# Book Reviews

## Minicontinent

**Biogeography and Ecology in Madagascar.** R. BATTISTINI and G. RICHARD-VINDARD, Eds. Junk, The Hague, 1972. xvi, 766 pp., illus. 190 guilders. Monographiae Biologicae, vol. 21.

It was early recognized that the animals and plants of Madagascar, "La Grande Ile," are unique and present many problems both baffling and instructive. Mentions of them began to appear several hundred years ago, and within the last century they have been the subject of a number of now classic monographs. Recently study of them has increased markedly in both extension and intensity, stimulated especially by the establishment of a research institute (IRSM) and later of a university in Tananarive, by creation of a special branch of the overseas research institute (ORSTOM) in Paris, and by the involvement of leading French scientists at other Parisian institutions. Many of their results are summarized in the present most recent volume of the series on regional ecology and biogeography in the Monographiae Biologicae.

The volume contains 24 chapters by 28 authors. Five chapters treat the physical background: geomorphology, geology, climate, pedology, and hydrology. Two discuss the flora and 12 the fauna, including coral reefs and freshwater fishes but emphasizing the terrestrial arthropods, mollusks, and vertebrates. Three scattered chapters bear primarily on conservation and one on ecological aspects of human diseases. A final chapter is useful but not completely successful in organizing and summarizing the results of these rather disparate contributions.

Certain themes do constantly recur in different contexts, and they demonstrate why the ecology and biogeography of this region have so long fascinated so many workers in so many specialties. The biota is extraordinarily endemic. Among adequately known terrestrial organisms some 90 to 100 percent of species are endemic in most groups, figures comparable to those for Australia or New Zealand at this taxonomic level in spite of the greater isolation of the latter regions. At higher taxonomic levels endemism is less in Madagascar. Numerous species and to less degree genera belong to comparatively few higher taxa, thus appearing to represent the diversification on the island of a limited number of founder stocks. Those founders are inferred to be heterochronous in all the groups here reviewed; that is, they appear not to have reached Madagascar or to have evolved there as balanced biotas comparable in age but to have arrived more or less singly at different times from the Cretaceous onward. Some are quite ancient, although an old idea that the biota as a whole is archaic (repeated here by Millot) is not justified.

All the major groups here considered have their closest connections with Africa, and there can now be no remaining doubt that Africa was indeed the source of the great majority of the founder stocks of both plants and animals. Nevertheless many groups highly characteristic of Africa and in some instances ancient there are absent from Madagascar. No known Recent Malagasy plants or animals can reasonably be explained by distribution over an ancient Gondwanaland. The geological evidence here given, primarily by Brenon, indicates definitive separation of Madagascar from Africa in the Permian, before any of the Recent major taxa yet existed, and also indicates continuous presence of the Mozambique Channel as a water barrier ever since, although its width has varied and there is some dissent as to this conclusion.

It is now beyond reasonable doubt that Madagascar is biogeographically an oceanic island and that it owes its biota to stochastic or sweepstakes dispersal of founders almost all from Africa at varying intervals over a long span of geological time. That view, briefly but definitely set forth by W. D. Matthew long ago (*1*) on the evidence of the mammals, is fully supported by present knowledge of the mammals, here reviewed by Heim de Balsac, F. Petter, J. J. Petter, and Albignac, and by added evidence of the reptiles, here analyzed by Blanc in an unusually complete study.

The birds, treated here by Dorst, are to some degree a special case. Their endemism, although also high at the specific level, is less than for most other studied groups of organisms. The birds also are mainly of African affinities, and here, too, there is the effect of impoverishment in main stocks, or higher taxa, that abound in Africa but are absent in Madagascar. Most notable and most unlike any other studied group is the evidence that a small but important minority of bird founders were of Indo-Oceanic, not African, origin. This does not indicate former land connections but a different capacity and direction of sweepstakes dispersal by the ancestors of those birds.

How many founder stocks were involved in the biota of Madagascar has been questionable and remains so. It long seemed a reasonable assumption that the tenrecs (the endemic mammalian insectivore family Tenrecidae) had a single founding episode and evolved entirely on the island. Now, however, the discovery of closer Recent relatives and of Miocene members of the family in Africa falls little short of proving that the origin of the family and the beginning of its deployment occurred on the mainland. There is as yet no such direct evidence for other polytypic groups, but the same may have been true for a number of them. For example, the cricetids have been supposed to have a single founder, but it has also been suggested that there was a separate founder population for each of the seven Recent genera. "Francis" (François) Petter here gives some reason to adopt the latter view. For very large and diverse taxa, such as the insects and the plants, there must correspondingly have been a large number of founders, but almost certainly many fewer than the existent numbers of genera and species. For such groups estimates of numbers of founders have not hitherto been made, and none are given here.

Koechlin's discussion of the flora is not in good agreement with the conclusions from the fauna. He distinguishes an ancient element, with pantropical, southern, and oriental affinities, that he believes to have been introduced over extensive land connections before the late Cretaceous, a later Tertiary element, partly pantropical but mainly African, from continuing connection with Africa only, and a latest group introduced by

sweepstakes dispersal from the Pliocene onward. All the geological and all the faunal evidence does not accord with that interpretation. Nothing in the observational data adduced by Koechlin seems sufficient to controvert the hypothesis that the plant founders, too, with frequently superior capacity for sweepstakes dispersal, came predominantly across a varying Mozambique Channel barrier and in quite small part by likewise sweepstakes dispersal from Indo-Oceanic sources.

