

several important rock types (pelites, metabasites, carbonates, ultramafic rocks, etc.). The fourth part is concerned with the practicalities of extracting quantitative petrological information from metamorphic rocks, and includes the calculation of phase equilibria, the uses of zoned minerals, the estimation of fluid compositions, and other aspects of fluid–rock interactions. The last part deals with the application of geochronology to metamorphic systems and with the relationships between P – T paths and tectonic processes.

The organisation of topics is logical and, by and large, the coverage is extremely comprehensive. However, one topic stands out as receiving less than adequate treatment, namely petrography, particularly the interpretation of mineral textures. This is a pity because petrographic study is generally the starting point of detailed petrological work. The book is not entirely without discussion of metamorphic textures but the topic is not, in my opinion, given the prominence it deserves. References to textures are sporadic and nowhere in the book are there any photomicrographs; instead, in partial compensation for this, the author has used the ruse of referring to the colour photomicrographs in Yardley, MacKenzie and Guilford's book *Atlas of Metamorphic Rocks and their Textures* (1990, Longman) where he thinks fit. This works fairly well, but to my mind is inadequate recompense for the absence of a well illustrated petrographic chapter. Elsewhere, the author uses examples from his own work a good deal, but takes pains to bring in other people's approaches and findings where appropriate. The reference list is extensive (but not exhaustive) and up-to-date. The text is clearly written; complex topics are introduced in a lucid and logical manner and are supported by a plethora of helpful, well annotated diagrams. Typographic and other errors in the second printing (1995) seem to be virtually non-existent.

Professor Spear's monumental book will prove to be an invaluable reference work to all practising metamorphic petrologists for many years to come. No serious student of the subject should be without his/her own copy; borrowing from the library just won't be good enough! For the huge amount of information it contains, it is a real bargain.

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Klein, C. *Mineralogy Tutorials: Interactive Instruction on CD-ROM*. New York (John Wiley & Sons) 1996. Special introductory price £199.00 (US\$395.00). ISBN 0471109967.

This is a highly interactive colourful teaching aid for basic mineralogy and crystallography, that successfully uses 3-D high-resolution graphics and anima-

tions to relate atomic scale structures to real mineral morphologies. But it does much more than that. It comes with a short 11 page User Manual, all that is really needed to get you started, since everything about the way it runs is largely intuitive and on-screen Help (bubble type) is available. The main index leads to four individual Modules, within which a constant clear toolbar at the base of the screen allows individual search paths to be retraced and gives the user a high degree of control over rate of progress through the package, including printing (landscape/screendump) and constant access to the main Menu, Help, and Index. Each page of information contains a minimum of text provided as a digest in the top right hand side under Notes, which has been expertly selected to guide the student through, and is largely intuitive. Each Module has a similar appearance but offers subtle variation in clickable buttons, icons and control modes which encourages prolonged exploration. Module 1 (Crystallography – external form) presents symmetry operators using rotatable 3-D models, crystal classes with total symmetry and full-screen photos of real minerals, and Miller Indices from concept to experimental application by the viewer. The unlimited access to 'previous page' works extremely well here for teaching. Module 2 (Crystallography – internal order) presents 1–2 and 3 dimensional animations which clearly illustrate symmetry operators in crystal structures. Module 3 (Crystal and mineral chemistry) uses extensive 2-D and 3-D animated graphics to illustrate crystal structures, coordination of atoms in mineral structures, Pauling's Rules, and solid-solution mechanisms. The latter includes substitutional, interstitial, omission and exsolution, allowing, for example, user selection of cation distribution in amphiboles to illustrate the effects of composition, end-members and P – T phase relations. The colour phase diagrams applied to exsolution are particularly clear. Module 4 (Systematic mineralogy) provides specific information on about 100 common minerals under the groupings of silicates (tecto-, ino-, phyllo-, nesos- etc.), oxides and hydroxides (12), sulphates, phosphates and carbonates (13), sulphides, halides and native elements. This section has 'hot' text hyperlinked to additional information, phase diagrams and compositional diagrams (e.g. pyroxenes, with T – X cross-section overlay).

In summary, this software is an excellent teaching aid to augment any standard course texts in Mineralogy and Crystallography including those by the same author! It is visually entertaining, and the front end interface gives the user powerful control, from a quick dip (start-up time is a few seconds) to long and entertaining first-level reference work. It is certainly amongst the best I have used so far. It is not

a compendium of minerals, but would work nicely in conjunction with, for example, the CD *MinSource*, which is. It runs on both Macs and IBMs, including quite modest machines which are widely available.

Once seen and tried, it is in the 'must-have' category for teaching Mineralogy and Crystallography.

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