

studies, is that by Harley, reviewing the state of knowledge of ultra high temperature metamorphism. These are rocks whose assemblages are stable at temperatures in excess of 900°C, and indeed their very existence is doubted by the more devoted servants of cation exchange geothermometry, since simple thermometers give blocking temperatures in the normal granulite-facies range. Harley shows that, although such occurrences are relatively few in number, they display a range of *P-T* histories, and so are unlikely to all represent a single tectonic setting.

Papers on reaction mechanisms are serendipitous, but deal with some important aspects from very different angles. This is a first rate selection of papers that emphasise a wide range of aspects of metamorphism where an understanding of irreversible processes is essential to the final interpretation of a metamorphic suite, and I will highlight just two. Rubie gives an overview of the nucleation problem in metamorphism, and the situations in which it is most likely that assemblages present will not be the most stable. He rightly points out that this is not just a problem for dry metamorphism, such as deep burial of gabbro bodies, and emphasizes the potential for non-equilibrium where two phases must nucleate. Vernon revisits the remarkably controversial issue of mass and volume change during prograde metamorphism of sediments, which has seen structural geologists and metamorphic petrologists (or at least those with an understanding of the chemistry of open systems) go head to head in a debate that has closely paralleled the controversy over the scale of silica mobility during sandstone diagenesis between the 'BP' and 'Norwegian' schools. His careful appraisal of the evidence is a valuable point of reference for those of us who know that we already know the answer!

In summary, what this book lacks in coherence and in critical areas of the subject (such as high pressure metamorphism), it makes up in the quality of many of the individual chapters. It will be an invaluable collection for metamorphic petrologists for many years to come, although it does not comprise a comprehensive introduction for the outsider. My copy is already becoming well-thumbed, and if you work with metamorphic rocks you should go out and buy it.

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Gilbert, J. S. and Spark, R. S. J. (Eds). *The Physics of Explosive Eruptions*. London (The Geological

Society, Special Publication No. 145), 1998. vi + 186 pp. Price £59.00 (£29.00 for Geol. Soc. members). ISBN 1-86239-020-7.

Until relatively recently, volcanologists could only theorize as to the origin of ignimbrites and the other massive flows resulting from explosive volcanism. These massive deposits could be seen in the field, but the rate and nature of deposition was very poorly understood. Films and pictures (some even taken from the space shuttle) of the progress and development of recent eruption columns have provided valuable insight into the processes governing this most devastating volcanic phenomenon. Apart from the academic interest in the genesis of these deposits, there is an urgent need to understand them now because of the serious ramifications for aviation and climate change. The fascinating subject of the recent leaps in physical and mathematical modelling of eruption columns and the deposits they produce were the subject of an Arthur Holmes meeting on the island of Santorini in 1996 and discussions at that meeting provided the enthusiasm and impetus for this book. *The Physics of Explosive Volcanic Eruptions* contains eight well illustrated review-style chapters by active researchers in the subject. The first chapter illustrates the considerable progress that has been made in developing our understanding of explosive eruptions, and highlights the huge range of areas now ripe for further research. In particular, it is emphasized that closer collaboration is needed between seismologists, modellers, petrologists and physical volcanologists. Open and closed system degassing processes are discussed in the light of recent field, laboratory and theoretical studies and the conditions within the conduit and chamber needed to initiate and maintain Plinian eruptions are explained. Recent experimental progress in determining melt properties and the effects of bubbles and crystals on the physical properties of magma are illustrated with good quality diagrams and photographs. A particularly valuable feature of each chapter is that they end with a section looking to the future. In many cases, this is a 'wish list' of parameters that needs to be better constrained; further developmental work on physical modelling may make these realities sooner rather than later. A comprehensive index makes this a valuable reference book, which I would recommend for researchers and students of all aspects of explosive volcanism. H. RYMER