Mineral Deposits of Canada
A Synthesis of Major Deposit Types, District Metallogeny, the Evolution of Geological Provinces and Exploration Methods

WAYNE D. GOODFELLOW
EDITOR
National Library of Canada Cataloguing in Publication Data
Main entry under title:
Mineral Deposits of Canada: A Synthesis of Major Deposit-types, District Metallogeny, the Evolution of Geologic Provinces, and Exploration Methods
Geological Association of Canada, Mineral Deposits Division, Special Publication No. 5

Publisher
Geological Association of Canada - Mineral Deposits Division
Department of Earth Sciences
Memorial University of Newfoundland
St. John's, Newfoundland, Canada A1B 3X5

Technical Editing: Elizabeth J. Ambrose, Lee Ewer
Jennifer Owen, Ingrid Kjarsgaard, and Shawn Hood
Technical Editing of French Abstracts: Benoit Couture
Desk Layout: Elizabeth J. Ambrose, Lee Ewer
Printed and bound in Canada by Friesens Corporation

Geological Association of Canada
Department of Earth Sciences
Memorial University of Newfoundland
St. John's, NL A1B 3X5 CANADA
Tel: (709) 737-7660; Fax: (709) 737-2532
Web: www.gsc.ca
E-mail: gac@esd.mun.ca

Authorization to photocopy items for internal or personal use, or for internal or personal use of specific clients, is granted by the Geological Association of Canada for libraries and other users provided that they obtain a copying licence from Access Copyright (The Canadian Copyright Licensing Agency), 1 Yonge St., Suite 1900, Toronto, ON M5E 1E5, Ph. (416) 868-1620; (800) 893-5777; Fax (416) 868-1621; www.accesscopyright.ca; licensingadmin@accesscopyright.ca
This permission does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. For such copying, arrangements must be made with the publisher in advance of publication.

L'Association géologique du Canada autorise les bibliothèques ou d'autres clients à reproduire des parties de ses publications pour leur usage interne ou personnel, ou l'usage interne ou personnel des clients désignés ou d'autres clients, à condition qu'ils aient obtenu préalablement une licence à cet effet de Access Copyright (The Canadian Copyright Licensing Agency), 1 Yonge St., Suite 1900, Toronto, ON M5E 1E5, Tél. (416) 868-1620; (800) 893-5777; Fax (416) 868-1621; www.accesscopyright.ca; licensingadmin@accesscopyright.ca
L'autorisation susmentionnée ne comprend pas toute autre reproduction, telle la reproduction pour fins de distribution générale, de publicité ou de promotion, pour la confection de nouveaux travaux collectifs ou pour la revente. Pour toute reproduction de cette nature, on doit au préalable convenir d'ententes à ces fins avec l'éditeur.

Gold-rich specimen from the Dome Mine, Timmins, Ontario that was presented to GSC in 1923 by the then Board of Directors of Dome Mines. Weight is 136 lbs (61.8kg) of which about 20% by weight is gold. This specimen is a high-grade Timiskaming conglomerate hosting folded carbonate-pyrite-quartz veins with spectacular visible gold. It most likely came from the bonanza East Dome area which was discovered in 1910. It consists of sub-rounded to sub-angular altered and non-altered clasts and folded cross-cutting veins of coarse pyrite,ankerite and minor quartz, shattered and invaded by gold. GSC sample from National Mineral Collection No 10005. Photograph by Igor Bilot, GSC. (see Dubé and Gosselin, this volume).
# Mineral Deposits of Canada

A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods

Edited by
Wayne D. Goodfellow

## Introduction and Mining History

Mineral Deposits of Canada: A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods - An Introduction
Wayne D. Goodfellow ................................................................. 1

An Overview of the Economic and Geological Contexts of Canada’s Major Mineral Deposit Types
John W. Lydon .......................................................... 3

