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The Science and Politics of Paleoecology

These days, paleoecologists seem decidedly angst-ridden. For at least a generation, they have been struggling to categorize their science, and, thus, attract a consistent scientific audience beyond that of colleagues working on the same topics. Having noted this, it becomes evident that the problem is only partly scientific; in fact, it is largely political. Many paleoecologists believe that the future of the profession depends on convincing other scientists, and funding agencies, that paleoecology is relevant to their needs. While there is obviously some truth to this, paleoecology is hardly alone in this regard; scientific issues that govern much of the current direction of potential research funding (e.g., global change) demand an interdisciplinary approach. Any subdiscipline that is seen as irrelevant to these large-scale programs will inevitably suffer.

My purpose here is to suggest that: 1) from a scientific perspective, the angst is ill-founded; and 2) armed with research results of general relevance that can only be provided from a paleoecological perspective, we need to launch an all-out effort to disseminate our findings to a wider scientific audience. Ironically, for all our worries that nobody is listening, we have made few real attempts to broadcast on frequencies tuned-in by other scientists.

When I took my first course in paleontology as an undergraduate, I was taught that paleoecology is, in effect, the study of the interrelationships between fossil organisms and their environments (see the first two sentences of Chapter 9 in Raup and Stanley, first edition). Note that if you substitute the word "Recent" for "fossil," you have a definition for ecology, rather than paleoecology. My gut sense is that this remains the definition of choice in most introductory courses, and would probably be viewed as suitable by our colleagues outside the subdiscipline.

The problem with this definition is that it ignores the primary aspect of paleoecology that distinguishes it from ecology: *the geologic time dimension.* Without this added facet, paleoecology is (and has been) relegated to a kind of

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second-class status that is viewed as dependent on ecology for principles that are applied to the fossil record with typically unsatisfying results. However, when geologic time is added to the mix, the result is a synergistic subdiscipline that resides at the cusp of evolutionary biology and ecology. The past two decades are replete with examples of this synergy, including (to cite just a few): the numerous studies of environmental trends accompanying the radiations and demises of clades (e.g., "onshore-offshore" patterns); assessments of long-term community stasis; evaluations of biological selectivity associated with mass extinctions; Vermeij's work on the Mesozoic marine revolution; Thayer's investigations of biological bulldozing; and Ausich and Bottjer's analyses of Phanerozoic transitions in faunal tiering.

In my opinion, *this* is the essence of paleoecology. Call it evolutionary paleoecology if you like; the label does not really matter. [Actually, I have been tempted to call it macroecology, with the implication that (neo)ecology is microecology, but I do not want to open *that* can of worms].

Many paleoecological studies illustrate a kind of *de facto* feedback loop between ecology and paleoecology: commonly, ecological principles that govern distributions and interactions among organisms on confined scales in the present-day are found to be important in affecting ecological, morphological, environmental, or geographic trends that we recognize among organisms through geologic time. These (often) large-scale, historical patterns, perhaps paradoxically, provide insight concerning the present-day distributions of organisms, as well as their interactions with their environments and each other (i.e., ecology). Thus, scientists who are trying to come to grips with ecosystems can ill-afford to ignore the geologic time dimension; understanding the present-day nature and long-term fate of any ecosystem may depend on understanding its long-term history.

Similarly, paleoecology should be considered an essential aspect of evolutionary biology. An organism's paleoecological context (e.g., the paleoenvironmental range of a taxon) is as much a part of its gestalt as is its morphology; thus, paleoecological data must be incorporated routinely into analyses of evolutionary patterns and trends. This is perhaps best illustrated by the onshore-offshore overprint on marine faunal diversification that has now been documented for various groups. To the degree that such a pattern can be shown to transcend the morphological peculiarities of individual clades, it suggests an ecologically-mediated evolutionary law.

Thus, for some time, paleoecology has made significant contributions to scientific progress that have been attainable because of the unique perspective of the subdiscipline. The problem is that many of our colleagues outside of paleontology are either unaware of all but the most highly publicized of these contributions or, alternatively, wouldn't view them as emanating from the domain of paleoecology. How can we change this? First, we can make a concerted effort to reach a wider audience. In the past few years, I have attended several symposia, workshops, and technical sessions that have addressed major themes in paleoecology and put on display many of the best attributes of the profession. However, with a few important (and apparently fruitful) exceptions, most of these confabs have taken place in conjunction with conferences that were predominantly geological in focus. This virtually guarantees that we end up speaking to ourselves. If we want to change the mix, and reach a wider audience, we are going to have to *routinely* hold paleoecology seminars and workshops at biological meetings. I know that meetings are a pain and there are already too many, but it is our best opportunity to quickly break the barrier to communication, real or imagined, that many of us perceive between paleoecology and biology. A series of well-focused sessions at national and international biological meetings might, in themselves, have immediate impact. More importantly, if such sessions were to take place regularly, from year to year, we would inevitably insert ourselves into the biological consciousness.

Second, we much recognize that much of what we do has ramifications in the context of major research issues of the day. For example, in a report to the U.S. Congress published by the National Office of Science and Technology (1990) paleoecology is listed explicitly as a scientific priority in the framework of research on global change. After all, the fossil record is the only data base available for understanding the long-term effects of physical changes and perturbations on living systems; the kinds of questions driving research (and funding) in global change require, in part, the perspective of geologic time.

Finally, those of us at universities must educate our colleagues and administrators about the importance of paleoecology, and paleontology in general. I confess that I have been rather passive about discussing the nature of paleontology as a science with non-paleontological faculty in my department at Cincinnati; for the most part, this is also true of my closest departmental associate, Dave Meyer. As a consequence, my impression is that many of my colleagues have a view of paleontology that is at least twenty years out of date (I hope they don't read this . . . which, I suppose, amplifies my point). If this is generally true of geologists elsewhere (and I believe that it is), imagine what the views of scientists outside of geology must be.

Some say that it doesn't matter what other scientists and college administrators think of us (I recently read a wonderful book by Richard Feynman entitled: *What Do You Care What Other People Think?*). Perhaps it shouldn't, but it does. From a scientific perspective, we stand to be shortchanged, in ways that we might never understand, by a failure to interact fruitfully with colleagues in a related discipline (it's their loss as well). From a political perspective, we risk missing opportunities for further development and recognition of our science, and the many perks that come naturally with a deserved higher profile.

—ARNOLD I. MILLER