

Anyone who undertakes to survey a field like this faces something of a dilemma. The traditional method, which is adopted by Ewing, arranges the subject by research technique: biophysics, sensory physiology, motor physiology, ethology and evolution. On the one hand, this makes it easy to compare species and to draw out general principles within each subject area. On the other, it separates things that clearly belong together, namely the behaviour and physiology of a group of insects seen in the context of their natural environment. Thus, anyone seeking a rounded picture of acoustic communication in field crickets would need to quarry in seven different chapters.

Essentially, what is offered is a comprehensive survey of recent research, presented in a way that should make it accessible to both graduate students and undergraduates. The chapters that top and tail the book should be particularly useful to the beginner. Some aspects of the physics of sound that are relevant to insects are outlined in the first chapter, where the main terms are defined. The last chapter describes methods for recording and analysing sound. The illustrations showing the same sound displayed as an oscillogram, a sonagram and a power spectrum are very helpful for the uninitiated, and might have been better at the start than at the end.

In between, there is a catalogue of research results: the physical mechanisms of sound production and reception, the

neural mechanisms of hearing and singing, then acoustic behaviour and the functions of calling, courtship and aggressive songs. Finally, genetics and evolution get the nod. Each group of insects receives its fair share of attention, depending on the amount of research that has been done. This means that the Orthoptera are the dominant group, but others such as cicadas and the author's own favourite, *Drosophila*, are not neglected.

The coverage of each subject is clear, accurate and thoughtful. It is not complete, however, and those interested in particular areas will need to search other recent references to get the full picture. This problem is most evident in the behavioural chapters on the calling and courtship songs of insects, particularly of crickets and cicadas. But the reference list provides an up-to-date guide to the literature, and even expert readers are likely to find some entries new to them.

Altogether, then, Ewing's book is a welcome contribution, the more so as it is the first of its kind since Haskell's *Insect Sounds* a generation ago. A comparison of the two books shows how much progress has been made. The breadth of coverage that Ewing has been able to maintain is particularly welcome. Even allowing for the present rate of progress, *Arthropod Bioacoustics* should be a valuable source-book for several years to come. □

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and ill-defined sketches of the outcome of palaeopedological research in this area.

One palaeosol type for which there is an abundance of information is the peaty soil (called entisol and histosol in the US system). But Retallack again fails to exploit this resource and his attempt to define the timescales of peat accumulation on the basis of peat thickness is positively misleading. To suggest that a peat depth of under 40 centimetres indicates an age of less than 800 years is entirely unacceptable. If Retallack had spent a little time in explaining the process of peat formation, including litter formation, detritivore and microbial activity, hydrological interactions and compaction effects, then it would soon become apparent that there can be no simple relationship between depth and age. There is evidence of a degree of oversimplification both here and elsewhere in his treatment of the interpretation of fossil soils.

The final section of the book, which is potentially the most interesting, is the story of the Earth's history as seen through the pores of the soil. In fact, the story begins beyond the Earth, on the Moon, Venus and Mars, with an account of totally abiotic soils. We are then led through the development of early terrestrial soils and the impact upon these of the rising oxygen levels in the primitive atmosphere. Immediately we hit upon the problem of a total lack of modern analogues: Hartley was right, the past is indeed a foreign country. It is difficult, therefore, on the basis of soil evidence, to determine the oxygen component of the Precambrian atmosphere.

The development of land vegetation provided a new soil-forming factor, and some palaeosols, such as coals, are an important source of information on plant palaeoecology. But again Retallack fails to deal adequately with the reconstruction of conditions in the coal-forming swamps (or bogs?) of the Carboniferous. We are left with no clear idea of the ecological, climatic or hydrological conditions in those palaeohabitats where coal ultimately accumulated.

The greatest strength of this book is in the clarity of its diagrams and Retallack's graphic explanation of soil-forming processes and soil classification systems. Its weakness lies in the author's failure to relate specific details of soil study to the broad process of environmental history. The complexity of soil terminology often seems to contribute to this lack of clarity, statements becoming buried and obscured by jargon. Whether or not things were done differently there, visiting the soils of the past certainly demands a foreign language. □

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Foreign visit

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Soils of the Past: An Introduction to Paleopedology. By G. J. Retallack. *Unwin Hyman*: 1990. Pp. 520. Hbk £60; pbk £24.95.

THE past, according to novelist L. P. Hartley, is a foreign country — they do things differently there. But it is the ardent hope of palaeoecologists (a group including the palaeopedologists) that they did things much the same, so that we can confidently use the present as a key to understanding the past. For this reason, any book on palaeosols needs to begin with a section on modern soils and soil processes before it can adequately discuss the soils of the past. Here, Retallack provides a graphic description of three classification systems of modern soils — the traditional Australian system, the US system (with its hierarchical structure and distinctive language), and the rather hybrid FAO system. Retallack compares these in diagrammatic form and, together with discussions of soil structure and soil-forming processes, provides a secure basis

for the analysis of the yet more complex problems of describing and interpreting fossil soils.

Time is involved at two levels in the study of palaeosols: in the initial development and maturation of the soil, and in an extended period during which the soil lies in a 'fossil' state. Interpretation of a palaeosol entails the separation of these two processes. Post-burial diagenesis often involves compaction and, at high temperature, may even involve metamorphosis of the soil. Cementation and mineral replacement can take a soil far from its original, pre-burial state. Confusion of the two timescales is possible, as the author shows by examples from the Carboniferous and the Permian.

Yet some clues to a soil's original condition remain intact, such as the nature of the organisms, or their traces, left within the palaeosol. From fungi to termites, and from nematodes to mammals, a vast range of biological information lies within the fossil soil and provides some secure evidence of past climates and conditions. On the basis of such information it should be possible to reconstruct whole ecosystems of the past from a fossil soil, but here Retallack is disappointingly brief and superficial, supplying only vague