## Synthesis of Major Deposit-Types

Greemstone-Hosted Quartz-Carbonate Vein Deposits
Benoit Dubé and Patrice Gosselin ................................................. 49

Gold-Rich Volcanogenic Massive Sulphide Deposits
Benoit Dubé, Patrice Gosselin, Patrick Mercier-Langevin, Mark Hannington, and Alan Galley 75

Reduced Intrusion-Related Gold Systems
Craig Hart .......................................................... 95

Epithermal Gold Deposits
Bruce Taylor ................................................................ 113

Volcanogenic Massive Sulphide Deposits
Alan G. Galley, Mark D. Hannington, and Ian R. Jonasson 141

Sedimentary Exhalative (SEDEX) Deposits
Wayne D. Goodfellow and John W. Lydon .................................. 163

Mississippi Valley-Type Lead-Zinc Deposits
Suzanne Paradis, Peter Hannigan, and Keith Dewing 185

Magmatic Nickel-Copper-Platinum Group Element Deposits
O. Roger Eckstrand and Larry Halbert .................................. 205

Porphyry Deposits
W.D. Sinclair .................................................................. 223

Kimberlite Diamond Deposits
B.A. Kjarsgaard ................................................................ 245

Unconformity-Associated Uranium Deposits of the Athabasca Basin, Saskatchewan and Alberta
C.W. Jefferson, D.J. Thomas, S.S. Gandhi, P. Ramaekers, G. Delaney, D. Brishman,
C. Cuirs, D. Quirt, P. Portella, and R.A. Olson 273

Iron Oxide Copper-Gold Deposits: A Canadian Perspective
Louise Corrievau ................................................................ 307

## Metallogeny of Major Mining Districts

Metallogeny of the Sudbury Mining Camp, Ontario
Doreen E. Ames and Catharine E.G. Farrow .......................... 329

Ni-Cu-(PGE) Deposits in the Raglan Area, Cape Smith Belt, New Québec
C.M. Leshner .................................................................. 351
### Table of Contents

The Voisey's Bay Deposit, Labrador, Canada  
*Anthony J. Naldrett and Chusi Li* .................................................. 387

Migmatic Ni-Cu-Platinum-Group Element Deposits of the Thompson Nickel Belt  
*Daniel Layton-Matthews, Michael Leahy, O. Marcus Burnham, Janice Liviang, Norman M. Halden, Larry Halbert,* and *David C. Peck* ...................................... 409

Overview of the Geology and Cr-PGE Potential of the Southern Québec Ophiolite Belt  
*J.H. Bédard, P. Pagé, V. Bécu, J.-M. Schroetter,* and *A. Tremblay* .................. 433

Metallogeny of the Bathurst Mining Camp, Northern New Brunswick  
*Wayne D. Goodfellow* ............................................................................ 449

Volcanic-Hosted Massive Sulphide Deposits of the Finlayson Lake District, Yukon  
*Jan Peter, Daniel Layton-Matthews, Stephen Piercey, Geoffrey Bradshaw, Suzanne Paradis,* and *Amy Boulton* .......................................................... 471

Metallogeny of the Paleoproterozoic Flin Flon Belt, Manitoba and Saskatchewan  
*Alan G. Galley,* *Ric Syne,* and *Alan H. Baines* ....................................... 509

Volcanogenic Massive Sulphide Deposits of the Archean, Noranda District, Quebec  
*Harold L. Gibson and Alan G. Galley* .................................................. 533

Base Metal Metallogeny of the Selwyn Basin, Canada  
*Wayne D. Goodfellow* ............................................................................ 553

Geology and Metallogeny of the Belt-Purcell Basin  
*John W. Lydon* .................................................................................... 581

Metallogeny of the Pine Point Mississippi Valley-Type Zinc-Lead District, Southern Northwest Territories  
*Peter Hannigan* .................................................................................... 609

Metallogeny of the Robb Lake Carbonate-Hosted Zinc-Lead District, Northeastern British Columbia  
*Suzanne Paradis and JoAnne L. Nelson* .................................................. 633

