How-To-Do-It

The Transported Fossil Bed

Bringing Field Studies in Ancient Life to Any Campus

Elliott M. Hartman, Jr.
Nathan Dubowsky

There is probably no more convincing evidence for the fact of evolution than that found in the fossil record. Since the time when Charles Darwin first discovered "in the Pampean formation great fossil animals," students have been deeply impressed with the remnants of ancient organisms that they have found for themselves in the Earth's crust. These discoveries inevitably lead these students to a reaffirmation of Darwin's conclusion that life existed in the remote past, and has "gradually become modified" over time (Darwin 1892). Duane Keown (1988) notes that learning to read the record of ancient life recorded in the rocks is a unique experience that no science student should miss, but sadly, all too many do. However, this need not be the case.

For faculty and students whose campuses are located in fossiliferous regions, fossil collecting and identification is a field activity that can be accomplished both easily and inexpensively. Often, fossil-bearing strata can be found right on the home campus within a few minutes walking time from the laboratory or, at most, within a few minutes drive. But, for students whose home campus is located in regions characterized by metamorphic and/or igneous rock formations, merely finding a fossil is a thrill indeed.

Our campus, for example, is located about 15 miles north of New York City, in the Manhattan Prong, underlain by Precambrian and early Paleozoic metamorphic and intrusive igneous rocks, which bear no trace of fossils. West of the Hudson River lies the fossil-impoverished Newark Basin of the Triassic Lowland and, beyond that, the metamorphic Reading Prong. A narrow belt of partly fossiliferous Paleozoic rocks lies a few miles beyond, necessitating a trip of some 50 miles to visit a severely picked-over fossil site. Under the circumstances, the cost in time, effort, vehicle use, and dollars spent to visit these sites is difficult to justify. In addition, teachers are sometimes reticent to undertake field trips, and landowners, similarly, are reluctant to grant permission for use of their land because of the potential for litigation in the event of an injury or damage to property. It is unfortunate that this concern exists, but for many it is very real.

It occurred to us that nearly every campus in this country must be within a few hundred miles of rich, fossil-bearing rock layers. And, if we couldn't easily take the students to the fossils, we could surely bring the fossils to the students. Indeed, this concept was employed by us on a smaller scale, and discussed in a previous paper (Dubowsky & Hartman 1986). A large box containing fossiliferous rock, which we called a portable shale pit, was wheeled into the laboratory for students to sort through and to find fossils invariably present in the unsorted shale fragments. While initially successful, the problem of student sampling without replacement led to an impoverished portable shale pit far more often than we had envisioned. The successes and limitations of the early shale pit demonstrated that while the concept was educationally sound and workable, it had to be expanded.

This led us to request a modest grant from the Foundation for Westchester Community College for constructing an outdoor learning area, including space for the transported

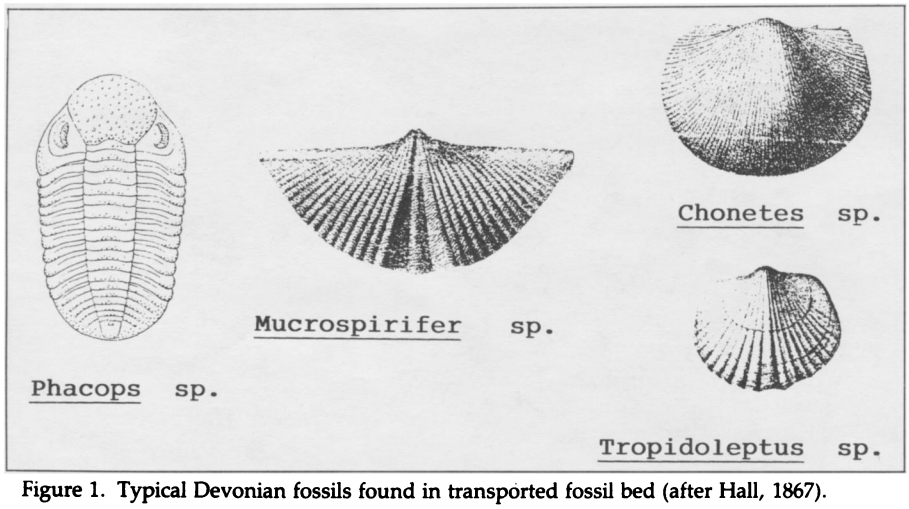

Figure 1. Typical Devonian fossils found in transported fossil bed (after Hall, 1867).