It has long been known that Madagascar had numerous striking land vertebrate taxa that lived on until after the arrival of man on the island and later became extinct. That subfossil fauna, here summarized by Mahé, included such curiosities as giant tortoises, the great ratite *Aepyornis*, and the large lemur *Megaladapis*, along with many other, smaller and less striking, animals. Many species in the surviving fauna also are now in serious danger of extinction, as is emphasized here by Griveaud, Albignac, Millot, and others. There is here no impelling evidence either for the extinct subfossils or for the present fauna that direct predation ("overkill") by man is a main cause of extinction. These authors indicate that the most evident although not necessarily the sole and sufficient cause has been the great environmental changes that have followed occupation and ecologically destructive exploitation of the island by man. Nevertheless Battistini, who here writes on geomorphology only, has elsewhere (*2*) with Vérin maintained the direct or "overkill" hypothesis for the larger subfossil species, at least, and so has Walker (*3*) for the extinct subfossil lemuroids as a whole. The point might here have been more fully and explicitly considered.

Although English is not the language of any of the authors, 20 of the chapters are published in English. They have been professionally translated from French in London and the result is uniformly clear and reasonably idiomatic. Why four chapters were left in French is not explained; on arachnids, mollusks, reptiles, and insectivores, they are among the most significant. The editing is subject to some criticism. Apart from misprints, it is, for example, possibly baffling to come across text references to a "Booker Mac Dowell" (who is Samuel B. McDowell) and a "Findell Hopwood" (who was Arthur Tindell Hopwood), and to have no help from a bibliography, which is absent from six chapters and deficient for several others. The index, which includes only technical names of genera, is of little real use.

Despite some unevenness and flaws, this is a noteworthy contribution to biogeography and is now the best general source in (for the most part) English on the natural history of a fascinating island that might be called a minicontinent.

GEORGE GAYLORD SIMPSON
*Department of Geosciences, University of Arizona,* and *Simroe Foundation, Tucson*

**References**

1. W. D. Matthew, "Climate and Evolution," *Ann. N.Y. Acad. Sci.* **24**, 171–318 (1915); second edition, 223 pp., 1939.
2. R. Battistini and P. Vérin, in *Pleistocene Extinctions*, P. S. Martin and H. E. Wright, Jr., Eds. (Yale Univ. Press, New Haven, Conn., 1967), p. 406.
3. A. Walker, *ibid.*, p. 425.

## Productivity Studies

**Tundra Biome.** Proceedings of a meeting, Leningrad, Oct. 1971. F. E. WIELGOLASKI and TH. ROSSWALL, Eds. International Biological Programme Tundra Biome Steering Committee, 1972 (available from Swedish IBP Committee, Stockholm). 320 pp., illus. Paper, $4.

The tundra has had a provocative influence on the study of ecology. Early trophic studies by Elton and more recent work on physiological and population ecology of tundra organisms have included noteworthy advances in basic science. Some of the recent investigations of tundra productivity were reviewed in the symposium from which this volume stems.

The volume includes research results from tundra research projects in nine cooperating nations. For the most part, the contributors present progress reports rather than final summaries. Indeed, there are prominent statements suggesting that the contributions, except for those of the Soviets, are to be regarded as preliminary. A review of the papers does provide some perspective on the status of the investigations as a whole.

Fully two-thirds of the text is devoted to material from four major Soviet project sites. The papers vary from the philosophical to a detailed description of techniques for marking reindeer during river crossings. The majority are purely descriptive of the kinds, numbers, and biomass of organisms. There is a fairly even balance in coverage among primary producers, consumers, and decomposers. Matveyeva provides a synthesis of trophic-level productivity estimates for the Tareya site (western Taimyr) comparable to summaries presented for Canadian and U.S. projects.

Soviet interest in the abiotic environment is solidly focused on the soils. The influence of soil characteristics on organism distribution and productivity is not entirely clear from the work cited. The abundance of microorganisms does vary with soils of different structure (Aristovskaya and Parkinkina), but the distribution of vascular plants seems to relate more to microrelief (Ignatenko *et al.*). Vertebrate and invertebrate productivity is described as being coupled to the abundance of food. Smirnov and Tokmakova's description of the stimulatory effect of rodent grazing on primary productivity is one of the few examples of this type of feedback control.

The remaining articles include diverse research reports by non-Soviet investigators and a series of national project reports by biome leaders from eight countries. The paper by Tieszen (U.S.A.) on primary productivity is one of the best in the volume for its integration of process and descriptive information. Much of his work has been published elsewhere, however. Wielgolaski has done an admirable job of summarizing primary production information from several tundra programs. An intriguing paper by Bliss (Canada) on conservation and human impact is all too brief in view of its importance. Only one other paper (Dorogostaiskaya) is devoted to human influences on the tundra.

The national reports provide summary descriptions of component programs. Most include enough specific information to allow a comparative analysis of tundra productivity as revealed by the programs and to provide the rough outlines of an ecosystem-level simulation of productivity. The ecosystem-modeling efforts represented at this point are in the form of static pictures, with a promise that dynamic formulations will be provided in the future. Brown (U.S.A.) does present a flow chart for a dynamic simulation, but without specifics.

This volume will be useful primarily to those with an ongoing interest in tundra productivity. The symposium