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LEAVING A LEGACY: SPECIMEN COLLECTION IN ARCHAEOLOGY AND BIOLOGY

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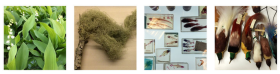
Joyce Havstad writes...

Lately I have been thinking, rather often, about varying practices of specimen collection throughout the biological sciences. To employ a bit of jargon: paleontologists study ancient and often extinct species, so their specimens tend to be fossils; neontologists study extant species, so although they sometimes collect fossil specimens, more often they are sampling from current populations for their collections. Botanists collect plants; lichenologists collect lichens; microbiologists collect microbes; and zoologists collect animals.



Neontological specimens: botanical, lichenological, and zoological. Microbes not pictured.

Sometimes people are surprised to discover that field biologists who study extant species still tend, under certain circumstances, to collect and kill live specimens as part of their scientific practice. This is called ‘harvesting’ and it is, for instance, a routine part of documenting the discovery of a new species, or the rediscovery of a species previously deemed extinct. Harvesting in this sort of case is routine because it is what furnishes so-called ‘voucher’ specimens—specimens that document for the scientific community that a new species has, in fact, been discovered; or that an old one has been rediscovered.

Periodically, the need for this sort of practice—and the prudential value of showing restraint when collecting in certain circumstances—is (re)considered by members of the relevant scientific communities. For instance: a small but interdisciplinary group (including specialists in conservation biology, environmental ethics, and evolutionary ecology) recently argued in *Science* that, given handheld and other technological

advances, nonlethal information-gathering techniques may suffice for documenting many current cases of species (re)discovery [Minteer et al. 2014, p. 261]. The authors suggested that high-quality photographs are especially useful substitutes for harvested specimens, and that supplementary data from molecular, behavioral, ecological and other sources of evidence can helpfully complement photographic documentation. Motivated especially by concern with collecting specimens from small, extremely vulnerable populations of new or newly recovering species, Minteer and co. requested that potential collectors re-examine their impulse to harvest specimens—at least when under such conditions.

Objections were quickly registered: to many different components of Minteer et al.'s portrayal of the collecting situation, and of their resulting proposal. One vehement letter published in the May 23, 2014 issue of *Science* was signed by 123 specialists from around the world ["Specimen Collection: An Essential Tool"]. Setting aside the question of what to do when dealing with extremely vulnerable populations—when even collecting just a few samples for further study might push a species to extinction—I want to hereby reflect on a particular style of justification that I've seen in the literature, one that purports to justify the having of extensive specimen collections in general, and thereby the widespread collecting practices that are necessary to gather such collections.

The purported justification goes something like this: collections are essential, and irreplaceable, because they grant our future scientific selves an opportunity to conduct research on physical and / or historical material that would otherwise be inaccessible to them, and which we cannot possibly predict the nature of and requirements for at this current moment in time. So we collect now, and then later, when we better know what we need from them, the specimens are there to provide us with the answers we need. [This argument appears in many places, but it is for instance present in the "Specimen Collection: An Essential Tool" letter mentioned above and cited below.]

When we wanted to know about the long-term effects of DDT on rates of bird reproduction, it turned out to a really good thing that we had collected and stored all those eggshells. And those craniums we collected over the years are sure coming in handy, in ways we didn't expect, now that we can pair sophisticated imaging with 3-D printing tech to make a whole bunch of brain models. Our molecular recovery techniques are currently advancing at a remarkable rate; who knows how much genetic data we'll have managed to save from oblivion, housed unsuspecting in collections that were in some cases begun centuries ago, by the time we've finished applying ourselves to that problem. Etc.

Ok, I am supposed to be reviewing this book—*Evidential Reasoning in Archaeology* by Robert Chapman and Alison Wylie—and it is past time that I got down to it. Probably the most delightful and totally unexpected aspect of reading this excellent book was, for me, that it suggested an extremely rich and I think quite promising way of developing the above justification for specimen collections **in biology**. And this is despite the fact that the subject matter of the book itself is **in archaeology**. I feel like this is a point that the authors would themselves appreciate, as they obviously value interdisciplinarity and cross-sectional expertise. Chapman & Wylie dedicated a substantial portion of their book to the concept of 'trading zones'—research areas of diverse investigation in which "no one domain-specific body of background knowledge will do the job" [p. 143].

