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Newsletter

Friends of the Florissant Fossil Beds eNewsletter

Every Fossil Needs a Friend

#38—July 2018

Fossil Beds 50TH Anniversary Is Just Around the Corner

August 2019 will be the 50th anniversary of the establishment of the Florissant Fossil Beds National Monument. Our group will be instrumental in planning, preparing and supporting the celebration. You can help make this a remarkable experience for visitors and long term supporters of the Monument. The Friends' board wants to invite interested Friends to participate in development and implementation of the event. Our initial planning committee meeting will convene in August (date TBD) to lay out the vision and establish subcommittees.

The hope is to develop an event that will draw visitors from near and far to participate. If you have any interest, big or small, we need you! We will need assistance with advertising, fundraising for supplies and materials, site preparation (make our trails exquisite), parking assistance and outreach to local businesses. You probably have hidden talents we haven't even thought of yet.

What has been your personal history with the Monument? Did you or a family member participate in the establishment of the Monument? Did you do research here? Do you possess memorabilia that you think would be valuable to display? Have you volunteered or worked at FFBNM? Do you have an anecdote to share? We'd like to make the 50th Anniversary an opportunity to gather hidden gems regarding the Monument and share them with our visitors throughout 2019.

If you would like to participate in any way please contact us via:

Friends of Florissant PO Box 851 Florissant, Co 80816

Website: www.fossilbeds.org

Facebook: <https://www.facebook.com/Friends-of-the-Florissant-Fossil-Beds-134478276592036/>

Phone: 719-748-3253 ext. 109

Email: friends@fossilbeds.org



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50th Anniversary

“Members Only” Fossil Quarry Day – June 2018

On Saturday, June 16th, the Friends quarterly “members only” event was held at the Florissant Fossil Beds NM. The program began at 10 AM in the theater in the Visitor Center. Dr. Herb Meyer, paleontologist and Dr. Sarah Allen, postdoctoral biologist who has been at the Florissant Fossil Beds for over a year, presented a program on their recent trip to Sexi, Peru where there is a petrified forest dated closely to Florissant. Dr. Meyer has had a working relationship with Sexi for many years. With financial support from the Friends, Dr. Meyer helped them build a small museum building where they could display their fossils. From their program we learned about the culture, the small town of Sexi, the people there and their petrified forest that the people in Sexi are working hard to protect. We all valued the information that Dr. Meyer and Dr. Allen presented. It isn't very often that the public gets to hear a presentation by the Park Paleontologist in a National Park Service area.

After that program, all members of the Friends went to the Fossil Quarry to split shale. Dr. Meyer and Dr. Allen were there to help us identify “finds” A good time was had by all.

Be watching our email communication and website for information on the next “member only” event.



FOSSIL QUARRY DAY



Dr. Sarah Allen, Dr. Herb Meyer, and Jean Rodeck



A Year of Experiences as Florissant's Postdoctoral Paleontologist

It is with mixed emotions that my time at Florissant Fossil Beds National Monument is coming to an end. I have spent the last year in the paleo division as a postdoctoral paleontologist through the Geoscientists in the Parks program. This has been a wonderful opportunity to work at one of the most well-known paleontological sites in the world. While at the monument, I contributed to numerous projects some of which I will highlight below.

You may already be aware of some of the projects I worked on as many are visible to the public. I designed a new trailside exhibit on geologic time, titled "Reading the Rocks through Time." This is near the start of the geology trail. GIP interns from 2017, including Ricardo Escobar, Alex Lowe, and Erikka Olson, also designed three other new trailside panels for this trail. These were just installed in June 2018 with help from the Mile High Youth Corps (see photo), so it is something new at the monument to come see!

Former GIP postdoc Evan Anderson and I wrote descriptions to accompany photographs of nearly 300 of Florissant's fossil specimens on museum.nps.gov. This website is accessible to all who want to learn more about Florissant's paleontological resources. I also wrote many of the #FossilFriday Facebook posts over the last year. I thank current GIP interns Anna Golub and Alyssa Johnson for taking over that task.

I was also actively involved in the park's stump conservation project over the past year. This project, in conjunction with researchers from the University of Pennsylvania, is studying what methods will be the best to stabilize the fractured petrified stumps near the Visitor Center. We installed a weather station in September 2017 to monitor the local conditions around a stump to help inform our conservation decisions.

I also had numerous "behind the scenes" projects including providing edits and updates to ICMS. ICMS is the park service's collection management software. Florissant Fossil Beds National Monument has over 10,000 natural history entries. I concentrated on updating the fossil plant entries. One of the more interesting mini-research projects was estimating the height of the trees from the fossil stumps. Using the known diameter of many of the stumps in the park, I was able to estimate that the redwood trees would have averaged approximately 200 feet tall! I also was actively involved in other research projects, including the two that the Friends of Florissant Fossil Beds helped to fund (see below).



Sarah beside the new trailside exhibit

I would like to especially thank the Friends of Florissant Fossil Beds for providing direct and indirect (via the Lake George Gem and Mineral Club) financial assistance to support my travel and expenses to attend two scientific conferences. The first was the 2017 Geological Society of America Annual Meeting in Seattle, WA last fall where I presented on my ongoing research on Digital Leaf Physiognomy. This project, in collaboration with former GIP intern Alex Lowe, Dr. Herb Meyer, and Dr. Dan Peppe (Baylor University) has provided some new paleoclimate estimates based on the Florissant flora. This work is still in progress and we are working on a manuscript for publication. Also, this upcoming July, I am attending the Botanical Society of America Annual Meeting in Rochester, MN. I will be presenting a poster on the unidentified plants in the collections at Florissant Fossil Beds National Monument.

