



# Friends of the Florissant Fossil Beds Newsletter

Volume 2007 Issue 1

May, 2007

## Inside this issue:

A Tale of Two Lakes 2

The Guffey Volcano 2

Fossil Research 3

Upcoming Events 3

News from FLFO 4

Potential Fee Increase 4

Help Wanted 4

Trivia—20 Years of Friends History 5

Summer Seminar Schedule—Teacher Sign-up 6

## Letter from the New Superintendent

*Florissant Fossil Beds National Monument is experiencing many exciting changes in 2007, including construction of a screening room for the park's new film, new wayside and visitor center exhibits, and the Antero Formation research project. One of the biggest changes, however, is the appointment of the new superintendent, Keith Payne. Superintendent Payne has been with the National Park Service for almost 20 years, and we're excited to have him at Florissant.*

March 7, 2007

Hello, everyone. I want to take this opportunity to introduce myself. I am the new Superintendent at Florissant Fossil Beds National Monument. Although I was appointed to the position in December, my wife Judy and I have only just completed the move to our new home in Teller



County and begun to settle into the community.

I am a Landscape Architect and came to the National Park Service in 1988 as a planner in the Denver Service Center. I left

Denver to work for Rocky Mountain National Park as Corridor Planner for the Cache La Poudre River Corridor National Heritage Area in the Fort Collins-Greeley area. I left Rocky in 2004 to become Project Manager for major construction projects in the Line Item Construction Program of the NPS' Intermountain Regional Office in Denver. In that last position, I undertook several projects at Florissant Fossil Beds and met several of you during that time. When this latest opportunity opened for me, it was an easy decision to come to Florissant. You have all helped to make the transition effortless for me. Thank you.

I look forward to continuing several projects at the Fossil Beds, not the least of which is the quest for a new visitor center.

*(Continued on Page 5)*

## Friends Celebrate 20<sup>th</sup> Anniversary

by *Sally Maertens*

*The initial Board of Directors meeting of the new support group for the Florissant Fossil Beds NM was held on Sunday August 9th, 1987 at 2 P.M. at The Lakes at Eagle Wing. Several more breakfast or luncheon meetings were held with a small but determined group which included: Rick Bradley, Tom*

*Wylie (Superintendent), Tom Huber, Duncan Rollo (Chief of Interpretation), Boyce Drummond, Will Fowler, James D. Clark (lawyer) and others. On October 5, 1987, the Friends group had its first official meeting.*

*Rick Bradley was chosen as the founding President.*

The history of the Friends of the

Florissant Fossil Beds, Inc. shows an organization that has remained active and true to the mission of the group for 20 years. Many exciting activities and projects punctuate every year. Five presidents have guided the Friends: Rick Bradley, Kent Borges, Bill Dexter, Sally McCracken Maertens and

*(Continued on Page 7)*

## A Tale of Two Lakes

by *Melissa Barton*

Pines and oaks surround the shallow lake. Rhinoceros-like bron-totheres, tiny horses, deer-like animals the size of dogs, and rabbits graze on lakeshore foliage such as mountain mahogany and blueberry as insects buzz around them. Underwater, tiny snails and ostracods or “seed shrimp” the size of sand grains feed on algae, which forms large algal reefs on the lake floor.

In the distance, a volcano rumbles. Suddenly a cloud of ash fills the sky. Violent volcanic mudflows speed down the slopes of the mountain, burying panicked animals, and ash covers the remains of plants, insects, and mollusks in the lake, preserving them in stone for over 30 million years.

Sound familiar? This isn't the story of Lake Florissant.

This is the story of the ancient Lake Antero, which deposited the Antero Formation of South Park, less than an hour's drive from Florissant. Like the Florissant Formation, the Antero was also formed by layers of volcanic ash, mudstone, and sandstone deposited in an ancient lake valley. It preserves plants—including fossil wood—insects, mollusks, ostracods, and the occasional mammal. It's even close to the same age as Florissant, only a quarter of a million years younger.

Unlike the Florissant Formation, however, few scientists have



*Mountain mahogany (Cercocarpus) is one of the more common plant fossils in the Antero Formation. Photo: FLFO)*

studied the Antero Formation. Almost all of the formation lies on private land, and fossils are less abundant than in the Florissant Formation. Previous collection efforts by scientists in the 1930s-1990s produced a small selection of mammals, plants, and snails, but efforts to locate most of these specimens have been unsuccessful.

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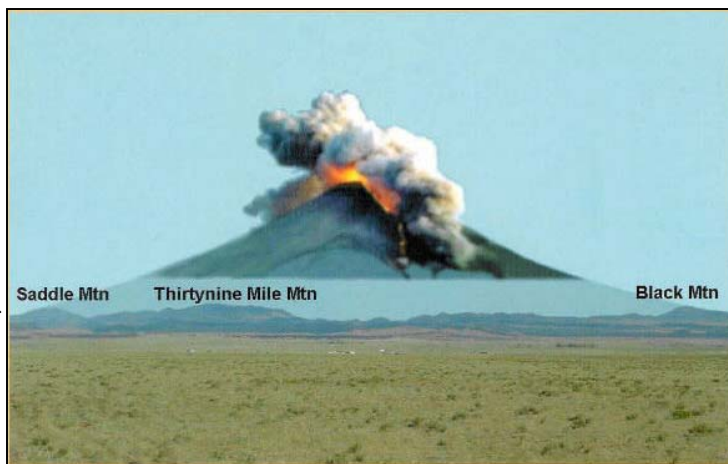
## The Guffey Volcano: An unusual kind of volcano

by *Donald P. McGookey, Ph.D.*

There are modern volcanoes that are something like the Guffey volcano, but to my knowledge, none have the unique characteristics of Guffey. In order to understand the Guffey volcano in context, it is important to understand how volcanoes form.

If you depend on documentaries on television for information about volcanoes you will invariably receive a confusing story that is designed to entertain, not to inform. Documentaries almost always mix scenes from a wide variety of volcanoes to make the most spectacular presentation. They rarely differentiate between oceanic and continental volcanoes. Likewise they say little about the temperature, chemistry and viscosity of the extrusive material.

