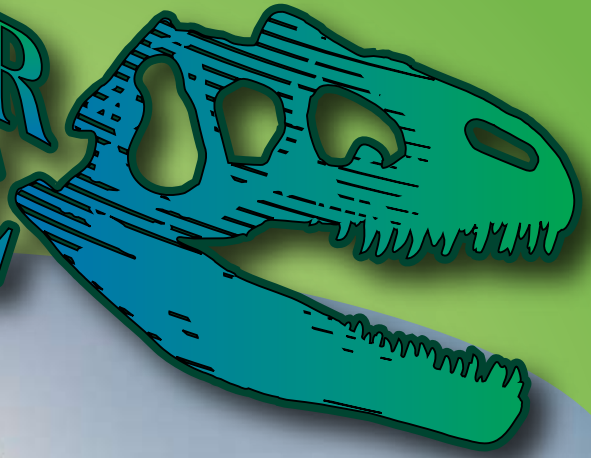


Volume 22, Number 3

DINOSAUR RIDGE



Ridge Report – Winter 2010

The mission of the Friends of Dinosaur Ridge is to preserve the paleontologic, geologic and historic resources on Dinosaur Ridge, Triceratops Trail and the outlier sites in the Golden-Morrison Fossil Area National Natural Landmark and to educate the public about these resources.

Friends of Dinosaur Ridge
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Phone: 303-697-3466
Web: www.dinoridge.org

Major Contributors:

- * Rocky Mountain Association of Geologists (RMAG)
- * Greater Denver Area Gem & Mineral Council
- * Jeffco Conservation Trust Funds
- * Scientific & Cultural Facilities District (SCFD)
- * Golden Civic Foundation
- * Dan & Mac Turner Estates
- * Xcel Energy Foundation
- * Western Interior Paleontological Society (WIPS)



**Scientific & Cultural
 Facilities District**

Making It Possible.

Cover Photo:
 Mr. Bones at Girl Scout Day

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- Clare Marshall
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- Tom Moglestad**
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- Curation/Ridge Report Editor
- Exhibits
- Tours, Events, Brochures, Posters, Signs

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Driver/Tour Guide	Amber Cain

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Mr. Bones eats Girl Scouts on Oct. 16th, 2010

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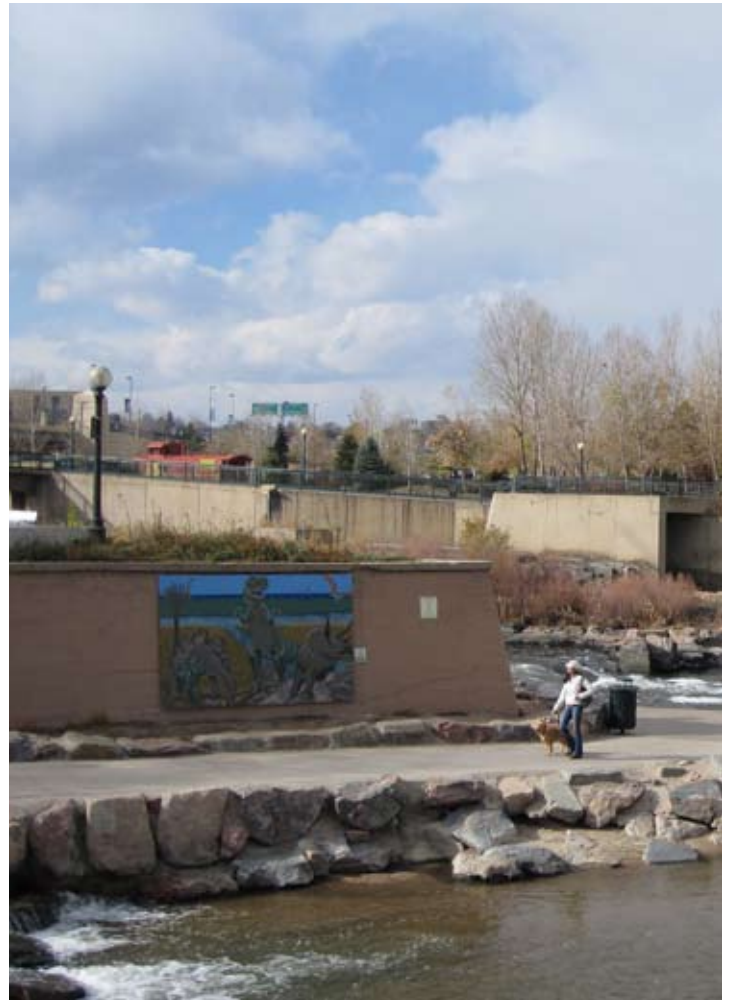
PRESIDENT'S MESSAGE

Volunteerism is the essence of the Friends of Dinosaur Ridge. Because of the tremendous commitment of our volunteers together with our programs staff, we have completed another record breaking summer and fall of programs on the Ridge. School tours are up 30% over 2009. Volunteers have been the key to our success, not only for this year but for each of the last 21 years, and will continue to be the heart and soul of the Friends of Dinosaur Ridge into the future. Thanks to all of the Dinosaur Ridge volunteers and to all of the volunteers from other organizations; you have been indispensable in supporting our quality programs throughout the years.

