology in the Pointe Brule Area, AB

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The Athabasca basin of northern Saskatchewan and Alberta, underlying an area of approximately 100,000 km2, is filled with orthoquartzitic red-bed sandstones, conglomerates, and minor shales and dolomite of the Middle-Proterozoic Athabasca Group.

Six vertical drill holes were drilled by Golden Eagle in 1978 and 1979 in the Pointe Brule-Stone Point area of northeastern Alberta. Four of these holes were sampled and analysed (petrography and mineralogy) in 1981/2 and 1984 (78-2, 78LAJV003, 78LAJV004, and 78LAJV006). One was re-examined and relogged in 2001 (78LAJV006: Athabasca and sub-Athabasca petrography, mineralogy (XRD, PIMA), and lithogeochemistry).

The interstitial matrix clay mineral assemblage of the sandstones is kaolinitic (*sensu lato*: kaolin-bearing), with generally lesser illite and rare sudoite (di,trioctahedral chlorite). All Formations display size-fractionation with respect to the clay mineral matrix assemblage with whole-rock analyses being invariably more kaolinitic and less illitic/chloritic than the equivalent clay-size fraction assemblage. Similarly, the clay mineral proportions of both silt/claystone interbeds and clay intraclasts are more kaolinitic than the matrix of the host sandstone.

The matrix clay of the fluvial clastic sandstone Formations (e.g. Fair Point, Manitou Falls, and Locker Lake) is well-crystallized kaolin of detrital origin, with generally moderate to sub-equal amounts of authigenic illite along the pore margins and as isolated flakes. The Upper Manitou Falls Formation (MFc and d) is generally easily distinguished in the southern part of the Basin (MFd: clay intraclasts and lacking coarse-grained to fine pebble conglomeratic beds; MFc: lacking clay intraclasts and with an increasing number of coarser beds). However, in the northern part of the Basin, the MFd and MFc are less distinctive, but the MFd still tends to carry more clay intraclasts and fewer coarse beds than the lower portion (MFc), and vice versa.

Both kaolinite and dickite occur in the regional "background" peak-diagenetic sandstone and local retrograde-diagenetic sandstone. Dickite is the most common kaolin-group polymorph in "background" fluvial clastic sandstone distal from unconformity-type uranium mineralization. However, in the relatively silt- and clay-rich, less permeable marine/lacustrine Wolverine Point Formation, kaolinite is the dominant kaolin-group polymorph. The presence of varying proportions of (sub-) vermicular kaolinite and blocky dickite in many sandstone samples suggests that the diagenetic, fluid-mediated, dissolution-crystallization transformation of detrital kaolinite to dickite commonly did not go to completion.

The marine/lacustrine Wolverine Point Formation contains interspersed fine-grained, clay-rich quartz sandstone-dominant intervals and massive to horizontally-laminated siltstone/mudstone intervals with local tuffaceous beds. Two facies are present in the Upper Wolverine Point Formation (WPb):

(1) WPb1 variably hematitic, horizontally-laminated siltstone/mudstone, and (2) WPb2 fine- to lesser medium-grained quartz sandstone with minor siltstone interbeds. The WPb is typically distinguished by high proportions of illite and chlorite, combined with a general lack of kaolin, particularly in the silty material. Where present, the kaolin polymorph is generally kaolinite. The underlying Lower Wolverine Point Formation (WPa) is transitional from the Manitou Falls Formation and shows predominance of illite with intermediate kaolin and generally accessory chlorite.

The Archean/Paleoprotorozoic basement to the Athabasca Group in the study area consists of Wylie Lake granitic orthogneisses which are medium- to coarse-grained, moderately to strongly foliated, pink to medium-grey in colour, and mineralogically simple (plagioclase, K-feldspar, quartz, biotite, and garnet). Two phases are present: pinkish "felsic mylonite" (K-feldspar ± plagioclase and biotite) and "grey foliated granitoid" (plagioclase and biotite). The biotite is partly to completely altered to chlorite and muscovite due to retrograde alteration. A sub-Athabasca paleoweathering alteration profile (red, red-green, and green zones) on the basement is well displayed. The upper "white" and "red" zones contain of well-crystallized kaolinite, without dickite, while the lower zones contain increasing proportions of illite and chlorite at the expense of kaolinite.

