

Lovering considers the large, low-grade metalliferous deposit in relation to the Lasky concept, that as grade decreases arithmetically, tonnage of ore increases in geometrical ratio. While he shows that the concept is not valid for high-grade deposits or indeed for any deposit with a sharp wall-rock cut-off, it has a wide area of validity for deposits such as the 'porphyry' coppers and it may extend downwards to grades that are within an order of magnitude of the Clarke. Thus for copper, nickel, cobalt (and, I would be tempted to add, for gold in some instances), larger and larger tonnages can be brought in as technology improves. There is, however, an important class of elements, including tin, mercury, tantalum, silver to which this certainly does not apply, and the position of metals such as lead and zinc is ambiguous. The implication is that the notion that, as the highly concentrated ore deposits become exhausted, man will turn to the 'natural' crustal rocks for his supplies has only a very limited validity. Nor is the sea and sea-bed, now supplying about 5 % of his 'mineral' raw material needs, likely to offer a long-term solution. In the energy field, King Hubbard sees little more than a century of life for world petroleum, and no more than three or four centuries for coal. In the long-term, the breeder reactor is the hope, if the difficult problem of waste disposal can be solved.

Among its recommendations, the Committee calls for a large increase in the effort directed towards a comprehensive geochemical census of the crustal rocks and a new and more vigorous monitoring system for radioactive waste. It further proposes that the reuse of materials that can be re-cycled be encouraged, especially for mineral products in short supply; that the time-lag between the recognition of mineral-resource shortages and investigation intended to alleviate it be reduced; and that geological exploration of continental shelves be accelerated.

For the mineralogist who sees his work as part of the human struggle for survival, this book deserves attention.

K. C. DUNHAM

DEGENS (EGON T.) and ROSS (DAVID A.), editors. *Hot Brines and Recent Heavy Metal Deposits in the Red Sea*. Berlin (Springer-Verlag), 1969. xii+600 pp., 220 figs. (8 in colour). Price DM 128.

The first indication of anomalously high temperatures near the bottom of the Red Sea were recorded by the Swedish research vessel *Albatross* in 1948. During the period 1963-5 the combination of stratified high-temperature and high-saline waters were reported by Charnock and Swallow (R.V. *Discovery*), Dietrich and Krause (R.V. *Meteor*), and by Miller (R.V. *Atlantis II*). The latter cruise was also the first to core the sediments and discover their high metal content. The observations and sample collecting by R.V. *Chain* during 1966 (sponsored by N.S.F. and N.A.S.A.) serves as the main source of material in this book. There are over 70 contributors and the subject matter is assembled under seven main headings:

Introduction, 21 pp. (mainly the history of exploration in the Red Sea up to, and including, U.S.C. and G.S.S. vessel *Oceanographer* in 1967); Geological and geophysical setting, pp. 25-128 (general structure, thermal, magnetic, gravity, and seismic profiles); Water, pp. 131-260 (circulation, temperature, and chemical composition); Organisms,

pp. 263–359 (Foraminifera, Radiolaria, oxygen isotope ratios in fossils, bacterial sulphate reduction, radiocarbon chronology); Sediments, pp. 363–532 (chemical composition, sulphide minerals, goethite–haematite relations, isotopes of S, Pb, and U, comparison with other ironstone and iron formations); Economic and legal implications, pp. 535–56 (average assays in *Atlantis II* Deep deposits are Fe 29, Zn 3.4, Cu 1.3, Pb 0.1 %, Ag 54 ppm and Au (probably) 0.5 ppm); Summary, pp. 557–71; Indexes, pp. 575–600 (author, Latin name, and subject).

The large format ($8\frac{1}{4} \times 11$ in.) provides good clear maps, tables and text figures. It is an extremely up-to-date, if expensive, compilation of data that is widely scattered through the literature. [M.A.70–85] T. W. B.

SPRY (ALAN). *Metamorphic Textures*. Oxford (Pergamon Press Ltd.), 1969. viii + 350 pp., 65 figs., 31 pls. Price, hard cover 60s. (\$10.00); soft cover 50s. (\$8.00).

Metamorphic Textures is the first modern book on this rapidly expanding field, treating the subject rather as a series of structural transformations of crystals than as a succession of chemical reactions.

The author collects together most of the relatively modern work, and presents the information in a concise and orderly manner with clear and ample illustrations together with a very comprehensive bibliography. A very careful distinction has been made between those terms of a descriptive nature and those having a genetic connotation.

The chapters on grain boundaries, mineral transformations, and crystallization are excellent, information from the metallurgical and ceramic fields being often drawn upon, although the reviewer is left with the impression that the chapter on preferred orientations is not sufficiently well illustrated, nor is enough crystallochemical bond information given.

Although not within the subject covered by the title of the book, readers interested in the subject of metamorphic textures may feel that a section on carbonate diagenesis would have been useful.

The chapter on regional metamorphism is thorough and very comprehensive, but unfortunately the author completely misinterprets the work of Powell and Treagus on the geometrical form of inclusions within 'snowball' garnets. [M.M.36–453]

The book is the only one of its kind covering this rapidly expanding field of study, and the style is suitable for final year university students and those engaged in this field of research. The extensive bibliography and very reasonable price ensure that this volume will become invaluable to all metamorphic petrologists.

J. W. OLDHAM

LENZEN (G.). *The History of Diamond Production and the Diamond Trade*. Translated from the German by F. Bradley. London (Barrie and Jenkins), 1970. xvi + 230 pp., 21 figs., 12 pls. Price 80s.

This English translation of a work originally published in 1966 represents the first attempt to relate the history of diamond production to economics. The author is well