The number of volunteer hours and their monetary worth are extremely important factors in judging the impact of a non-profit. Each volunteer hour is worth somewhere between \$14 and \$20 when accountants figure the value of a non-profit's program. Thus, it is extremely important to accurately capture these volunteer hours. Over the years, the Friends of Dinosaur Ridge has estimated the ever-increasing number of volunteer hours that have been donated to our programs.

Our Development Committee is investigating methods to more accurately account for the donated volunteer hours. Board member Marj MacLachlan has volunteered to help us get started. The staff and committee chairpersons will tabulate the volunteer hours accumulated during the previous month and report these hours by individual to Marj, who will then sort, tabulate, and report them to the Board.

By next summer we hope to improve our tabulation of volunteer hours by having the individuals account for their own hours and report them directly to the program leads. Once we get the system in place, we will be amazed at the true value of volunteers to the Friends of Dinosaur Ridge. Also, as you start counting the volunteer hours that you are donating to Dinosaur Ridge, you too will likely be astonished at the actual number of hours and how fast they add up.



"This mural was sponsored by Marj MacLachlan and painted by Denver elementary school students and Emanuel Martinez in memory of Jim MacLachlan."

So far the gift shop is also having another record breaking year. With Christmas fast approaching, we can provide a one-stop shopping center for all of your Christmas needs. To round out the year, Roger has accumulated a vast, ever-changing and intriguing stock of unique dinosaur-related items: books, rocks and minerals, as well as shoes for the adventurous, dinosaur-trekking tykes. With this unique selection, I am sure that there is something in the gift shop for everyone on your Christmas list. So, please consider the gift shop at Dinosaur Ridge in your Christmas shopping plans.

-SAM BARTLETT

MANAGEMENT REPORTS

EXECUTIVE DIRECTOR'S REPORT

Grants Received:

- \$56,250 from the Scientific and Cultural Facilities District for general operations, school tours, and the Rooney Ranch book.
- \$30,000 from the Jefferson Conservation Trust Fund for the construction of the cover over the Palm Frond Wall at Triceratops Trail

Grants Committed:

- \$10,000 from the Gates Family Foundation for the construction of the cover over the Palm Frond Wall at Triceratops Trail.

Grant Application Submitted:

- \$10,000 to the National Park Service to install 60' of metal banding at the track site on Dinosaur Ridge. We will hear in November whether or not we will be funded.

Projects Completed:

- Interpretive kiosks on the east and west sides of Dinosaur Ridge. Eagle Scouts Ben Campbell and Spencer Cutright and their troops constructed these kiosks (see photos) and they are awaiting the interpretive panels.
- Interpretive kiosk at Triceratops Trail. Eagle Scout Jason Lindsey and his troop constructed this kiosk (see photo) and it is awaiting the interpretive panels.



- Busasaurus stop at the Visitor Center. This bus stop was constructed by Eagle Scout Justin Olson (see photo) and his troop and it is awaiting a couple of informational banners to be attached.
- Port-a-potty enclosure on Dinosaur Ridge. This wooden enclosure was constructed by Eagle Scout Will Smith and his troop.

Coordination with the Lariat Loop National Scenic Byway:

The Lariat Loop National Scenic Byway was selected as part of the final stage of the Quiznos Bicycle Race in Colorado next August. The stage begins in Golden and ends in Denver. There will be international press coverage of this event and some beautiful TV shots as they wind their way through Red Rocks Park and over Dinosaur Ridge.

-JOE TEMPEL



MANAGEMENT REPORTS

PROGRAM DIRECTOR'S REPORT

January – June, 2010 Visitation, Attendance and Sales

Program	2009 Jan – Sept	2010 Jan – Sept	Change
Visitors to Visitor Center	46,871	44,396	-5%
Tours (Total Attend.)*	24,524	31,654	+29%
Trek Through Time	17,684	17,641	0%
Chats, Hikes, Field Trips	202	177	-12%
Traveling Exhibit Visitors	2,200	2,100	-5%
Dino Discovery Days (5)	3,800	4,150	+9%
Triceratops Trail Day	100	61	-39%
Sales (\$)***	200,039	234,598	+17%

* includes guided school tours, shuttle bus tours and school outreach

*** includes receipts from Gift Shop, Shuttle Bus, School Tours, Birthday Parties and *Trek Through Time*

School tour attendance and shuttle bus ridership were both up significantly. Adding a third shuttle bus for the summer contributed to increased ridership; marketing to teachers may have increased the number of students on tours. Even with the June rainstorm, DDD attendance was up from a year ago; the addition of door prizes and interactive booths such as metal detecting and gold panning may have contributed to the increased attendance.

