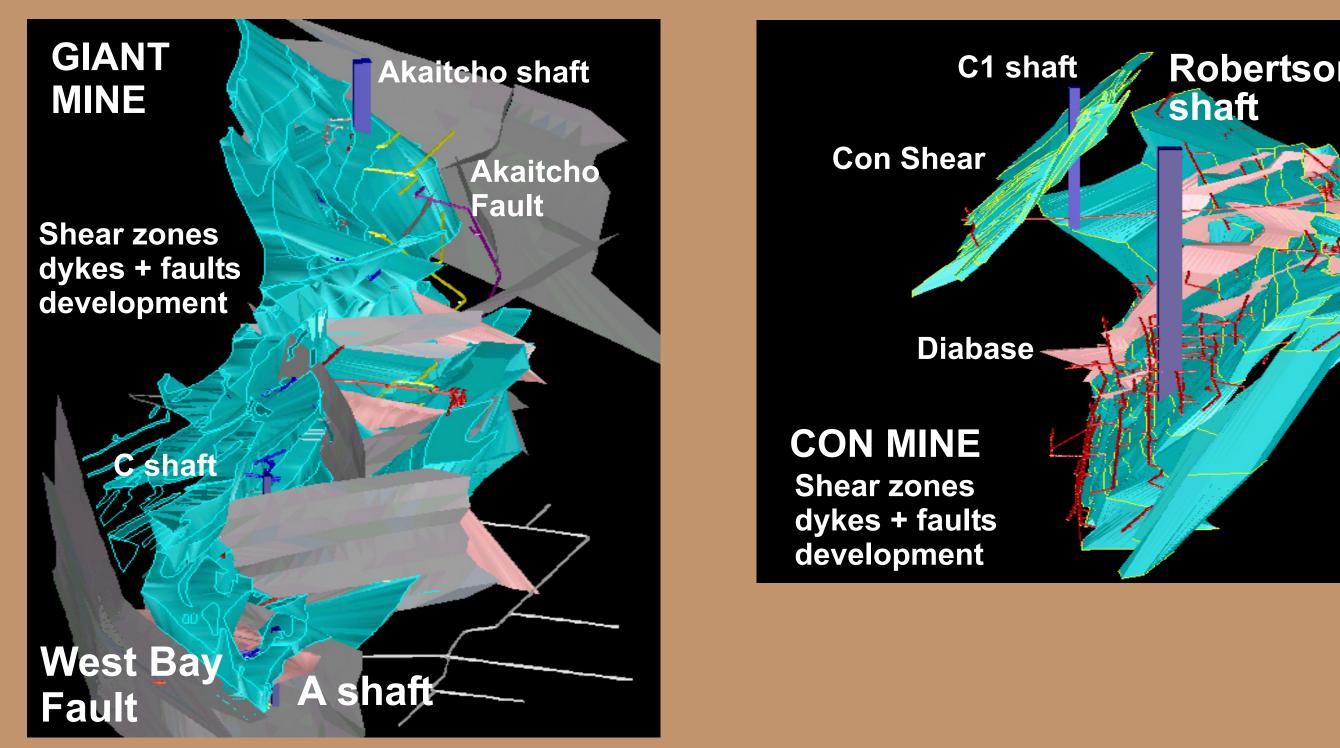
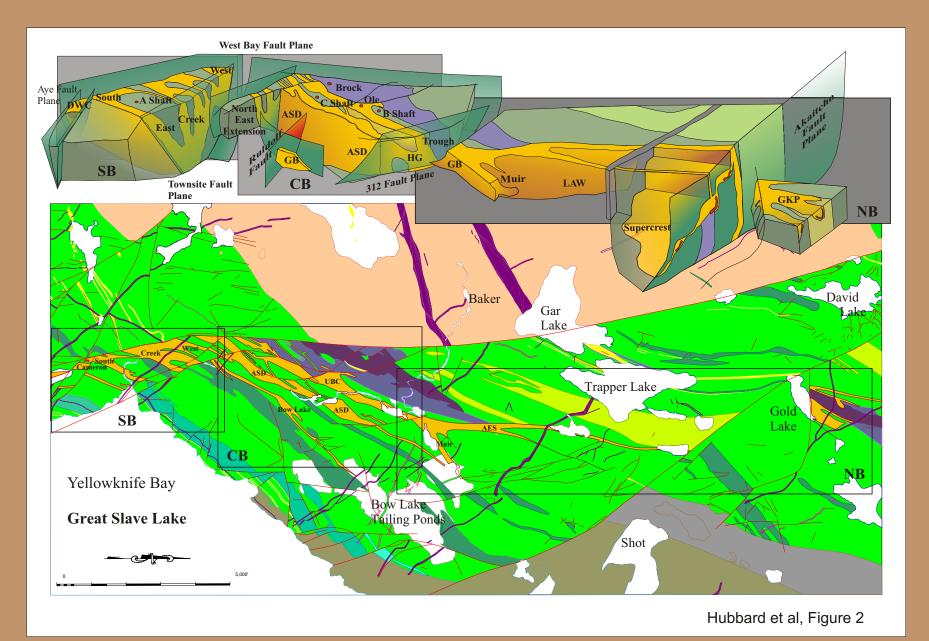


