

ance of CO₂ or CO₃ in silicate melts has not yet been reached; (iii) likewise the relative importance of CO₂ or CO₃ in silicate melts has not yet been fathomed; (iv) the solubility of CO₂ in peralkaline melts is considerable and has a significant effect on their melting temperature.

Even the discussion of the SiO₂ phase diagram (p. 137) I find confusing, for example, the stishovite, keatite, β -cristobalite phases are mentioned in the text but not shown on the diagram. Displacive and reconstructive phase changes are discussed but no explanation of why the α - β quartz phase boundary is shown and the α - β cristobalite one is not; what happened to α - β tridymite etc. anyway? In this case the author is again in 'a half-way house' situation having given more than the minimum information but has not then explained it fully enough. Also in the phase equilibrium section I could not see the advantage in using terms such as 'forbidden zone' and 'Claperyon diagram' for 2-phase region and *PT* diagram respectively; the latter two might be old fashioned but are at least self-descriptive.

Relatively speaking a lot of space is devoted to variation diagrams (pp. 286-313) but yet no mention is made of the Pearce diagram, which is generally agreed to be an advance in this subject. This seems to be quite a surprising omission.

So this book is far from perfect. Most, but certainly not all, of these imperfections stem from the ambitious nature and scope of the book. It has many good points. I particularly liked the worked examples which are done in detail and to completion so that the reader has no doubt of the result. Many commonly used but often unexplained terms such as LOI in rock analyses, Mg number of basalts and olivine, accuracy and precision, are explained, and this service should be appreciated by students and non-specialists alike.

I would estimate that a wide range of Earth scientists would benefit from reading this book as I certainly did. I suppose that in the British University system our second year students would find the examination of the top of the icebergs very useful before going on to see what is below the water in their third year. Also, non-specialist geologists switching into the subject at the graduate level might find this book very helpful. Therefore, despite some objections to the content and method of treating some subjects I can highly recommend this book—it really is packed full of useful information and well worth a place on your shelf.

D. L. HAMILTON

Foster, R. P., Ed. *Gold metallogeny and exploration*. Glasgow (Blackie Publishing Group), 1990. xvi + 432pp. Price £85.00

It is rather surprising that the intense exploration activity for gold during the last decade has not prompted the appearance of any books reviewing the geology of gold deposits. Several useful conference proceedings or special society publications on aspects of gold mineralization have been published, but there has been no up-to-date, standard reference since the classic text by Boyle was published more than ten years ago. Considering the major advances in our understanding of the characteristics of gold deposits this new text is therefore most timely.

The book includes chapters on a wide range of topics, each written by well-known experts in the respective fields, and its stated aims are to provide 'succinct syntheses of all major aspects of gold metallogeny and exploration' (M.A. 92M/2665-2677).

Chapter 1 by Crocket summarises the distribution of gold in the Earth's crust and includes modern analytical data for gold content of a large number of igneous, metamorphic and sedimentary rocks, from a variety of geological settings. The overall higher contents in mafic compared to felsic igneous rocks are highlighted and ascribed to differences in magma source regions, but it is surprising that no reference is made to the recent high gold contents found in some lamprophyres.

Chapter 2 by Seward summarises the hydrothermal geochemistry of gold and in particular the mode of transport of gold in hydrothermal fluids. Bisulphide and to a lesser extent chloride ligands are favoured for transporting gold but also highlighted are the many areas where experimentally-based thermodynamic data at elevated temperatures are lacking, or a matter for debate. Seward illustrates how boiling of a gold-bearing hydrothermal fluid can affect its chemistry and thus influence gold deposition. He also introduces the possibility that mineral surfaces and sulphide gels may be important for adsorbing or scavenging gold from solution.

Chapter 3 by Groves and Foster covers the Archaean lode gold deposits. The authors highlight the worldwide association with banded iron formations, mafic volcanics, and felsic intrusives in greenstone belts. Models of genesis seem now to be generally accepted but the source of the fluids is still uncertain (metamorphic, igneous, or mantle degassing).

In contrast to the rather uniform characteristics of the Archaean lode gold deposits, those of the Phanerozoic are more diverse in nature. In

Chapter 4, Nesbitt covers those mesothermal gold deposits which are found in active continental margin settings, and which are often associated with felsic intrusives or with turbidites. Similarities with Archaean deposits are highlighted and although several genetic models have been proposed, Nesbitt favours a derivation from circulating convective meteoric water.

Chapter 5 by Henley covers volcanic associated epithermal deposits, the type subjected to so much exploration interest over the last decade. Case histories of the discoveries and characteristics of such deposits are given, and their geological features are compared to those of active geothermal systems.

Sillitoe continues on the theme of intrusion-related gold deposits in Chapter 6 with a description of the varied intrusive settings which can host gold deposits (porphyries, skarns, veins, breccias, and maars).

Chapter 7 by Berger and Bagby is devoted to Carlin-type deposits, particularly those in the classic settings of western North America and the more recently discovered deposits of southern China. The authors note the possible association with granodiorites containing W-skarns and Mo-stockworks, and summarise the evidence for the intriguing proposal that such deposits may represent the proximal equivalents of Carlin-type gold deposits.

Hannington, Herzig, and Scott in Chapter 8 describe auriferous precipitates on the modern sea floor and demonstrate their similarity to many massive sulphide deposits. They refute the conventional wisdom that oxidation of sulphide deposits is purely a subaerial process by showing that submarine weathering can produce gossans on the sea floor, and that these often contain elevated gold contents (up to 21 ppm Au).

Ancient placer gold deposits are covered in Chapter 9 by Minter, who stresses the importance of those in South Africa in terms of the western world's gold production. He illustrates how a sound sedimentological approach to ore genesis has been critical to understanding the genesis of

such deposits. However the ultimate source of the gold in these deposits remains unclear.

The next three chapters are devoted to exploration methods for gold: geochemical exploration in temperate, arid, semi-arid, and rain forest terrains (Chapter 10 by Zeegers and Leduc), geochemical exploration in glaciated terrains (Chapter 11 by Coker and Shilts), and geophysical exploration for gold (Chapter 12 by Paterson and Hallof). These three chapters provide several case histories and demonstrate that the unique chemical and physical properties of gold hamper exploration. Increasingly exploration is turning to indirect methods, such as the overall geological environment or the associated elements and minerals.

Finally, in Chapter 13 Mackenzie presents a useful insight into the economics of gold deposits and how it is 'all too easy to let economic deposits slip through our fingers, and to be misled into backing uneconomic projects'.

This book does not aim to embrace all aspects of gold mineralization but its coverage is still fairly comprehensive (notwithstanding the absence of a chapter on modern placer deposits). Its greatest values lie in the numerous descriptions and case histories of exploration for individual deposits, and the abundant up-to-date reference lists; for these Dr. Foster should be congratulated. Presentation is on the whole good or adequate, but for a book of this price the reproduction quality of diagrams is modest and in some cases they cannot be fully interpreted (e.g. Figs. 3.2, 11.12, 12.8, 12.9).

This book is recommended to all who have interests in the geology of, and exploration for, gold deposits. It will be particularly useful to final year undergraduate students and researchers needing a good introduction to particular aspects of gold mineralization. The exorbitant cost will naturally be a major drawback to most individuals but it should be present in all major libraries.

D. H. M. ALDERTON