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VOLUME ONE

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Dedication

With deep appreciation for his contributions to the mining industry, we dedicate this 3rd edition of the SME Mining Engineering Handbook to the memory of Richard E. Gertsch, 1945–2005.

Richard provided the initial leadership and direction for this edition. His guidance allowed others to carry on with his vision.

Richard was a widely respected and admired mining engineer enjoying an illustrious career spanning decades of work both in industry and academia.

Richard served on the SME Board of Directors and as the Chair of the M&E Division. He was active on many committees working on important SME functions such as peer review, programming, membership, publications, nominations, scholarships, and awards. He received the Distinguished Service Award in 1991.
Foreword

Mining engineers throughout the world are the salt of the earth, and this third edition of the SME Mining Engineering Handbook will be their bible. It builds on the grand tradition begun by highly respected leaders of the mining industry—Peele (1918, 1927, and 1941) and continued by Cummins and Given (1973) and then Hartman (1992).

Handbooks by their nature are often hard to read, but this one is a striking exception. Its readability immediately stands out and allows one to quickly absorb and comprehend its content—not only the text, but also the many tables, figures, and photographs. Artwork has been substantially upgraded and is especially appealing. The superb presentation reflects the managing editor’s technical writing background, as well as the input and skills of Jane Olivier, SME’s manager of book publishing, who spent a decade urging a new edition, and Diane Serafin, an editing specialist, who delved doggedly into the tedious details.

The bar of excellence in the quality and scope of material is well maintained and at a high level throughout. Often a work involving numerous experts can lead to conflicting views on countless aspects. However, the clashing of ideas is notably a hallmark of serious thinking. The clear beneficiary of the high standard is the reader, which in this case is the practicing mining engineer in the worldwide mining industry, as well as others in academia and government.

The strength of this handbook lies clearly in the quality of the chapter authors and peer reviewers. They are indeed talented experts in their specialized technical fields. A decided trend toward internationalism, paralleling similar trends in the supply and demand of mineral and energy raw materials, is evidenced by a cursory perusal of the lists of contributing authors and technical reviewers. Almost half of them are working and living outside the United States. In total, ten countries are represented—primarily English-speaking ones.

Such a diverse cadre of individuals offers wide-ranging views of the worldwide mining industry’s multifaceted problems and potential solutions in a period of accelerated technological and social change. The broad scope is another strength for which no unanimity of thought can be expected or anticipated when taking a global perspective on the various issues.

Carryover material from previous editions is strictly limited, and when included, it is updated to be genuinely contemporary and purposeful. Practical and useful instead of merely theoretical and interesting are the watchwords throughout the work.

Comprehensiveness is an important feature not to be overlooked in a world-class handbook. This edition sets the standard and will be emulated far into the future. Much attention has been given to what can be instead of what is past. Productiveness received authoritative treatment. Specific emphasis has been given to broad topics that will continue to confront the industry in the years ahead, such as environmental issues, public concerns, health and safety matters, and sustainability. This handbook provides a pathway for the synthesis and solution of many of the complex issues and problems the mining industry is facing in the 21st century.

Raymond L. Lowrie
Editor of the SME Mining Reference Handbook
Recipient of the 2004 SME President’s Citation
February 2011
Preface


From that initial publication in 1918, the handbook has been acknowledged as the repository of all essential information and useful, practical detail relating to virtually every aspect of mining.

From the beginning of my mining career, I have relied heavily on this book as a source of inspiration and information. With the honor of being asked to take on the somewhat challenging role of managing editor for this third edition, I owe a debt of professional gratitude to several generations of managing editors, authors, and technical reviewers who set the seemingly impossible high standards in the previous editions of the handbook.

From the onset, several objectives were established. These objectives included (1) to produce a book that would stand shoulder to shoulder as an equal alongside previous editions, (2) to maintain its tradition of being the “handbook of choice” for every practicing mining engineer, (3) to be practical rather than theoretical in its content and approach, and (4) to be international in its appeal and examples.

Mining is an international business, and the importance of sharing experiences, knowledge, and examples from around the world cannot be overemphasized. A water “problem” in one part of the world may be considered “normal” in another. A “deep” mine on one continent may connote “very deep” on another. Tailings dams in some countries need to be earthquake proof, whereas in other countries they must be free draining.

This edition attempts to take the best of the best from around the world and package it in a standard and logical format for the benefit of the global industry. This internationalism is shown by the subjects covered in each chapter as well as by the nationalities of the world-class authors and technical reviewers represented. It is noteworthy that most significant mining operations have graciously shared their knowledge, techniques, experience, and alternative viewpoints.

