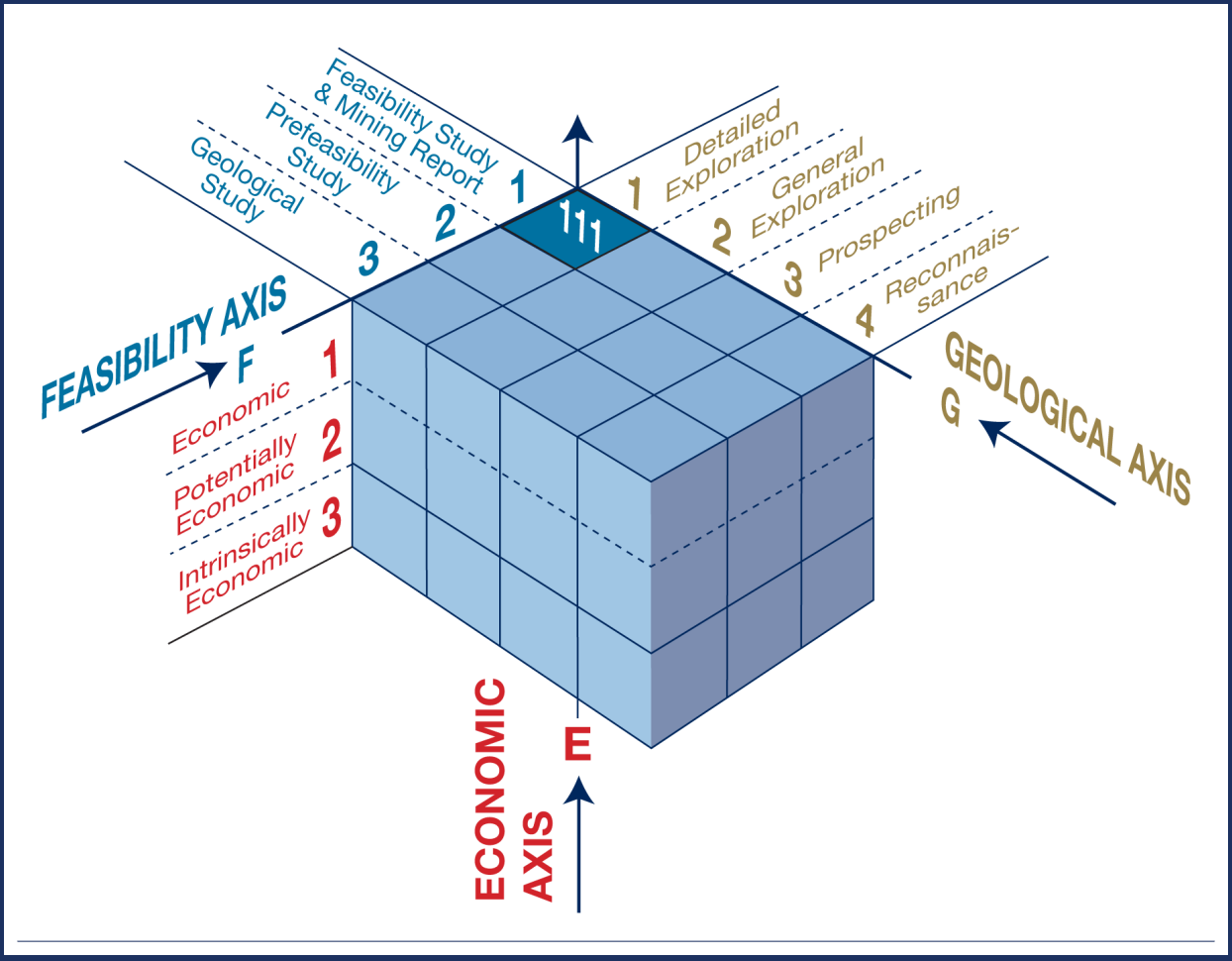
www.segweb.org

Special Publication, No. 3

Ore Reserve Estimates in the Real World



Editors

J.G. Stone and P.G. Dunn

SOCIETY OF ECONOMIC GEOLOGISTS, INC.