Synopsis of the Polaris Zn-Pb District, Canadian Arctic Islands, Nunavut  
*Keith Dewing, Robert J. Sharp,* and *Elizabeth Turner* ................................ 655

Metallogeny of the Doyon-Bousquet-LaRonde Mining Camp, Abitibi Greenstone Belt, Quebec  
*Patrick Mercier-Langevin, Benoît Dubé, Benoît Lafrance, Mark Hannington,*  
*Alan Galley, James Moorhead,* and *Patrice Gosselin* ................................ 673

Base Metal and Gold Deposits of the Betts Cove Complex, Baie Verte Peninsula, Newfoundland  
*Alan L. Sangster,* *Stephanie L. Douma,* and *Jamie Lavigne* .................... 703

Metallogenic Summary of the Meguma Gold Deposits, Nova Scotia  
*Alan L. Sangster* and *Paul K. Smith* .................................................. 723

**Evolution and Metallogeny of Canadian Geological Provinces**

Geological History, Mineral Occurrences, and Mineral Potential of the Sedimentary Rocks of the Canadian Arctic Archipelago  
*Keith Dewing, Elizabeth Turner,* and *J.C. Harrison* .................................. 733

Tectonics and Metallogeny of the British Columbia, Yukon, and Alaskan Cordillera, 1.8 Ga to the Present  
*JoAnne Nelson* and *Maurice Colpron* .................................................. 755

Pre-Carboniferous Tectonic Evolution and Metallogeny of the Canadian Appalachians  
*Cees R. van Staal* .................................................................................. 793

Prospective Metallogenic Settings of the Grenville Province  
*Louise Corriveau, Serge Perreault,* and *Anthony Davidson* ......................... 819

The Slave Craton: Geological and Metallogenic Evolution  
*Wouter Bleeker* and *Brian Hall* ......................................................... 849
# Table of Contents

Tectonic Evolution and Metallogeny of the Southwestern Trans-Hudson Orogen  
*D. Corrigan, A.G. Galley, and S. Pehrsson* ........................................ 881

Geology and Metallogeny of the Superior Province, Canada  
*John A. Percival* ................................................................. 903

Large Igneous Provinces in Canada Through Time and their Metallogenic Potential  
*Richard Ernst* ........................................................................ 929

## Geophysical and Geochemical Exploration Methods

Overview of Geophysical Signatures Associated with Canadian Ore Deposits  
*K. Ford, P. Keating, and M.D. Thomas* ........................................ 939

Application of Seismic Methods to Mineral Exploration  
*Matthew Salisbury and David Snyder* ........................................... 971

Indicator Mineral and Surficial Geochemical Exploration Methods for Kimberlite in Glaciated Terrain; Examples from Canada  
*M.B. McCluney and B.A. Kjarsgaard* ........................................... 983

Aqueous Geochemistry in Mineral Exploration  
*Matthew J. Leybourne* .............................................................. 1007

Alteration Vectors to Metamorphosed Hydrothermal Systems in Gneissic Terranes  
*Anne-Laure Bonnet and Louise Corriveau* ...................................... 1035

3-D Geological Modelling Supporting Mineral Exploration  
*Éric de Kemp* .......................................................................... 1051

## DVD Contents

1. Appendices consisting of spreadsheets containing the key attributes (about 40) of deposits in Canada and worldwide.
2. ArcGIS multiparameter, attributed, and co-registered database of mineral deposits of Canada and the world.
3. Ore photo library of major deposits including a) location map, b) geological maps and cross-sectional geology, c) genetic model(s), and d) photographs and photomicrographs of representative rocks, including host lithologies, ore facies, and alteration facies.
4. Digital files of all figures and tables from papers within the volume.
5. An Endnote bibliography of all literature referenced in the volume. A Microsoft WORD file of all references is also included.
6. PDF files of all papers in the volume.