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José M. Azcue (Ed.)

Environmental Impacts of Mining Activities

Emphasis on Mitigation and Remedial Measures

With 76 Figures and 54 Tables

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Editor

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Preface

"It is mined from deep mines,
for it is material that nature hides from us,
teaching us to leave it alone as harmful,
but this does not cause the arrogant miners to leave it"
(Birringucio 1540)

Mining has gone on for thousands of years and abandoned mines and active mine operations are found throughout the world. Mining has played a key role in the development of humanity and is a major asset to the economy of many countries. Our ancestors were already aware of the potential toxic risks of some of the mining activities, as shown in the above citation regarding arsenic mining (V. Birringucio, 1540 *The Pirotechnia.* The MIT Press, Massachusetts, 1943). The concern for the health of miners has evolved in parallel with mining development. However, only in the last decades did the environmental impacts of mining activities become a social concern.

Multidisciplinary approach is a prerequisite to tackle mining problems. This book was designed to serve a wide international audience, including those working in government agencies, universities, and the private sector, evaluating environmental impacts and suggesting remedial measures. Special attention was given to selecting an eclectic group of problems and approaches. The information is divided in to three sections, namely, Section A '*Evaluation of Effects of Mining in the Environment*', Section B '*Treatment Methods for Mine Effluents and Rehabilitation of Mine Tailings and Overburden Materials*', and Section C '*Study Cases*'. Care has been taken to provide suitable literature sources for those desiring more specific information. Due to the magnitude of the problem and the vast range of solutions no attempt has been made to cover all aspects and this book does not pretend to be a final answer but a step in a new approach.

Section A (Chapters 2 to 7) covers a wide range of relevant topics for the evaluation of environmental effects of mining activities. Mining inevitably represents an alteration in the environmently of its area of influence. Nevertheless, its environmental impacts can be significantly minimized by using environmental compatible mining and ore-dressing techniques and by developing new technologies for treating ores, effluents, and waste materials. An understanding of the causes originating some of the environmental problems led to the application of preventive measures. The technologies for treatments of mining effluents and rehabilitation of mine tailings are under continuous development. Section B (Chapters 8 to 12) presents several physico-chemical and biological treatment methods for mine effluents and overburden materials. There are numerous studies in the literature showing severe environ-

mental effects of mining activities. For instance, the environmental effects of the uncontrolled and intensive development of gold mining activities in the Brazilian Amazon during the past 15 years have shown to have global significance (Lacerda and Salomons 1997 *Mercury from gold and silver mining: a chemical time bomb?* Springer-Verlag). Fortunately, there are as well several positive examples of improved industrial technologies and land and water reclamation techniques such as the Sudbury case in Ontario, Canada (Gunn 1995 *Restoration and recovery of an industrial region.* Springer-Verlag). In Section C four different study cases are presented.

Nowadays large amounts of money and efforts are being devoted by many countries and industries to minimize environmental mining problems. However, many of the mineral resources are located in less-developed countries where environmental protection measures are a low priority. This represents a major challenge and responsibility in order to approach the environmental effects of mining activities on a global scale. We should make sure that the problems that industrialized countries are facing today will not be repeated in new mining developments.

José M. Azcue
Lisbon, 1998

Contents

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