Looking ahead, I will be moving to Pennsylvania to start a position as an Assistant Professor in the Biology Department at Penn State Altoona. I know that my time and experience working at Florissant Fossil Beds National Monument will be very beneficial in my new role. For example, in many of my projects at Florissant, I have developed educational materials for a diverse audience. One of the courses I will be teaching in the fall will be a diverse audience as it is introductory biology for non-majors.

It has been a great year, working with an awesome staff. I look forward to hearing updates about the ongoing projects at the park!

Thank you,

Sarah Allen

GIP Postdoctoral Paleontologist



FLFO Postdoctoral Paleontologist, Sarah Allen, giving her presentation on Digital Leaf Physiognomy at the 2017 Geological Society of America (GSA) annual meeting in Seattle, WA.

Photo by FLFO GIP intern Ricardo Escobar.

New Projects by Florissant's Paleontology Interns

Hi All! My name is **Alyssa Johnson**, and I am one of the Geoscientists-in-the-Parks interns this summer. I have my master's and bachelor's degrees in geoscience and I'm interested in the sedimentary record, fossils, and climate science. I've been enjoying learning about our fossils, conducting inventory and monitoring, mapping the fossil sites for emergency planning, and working on my personal project that focuses on stratigraphy within the park. I'm excited to be in Colorado and have been spending much of my free time hiking trails in the park and beyond! This internship has been a great stepping stone for my career, and I will be moving to Boulder, CO, this fall to pursue an opportunity in climate science.



Hello! My name is **Anna Golub**, and I am a Geoscientist-in-the-Parks paleontology intern here at Florissant! I am a rising senior undergraduate at Lafayette College in Pennsylvania. I am majoring in geology and especially interested in paleoecology and oceanography. Being here at the park has allowed me to build upon my interests and delve into paleobotany, which has been really exciting so far! With the help of Drs. Meyer and Allen, I have started a research project attempting to reconstruct Eocene climate at Florissant based on a significant collection of leaves. This fall, I hope to continue this work in Pennsylvania. Additionally, I have enjoyed spending time in the park for field work, monitoring geologically significant sites. I have learned so much here not only about paleontology and the Southern Rocky Mountains but also about collections management and museum work. I am so grateful for the opportunity to pursue this work in such a beautiful place with the most supportive coworkers!



Hello everyone, my name is **Christa Smithers** and I am an undergraduate student in my final semester of my Bachelor of Arts Geography and Environmental Studies degree at University of Colorado, Colorado Springs with a certificate in Geographic Information Science. I am currently involved with the Geoscientists in the Parks internship program. While at Florissant Fossil Beds National Monument Park, my internship project involves modifications of current databases, design and management of newly constructed databases of archived collections, along with evaluating and georeferencing map data. The internship allows me to utilize what I have learned as a student and apply it to a real-world situation by fine tuning my database skill set. The park will gain a catalogued information system at their disposal for current and future needs.



Geology/Paleontology Camp for 4th & 5th Grade Students

Hello Friends of Florissant Fossil Beds! This is Karleen and Kevin checking in from Geology/Paleontology Camp. This camp is a weeklong collection of science based activities designed for 4th/5th grade students, that takes place right here at the Florissant Fossil Beds. Over the past two years, many people have been involved in designing, implementing, testing and providing feedback for and about this project and the hard work done by so many individuals has really paid off. Our days have been filled with so many fun and meaningful activities from reconstructing the layers of the Earth using clay, to learning about the rock cycle through hands on experiments, to conducting paleontological research. We have concluded week three of camp and have had some wonderful experiences with students from the Colorado Springs area. The students have been phenomenal and are truly enjoying their time with us. To quote one of our first week campers, “Camp should really be 10 days long because I don’t wanna leave!” We are receiving positive feedback from teachers and are constantly evolving in our practices in order to make a lasting experience for our campers and, who knows, maybe even encourage a future geologist/paleontologist! We appreciate all of the assistance provided by the Friends group including the string backpacks that we have been able to distribute and the “Every fossil needs a friend” pictures that the campers really enjoy. We are looking forward to three more weeks of camp and a bright future of opportunities to inspire a new generation of resource stewards. Thank you for all that you do to make this great place even greater!

Karleen Mays

Geoscientists-In-The-Parks Intern

Kevin Jauregui

Latino Heritage Intern



“Camp should really be 10 days long because I don’t wanna leave!”

“Sister Parks” & “Sister Friends”: 2018 Expedition to Sexi, Peru

For the past several years, The Friends of the Florissant Fossil Beds have helped support the monument’s interaction with a petrified forest in Peru, El Bosque Petrificado Piedra Chamana. This significant petrified forest, informally the monument’s “sister park,” is located in the Andes Mountains of northern Peru near the primitive little village of Sexi (pop. ~300). The Friends have been involved in a formal partnership with a comparable nonprofit organization in Peru. We thank the Friends for their financial support during this time, which has been very helpful in Peru. The Friends also host a website about the site in Peru, which can be viewed at peru.fossilbeds.org.