Volcanoes are formed by the **extrusion** upon the surface of the earth of molten rock, solid rocks, ash, and gases from an underground magma chamber. The magma source may be a few thousand feet to a few miles below the surface of the earth. The route from the magma chamber to the surface may be along a crack in the earth's crust, or up one, or a spread of pipe-like feeds. Once the magma breaks through to the surface the form of the extrusive body varies from broad flat lava flows to broad rounded volcanoes to



*Figure 1. View from the north at the eroded profile of the Guffey Volcano from Saddle Mountain on the east to Black Mountain on the west, a distance of over 25 km (16 miles). If the volcano developed as high as depicted, it would have had an elevation of over 6,000 m (19,000 feet) above the surrounding area. Over the 3 million year active life of the volcano, the volcano was undoubtedly built, deeply eroded and rebuilt several times. When rebuilt with multiple feeds as shown on Figure 5, it would have had an irregular profile with more than one peak, and less elevation.*

*(Continued on Page 8)*

## Fossil Research Presented at Geological Society of America

by *Melissa Barton*

Scientists presented the results of two paleontological research projects at Florissant at the 2006 Annual Meeting in Philadelphia of the Geological Society of America (GSA) last October, one of the largest professional conferences for the geosciences. The Florissant Fossil Beds have provided a rich resource for researchers for well over a century, and active research is still taking place both in the park and on historical collections.

Dr. Dena Smith, Curator of Invertebrate Paleontology at the University of Colorado Museum, chose to study the preservation of fossil insects in the museum's collections. These insects were collected in the early 1900s by University of Colorado (CU) professor Dr. T.D.A. Cockerell, who published over 130 scientific papers on Florissant fossils.

"When you talk about the best preservation for fossil insects, one of the first places that comes to mind is the Florissant Formation in Colorado," Smith said. The Cockerell expeditions took *all* of their finds back to the museum instead of sorting in the field.

Their collections are representative of the range of preservation



*Some common Florissant diatoms, prepared by Jess Debusk. (Photo by E. F. Stoermer)*

*(Continued on Page 7)*

## Upcoming Events

Be sure to mark the following dates on your calendar:

- ◆ **Saturday, June 9, 2007** - The Summer Seminar Series kicks off with Dr. Bob Reynolds, a research associate at the Denver Museum of Nature & Science. Dr. Reynolds will present a seminar on global climate patterns and their effect on Colorado. For those who heard him in February at Colorado College during the Friends' Community Seminar Series, he will spend the day expanding on this topic.
- ◆ **The Summer Seminar Series** will continue through August 2007. The brochure will be available in early May. Teacher flyers will go out in late April. If you don't receive the info by the middle of May, please call the Monument at 748-3253 and ask for the schedule.
- ◆ **July 28th and 29th - 10 A.M. - 3 P.M.** - Homestead Days will be held outside at the Hornbek Homestead. July 28th will be part of the Heritage Days in Florissant, and the Friends will be working together with our



great partner, the Pikes Peak Historical Society, to hold a Homestead Tour of the entire area. It will be an exciting weekend!

- ◆ **Saturday, August 4, 7:00 P.M.** - Traditional Ute Dancing will be held in the amphitheater at the Monument. This is our yearly visit with the Utes who make their annual visit to their roots every August. Pikes Peak Historical Society and the Friends are so honored to be able to host them every year.
- ◆ **Saturday, August 18** - The Friends will be celebrating our 20<sup>th</sup> anniversary! There will be special events and activities all day at the Monument, and a catered dinner in the evening. We hope that you will plan on spending at least part of the day celebrating with us.

This summer will be an exciting time at the Monument. The next newsletter will have more information about all of the activities and events. Please plan on joining us when you can and bring your family and friends.

## News from FLFO

### Jo Beckwith Accepts New RMNA Position

by *Sally Maertens*

Jo Beckwith came to the Florissant Fossil Beds NM as the concessions manager for the Rocky Mountain Nature Association (RMNA) in February 1990. Her smiling face, pleasant ways and constant helping hand have helped many visitors, employees and volunteers over the years. She has an incredible sense for the best books and items to have available in the Visitor Center.

Jo has just received a promotion with RMNA. She will now be the retail manager for 41 RMNA outlets in Colorado and Wyoming. These outlets are in state parks, as well as Forest Service, National Park Service, and BLM units. Her office is now in her home and she will be traveling a lot.

We will still have an opportunity to see Jo at the Monument when she comes to check RMNA's outlet at Florissant. She will

continue to look for the items that we sell, order them and do the inventory.

When speaking with Jo, she assured me that she loves the Monument and looks forward to her visits. Jo has been a staunch supporter of the Friends over the years. We deeply appreciate her support and wish her well in her new position.

### Erica Miller Receives 2006 Visitor Service Award

by *Sally Maertens*

At the Annual Meeting of the Friends on October 15, 2006, summer intern Erica Miller received the Visitor Service Award for 2006. The Friends began giving the award back in 1991 when the first recipient was Leona Bowersox. The award is given to the person who best exemplifies the best in visitor service. Both

*(Continued on Page 13)*

## Proposed Fee Increase

Florissant Fossil Beds National Monument is soliciting public comments regarding a proposed change in the park entrance fee. Authority for this action is granted by the Federal Lands Recreation Enhancement Act. The annual Florissant Park pass which allows entrance into the Monument for one year would increase from \$15.00 to \$30.00.

Two public meetings were held on April 18 and 19 in the Florissant and Woodland Park Libraries. The public had an opportunity to make comments regarding the change.

Hopefully, you as a member of the Friends received the letter regarding these public meetings. If you didn't, there is still time for you to express your feelings regarding the fee increases. If you wish to comment on this proposal, please send a letter to the park superintendent, Keith Payne at the following mailing address or e-mail:

Address: Florissant Fossil Beds NM

P.O. Box 185

Florissant, CO 80816

keith\_payne@nps.gov by May 25, 2007.

Please include your name with any e-mail message.

All comments, along with the names and addresses if individual respondents, will be available for public review during regular business hours. Requests to withhold personal information will be honored to the extent allowable by law, and must be stated prominently at the beginning of your comment. All comments from businesses or organizations, and individuals or officials, who represent organizations or businesses, will be available for inspection in their entirety.

Please consider sending your comments. The Board of the Friends appreciates your interest in the Florissant Fossil Beds NM.

## Help Wanted

### FOR THE MONUMENT:

The Monument especially needs volunteers to help staff the Visitor Center. Please call Jeff Wolin at (719) 748-3253 for more information. There are many other opportunities for volunteers with a variety of skills and abilities as well, both behind the scenes and helping visitors directly.

### FOR THE FRIENDS:

The Friends are looking for people to serve on the Board of Directors. We are trying to have four board meetings a year with

smaller committees working on projects between board meetings. We currently need a treasurer and a membership chairman, who don't have to be board members.

In addition, the Friends really need volunteers to help with special events like the 20th Anniversary Celebration, the Summer Seminar Series and the Community Seminars for next winter.

