CSIRO Publishing

Australian Journal of Botany

Volume 49, 2001

An international journal for the publication of original research in plant science

All enquiries and manuscripts should be directed to:

Australian Journal of Botany
CSIRO Publishing
PO Box 1139 (150 Oxford St)
Collingwood, Vic. 3066, Australia

Telephone: +61 3 9662 7613
Fax: +61 3 9662 7611
Email: ajb@publish.csiro.au

Published by CSIRO Publishing
for CSIRO and the Australian Academy of Science

www.publish.csiro.au/journals/ajb

Preface

The Southern Hemisphere is a rich source of biogeographic information, with impressive living and fossil biotas whose distribution can be overlain onto the complex history of Gondwanan rifting. Many have been drawn to this biota and have offered a wide variety of explanations for the patterns observed. However, in common with many attempts at a human explanation of history, the reality has proven to be much more complex and subtle than once imagined. Many of the early attempts at explaining Gondwanan biotic history can now be considered as too general and simple (and anecdotal), although in their proper historical context they provided the foundation for later, much more precise, research.

A fundamental requirement of Gondwanan biogeography is a sound appreciation of the rifting process. Biogeographers must be aware of what is known of Gondwanan history, and with what certainty. While it is important not to accept all geological reconstruction uncritically, it is even more important not to propose impossible geological scenarios to fit with biogeographic hypotheses that may be flawed for biological reasons. McLoughlin provides a broad overview of the current state of knowledge of Gondwanan rifting, along with general biotic patterns. This is an important backdrop for the biological research presented in the other papers.

We stand at an interesting time in the history of research into the Gondwanan biota. Sophisticated algorithms are being applied in an attempt to link the phylogenetic history of taxa with the known history of Gondwanan rifting. This has been happening for some time, but the results are still controversial. A difficult issue for biogeographers, particularly those with an interest in the Gondwanan biota, is that in broad terms biogeography has two strands: vicariance and long-distance dispersal. We cannot deny that both occur, but the separation of their consequences is very difficult indeed, with the difficulty generally increasing as the events being reconstructed move further back into time. No doubt many biogeographers wish that long-distance dispersal had not occurred—it is likely to be capricious and thus difficult, if not impossible to reconstruct in what can be regarded as a scientifically stringent way.

This problem has led to a variety of approaches. Many, and particularly those interested in the fossil record, have relied on an anecdotal approach. This is open to the fair criticism that it does not really further our knowledge, because it is too specific and untestable. However, the approach to palaeontological research is changing, and much more rigorous analysis is becoming the usual approach. As a result, palaeontological data will be more appropriate for inclusion in general phylogenetic and biogeographic analyses in the future.

Nevertheless, the need to provide the best data possible is still an aspect of biogeography that does not receive enough attention. In this issue, Barnes *et al.* provide an updated review of the fossil record of the important Gondwanan family Cunoniaceae, which has an interesting fossil record, especially since its pollen is often overlooked (the grains are very small) or underinterpreted (the grains are relatively bland in morphology). However, the macrofossil record is providing important insights into past distributions and minimum times of origin for genera and species. The view that there is any key taxon that might explain general patterns of dispersal within Gondwana is now of historic interest only, but there are some taxa that receive a disproportionate amount of attention. Premier among these is *Nothofagus*, largely because it has such an extensive fossil record. Hill presents a review of this fossil record, especially focusing on what it can tell us about past diversity, and also examining the real information content of the published fossils. Palaeontological research cannot afford to be exclusive of strict phylogenetic approaches, and if macrofossil identifications of *Nothofagus* are subjected to this, most of them fail at the most basic level. The depth, and particularly the spatial breadth of the *Nothofagus* macrofossil record in Gondwana is largely an illusion, since too many poorly preserved macrofossils have been assigned to the genus without adequate justification. When well-preserved and described macrofossils are available, and there are many of these amongst *Nothofagus*, they make a valuable addition to the data source. The challenge for palaeontologists is to present their data in a way that makes this readily apparent.

Passion is high in biogeography and that was evident at the IIIrd Southern Connection conference, where the papers in this issue were presented. Certainly the issue of separating dispersal from vicariance was at the forefront. While disagreement was the most common outcome, it was encouraging to see that various attempts are being made to quantify the amount of long-distance dispersal that has taken place (see papers by Jordan, Lee *et al.* and Pole). Although this is not a simple task, some of the data presented certainly point to patterns that are best explained by random, transoceanic dispersal events (see Jordan). This presents a challenge for those with an interest in quantitative analysis, and where a few years ago the approach seemed to be to ignore the possibility of long-distance dispersal, many are now recognising its reality and are trying to overlay this onto general vicariance models (see papers by Swenson & Hill and Chambers *et al*.).

The quantitative models themselves are under attack for being overinterpreted, and Nelson and Ladiges provide a timely review of the procedures involved in vicariance biogeography and advocate a strict protocol that will generate soundly based hypotheses of the history of Gondwanan taxa.

Several months have passed since the papers published here were presented in New Zealand. During that time I have had the opportunity to talk to many people about the issues involved. I believe that much of the controversy in Gondwanan biogeography is caused by lack of adequate data.

10.1071/BTv49n3_PR 0067-1924/01/03000i

While the debate centres on methods of analysis, progress will be made in this area, and that is only right. However, the real problem is that too many people are relying on old and incomplete (and at least sometimes inaccurate) data sets. There is no substitute for really getting to know the organisms you are working on. The need for more researchers to undertake the basic data collection that will underpin our continuing interest in such basic issues as the history of the biota of the southern half of the world has never been stronger. I am sure all those involved hope that the papers presented here will go some way towards inspiring a new generation of dedicated scientists to gather and interpret data, so that we can demonstrate progress in the future by making this current set of papers quickly redundant.

Robert S. Hill

University of Adelaide, Department of Environmental Biology, Adelaide, SA 5005, Australia.
Email: bob.hill@adelaide.edu.au