DDD-Geocaching

The weather was close to perfect on August 14th as an estimated 750 visitors stopped by the Visitor Center and/or the ridge trail. The sponsor, **Greater Denver Area Gem & Mineral Council**, gave away samples at the Visitor Center and at Eastgate. Participating partner, **Geocaching Colorado**, hid actual and temporary caches on the grounds and on the trail, gave demonstrations, loaned out GPS devices that were provided by the **USGS**, and donated several door prizes. Activities at the Visitor Center included gold panning, track painting, and fossil finding in the sandbox. For the third time this year **Lookout Mountain Nature Center** presented ecology on the ridge trail. Visitor **Ed Shank** won a Magellan Explorer GPS device valued at \$220 donated by Geocaching Colorado and Friends of Dinosaur Ridge. **Geocaching Colorado**, **Rocky Mountain Dinosaur Resource Center** and **Morrison Natural History Museum** donated another 13 door prizes, which were drawn for every 15 minutes. Thanks to **Kermit Shields** and **Sam Bartlett** for helping with the event including set

up and tear down. A Boy Scout troop cooked hamburgers and hot dogs for visitors and volunteers.



DDD-Reading

Again the weather cooperated on September 11th as an estimated 700 visitors either checked out the activities at the Visitor Center or on the ridge or both. **Mary Kuehner**, traveling librarian for event partner, the **Jefferson County Public Library** system, displayed the libraries' latest dinosaur books for kids and read to several young paleontologists. Thanks to event sponsors **Dinosaur Designs, LLC** and **Bandimere Speedway**. Member **DuWayne Ebertowski** brought his metal detector and facilitated the metal detecting activity at the entrance to the exhibit hall. **Ed Post**, **Blair Roberts** and **Sue Jenne** made sure that kids had fun learning to pan for gold. **Lou Taylor** conducted a used book sale as did **Martin Lockley**. To mark the day the most recent publication of the Friends

MANAGEMENT REPORTS

of Dinosaur Ridge, *The Rooney Ranch*, went on sale for \$9.95. This excellent 33-page paperback was co-authored by gift shop employee **John Davidson**, member **Katherine Honda**, and FODR secretary **Beth Simmons**.

More Wildlife – This time a bobcat

How do you top seeing bighorn sheep on Dinosaur Ridge, having a bear trash the dumpster, and watching raccoons nap in the grape arbor above the patio with picnickers dining below? How about having a bobcat dart across Alameda in front of the electric bus? Driver Ted Gildea reported that a bobcat stopped on the outcrops north of the track site and posed for pictures.

Trek Through Time Adds Dig Area

An 8'x8' sandbox was built in front of the exhibit hall to be used with an interactive metal detecting booth that was erected for a couple of Dinosaur Discovery Days. Between events kids would climb into the box sometimes bringing their own digging utensils from the trunk of the family car in order to dig in the barren sand. Meanwhile the casting volunteers led by **Doris Meakins**, **Karen Eberhardt** and **Sue Jenne** began replicating small fossils such as shark teeth, bivalves, mososaur teeth and ammonites and hiding them in the sand for our visitors – kids AND adults. Ultimately this dig together with a discussion of the Benton/Seaway mural has been incorporated into certain school tours.

-TOM MOKLESTAD

GIFT SHOP

As usual, the summertime in the Friends of Dinosaur Ridge Gift Shop was bustling with activity! The sales for July, August, and September saw dramatic increases! Many new items have been introduced thanks to Sue Kaberline's extensive collection of fossils and minerals, which are being sold on consignment. We have a few new children's items such as our glow-in-the-dark dinosaurs and dinosaur-shaped rubber bands (the latest fad) that have been selling as fast as we stock them! Come on by and check out some of our great merchandise!

— BOBBI KILGORE

DDD-GIRL SCOUT DAY

On October 16 the final Dinosaur Discovery Day of 2010 was attended by 700 visitors; about half were registered Girl Scouts, their family members and scout leaders and the rest were from the general public. Many thanks to the sponsors: the **Rocky Mountain Association of Geologists (RMAG)**, the **Association of Independent Professional Geologists (AIPG)**, and the **Association for Women Geoscientists (AWG)**.