**Please** consider helping the Friends in some small way. Our 20 years of helping the Monument achieve its goals have been very productive. Please join us in making the next 20 years even more fulfilling for everyone.

## Superintendent (Continued)

As we hopefully await the visitor center project, there are several other ongoing park ventures. The Hornbek Homestead stabilization is on track for completion this summer, and we are pursuing grant funds to accomplish a Historic Structures Report for the entire Hornbek building complex to guide further stabilization and preservation efforts there. New wayside exhibits and temporary visitor center exhibits are being designed and fabricated. To complement the exhibits, the farmhouse visitor center is being partially remodeled to provide a separate, dedicated theater room for viewing the interpretive film. We are also exploring means to fund a study of culturally modified trees within the park. Of course, there are numerous paleontological research projects in process.

Finally, the federal government has initiated a Centennial Celebration program to prepare the National Park Service for the celebration of its 100<sup>th</sup> anniversary in 2016, and the program will begin this spring. This program will provide added assistance in funding and manpower to repair and upgrade park facilities and programs. There will also be a Centennial Challenge program

that will provide dollar-for-dollar matching funds over the next 10 years to encourage and leverage private donations for park projects.

This promises to be a busy year. We appreciate the substantial support of the Friends of Florissant Fossil Beds and look forward to continuing our collaborations to achieve the goals of Florissant Fossil Beds National Monument.

Thank you all for your continued support.

Keith Payne  
Superintendent

## Trivia—20 Years of Friends History

How do you catch the essence of an organization that has been in existence since August, 1987? Do you talk to people, read records, listen to tapes, or look at pictures and newspaper clippings? All of the above and more!

Having spent a little more than a month doing the above, I have only touched the surface of the richness of the 20-year history of the Friends of the Florissant Fossil Beds, Inc. The time I can steal each day to read minutes, pore over financial statements, and imagine those giants of the early years at meetings, inspires me to continue with the project of organizing the history.

I want you to want to know more about the beginnings of the Friends, the last ten years, and our future. When you read the next few newsletters, I hope you will understand more about the incredible people who dedicated their energies, knowledge, and talents to bring us to our 20th Anniversary Celebration on August 18, 2007.

Here are some questions to pique your interest. Some of the answers can be found in this newsletter, and a key will be printed in the next issue. How many can *you* answer?

- Who was the Superintendent when the Friends formed in August of 1987?
- Who was the founding President?
- What was the original name of the Friends?
- What Colorado College professor testified in 1986 about saving the fossil beds?
- What U.S. congressman has been the Monument's supporter for the longest time?
- How many different t-shirt designs have the Friends had?
- Who helped design our present design and when was it first sold?
- Who were the main speakers at the Monument's 25th Anniversary and where was the celebration held?
- When did the Summer Seminar Series start?
- How many Superintendents have the Friends worked with?
- What did the blueprints for the stump shelters call them?
- When were the two stump shelters put up?
- What were the shelters?
- When was the first "March for Parks"?
- When was the first Memorandum of Agreement signed between the Friends and the NPS?
- What was the first bank that we deposited our "big bucks" in?
- When was the Friends' first Annual meeting held?
- When was the first "Stomp for the Stumps"?

**Scoring:** (18-15, excellent; 14-11, good; 10-8, fair) Answers in the next newsletter). Watch for installment # 1 of the Friends' history and join us on August 18<sup>th</sup> at the 20th Anniversary Celebration to hear the great stories.

*You will have to wait for the next issue for the answers.*

# Florissant Fossil Beds

National Park Service  
U.S. Department of the Interior

Florissant Fossil Beds  
National Monument



## Summer Seminars Series and Fees

The Friends of Florissant Fossil Beds, Inc. offers one or two-day seminars in a variety of geology, biology, humanities, and paleontology courses. The regular fees for each seminar are \$50.00 per person for a one-day seminar and \$65.00 for a two-day seminar. Reduced rates are available for members of the Friends of the Florissant Fossil Beds, Inc. (See section on Friends group below). A special rate is available for teachers who join the Friends of the Florissant Fossil Beds and sign up for seminars between May 5 – May 20, 2007. This can be by phone or mail postmarked by May 15<sup>th</sup>, 2007. This special rate is \$30.00 for a one day (1/2) and \$40.00 for a two day seminar.

Registration information will be available on the Monument's website after April 27<sup>th</sup>, 2007 at <http://www.nps.gov/flfo> and go to the link for Education Programs.

## Teacher Friendly Graduate Credit

Teachers can earn graduate credits through the Division of Extended Studies of Adams State College. Adams State charges \$22.50 for a 1/2 graduate credit (one-day seminar), and \$45.00 for 1 graduate credit (two-day seminar). BOCES recertification credit is available for \$5.00 for 1/2 credit, and \$10.00 for 1 credit. (No discounts are available for tuition).

## Friends of the Florissant Fossil Beds N.M.

If you join the Friends of the Florissant Fossil Beds, Inc. either as an individual or family, you will receive a \$10.00 discount on the seminar fee. A one-year, individual membership to the Friends is \$15.00 and a one-year, family membership is \$27.00. Seminar discounts are only available to current members or those who join with their seminar registration. If you are no longer a member, you may wish to renew. Remember, if you are a teacher AND a Friend member AND you register early (See first section) you get a special rate of \$30.00 for a one day seminar and \$40.00 for a two day seminar.

Schedule	Date	Time	Topic	Instructor(s)
	June 16, 2007	9 - 5	Global Change and its Impact on Colorado	Bob Raynolds
	June 23, 2007	9 - 5	Cenozoic Geology and Happenings Recorded at Selected Sites in Southwestern South Park, Colorado	Don Rasmussen
	June 29, 2007	5pm - 2am*	Natural History and Ecology of the Flammulated Owl	Brian Linkhart
	July 7, 2007	9 - 5	Traditional Living and Survival Skills	Robin Blankenship
	July 28 - 29, 2007	9 - 5	The Eocene Life of Florissant: Paleontology of the plants, insects, mammals, and diatoms of the Florissant Formation	Herb Meyer Dena Smith Jaelyn Eberle Mary Ellen Benson
	August 4, 2007	9 - 5	Geology of the Cripple Creek Mining District	Steve Veatch
	August 11, 2007	9 - 5	The Aspen Tree; It's Ecology, Management, and Restoration	Wayne Shepperd

## Contact Information

For more information about prices, logistics, registration, or any other questions, please look at our website: <http://www.nps.gov/flfo> and go to the link for Education Programs. You may also contact Jeff Wolin at (719) 748-3253 or fax at (719) 748-3164 or email at [jeff\\_wolin@nps.gov](mailto:jeff_wolin@nps.gov) or send a letter to PO Box 185, Florissant, CO 80816.

