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Building the Case for Paleontology

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Roy Plotnick and Carrie Schweitzer have recently discussed paleontology in these pages, primarily from an academic, invertebrate paleontology perspective. I would like to contribute some thoughts on paleontology from a different point of view, primarily that of micropaleontology and industry biostratigraphy. My thoughts include the problem of paleontology without paleontologists, poor communication within the discipline, importance of new ways to apply paleontology to "outside" problems, and suggestions on the way forward.

Current Situation

"without biostratigraphers, the effective application of biostratigraphy is not possible."

Farley and Armentrout (2002)

In the petroleum industry, biostratigraphy refers to any use of paleontology. This came about to emphasize problem-solving rather than the fossils themselves. From 1985-2000, the number of U.S. paleontologists employed by oil companies fell from more than 300 to 30 (Farley and Armentrout, 2000). Since then, the number has more or less stabilized, but this is only relatively good news, because the population is still very low. This change represents not only loss of employment opportunities, but a reduction in direct and indirect support for academic micropaleontology.

Parallel effects have occurred in academic micropaleontology. The vast majority of U.S. pre-Quaternary palynologists received their graduate training at a handful of universities. As the palynologists at these schools retired, most were not replaced at any doctoral-level institution. Consequently, training of new palynologists with expertise in most of the geologic column has nearly stopped. This is not a problem of a narrow specialty: we routinely see fossils of three kingdoms in single samples and all five kingdoms can be found as palynomorphs. This has negative implications for academia, industry and other paleontological disciplines that might need our results.

A different mechanism has had similar effects elsewhere in micropaleontology. Because of limitations in paleontological research funding, there has been a shift of calcareous microfossil specialists to what I call the "plop, plop, fizz, fizz" school of paleontology (i.e., stable isotope analysis) because of greater funding opportunities available in NSF's oceanography program. Some foram micropaleontologists have expressed concern to me that the resulting emphasis on destroying forams in order to study them has led to diminished expertise in taxonomy, another example of the issues described by Schweitzer (2008).

At the most recent BSA meeting I attended, I was disconcerted to hear a prominent molecular systematist proclaim that morphology is now obsolete as a systematic or phylogenetic tool. Paleobotanists were fighting this narrow perspective that could put NSF systematics funding at risk for paleontology, but this threat to paleontology's basic data doesn't seem to have received much notice in the broader paleontologic community.

As pointed out by Plotnick (2007), lack of discipline unity is a key weakness of paleontology. Earlier in this decade, I noted that many industry paleontologists were unaware of academic developments in multivariate statistical analysis or even

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paleontological input into molecular clocks (Farley, 2002). Meanwhile, non-micropaleontologists in academia have been unaware of approaches to biostratigraphy (in the narrow sense) in the Ocean Drilling Program or the petroleum industry. As an example of the latter, BP paleontologists at the Marine Micropaleontology Research Group meeting last spring at AAPG/SEPM summarized their Neogene zonation that includes about 250 biostratigraphic events (thus, average resolution of 93 ky) with local Miocene resolution down to 27 ky. Reasons for this accomplishment include the enormous database (thousands of wells for just the Gulf of Mexico) and the resolution even ditch cuttings provide because of the high sedimentation rates in petroleum-prospective basins. Industry paleontologists now recognize that oil companies need to be better at making these results public so the entire community can benefit, and many examples have already been published (e.g., Jones and Simmons, 1999).

Late in my industry career, I met a geological new hire who expressed surprise that Exxon had any paleontologists because it was obvious to him that invertebrate fossils would be ground up by the drill bit. So while he had learned about invertebrate paleontology somewhere in his undergraduate or graduate experience, he had never been clued in that there were such a thing as microfossils. This mirrored my teaching experience in Exxon's sequence stratigraphy course that new hires of the late 1990's had never heard of the Ocean Drilling Program generally, let alone its wealth of (micro)paleontologic data. Paleontological instruction needs to include information on the complete spectrum of the field.

Building a Case For Paleontology

The lack of internal cohesion in the field means that we have not effectively promoted the value of paleontologic approaches applied to problems outside "traditional paleontology." In the broadest perspective, the U.S. government funds science because it has benefits to society. Although we love fossils for themselves and for the paleobiological problems we can solve with them, I believe solving new non-traditional problems can make the most compelling case to external funders that paleontology is worth merits much greater support.

