

the reader is introduced to a geologist's way of thinking, the plate tectonic theory, the nature of minerals and the geological cycle. The tone of the text is authoritative yet simple and 'down to earth': thus if a temperature of 1500°C is needed to synthesize a mineral in the laboratory, then looking for that mineral in rocks that form at lower temperature would make little sense. And again 'minerals are like people, they like to be comfortable in their surroundings; just as we respond to changes in our environment, so do minerals'.

The later sections deal in turn with minerals from molten rocks, minerals and water, chemical alteration, and recrystallization, each section being illustrated by excellent colour photographs, by J.A. Scovil, of choice specimens from the Museum collection. The narrative text continues in the refreshingly lucid style. It is explained briefly why olivine can accept iron partly substituting for magnesium but how other elements such as potassium or beryllium do not fit easily into the olivine structure and therefore remain in the magma to form different minerals later on at lower temperatures. This theme is followed up in the chapter on granitic pegmatites, illustrated with photographs of tourmaline, topaz, euclase, albite and columbite, and a chapter on apatitic pegmatites (did you realise that these were named for Apat, a locality in southern Greenland?). The section on chemical alteration introduces the concept of equilibrium and chemical reactions, including hydration-dehydration, oxidation-reduction, the formation of secondary minerals, and replacement deposits: we are reminded that no mineral is immune to chemical alteration given the right physical and chemical conditions. The changes due to heat and pressure are dealt with comprehensively, and it is good to find chapters on both skarns and rodingites. The final section introduces the concept that more than one geological process may be required to produce such relatively rare occurrences as the emerald deposits of Colombia or the massive volcanogenic sulphide deposits in black smokers.

Throughout the book, in addition to the colour photographs of well-crystallized mineral specimens and the equally illuminating text, there is a sprinkling of a dozen or so coloured figures illustrating the geological processes involved. The size of all the specimens photographed is stated; most are somewhat magnified, but the overall result is to make this a very desirable book, and one which will appeal to professional and amateur mineralogists alike, particularly at the very reasonable price. If one may be allowed a tiny quibble, it is stated several times that the specimens are from the Canadian Museum of Nature – but nowhere is there mention of which town or city contains this treasure-house. R. A. HOWIE

Cairncross, B. and Dixon, R. *Minerals of South Africa*, Johannesburg (Geological Society of South Africa), 1995. xix + 296 pp, numerous coloured maps and photographs. Standard Edition (ISBN 0-620-19324-7) U.S.\$ 115.00; Luxury leather-bound collectors Edition (ISBN 0-620-19325-5) U.S.\$ 300.00 (available from the G.S.S.A., P.O Box 44283, Linden 2104, South Africa).

This volume, which deals exclusively with minerals found in South Africa, combines mineral photographs in colour with descriptions of the minerals, together with their geological settings; historical information and abundant locality maps are also given, as well as a coloured geological map showing the simplified geology of the whole country.

The main section of the book takes a chronostratigraphic approach, from the Archaean (Monarch cinnabar mine, the asbestos deposits of the Barberton greenstone belt, the gold deposits of the Witwatersrand Basin, the Messina copper and Pafuri nickel deposits), on to the Proterozoic, and the Phanerozoic, concluding with the carbonates and phosphates of cave deposits. Most of the individual mines and deposits are shown on clear locality maps, which are just one of the strengths of this work; for many of the mining areas, alphabetical lists of minerals occurring there are presented.

The text is absorbing and both geologically and mineralogically authoritative. A typical section on the Archaean deposits, gives details of the Bon Accord Ni deposit, with a geological sketch-map and a list of rare nickel minerals including bonaccordite, cochromite, liebenbergite, nichromite, nimite, trevorite and willemsite for all of which this is the type locality. The discovery of the Witwatersrand gold deposits is summarized; this basin has already produced over 40 000 tons of gold and in 1972 was producing more than 66% of the world's gold, though this proportion has now declined. In the section on the Proterozoic, detailed descriptions are given of the Kalahari manganese field to the W of Kuruman in the Northern Cape Province, with numerous mines yielding not only kutnahorite, hausmannite, bixbyite, rhodochrosite, manganite, etc., but also the more exotic inesite, sturmanite and vonbezingsite; of around 150 species recorded here, 10 have to date been found only in the Kalahari Mn field. Then we come to the Bushveld complex, which with three large suites of igneous rocks occupying an area of 65 000 km<sup>2</sup> is the largest layered complex in the world. This has provided type specimens for 14 PGM as well as being rich in chromite; it also has some zeolites. As throughout, there are maps and sections, as well as an old photograph of one of the first excavations of the Merensky Reef, including H.

