

BOOK REVIEWS

Pitcher, W. S., Atherton, M. P., Cobbing, E. J., and Beckinsale, R. D., eds. *Magmatism at a Plate Edge: the Peruvian Andes*. Glasgow (Blackie) and New York (Halsted Press), 1985. x + 328 pp., 246 figs., 2 coloured geological maps. Price £65.

This book celebrates one of the outstanding achievements in geological sciences accomplished over the past twenty years. Before the early sixties, most modern interest and research effort in igneous petrology had been directed towards understanding the processes and significance of basic magmatism, both volcanic and plutonic. In 1965 Wallace Pitcher, who had previously carried out in Donegal some of the most interesting of the little work done on granite bodies, initiated what became an exceedingly ambitious and enterprising field and laboratory research programme—the study of the Coastal Batholith of Peru. Using the resources of his department at the University of Liverpool and working in close collaboration with a team from the (then) Institute of Geological Sciences, as well as with geologists from the Geological Service of Peru, an assault was carried out on the great complexity of this ‘granitic’ terrain with its marvellous three-dimensional exposure but daunting logistic problems. Numerous geologists, including research students and professional specialists, became involved as mapping was collated and followed up by detailed petrographic, geochemical, and isotope studies. Concepts were developed and refined into a comprehensive model for the evolution of the batholith in relation to its destructive plate margin environment. Although many aspects of this work have appeared in print since the programme got under way, the twenty-five chapters in this book represent the only complete and comprehensive review of the results and their significance.

Each chapter is in essence a review-type summary co-authored by those who have collaborated on each topic. There are some thirty contributors in all. The first five chapters are concerned with the general geological setting and pre-Mesozoic history of the Peruvian Andes, including the Arequipa massif and the Eastern Cordillera, with notable contributions from French and Canadian teams who were not part of the main programme. This places the subsequent chapters in a more complete context and adds considerably to the value of the book to the non-specialist. Three further chapters establish the early environment into which the granites were emplaced—the volcanic/sedimentary fill of an ensialic marginal basin, its burial and metamorphism, and the early basic intrusions

which are related to aborted rifting rather than to the calc-alkaline magmas. The core of the book—chapters 9–21—deals with the batholith itself; its classification (especially the concept of units and superunits which can be recognized in the field and provide a key to the magmatic history), its mineralogy, mechanics, structure and form. Of special importance are the chapters on geochronology and the geochemical characteristics of individual superunits, as well as the use of both these aspects to identify the source of the magmas as a uniform sub-crustal region, possibly basaltic underplating. The remarkable linear regularity of the batholith is used to argue for long-lived lithospheric fractures controlling the ponding and rise of evolving magmas. The final chapters deal with the metallogenic history associated with the batholith, including both early Cu-Fe and late porphyry-Cu mineralization events, and the overlying plateau-type volcanic rocks.

Considerable care has gone into the production of this book. Its readability and comprehensiveness is much enhanced by the chapters in which the main editors are also authors, providing general comments, links between various aspects and synthesis of conclusions. It is lavishly laid out and illustrated and includes two coloured maps covering the area from Chimbote southwards to the Chilean border (at scales of 1:500 000 and 1:700 000). There are unfortunately some signs of last minute haste in its preparation, the most obvious being the reference list for the entire volume which has an addendum but is still incomplete. However, this is a small flaw in an exceptionally important work. As pointed out by Sir Malcolm Brown in his Preface, publication happily celebrates the 150th anniversary of the British Geological Survey, whose mapping contract with the Peruvians was a lynchpin of this programme (MA 81–4515). However, to a large part of the geological community, this volume will chiefly represent a fitting monument to breadth of vision and resourcefulness of Wallace Pitcher.

R. J. PANKHURST

Wright, J. B. with contributions from Hastings, D. A., Jones, W. B., and Williams, H. R. *Geology and Mineral Resources of West Africa*. London (George Allen and Unwin), 1985. xiii + 187 pp., 49 figs. Price £30.

This book provides a broad summary of West African geology and mineral resources for undergraduates who have already been introduced to the

basic principles of geology. It will appeal to all those wishing to study West African geology, especially undergraduates in the countries of the region. It covers the area, south of the Sahara, from about 15° N. (Senegal to Niger) to about 5° N. (Sierra Leone to Nigeria).

