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^2 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 mozartite, 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 stongly 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

to igneous petrogenesis. This happens despite there being chapters on both topics – the integration of the modern techniques into the individual chapters is almost totally lacking. A reading of the 'Isotopic composition' chapter would leave a student with the totally incorrect concept that the main use of isotopes in igneous petrology is to yield the age of the rocks they are dealing with. The author largely avoids the concept of using isotopes as tracers to fingerprint petrogenetic processes and magma sources, and this is a serious flaw in the book.

The new edition had an opportunity to improve on this aspect, but in fact, only cosmetic changes have been made. A 'new' chapter on the 'Chemical composition of igneous rocks' turns out to be a re-write of the old chapter on trace elements, preceeded by 7 additional pages on major element composition and variation. Another 'new' chapter on 'Alkaline rocks' is likewise a concatenation of two old chapters, those on 'Trachytes and phonolites' and 'Nephelinites and carbonatites', but lacks a general introduction to the subject. Most of the major advances in isotope petrology, especially in the ^{10}Be, Lu–Hf and Re–Os systems, are ignored. Minor changes are evident elsewhere, for example in the chapter on 'Magmatic Differentiation' some diagrams have been replaced by more recent examples, and in the 'Granites' chapter isotherms have been added to the phase diagrams. Kimberlites finally receive an isotope diagram. The 'Peridotites' chapter has been improved but, as usual, has nothing on the isotope and trace element data which have become available for peridotite massifs since the first edition. Throughout the second edition, there is a minor upgrading of references, but few major changes.

In summary, if you already own the first edition, there is no compelling reason to rush out and buy the second. However, if you do not have a copy, the book is an important general textbook on the subject, and if you cannot distinguish Nb from Nd, it is definitely the igneous petrology textbook of choice.

H. DOWNES

Schiffman, P. and Day, H.W., Eds. *Low-grade Metamorphism of Mafic Rocks*, Geological Society of America Special Paper 296, 1995. iv + 191 pp. Price US$ 50.00 (post paid). ISBN 0-8137-22969

Physical conditions for sub-greenschist facies rocks range from ambient to temperatures of about 300°C and several kilobars pressure. They thus span a large proportion of the physical conditions to which rocks commonly exposed at the surface of the Earth have been submitted, including the field of diagenesis. Furthermore, a very large proportion of industrial materials extracted from the Earth have been developed under these conditions. These are reasons enough for their intensive study by an expanding armoury of techniques. International Geological Correlation Program 294 was set up to advance the understanding of very low-grade metamorphism. An IGCP 294 meeting entitled 'The transition from basalt to meta-basalt: environments, processes and petrogenesis' was held at University of California, Davis, in September 1992, to discuss recent advances and to identify areas for further research in the study of low-grade metamorphism of mafic rocks, although many of the contributions considered other rock types including pelites and psammites. The present volume consists of papers based on presentations at that meeting. All workers in the field will need to consult it, and others will find it provides a useful sample of recent work on low-temperature alteration processes in rocks from a wide range of tectonic settings and employing a wide range of research techniques. A recurrent theme is the attempt to quantify pressure-temperature-compositional conditions in rocks in which a long-range approach to equilibrium is at best problematic.

First after the Introduction is a study of mineral parageneses involving pumpellyite and their graphical analysis. This is followed by three regional studies dealing respectively with the northern Sierra Nevada; a suite of mostly pumpellyite-actinolite facies rocks near Juneau, Alaska; and Early Proterozoic metabasalts near Flin Flon, Manitoba. A wealth of information on chemical mineralogy and, in one case, illite crystallinity is included. Fluid-rock interaction is a common theme in the next three papers, which are directed at a hydrothermal upflow zone in the Troodos Ophiolite, Cyprus; 'pumpellyosite' and 'prehnitite' developed, like epidosite, by Ca metasomatism during upwelling of hydrothermal fluids attributed to a spreading axis in the case of the Josephine Ophiolite of northern California and southwest Oregon; and the inter-relationships of porosity, permeability, and contact metamorphism of basalt adjacent to the Skaergaard intrusion of east Greenland. These in turn are followed by a study of chloritic minerals from prehnite-pumpellyite facies rocks in Maine; mineral and isotope features associated with resetting of Rb-Sr isotope systems during low-grade metamorphism; and a detailed study of structurally homogeneous but chemically zoned pumpellyite from a metadolerite from the Archidona region, Subbetic Cordillera, Spain. Recent papers in the clay mineral literature demonstrate by use of transmission electron microscopy and selected area electron diffraction that low-temperature phyllosilicates are commonly mixed-layer intergrowths of two or more phases on a scale too small for resolution by the electron microprobe,