

LANDMARK PAPERS: *Metamorphic Petrology*<sup>2</sup>

Published by the Mineralogical Society of Great Britain and Ireland, the Landmark Papers series is intended to provide historical context, particularly for students, for the development of a particular branch of mineralogy. This volume (#3) contains Bernard Evans' selection of seminal articles in metamorphic petrology, and his delightful and invaluable commentary on each topic. Evans is absolutely the perfect scientist to have taken on this daunting task. He played an integral role in the flowering of metamorphic petrology after the 1950s, yet was directly linked to

those who earlier laid its foundations—after all, how many of us actually spent time in the field discussing metamorphism with Pentti Eskola?! As Bruce Yardley notes in his gracious foreword, it is really Evans' commentary that compels the reading of this book. If pressed, any one of us could probably list a dozen or two articles that we view as integral to our science. But how many of us could explain as eloquently as Evans the context under which each article was written, how it was received at the time, and how it fostered further research? Few of us, indeed, and we are fortunate for his efforts.

The book consists of 15 chapters and 17 papers reproduced in the original form (one in translation). Yardley comments that several papers would not figure in the Science Citation Index, and I'll admit I had not read all of them previously, let alone referenced them. But make no mistake—the average number of citations per paper is well over 400, and 3 or 4 rate 1000+ citations each. Each represents a *major* contribution to our science, and scholars of metamorphic petrology are advised to read them and consider Evans' commentary closely. The chapters are organized chronologically and cover fairly specific topics, but rather than listing them individually, I think of their authors as focusing on three main questions:

- ① How do we make sense of the minerals we observe in the field? (Barrow 1912; Eskola 1920; Ernst 1971; Ferry 1983; Chopin 1984; Austrheim 1987)
- ② What are the chemographic and thermodynamic foundations for interpreting metamorphic mineral assemblages? (Goldschmidt 1912; Bowen 1940; Thompson 1957; Greenwood 1962; Hensen 1971)
- ③ How do we quantify the conditions or processes of metamorphism? (England and Richardson 1977; Ferry and Spear 1978; Helgeson et al. 1978; Wood and Walther 1983; Berman 1988; Holland and Powell 1990)

<sup>2</sup> Evans B (2007) Landmark Papers: Metamorphic Petrology. Mineralogical Society of Great Britain and Ireland Landmark Paper Series 3. 295 pages, ISBN 978-0-903056-24-3, £32

These articles and Evans' commentary illustrate not only the longevity of these questions, but also the importance of synthesis: many studies, as far back as Goldschmidt's and Eskola's, could be readily included in two or even all three categories. Seeing all these articles together helps us understand not only why we use the approaches we do, but also how multiple methods interconnect to illuminate larger questions of mass transport, mineral growth, plate tectonic processes, etc.

Evans notes that some readers may reasonably question his choice of articles. In part this reflects a planned Landmark Papers volume on experimental petrology that subsumed some articles he would otherwise have included. But we each have our biases. Were I to suggest landmark papers, I might include the importance of chemical zoning in metamorphic minerals and its quantitative interpretation (e.g. Hollister 1966), a bit more on the direct links between metamorphism and tectonics via P–T–t paths (i.e. not just England and Richardson's geodynamic modeling, but also Spear and Selverstone's field and theoretical analyses), and Carlson's work on mineral growth and textures. Others no doubt have their favorites as well. In that regard, I should stress that, first, not all research areas can be linked to a single landmark paper; for example, the origins of metamorphic geochronology are so diverse, they might be better discussed in other contexts. Many will notice that Frank Spear's monograph is repeatedly referenced and provides a good additional resource for students. Second, it is important that Evans' commentary does cover most alternative "landmark" articles and also some recent reviews. He fully acknowledges that ideas were developed in multiple ways with further major (arguably "landmark") contributions, and also that one researcher commonly produced multiple articles of similar import. For example, how do we choose *one* article from the numerous contributions of, say, Gary Ernst in high-pressure metamorphism or Philip England in geodynamics? Most of these "also ran" papers are referenced in Evans' commentary. So, if I have one quibble, it is really about how the Landmark Papers series is laid out. The historical context leading into a landmark paper is well defined, but the diversity and sheer number of subsequent articles make it difficult to know which were really important: in the forest of papers seeded by a "landmark" contribution, it is all too easy to lose the larger trees for all the smaller ones. It would help in future volumes to provide a mechanism for designating more clearly which half-dozen or so other articles represent major contributions associated with a landmark.

To return to this book's emphasis on interdisciplinary integration in metamorphic petrology, I remember once telling a fellow graduate student that I was studying metamorphic petrology, to which he replied, "Metamorphic petrology? I could never do that—you have to know too much about too many things." *Landmark Papers: Metamorphic Petrology* illustrates beautifully why metamorphic petrologists actually do routinely integrate thermodynamics, phase equilibria, kinetics, geodynamics, field methods, petrography, structural and regional geology, quantitative chemical analysis, mineral structure, and crystal chemistry. Perhaps most importantly, Evans' commentary captures the beauty and magic of metamorphism and metamorphic minerals, as well as the excitement that drove the curiosity of so many of geology's intellectual giants. We can only hope that these articles and commentary will further excite new generations of geology's finest.

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### AMPHIBOLES: CRYSTAL CHEMISTRY, OCCURRENCE, AND HEALTH ISSUES (Cont'd from page 212)

This book is well written, rich in high-quality illustrations, and carefully edited. It is a present-day synopsis of what is known in amphibole mineralogy, just as volume 9 of *Reviews in Mineralogy* was the most up-to-date compendium of amphibole knowledge 25 years ago. It is an essential volume for anyone who does research in the amphibole group;

it is also a very necessary reference for anyone who teaches aspects of silicate mineralogy. It is a great reference volume, and I highly recommend it.

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