Gold in the Yellowknife Greenstone Belt, Northwest Territories: Results of the EXTECH III Multidisciplinary Research Project edited by C.D. Anglin, H. Falck, D.F. Wright and E.J. Ambrose **GSC, GAC-MDD Special Volume**

The Yellowknife 3-D Geoscientific Model - Tool for Exploration G.D. Kirkham, J.P. Siddorn, and H. Falck



Compilation of information from more than 50,000 drillholes at the Con and Giant mines, integration with data on the mine workings and lithogeochemical samples, and 3D structural interpretations have refined the understanding of the geology of these mines and allowed for the selection of a number of promising targets for future drill programs.



Giant mine: Alteration and mineralization study

by Laura Hubbard, Dan Marshall, 'Lyn Anglin, Derek Thorkelson, and Morris

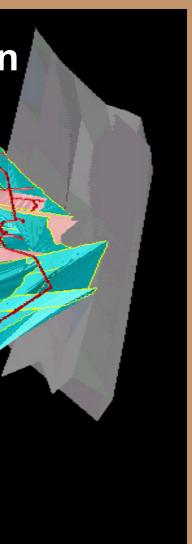
iqure 2. Giant Yellowknife mine, surface geology and three-dimensional shear block

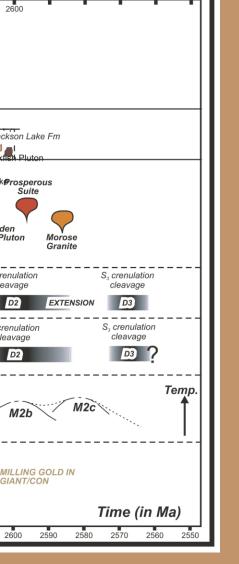
The stratigraphy of the Yellowknife greenstone belt, **Slave Province**, Northwest **Territories.**

