

Dan Holtstam and Erik Jonsson. All reliably identified species receive an entry, in alphabetical order from adelite to zoisite. Entries provide a formula, a crystal system, and detailed data on physical appearance(s), association(s), original locations underground where known, and a few references. A large proportion have crystal drawings and optical or SEM photographs, mainly of specimens in the collection of the Swedish Museum of Natural History. Jonsson's short chapter 'Collecting at Långban' provides a nice postscript.

The bibliography, by Urban Strand, collates 567 references covering a time span from the late 1970s to 1995. These apply to the 'minerals' chapter only: the earlier chapters each have their own specific reference lists which are additional to the bibliography. Next is a 'mineral index' which locates references to general topics and specific minerals in the bibliography. Like the bibliography, it is complete up to only 1995, containing no reference to philolithite, for instance, although the mineral and reference to its 1998 descriptive paper do appear in the 'minerals' chapter. Then follow three appendices: a systematic list of Långban minerals, a list of some varietal and obsolete names, and a list of fluorescent species.

My criticisms are few. Specific topics that are not mineral species are not indexed in detail, and the bibliography already needs updating. More important, this book is not sufficient in itself to allow identification of species acquired by the collector or researcher. Properties such as hardness, density, cleavages, optical constants and powder X-ray data are not provided, meaning that a comprehensive mineral encyclopedia is needed as an adjunct. Goniometric data are also absent despite being useful to keen amateurs. Admittedly, inclusion of such additional data would double the size and price of the book. *Långban* remains invaluable for the site-specific information that it does provide, which is often condensed, garbled or absent in more general texts.

The last and most tantalizing omission is any treatment of minerals absent at Långban but present in the other deposits of similar type nearby. Thus, the Mn-Be silicate *harstigitite*, found only at Harstigen, is missing, as is the melanostibite of Sjögruvan. Harstigen is also the type locality for pyrophanite, Jakobsberg for jacobsite, and Nordmark for hedenbergite, which highlights the importance of the area as a whole to mineralogy. The authors have whetted my

appetite for a sequel volume on these related mines.

To those with an interest in exotic skarn mineralogy, Swedish regional geology, comparison with other ore deposits such as Franklin, and to collectors and curators everywhere, I can only recommend: buy this book — it is beautiful, informative and excellent value. A. G. CHRISTY

Hacker, B.R. and Liou, J.G. (Eds). *When Continents Collide: Geodynamics and Geochemistry of Ultrahigh-Pressure Rocks*. Dordrecht, Boston and London (Kluwer Academic Publishers). 1998, Hardback, x+32 pp. £90.00 (US\$144.00), ISBN 0-4128-2420-5.

Ultrahigh-pressure rocks are gaining greater importance as more localities are discovered and as the areas of those localities that are known are being expanded. The fact that large pieces of continental crust have been subducted to depths of ~150 km (or indeed even deeper) requires some radical methods for both the subduction and, more importantly, the recovery which preserves the mineral assemblages. All of these problems are addressed in this rather timely and useful book. The volume, which would have benefited from some form of introduction by the editors, comprises 12 essentially unconnected papers which cover aspects of specific sites, models and theory. Overall, an up to date summary of many UHP localities and their importance is presented. The organization of the book might be viewed as odd since it starts with two chapters that deal with theory rather than UHP rocks themselves, i.e. the database. In Chapter 1, Lin and Roecker present a synthesis of new, directly and remotely acquired geophysical data from Taiwan, which previous models have suggested to be an accretionary wedge. Instead, they propose that at least part of the island is a site where active exhumation is taking place above a subducting slab. This model provides an explanation of how UHP rocks may be recovered to the surface. Douce and McCarthy then examine the melting of crustal rocks during subduction in Chapter 2. The experimental data are derived from very ordinary crustal rocks of the type one might expect to find in subduction zones and the results do seem to produce some of the magmatic rocks found at higher levels as well as granulitic and eclogitic residues. Rheological aspects of crustal rocks at UHP conditions are explored by Stöckhert and

Renner in Chapter 3. They describe evidence indicating that UHP rocks appear to have undergone little deformation requiring a high degree of strain partitioning. However, shear zones have not yet been identified in these rocks. The suggested low strength of UHP rocks is interpreted to be due to the presence of fluid released by metamorphic reactions or by small amounts of melt which wets grain boundaries.

