

options available from traditional colorimetric methods to include an evaluation of more sophisticated portable instrumentation, which may revive interest in this approach to exploration.

There are a few weaknesses. The omission of consideration of instrumental neutron activation analysis is perhaps understandable given the limitations imposed by the modest size and price of this volume. A greater degree of constructive criticism of some of the quoted methods would however have been welcome. The method described for the determination of tellurium, for example, has been validated only at low concentration levels in two silicate reference materials, and interference investigated from only two elements. This method is a useful contribution but the inevitable uncertainties of its applicability to general exploration samples should be stated.

I would also have liked to see more comparison of the relative merits of the various techniques for certain analyses, particularly their particular suitability with regard to accuracy and susceptibility to interference for difficult types of sample.

Overall I'm sure that this volume will provide a valuable resource for analytical geochemists working both in exploration and more general areas of geochemistry.

M. H. RAMSEY

DePaolo, D. J. *Neodymium Isotope Geochemistry: an introduction*. Berlin, Heidelberg and New York (Springer-Verlag), 1988. xii + 187 pp. Price \$49.50.

At last after a decade and more of significant advances in petrogenesis as a result of the Sm-Nd isotopic technique, a text devoted to the subject written by one of the pioneers. It is divided into three parts: I) Principles and Processes; II) Nd isotopic variations—a planetary perspective; and III) Nd isotopic variations—petrographic studies. For most geologists and geochemists section III is perhaps the most important. Most topics are covered to a satisfactory degree, others much too briefly. Despite the 1988 publication date and an extremely up-to-date reference list for the author's work, a considerable amount of work published several years previously has been omitted. This is unfortunate because such a text above all could be a very valuable reference source for students. One of the most inexplicable omissions is the highly significant application of the Sm-Nd technique to problems associated with diamond genesis and the implications of micro-inclusion work for our understanding of Archaean pro-

cesses and Earth evolution (e.g. Richardson *et al.*, 1984, 1985). Acknowledgement of this work would have helped give a less biased view in the petrogenetic section with regard to the existence of a major trace element repository in the lithosphere which reaches 200 km in depth under the Archaean crust (see page 110). Otherwise an interesting and timely text that unfortunately will not land on the desks of the graduate students who should read it due to the price.

M. A. MENZIES

McMurray, G. R., ed. *Gorda Ridge: a Seafloor Spreading Center in the United States' Exclusive Economic Zone*. Berlin, Heidelberg and New York (Springer-Verlag), 1990. xv + 311 pp., 122 figs. Price DM 182.00.

Some 39 authors contributed to the 22 papers in this book reviewing work on the 300 km long Gorda Ridge which lies off the Pacific coast of northwestern USA. Being the only spreading ridge in the US 200 mile EEZ declared in 1983 it was guaranteed detailed attention, and the discovery of hydrothermal vents in 1988 ensures that more studies can be expected. Though concerned with what, after all, is only a short section of the global ridge system, and certainly a feature which is atypical of Pacific ridges, being deeper and slower spreading, the book describes every facet of that Ridge as it was known in 1986 with updates to 1988. As such the book is an all embracing reference to the techniques which may be brought to bear in the study of ocean ridges. Nearly half the book is concerned with the mineral potential of the Ridge, the remainder being equally divided between technologies for ridge exploration and exploitation and the ridge's benthic ecology. Well illustrated and well referenced, it represents good value at DM 182.

A. J. SMITH

Daly, J. S., Cliff, R. A. and Yardley, B. W., editors. *Evolution of Metamorphic Belts*. London (Geological Society: Special Publication No. 43), 1989. x + 566 pp., 72 figs., 50 maps. Price £80.00.

The papers in this volume were accepted for presentation at a joint meeting of the Metamorphic Studies Group (of the Mineralogical and Geological Societies) and IGCP Project 235 (Metamorphism and Geodynamics) held in Dublin in 1987.

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 frac-

ture 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