In addition to Rocks and Roles for the Girl Scouts, national and international events were celebrated – National Fossil Day together with Earth Science Week, International Astronomy Day and World Space Week. **The National Park Service (NPS)**, organizer of National Fossil Day, led a fossil activity and the **American Geological Institute** and the **United States Geological Survey (USGS)** provided thick informational packets, "Exploring Energy," for Earth Science Week. A popular astronomy section had activities led by Dale Moser from the **Planetary Society** assisted by **Brian Marshall**, and **Fred Olson** from **Fred Olson Meteorites**, and **Janie Bennett** and **Blair Roberts** from FODR.

Visitors learned about careers in earth science and how to identify rocks, minerals and fossils. They sifted for small fossils, panned for gold, and over 300 of them toured *Trek Through Time*.

Thanks go to the **National Speleological Society** for their presentation about a new disease threatening cave bats and to **Colorado Groundwater Association** for an interesting demonstration of factors affecting the quality of groundwater. Thanks once again to the **Legendary Ladies**, who wowed visitors with period costumes similar to clothing worn a century ago by early female earth scientists, and thanks to **Mr. Bones**, whose boney skeletons slinked about the grounds.

Thanks to the **Thunder Valley Moto-Cross Park** for donating off-site parking and to **Boy Scout Troop 537** for feeding visitors and volunteers. Thanks to the more than **80 volunteers** who helped on the trail and at the visitor center and who were indispensable to the success of this event.

-TOM MOKLESTAD

CALENDAR OF EVENTS

FIRESIDE CHAT SCHEDULE

All presentations will be at the Lutheran Church of the Master, northeast corner of Bear Creek Parkway, West Jewell Ave and Alameda Parkway, at 7:00 PM.

Tuesday, November 30, 2010 – Booksigning and Presentation -- **Gary Raham**, author of “The Dinosaurs’ Last Seashore.” Gary is a noted author of children’s science fiction books, including “Deep Time Diaries,” illustrated with his own diagrams and drawings. “The Dinosaurs’ Last Seashore,” a coloring book and reading adventure, records the observations of a time traveler along the Western Interior Seaway.

Tuesday, January 25, 2011 – Presentation – **Dr. Whitey Hagadorn**, Denver Museum of Nature & Science, “Death of a Megapredator.” Debunking, downsizing, and constraining the record of predation in the Paleozoic, with emphasis on showing that the famous predator *Anomalocaris* of Burgess Shale fame was not a ferocious trilobite-eater.

Whitey is the new Curator of Earth Sciences at the Denver Museum of Nature & Science. A broadly-trained geoscientist with interests in understanding surface-earth processes, both in deep time and today, Whitey’s scholarship focuses on how animals and microbes first colonized land, what prevegetated coastal systems were like, and why organisms began building biomineralized skeletons. He also has strong interest in science communication and in helping others become informed citizens of the planet. As a recent transplant to Colorado, he is excited to be at DMNS, and to have the opportunity to explore and work with the amazing geology of the Rocky Mountains.

Tuesday, February 22, 2011 - **John Ghist**: “The Life and Times of Geologist Edwin D. McKee”. An FODR board member and long-time award winning science teacher, John researched and archived McKee’s papers at the U.S. Geological Survey and National Park Service during the summer of 2010 as part of the Geologist in the Parks program.

Wednesday, March 16, 2011 – Friends of Dinosaur Ridge Annual Meeting. Speaker to be announced

-BETH SIMMONS

Teacher Enhancement Course Scheduled For May 2011

Lou Taylor will teach an introductory course that includes field trips on Dinosaur Ridge and Triceratops Trail. Designed for teachers from K-12, the course will be held at the Dinosaur Ridge Visitors Center. Participants will receive 1 semester hour of continuing education credit from Colorado School of Mines.

Introduction To Paleontology And Geology (K-12)

CSM Course CT-1015-10S

Dates: Saturday, May 14, 2011 & Saturday, May 21, 2011; 8:00am-5:00pm

This introductory lecture and field trip course will focus on fossils (history, classification, and evolution) and rocks (stratigraphy and sedimentology). Field trips to Dinosaur Ridge and the Triceratops Trail in Golden will reinforce the classroom lectures.