In Chapter 4 Davies and von Blanckenburg discuss the theory of thermal controls on slab breakoff and make comparisons between modern and Archaean environments. The differences between old, cold, thick slab and thinner, hotter, younger crust subduction are examined. This theme is followed by Grasmann *et al.* who discuss the exhumation of UHP rocks in Chapter 5. The different shapes of *P-T-t* paths are explained by using an exhumation rate of ~5 mm/yr and argue that the two-stage cooling proposed for some occurrences could be the result of a constant rate of exhumation. Chapter 6 by Blythe presents a comparison of the uplift and exhumation rates observed in active orogenic zones with the theoretical rates required for the preservation of UHP assemblages. It is found that few modern environments produce the >10 mm/yr rate theoretically required for preservation. The conclusions are that exhumation of these rocks might be possible at rates <10 mm/yr and researchers are urged to find alternative explanations.

The $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology of UHP assemblages, which so far has proven rather difficult, is examined in Chapter 7 by Scaillet. Using the western Alps it is shown that by careful choice of samples and the path by which peak conditions were obtained, the excess Ar problem can be overcome and a sensible interpretation reached. Other geochemical and isotopic characteristics of the Dabie Shan UHP and associated ultramafic rocks are presented by Jahn in Chapter 8. The results show that the types I and II eclogites are of basaltic chemistry with a Precambrian signature. The case is presented that the rocks were not Thethyan oceanic crust. Type III eclogites are related to the ultramafic rocks which were mantle-derived.

In Chapter 9, which could easily have been the first in the book, Rumble asks the fundamental question "were the protoliths of UHP rocks ever at the surface?". He shows conclusively that the answer is "yes", and that the rocks have participated in near-surface processes. Using the Chinese rocks at Dabie Shan he describes some of

the very low $\delta^{18}\text{O}$ values as "shocking" and sets about investigating the nature of this negative signature. Chapter 10 by Tabata *et al.* also describes aspects of the Dabie Shan rocks. Zircons can provide resistant time capsules regarding inclusions and they may preserve UHP minerals. This concept is tested here and it is found that in totally retrogressed areas, UHP inclusions are still present in some of the zircons. The original extent of the UHP rock was clearly much greater. From this work the size of the crustal slab that was subject to UHP conditions is shown to be much larger than previously thought. This obviously has consequences for modelling.

Fluids during metamorphism are obviously important in controlling the results and the final two chapters address this aspect. In Chapter 11 Ernst *et al.* look at the theory of water recycling during collision and discuss consequences for phase-equilibrium and kinetics. Austrheim describes convincing field evidence for the importance of fluid ingress and the controls on development of eclogitic and UHP assemblages in Chapter 12. Examples from several of the main occurrences are discussed using several different starting protoliths. The implications are explored regarding crustal thickening, the timing of fluid influx and the possible source of the fluid, as well as both prograde and retrograde effects.

Even accepting that UHP rocks are a specialist subject, the volume is not cheap and there are a couple of points that are disappointing. First, reproduction of many of the figures is poor which, given modern computer techniques, is surprising. Second, there is a loose erratum sheet, which only applies to one chapter and does not cover the typographical errors in others. Given the rate at which discoveries are being made and the subject is advancing, with all the implications for the validity of the models proposed, some may query if it represents good value. However, as a summary of our present knowledge of these incredible rocks the book currently stands alone and should be in the library available to researchers.

C. R. L. FRIEND

Papike, J.J. (Ed.) *Planetary Materials*. Washington (Mineralogical Society of America, Reviews in Mineralogy, Vol. 36), xvi + 1059 pp. US \$40. ISBN 0-93950-46-4

I am not quite sure where to begin in reviewing this book, just as I was not quite sure where to