A SIGNIFICANT FOSSIL COLLECTION COMES HOME

BY CLINT A. BOYD

Ferocious dinosaurs and towering mammoths are among the first things that come to mind for most people when the topic of fossils is mentioned. These engaging creatures capture the imagination, conjuring images of ancient North Dakota landscapes far different from anything we see here today. While the ghosts of the animals that roamed those environments will forever haunt our collective consciousness thanks to countless documentaries and blockbuster movies, accurately reconstructing these lost worlds requires studying all the evidence preserved in the fossil record. In particular, the study of fossilized plants (paleobotany) plays a crucial, and often underappreciated, role in understanding how the climate in North Dakota has changed over hundreds of millions of years.

The Paleocene Epoch spans from 66 to 56 million years ago (Cohen et al., 2013), an important interval of time immediately after the abrupt and brutal extinction of the non-avian dinosaurs. Rocks deposited during this time period record the early evolution of mammals as they rose from the ashes of the dinosaur dominated world. Extensive areas of western North Dakota are covered by Paleocene rocks of the Fort Union Group, making our state one of the best places in the world to study this key transition in the history of life on Earth. Fossilized plants are commonly found in these rocks, typically as large sections of petrified wood or carbonized imprints of leaves. A few fossil plant sites stand above the rest in terms of both the quality and quantity of the fossils they preserve. Arguably, the best of those sites in North Dakota is the Almont Fossil Plant Site: a treasure trove of fossils that provides a uniquely detailed snapshot of a moment from North Dakota's past. We are excited to announce that in the fall of 2022 a large collection of fossils from the Almont Fossil Plant Site was permanently transferred to the North Dakota State Fossil Collection.

HISTORY OF THE ALMONT SITE

The Almont Site consists of a series of small outcrops of mostly yellow-brown, finely laminated claystone that extend over hundreds of yards in the local area (Crane et al., 1990). The productive fossil layer is approximately 20 inches thick, sits above a green to gray sandstone, and is covered in most places by up to 18 inches of soil. The claystone is silicified, making it more resistant to erosion than a typical claystone and causes it to exhibit conchoidal fracture when it breaks. As a result of the fine laminations and the silicification, rocks from the site can be split along bedding planes, exposing the fossils preserved within (fig. 1). The fossils from the site are exquisitely preserved, in some cases even preserving minute cellular structures (Crane et al., 1990).

FIGURE 1.
Photograph of a large slab of plant fossils from the Almont Site showing the density of fossils typically recovered from the site. Colored arrows indicate different plant specimens on the slab. Each square on the scale bar at the bottom equals 10 mm.

Work at the Almont Site by museum crews began in 1982 (Crane et al., 1990), though collecting by locals and amateur fossil collectors likely began earlier. John Hoganson, a retired NDGS paleontologist, first visited the site in the fall of 1983 and immediately recognized its significance. Over the years NDGS paleontologists collected hundreds of specimens from the site and accepted donations of exceptional specimens collected from the site by local North Dakotans. The first scientific article to include material from the site was published in 1982 (Manchester and Dilcher) and over the ensuing 40 years, dozens of papers have been published on specimens from the site (e.g., Crane et al., 1991; Pigg and DeVore, 2005; Benedict et al., 2008; Zetter et al., 2011; Ickert-Bond et al., 2015). The site is located on private property and permission must be obtained before visiting the site or collecting specimens.

THE FLORA OF THE ALMONT SITE

The flora preserved at the Almont site is exceptionally diverse, with at least 50 species representing 30 different families of plants reported thus far (Ickert-Bond et al., 2015). By comparison, over 95% of documented Paleocene fossil plant localities preserve less than 10 species (Crane et al., 1990). By far, the most abundant fossils recovered at the site are leaves of a close relative of the modern *Ginkgo* tree: *Ginkgo cranei* (fig. 2). Other plants present at the site include members of the walnut family (Juglandaceae), the eucalyptus family (Myrtaceae), the dogwood family (Cornaeae), and the white pear family (Icacinaceae).

FIGURE 2.
A fossil *Ginkgo* leaf from the Almont Site in central North Dakota.

Leaves are the most common types of plant fossils found at the site, but a variety of other plant structures are also present (fig. 3). Fruiting bodies and other types of seed-bearing structures are known for multiple species at the site, including intricate fruiting bodies from a close relative of the modern bird's eye bush (figs. 3A-C). Flowers are also preserved for some species, including clusters of flowers from *Hamawilsonia boglei*, a member of the witch hazel family (Benedict et al., 2008).

Overall, the plants preserved at the site indicate a warmer and wetter environment than found in North Dakota today, more similar to temperate forests seen today in North and South Carolina (Crane et al., 1990). The types of plants preserved at the site, along with the abundance of fish fossils, indicate these fossils were deposited in an aquatic environment. The delicate preservation of the fossils and the finely laminated rocks present at the site rule out higher energy aquatic environments like rivers or streams, indicating the site likely represents a calm pond or lake environment.

