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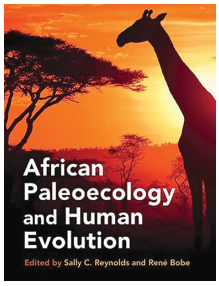
African paleoecology and human evolution



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The next steps in human evolutionary palaeoecology

The science of human evolution has seen several milestone books over its history. Such books end up being highly influential and they normally take one of two forms. First, there are those that tackle a key research problem and bring together a wide range of researchers and opinions illustrating the agreements and disagreements. An example is the Mellars and Stringer book[1] on modern human origins. A second type are the encyclopedia or data-heavy books that summarise a generation or more of research and offer it up to the student and scientist in a single book. These often have two points of value to them. First, they compile data that are spread widely over sometimes many papers and books. Second, and sometimes inadvertently, they illustrate a weakness in the field, an impasse that requires a new approach or method.

African Ecology and Human Evolution[2], edited by F. Clark Howell and François Bourlière, is a landmark book of the second type, and *African Paleoecology and Human Evolution*, edited by Sally C. Reynolds and René Bobe, is a worthy successor. The former was a standard reference for 20 years and was a tour de force of presentation and synthesis. But it also illuminated the weak underbelly of palaeoanthropology – the lack of chronometric dating and insufficient climatic and environmental context. A revolution followed in both areas, and *African Paleoecology and Human Evolution* is the proof – our progress in dating has been fabulous and is getting better all the time, and we now have many proxies that provide both climatic and environmental contextual data from the sites themselves and from other valuable sources.

One of the most important of these other sources, and most used, are the long continuous palaeoclimatic and palaeoenvironmental records from ice cores, deep sea cores, and other palaeo-archives. They have become a go-to comparative data set, and these comparisons often have two forms. Researchers will often compare or slot-in their typically more discontinuous site-based records, or they will compare archaeological and palaeontological sequences to these records. This is seen repeatedly in *African Paleoecology and Human Evolution*, and, in my opinion, is a procedure that has reached its limits in returns.

The book opens with five chapters that introduce the volume and synthesise some time periods. It then follows a standard regional structure – Southern Africa, Eastern and Central Africa, and Northern Africa. Within these regions, experts, mostly people who were once or still are engaged in fieldwork and laboratory work, then provide summaries of the evidence for sites and localities (for example, Cooper's Cave and Gona) or small regions (for example, Dandiero Basic and Nachukui Formation). I count about 32 chapters of this type. I found each of these to be good to excellent, and I know that I will be regularly pulling this book off my shelf to consult with these chapters when I need some basic facts. A valuable exercise would be a graduate seminar that worked its way through every chapter just to make sure students specialising in African palaeoanthropology know the data.

For the most part, this book stops at the end of the Middle Pleistocene, and I found that curious and a little frustrating. The record for modern human origins, which is rich, is for the most part left out and you will need to go elsewhere to find it. But from the Pliocene through to the Middle Pleistocene, this book is a fantastic reference. The primary materials presented are the faunal assemblages and summary descriptions of those. Dating and geology are also regularly presented in tandem with the fauna. There is some archaeology presented but not a lot.

What does this volume reveal as areas of weakness and areas for growth? I see two. First, it shows us that, despite the title, there is very little palaeoecology happening. Ecology is the science of the interaction of organisms with their environment, which of course includes other animals. The vast majority of what is presented is palaeoenvironmental reconstruction and description of faunal communities. That is good, but it is not palaeoecology. What kinds of palaeoecological questions would I see as important? Something to remember is that our focus is human evolution, so our target is hominins and their interactions with the environment and other fauna. Here are some palaeoecology questions: What was the distribution of water, and how did hominins position themselves relative to it? Modern human hunter–gatherers always place their campsites near water – it structures much of their movement. What animals were the primary predators of hominins and how did hominins avoid them? The theory of landscape of fear shows us how important this question is. Do the faunal data show us what edible plants were available, and how these changed over time? We have become very good at assigning fossils to taxonomic groups and dating them, but we have yet to really make headway into understanding what these past ecologies were like.

Second, the book shows us that we have reached a glass ceiling with our current approach. Our current approach finds fossils, describes them, dates them, and then uses specific animals or groups to infer what the environment was around the site. If there is a sequence, then we might describe how that changes over time, juxtapose it against a long climate and environmental archive record, and look for correlations. We are still very much in an inductive phase of science, and most sciences eventually mature into more deductive forms where the data are used to test hypotheses. We now have the ability to begin to do this. Advances in our ability to create climate models, and environmental models from those, has exploded in the last 10 years and will become increasingly powerful. My recommendation, which we have argued for elsewhere[3], is that we start to nudge ourselves in that direction. In such a procedure, we would create formal models of climate and environment across regions, and then use our fragmented sequences to test and refine those models, thus creating palaeoscape models. Within those palaeoscapes, we can use computer simulations such as agent-based modelling to experiment with interactions between fauna and their environment, which of course moves us truly in the direction of palaeoecology.

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