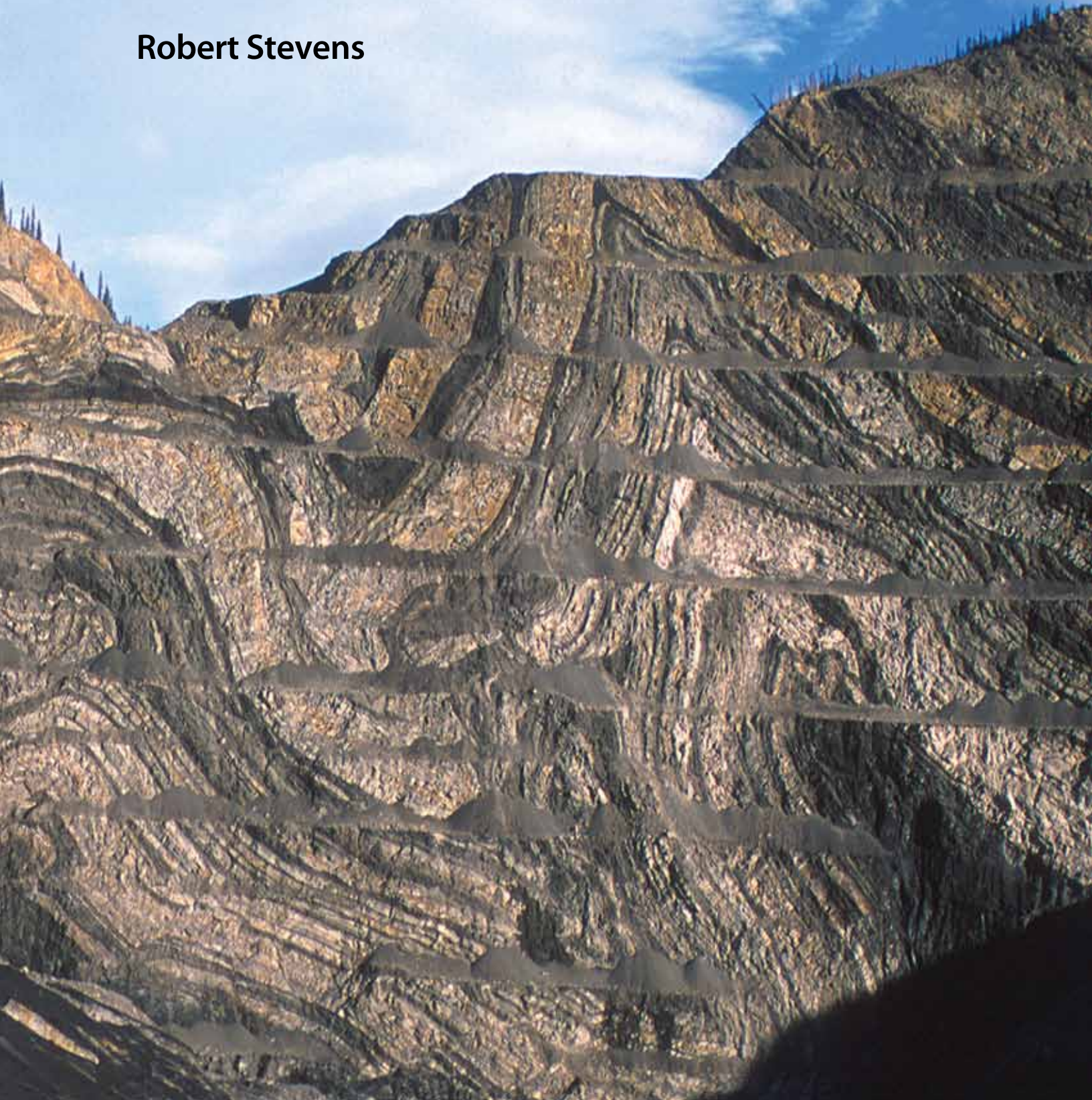


Mineral Exploration and Mining Essentials

Robert Stevens



**MINERAL EXPLORATION
AND MINING ESSENTIALS**







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Association for Mineral Exploration

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Folded coal seams and sedimentary rocks from the 'A North' highwall at the Cardinal River Coal Mine in southwestern Alberta (image courtesy of Teck Resources).

Frontispiece

Open pit at Barrick Gold's Goldstrike Mine in Nevada in March, 2010 (photo by Bryan Farbridge).

Previous page

Northern lights shine over an exploration field tent at the Revenue Camp, Yukon (photo copyright Mark Roden, Northern Freegold Resources Ltd.).