In May, the Monument’s Paleontologist Dr. Herb Meyer and GIP Postdoctoral intern Dr. Sarah Allen joined non-NPS scientists to provide scientific research and site monitoring during a visit to the site. The project is supported by funding from a National Geographic Society grant entitled “What Can a 39-million-year-old Ecosystem Tell Us about Earth History?” Other project participants included Dr. Deborah Woodcock of Clark University, Dr. Dennis Terry of Temple University, a free-lance photographer for National Geographic, a botanist from Brazil, and two Peruvian botanists. Five full days were spent on location at the site. Local drivers and vehicles provided transport, and simple lodging and meals were provided by home-stays with local residents in the village of Sexi.



Herb and Sarah monitor changes in the petrified forest. Photo by Jean Schnell.

The fossils from El Bosque Petrificado Piedra Chamana were protected under the patrimony of Peru in 1997 and are administered by the Peruvian Ministry of Culture, with additional scientific input provided by INGEMMET (the Peruvian geologic agency). The fossils at the site are protected, but not the land, which remains under cooperative legal ownership by a local cattleman’s association. El Bosque Petrificado Piedra Chamana and Florissant Fossil Beds National Monument are similar in that both preserve petrified trees of Eocene age that provide scientific information about paleoclimate. Fossil resources at both sites are in need of similar specialized conservation treatments. NPS is able to share expertise about the methods for inventory and monitoring of fossil sites as well as conservation of petrified trees. This interaction helps provide capacity for understanding conservation of petrified forests worldwide.

One purpose of this travel was to follow-up on the inventory and monitoring of the petrified trees. During one of our earlier visits in 2005, we inventoried the entire site and took about 100 photos from precisely mapped locations to record the condition of the petrified trees. During the trip in May, we reexamined more than half of these and found some significant changes happening. These changes included both natural and human phenomena. Human impacts are becoming much more evident than in 2005. Several instances of probable theft were documented, including the disappearance of a small petrified stump and at least one palm trunk.



Before and After (2005 and 2018): Evidence of human impacts

Numerous instances were observed where petrified wood had been stacked to construct cairns and other ornamental arrangements. This phenomenon was almost completely absent in 2005. About half of the sites showed some kind of disturbance, showing that the pristine condition of this unusual petrified forest is beginning to deteriorate. This has been caused by more people coming to this remote location, and by heavy rains during the past few years causing erosion. Other sources of disturbance include widespread activity by livestock such as cattle, goats, and horses. A report of our findings will be translated into Spanish and provided to the Peruvian Ministry of Culture.

Another purpose of this trip was to meet and interact with various Peruvian agencies and local residents to facilitate implementation of shared conservation objectives. Several formal meetings were arranged where we held discussions and gave presentations about our conservation and scientific research. One of these was with the staff of the Peruvian Ministry of Culture in Lima, which is the agency responsible for the site's management. We also met in Lima with Isabel Prado, who is the curator of the site's fossil plant collections at the Museo de Historia Natural. Isabel visited Florissant and attended the Fossil Resources Conference in 2001.

While in Sexi, we arranged a town hall meeting with the residents, teachers, cattleman's association, and the national governor representing Sexi. This turned into a lively interaction where a number of contrasting concerns came up about conservation and access to the site. The following morning, the entire class of the local high school joined us in the petrified forest to learn about our recent discoveries. In the city of Chiclayo, about three hours away, we met with members of a new group interested in developing eco-friendly tourism to Sexi. They are hoping to find a way to bring organized groups of visitors to the site, and to find a solution to the lack of infrastructure such as hotels and restaurants. For an outsider coming into the village, life is extremely basic and simple. We also met in Chiclayo with professors and students at Universidad Nacional Pedro Ruiz Gallo, along with members of the local cattleman's association, to talk about problems of soil erosion at the site and the possibility of installing a fence to protect the fossils.



The village of Sexi, Peru



Meeting with Sexi residents to discuss our project and the needs for conservation

Another important meeting was with Santiago Asenjo, who is working to establish a new nonprofit group to support the fossil site and the village of Sexi. The Friends of Florissant provided support to bring Santiago to Florissant in 2013 to learn about conservation of fossil sites in the US. The former nonprofit group in Peru with which the Friends had a partnership is now defunct, but there is an open door to establish a new partnership with this newly formed organization.

Our visit also involved scientific research both in paleontology and botany. The primary accomplishments of our trip involved new scientific research, an assessment of the condition of the petrified trees, and our many conversations with local community leaders and partners about the needs for conservation, tourism, and multiple-use of the land. One of the primary challenges we face is in working with parties who have wide ranging and sometimes conflicting interests in the site and its management, both among Peruvian government agencies and between local museums, government administrators, landowners, and residents. Our efforts to facilitate various meetings with these parties led to encouraging discussions to promote common interests in the management, conservation, and development of ecotourism of the petrified forest.

What does the future hold? The Friends of Florissant might consider establishing a new nonprofit partnership agreement with the new friends group in Peru. There are ongoing needs in Peru, such as materials to build a fence around the fossil site. There could be new opportunities for fund-raising for the Friends of Florissant's "Peru fund." There has been interest expressed by some members of the Friends for a possible visit to the site in 2019.