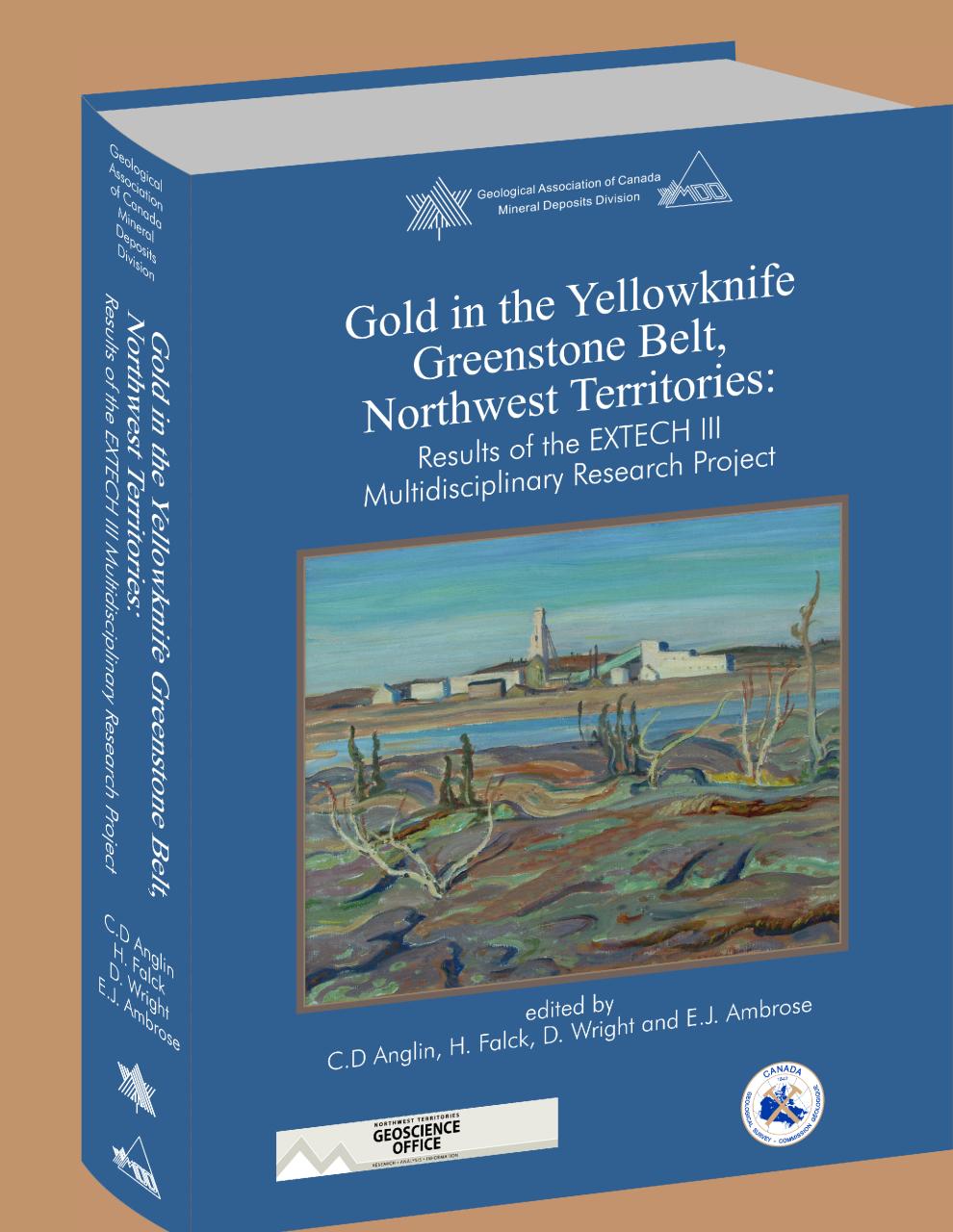
by Hendrik Falck, John Ketchum, and **Brian Cousens**

3000 2900 2850 2800 Chan Formation	2750 2700 2650 260
Time (in Ma)	Clan Lake Volcanics
?	Crestaurum Formation
Central Slave Cover Group>?	Townsite Formation
VOLCANISM	Kamex Formation
Central Slave Cover Group	Walsh Formation
	Burwash Formation
SEDIMENTATION	Duncan Group
Central	
Slave	
Basement Complex	Townsite QFP Anton Suite' Wool Bay Diorite
PLUTONISM	+Gabbro? ■ Ryan Lake → Defeat Suite →
	S, slaty S ₂ crenul cleavage cleava
REGIONAL FABRICS & DEFORMATION	
	S, crenu
	cleava
GIANT & CON FABRICS & DEFORMATION	D1 2 D2
METAMORPHISM	M1 M2a M
	Mo-Qtz VEINS
	WOTRAGENOLD REFRACTORY GOLD IN GIANT/CON? FREE-MILL
	GIAN GOLD: GIAN
GOLD	HIGH GRADE QTZ VEINS W. CHALCOPYRITE (Oro Lake)
3000 2900 2880 2860 2840 2820 2800 2790 2780 2770 2760	
2000 2000 2000 2000 2000 2000 2190 2180 2110 2100	50 2750 2740 2730 2720 2710 2700 2690 2680 2670 2660 2650 2640 2630 2620 2610 2600

Figure 4. A schematic representation of the Yellowknife greenstone belt stratigraphy and the chronology of significant events. (Modified from Siddorn and Cruden, 2000; Originally adapted from Bethune et al., 1999 and Bleeker and Davis, 1999).







