Recent developments in the methods and application of geothermometry and geobarometry, relative thermobarometry and in textural and isotopic dating of metamorphic events are reviewed. New thermal and tectonic models for metamorphism in different tectonic settings are presented. Case studies make up a substantial part of the book, many in the form of short summary papers that describe *P–T–t* paths for specific field areas from different tectonic settings world-wide. [Each of the 54 papers is abstracted in the Petrology section of *Mineralogical Abstracts*—M.A. 90M/4827–4880.] The multi-disciplinary character of research outlined here on the thermal evolution of metamorphic belts will be of interest to all petrologists.

R. A. HOWIE

Roberts, R. G. and Sheahan, P. A., eds. *Ore Deposit Models* (Geoscience Canada Reprint Series, 3). St Johns, Newfoundland (Geological Association of Canada), 1989. vi + 194 pp. Price $ (Canadian) 20.00.

This book contains 13 papers originally published between 1980 and 1988 in Geoscience Canada and produced here in reprint form similar to the very popular *Facies Models* series. The papers, with an emphasis on North America and Canada in particular, cover ore deposit models from lode gold deposits, porphyry copper deposits, and MVT to volcanogenic massive sulphide deposits. The emphasis in this series is not so much on descriptions of deposits but upon genetic models for ore deposit formation and the key characteristics of the deposits for the determination of deposit models. Lacking, however, are discussions of banded iron formations, skarns, vein deposits, magmatic nickel sulphide deposits, placers deposits or evaporites.

Paper 1—Archaean Lode Gold Deposits by R. Gwilym Roberts describes current theories for the formation of lode gold deposits in Archaean greenstone belts with a particular emphasis on structural control and ductile shear zones. A synopsis of wall rock alteration and isotopic systematics for these types of deposits is presented together with a discussion of the origin of the fluids responsible for gold transport and deposition. Paper 2—Disseminated Gold Deposits by S. Romberger proposes, for Carlin style mineralization (generally in sediments), a model of elevated geothermal gradient, migration of volatiles, fracturing and influx of shallow oxidizing groundwater that permits precipitation of shallow fracture controlled, partially oxidized disseminated pyritic gold deposits. Paper 3—A Canadian Cordilleran Model For Epithermal Gold-Silver Deposits by A. Panteleyev reviews the characteristics of epithermal precious metal deposits in terms of boiling models (Buchanan model), and alteration and replacement models. Particular emphasis is placed upon 'Cordilleran Epithermal Models' for Jurassic–Recent deposits in the Canadian Cordillera. Paper 4—Porphyry Copper Deposits—W. McMillan and A. Panteleyev give a concise review of the important characteristics of porphyry copper deposits with particular emphasis on Canadian Cordilleran deposits. Alteration, metal zoning, ore fluids, plate tectonics and genetic models are discussed. Paper 5—A model for Granophile Mineral Deposits by D. F. Strong is a short review on the petrogenetic and geochemical characteristics of mineralization associated with quartz-rich leucocratic granitoids with a particular emphasis on tin deposits relating geological features to *P–T* environments.

Paper 6—Sedimentary-Type Stratiform Ore Deposits: Some Models and a New Classification by J. Morganti proposes a threefold classification for stratiform base metal sulphide deposits based upon the type of basin hosting the deposits. Comparisons, amongst others, are made between the Selwyn Basin (Canadian Cordillera), Mt. Isa and McArthur River (Australia), the Zambian Copper Belt and Meggen and Rammelsberg (W. Germany). A discussion of basin setting and ore forming fluids is presented. Unfortunately this paper is a little dated (1981) and therefore cannot take into account the more recent research on these types of deposits. Paper 7—Mississippi Valley-Type Deposits by G. Anderson and R. McQueen is an excellent summary of the features of this type of deposit. Models for the fluid and transport of the mineralization are discussed. An interesting discussion on the problems of timing, hydrological regimes and relationships to oil field brines (amongst other topics) is presented.