**REGISTRATIONS WILL NOT BE TAKEN UNTIL ON OR AFTER MAY 5, 2007**

The seminar series is sponsored by the Friends of Florissant Fossil Beds, Inc.



## Anniversary (Continued)

Steven Veatch. The Friends have worked with 7 park superintendents over the 20 years: Tom Wylie, Noel Poe, Dale Ditmanson, Jean Rodeck, Jeff Mow, Reggie Tiller and now Keith Payne.

Highlights of the first 20 years include the 20th, 25th, 30th, and 35th anniversary celebrations of the park (the 40th will be in 2009), March for Parks events, the Stomp for Stumps events to raise money to protect the stumps, the purchase and erection of the yurts over the stumps, support for the building of a new visitor center, establishment of the Summer Seminar Series (which has run for 13 years now), and the establishment of the annual meetings (first one was Saturday, November 4, 1989).

Financial support for research, interpretation, publications, support of interns and many other projects has been an important role for the Friends. Each year, the Friends sponsor a paleontology intern, fund the Monument's newspaper, and help fund and produce the Summer Seminars. The Junior Ranger booklet and patches are also funded through the Friends.

Most recently, the Friends raised \$10,000 through a grant from the F. Martin Brown

Foundation to help pay for the new Monument film. It is a welcome addition to interpretation of the Florissant Fossil Beds. This spring will see the completion of the theater in the Visitor Center.

It would be impossible to mention all the people, projects and activities that have been a part of the last 20 years in one short article. In order to give everyone a taste for the players and the events, the history will be printed in this newsletter over the next several issues. If any member has some thoughts to add, please send them to Sally Maertens c/o Florissant Fossil Beds National Monument. All information in any of the articles has been gathered from a number of places and inaccuracies may occur. Please let us know if you find any items that need to be corrected in this or any of the future articles on the history of the Friends.

Several activities will be planned this year for the **20th Anniversary Celebration**. Please put Saturday, August 18, 2007 on your calendar and join us for a fun day at your Monument. More information will be published in the next newsletter. If you would like to help with the Celebration, please call Sally at 719-687-9204.

## Fossil Research (Continued)

quality found in Florissant fossils and thus a good sample for study.

Smith assigned the fossils to 5 different "taphonomic grades" or preservation categories, and then attempted to identify them to the family and species level. Surprisingly, she found that 83% could be identified to at least the family level, despite being primarily of middling preservation quality. Even more surprisingly, of the worst specimens (grade 1), 32-38% could still be identified to species level, compared to 59% of the best (grade 5).

"The first lesson...is to collect everything," Smith said. "No more high-grading. Even poor specimens can be identified to the family level at least."

She also found that the species found at near shore and off shore sites were quite different. "Collecting from one depositional environment would greatly underestimate the diversity," Smith said. "Depositional environment does matter. I'm urging those of you who are publishing new fossil insect taxa to describe the geological environment as well."

One of Smith's graduate students, doctoral candidate Mary Ellen Benson, has been studying ancient Lake Florissant's diatoms (microscopic algae) for her dissertation research under the guidance of Smith, Dr. Sarah Spaulding of the Institute of Arctic and Alpine Research at the University of Colorado (CU), and park paleontologist Dr. Herb Meyer. The project is funded by visitor fees from the Federal Lands

Recreation Enhancement Act and a cooperative agreement with CU. Benson presented some results from collections last summer



A fossil termite (*Paroterme scudderii*) from Florissant, in the collection of the University of Colorado Museum. (Photo: CU Museum)

from the Lower Shale unit at the Florissant Fossil Quarry. Benson is systematically collecting diatoms from each of the three shale units outcropping at the quarry and within the park.

Although her results are still incomplete, Benson has already found that Florissant's diatoms are unusually diverse, and show many modern affinities when compared with living and recent fossil diatoms. She has identified 14 genera of diatoms so far, using light microscopy and a scanning electron microscope. The two most abundant are *Aulacoseira*, one of the earliest known freshwater diatoms, *Synedra* (which forms mats of algae), and *Diatoma*. Of the 14 genera identified so far, Florissant represents the earliest known fossil occurrence for 9.

Benson says that the Florissant diatoms appear to be one of the most modern early diatom flora in the fossil record. She is currently continuing her research with samples from two sections within the Monument.

## Guffey Volcano (Continued)

cone-shaped volcanoes, according to a number of variables.

Plate setting: The molten soup of materials in magma on an **oceanic plate** may originate over 50 miles below the surface in the upper part of the mantle. The volcanoes of Hawaii are an excellent example. A local hot area within the mantle produces the magma chamber. The magma extrudes from the crest of broad shield volcanoes or from cracks (faults) in the crust of the earth. Coming from a great depth the magma is very hot (> 1400 degrees centigrade), has a basic rather than acidic chemistry (basalt), and is very fluid. Thus the volcano is built by repeated flows of lava with only a small amount of gas. The lava is so hot that it will flow for miles downhill away from the source. These broad, rounded volcanoes are called shield volcanoes

Volcanoes on **continental plates** are more complex and much more dangerous than oceanic volcanoes. The rocks that make up the continental crust are very different from those in oceanic settings. They include igneous, metamorphic, and sedimentary rocks. The magma chamber may form deep in the earth in the upper mantle and work its way to the surface assimilating (melting) rocks of continental origin along the way, or the magma chamber may form in continental crust above the mantle layer. Chemically, the melting of continental rocks contributes an intermediate to acidic character to the magma. Generally, continental magmas have a lower temperature (700 to 1100 degrees centigrade), which results in a more viscous (sticky, less liquid) magma. The water found in continental crust rocks, which turns to gas because of the high temperatures, often adds an explosive element to the extrusions. The resulting eruption commonly mixes or alternates extrusions that consist of acidic, intermediate, or basic igneous rock and ash.

Figure 3 shows that the Guffey volcano of the Thirtynine Mile Volcanic Area is only one in a wide distribution of eruptive centers in the Central Colorado Volcanic Field (CCVF). The eruptive centers are in the Sawatch Range, southern Mosquito and Front Ranges, the Wet Mountains and Wet Mountain Valley, the northern Sangre de Cristo Range, and South Park. These centers were active during the middle Tertiary 38-29 million years ago (abbreviated "my"). Some of the early extrusives of this nine million year period were very hot and violent. The explosions from some of those volcanoes were from the sides of the volcano, similar to Mount St. Helens. They put out massive incandescent clouds of ash and tuff (small pieces of lava) that floated downwind as much as one hundred miles to the east-northeast. Remnants of these welded tuffs (called ignimbrites) are present in the Castle Rock areas of the High Plains (Figure 4). Some of these pyroclastic flows, like the Wall Mountain Tuff, were so hot when deposited that particles of ash pumice and rocks welded together to form a very hard rock.