GOLD IN THE YELLOWKNIFE GREENSTONE BELT, NORTHWEST TERRITORIES: RESULTS OF THE EXTECH III MULTIDISCIPLINARY RESEARCH PROJECT Geological Association of Canada, Mineral Deposits Division, Special Publication No. Edited by C. D. Anglin, H. Falck, D. F. Wright, and E. J. Ambrose

TABLE OF CONTENTS

The Yellowknife EXTECH Project Overview and Highlights C. D. Anglin, H. Falck, and D. F. Wright, and members of the EXTECH Advisory Committee
Part I
HISTORICAL BACKGROUND
The History of Minig and Its Impact on the Development of Yellowknife I. Moir, H. Falck, R. L. Hauser, and M. Robb
Evolution of Geological Understanding of the Yellowknife Mining District H. H. Helmstaedt
Socio-Economic Impacts of Mining in the Yellowknife Mining District W. Bullen and M. Robb
Part II
REGIONALGEOLOGY OF THE YELLOWKNIFE GREENSTONE BELT
Yellowknife Greenstone Belt, Slave Province, NWT H. Falck, J. W. F. Ketchum, and B. Cousens
Geology and Geochemistry of the Bell Lake Volcanic Complex and Its Relationship to the Yellowknife Greenstone Belt
V.A. Jackson and B. L. Cousens
Geology and Geochemistry of the Townsite Formation: Recognition of Felsic Porphyritic Intrusions Adjacent to Gold-Bearing Shear Zones in the Yellowknife Greenstone Belt, NWT C. S. Finnigan and N. A. Duke
Regional Correlations, Tectonic Settings, and Stratigraphic Solutions in the Yellowknife Greenstone Belt and Adjacent Areas from Geochemical and Sm-Nd Isotopic Analyses of Volcanic and Plutonic Rocks B. Cousens, H. Falck, L. Ootes, V. Jackson, W. Mueller, P. Corcoran, C. Finnigan, E. van Hees, C. Facey, and A. Alcazar
Structural Evolution of the Yellowknife Greenstone Belt, with Emphasis on the Yellowknife River Fault Zone and the Jackson Lake Formation E. Martel and S. Lin
Structure and Crustal Architecture in the Yellowknife Greenstone Belt from SNORCLE Seismic Survey

D. B. Snyder, W. Bleeker, B. J. Roberts, and M. D. Salisbury Electrical Resistivity Structure of the Yellowknife River Fault Zone and Surrounding Region A. G Jones and X. Garcia Metamorphic Constraints on the Geological Setting, Thermal Regime, and Timing of Alteration and

Gold Mineralization in the Yellowknife Greenstone Belt, NWT, Canada P. H. Thompson

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Part III MINERAL DEPOSITS AND REGIONAL METALLOGENIC STUDIES Geology of the Miramar Con Mine R. L. Hauser, D. W. McDonald and J. P. Siddorn Discovery, Mine Production, and Geology of the Giant Mine T. W. Canam **Fiant Mine: Alteration and Mineralization Study** L. J. Hubbard, D. D. Marshall, C. D. Anglin, D. Thorkelson, and M. H. Robinson The Giant-Con Deposits: Structural and Mineralization Histor J. P. Siddorn, S. Cruden, J. Armstrong, and L. Hubbard Large Lithogeochemical Alteration Halos Around Vellowknife Gold Deposits and Implications for Fluid E. H. van Hees, G D. Kirkham, M-L. Sirbescu, K. L. Shelton, R. L. Hauser, and H. Falck L. Ootes, D. R. Lentz, L. J. Cabri, and D. C. Hall Genesis of the Ptarmigan Gold Deposit: Is It of Magmatic Affinity? E. H. van Hees, M-L. C. Sirbescu, G D. Washington, K. J. Benda, K. L. Shelton, H. Falck, and R. T. Trenaman Pb Isotopic Compositions of Suphide Minerals from the Yellowknife Gold Camp: Metal Sources and Timing of Mineralization B. L. Cousens, H. Falck, E. H. van Hees, S. Farrell, and L. Ootes Surficial Geology and Exploration Geochemistry, Yellowknife Area D. E. Kerr Geophysical and Petrophysical Characteristics of Host Rocks, Alteration Zones and Structures Associated with Gold Mineralization in the Yellowknife Domain T. J. Katsube, J. Kerswill, S. Connell, P. Keating, and N. Scromeda-Perez Greenstone Belt, NWT C. J. Mwenifumbo, J. Kerswill, B. E. Elliott, H. Falck, P. Thompson, and L. Ootes Ground Electromagnetic Responses of the Gold Lake and Crestaurum Areas, Yellowknife Domain, Northwest Territories P. Keating and J. Katsube The Yellowknife 3-D Geoscientific Model - A Tool for Exploration G D. Kirkham, J. P. Siddorn, and H. Falck D. Wright and B. Daneshfar **Colour Diagrams and Photographs**