The first chapter introduces the geological setting of West Africa, whilst the remainder of the text treats the subject in four parts: the Precambrian; sedimentary basins; Mesozoic to Cenozoic igneous activity; and the Quaternary. Each chapter has a useful summary, and each of the four parts begins with an introductory chapter setting out the general geological principles and the arrangement of the ensuing chapters. Thus the Precambrian is introduced by an informative chapter describing crustal reactivation, regional patterns in West Africa, basement rocks, and supracrustal and granitic rocks. This is followed by chapters on the Archaean, the Proterozoic, the Pan-African of the western and eastern parts of the area, and a synthesis. The Pan-African is dealt with in this part because it represents the final stage in the formation of the African shield although it is largely younger than the Precambrian.

The sedimentary basins described in Part 2 comprise the Late Precambrian (Infracambrian) to Lower Palaeozoic sequences, Mesozoic to Tertiary inland basins, and coastal basins. A description of the general occurrence of sedimentary basins within and around continental masses introduces these subjects, which are followed by a chapter on the economic potential of the younger basins referring especially to oil, coal, uranium, and phosphates. A short chapter on the generality of anorogenic magmatism in the area introduces Part 3, which consists of brief chapters on Permo-Triassic dolerites and carbonatites, the Younger Granites (especially the Nigerian tin granites), Cretaceous to Cenozoic magmatism and volcanism including kimberlites and the diamond fields. In the final part, the Quaternary is introduced by a chapter on earthquakes, volcanoes and meteoric impact; it also deals with geomorphology, Quaternary deposits including laterites, and water resources.

The authors have set out to provide a thorough treatment of fundamental principles and their application to West African geology in 162 pages of text, with the result that a great deal of information is condensed into a slim volume, giving a rather staccato style. For this task they have appreciated that many standard references are often unavailable to their intended readers and that there is a necessity to emphasize the role of geological provinces without offending nationalistic sensibilities. They have brought together a mass of information on the area despite local differences in placing

boundaries or interpreting the mechanisms of formation. Above all this book is intended to be helpful and constructive in these matters. There are useful and informative maps and diagrams, although some of the diagrams showing plate tectonic reconstructions are occasionally so stylized as to seem almost inapplicable to West Africa in the Precambrian. The reader is helped by the full contents list and index and the glossary of terms from *Abakaliki Basin to Zungeru mylonites* which also includes general items such as *cauldron subsidence* and terms like *thermotectonic event* developed specifically in the context of African geology.

JOHN F. W. BOWLES

Shepherd, T. J., Rankin, A. H., and Alderton, D. H. M. *A Practical Guide to Fluid Inclusion Studies*. Glasgow and London (Blackie), 1985. xi + 239 pp. Price £26.

The enormous growth of the use of fluid inclusions in all branches of geology has led to the publication of a large number of books, short course notes and special issues on the subject. One item that has been missing is an extensive work on the practical aspects of fluid inclusion analysis. However, this book exactly fills the gap in the literature, being a text dedicated to aiding researchers in obtaining meaningful data from fluid inclusions.

Chapter 1 provides a background to fluid inclusion analysis including information on the types of fluid inclusion, their formation and post formation changes. Chapter 2 is concerned with the preparation of material for analysis and Chapter 3 with the information obtainable from optical examination. Thermometric analysis is dealt with in Chapters 4–7, covering everything from equipment and standards to the presentation of data. There are detailed step-by-step accounts of how to handle fluid inclusions of all chemistries (from simple H₂O–salt inclusions to CO₂–CH₄–N₂-bearing inclusions) during heating and freezing. Chapters 8 and 9 are devoted to chemical analysis and all methods are described, and their respective merits discussed. The methods dealt with vary from crush-leach analysis to more specialized spectroscopic techniques of ICP-decrepitation analysis, SEM analysis of daughter minerals and Laser Raman analysis of single inclusions. Chapter 10 speculates on the areas in which new advances will be made and this is followed by appendices providing addresses and manufacturers of the materials and equipment needed for preparation and analysis (nearly all UK).

The book is sympathetic to the reader and assumes no previous knowledge on the subject. It