This might be possible to arrange if there is enough interest. If a visit to a remote fossil site on the rim of a 5000-foot-deep canyon and living for a week in a simple little village called Sexi sounds appealing to you, please let us know (Herb_Meyer@nps.gov, 719-748-3253).

This project was sponsored and supported by the National Geographic Society.



Sexi residents hosting our home-stay
and providing field



Petrified tree at El Bosque Petrificado
Piedra Chamana, overlooking the
deep canyon of the Rio Chancay.



Field trip for Sexi high school students

Lake George Gem and Mineral Show-August 18th and 19th

Calling all volunteers!! If you are available on either Saturday the 18th or Sunday the 19th to man a table to represent the Friends and the Monument at the Mineral Show, your help would be greatly appreciated. It only requires a love of the Monument and the ability to hand out information and give a little background about what is available at the Monument. If you have a few hours to offer please contact Patty Glatfelter 719-689-3174.

19th Annual Lake George Gem & Mineral SHOW!

AUG. 17-18-19, 2018

9am - 5pm



www.LGGMclub.org

FREE Admission! FREE Parking!!

Located in beautiful

Lake George, Colorado on Hwy 24

*Local Specimens, Rocks,
Minerals, Fossils, Gems, Beads,
Jewelry, Lapidary & More!*



Scan to view our Website!

Does Your Employer Provide Time off for You to Volunteer?

Many companies do, or they will sometimes make donations to the non-profit of your choice. If your employer is willing to help you support a non-profit that you are passionate about, here is a statement you can provide them:

“The Friends of the Florissant Fossil Beds, Inc is a non-profit 501(c)3 organization (EIN: 84-1114146) whose sole purpose is to assist the Florissant Fossil Beds National Monument staff protect and preserve the natural and cultural features of the Park. Through our fund raising and donations, we assist the National Park Service (NPS) with activities they will not/cannot fund (either legally or because of insufficient budget) and help with volunteer labor for many of their projects. With 6,000 acres, over 15 miles of trails and numerous buildings (including a brand new Visitor Center), there is a never ending list the superintendent needs help with. Our website www.fossilbeds.org provides insight into all the things Friends volunteers are involved in.

Some of the activities supported are:

- Planning and conducting graduate level seminars during the summer that are open to the public, but are aimed at helping public school teachers by providing accredited continuing education credits. In addition to logistics, honorariums are required for that level of speaker.
- Providing adult supervision and interaction with youths participating in the NPS Junior Ranger program
- Providing refreshments throughout the year to school children on class outings, youth groups providing volunteer trail maintenance assistance during the summer, National Parks Service staff members during special events, and many more.
- Funding summer internships for paleontology interns to work with the Park paleontologist, Dr. Herb Meyer.

With the federal budget cuts of the last several years, the Florissant Fossil Beds National Monument is more reliant than ever on donations and volunteer assistance. Please support your employee's willingness to volunteer in support of this worthwhile activity that benefits local and regional visitors to the Pikes Peak area. “

July 2018 Activities & Events



National Park Service
U.S. Department of the Interior

Florissant Fossil Beds National Monument
15807 Teller County Road 1
Florissant, CO 80816

Release date: Immediate
Contact: Jeff Wolin
Phone number: (719) 748 – 3253 ext. 202
Date 6/25/2018

Florissant Fossil Beds National Monument News Release

Activities Planned at Florissant Fossil Beds National Monument in July

Florissant Fossil Beds National Monument is open year round. During June the Monument is open
8:00 AM – 6:00 PM.

Daily Interpretive Program Schedule

Interpretive Talk, Every Day 10:00 AM and 4:00 PM, 30 minute interpretive presentation in the amphitheater

Ranger Guided Walk, Every Day 11:00 AM, 1 mile guided hike on the Petrified Forest Trail

Fossil Learning Lab, Every Day 1:30 PM – 3:30 PM, learn how scientists discover and research fossils in the Yurt

Hornbek Homestead, Every Day 11:00 AM – 1:00 PM, take a tour of an 1878 homestead

Weekly Programs:

Yoga Hikes, Mondays, 9:00 AM – 10:30 PM. Join a certified yoga instructor and a Park Ranger for a 1 hour and 15 minutes, 1 mile yoga hike. This will be a hike interspersed with standing yoga poses. This program is geared for beginner to intermediate yoga enthusiasts. Meet at the visitor center.

Fossil Demonstration Excavation Site, Wednesdays, 10:00 AM – 12:00 PM. Meet geologist, Dr. Bob Carnein at the demonstration excavation site and see the fossil beds in situ and learn about how excavations are conducted. This site is located off the Petrified Forest Loop approximately 1 mile round trip from the visitor center.

Art in the Parks, Thursdays, 10:00 AM – 12:00 PM. Everyone is an artist! Drop in and join volunteer artists and other visitors to sketch and/or water color paint scenes of Florissant Fossil Beds. Stay as long or as short as you would like anytime between 10 AM – 12:00 PM. Ask at the visitor center desk for location. Limited art supplies and seating available. Interested artists may also bring their own supplies and portable chairs.

Wildflower Walks, Saturdays, 9:00 AM – 10:30 AM. Join Ranger Stacey for a weekly look at blooming flowers. This may be a 1 – 2 mile hike. Meet at the visitor center.