Something has always bothered me about appealing, in order to justify collections, to the ability of physical specimens to preserve unanticipated data for future research. In a

sense it's a very compelling appeal—but its charm rests rather heavily on (a) the allure of the flagship studies trotted out in demonstration, and (b) a failure to think about the relative costs incurred in order to achieve those benefits, as wonderful as they are. How much actual collecting, incurring actual costs, is justified in order to secure such potential benefits? How might we begin to compute the answer to such a question in anything like a principled manner? I hate these kinds of questions, and so I tend to seek justifications that do not rely on them.

Chapman & Wylie's book contains extensive discussion of what the authors term 'legacy data'—old data gathered by previous scientists in the course of prior studies, consisting of everything from the collections themselves and the records gathered during collection to the sites where collection happened and the "temporal, spatial and formal patterns of association among the material traces" [p. 95]. In the course of exploring how material objects persist and may eventually push back against constructive theoretical interpretation in archaeological practice (aka "the paradox of material evidence"), the authors document how physical residues and historical records of collections made by one archaeologist can leave a legacy of data for other archaeologists to re-examine. The physical stuff lingers, and it can be used to challenge even the most basic descriptions an initial archaeologist used to characterize a site, an object, a position, a mark. What one archaeologist records as a post-hole might turn out to be an animal burrow, according to later review conducted by another.

The point is that even the data that we are tempted to view as factual—as straightforwardly reported by the world, without the filter of our interpretation—is subject to our interpretation and re-interpretation. Collections aren't just valuable because, well, the collecting scientists might have gotten all the facts they could from the specimen but maybe one day a better-equipped scientist might be able to extract a new fact of an as-yet-unimagined kind; they are valuable because they are a physical site on which one scientist's original extraction of facts can be re-evaluated by another.

And we shouldn't necessarily cast these re-evaluations in a presumptive or a judgmental light. Theories change, and observational assessments increase or decline in plausibility as a result. Voucher specimens are often talked about in biology as sources of authentication, credibility, and reproducibility [see, e.g., Culley 2013, in botany; Turney et al. 2015, in zoology]. This is in line, I think, with the way that Chapman & Wylie are thinking about legacy data; but it's not the whole story. *Evidential Reasoning in Archaeology* is dedicated to documenting the way that physical data is interpreted as archaeological evidence—for particular claims, and given a set of related theoretical assumptions that purport to warrant the interpretation being given to the data. Legacy data in archaeology offers an opportunity to re-evaluate that whole process of interpretation.

So do collections in biology, and appealing to a need for authentication and reproducibility of results portrays the situation as a simple one in need of legions of fact-checkers and experiment re-runners. But biological theorizing is an ongoing and a cohesive practice, as is archaeological theorizing. It is a dynamic learning process—one in which we are constantly learning new things, and revisiting things we thought we had already learned, and re-interpreting them, and revising them. Not just reproducing or rejecting.

If we are going to engage in this kind of (re)interpretive theorizing, then we need material evidence that is (re)examinable and (re)interpretable. Biological specimens are perhaps

the richest source of legacy data that field biology has—and not just because we can't trust each other or ought to be seeking simple replications. Thanks to Chapmen & Wylie's book, we don't even need to discover some new kind of tech to make these collections worthwhile.

And that's it from me. Though I've just realized that there's not a whole lot for the paleontologists in this post… lucky for them, I guess? That they don't have to worry about the prudence (or not) of live specimen collecting? Regardless, here is some paleontological imagery to make up for my failure to provide more of a blog-relevant composition this time around:

<img
src="https://static1.squarespace.com/static/56041e02e4b052a81e91c382/t/5a1c430f8165f542d6d46da3/1511801639060/Paleontological.jpg" alt="Paleontological specimens. Ok, one of these is not actually a fossil specimen. All pics in this post by author." />

Paleontological specimens. Ok, one of these is not actually a fossil specimen. All pics in this post by author.

I'm grateful to Robert Chapman and Alison Wylie for writing this lovely book, and to y'all for reading the reflections it prompted in me. Enjoy the holiday season!

References

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In Introductory Materials, Joyce Havstad