Elliott M. Hartman, Jr. is an associate professor of physical sciences at Westchester Community College, Valhalla, NY 10595. He holds an A.B. from Colgate University, a M.A. from Columbia University and has completed all coursework for the Ed.D. at Columbia. **Nathan Dubowsky** is professor of biology at Westchester Community College. He has a B.S. in biology from Brooklyn College, a M.S. in microbiology from Long Island University and an Ed.D. in biology from Columbia University. The authors serve as directors of the Westchester Museum of Natural History. They received a LOCI grant from NSF to develop multidisciplinary teaching modules on the origin of life on Earth. Both are interested in the development of new approaches to science literacy courses for nonscience majors.

fossil bed; transporting a large quantity of fossiliferous sedimentary rock to the outdoor learning site; and, constructing a containment crib for the fossil-bearing rock.

The outdoor learning area consists of permanently anchored student benches (to accommodate about 25 students), a podium and chalkboard conveniently located adjacent to our science building. The transported fossil bed contains over 23 tons of richly fossiliferous shale obtained from a commercially operating quarry.

The rock placed in the transported fossil bed was taken from the Moscow formation of the middle Devonian Period, Hamilton Group. It was deposited some 375 to 390 million years ago in a moderately shallow inland sea occupying what is today the Finger Lakes region of central New York State. This formation contains a very rich and diverse fossil assemblage. Most notable are the brachiopods (e.g., *Mucrospirifer* sp., *Tropidoleptus* sp., *Chonetes* sp., as well as many others), trilobites (e.g., *Phacops* sp., *Greenops* sp., and *Dipleura* sp.), corals (e.g., *Heliophyllum* sp., *Favosites* sp.), bryozoa (e.g., *Fenestrellina* sp., *Polypora* sp.) and a few pelecypods (e.g., *Actinopteria* sp., *Palaaeoneillo* sp.). They are typically very well preserved, showing fine surface detail (see Figure 1). A more detailed description of the rock obtained, the fossils contained within it, and the geographical source of the rock may be found in Grasso et al. (1986).

The cost of this facility was most modest. In 1987, we were able to purchase 23 tons of rock and transport it approximatley 250 miles to our campus for a total cost of slightly under $600. Most of the cost was, of course, for the round-trip transportation by a large dumping tractor-trailer truck.

The transported fossil bed is located adjacent to the outdoor learning area, and is about 20 feet square. The site for the transported fossil bed was prepared by first excavating a shallow pit to a depth of about two feet. Then a wooden containment frame was constructed around the perimeter, using pressure-treated 4- by 4-inch posts embedded and cemented vertically into the pit floor. Pressure-treated 2- by 12-inch framing lumber was then nailed to the posts, forming a narrow sitting/work area around the perimeter of the transported fossil bed. The lumber and other construction materials were purchased locally at a cost of slightly under $100. The frame was constructed in one afternoon by college maintenance personnel under the direction of the authors. We estimate that there is enough fossil material to last 5 to 10 years and perhaps longer.

Figure 2. Students searching transported fossil bed for specimens to be used in fossil identification lab study.

This transported fossil bed provides the opportunity to take our students on a fossil-collecting field trip without the problems and the time consumed in travel to a remote field site. The objectives of most of the laboratory protocols employed can thus be accomplished in the framework of a two- to three-hour laboratory period. It also provides students with the opportunity to visit an outcropping of fossil-bearing rock in a quasi-field setting. Because this rock has not been picked over extensively, even statistical studies of relative species abundance may be done.

We believe that the most important characteristic of this transported fossil bed is that students can be given the opportunity to experience first hand, the thrill of discovery—the excitement of seeing something that no one has seen before. Part of the intellectual excitement of the transported fossil bed lies in the fact that neither student nor instructor ever knows precisely what finds will be made on any given day. The very real and distinct possibility exists that they just may find something truly unique, perhaps a museum-quality specimen, or even an organism heretofore unknown to science. Is this not the goal of an investigative laboratory?

Clearly, this project opens opportunities to develop investigative laboratory experiences in relative age-dating, paleoecology and paleoenvironmental interpretation for courses in earth science and oceanography as well as laboratory studies in evolution for the biological sciences. In addition to these formal experiences, we encourage students, faculty and visitors to our campus to poke through the bed, to collect specimens and to enjoy themselves while they are learning (Figure 2). Lastly, as part of our mission as a community college to reach out to the community and provide enrichment programs, we have developed tours and experiential programs for elementary and secondary school classes which are invited to visit the campus for this purpose. For these groups our programs emphasize more general learning activities and process skills such as collecting, organizing, comparing, observing, hypothesizing and drawing conclusions.

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