For more information and to register go to <http://te.csmospace.com/register.php> -- e-mail te@mines.edu -- phone 303-279-3855 – write Teacher Enhancement Program, Office of Special Programs and continuing Education, Colorado School of Mines, 1600 Jackson Street, Suite 160A, Golden, CO 80401

ARTICLES

MESOZOIC MOMENTS

MeMo #16

The Bone Wars – Marsh vs. Cope

O. C. Marsh (1831-1899) and E. D. Cope (1840-1897) were the two most famous American vertebrate paleontologists in the second half of the 1800s. Their spectacular scientific successes were moderated by the incredible feud that developed between them – the Bone Wars. This feud is well documented in many books, including “The Bonehunters’ Revenge”⁽¹⁾ and “The Gilded Dinosaur”⁽²⁾. These books, published in 1999 and 2000, respectively, are remarkably similar in story line, quoted passages, photographs and conclusions. Both also take many detours to talk about Indian wars, railroads, development of the West, politics, and other sciences. I found “Bonehunters” to be more readable. A more concise summary of the Bone Wars can be found online in Wikipedia⁽³⁾.

There are a few possible misconceptions about this feud. The conflict did not start over dinosaur fossils; it developed well before the 1877 dinosaur discoveries in Colorado and Wyoming, when Arthur Lakes and Dinosaur Ridge played a small part in this feud⁽⁴⁾. Marsh and Cope were both famous for work in the Tertiary section in areas such as horse evolution and bird evolution. While they both had exciting field seasons in the Rocky Mountain region, most of these were before 1877; after which they paid collectors to do their field work. ^(1,2) Although their major summer-long expeditions may have ended, they still traveled to the west for reconnaissance and politicking⁽⁵⁾.

There was a positive side to this Marsh-Cope competition. Each produced an incredible record of discovery. Marsh named 86 species of dinosaurs; Cope named 56. Cope wrote over 1200 scientific papers; Marsh wrote 270, some of which were comprehensive monographs. They both were instrumental in creating ideas for classification of ancient life and for providing data in support of new ideas about evolution. ^(1,2) To put this in perspective, prior to Marsh and Cope there were only nine dinosaur species named in North America.⁽⁶⁾

There was also a negative side. Their smash-and-grab method of retrieving fossils ruined much evidence that modern paleontologists would love to have. Their rush to name and publish new species often led to critical mistakes. Marsh

was happy to point out that Cope reconstructed an *Elasmosaurus* in 1869 with the head at the wrong end of the spine. Marsh later created his *Brontosaurus*, in 1883, by putting the head of a *Camarasaurus* on the body of an *Apatosaurus*. In fact, of the 26 genera of dinosaurs that Cope named, only three are still considered to be valid. Both paleontologists had so many fossils that they were unable to describe them all; many boxes remained unopened at their deaths. ^(1,2)

Another interesting book titled “The Bone Wars” is a good read, but has only a small bit of coverage of the Marsh-Cope conflict in the first chapter or two. Most of the book is about Carnegie’s quest to get a good *Diplodocus* skeleton for his personal collection and most of this story occurred after the death of both Marsh and Cope. This book was reviewed in our 2003 Annual Report. ⁽⁷⁾

The story of the personal and scientific conflict between Marsh and Cope is fascinating on many levels and can be a valuable addition to many of our talks on the Ridge.

Visit the MeMo repository in the Dinosaur Ridge Volunteer Room.

-KERMIT SHIELDS
October, 2010

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- ¹ Wallace, David Raines, 1999. *The Bonehunter’s Revenge – Dinosaurs, Greed and the Greatest Scientific Feud of the Gilded Age*. New York: Houghton Mifflin.
- ² Jaffe, Mark, 2000. *The Gilded Dinosaur – The Fossil War Between E. D. Cope and O. C. Marsh and the Rise of American Science*. New York: Crown Publishers.
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- ⁷ Bartlett, Sam, 2003. *Bone Wars Review*. Dinosaur Ridge 2003 Annual Report.

ARTICLES

VOLUNTEER NOTES

Why Volunteer at Dinosaur Ridge?

There are a lot of reasons why people volunteer. They may want to find a way to keep busy. Or have an excuse to get out of the house. Or build up some mileage for a tax deduction. Or meet friends and socialize. Or interact with visitors from all over the world. Or maybe their spouse just tells them to go do something - "just get out of here and do anything!" There is nothing wrong with any of these reasons.

At Dinosaur Ridge, it sure looks like many of the volunteers are putting in long hours, sometimes in less-than-ideal conditions, for many reasons that are even better.

I see volunteers who are really dedicated to teaching children and adults about how science works, about the geologic principles that are demonstrated by our outcrops, and about the unique vertebrate paleontology and ichnology of Dinosaur Ridge. I see volunteers who are committed

to getting kids outdoors to appreciate our great Colorado environment, even though some of our guests may not seem very prepared for outdoor learning. But, that is all part of the education we offer. I see volunteers who have benefited from their own educational and work experience in the geologic and natural sciences who really want to pass on their knowledge to others. I see volunteers who are concerned about the preservation of the Ridge and want to show our guests why we need save our site. I see volunteers who really love Dinosaur Ridge and want to pass on that feeling to others.