Merensky in person. The Phalaborwa carbonatite complex, about 550 km NE of Johannesburg in the Northern Transvaal, has been developed to become one of the largest open pit copper mines in the world; magnetite, uraninite-thorianite and baddeleyite are subsidiary products (a photograph shows a 10 cm baddeleyite crystal), and fine zeolites occur associated with cross-cutting dolerite dykes in the open pit. The Namaqua-Natal Province includes the 3000 km<sup>2</sup> Okiep copper district with well-crystallized chalcopyrite and chalcocite, and granitic pegmatites are widely distributed in the NW part of the Northern Cape Province, yielding crystals of tantalite, libethenite, beryl, native bismuth, bismoclite, etc. Polymetallic deposits in this province include the Aggeneys Pb-Zn deposits (Gamsberg Zn deposit, Broken Hill with Pb, Zn, Cu and Ag), various small tungsten deposits and the Steenkampskraal high-grade monazite deposit.

The Phanerozoic era was characterized by the deposition of sediments in two large basins (the Cape supergroup and the Karoo supergroup) and at least two periods of volcanism. The Karoo lavas that form the Drakensberg Mts have a maximum thickness of 1400 m in N Lesotho and were erupted from the early Jurassic to the early Cretaceous; their associated dolerite dykes contain abundant secondary minerals, ranging from amethyst and agate to calcite, prehnite, apophyllite and numerous zeolites. Pipes and dykes of Phanerozoic age include kimberlite, the primary source of diamonds; a brief account is given of the development of the diamond mines and of the indicator minerals used to locate kimberlites.

This geologically integrated section of this book is followed by a 75-page alphabetical compilation of South African minerals, again well illustrated, and giving brief historical and locality details. The minerals mentioned earlier in the text are included, but there are descriptions here of many more, ranging from 3 mm crystals of erythrite, to moztartite, poldervaartite and werdingite. We learn that prehnite was the first mineral to be described from South Africa (from the Karoo dolerites) and was also the first mineral to bear the name of a person. There follow a glossary of terms, a list of Museum and institutional collections in South Africa, a stratigraphically arranged bibliography of some 540 items and a comprehensive index.

We may all be familiar with some aspects of the geology and mineralogy of such areas as the Witwatersrand, Kimberley, the Bushveld complex, and the Karoo lavas, but as one reads this book the immense mineral wealth of South Africa (in both financial and intrinsic terms) comes to be realised. This beautifully produced volume tells not only of gold, platinum and diamonds, but also of an exceptional variety of pristine mineral specimens

frequently associated with the major mineral deposits. It also manages to give some impression of the harsh and uncongenial conditions often confronting the early prospectors, not to mention such hazards as finding, in 1992, two elephants at the bottom of the opencast mine in the Phalaborwa complex which had to be herded out before the day's mining could begin. This book should be in every library claiming to cover aspects of economic geology and mineralogy, and must also be strongly recommended for all interested in fine minerals, to which the high-quality photography does full justice. The authors and photographers are to be congratulated, as are the Geological Society of South Africa who have published the work as part of their Centennial Congress celebrations. Their slogan was "South Africa – land of Geological Superlatives" and this sumptuous production appropriately puts on record their bountiful mineral heritage. For such an excellent and informative production, the price is eminently reasonable: order it today! R.A. HOWIE

Hall, A. *Igneous Petrology*, 2nd edition. London (Longman Group), 1996. xiv + 552 pp. Price £26.99. ISBN 0-582-23080-2

The first edition of this book, published in 1987, was intended as a textbook for 2nd and 3rd year undergraduate students. It contained 'all you need to know about igneous petrology' in terms of background understanding of the concepts and, in particular, ideas based on field studies and experimental petrology. However, it did not extend a student's understanding into the complex modern petrogenetic schemes derived from the systematic application of isotopic and trace element analysis. The latter is far better covered by Wilson's 'Igneous Petrogenesis'. In many ways, the two books are complementary and I often find myself recommending that a student should read a chapter in 'Igneous Petrology' followed by a chapter from 'Igneous Petrogenesis'. 'Igneous Petrology' was described as a 'safety-net' for students who could not cope with the complexity of isotopes in petrogenetic studies.

'Igneous Petrology' is an easy-to-read textbook, presenting the major ideas and explaining that there was not always a single explanation for the observations. It contains useful sections on peridotites, anorthosites and other rock-types which are often omitted by textbooks. It is very suitable for students who lack a chemical and mathematical background. Its strength is the application of field data and experimental petrology to the petrogenesis of igneous rocks. Its weakness is the lack of systematic application of isotopes and trace elements