VERTEBRATE FOSSILS FROM THE ALMONT SITE

While the Almont Site is best known for the beautifully preserved plant fossils, there are some fossils known from the animals that were living in this ancient lake. The best known of these is the extinct fish *Joffrichthys triangulpterus*, a distant relative of modern arowanas that grew to around 12 inches in length and is only known from the Almont Site (Newbrey and Bozek, 2000). This species is most commonly represented by isolated scales found mixed amongst the plant fossils, but a few nearly complete, well-preserved specimens are known (fig. 4). While the more complete specimens help paleontologists determine what the fish looked like and what it is related to, the large number of isolated scales preserved at the site also provide important information about this species that would otherwise be difficult to determine. As these fish grew during their lifetime each scale added a new layer of growth around the outer edge of the scale. As a result, paleontologists can count these growth rings to determine the age of the fish when it died, similar to counting tree rings to determine the age of a tree. By studying hundreds of these scales, paleontologists were able to understand how long these fish lived and even where they lived in the lake at different ages in their lives. The oldest fish was nine years old when it died, and the most common age encountered was three years old. Relatively few scales from fish that were less than three years old were identified at the site, suggesting that the younger fish preferred to live in a different area of the lake (Newbrey and Bozek, 2003). This separation of different ages of fish in different parts of a lake is known to occur in many species living today.

Another interesting aspect of the fish fossils from the site is that several were found in bird coprolites (fossilized feces). These fish bones were the only bones present in those coprolites. This indicates that there was a species of fish-eating bird living around this lake that was preferentially feeding on this fish species. It is exciting to think that we know about the presence of a species of bird at this site and even have insight into its preferred diet despite the fact that no bones from that bird species have yet been found at the site!

RECEIVING THE COLLECTION

In the spring of 2019, the North Dakota Geological Survey was contacted by Ray Reser at the University of Wisconsin-Stevens Point Museum of Natural History (UWSP) about their extensive collection of fossils from the Almont Site.