For those of you who have made the commitment to help by volunteering your time, thank you so much. We couldn't do it without you. And for those of you who are not yet volunteers, please consider coming in and talking to us about the many opportunities that are available to you.

-KERMIT SHIELDS

GEOBIOLOGY:

MICROBIAL MATS IN SANDY DEPOSITS FROM THE ARCHEAN TO TODAY

By Nora Noffke: REVIEW by Beth Simmons

Springer Publications, Berlin, Germany. 8.5" X 10", 194p, richly illustrated, \$126 American

In May of 2010, the Friends of Dinosaur Ridge had the pleasure and honor of hosting Dr. Nora Noffke, her Old Dominion University graduate student Joyce Strain, and a convention of geobiologists "on the Ridge." They studied the array of ripple marks and evidence of bacterial mat development in the ancient tidal flat that we call the Dakota Sandstone. Dr. Noffke has established landmarks in the study of bacterial mats, from the modern shorelines of Europe, North America, and Australia to the ancient shoreline of the 2.9 billion year old Pongola Supergroup in South Africa. Her studies have encompassed almost two decades, have taken her around the world, and allowed her theories to grow into a set of facts that extend the time of life along shorelines far back into Precambrian time.

Cyanobacteria (blue-green algae) create mats in the sandy upper most upper tidal zone and the lower supratidal zone of interwoven filaments and biofilms around quartz grains.

Below the tide line, where the water action is too variable for mat development, biofilms coat sand grains, but don't grow into mats. In the upper reaches of the quieter tide zone, different genera of bacteria create two prominent different types of mats. *Oscillatoria limosa* lives in the lower of the two zones just below the spring high tide line in endobenthic mats which do not rise above the sediment surface but bind it together. Just above the spring high tide line where the tidal flat may be exposed for up to months, *Microcoelus chthonoplastes* grows in epibenthic mats that grow above the sediment and water interface.

Sedimentary deposits controlled and created by these mats, called "microbially induced sedimentary structures" (MISS), exhibit standard physical characteristics, growth layers, and grain size distribution, in addition to enclosing the fossil filaments of the bacteria. Ripple marks in such mats are distinctly different than ripple marks in "naked sand." When the mat breaks down, usually as a result of seasonal changes, chips break off; they are rolled around by the currents onto the main mat where they decay and leave their distinctive shape in the fossil record. Tufted mats of the supralittoral zone impart a characteristic surface on the sand of the tidal flat, as do polygonal oscillation cracks on the surface of a decaying mat. One interesting structure Nora showed us "on the Ridge" were "gas domes" where the gases from the decaying mat gather under

Continued on next page

ARTICLES

Continued from previous page

the mat and buoy it upward until it usually finally bursts and leaves a small hole or triangulated pattern on the mat surface.

At a special Fireside Chat, Dr. Noffke shared the most enlightening result of her amazing research - the discovery of the oldest cyanobacteria deposits on Earth, recognizable and definable MISS structures in the slightly metamorphosed 2.9 billion year old Nhlazatse Section of the Pongola Supergroup, a Geological World Heritage site in South Africa.

Read her book to learn more about the role of bacteria in sediment accumulation, trapping, baffling, and cementation. You will be sure to be amazed. We look forward to hearing what results Joyce discovers in her study of the microbial mats in the Dakota formation.

JOHN M. KELLY – IN MEMORIAM

The Friends of Dinosaur Ridge lost an enthusiastic and dedicated volunteer guide and Board member when John Kelly, Geologist, passed away September 4, 2010. His service spanned almost two decades.

John was born in San Francisco in 1928. He was a member of the “Greatest Generation” as his family endured the depression and John later enlisted in the Marine Corps near the end of WWII. He served in China and then attended the University of Kansas. While at Kansas he was recalled by the Marine Corps for service in the Korean War. He was proud of his service as an amphibious tank commander and driver, and this fall John was looking forward to attending a 60-year reunion of veterans of the Inchon invasion.

From early childhood, John had a natural curiosity that propelled him into his life-long pursuits in science. For example, at age 9 on a walk with his family across the newly built San Francisco Bay Bridge, John put his head through the railings and ironwork to investigate the underpinnings of the bridge. Realizing that he could not withdraw his head from the bridgeworks, the emergency brought the police, engineers, and fire department with saws and other equipment to the scene. Finally, when the firemen applied a liberal amount of grease around his head, John was released from the grip of the bridge railings to the relief of his family.

Upon receiving his Masters degree from the University of Nevada, he joined the Chevron Oil Company as a geologist. While working as an exploration geologist in the Salt Lake City area, he met and married Barbara, who preceded him in death. They had two sons, Sean and Scott.