I have not found current examples of pyroclastic flows that re-

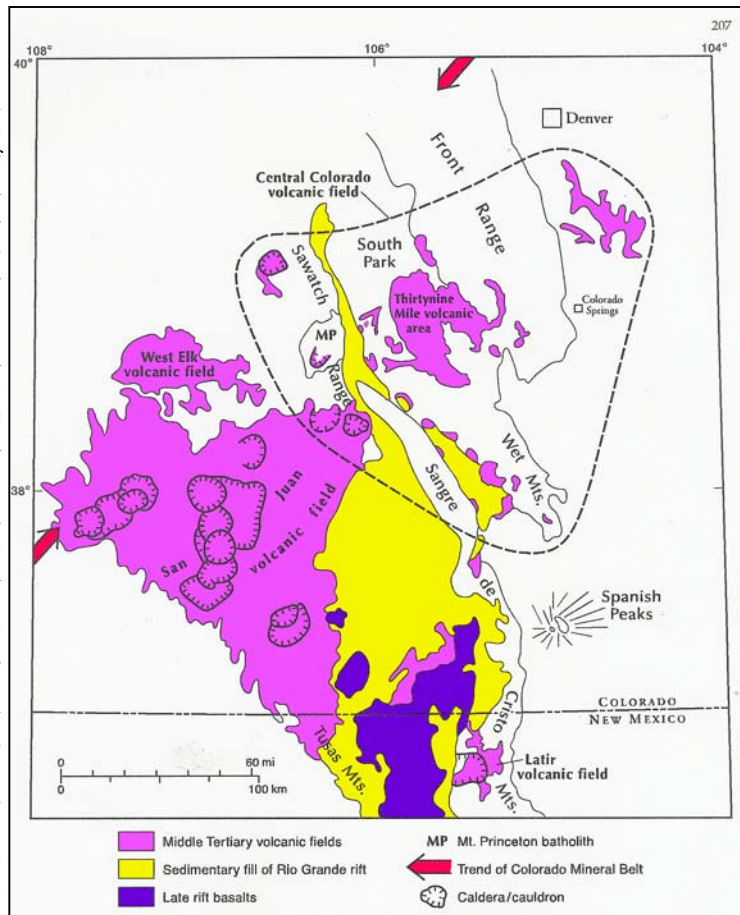


Figure 2. W. C. McIntosh and C. E. Chapin's (2004) map of the Southern Rocky Mountains showing erosional remnants and inferred original extent (heavy dashed line) of the central Colorado volcanic field (CCVF) and adjacent volcanic fields. Modified by McIntosh and Chapin from Lipman (2000). The CCVF is separated from the San Juan Volcanic Field (SJVF) on the basis of the age of extrusive activity. The SJVF igneous activity generally is younger than that of the CCVF.

sulted in welded tuffs, although pyroclastic flows are still a common form of volcanism. The Smithsonian Global Volcanism Program web site ([www.volcano.si.edu](http://www.volcano.si.edu)) has information about many currently active volcanoes. Soufrière Hills on the island of Montserrat in the West Indies put out pyroclastic flows and ash that forced evacuation of half of the island and displacement of over 20,000 people in the 1990s. Blocks of red-hot lava up to 3 meters in diameter were present in the flows and landed on buildings, frequently setting them on fire. The Stromboli volcano on an island west of Italy is noted for spectacular fountain-like eruptions of blocks of lava high into the air. These fall on the upper flanks of the volcano and then move downhill as pyroclastic flows. Arenal Volcano in Costa Rica has four separate cones that are active. This volcano emits gas and strombolian eruptions, some lava flows, and occasional pyroclastic flows down chutes

(Continued on Page 9)



## Guffey Volcano (Continued)

or ravines. Arenal Volcano is predictable enough that the area has become very popular as a tourist attraction. We once sat on the veranda of our hotel cottage eight km (five miles) from the volcano and could hear and see red-hot, bus-sized blocks of lava bounce down the one of the chutes. But like the pyroclastic explosion from the north side of Mount St. Helens, none of these pyroclastic flows from recent volcanoes has been incandescent hot like the flows from the Guffey volcano.

### Guffey Volcano

Figure 1 shows a reconstruction of what Guffey Volcano may have looked like at one stage of its history. We saw with Mt. St. Helens that volcanoes build, then may be eroded or blown away, and then rebuild again sometimes with a different shape. The 'i's on Figure 5 identify the location of some of the multiple feeds to the Guffey volcano from the parent magma. The volcano is different from most continental volcanoes in that the slopes were almost entirely built by repeated breccia mudflows. These deposits were a soup of breccias (broken rocks) that combined with large amounts of extruded ash high on the slopes. With each heavy rain or melting of snow, the combination of broken rocks and ash formed mud flows (lahars) that flowed rapidly down the slopes and spread out from the volcano as far as 38 km (24 miles). There are similar breccia mudflows on the flanks of other early Tertiary volcanoes of the western North America. We are still looking for current exam-

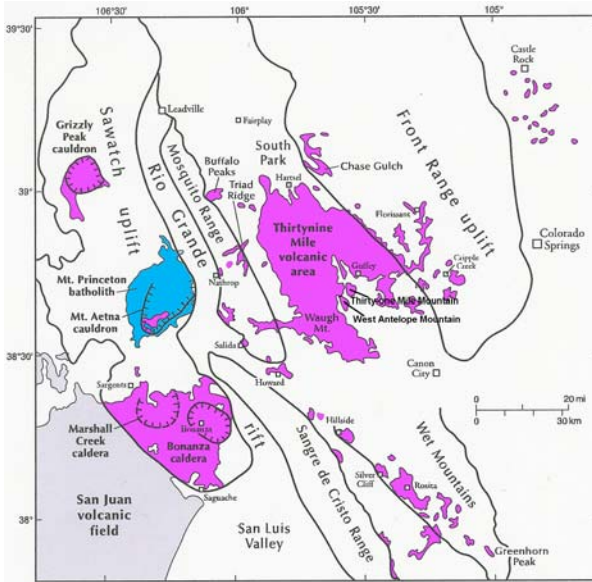


Figure 3. W. C. McIntosh and C. E. Chapin's (2004) sketch map of the central Colorado volcanic field showing major geologic features, known calderas, and distribution of CCVF outcrops.

ples of mudflows that have mixtures of large breccia blocks and large amount of ash.

