

Book reviews

Panbiogeography — Tracking the History of Life. Robin C. Craw, John R. Grehan and Michael J. Heads. Oxford University Press, New York. 1999. Pp. 229. Price £45.00, hardback. ISBN 0 19 507441 6.

I plead guilty. Prior to reading this book I was one of those conventional biologists who understood the basics of the panbiogeographical method but who had not considered it a major paradigm in modern historical biogeography. I looked forward to reading the book (especially in the light of the second author's extensive contributions promoting panbiogeography on the 'taxacom' E-mail discussion list). I hoped that the book would educate me, perhaps convince me that panbiogeography had real value, and perhaps integrate panbiogeography with the now widely accepted vicariance-plus-a-bit-of-dispersal biogeographical paradigm (e.g. Cox, 1998). Having read the book (and delved deeper into the literature), I have certainly learned something, but I remain that same conventional biologist.

For readers of *Heredity*, it may be appropriate to outline briefly what panbiogeography is. It is a method, originally proposed by Léon Croizat (1958) and subsequently developed in large part by the authors of the present book and their colleagues, of describing biogeographical patterns by connecting localities of populations within species, of species within genera, and so on, by lines known as 'tracks'. If a number of tracks are congruent or overlap to a large degree they become a 'standard track' or 'generalized track'. The patterns of standard tracks, the 'nodes' at which two or more standard tracks overlap or meet, and the 'baselines' (major geographical or geological features such as an ocean or tectonic fault zone) that are considered diagnostic characters uniting tracks, are interpreted as representing major biogeographical features such as a common pathway of dispersal or a vicariant event that has led to common patterns of diversification.

But is panbiogeography more than this and is it indeed an informative methodology for biogeographical analysis? I thought that the first chapter — 'What is panbiogeography?' — might provide the answer. The crucial paragraph starts: 'Panbiogeography is an attempt to reintroduce and re-emphasize the importance of the spatial or geographical dimension of life's diversity for our understanding of evolutionary patterns and processes.' A little later, referring to modern mainstream biogeography, 'It is as if the geographical context was being written out of the subject [biogeography] altogether'. This is an exaggeration that seems to condemn the mainstream largely in order to justify the alternative, panbiogeography. And further on, more than once, it sets up the straw man of the conflict between vicariance and dispersal as the unifying explanation of biogeographic patterns — even though most modern biogeographers would acknowledge the importance of both — in order again to justify panbiogeography as an alternative, in

this case because it has no preconceived position in the vicariance/dispersal conflict. With the exception of the methodological section that explains clearly the construction of tracks, nodes, baselines, etc., the chapter continues in equally vague and, I felt, somewhat confrontational terms and by the end of it I still had no better idea of what modern panbiogeography really is, beyond a method for describing patterns, than before I picked up the book.

The remainder of the book is divided into six additional chapters, each distinct and more or less self-contained. Chapter 2 stresses the importance of geology, ecology and history in biogeographical analysis. Some specific points are argued. (i) That panbiogeography, unlike much other biogeography, acknowledges that the first appearance of a taxon in the fossil record may not represent the time of origin of that taxon. (ii) That the origin of the present biogeographical patterns of much modern life are Mesozoic and early Tertiary, much earlier than often suggested. (iii) That patterns of biogeographical distributions are frequently related to zones of tectonic activity. (iv) That islands, even oceanic islands such as the Hawaiian Islands, may have a biota derived from a time long before the appearance of the current islands, and that the biotas of some oceanic island groups (e.g. the Galápagos) are fundamentally associated with complex tectonic activity. These ideas are of real interest and I suspect few would disagree with them in principle (except perhaps the Mesozoic/Tertiary origin of present biogeographic patterns, an issue I am not qualified to judge), but they are not new insights derived from a panbiogeographical approach (for a more detailed critique of these issues see Cox, 1998). This chapter seems to deal with issues that are not illuminated exclusively by panbiogeography and does not convince me that panbiogeography 'offers general principles and methods for integrating these events [individual cases of a general relationship involving earth and life evolving together] within a broader understanding of ecological communities in general'.

Chapter 3 focuses on Africa and its relationships with Asia and South America, with many interesting examples of disjunct distributions, mostly explained by their Gondwanan origins. A case is made that Africa is not depauperate in biodiversity compared to Asia and America because while lacking the numbers of species, Africa's phylogenetic diversity remains high. Interesting to ponder and worthy of more detailed analysis, but again I did not see any new insights that could only have been derived from panbiogeography.