Later, while based in Denver with Chevron, John joined FODR as a volunteer guide because of his interest in interpreting the examples of geology and paleontology and for making it a meaningful experience for visitors and school kids. John enlisted a number of other geologists to serve as volunteers at the Ridge.

John had a passion for working with school kids and enjoyed involving them in his presentations especially at his favorite location – the bone site. As a Board member, he was the prime advocate for the bone site as an important facet of our outdoor laboratory. When preservation and interpretation of the track sites was discussed at Board meetings, John would expound, “Don’t forget the bones – they are the actual parts of the dinosaurs, not just the traces of dinosaurs passing by.” John was known for his Irish humor and willingness to express himself during Board discussions.

John was a vociferous advocate for investigating the subsurface rock in areas where the Board was considering relocating the visitor center. He became a member of the evaluation committee and insisted on drilling boreholes to test the substrate for evidence of expanding clays and potential sliding surfaces.

We will remember John for his dedication to the mission of preservation and education on Dinosaur Ridge. A memorial fund has been established in John’s name to provide for additional equipment, perhaps signs and other items for use at the Bone Site. Contributions may be made to the Friends of Dinosaur Ridge in memory of John Kelly.

-NORBERT E. CYGAN,
November 9, 2010

ARTICLES

THE DINOSAUR TRACKS OF DINOSAUR VALLEY STATE PARK, TEXAS

History

The first discovery of tracks in the Glen Rose area of Texas was made by a truant schoolboy in 1908. While playing hooky, George Adams found some large three-toed tracks and reported them to his teacher (we do not know what the punishment from this escapade was). Eventually articles about these and other tracks in the Paluxy River bed were published by Ellis W. Shuler of Southern Methodist University, but they did not make much of a splash in the scientific community.

In 1938, Roland Thaxter Bird of the American Museum of Natural History rediscovered the dinosaur tracks on the Paluxy River near Glen Rose, Texas, within the area of present day Dinosaur Valley State Park. Bird returned in 1940 with a WPA work crew to begin uncovering several trackways in the river bed. By the end of the season, Bird had mapped a large trackway and removed portions of a sauropod trackway that contained also contained theropod tracks, possibly in pursuit of the sauropod. This trackway was collected and later reassembled for display at the American Museum of Natural History in New York.

Paleoenvironment

Prior to the Early Cretaceous, much of central Texas had been dry land, eroded by numerous rivers and streams into a relatively flat surface. During the early Cretaceous, this flat land surface was alternately flooded and drained by advancing and retreating seas with an increasing trend of submergence. As sea level changed, the marginal marine and coastal habitat shifted accordingly. The rocks resulting from these changing shorelines belong to the Comanche

Series of which the oldest assemblage is the Trinity Group. The dinosaur trackways found at Dinosaur Valley State Park occur within the Glen Rose Limestone of the Trinity Group, and are estimated to be older than 100 million years old.

The Glen Rose Limestone represents a low lying coastal environment associated with a Cretaceous sea advance. Offshore of this coastal area lay a belt of bivalve-constructed reefs. Between the reef and shore were shallow-water marine lagoons, and closer to the shore were tracts of limey mud flats and salt marshes with mangrove like vegetation. Dinosaurs often moved across these mud flats, leaving their trackways as evidence.

Types of Tracks

In addition to frogs, salamanders, turtles, lizards, crocodilians, pterosaurs, and mammals, three types of dinosaur tracks have been found within the marginal marine rocks of the Trinity Group at Dinosaur Valley State Park. The majority of the dinosaur tracks in the Paluxy River bed belongs to large theropods and is attributed to the Early Cretaceous dinosaur *Acrocanthosaurus*. Other large bipedal tracks belong to ornithopods and are attributed to Early Cretaceous iguanodonts, possibly of one of the three species of *Iguanodon*. The third type of dinosaur tracks belongs to sauropods.

The sauropod trackways at the site were originally ascribed to *Pleurocoelus*, remains of which have been found in a few locations in Texas, including a mass accumulation near Stephenville. However, in 1996 paleontologists from Southern Methodist University and the Fort Worth Museum of Science and History excavated a new sauropod species, *Paluxysaurus jonesi*, farther up the Paluxy River, not far from Dinosaur Valley State Park. This new species, described by Southern Methodist University student Peter Rose, now is believed to be the track maker at Dinosaur Valley State Park

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and was subsequently named the official Texas state dinosaur in 2009. The *Paluxysaurus* specimen currently is on display at the Fort Worth Museum of Science and History.

One of the more curious features of many of the Glen Rose tracks is the narrow, slit-like toe impressions. Apparently after the dinosaur foot left very soft limey mud, the sediment started to deform and flow back into the toe portions of the tracks prior to lithification. This feature gives some of the tracks the appearance of being formed by extremely narrow toed dinosaurs.

