

world's largest copper mine. Nchanga (Zambia) holds third place and Bingham Canyon, for long supreme, fourth; Panguna (Bougainville) developed by RTZ is fifth.

The book is divided into three parts: I. Management of Copper Technology; II. Strategy in the Industry; III. Company Histories. The first section covers exploration, mining, smelting, refining, fabricating, sales, and politics while the second gives an illuminating historical review, by periods, somewhat weighted towards the United States, but interestingly written. Among the companies reviewed are, of course, Anaconda, Kennecott, AMAX, ASARCO, and Phelps Dodge, with nine other American concerns, and six foreign companies. Here one can only regret that it has been possible to say so little about the Soviet Union in view of its increasing importance in so many fields of mineral production. As is well known, the copper industry is more sensitive than most to fluctuations in world economy that have a marked effect upon price and therefore upon exploration, development, and associated technologies. The industry has survived reasonably well the onslaught of nationalization, but seems as far as ever from finding an answer to the vagaries of price.

KINGSLEY DUNHAM

Gribble (C. D.), Durrance (E. M.), and Walsh (J. N.). *Ardnamurchan: a guide to geological excursions*. Edinburgh (Edin. Geol. Soc.), 1976. x + 120 pp., 2 figs., 14 geol. sketch-maps, 1 coloured geol. map (in pocket). Price £2.00.

Although based on the earlier guide by Richey, this field guide includes recent ideas on the form and structure of such Tertiary igneous centres and outlines some of the remaining problems, which include the spatial and temporal association of acid and basic magmas that gave rise to most of the plutonic intrusions of Centre 2. A 68-page text is followed by a comprehensive bibliography covering the recent work on the igneous rocks of Ardnamurchan, and by details of seven excursions (45 pp.). There is a glossary of Ardnamurchan place names (but no derivation of the name *Ardnamurchan*) and an important new geological map (1:40 000). Extra copies of the latter are available (both folded and flat), price 60p each.

In Centre 3 one of the problems still unresolved is whether the intrusions comprising the complex dip inwards or outwards: although none of the recent studies has disproved the original concept that the intrusions are a series of outward-dipping ring dykes, the fluxion structure of three of the gabbros

suggest a funnel or saucer shape (if it is assumed that the fluxion structure is a flow phenomenon and lies parallel to the wall of the intrusion). All the basic rocks of Centre 3, the eucrites, gabbros, and the dolerite, are closely related and form three separate and distinct groups of rocks, which are part of a differentiation sequence (MM 40-335). The tonalite and quartz monzonite in the very centre of the complex cannot have formed, however, by continued fractionation of the magma and are interpreted as hybrids formed by partial remelting and assimilation of country rocks into basic magma.

Despite the general title, the main text pays scant heed to the Moine country rocks, which have a story to themselves (MM 32-866), and although more detail is accorded to the Mesozoic sediments, little mention is made of their metamorphism. Glebe Hill sapphire locality in the hypersthene gabbro is documented, however, whether this plagioclase-spinel-corundum assemblage represents xenoliths of an aluminous bole produced by weathering of adjacent Tertiary lava or thermally metamorphosed basic igneous rock.

But in the main it is for the excellent documentation of the Ben Hiant vent associated with Centre 1, the layered hypersthene gabbro and the granophyric quartz dolerites of Centre 2, the ring intrusion of Centre 3 and the Great Eucrite, and the spectacular cone-sheets on the coast near Kilchoan that this guide will be welcome. Its true pocket-size will ensure its use in the field and its price should ensure its presence on the shelves of most petrologists (or in their pockets).

R. A. HOWIE

Walton (Anne). *Molecular and Crystal Structure Models*. Chichester (Ellis Harwood, Ltd.) and New York (John Wiley: Halsted Press), 1978. 201 pp., 58 figs. Price £9.00.

Although Dr Walton's book is about molecular and crystal structure models of all kinds, quite a large proportion of it is of relevance to readers concerned with the structures of minerals and related inorganic compounds. The three kinds of model most used in this context are: spheres in contact, balls and spokes, and polyhedra. Their relative merits are discussed, and for each many examples are mentioned, made from a wide variety of materials including metal, glass, plastics, wood, and paper. Information is given about ready-made complete models, model-making kits for assembly, and even more basic do-it-yourself versions; for the latter, suitable jigs, adhesives, and other accessories