Mudflows move fast (up to 160 km (100 miles) per hour) and are very destructive. Mount Pinatubo in the Philippines erupted explosively in 1991. Gases, including sulfur dioxide and fluorides, accompanied the emission of tremendous quantities of ash. Thick ashfalls caused the collapse of some 40,000 houses. There were no reported deaths during the eruption because geologists had accurately predicted it and the surrounding area had been evacuated. It was reported that mud lahars, caused by later rains that mobilized ash on the slopes, killed 500 people. In 1985 the slopes of a volcano in Columbia were heated by volcanic activity. Glaciers melted and the resulting mud lahar swept through a nearby town. An estimated 22,000 people lost their lives in that mudflow.

The history of Guffey Volcano is as follows (read from bottom (oldest events) to top (youngest events).):

Small basalt dikes and small rhyolitic stocks comprise the youngest activity, which intrude the older sequences.

Upper Member, Thirtynine Mile Andesite (35 my)

Basaltic trachyandesite flows and interbedded breccias that form a ring of mountains surrounding the Guffey volcanic center. They are remnants of a large (16 by 26 km basal dimensions) stratovolcano formed by the upper member

(Continued on Page 10)

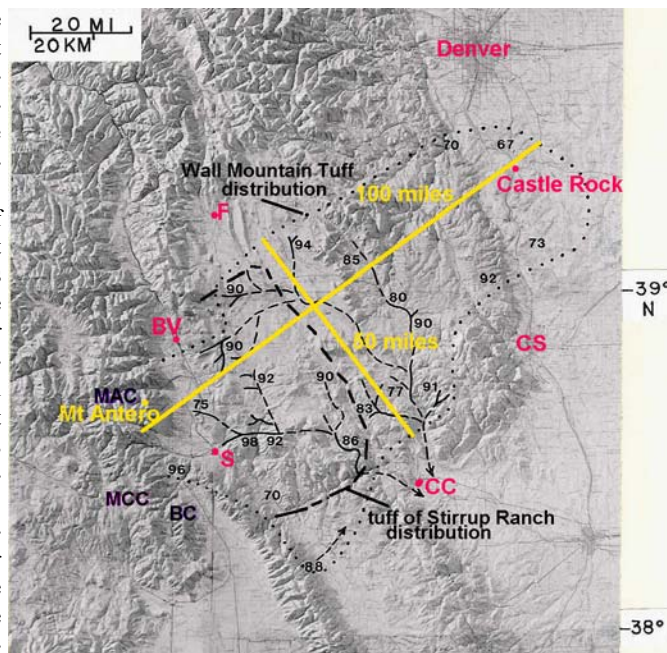


Figure 4. The base is a composite of Army relief maps (two degree quadrangles) and shows the late Eocene drainage of South Park. The approximate location of late Eocene calderas is shown by the initials MAC=Mount Aetna cauldron, MCC= Marshall Creek caldera, and BC= Bonanza caldera. Known paleovalleys are shown with solid and dashed lines. The dotted line shows the extent of the Wall Mountain Tuff (36.7 my) based on outcrops. The heavy dashed line is the inferred distribution of the tuff of Stirrup Ranch (36.5 my). The Wall Mountain Tuff is thicker in the Late Eocene valleys and lies on a conglomerate in the valleys. Thus the base of the combined sections defines the valleys. The numbers represent present elevations in hundreds of feet of the base of the Wall Mountain Tuff, which lies on the late Eocene surface. Please see Epis and Chapin, 1975 for additional discussion of this surface. (Figure provided by Dr. Charles Chapin.)

## Guffey Volcano (Continued)

that surrounds a complex of Lower member intrusive and extrusive domes, plugs and flows.

Lower member, Thirtynine Mile Andesite (37 to 36 my)

This is the sequence that disrupted the drainage from South Park and caused the formation of the Florissant and Ancestral Antero Lakes. The Lower member is the most voluminous and areally extensive unit exposed in this area (McIntosh and Chapin, 2004, p. 208). It is a breccia (broken rocks) complex of intermediate to mafic rocks that covers approximately 2,600 square kilometers to an average depth of 150 meters (please also see Epis and Chapin, 1974). It is described as aprons of lava flows and breccias surrounding widely scattered central volcanoes and grading laterally into mudflow breccias and other sedimentary deposits.

The breccia vents form small (0.8 km diameter by 150 m high) cones in which all rocks are breccias, including breccia dikes and brecciated plugs that seal the vents (McIntosh and Chapin, 2004). These breccia deposits are somewhat unusual. They have been interpreted as products of subterranean fragmentation and subsequent eruptions as breccias. Autobrecciated lava flows comprise about 10 percent of the sequence. The lava flows are only found close (< one mile) to the source(s).

*Donald P. McGookey is the author of the book Geologic Wonders of South Park, Colorado, With Road Logs. He has a Ph.D. from Ohio State and is currently an independent geoscientist.*

Websites for Current Volcano Updates:

[www.volcano.si.edu/reports/usgs](http://www.volcano.si.edu/reports/usgs)

[www.ngdigitalmotion.com/](http://www.ngdigitalmotion.com/) has pictures by Steve and Donna O'Meara

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Lipman, R.W., 2000, Central San Juan caldera cluster-regional volcanic framework: *in*

