Preface to Second Edition

The first edition of this book was reviewed by Stephen Kesler who was generally positive, but suggested that Chaps. 4 and 5 could be expanded to provide more information on deposits of current exploration and research interest. To resolve the problem he was invited to join as a co-author for the new edition. We made minor revisions to Chap. 3 on magmatic deposits and revised thoroughly the chapters that open and close the book. In so doing we were able to take into account recent developments in the world of economic geology. We revisited the question of peak copper—when, or if, we will ever exhaust our reserves of mineral products—and added new sections on the impact of China of the global mineral industry and on the ever more important socio-economic factors that influence the exploitation of ore deposits.

During the writing of the second addition we received help from many friends and colleagues. In addition to those who reviewed chapters in the first edition we particularly thank Steve Barnes, Jean Cline, Richard Goldfarb, Mark Hannington, Jeffrey Hedenquist, Murray Hitzman, Richard Kyle, Kurt Kyser, Eric Marcoux, John Thompson and Olivier Vidal for reading selected chapters and offering comments and advice. The French Centre Nationale de Recherche Scientifique (CNRS), the Université Grenoble Alpes and the Université de Nice—Sophia Antipolis supported us during the preparation of the manuscript.
In the years that preceded the writing of this book, metal prices first soared to record levels, then plummeted to half these values (Fig. 0.1). Accelerating demand from China and other developing countries triggered the rise; collapse of the world economy triggered the fall. When prices were high, mineral exploration companies doubled their efforts to find new resources, and geologists were in great demand; the fall has stifled this demand. When the economy eventually recovers, the demand will renew. Production in existing ore deposits will accelerate and new deposits will be sought, and once again there will be a need for geologists with a sound knowledge of how ore deposits are formed. These geologists will also need to know something about economic geology in general.

We wrote this book to fill a gap in the literature available to students of the earth sciences. Many excellent and modern books describe in detail the characteristics of ore deposits and others discuss how the deposits have formed. Some books deal briefly with the economic issues that govern the exploitation of ore deposits, but usually this treatment is secondary. As we explain in the first chapter, the very definition of an ore and of an ore deposit is grounded in economics (ore is natural material that can be mined at a profit). Any comprehensive treatment of the subject must include discussion of what distinguishes an ore deposit from any other body of rock and to follow such a discussion requires at least a basic knowledge of the commercial aspects of mining operations and of world trade in mineral products. Our aim here is first to provide basic information about the scientific issues related to the nature and origin of ore deposits, to explain how, where and why metals and mineral products are used in our modern society, and to illustrate the extent to which society cannot function without these products.

In the past, and most probably in the future as well, the minerals industry has employed geology students. The activity in this domain is notoriously cyclic and at the time we finished the book the minerals industry was at low ebb. But with improvement of the global economy, demand for metals will inevitably pick up, fuelled by the enormous needs of China and other developing countries. Earth science students in most European and North American universities have a broad geological education that includes high-level courses in the subjects required of an
exploration geologist – structural geology, field mapping, remote sensing, geophysics. What is missing is an elementary knowledge of economic geology.

The expansion of exploration and development of ore deposits will coincide with an increasing awareness of the fragility of our planet’s environment, particularly the threat posed by global warming. Calls for "sustainable development" will accompany this economic revival, and the mining, transport, refining and consumption of raw materials will be subject to close scrutiny. At present most university students are taught almost nothing of this issue (or if they are taught, in courses on ecology and the environment, the reference to mining is totally and massively negative). The exploitation of ore deposits in the past has caused great damage to small parts of the Earth’s surface, and mining with no regard to the environment can no longer be permitted. But if the world requires steel or aluminium – to build wind turbines, for example – or copper and silica to build solar panels, the raw materials must be mined. These and other issues are discussed in our book.

Throughout the book, exercises are provided to illustrate the complexities, contradictions and dilemmas posed by society’s needs for natural resources. We discuss the issue of when, or more exactly if ever, our supplies of metals will be exhausted. We consider the notion of sustainable development and the environmental damage done by many mining operations. At present the needs of the industrialized “first-world” countries are met in large part by the importation of ores from lesser-developed countries; we consider the economics and the ethics of this trade. Throughout the book we have not hesitated to express our opinions. To a student who has received all his or her knowledge of mineral economics and global trade from local media and other popular sources of information, many of these views will come as a surprise, even as a shock, but we have not toned down the our treatment to conform to prevailing viewpoints. Instead we have written many relevant sections in a deliberately provocative manner in order to encourage discussion of these important issues.

In the first two chapters and in the last, geological and economical issues receive equal billing. In these chapters we define ores and ore deposits, discuss how they are classified, and explain that the study of ore deposits is intrinsically linked with the global economy. We explain how the viability of an ore deposit depends directly on the metal price, which in turn is linked to the demand from society for the mineral product. The factors that control this demand and the way the demand is satisfied by the discovery of new mineral deposits is a major subject in these chapters. Chapter 2 is an overview of the global distribution of ore deposits – where they are mined, where they are refined, and where the final products are consumed.

The following three chapters are more geological. In them we discuss the nature and origin of three broad groups of ore deposits: those that form through magmatic processes, those that result from the precipitation of minerals from hydrothermal fluids, and those that form in a sedimentary or superficial environment. The emphasis is on the ore-forming process and exhaustive descriptions of the ore deposits themselves are largely missing, but important principles are illustrating by way of discussion of a selection of well-known examples.
In the final chapter, which deals with the future of economic geology, we consider two ‘new’ types of strategic ores – rare earth elements and lithium – that will become increasingly important for the electronics and transport industries of the 21st century. We chose these examples because they illustrate well the paradoxes and challenges posed by the need to supply society with strategic materials at a time when the global balance of power is rapidly changing.

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