



BOOK REVIEW

Granite tectonics

Bouchez, J.L., Hutton, D.H.W. and Stephens, W.E (eds.) 1997. *Granite: From Segregation of Melt to Emplacement Fabrics*. Kluwer Academic Publishers, Dordrecht, The Netherlands. 358 pp. ISBN 0-7923-4460-X. Price: hardcover US\$166.

There are few topics in the Earth sciences that have been as controversially debated as the geology of granites. The main thrust of this controversy has shifted quite regularly, reflecting developments of new analytical and field techniques from early structural and petrographic studies on the origin of granite to geochemical and isotopic investigations on the source of granite to, more recently, geochronologic and modelling studies on the ascent and geometry of composite granite plutons. The last 10 to 15 years have seen an increasing participation of structural geologists and metamorphic petrologists in this debate who discuss segregation, ascent and emplacement mechanisms of granite in the light of new structural approaches that entail concepts of solid state physics, fluid dynamics, and numerical methods. Before that background, this volume on *Granite: From Segregation of Melt to Emplacement Fabrics* presents a collection of papers that show a remarkable unity of purpose, namely to describe and apply the study of fabrics in granite and their role for the interpretation of granite tectonics. The 19 journal-style articles with abstracts in this book spring from the EUG 8 Meeting, XI2 Symposium on 'Emplacement of granitic magmas in the Earth's crust' held in Strasbourg during April 1995. Right from the onset a statement has to be made that this volume is an excellent contribution in terms of practical usefulness, scientific clarity and layout, that describes new advances in the acquisition and integrated use of fabrics in granite.

The book comprises three parts. Part 1, *Melt and Magmas: Properties and Segregation*, consists of 5 papers. The introductory paper, applying information theory to the formation of granites, qualitatively evaluates the relationship between the main factors involved in granite formation: i.e. partial melting, melt segregation, magma ascent and magma emplacement and processes that may subsequently alter the information contained in the granite. The following papers deal with the physical aspects of granitic melts presenting experimental data on melt viscosities and factors that may influence the rheology of magmas and wetting-angle properties of melts. Two field examples illustrate mechanisms of melt segregation due to late-stage magmatic fracturing and during magmatic mixing and mingling in deep-seated conduits.

Part 2, *Fabrics in Granite*, comprises 6 papers. A review about fabrics defined by the shape preferred orientation of minerals (SPO) and magnetic fabrics defined by the low-field anisotropy of magnetic susceptibility (AMS) in granite forms the background to papers presented in this chapter. A field-orientated study introducing the techniques and use of magnetic fabrics in mapping granite plutons is followed by two experimental investigations on the origin and development of mineral fabrics in simple shear and their relation to finite strain. Two numerical modelling studies investigate the formation of planar and linear structures in granites in terms of strain regime and particle shape and the periodic vs steady-state nature of mineral fabrics in simple shear is discussed. The emphasis in this chapter is on the application and measurement of magnetic fabrics in terms of their kinematic and rheological significance for granite tectonics, a technique

that has been advanced and used by particularly French researchers over the past ten years or so.

Part 3, *Emplacement of granite plutons: case studies*, comprises 8 articles that demonstrate how integrated field work coupled with detailed and systematic fabric analyses may be used to reconstruct the emplacement history of composite granite plutons. An introduction to the 'space problem' associated with syn-tectonic granite emplacement is followed by a number of case studies from Spain, the western U.S., Nigeria, Brazil, and Japan. All papers present impressive field, analytical and/or experimental data sets aimed at determining the internal structure of granite plutons in relationship to their geological framework. The use of magnetic fabrics (in particular magnetic lineations) in conjunction with conventional fabric analysis beautifully illustrates how magmatic flow cells and feeder zones of granites can be made visible through systematic sampling and measurement even in large granite massifs. Most papers emphasize the role of deformation for magma emplacement and, in fact, the positive feedback effect between magma generation and strain localization on all scales, documenting how regional-scale shear zones interacted with granite emplacement. Nicely balanced, however, two beautifully executed and illustrated field and experimental studies on diapiric granite emplacement above a subduction zone are included at the end of this chapter, 'reminding us that diapirism may exist'.

Fabric is the key word in almost every paper of this book, convincingly demonstrating that, in terms of fabrics, there is more to a granite than meets the eye. This is the main thrust of this book: to describe new advances in the acquisition of fabrics in granite, namely magnetic lineations and foliations, to characterize their origin and relationship in terms of strain regime and kinematic significance, the practical application of this knowledge and integrated use of fabric analysis together with regional structural, geophysical, and modelling studies. One might be critical of the heavy emphasis on magnetic fabrics compared with 'traditional' fabrics (i.e. the shape preferred orientation of minerals, enclaves or the orientation of co-magmatic dykes and veins), but the quality of the field examples and the presentation of recently developed methods for the collection and interpretation of magnetic fabrics and their significance for unravelling granite tectonics cannot be faulted. Those who seek an in-depth treatment of melt accumulation and segregation mechanisms might want to look elsewhere for a more detailed discussion of this topic, but in terms of fabric studies applied to granites, this volume provides a comprehensive review of the current state-of-the-art techniques clearly pointing the way to increasing sophistication in the acquisition and interpretation of fabrics in granitoids.

This book will certainly have a wide appeal not only to structural geologists and metamorphic petrologists working on granite formation and tectonics, but also to anyone working in the field of regional geology who will find that granite emplacement forms an intricate part of large-scale tectonometamorphic processes from which regional-scale crustal tectonics can be inferred. Hence, this book is a very useful addition to the available literature on granite formation. The volume is well-edited, containing only a few typographic errors, and the quality of the figures is excellent. The 21 page long bibliography and a (short) index at the end of the book add to the superb layout of this volume. At US\$ 166, the book is rather expensive and probably difficult to afford for individuals, but any Earth science library should have a copy on their shelves.

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