The handbook has moved with the times to cover the issues that are exercising the industry, the innovations that are exciting, and how the industry is dealing with changing attitudes toward a number of its constituents such as energy (both electrical generation and carbon/petroleum based), water management, resource maintenance, and the whole subject of sustainable development. One of the significant areas in which this handbook differs from previous editions is that it includes several chapters on both the social and environmental issues often associated with mining, and, more importantly, how these issues and their impacts can be mitigated and managed.

It is important to note that this is a handbook and not an encyclopedia of everything mining. Several subjects previously included as dedicated chapters are now covered in less detail within other chapters. This move was not designed to marginalize or dilute the importance of certain subjects but was done to acknowledge the significant shifts in the way mining has changed as a result of new technologies. It also reflects how the work and the responsibilities of today’s mining engineer have changed and developed.
Attempts to encapsulate the essence of so diverse a discipline as mining engineering could not have been possible without the unselfish contributions of the hundreds of authors, coauthors, technical reviewers, and mentors who are very much the unsung heroes of this publication. Much gratitude and thanks are due to the many talented and world-class professionals who have given so freely, patiently, and enthusiastically of their time, hard-earned experiences, and masterful knowledge on a plethora of mining and related subjects to ensure that this handbook was produced on time and to the meteoric standards that the industry has come to expect.

One of the many delights of managing this project has been the acquaintance (usually electronically) of so many helpful, patient, enthusiastic, and friendly people from within the various mining associations, academic establishments, mining companies, and consultancies, as well as retired engineers and specialist editors—everyone an expert in their field. Without their cooperation, steady guidance, constructive comment, and encouragement, the managing of this edition would have been an impossible task. I cannot name them all, and to mention some but not others would be ungracious, but tremendous appreciation is due.

These experts are headed by the authors themselves, almost every one of whom is a world leader in their specialist field. Often with the briefest of guidance and without any form of remuneration, they have passionately undertaken their writing tasks. Their enthusiasm, commitment, and professionalism formed the bedrock on which the handbook has been based, and, as a result, they have produced superb and exceptional texts. I salute and thank you all.

Next, I acknowledge the many technical reviewers who, often at short notice and, as this project progressed, with an ever shortening lead time, have been called on to read through many drafts before articulating and listing their comments, suggestions, and observations. It typically was not an easy task and often may have been a marathon requiring skills, diplomacy, and knowledge that went well beyond their original brief. I apologize and thank you.

Thanks are extended to SME’s book publishing team who have been thoroughly professional and efficient in their handling of this edition. This team has checked every comma, word, phrase, sentence, and illustration. They have ensured that copyright rules have not been flaunted in the quest for expedition, checked and rechecked references, standardized units of measure, and performed a hundred and one other tasks to ensure that this finished product is a source of information in a format that at best pleases and at worst does not annoy. Their attention to detail in this exacting task is very much appreciated.

I also thank SME for affording me this opportunity to repay some of the debt that I believe is owed to an industry that has kept me fed, watered, enthralled, and enthused for more than three decades.

Finally, I trust that any errors in opinion, facts, or perceptions in the handbook are few in number and will not overtly detract from the usefulness of and, I dare say, enjoyment of this third edition of the *SME Mining Engineering Handbook*.

Peter Darling
February 2011
Peter Darling, managing editor of the third edition of the SME Mining Engineering Handbook, has more than 30 years of experience as a mining engineer and journalist.

A graduate of the Royal School of Mines, Imperial College, London, Darling worked as an oil industry engineer on offshore projects in Gabon, Congo, Angola, the Gulf of Guinea, the Gulf of Mexico, the North Sea, Tunisia, Egypt, and Abu Dhabi. He was also involved in underground platinum mines in South Africa and open-pit tin operations in Brazil.

Darling then embarked on a career as a technical writer and editor. His assignments took him to mines, quarries, tunnels, and construction sites stretching from Chile to China, Alaska to Australia, Peru to Papua New Guinea, and Russia to La Reunion. During this period he served as editor for a variety of respected industry publications, including International Mining, Engineering and Mining Journal, Rock Products, Tunnels & Tunnelling International, International Construction, The Cement Edition, Construction Asia, and Coal (North America). Darling also served as the press officer for Rio Tinto in London.

As a Royal Air Force Reserve officer, Darling was deployed to Gulf War II and twice to Afghanistan where he completed the final edit of the handbook. He is a Chartered Engineer and member of the Institute of Materials, Minerals and Mining and a member of the Society for Mining, Metallurgy, and Exploration.

Darling is currently a freelance technical editor, journalist, reporter, and speech writer specializing in mining, quarrying, oil and gas, tunneling, heavy construction, and engineering.

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