but that their compositions can be determined with surprising precision by analytical electron microscopy. Both TEM and AEM studies were employed for the pumpellyite paper referred to. The absence of a contribution on the application of these methods to phyllosilicates in low-grade metamorphic rocks highlights the need for more such studies.

I feel attention should be drawn to two slips of conceptual significance. A belief appears to have grown up that the zeolite and other very low-grade facies were originally defined largely for, or on the basis of, mafic rocks. This misconception is given some substance in the opening sentence of the introduction to the volume. In fact, while a mineral or metamorphic facies embraces rocks of *all* compositions, the facies concerned were defined on the basis of the co-existence of various *quartz-bearing* assemblages observed primarily in sandstones and tuffaceous rocks of *intermediate to siliceous composition*, and in the case of the prehnite-pumpellyite facies, in 'metagreywackes'. The second problem I refer to arises in a discussion of facies in the first paper following the introduction. Here it is stated that the founding definitions of the low-grade facies imply substantial overlap of P-T conditions, stating as an example that prehnite and pumpellyite commonly occur with zeolites 'in mafic bulk compositions'. The 'founding' definition of the prehnite-pumpellyite facies was, in fact, specifically worded to avoid this particular overlap by defining the facies "to include those assemblages produced under physical conditions in which the following are commonly formed: quartz-prehnite-chlorite or quartz-albite-pumpellyite-chlorite, *without zeolites*....." (italics added by reviewer). Unfortunately, the second half of this sentence was overlooked in the paper referred to. The authors are correct, however, in pointing out difficulties that have arisen through attempts at defining facies too precisely. It is well to recall the definition of facies due to Eskola and F. J. Turner and others as associations of mineral assemblages that consistently recur together in the field. Boundaries will inevitably be fuzzy. Meanwhile attempts towards improved quantification of the many variables that have produced individual low-grade metamorphic rocks continue, as is evident from the present volume.

DOUGLAS S. COOMBS

J.E. Andrews, P. Brimblecombe, T.D. Jickells and P.S. Liss. *An Introduction to Environmental Chemistry*. Oxford (Blackwell), 1996. xviii + 209 pp. £12.95 ISBN 0-632-03854-3.

The past ten years have seen the explosion of new BSc courses in environmental geology. Such degree programmes tend to appeal to students whose background in the sciences is weaker than those entering mainstream geology courses. Anyone who accepts that some grasp of chemical principles forms a vital pre-requisite for a successful career in environmental geoscience is therefore bound to welcome the publication of an up-to-date text in environmental chemistry, if it caters for readers with little or no chemical background.

This book from the School of Environmental Sciences at UEA makes just such a claim, aiming 'to introduce some of the fundamental chemical principles which are used in studies of environmental chemistry and to illustrate how these apply in various cases, ranging from the global to the local scale'. The book is the successor to the established 1980 text by Raiswell and colleagues (*Environmental Chemistry: the Earth-air-water factory*), and follows a similar layout. The opening chapter deals briefly with the formation of the elements, the Earth, the hydrosphere and life. The three central chapters are devoted in turn to the physics and chemistry of the atmosphere, to the 'terrestrial environment' (including substantial sections on weathering, clays, and continental waters) and to the oceans. The concluding chapter examines various aspects of global change. The book is concise, well illustrated (except for Chapter 2) with high-quality diagrams, including three colour plates, and provides good value for money.

According to the introduction, the book caters for students with little or no previous chemistry background. Elementary chemical principles are introduced in text boxes which the chemically literate reader can bypass. This sensible arrangement is not always as successful is it might be, however; some of the explanations of basic chemistry are a little too compressed to enlighten, and will either mystify the reader or encourage a rote-learning strategy. Some of the notation used is also rather unsympathetic: for example on page 18, in relation to the reaction

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$$

we are confronted by the equation:

$$K = \frac{cCO_2 \cdot cH_2O^2}{cCH_4 \cdot cO_2{}^2}$$

in which the unsubscripted species labels and the ambiguously printed powers are certain to confuse some readers. Moreover, mystifying terms like 'hydrolysis', 'activity' and 'electrolyte' tend to creep into the discussion without sufficient definition: this could easily be overcome in a second edition by providing a simple glossary of terms. Whilst in carping mode, one might also question the occasional use of weight where mass is intended.

These reservations aside, however, the book is in nearly all environmental respects readable, well

balanced and authoritative. The authors give proper emphasis to the geochemical workings of the natural world, so that human perturbations can be seen in their proper mineral structure and chemistry, although X-ray methods of identification are not covered. I also liked the Oceans chapter, which contrasts element cycling in the open oceans with human impact on an enclosed sea, illusstrated by the Baltic. There are a few surprising ommissions that may diminish the book's value for the option student for whom this is the only encounter with environmental science; for example, despite the Chernobyl anniversary, there is little mention of fission products and nuclear waste disposal. There is also no mention of the *combined* effect of SO_2 and smoke in London smogs, or the combined impact of acid rain and ozone on plants and forests, but there are limits to what can be packed into such a book of this size. Overall I recommend the book, especially for the chemically literate reader; it will provide an invaluable, up-to-date and stimulating source for first-year students in all branches of environmental science.

ROBIN GILL

Faithfull, J. *The Ross of Mull Granite Quarries*. Inverness (New Iona Press), 1995. 56 pp. Price £5.95 (+ £0.50 p&p). ISBN 0-9516283-6-4.

This booklet opens with a description of the geology of this Caledonian granite, including a geological map, and continues with a detailed account of the intermittent working of the granite quarries over the last 150 years (the Tormore quarry reopened in 1986). The Ross of Mull granite has a distinctive rich red colour when polished, and can be found used in bridges, docks, lighthouses and memorials, ranging from the Albert Memorial and pillars below Holborn Viaduct in London, to Dunrobin Castle, Skye, and docks and harbours in Glasgow, Liverpool and New York, as well as a memoriam in Shandung Province, China, to the Scottish athlete and missionary Eric Liddell who died there in 1945. The book is well illustrated with maps, diagrams and photographs of the quarries, the cover being on a background of a colour photograph of a polished surface of this granite.

R. A. HOWIE