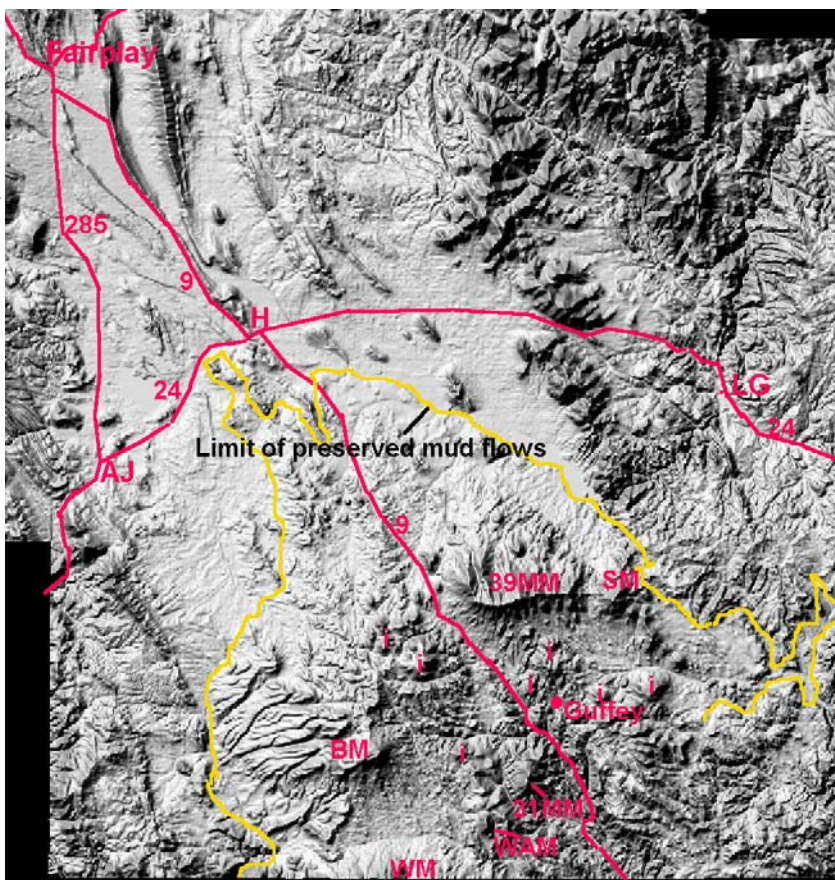


Figure 5. Physiographic map of southeast Park County. Map covers most of the Thirtynine Mile volcanic area. The first extrusive activity is at WAM= West Antelope Mountain center, a 250 meter (800-foot) high lava dome with extrusive ash, pumice and tuff. The second feature is labeled 31MM= Thirtynine Mile on the west flank; 39MM= Thirtynine Mile Mountain is on the north flank and SM= Saddle Mountain is on the northeast flank. Almost all of the south flank and most of the east flank has been removed by erosion. The limit of preserved mudflows (lahars) from the volcano is labeled. The volcano appears to have been fed by numerous intrusive vents, some of which are indicated by the 'i's. The Waugh Mountain center (WM is on the north flank) is the youngest feature of the volcanic area. It is described as several domes, necks and dikes of latitic to rhyolitic composition along pre-volcanic faults. The oval-shaped depression around the center of the Guffey volcano looks like a caldera, but Charles Chapin thinks (personal communication, 2004) that it is solely an erosional feature.

Ancient Lake Creede-its volcano-tectonic setting, history of sedimentation, and relation to mineralization in the Creede mining district: Geological Society of America Special Paper 346, p. 9-69

McGookey, D.P., 2002. Geologic Wonders of South Park, Colorado: Published by D. P. McGookey, 174 p.

McGookey, D.P., 2005, Lake Florissant's Big Neighbor and the South Platte River: Friends of the Florissant Fossil Beds Newsletter, Volume 2005, Issue 3, p. 1-12.

(Continued on Page 11)

## Guffey Volcano (Continued)

McIntosh, W.C. and C. E. Chapin, 2004, Geochronology of the central Colorado volcanic field: *in* New Mexico Bureau of Geology and Mineral Resources Bulletin 160, p.205-230.

*Figure 6. Looking northeast at Thirtynine Mile Mountain. Over 600 meters (2,000 feet) of layered, north dipping (10 degrees), mudflows, with a few lava flows, is exposed. The mountain is part of the north flank of the Guffey Volcano formed during the Upper member phase of the Thirtynine mile Andesite.*



*Figure 7. Outcrop typical of mudflow deposits of Thirtynine Mile Mountain. The matrix of the formation is mud that originally was volcanic ash. The blocks of igneous rock may have been extruded as breccia or may have been exploded as volcanic bombs.*

*Figure 8. This outcrop of breccia is along Park County Road 53, 24 km (15 miles) northwest of the Guffey Volcano. Other flows extended at least 38 km (24 miles) from the Guffey Volcano.*



## Two Lakes (Continued)

Why is the Antero worth studying, if it's so similar to Florissant and so difficult to collect? Because the Antero is even closer in time to the boundary between the Eocene and Oligocene geological epochs, comparing the two may tell scientists something about ecological and climatic change. At about this time, the global climate began cooling rapidly, so the Eocene-Oligocene boundary has long been an important topic of study for geologists.

During the summer of 2006, Florissant Fossil Beds National



*There are about 400 insects from the Antero at Yale University, and they are the best-studied Antero organisms. This insect collected last summer has not been identified. Photo: FLFO.*

Monument Paleontologist Dr. Herb Meyer led a preliminary collecting excursion to South Park with workers from the park and the Bureau of Land Management (BLM) in Canyon City, and geologists Dr. Charles Chapin, Dr. William McIntosh, and Dr. Donald Prothero. The trip's goal was to collect samples for Prothero's paleomagnetism research and to determine whether a comparison project with the Antero would be productive.

The Monument's paleontology program often works outside the park's boundaries to obtain information vital for understanding and interpreting the fossils of Florissant.

The excursion collected a few fossil conifer needles and many mountain mahogany leaves, as well as a few unidentified insects. Although this is not a large sample, it may suggest that the Antero flora was quite different from Florissant, perhaps growing in a cooler climate. Earlier work by Dr. Jack Wolfe supports this hypothesis.

The Monument expects to continue to cooperate with the BLM and the University of Colorado (CU), and serious collecting is planned for this summer. Dr. Dena Smith, Curator of Invertebrate Paleontology at the CU Museum, will be involved in the project.

Prothero's paper on paleomagnetism in the Front Range, including Antero and Florissant, will appear in the upcoming Geological Society of America Special Volume on Florissant, edited by

Meyer and Smith.

*Thanks to Dr. Herb Meyer for assistance with this article.*

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*Conifers previously identified from the Antero include redwood ( Sequoia affinis) and pine (Pinus). This fossil is tentatively identified as a sequoia. Photo: FLFO*



*This thorn is probably from a rose ( Rosa). Photo: FLFO*

## News (Continued)

employees and volunteers who work at the Monument are invited to make nominations.

Erica exemplified the best in service in the visitor center, on the trails and in her interpretation. If she didn't know the answer to a question, she would find the answer or find someone who could answer the question. She always went the extra mile, even connecting a young visitor who loved animals to a local animal shelter where he could help.

A geology class she took at Colorado College (CC) brought Erica to the Florissant Fossil Beds and sparked her interest in geology. After meeting Lead Interpretive Ranger Jeff Wolin at the Monument, she applied for an internship during the summer of 2006.

Erica said that she was scared to speak in front of people at first, but her internship as an interpreter was a great experience. At the beginning of the summer, she struggled to try and make her programs perfect. She soon realized that being passionate about your subject hooks the visitor. People really enjoy learning when they can see that the subject matters to someone else.