Combining Remote Sensing Techniques to Explore for Lead and Zinc: Pine Point, a case study

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The correlation between basement structures and bedrock topography and the deposition of lead and zinc in MVT deposits has long been recognized. The objective of this study is to identify large-scale geological structures, which may have been used as conduits controlling the distribution of lead-zinc at the Pine Point area of southern NWT.

In the Pine Point area, a large-scale structure has been identified: M^{c}Donald fault. However, long sections of this fault are obscured by Phanerozoic and Quaternary cover to the point that it is unrecognizable by conventional mapping techniques. To the west, the Tathlina fault may also be a significant crustal feature that can only be recognized by geophysics, well logs and seismic interpretation.

The intent of this study is to use remote sensing techniques such satellite imagery and regional scale geophysical surveys to extend the known trace of this fault through Great Slave Lake where it juxtaposes near Windy Point, an area where 1980's exploration has identified promising exploration targets.

A multi-layered Geographic Information System (GIS) will be used as a means of integrating, managing, and analyzing/ interpreting the spatial data collected and compiled during this project, leading to a better understanding the spatial relationships through data integration techniques using all the data.

Currently some of the data includes scanned geological maps (1:250,000 scale GSC Maps 1370/1371), well log data, 1:250,000 topographic data (contours and Digital Elevation Model) and a range of remotely sensed data including Landsat-7, Radarsat fine mode imagery, aeromagnetic data, gravity data, airphotos, vegetation classification, and detailed maps from the mine site.

The stratigraphy and structure of a representative klippe of the Bravo Lake Formation Piling Group, central Baffin Island, Nunavut

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The Bravo Lake Formation (BLF) comprises part of the lower sequence of the Paleoproterozoic Piling Group of the Foxe Fold Belt. It consists of a sequence of metamorphosed mafic volcanic, ultramafic, and associated metasedimentary rocks that is thought to represent the onset of volcanism in the Piling Basin. The BLF extends in a discontinuous E-W belt across central Baffin Island at a latitude of approximately 68°30' N that is in thrust contact with underlying psammitic to pelitic rocks of the Longstaff Bluff Formation (LBF). A particularly well exposed part of the BLF, located at 68°30'N, 72°30'W, has been isolated from the main thrust sheet as a shallow, dish-shaped klippe 5x4 km in area and 700-1000 m in thickness. The klippe and surrounding metasediments have been metamorphosed to upper amphibolite facies.

In the klippe, seven different units of variable lateral extent and thickness have been identified. The basal unit (Unit 1) consists of rusty psammite and semipelite. A strong platy foliation and isoclinal folds whose axial planes are subparallel to the foliation are consistent with a thrust contact with the underlying LBF metasediments. Unit 1 is overlain by mafic volcanic and volcaniclastic rocks, subdivided into a lower unit of flows and volcaniclastics (Unit 2), and a distinctive upper unit of pillow basalt (Unit 3), the latter with abundant calc-silcate alteration. The pillows are overlain by a layer of mafic volcaniclastic rocks (Unit 4) interlayered with iron-formation, ultramafics, and calc-silicate.

Unit 5 contains thick ultramafic sills at its base, and rusty mafic metasediments intruded by sills near its top, including local, mm-cm-scale Po+Py+Ilm-rich stratiform sulphide layers. Unit 6 contains metavolcanic flows at its base and volcaniclastic rocks near its top, the whole unit characterized by a distinctive green colour and toughness. The highest stratigraphic level in the klippe (Unit 7) consists of extremely rusty psammite to semipelite, iron-formation, ultramafic sills, and a dm-cm-thick layer of banded Py-rich sulphide. Coarse Py-rich psammite and semipelite at the top of the unit may represent the base of the Astarte River Formation, which in turn grades upwards into the LBF, as seen in adjacent, thicker klippen.

Metamorphism post-dated thrusting: metamorphic amphiboles in the klippe rocks are randomly orientated and crosscut the platy tectonic fabric in Unit 1.