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

A total of 26 papers has been submitted for the volume which is organized into themes of: Historical Background; Regional Geology; Mineral Deposits and Regional Metallogenic Studies; Surficial Geology and Exploration Geochemistry;Geophysical Approach to Gold Exploration in the Yellowknife Area; and Data Integration and Guides to Exploration. The publication will also include a DVD containing: 1) digital files of appendices and tables; 2) a compilation of georeferenced geoscience data for the Yellowknife greenstone belt in a 2-D GIS database; and 3) over 50,000 drill holes from the Con and Giant mines compiled in a 3-D GIS database.

Some of the key results include:

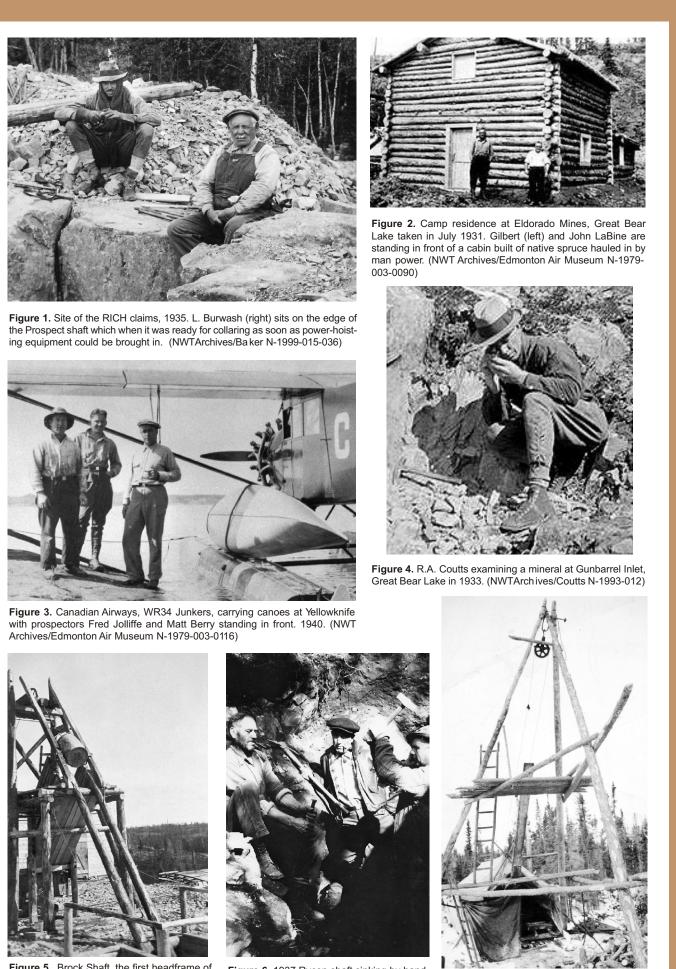
1) The compilation of information from over 50,000 drill holes at the two mines, integrated mine workings and lithochemical samples, utilizing 3-D GIS modeling undertaken collaboratively with mine geologists, has identified a number of drill targets for future

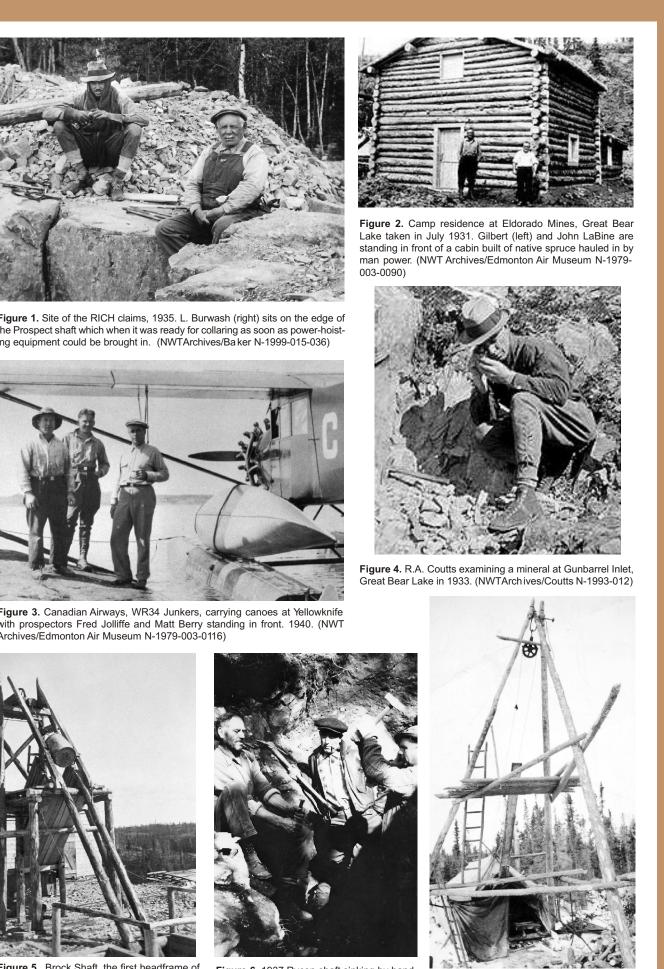
2) Metamorphic mapping has resulted in a comprehensive definition of the metamorphic isograds and their location for the main part of the Yellowknife greenstone belt and provides useful constraints on genetic modeling;