Special Publications of the Society of Economic Geologists

Special Publication, No. 3

Ore Reserve Estimates in the Real World

John G. Stone and Peter G. Dunn, Editors

First Edition, 1994
Second Edition, First Printing, 1996
Second Edition, Second Printing, 1998
Third Edition, 2002
Fourth Edition, 2012

Additional copies of this publication can be obtained from

Society of Economic Geologists, Inc.
7811 Shaffer Parkway
Littleton, CO 80127

www.segweb.org

ISBN: 978-1-629496-21-4

About the Authors

JOHN G. STONE received his undergraduate training at Yale University and a Ph.D. degree in economic geology from Stanford University. Following graduation, he joined the Hanna Mining Company as a staff geologist and for the next 30 years served in various positions in exploration and mine geology, project management, mine development, and financial analysis of new and existing mining ventures. In 1979, he was named manager of Hanna's Pilot Knob operation in Missouri, and from 1982 until 1989 served as Chief Geologist, Mineral Resources. During the course of his career he has been involved with the exploration, evaluation, development, or management of direct shipping, "taconite," and volcanogenic iron deposits, porphyry copper, volcanogenic copper-zinc, magmatic copper-nickel, Mississippi Valley-type lead-zinc, epithermal vein and disseminated gold, nickel laterites, and placer gold and gold-diamond deposits. He has worked in Canada, Mexico, Guatemala, Venezuela, Colombia, and Brazil.

PETER G. DUNN received a B.S. degree in geology from Yale University in 1955 and started work as a mining engineer at Miami Copper Company in Arizona. He received an M.Sc. degree in mining geology from Stanford University in 1958, and migrated to Australia where he worked for five years with the Australian Bureau of Mineral Resources and Mount Isa Mines. After returning to the United States, he worked for Kennecott in Arizona and in South America, for Quintana Minerals in the western United States, and for Chevron Resources in the United States, Australia, and Chile. He is currently a consulting geologist specializing in porphyry copper exploration and property evaluation, working in North America, South America, and Asia.

Foreword

This text was originally based on notes presented as a short course given at the 1993 conference, entitled *Integrated Methods in Exploration and Discovery*, sponsored by the Society of Economic Geologists, The original notes were subsequently modified, expanded, and appeared as Special Publication Number 3 of the Society of Economic Geologists. Based on comments and suggestions received since the publication of the first edition in 1994, the publication of several relevant papers, and the comments of various attendees at several presentations of the short course, the text was revised, first in 1996, and again in 2000. Since that time, there has been a steady modest demand for this publication, and we have been asked to consider whether or not a re-write would be in order.

Clearly, commodity prices used in some of the economic evaluation exercises are no longer applicable (a gold price of $350/oz seems like a quaint anachronism!). However, if we were to escalate metal prices, we would also be faced with the problem of escalating operating costs. The original premise behind the various exercises was not so much a financial evaluation of a specific property but an illustration of the use of financial considerations in the evaluation of a potential mining venture. Many of those exercises, and some of the discussion in Chapter II, were based on actual cost sheets of real operations, many of which are no longer in operation. Therefore, we have elected not to attempt an artificial modification of costs and prices, but to retain the original figures as representative of the importance of economics in the process of evaluation of any potential mineral venture.

As with earlier editions, this text does not purport to be a course in geostatistics or financial evaluation, nor is it a collection of "cookbook" recipes for reserve estimation. It was intended as a discussion of various important aspects of reserve estimation that in our view are often neglected in the real world, and for that reason, it does not necessarily follow the normal progression of exploration and deposit development. Although published under the aegis of the Society of Economic Geologists, it is hoped that the material herein will be of interest to mining engineers and others dealing with the practical aspects of reserve estimation.

Both the original text and subsequent revisions owe a great deal to the attendees of numerous short course presentations over the past years, to all of whom we express our sincere gratitude. Discussions with Robin Oram of Santa Barbara Mining Services, with M. Sander and R. Hasler of Magma Copper, and R. Sims of the Winters Company have contributed a great deal to the section of the text dealing with the reconciliation of reserve estimates. F.T. Graybeal, A.J. Erickson, H.M. Parker, I.S. Parrish, D.E. Ranta, H.W. Schreiber, and S.l. Ristorcelli all reviewed the original text. G.A. Hahn very generously provided a case history summarizing many of the points we consider important in reserve estimation. Alan Noble very kindly allowed us to incorporate previously unpublished work in the section of the text dealing with the evaluation of the geometry of a given deposit. We are indebted to John Thoms for his encouragement and forbearance during the preparation of the third edition of the text, and to Alice Bouley for offering us an opportunity to correct several minor "typos" in the text. The following organizations gave us permission to use the data on which much of the discussion and various practical examples are based.

ASARCO, Inc.
Battle Mountain Gold (California)
Cia. Cerro Matoso
CoCa Mines
Cominco American Resources
The M.A Hanna Co.

Quite obviously, we still remain responsible for the views expressed herein.

JOHN G. STONE
PETER G. DUNN

Contents