Some of these approaches are not far removed from traditional paleontology. One example is the success in using micropaleontology to understand the history of the "dead zone" in the Gulf of Mexico. As a geologist, I commonly wonder if some current environmental discovery is really a new phenomenon or if we have now merely noticed something that has been there all along. Reports such as Sen Gupta, et al. (1996) and Osterman, et al. (2005) demonstrate that the dead zone has become more prominent over the period marked by increased anthropogenic input to the Gulf of Mexico. Environmental micropaleontology (see Martin, 2000, for other examples) represents applying deep time techniques to very shallow time, which is highly relevant to society.

Other examples are truly different from traditional paleontology. One is the use of palynology techniques to understand the life cycle of agricultural pests, such as the corn earworm or boll weevil, in order to improve pest management (see, for example, Jones and Coppedge, 2000 or Jones, et al., 2007). Traditional agricultural approaches concentrated on the pest's activity on the crop and ignored the life of the moth that the larval pest ultimately became. When the USDA decided the moth's life was worth understanding too, palynology was applied to help determine what the moth eats and how it migrates. To determine how large an area the moth covers, Lycopodium (club moss) spores, stained as for microscopy, were used in moth feeders as markers. Early successes led the USDA to hire a palynologist to pursue this. The work had feedback for systematic palynology because a synoptic atlas of modern pollen of the southeastern U.S. proved necessary. This atlas was published and became a resource for the broader community.

The Way Forward

Whether we solve traditional questions or contribute to new outside areas, we need to communicate our successes. We cannot expect that the broader scientific community will pay attention and learn from us just because they ought to. A most effective way to bring our contributions to the broader community is by infiltration. In infiltration, individual paleontologists present their work to others in their arena. The others may be other fields of paleontology or scientists in quite different fields. This may mean giving presentations in unfamiliar sessions at familiar meetings or venturing to completely unfamiliar settings. Besides alerting the outsiders about the value of your approach, this is also an effective mode for gaining ideas from them that will benefit you. Don't underestimate the value of conducting infiltration by convenience by appearing at meetings that are coincidentally occurring in your city.

An outplacement specialist asked me, in assisting with my post-Exxon job search, "Does paleontology have a society?" As we all know, "a society" doesn't begin to cover it. Our societies have reasons for existing, but they have allowed groups of paleontologists to act as if all the others don't exist. Infiltration by individuals within the field can help overcome the fragmentation of disparate societies, while the societies get their act together.

Some improvements have already occurred. The inclusion of many paleontological journals in "Geoscience World" where their papers are instantly available to all subscribers is a major plus. Interaction among micropaleontological societies has increased with a number of coordinated meetings (2002, 2005, 2009) involving NAMS, AASP, Cushman, and TMS. This is interdisciplinary and international and is easier as societies like AASP now have a majority of members from outside North America.

The PS–organized sessions at GSA are now usually arranged by the problem addressed rather than the fossil group used. This is a wholesale form of infiltration. Still, there is little connection at this annual meeting between PS, Cushman, and AASP, which now meets with GSA on a recurring schedule. Thus, there is still work to do at this single meeting to improve connectedness of the field.

Beyond meetings, some fairly obvious links are missing. Many paleontological societies have programs to support student research, but there is no union list to ensure students learn about all the opportunities that might benefit them.

I like to think that PS is the obvious umbrella society, but it has not fulfilled this role yet. Infiltration means that individual paleontologists can act without waiting for the ponderous machinery of our societies to swing into action. We need to avoid the disturbing prospect of a world of valuable paleontological knowledge and techniques without paleontologists to use them. Paleontology can become better integrated so we all know what has been accomplished and benefit from the insights throughout the field. This will improve our external contributions and demonstrate our merit to the broader community.

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Glossary of society abbreviations: BSA=Botanical Society of America, which includes the Paleobotanical Section; PS=Paleontological Society; AASP, the Palynological Society; Cushman Foundation, NAMS=North American Micropaleontology Section of SEPM; TMS=The Micropaleontological Society.

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