

devoted their professional lives to its advancement. Mayr is an ornithologist who has contributed monumentally to systematics; he is known to all biologists for his work on the biological species concept. An eminent entomologist and theoretician of systematics, Ashlock died before the book was completed.

This is not intended as a "recipe" book on taxonomic methods, but several sections will be of interest to readers in search of practical advice. Chapter 11, on numerical phenetic and phylogenetic methods, will be very useful for beginners. We especially like the approach of providing a simple sample data set for readers to work with by hand. This should do much to dispel the mystique that computer analysis somehow bestows data (and results!) with emergent qualities. Also extremely useful is the chapter on the publication of systematic work; it should be read by every graduate student of systematics. Not for the beginner, however, is the chapter on nomenclature, which is mostly a critical commentary. Those looking for an entry guide to the International Code of Nomenclature would do better with a copy of the 1985 third edition of the Rules plus chapter 12 of the 1969 edition of *Principles of Systematic Zoology*.

The updating of the 1969 edition (which was authored by Mayr alone) has not been thorough. In several places, the latest references to areas within systematics that are advancing rapidly are 15 or 20 years old. The treatments of such important topics as phenetics, vicariance biogeography, character polarity, morphometrics (including allometry), numerical methods in microtaxonomy, and molecular techniques are incomplete and dated. For example, we think it a disservice to claim that the 1960 *Quantitative Zoology*, by Simpson, Roe, and Lewontin, is still "the best for the everyday needs of the animal taxonomist." *Quantitative Zoology* remains a useful book, but recent statistical texts, computer manuals for statistical packages, and a rich primary literature are in ample supply. The new edition of *Principles of Systematic Zoology* would have benefited from careful editing of the figures and tables for clarity and relevance. Readers will be annoyed, for example, to discover that sources of several figures are cited incompletely or are not included in the bibliography.

Mayr and Ashlock's seasoned perspective provides valuable insight on the school of biological classification known as "evolutionary systematics." According to Mayr and Ashlock, evolutionary systematists begin by grouping organisms on the basis of overall similarity. Cladistic principles are then used to test the provisional groups to identify and

correct any that may be polyphyletic. Hierarchical rank of the resulting taxa is determined by consideration of genealogical relationships, within-group homogeneity of characters, and between-group character gaps. Special consideration is given to complex features related to "adaptive zones" and, insofar as possible, stability of traditional classifications. Mayr and Ashlock's "evolutionary systematics" thus combines the best of phenetics and cladistics to produce informative and stable classifications that are genealogical while also reflecting phenetic and ecological differences among taxa.

Mayr and Ashlock's new edition emphasizes classification as the most important product of systematic research. In fact, much of the section on macrotaxonomy is devoted to rehashing the differences of opinion about classification that have filled many pages in *Systematic Zoology* and other journals since 1960. Certainly all systematists agree that classification is essential, and much practical progress has been made even as the ideal nature and content of classification have been passionately debated. We believe, however, that the book's heavy focus on classification is misplaced. Partly as a result of this emphasis, the book fails to convey the intellectual excitement that characterizes other areas of systematic biology today. There have been unprecedented advances in practice and theory, particularly in the area of phylogenetics. Systematists have shown that genealogies are utterly essential for investigating adaptation, speciation, coevolution, evolutionary rates, macroevolution, and historical biogeography. Increasingly, phylogenetic thinking and systematic research are attracting the attention and participation of ecologists, behaviorists, functional morphologists, and molecular and developmental biologists. There is a promising future for phylogenetic systematics in interdisciplinary research. At society meetings and in our classrooms, we see a new generation of bright graduate students, including many from biological disciplines beyond taxonomy per se, who are actively seeking training in phylogenetic systematics. Mayr and Ashlock's book will teach these students where systematics has been, but they will have to seek information and inspiration elsewhere as they prepare to take systematics into the 21st century.

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Beneath the Continents

Continental Mantle. MARTIN A. MENZIES, Ed. Clarendon (Oxford University Press), New York, 1990. xiv, 184 pp., illus. \$98. Oxford Monographs on Geology and Geophysics, 16.

Even those who study the continents sometimes forget that the continental plate consists predominantly of mantle. Though most of our knowledge of continents has and continues to come from the crust, the importance of the mantle has become apparent with the advent of plate tectonics. Understanding the forces that have formed and deformed the continental plate clearly requires knowledge of the mantle component. To the extent that the crust and mantle are complementary geochemical reservoirs, the continental mantle provides an important clue to the differentiation processes that formed the crust. In the earth sciences, we now stand a quarter-century into the plate-tectonic revolution, and one of our most important jobs is to utilize plate tectonics to unravel the earth's history as revealed in the continental crust and mantle. More than anything else, this book serves to give the continental mantle the thorough examination it deserves. In addition it makes the point (chapter 1) that the continents must be understood in the context of the entire mantle. This broadening of scope is essential and has been motivated by plate tectonics, the recent tomographic images of a convecting mantle, and the realization that the continents have responded over time to this convective system.

As with the continental crust, the study of the continental mantle involves a variety of subdisciplines in the earth sciences. The strength of this book is that it provides a thorough discussion of the most important current observational constraints from geophysics (especially seismology), petrology, geology, and various branches of geochemistry (geochronology, stable isotopes, fluids, and redox-oxidation equilibrium studies). In addition, it provides a fairly good historical perspective of two of these areas, seismology and petrology. Conspicuous in its absence, however, is any discussion of continental dynamics from a theoretical or numerical-modeling perspective. Such a chapter would have complemented nicely the observational emphasis.

Although each chapter was written independently, usually by a different author, there are several recurring themes in the book. The most important of these concerns the contrasting nature of the lithospheric mantle beneath various geologic provinces. In most early plate-tectonic models, the crust was regarded as the sole distinguishing

feature between continental and oceanic plates, with no distinction made between corresponding mantle components. That is, the continental mantle was seen as being governed by the same laws of boundary-layer thickening and subsidence that worked so well for the oceans. This simple and elegant model, however, has now confronted the features of the Archean cratonic mantle (as discussed in detail in the book): a thick, buoyant, seismically fast, lithosphere that is significantly depleted in basaltic components but enriched in incompatible trace elements compared to the oceanic upper mantle.

The difficulty appears not to lie primarily in the difference between oceanic and continental mantles, however. The point emphasized in several chapters is that the Phanerozoic and Proterozoic continental mantle is in fact petrologically, chemically, and seismologically similar to the mantle beneath old oceans. Such a conclusion is very important, since it implies that the most fundamental difference is between Archean and post-Archean rather than between continental and oceanic mantle. How this distinctive Archean mantle actually formed remains an intriguing question. The diamond inclusion data (chapter 3) suggest that it formed contemporaneously with the crustal rocks, rather than by the gradual thickening from thermal cooling. The oxygen isotope data discussed in chapter 7 argue for the incorporation of sea water in eclogitic nodules, suggesting that parts of the mantle were at some point involved in an ocean-related process, such as subduction.

While this book has many strengths, there are two areas of weakness that should be mentioned. First, there is a notable absence of synthesis, and given the unavoidable differences of opinions and differing orientations of the authors no one chapter provides a coherent overview of the multitude of existing constraints. Second, in some of the chapters there is a tendency to mix observation, interpretation, opinion, and speculation without warning the reader which is which. On balance, however, this book is worthwhile reading for anyone who seeks a full understanding of the continents.

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