Paper 8—Genetic Considerations Relating to Some Uranium Ore Deposits by J. Tilsley presents a model for the formation of major uranium deposits in the Early Proterozoic and in the Early Palaeozoic in near surface environments—for coarse clastic hosted deposits and for carbonaceous fine clastic hosted deposits. Paper 9—Unconformity-type Uranium Deposits by S. Marmont describes the characteristic of these high-grade deposits with an emphasis on their structural characteristics, alteration assemblages and mineralogical features. The author concludes that a diagenetic model for the mineralization accounts for the majority of the features found

in this class of deposit. Paper 10—The Platinum Group Element Deposits: Classification and Genesis by A. J. McDonald reviews the geological and geochemical characteristics of deposits that host this group of elements. A threefold classification is given: 1. Orthomagmatic; 2. Alluvial; 3. Hydrothermal. An excellent well ordered review of the types and modes of emplacement of the most important deposit types—the orthomagmatic deposits, is presented. Paper 11—Magmatic Segregation Deposits of Chromite by J. M. Duke reviews the important features of chromite deposits with succinct summaries of the Bushveld, Great Dyke, Stillwater, Kemi, Selukwe and Bird River Sill deposits. The models for magmatic segregation of stratiform chromite are summarized but there is a lack of discussion on structural controls on chromite body formation.

Papers 12 and 13 are excellent companion articles by J. Lydon on Volcanogenic Massive Sulphide Deposits—Part 1: A Descriptive Model, and Part 2: Genetic Models. These are comprehensive summaries that describe the geological and geochemical characteristics of VMS deposite (Part 1) and erect genetic models involving fluid compositions, deposition systems and alteration characteristics (Part 2). Ore Deposits Models contains a useful index at the back of the volume. On the whole the book is well produced and well illustrated. Some papers could be improved with more photographs of ore types and of ore textures.

Despite the shortcomings of this volume in that some of the papers are somewhat dated, being written in the early eighties, and also because of a lack of descriptions of world class deposits such as Olympic Dam, this volume contains a wealth of information, extremely useful reference lists, together with succinct summaries and descriptions of many of the major ore deposit types. The book will be of great value both to the economic geologist and to the non-expert alike and will be particularly invaluable to students. Undoubtedly it will be a best seller and represents extremely good value.

K. R. McCLAY

Zachrisson, E., Ed. *Proceedings of the Seventh Quadrennial IAGOD Symposium*. Stuttgart (E. Schweizerbart'sche Verlagsbuchhandlung), 1988. x + 694 pp. Price DM 238.00 ($140·00).

This publication contains 71 of the many papers presented at the 7th IAGOD (International Association of Ore Genesis) symposium held in Luleå (Sweden) in August 1986. The topics covered are wide-ranging and there are sections on the tectonics of ore deposits (9 papers), fluid inclusions (7 papers), paragenesis (7 papers), fluorite and baryte deposits (7 papers), skarns (7 papers), tin and tungsten deposits (6 papers), volcanic-hosted massive sulphide deposits (8 papers), and mineralization associated with granitoids (9 papers). In addition there are five introductory review papers: 'Ores in volcanoes' (Sillitoe), 'Precambrian metallogeny of Finland, Norway and Sweden' (Frietsch), 'Volcanogenic mineralization styles in the Early Proterozoic of Fennoscandia' (Rickard), 'Latest Proterozoic and Phanerozoic metallogeny in Fennoscandia' (Vokes), and 'A model for the genesis of sediment-hosted exhalative (SEDEX) ore deposits' (Russell). [Abstracts of all papers are given in M.A. 90M/0265–0335.]

There are several interesting and thought-provoking papers in this volume and the range of subjects covered ensures that most geologists concerned with mineral deposits will find something of relevance here. The presence of numerous review and compilation papers makes it a particularly valuable literature source for a wide range of mineral deposit types. The overall standard of presentation is high, and the editor must be congratulated on the production of this book.

D. H. M. ALDERTON

King, H. F. *The Rocks Speak*. Parkville, Victoria, Australia (Australasian Institute of Mining and Metallurgy), 1989. xii + 308 pp.

This book is an autobiographical collection of essays concerning the development of ore geology from an Australian perspective. Dr King's professional experience of sixty years has covered the entire modern period of thought on ore genesis and his work traces changes of ideas and subsequent approach to mineral exploration from local to global scale.

He uses the example of Broken Hill to show how until the 1950s this deposit was thought to have resulted from selective replacement of sedimentary horizons by 'ascending' hydrothermal fluids. Even after presentation of substantial evidence of the stratiform nature of the deposit by Ramdohr in 1951, showing that the high-temperature nature of the ore mineralogy was acquired during metamorphism, and field scale evidence by King, the hydrothermal view was retained by Australian geologists because of mineral replacement textures seen on thin-section scale. Stanton's work in 1972 finally demonstrated that the