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PREFACE

The Mineral Exploration and Mining Industry

The mineral exploration and mining industry is a dynamic, high-tech and diverse sector that is vital to our modern world. It combines science and engineering with business and finance and it is fuelled by a drive for discovery. It is an industry requiring the expertise of a vast array of participants, where technical and business professionals work alongside entrepreneurs, risk takers and creative thinkers to discover, develop, operate and decommission mines. The mining industry is a primary wealth creation industry. It provides the raw products needed for almost all other sectors and it supports the economic development of countries and communities across the globe. The mining industry continuously strives to operate more efficiently and to limit its impact on the environment, while supporting the economic and social development of communities and countries. As we move toward a more sustainable way of life on Earth, the products of the mining industry will continue to play a vital role in the development of emerging industries such as renewable energy technologies. The mining industry is not an industry of the past; it is an industry crucial to the present and the future. It is exciting to participate in and to learn about.

This book is aimed at non-technical individuals and professionals who are working, or interested, in the mineral exploration and mining industry. It will also be of benefit to students, investors, community leaders, regulators and the general public. The book provides an overview of the industry from exploration to mine closure and should serve as a valuable reference that can be reviewed and re-read over time. It is hoped that the book will lead to more informed business and investment decisions, will assist with the advancement of professional careers, and will support the effective review and evaluation of mineral development proposals by financiers, governments and communities.

Organization

The book is divided into nine chapters that more or less follow the typical path of a mining project from exploration through mine development, operation and closure. Each chapter stands alone, but a broader appreciation of the mining industry, as presented in the book, will be enhanced by reviewing each chapter sequentially. Chapter 1 provides an overview of the mineral exploration and mining industry in a global context, introduces the participants in the industry and discusses the sources of funding. Chapters 2 and 3 provide a brief review of geology and mineral deposits. Because the mineral exploration and mining industry is built around evaluating and extracting rocks and

mineral deposits, it is important to have a basic understanding of these technical topics. Where possible, the linkages between basic geology and mineral exploration or mining applications have been highlighted. Chapter 3 also includes a survey of 10 common mineral deposit types that will serve as a valuable reference. Chapter 4 discusses mineral exploration and includes business aspects such as option agreements and technical aspects such as geochemical and geophysical surveys and drilling methods. Chapter 5 covers topics that represent the transition from mineral exploration to mining, including mineral resource and reserve estimates and feasibility studies. It also includes a review of Canada's national securities instrument 43-101 (NI43-101). Chapters 6 and 7 discuss mining and mineral processing and review both surface and underground mining and the recovery of precious and base metals. Chapter 8 touches on a number of environmental considerations that are important to the industry such as sustainable development, environmental assessment, and closure and reclamation. Chapter 9 outlines some of the factors that should be considered when evaluating exploration companies and technical news releases, particularly from an investment point of view.

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This book has benefitted from the support of a wide range of individuals, companies and organizations. It has grown out of a manual that the author developed for courses on mineral exploration and mining for the business and investment sector, and for governments and communities. The feedback from many participants in these courses was an important driver leading to the development of this book and their comments have significantly improved the manual over the years. The first version of the manual was for a British Columbia Institute of Technology (BCIT) course called "MINE 1010: Exploration and Mining for Investment Advisors and Investors." This course is part of a collection of courses that the mining program at BCIT has run in partnership with the Association for Mineral Exploration BC (AME BC). Both organizations are thanked for their support in the development of this book. In particular, BCIT is thanked for providing the author with the time and resources needed to complete this book, for providing a supportive and dynamic environment in which to work, and for its commitment to high quality education. Paul Razzell from the Learning and Teaching Centre at BCIT provided invaluable help in editing and in the design and layout of the book.

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MEET THE AUTHOR

Robert Stevens, Ph.D., P.Geo.



Robert Stevens on an outcrop overlooking Vancouver BC in October, 2010 (photo by Scott McAlpine).

Robert Stevens is a professional geologist who is well known for his involvement in the mineral exploration community in Vancouver and for delivering dynamic and enlightening courses on the mineral exploration and mining industry. Dr. Stevens is the Vice President of Regulatory and Technical Policy at the Association for Mineral Exploration (AME) where he supports the mineral exploration industry by advocating for sound government policy and developing tools and workshops that help advance the practice of AME's members. Prior to that (2016-2018) he was the Director of Partnerships and Learning at the Canadian International Resources and Development Institute (CIRDI) based at the University of British Columbia. At CIRDI, Rob worked with developing country governments to support the sustainable management of mineral resources.

This book was written while Dr. Stevens was the Associate Dean of Natural Resources at the British Columbia Institute of Technology and a faculty member and head of the Mining and Mineral Exploration Technology department (2000-2016). He received his Ph.D. in geology from the University of Alberta and an Honours B.Sc. in geology from the University of Waterloo. In 2011, Dr. Stevens was awarded the Association of Professional Engineers and Geoscientists of British Columbia's premier award for professional geoscience, the C.J. Westerman Memorial Award. He is passionate about the mineral exploration and mining industry and enjoys the mix of science, engineering, business, discovery and entrepreneurialism that are integral to the industry.