3) New geochronological data from both Re-Os and U-Pb zircon dating with the addition of bedrock geochemistry has helped clarify the Au mineralization timing, redefined the belt stratigraphy as well as allowing for the identification of a major crustal break; 4) The refinement of the Quaternary geology and testing of new approaches to till sampling in conjunction with biogeochemistry has allowed for more efficient kimberlite indicator mineral and gold grain surveys and resulted in the discovery of two new

5) Detailed surface and downhole geophysical surveys combined with laboratory studies on physical properties of the deposit lithologies has allowed for the refinement of the geophysical signatures of the orebodies and accompanying sulphide mineralization; 6) The compilation of the history of mining in the Yellowknife Greenstone Belt and its economic impact has contributed to a better understanding of the potential socioeconomic implications of future mines and exploration projects in the north. This volume is expected to be completed by March 2005.

The history of mining and its impact on the development of Yellowknife by Ian Moir, Hendrik Falck, Bob Hauser, and Malcolm Robb

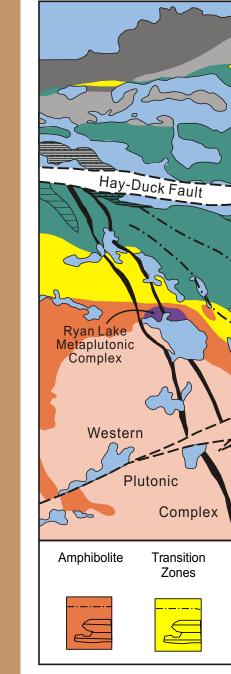




John Nyberg holding twisting, Jack Horan Figure 7. Con mine diamond drilling, 193



by P.H. Thompson



APPENDICES

ellowknife EXTECH 2-D GIS Data Compilation D. F. Wright, D. Irwin, and K. Pierce

- (A DVD containing all the data collected during the course of the EXTECH project plus al istorical data that has been collected and converted to a GIS format (e.g. bedrock geology. regional airborne geophysics etc.) 3-D Con and Giant Mine Compilation
- (Also on the accompanying DVD and will comprise the 3-D database compiled by G Kirkhar It will also include selected sections, a viewer, and documentation describing the database.) Compilation of Airborne Total Field Magnetic Geophysical Data for the Yellowknife Basin: NTS 85 I, J, O, P
- J. Robinson, L. Covello, and H. Falck Surface Geophysical Surveys for Gold Exploration in the Yellowknife Domain

T.J. Katsube, P.B. Keating, L. Covello, H. Falck, and S. Connell

- Geology and Gold Mineralization in the Crestaurum Mine Area, Northern Yellowknife Greenstone Belt,
 - **EXPLORATION TECHNOLOGY**
- Geophysical Characteristics of Gold Mineralization at the Giant and Crestaurum Deposits, Yellowknife

 - DATA INTEGRATION

- Spatial Analysis and Integration of Geoscience Data for Evaluation of Mineral Potential in the Vellowknife
- The painting on the front cover is "Negus Mine" by A.Y. Jackson, 1951. Courtesy of the Estate of the late Dr. Naomi Jackson Groves.