Many of R. T. Bird's observations led to reinterpretation of dinosaur behavior, particularly behavior of the sauropods. Resulting reinterpretations included the ability of the large sauropods to walk upright on land rather than living semi-submerged in lakes or lagoons and the possible herding instinct of large sauropods.

Site Description

Dinosaur Valley State Park is part of the Texas State Park System and is very well maintained. Texas probably has one of the best state park systems in the nation. Their parks are clean, well maintained, diverse with good interpretations, and do not seem to want for funding. I would not hesitate to recommend any of these parks for visitation.

Currently there are four sites of viewable trackways at Dinosaur Valley State Park. At the first site, only a few theropod tracks are evident adjacent to a swimming hole in the river. The second site is the largest and most easily accessible. It contains sauropod as well as theropod tracks although many have been previously removed. The third site is viewed from a bluff overlooking the river and is closed due to bluff erosion with the viewing site being fenced off. The fourth site has the most distinct theropod trackways, but all of the tracks were underwater and the site was hard to

access.

Glen Rose is also the site where prehistoric "human" footprints were purported to have been found adjacent to the dinosaur tracks. As a result of this find, there is a creationist museum of natural history just down the street from the Park entrance. Fortunately it was closed when we visited.

Kuban (1996-2010) notes that the alleged human tracks are actually elongated dinosaur tracks, the result of erosion, indistinct markings of unknown origin, and doctored and/or carved.

Preservation

The original trackway noted by T.R. Bird was not totally exposed when discovered. The method of preservation was to construct a cofferdam to expose the trackway, uncover it, break a portion of the trackway into smaller pieces, wrap the pieces in plaster and burlap or paper, remove them to the American Museum of Natural History, unwrap the pieces and fit the trackway back together. The remainder of the uncovered slab was left in place but is currently not accessible to the public. Consequently we do not know its condition. It appears to be flooded so presumably it should be in similar condition to the accessible trackways at the park.

This method of removal to a distant site has several advantages as well as several disadvantages. One advantage is to get the original slab removed from the natural elements and install it in a climate-controlled environment. This method also allows more visitors over the years to view the tracks than if it had been left in situ; as long as it remains part of the viewing area of the American Museum of Natural History exhibit and is not shuffled off to storage. The currently displayed trackway is used as a base for the display of dinosaur skeletons at the American Museum of Natural Science and as such its significance may be missed by many of the viewers.

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Unfortunately the disadvantages of track removal may outweigh the advantages. First, if the tracksite had been left unexposed it would probably have remained protected and viable for the very long-term, much like the unexposed tracksite north of the main tracksite on Dinosaur Ridge. However, leaving the trackways unexposed would preclude scientific study and viewing by the public. Next, the method of removal was extremely primitive and probably did more harm than good to the trackway. Sledge hammers and pick-axes and other destructive tools were used to create very ragged, highly fractured and broken blocks of rock; thereby, removing and destroying a good portion of the rock that might have been useful for paleoenvironmental studies. In addition, R. T. Bird's discovery and lack of long range planning lead to many of the original tracks being removed for sale as souvenirs over the years, thus diminishing the value of a portion of the trackways.

One of the park signs touts the fact that the tracks have been so well preserved because they remained underwater. There appears to be some merit to this claim. However it is more likely that the river "giveth and taketh away." During periods of large floods, some of the exposed tracks may be washed away and at the same time previously covered tracks may be exposed, leaving the impression that the tracks remain in a well-preserved condition. Whatever the case, the tracks at Dinosaur Valley State Park appear to be in much better condition than those observed in other parts of the Glen Rose Limestone, throughout the Texas Hill Country. Our visit was in late fall when the water in the river should have been its lowest during a drought year and most of the tracks were still underwater and appeared to be little affected by weathering.

One exception is a current effort to expose more tracks at site number two. No obvious efforts have been put in place to

preserve the tracks and the tracks are several feet above the low-water level. These newly exposed tracks may not survive the test of time without some kind of protection.

Presently a team of paleontologists, led by James Farlow of Indiana-Purdue University, is working to estimate the number of individual dinosaurs recorded by the Paluxy tracksites and to learn more about the behavior of either sauropods or theropods. The group also is interested in investigating the possibility that the trackway preserves the possible pursuit of a sauropod by a theropod.

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*Figure 1
Dinosaur Valley State Park
The original trackway excavated
by R. T. Bird in 1940.*



*Figure 2
Dinosaur Valley State Park
Theropod Track with Deformed outer edges*



*Figure 3
Dinosaur Valley State Park
View of reconstructed trackway at visitors center*

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