Bear and Mountain Lion Talk, Saturdays, 12:00 PM – 12:30 PM. Join Ranger Allan to learn more about big and often misunderstood predators.

July 2018 Activities & Events

Special Events:

Night Sky Program

Friday, July 13, Night Sky Program, 8:30 PM – 10:30 PM. Join park staff and members of the Colorado Springs Astronomical Society to gaze at the dark skies above Florissant Fossil Beds in search of planets, galaxies, nebulae, and more. Meet at the visitor center.

A Walk with the Paleontology Interns: Current Research on Rocks and Fossils

Saturday, July 21, 10:00 AM – 12:00 PM.

Meet our Geoscientists-in-the-Park Paleontology interns, and join them for a guided hike on our Geologic Trail! Learn about active research projects in geology and paleontology, as well as the geologic history of the park. Bring water, hats, sunscreen, enthusiasm, questions, and a burning desire to learn about our geologic past! Plan for approximately a one and a half mile hike (subject to change based on plan) on a moderate trail. Up to 2 hours.

Junior Ranger Day and Open House at the Hornbek Homestead

Saturday, July 28, 10:00 AM – 3:00 PM, Participate in engaging hands-on science activities and complete a Junior Ranger Book to earn a badge. Play some games from the 1800s and take a tour of the 1878 Hornbek House to learn about life in the Florissant valley in 1878. There will also be a family friendly Junior Ranger music concert. Bring your dancing shoes.

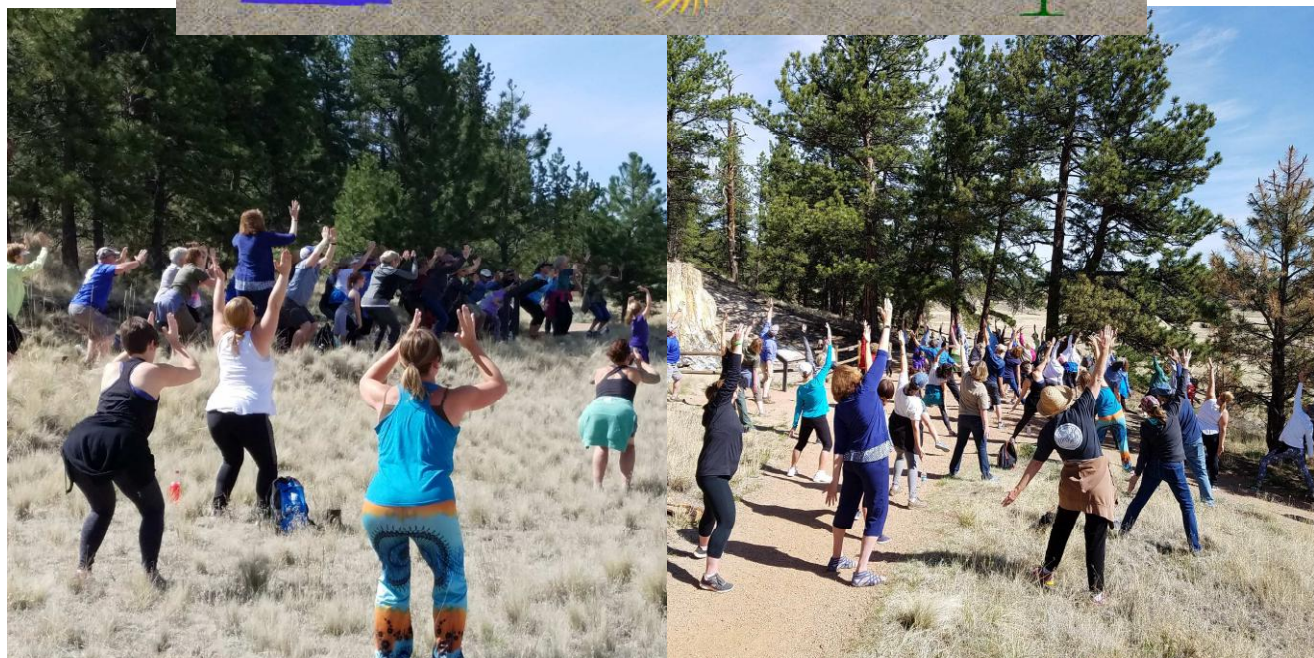
There are no additional fees for any park programs beyond the daily entrance fee of \$7.00 per adult (15 and younger are free). Florissant Fossil Beds National Monument offers 15 miles of beautiful, yet lesser known, hiking trails to explore, a free Junior Ranger Program, three short self-guided trails, a park video and museum exhibits, and bookstore. For additional information, please call (719) 748-3253 or visit our website: www.nps.gov/flfo or on Facebook or Twitter at /FlorissantNPS

About the National Park Service. More than 20,000 National Park Service employees care for America's 417 national parks and work with communities across the nation to help preserve local history and create close-to-home recreational opportunities. Learn more at www.nps.gov

EXPERIENCE YOUR AMERICA™

The National Park Service cares for special places saved by the American people so that all may experience our heritage.

