

Sampling the deep Earth

D. K. Bailey

Mantle Xenoliths. Edited by Peter H. Nixon. Wiley:1987. Pp.844. £100, \$215.

TRADITIONALLY, the main concern of geology has been with the Earth's crust, constituting less than 1 per cent of the planet's volume. Most of the Earth (84 per cent) is made up of the underlying mantle, and in recent years there have been international efforts to explore its composition (as distinct from its geophysical characteristics). Samples of the solid mantle are available in two forms: large slices (measured in kilometres) driven through the crust in episodes of mountain building, and small fragments brought to the surface by high speed volcanic eruption (xenoliths). Although the latter are haphazard samples torn from the sides of the volcanic conduits, they are especially valuable because there has been little chance of alteration during their transport to the surface. An assemblage of xenoliths from one eruptive centre can provide a profile through the upper mantle to depths as great as 250 kilometres. The evidence is fragmentary, in every sense of the word, but these are the only direct samples available from the major portion of our planet, and any attempt to produce a survey of existing knowledge must be welcome.

The book is divided into two parts. The first is devoted to regional studies and is aimed at providing a comprehensive review of the worldwide distribution of mantle xenolith locations in five geographic regions (lithosphere plates). After an introductory overview by the editor, several chapters are devoted to each plate, each chapter dealing with a different part of the plate. Coverage is variable, largely because of the paucity of information from particular regions, for example South America and India, but there are some puzzling omissions, such as West Germany in a fulsome coverage of the rest of Europe. A separate section devoted to mantle xenoliths within the ocean basins would have been useful, even though these may appear (at the moment) to be similar to some continental examples. Any deficiencies, however, are more than balanced by the gathering together of dispersed information, and invaluable surveys of hitherto poorly known or unevenly described regions. China has many geological marvels and the chapters here presage more wondrous things to come.

All in all, Part 1 is a splendid array of information, given coherence by the excellent overview and tables provided by the editor. One almost wishes he had

presented his own comprehensive atlas, but even so this format constitutes a major contribution in this complex field.

The first part of the book is an entity and could stand alone. Part 2 is devoted to "Principles, Processes and Special Studies" and, as its title suggests, is less coherent than the first part, suffering from a lack of linkages and general overview by the editor. The structural rationale is hard to discern, and the brief editorial introduction does not provide much guidance in spite of an amusing cartoon showing the chapter numbers on a schematic section through the Earth. Many of the individual contributions are excellent and some clearly relevant to principles and processes. Why some topics were singled out for special treatment, however, is less clear, especially when others, such as eruptive mechanisms, or melting processes, lack separate coverage.

In a book of this size it would certainly have helped the general reader to have had a chapter (or appendix) in which the classification of mantle fragments, in terms of modal mineralogy and fabrics, was clearly set out. The glossary is not sufficient. Naturally, in a compendium of

50 chapters (78 contributors) there is a wide variation not just in style but even in attack. Uniformity of terminology is thus all the more necessary: terms like 'asthenosphere', for instance, are difficult enough without the spectre of undefined and variable usage.

Many data have been brought together in well-constructed tables, which together with the maps provide a mine of information. The abundant colour plates not only inform but delight the senses, and the unfamiliar reader will readily appreciate one of the fascinations of these rocks.

There are a good many books dealing with the mantle, and mantle processes; some are restricted in theme and many are conference volumes, and as a consequence coverage of the subject is dispersed and uneven. This position has now been substantially rectified by the immense efforts realized in this book, which is a testimony both to the editor's fortitude, and to his insight, born of long experience in the field of mantle xenoliths. □

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Social climbing

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Evolution and Escalation: An Ecological History of Life. By Geerat J. Vermeij. Princeton University Press: 1987. Pp.527. \$47.50, £31.70.

THIS book is about adaptation and adaptations, especially those that arise as a result of interactions among species. The uses to which adaptations are devoted are certainly most easily studied in living organisms, but the success of particular sorts of adaptations in contributing to the dominance or longevity of lineages is best assessed in the fossil record. With fossil evidence one can commonly follow the origin, distribution and persistence of adaptations over long spans of geological time. Vermeij is a marine biologist, experienced in functional interpretations of morphology, and he knows the fossil record well. Here he traces some of the consequences of morphological adaptations and generalizes upon the patterns they display.

The book is divided into four parts. The first sets out a theoretical framework for the study of morphological aspects of adaptation. Although it is accepted that these adaptations evolve through fitness differentials, there is little or no understanding of the genes or gene systems underlying the morphologies involved, and therefore Vermeij employs a vocabulary suited to phenotypic rather than to

genotypic aspects of adaptation.

For example, adaptive traits (termed "aptations" regardless of whether they originally evolved to serve their present functions) arise through the action of selective agencies termed "hazards". The probability that an individual will survive an encounter with a hazard is a measure of the "effectiveness" of the appropriate aptation, while the "adaptive gap" is a measure of unsuccessful encounters; thus these terms substitute for "fitness" and "selective intensity" as used in the conventional evolutionary vocabulary. Within an evolving lineage, adaptive improvement occurs as effectiveness increases and the adaptive gap narrows. If a hazard is intensified, the response may be a further enhancement of the associated aptations, and "escalation" is said to have occurred.

The second part is entitled "The Acquisition of Resources", and the third part (the longest, and the heart of the book) "The Evolution of Armor and Locomotion". In both of them Vermeij goes into predatory and anti-predatory aptations in detail; competition is deemed to be important also, but is given less attention, perhaps because the morphology of competition is not so clear. In Part Three, aptations developed in organisms with distinctive hard-part ground-plans — bivalved organisms, articulated organisms and so forth — are explored group by group. Most attention is focused on molluscs, the dominant armoured phylum in the seas today. The fourth part summarizes the evidence marshalled earlier in the book, and discusses the conditions favourable