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Electrical resistivity structure of the Yellowknife River Fault zone and surrounding region

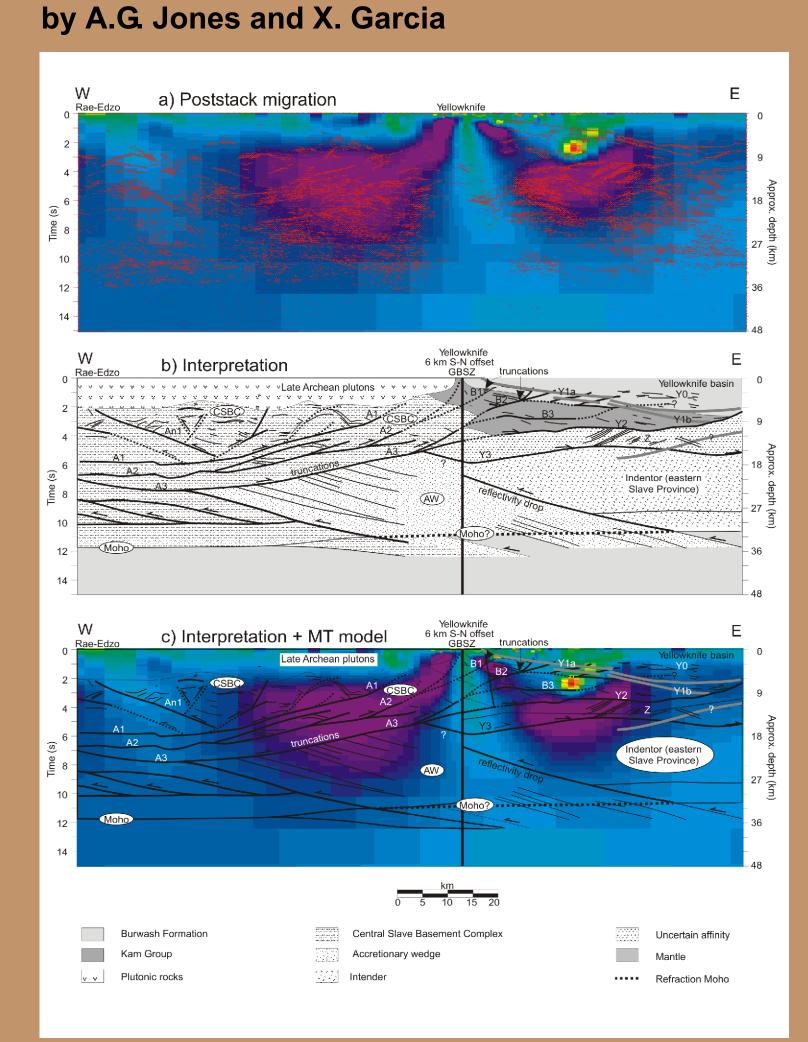


Figure 11. Seismic reflection migrated data and interpretation from Profile 1 of van der Velden and Cook (2002). The MT model has been distorted on either side of Yellowknife in order to take account of the road direction along which the seismic reflection data were acquired. (a) Migrated seismic reflection data on top of the resistivity model. (b) Interpretation by van der Velden and Cook (2002). (c) Comparison of the van der Velden and Cook (2002) interpretation with the resistivity model. (CSBC = Central Slave Basement Complex, GBSZ = gold-bearing shear zones)

Metamorphic constraints on the geological setting, thermal regime, and timing of alteration and gold mineralization in the Yellowknife greenstone belt, Northwest Territories.

> Greenschist Central Yellowknife Greenstone Belt (faults replaced Au mine -----Jackson Lake Fm (metaconglomerate, metasandstone) knotted schist / metagreywacke letabasalt/gabbro in Kam Group (mafic dominant, W of JLF slate, phylite / metagreywacke id in Banting Group (felsic dominant, E of JLF wnsite Fm _____, metatuff _-----)

Figure 5. Central part of the new metamorphic map of the Yellowknif greenstone belt (Appendix 14-3) with displacement across northtrending Proterozoic faults removed by assuming only a strike-slip component of movement and lining up granitoid contacts, the steeplydipping metaconglomerate unit in the Jackson Lake Formation (JLF) and Proterozoic diabase dykes. Th isograd defining the lower limit of the knotted schist zone is taken from Jolliffe (1942, 1946). The chlorite-carbonate zone (Appendix 14-3) is omitted here for clarity.

http://www.nrcan.gc.ca/gsc/mrd/extech3