YOGA HIKES



MONDAYS 9:00 AM - 10:30 AM
AT FLORISSANT FOSSIL BEDS NATIONAL MONUMENT

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Florissant Fossil Beds Fossil Vertebrates

National Park Service
U.S. Department of the Interior

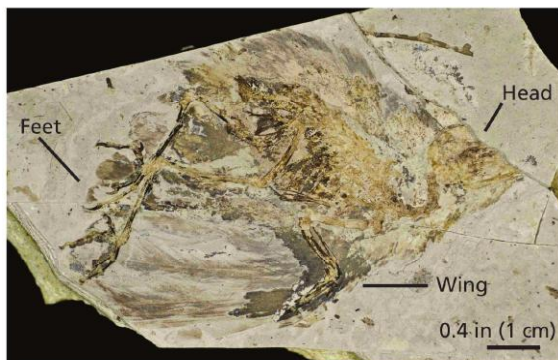
Florissant Fossil Beds
National Monument
Colorado



From snakes to mammoths, fossils of more than two dozen species of vertebrates have been found at Florissant. Vertebrate fossils are rare because of the environmental conditions necessary for their preservation. Of the fossil vertebrates found, fish skeletons and mammal teeth are the most abundant. Many of the mammals that lived 34 million years ago are unlike any living today. Scientists are still describing new species of animals from Florissant fossils.

Where are the dinosaur fossils?

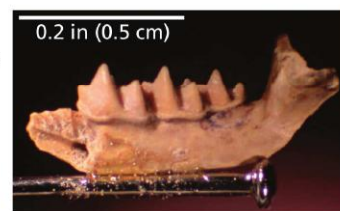
Almost all of the animals that fossilized at Florissant lived 34 million years ago, in the late Eocene geologic time epoch. The “age of dinosaurs” ended about 30 million years earlier, at the end of the Cretaceous time period, when an asteroid struck near the Yucatán Peninsula, Mexico. There are no non-avian dinosaurs preserved at Florissant, but fossils from other sites, such as Dinosaur National Monument and Garden Park Fossil Area, show that *Allosaurus*, *Stegosaurus*, and other dinosaurs lived throughout Colorado. They probably roamed the Florissant area as well, but the rock layers that would have contained their fossils eroded there by the late Eocene. All dinosaurs except one lineage, which evolved into birds, went extinct at the end of the Cretaceous. Since then, another group—mammals—has diversified and evolved to fill dinosaurs’ ecological roles. Florissant fossils come from the Cenozoic era (65 million years ago to the present day), also called the “age of mammals.”



This bird is preserved in Florissant shale with wings spread.
FLFO-9661

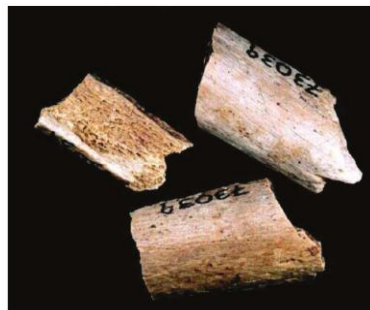
What are the most common vertebrate fossils?

Mammal teeth are the most abundant fossils from animals with backbones. Fortunately for paleontologists, teeth are unique to almost every mammal species. Several Florissant mammals, including the extinct rabbit *Palaeolagus*, have been identified by fossil teeth alone. Teeth and other bones are sturdy enough to remain intact after the rest of the body decays or breaks apart in a stream. They turn into fossils as groundwater deposits small crystals of dissolved minerals in the tissue pores, a process called permineralization.



This fossil jaw fits on a pinhead.

Occasionally, delicate structures like bird feathers or fish scales are preserved in Florissant lake shales, which also contain many fossil plants and insects. In a few rare cases, entire bird or fish skeletons were compressed in shale.



Bones become fossils as minerals form in the small internal spaces.
UCM-73039

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How many kinds of animals lived at Florissant?

Paleontologists have named more than 30 species of vertebrate animals from Florissant fossils. As new specimens are excavated, it is likely that more species will be described. By number of individuals and number of species, most of the species found at Florissant are plants and insects, and only a small proportion of fossils belonged to vertebrates. Plants and insects are still the most abundant multicellular life forms today, although they often go unnoticed. The particular environmental conditions of ancient Florissant, such as the acidity of the lake or the periodic input of volcanic ash, may have contributed to the large amount of leaves and insects but small number of vertebrates fossilized.

Fish

Fish are the most abundant animals with whole skeletons preserved at Florissant. Many of the fossil fish were bowfins (Amiidae), some of which reached 1 ½ feet (45 cm) in length. Fossil suckers (Catostomidae), catfishes (Ictaluridae), and pirate perches (Aphredoderidae) have been found as well. A paleontologist famous for naming dinosaurs, E.D. Cope, described species of Florissant fish in the 1870s.

Amyzon suckers (Catostomidae) were freshwater fish that grew up to about 5 inches (13 cm). They likely lived along the bottom of Lake Florissant, feeding on plants and small invertebrates. *Amyzon* fish went extinct at the end of the Paleogene, 23 million years ago, but related lineages of Catostomidae fish still live in North America. UCM-38711



Birds

At least half a dozen fossil birds have been found in Florissant lake shales, including a shorebird, roller (Coraciidae), cuckoo (Cuculidae), and passerine or perching bird. Isolated feathers are also found in shale. In some feathers, individual filaments are visible.



