BOOK REVIEWS

Hargreaves, D., and Fromson, S. *World Index of Strategic Minerals. Production, Exploitation and Risk.* Aldershot (Gower Publishing Co.) and New York (Facts on File Inc.) 1983. xiii + 300 pp., 68 figs. Price £37·50.

Modern industry demands for its use a wide range of mineral products, some of which, for a variety of reasons, are of strategic importance in times of international stress. This index embraces a far more extensive list than has been usual in recent discussions; for example, a symposium in 1980* considered only the ores of Cu, Ni, Co, Pb, Zn, Sn, W, Cr, Mo, U, and the precious metals, while in 1982 The Materials Forum† dealt with a more restricted list of strategic elements, but added Mn, V, Nb, and the Pt group: however, in this volume, supply of all these elements with, in addition, Al, Sb, Be, Bi, Cd, C (as diamond), Ga, Ge, Li, Mg, Hg, the *REE*, Se, Si, Ta, Te, Ti, and Zr are investigated. At this point the mineralogical or geochemical purist would undoubtedly object to the listing of *elements* as strategic minerals, for very few of them occur in the native state and thus deserve to be recognized as minerals *sensu stricto*. Some mention ought to have been made that the problem is the production and exploitation of the ores and other compounds in the cases of most of the elements. It is nevertheless only fair to admit that the Index is not mineralogical or geochemical in outlook; the aim is to assess from several points of view the chances of obtaining supplies of mineral products, and the risks inherent in the process. The first section of the book explains the principles on which a points system of assessment is based, and here the factors affecting production, transport, use and trade, lead to overall strategic assessment ratings. An independent system considers the country risks, under location, labour, politics, finance, and economics, arriving at a separate rating. Finally, sixty-two major companies are reviewed, including the well-known multinationals.

The authors are both from the directorate of research of Shearson American Express Ltd. David Hargreaves is a mining engineer with experience of mine management and direction as well as mineral product marketing; Sarah Fromson's background is in metallurgy at Cambridge. Together they have made a formidable job of systemizing data for thirty-seven elements, their sources and the factors that affect the winning of them; and this has been done for thiry-four mineral-producing countries. Necessarily, the emphasis is towards the Western and Third worlds; risk assessments can hardly be made for mineral production in China or the USSR and its satellites, having regard to the inadequacy of hard data and the differing political systems. Without attempting here to explain the methods of numerical assessment employed in this survey, some of the conslusions are of sufficient general interest to be worth quoting. As is well known, the largest raw mineral producers are Australia, Canada, South Africa, USA, and USSR, while the list of major refiners and consumers includes France, Germany, Japan, and the UK. The second rank of mineral producers making available substantial quantities on the world market includes Bolivia, Brazil, Chile, Mexico, Peru, Phillippines, Zaïre, and Zambia, while smaller producers with a range of minerals are Cuba, Finland, Indonesia, Malaysia, Papua New Guinea, Spain, Thailand, and Zimbabwe. However, the range of strategic ratings does not entirely agree with this list. Not surprisingly, USA, Canada, and Australia fare best, in a range lying between 4.30 (USA) and 7.30 (Guyana); Japan, in spite of its deficiency in domestic mineral production nevertheless comes out better than average because of its financial strength and industrial discipline. Zaïre, on the other hand, in spite of excellent mineral reserves, scores badly because of poor economic conditions. Most of the underdeveloped mineral-producing nations are bunched between 6.0 and 6.6 because though they have ample resources, capital is lacking to develop them. The highest risk minerals, taking into account all the many factors, emerge from this survey (in decreasing order of risk) as the ores of Cr, Mn, Co, Cu, Pt group, and gold.

This is a valuable reference book, interesting to the mineralogist with economic leanings, very desirable for the economic geographer, essential for the mineral strategist. Much of the information is given in tabular form summarizing 1981 production, reserve estimates (including fossil fuels) as well as the more subjective ratings. The bird's-eye view of the activities of the sixty-two companies is in itself worth having.

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* *Availability of Strategic Minerals.* Inst. Min. Metall. (1980), 108 pp.

† *Strategic Metals and the United Kingdom.* Inst. Mech. Engr. (1982), 32 pp.

Schreyer, W., (ed.) *High-Pressure Researches in Geoscience: Behaviour of Earth Materials at High Pressures and Temperatures.* Stuttgart (E. Schweizerbart'sche Verlagsbuchhandlung