Erica graduated from CC in May 2006 with a degree in biology, and will soon begin her graduate studies in microbiology. We all wish her success and joy in her studies and hope that she will visit when she can. Her optimism and bubbly personality are missed.

### New Exhibits, Theater, and Interpretation Changes for 2007

by *Sally Maertens*

When I spoke to Lead Interpretive Ranger Jeff Wolin recently, he outlined the many exciting things that are happening in interpretation at Florissant Fossil Beds National Monument. Jeff has an incredible amount of energy, enthusiasm and creativity to contribute to the many projects the park has taken on. Jeff and Chief Ranger Rick Wilson recently spent 3 days at the National Park Service Regional Office in Denver learning about servicewide changes in interpretation. They both returned excited and enthusiastic about the new ideas.

By the end of April, the new theater in the visitor center will be open to show the park's film. The theater will be ADA-compliant, with a large screen and seating for 15. 13-minute film, "Shadows of the Past," was produced on a tight budget of \$15,000 (\$10,000 of which was donated by the Friends).

Jeff has also been working on new exhibits for the visitor center, in cooperation with Colorado State University—Fort Collins. If you have visited Florissant since the fall, you know that the large wall display of fossils has already taken down. These fossils were on loan from Waynesburg College and most will be returned, although some are being incorporated in the new exhibit.

The visitor center and the porch will have 5 new thematic exhibits with many fossils from the Monument's collection that have never been seen by the public. The new exhibits will be more

hands-on, informative and child-friendly. The park hopes to have all of these exhibits in place by the summer season.

Six new wayside exhibits for the Ponderosa Loop Trail are planned, and there will be new posters for the outside kiosks. One of the two yurts is up again near the administration building. The yurt will be used for large groups during inclement weather and as storage for all of the interpretation materials.

The summer interpretive staff will include seasonal rangers, a TRT (Teacher-Ranger-Teacher), a Student Conservation Association intern, and a Jr. Ranger Ambassador. The Jr. Ranger Ambassador will work on the Jr. Ranger program and will design a new Jr. Ranger booklet. The Friends will also be funding a paleontology intern again this summer.

### Monument Opens New ADA-Accessible Mountain Trail by *Melissa Barton*



Last September, the Monument officially opened the new Ponderosa Loop Trail, replacing the old Walk Through Time Trail, in conjunction with the Friends' annual picnic. The wide, paved trail winds through open ponderosa forest, denser Douglas fir and ground juniper, and past several fossil stumps behind the administration building.

"Part of our job is to provide for the enjoyment, education, and inspiration of visitors and future generations," said Lead Interpretive Ranger Jeff Wolin at the ceremonies. "That's what this trail is about. It's for kids, school groups, people not used to the altitude...it's for those people who arrive at 4:43. It's for everyone."

On the surface, the Ponderosa Loop looks like a wider version of the other major trails in the park, covered with pink Pikes Peak granite gravel. Appearances are deceiving, however. The gravel is consolidated with a special resin, so visitors with wheelchairs

*(Continued on Page 14)*

## News (Continued)



and walkers can comfortably and safely use the trail. This may be the first Americans with Disabilities Act-compliant mountain trail in the Pikes Peak region.

According to Chief Ranger Rick Wilson, the project was submitted for funding about 10 years ago. Under the oversight of facilities manager Ken Springer, CMS Construction of Colorado Springs constructed the trail last summer. The half-mile loop trail usually takes 15-30 minutes to walk, and a self-guided brochure is available from the front desk of the visitor center.

### **New Website Design Goes Live** by **Melissa Barton**

The Friends website is finally up again at [www.fossilbeds.org](http://www.fossilbeds.org) with a new layout and more information! The front page will have regularly updated news about the Friends and the Monument, and we welcome contributions of photographs and short articles (200-500 words) about events, experiences, history, science, wildlife sightings, and people. Contributions, corrections, and suggestions can be sent to me at [webmaster@fossilbeds.org](mailto:webmaster@fossilbeds.org).



**Reminder—20th Anniversary Celebration**, August 18, 2007 at the Monument.

## Advertising Rates

Business Card Size:	\$6.00
¼ Page	\$12.00
½ Page	\$24.00
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You may submit advertisements to: Steven Veatch, P.O. Box 5938, Woodland Park, CO 80866 or via email: [sveatch@fossilbeds.org](mailto:sveatch@fossilbeds.org).

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Please send your current email address to [sveatch@fossilbeds.org](mailto:sveatch@fossilbeds.org). This will allow us to send you reminders or events and important news items as they occur.

Please provide us with feedback on the newsletter or any topic you are interested in to Melissa Barton ([webmaster@fossilbeds.org](mailto:webmaster@fossilbeds.org)). We would also like to know who is interested in serving on various committees or on the Board contact Sally Maertens at the address to the left or my email to [sammckind@aol.com](mailto:sammckind@aol.com).

For questions, contact the Editor.

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The Friends of the Florissant Fossil Beds newsletter is published quarterly by the Friends of the Florissant Fossil Beds and is governed by the by-laws of the Friends. Articles appearing in the newsletter do not necessarily reflect the views of the National Monument, officers, members, or sponsors of the Friends.

## About Our Organization....

In 1987, the Friends of the Florissant Fossil Beds, Inc. was organized by a group of dedicated individuals interested in assisting the National Park Service in its mission to preserve and protect our national treasures. As a non-profit organization, the Friend's mission is to secure resources to help preserve the fossils and promote programs and activities that enhance the Monument's education, research, and scientific objectives.

Friends' groups help many of the National Park service areas in a variety of ways. Membership fees and donations to the Friends of Florissant Fossil Beds are used for:

- Environmental education programs
- Field seminars
- Year-round interpretive programs
- Jr. Ranger programs
- Paleontological and geological resources
- Natural history resources
- Publications

Past accomplishments and ongoing support by the Friends of Florissant Fossil Beds includes:

- Major funding of the yurt shelters
- Travel and research funding for the Monument's paleontologist
- Assistance in the purchase of an all-terrain wheelchair for handicapped visitors
- Financial support for the University of Denver's (fossil data) Digitization Project
- Purchase of furniture for the seasonal rangers and intern housing
- Funding for other special Monument related celebrations and special events (such as the dedication of the new stump exhibit area May 11, 2002)
- Planning, funding, and coordinating the Monument's 30th Anniversary Celebration (1999) and 35th Anniversary Celebration (2004)
- Funding for the Monument's newspapers each spring
- Funding and coordination of annual Summer Educational Seminars Program

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