

## Progress on the margin

R.A. Scrutton

**Early Tertiary Volcanism and the Opening of the NE Atlantic.** Edited by A.C. Morton and L.M. Parson. *Blackwell Scientific*. 1988. Pp. 477. £80, \$85.

THE Early Tertiary Igneous Province has been studied by geologists and geophysicists for decades, and is the subject of a voluminous, ever-growing literature. Long-standing research such as this usually proceeds at a measured pace, but occasionally receives a major fillip as a result of an unexpected finding.

In the late 1970s, discovery of 'dipping reflector sequences' on seismic reflection profiles from the continental margins of the North Atlantic, and their interpretation as thick volcanic sequences of early Tertiary age, indicated that the igneous province could be studied not only on the continents bordering the Atlantic, but also at the continent-ocean boundary whose formation was heralded by the volcanism. Marine geophysics and deep-sea drilling became important new tools. Further impetus to research came from the repeated discovery of volcanic rocks of relevant age in hydrocarbon exploration wells in basins on the north-west European continental shelf. The new information, together with re-interpretation of older data, provided a great advance in our understanding of volcanic processes at passive continental margins, and of their products on the margins and elsewhere.

The book reviewed here stems from a conference held in London two years ago (discussed in a News and Views article in *Nature* 327, 191; 1987), the object of the organizers being to highlight those processes involved in the inception of sea-floor spreading in the North Atlantic. The resulting volume contains contributions from geophysicists, geochemists, volcanologists, structural geologists and sedimentologists, among others, but perhaps more importantly it brings together work from onshore and offshore.

One of the outstanding problems of the volcanic province is to get the chronology of events right throughout the province — here the magnetostratigraphy and radiometric dating of continuously sampled volcanic sequences on land can be wedded with the biostratigraphy of the drilled but less continuously sampled volcanic-sedimentary sequences in basins offshore. The need for further work in this field is repeatedly mentioned by the contributors. A number of the outstanding questions on volcanic processes at passive margins are also aired. Are dipping reflectors only in oceanic crust or do they also

occur over continental crust? Is the asthenosphere upwelling process a passive one or does it involve local convection beneath the rift? Is the underlying mantle convection system an upper-mantle or whole-mantle phenomenon? An exciting feature discussed here is the discovery of peraluminous volcanic rocks in Rockall Trough and on the Voring Plateau, and their significance for the role of crustal and sediment melts in the volcanic province.

The Geological Society of London Special Publication series has become an important vehicle for conference proceedings. This, the thirty-ninth volume, preserves that reputation. Although not a large book, the coverage of the Tertiary province is broad, with petrology and

geochemistry providing about half of the contributions. With few exceptions the articles are of high quality, and some are excellent.

As a report on the progress of research in what has become the classical area for the study of volcanic passive margins, this book will be widely used and much referenced. For those interested in passive margins, in volcanic products and processes in extensional terranes, or in the general geology of the North Atlantic, it is a must. For others it provides a useful reference work at a wide range of levels. □

R.A. Scrutton is Reader in Marine Geophysics at the Grant Institute of Geology, University of Edinburgh, West Mains Road, Edinburgh EH9 3JW, UK.

## Hole process

Richard A.F. Grieve

**Impact Cratering: A Geologic Process.** By H.J. Melosh. *Oxford University Press*. 1989. Pp. 245. £45, \$65.

THE study of impact cratering is a relatively new enterprise for geologists. Much present interest stems from space exploration programmes, which firmly established cratering as an important process in early planetary evolution. More recently, the suggestion that the Cretaceous-Tertiary mass extinction was the result of a large impact has stimulated interest in — and debate about — impact as a process affecting the Earth.

Melosh's is the first English-language textbook on the subject. As such, it is a very welcome addition to the literature, bringing the subject together and filling in the gaps left by compendia of papers in conference proceedings volumes which have dealt only with selected aspects.

Research on cratering is a multidisciplinary pursuit which Melosh approaches from his own discipline of physics. This is the underlying theme and strength of the book. The author is frank on what is known and not known in this rapidly expanding field, explicitly stating, sometimes repeatedly, the assumptions and the caveats.

The reader is introduced to the subject in a logical fashion. I particularly liked the discussion of scaling relations coming before discussion of the processes by which craters are modified. It is easy to forget that experimentally derived scaling relationships generally refer to the excavation and so-called transient cavity, not to the final crater, which will have undergone considerable structural modification, particularly in large, complex craters.



From Impact Cratering

Dark side of the moon: the largest crater (centre) is about 75 km across.

The subtitle is rather misleading. This book is about processes, not the geology of impact craters. In fact, the geological effects of impact are given little space. For example, shock metamorphism is discussed in one page, whereas five are devoted to the process of viscous relaxation of crater morphology. There are also a few minor factual errors, particularly when the text deals with geological observations. A few descriptive words are given for each reference, at the ends of chapters, to help students wishing to go further.

Impact cratering is increasingly being recognized as an important geological process. This well-written and amply illustrated book will serve as an excellent reference and teaching text for senior undergraduate and graduate students. I certainly wish it had been available a few years ago, when I was trying to teach the subject. □

Richard A.F. Grieve is in the Geophysics Division of the Geological Survey of Canada, Building 3, Observatory Crescent, Ottawa, Canada K1A 0Y3.