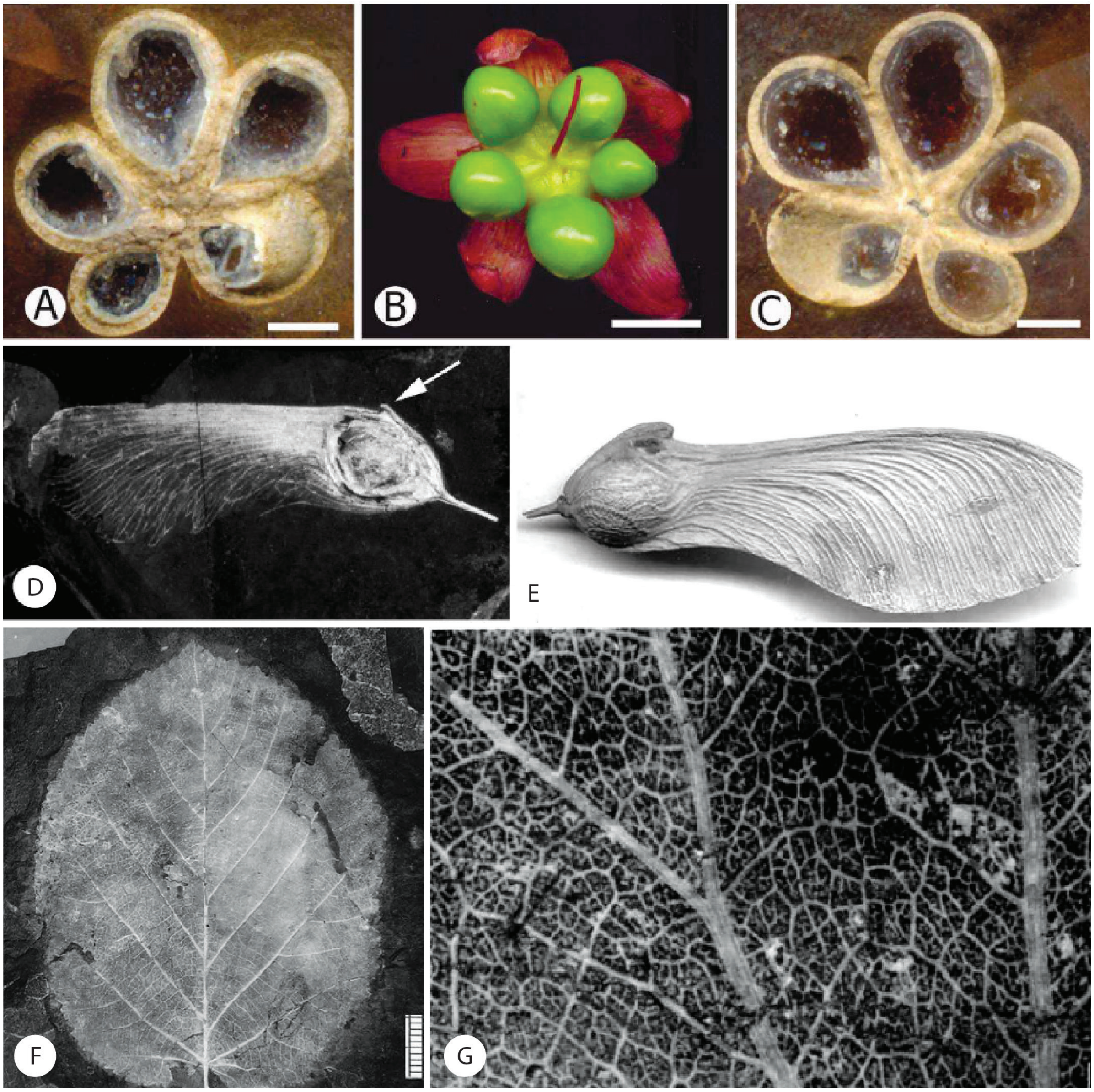

FIGURE 3. Examples of well-preserved plant fossils from the Almont Site. Fossilized fruiting bodies of the extinct plant *Paleoochna tiffneyi* (A and C) compared to a fruiting body from a closely related living species (B) (modified from Ickert-Bond et al., 2015: fig. 1A-C). Fossilized seed of the extinct plant *Paleosecuridaca curtisii* (D) compared to a seed from a closely related living species (E) (modified from Pigg et al., 2008: fig. 2a-b). A fossilized leaf from the extinct plant *Palaeocarpinus dakotensis* (F: modified from Manchester et al., 2005: fig. 7A). Close up view of the venation pattern on a fossilized leaf of the extinct plant *Zizyphoides flabella* showing the preservation quality of fossils from the Almont Site (G: modified from Crane et al., 1991: fig. 57). Scale bars 2 mm in A and C and 10 mm in B.

The UWSP spent years collecting thousands of specimens from the site, many of which have been used in scientific publications describing the overall flora preserved at the site and even for naming new plant species. The UWSP was downsizing its museum collections and they were attempting to identify other museums that were willing to take in parts of the collection. The North Dakota State Fossil Collection was a natural choice for the Almont Site specimens given that they were originally from here in North Dakota. We readily agreed to give these important specimens a home, and over the next few years the UWSP worked to get all of the material packed up and ready for the move.

In September of 2022, a small moving truck arrived from Wisconsin to deliver the collection. In all, 67 boxes of specimens, along with a dozen or so larger slabs that did not fit in boxes, were delivered into our care. In total, the collection numbers around 4,000 specimens, vastly outnumbering the number of specimens previously in our collection from the site. Volunteers are working with NDGS paleontologist Jeff Person to inventory and organize these fossils (fig. 5). As that work is completed for each box,

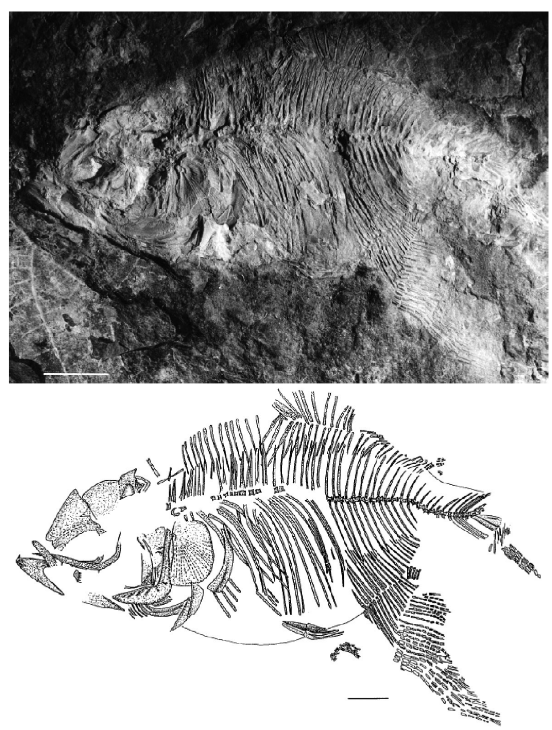

FIGURE 4. Image (top) and illustration (bottom) of the holotype of *Joffrichthys triangulpterus* (NDGS 13035), a fish only known from the Almont Site. Figure modified from Newbrey and Bozek (2000: figs 1 and 2). Scales bars equal 10 mm (top image) and 5 mm (bottom illustration).

the specimens are then moved into their permanent home in our collections facility (fig. 6). In total, we estimate the full Almont Site collection will fill three of our collections cabinets, or roughly 240 drawers, not counting the larger slabs that will have to be stored on our oversize shelving (fig. 1). Once this work is complete the collection will be available to researchers from across the world to examine, helping to improve our knowledge of North Dakota's prehistoric past.

FIGURE 5.
Volunteer Toni Neslen inventorying and organizing the newly delivered plant specimens from the Almont Site before their final placement in the collections cabinets.

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FIGURE 6.
One of the three collections cabinets filled with the newly delivered plant fossils from the Almont Site.