An artist's drawing of a fossil that has been interpreted as a rail (Rallidae) shows this slender shorebird wading in shallows. Its long beak can probe the mud and dig out small animals to eat.

Marsupial Mammals

Marsupial mammals are born relatively undeveloped and then mature in a mother's pouch. Most live in Australia, as kangaroos do, for instance. The Virginia opossum is the only marsupial that lives in North America today.

Florissant fossils show that an extinct species of small opossum lived in Colorado in the late Eocene.



An opossum (Didelphidae) is the only mammal that has been found in shale from Florissant. The other mammals were preserved in stream deposits.

Placental Mammals

Fossils from rodents, rabbits, horses, and other extinct mammals have all been documented at Florissant.

Horses evolved in North America but then went extinct there, until Europeans reintroduced them. Unlike horses today, the Eocene horse *Meshippus* had three toes, browsed on shrubs and trees, and stood only three feet (about a meter) high.



Teeth from the extinct horse *Meshippus* show that it ate leaves and twigs, not grasses. UCM-65951

The largest animals to roam the Eocene Florissant valley were brontotheres (Brontotheriidae). These giants grew to reach 8 feet (2.4 m) tall and weigh about two tons (nearly two tonnes). They sported a huge horn above their nose that forked into two prongs. Brontotheres likely used this weapon to fight off predators or settle rivalries among competing males.

Brontotheres were the largest animals at Florissant in the Eocene, 34 million years ago. Although they resemble rhinoceroses, they are an extinct group.



Images courtesy of Florissant Fossil Beds National Monument (FLFO), Smithsonian National Museum of Natural History (USNM), and University of Colorado Museum (UCM).

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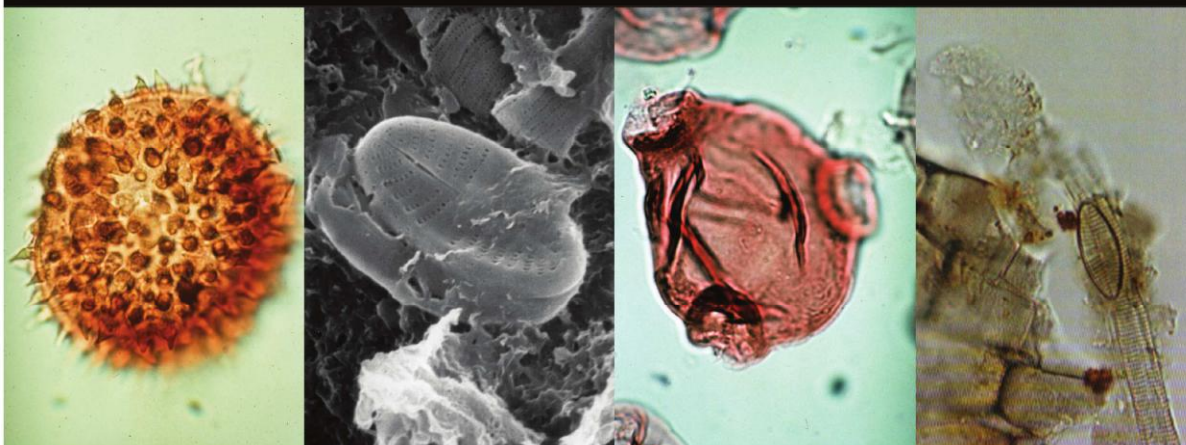


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Florissant Fossil Beds Microscopic World of Florissant

National Park Service
U.S. Department of the Interior

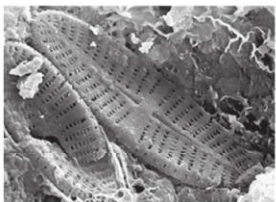
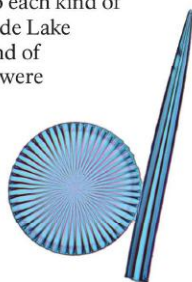
Florissant Fossil Beds
National Monument
Colorado



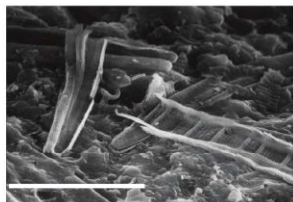
For every Florissant fossil large enough to see with the human eye, there are countless fossils only visible under a microscope. Millions of pollen grains, algae, and microscopic invertebrates are preserved at Florissant, and some played a key role in the process of fossilizing other organisms at the site. Microfossils are critical for understanding habitat, water quality, and climate at Florissant 34 million years ago.

Miniature Glass Ornaments

Single-celled algae called diatoms grow hard cases (frustules) out of silica. The glassy shells come in many shapes and are adorned with pores and ridges unique to each kind of diatom. Ash from volcanic eruptions made Lake Florissant rich in silica and acted as a kind of fertilizer that nourished diatoms, which were critical for the preservation of fossils at Florissant. Diatoms bloomed at the surface as they used up the silica. After the algae became stressed for resources, they exuded sheets of slimy mucus, which sealed around objects floating in the lake. The mucus trapped dead organisms and may have slowed their decay, helping to preserve them as fossils. The paper shales that contain many Florissant fossils are made up of layers of ash, clay, and diatom material.



Scanning electron microscopes reveal diatoms like these, less than 6/10,000 inch (0.014 mm) long.