Chapter 4 tries to be controversial (perhaps a little defensive) but seems essentially to say simply that biogeography is linked strongly to systematics and phylogeny. I agree. But I also believe that phylogeny (not geographical distribution) is fundamental (cf. Platnick & Nelson, 1988; Page & Lydeard, 1994), while I acknowledge that geographical distribution data can (and should) be important in directing the choice between

alternative phylogenetic hypotheses. A number of issues are brought up as novel, even iconoclastic, but I do not see that they are. The issue of 'character recombination' is essentially that of lineage sorting (e.g. Maddison, 1997) and the coadaptation of genotypes, which is an idea that has been around for some time (e.g. Clarke, 1968). Molecular drive as a postulated mechanism of evolution has also been around for some time (Dover, 1982) but, as the book's authors state, its 'evolutionary population dynamics remain largely unknown in natural populations'. Its importance overall in comparison with other means of evolution (natural selection, genetic drift) therefore remains unclear. Whether important or not, again I do not understand how these issues are exclusively the realm of panbiogeography.

Chapter 5 outlines ways of presenting maps of distributions, and then gets into the mechanics of the quantitative panbiogeographical method. As exploratory devices giving a visual representation of distributions, panbiogeographical minimum spanning trees may be useful (e.g. Weston & Crisp, 1996), but as a means of getting at the core of biogeography and evolution I remain unconvinced.

Chapter 6 summarizes the history of biogeographers' subdivision of the earth's land masses into regions. These attempts are suggested as being generally flawed because most of the traditional regions are geological composites (this logic is also more fully explained by Cox, 1998), and in panbiogeography they are replaced by a subdivision of the earth based on the oceans. Essentially, the traditional regions have become the boundaries of the panbiogeographical regions. Interesting and thought-provoking though this is, I am not sure where it leads us, and I think many biogeographers now feel that it is not especially useful to be able to divide the world up into biogeographical regions in these ways.

Finally, Chapter 7 deals with issues of conservation and how a panbiogeographical approach could facilitate conservation on a global scale. I agree with a lot of what is said here about the need to somehow shortcut the assessment of global biodiversity. But to base a global conservation agenda on a foundation as controversial as the panbiogeographical approach is a risk I would not take.

Overall, the book sets up a number of straw men (e.g. the vicariance/dispersalist debate that is essentially resolved) and is sometimes rather defensive. Many examples are used to suggest that panbiogeography can provide fresh insight into old biogeographical and evolutionary questions; many of these examples are fascinating and I certainly learned from them. However, new insights proposed in the book generally did not require an explicit panbiogeographical approach, but rather a careful understanding of the plate tectonic context. Occasional minor irritations included the use of 'dispersion' (the static spatial pattern of distribution of individuals) where 'dispersal' (movement of individuals) was correct. Reading the very first page, I chanced to look up 'Stoddart 1986' to find that it did not appear in the References. I found the writing sometimes lacked clarity (in contrast to some earlier works on panbiogeography, e.g. Craw, 1988), which may be why I have perhaps missed some crucial points. Many of the figures are unclear.

Panbiogeography seems to me at best to offer little new insight, at worst to be fundamentally flawed. Phylogeny is the

underpinning of any biogeographical analysis. Though the book acknowledges phylogeny as important, examination of distribution patterns remains the central pillar of panbiogeography. The authors condemn (wrongly in my view) mainstream biogeographers for ignoring geography, yet in promoting in panbiogeography the analysis of distribution patterns above all else, they commit the reciprocal error. And by focusing on patterns, processes are relegated to insignificance. Nevertheless, I wonder if panbiogeography has something to offer (cf. Polhemus, 1996), specifically in evaluating the role of dispersal in a more rigorous way than can be done using a cladistic approach. Perhaps this might involve looking for tracks that follow the 'paths of least resistance' along which dispersal may be somewhat constrained (dispersal not being entirely random), although this seems not to be quite the sense in which panbiogeography views tracks (Cox, 1998). As Myers (1990) wrote in a review of a previous offering in panbiogeography, you may not, as I do not, 'accept the conceptual framework of panbiogeography', but nonetheless there may be something of heuristic value in a panbiogeographic depiction of patterns. The book is thought-provoking and I am glad to have read it.

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