Diatoms and the organic material they produced form layers in Florissant shales. Scale is 4/1,000 inch (0.1 mm).

Stonewort Corkscrews

Some of the earliest plants to evolve, more than 400 million years ago, were freshwater algae called charophytes. Many charophytes, commonly called stoneworts, grow only in clear, still water. The presence of fossil charophytes in Florissant shales may provide evidence for similar water conditions in ancient Lake Florissant.

Stoneworts grow up to several feet (more than a meter) in length, but the fossils preserved at Florissant belong to a life stage only twice the thickness of a fingernail in diameter. Charophytes undergo a complex lifecycle with both a sexually reproducing and asexually reproducing stage, like all plants. The sexual form develops from a spore, which grows a protective capsule and is then called a gyrogonite. The most common fossils of charophytes are gyrogonites.

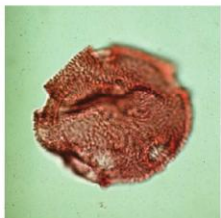


Spiral capsules protect spores of *Chara*, a kind of green alga, during harsh environmental conditions. Scale bars are 4/100 inch (1 mm).

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Fossil Pollen and Spores

Pollen and spores settled on the bottom of ancient Lake Florissant after wind blew them onto the surface or streams washed them into the water. Some of these tiny reproductive plant stages became fossilized in the layers of lake shale.



A grain of pollen is usually only thousandths to ten-thousandths of an inch (0.01–0.1 mm) wide. In order to examine such small fossils, paleontologists first isolate them by dissolving shale in various acids. Then they stain the extracted fossils with dye and mount them on glass slides to examine under a microscope. This is how the pictures at left were produced. These techniques were not developed when scientists first described fossils at Florissant, in the late 1800s. Only in recent decades have paleontologists been able to study fossil pollen to learn more about the ecosystem at Florissant in the late Eocene.

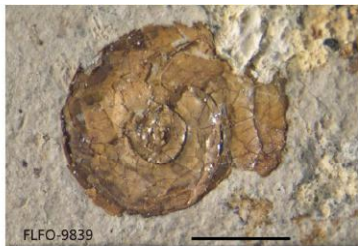
More than 130 different species of plants have been identified from fossil pollen and spores at Florissant. Of these, plants from 25 genera are known only from fossil pollen and spores. Some pollen travels long distances in the wind, providing evidence of the ancient forests that grew on nearby mountains.

What are the smallest fossil animals?

Fossils indicate that Lake Florissant may have held a rich assemblage of invertebrates. Some of the most common fossil aquatic invertebrates are ostracods, small crustaceans almost like a shrimp enclosed in a shell. They likely lived in the shallow areas of Lake Florissant, where they ate detritus that settled to the bottom. Several species of snails and clams are preserved at Florissant as well. The smallest of these, a snail called *Gyraulus* (below), grew up to about 1/4 inch (5 mm) across. Teeth from rabbits, rodents, and other mammals were preserved as fossils, many of which are only tenths of an inch (a few millimeters) long. Most of the species of Florissant mammals have been identified from teeth alone.



Fossil ostracod, 3/100 inch (0.7 mm) long.



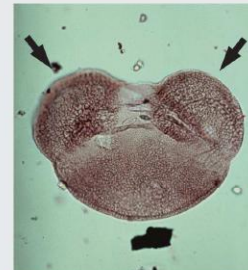
The name *Gyraulus florissantensis* means "spiral from Florissant." Scale bar is 2 mm, about 1/16 inch.

Images courtesy of Florissant Fossil Beds National Monument (FLFO), State University of New York at Postdam, University of Colorado Museum (UCM), and U.S. Geological Survey.

What kind is it?

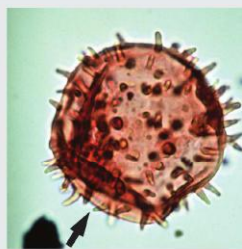
The size, shape, sculpturing, and number and location of pores and furrows are unique to each kind of pollen.

Some **conifers** make pollen grains with **two sacs**, like the fir (*Abies*) pollen grain at right. Botanists call this shape "bisaccate."



Water lillies (Nymphaeaceae) (bottom left) and some other plants make pollen grains with **one furrow** ("monocolpate").

Buttercups, roses, and relatives make "tricolpate" pollen grains with **three furrows** or pores (bottom right).



Why study shells?

Calcium-rich shells from ostracods, clams, and other aquatic animals are a kind of time capsule for scientists, providing clues about the original habitat in which an animal lived. As an animal grows its shell, it records chemical signatures of salinity, temperature, and other aspects of water quality. Fossils can be studied to reconstruct water conditions at Florissant 34 million years ago.



Fossil clams hold chemical signatures of past conditions.

Understanding how past changes in water conditions affected aquatic animals is important to predict how modern climate change will impact ecosystems over coming decades. In particular, ostracods, along with snails, corals, and many other aquatic animals, build shells from calcium compounds that dissolve in more acidic water. Acidity is defined by hydrogen ion concentration, which National Oceanic and Atmospheric Association measurements show has increased 30% (a pH decrease of 0.11) in oceans since the Industrial Revolution. The greater acidity is caused by an increased concentration of carbon dioxide molecules in the atmosphere, which react with water molecules to form carbonic acid.



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