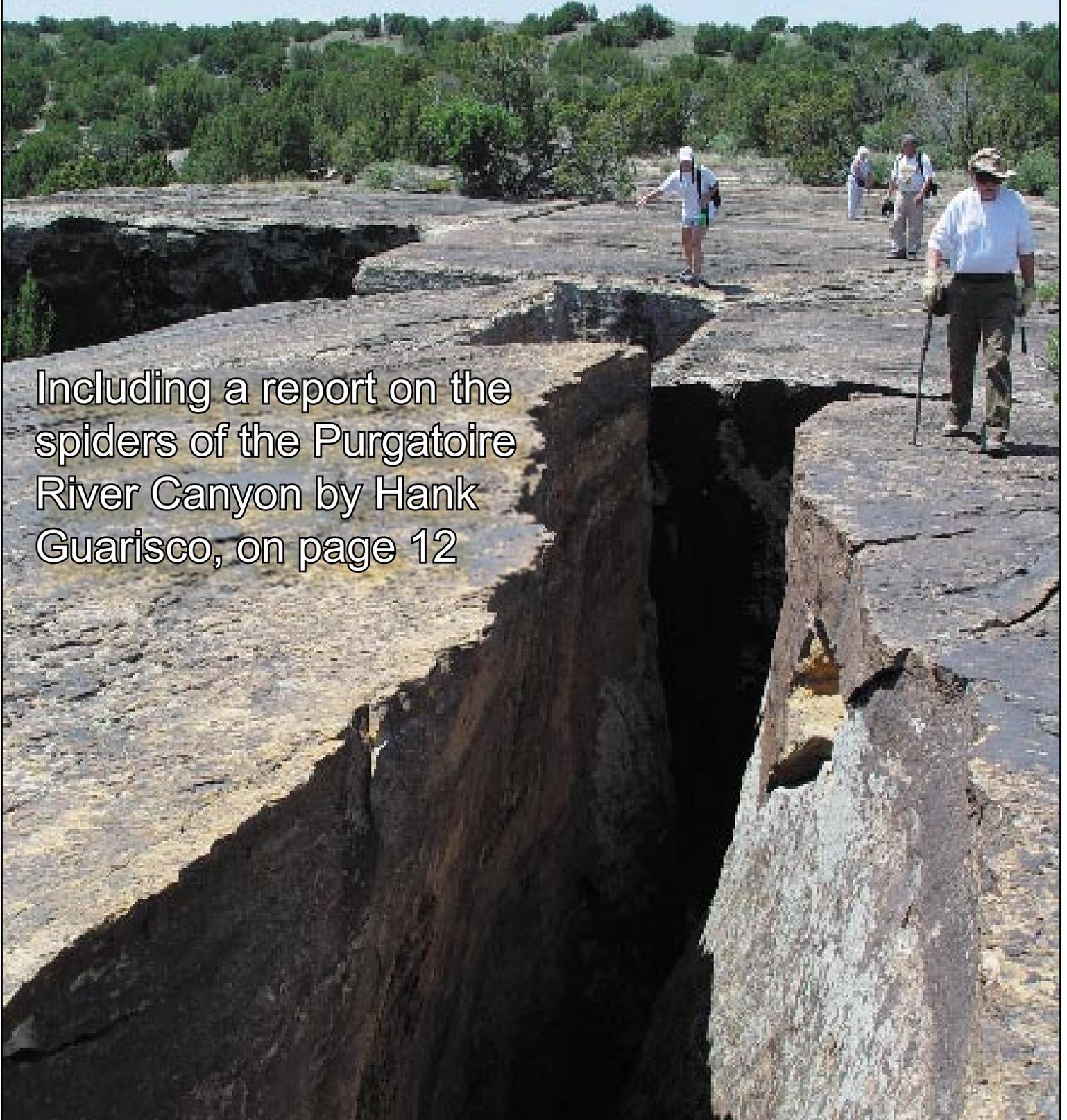


Comanche National Grassland Dinosaur Excavation Project

Field seasons 2002, 2003, and 2004

By Greg Liggett

Including a report on the
spiders of the Purgatoire
River Canyon by Hank
Guarisco, on page 12



Overview

This project is the latest product of a strong, ten-year partnership between the USDA Forest Service and Fort Hays State University's Sternberg Museum of Natural History. The partnership arose from the shared goals of the organizations to do the following: to discover and document the fossil resources found on land controlled by the Forest Service; to map the geologic units on Forest Service lands and assess their paleontologic potential; to identify any protection needs for those resources to preserve them from potential threats including erosion, vandalism, and theft; and utilize the resources for scientific and educational programs for the benefit of the public at large. Toward those ends a number of innovative projects have been undertaken with great success.

For example, parties from FHSU under contract with the Forest Service mapped the geologic units of the canyon and assigned a paleontologic potential index to each unit. That work provided a theoretical fossil resource potential map for land-use planning.

The relationship established between the partners is a model of cooperation between organizations interested in fossils, science, and public education. Such cooperative programs allow each of the entities to fulfill their separate missions of service to the public, while at the same time stretching their limited resources for maximal benefit. In the end, the citizens of the United States benefit through the preservation, research, and education done on our natural heritage in programs like this one.

This report documents the results-to-date of the most recent Challenge Cost Share (02-CS-11021206-006) agreement between the two organizations. This agreement arose after the Forest Service led a Passport In Time (PIT) program designed to survey for promising sites in the Purgatoire River valley in 2001. That initial survey identified a site with a large quantity of fossil material weathering out. The site looked promising for excavation and was designated CNG-007. The specimen was informally dubbed "Woody" and its excavation was begun in 2002.

The Forest Service offered the opportunity to work on the dinosaur to PIT volunteers and Sternberg Museum used this first year of excavation as an



Volunteers, teachers, and "Dino Bee" winners join together at the CNG-007 site to begin the excavation of "Woody" in 2002.

educational opportunity for teachers and winners of a museum-sponsored "Dino Bee." A similar continuing education program for teachers had been offered by the museum on previous digs, but this was the first time the dig opportunity focused on a dinosaur fossil. Teachers, primarily from Kansas, were invited to submit an application and be selected for the program. They were selected based upon their commitment to using their dig experience in their own classrooms in the coming school years. In this way, the experience that was offered to a dozen or so teachers was guaranteed to have spin-off value to many school students for years to come.

As part of their continuing education program, the teachers were given a lecture on dinosaurs and their biology prior to coming to the dig. They were informed of what the dig experience would be like, given lists of materials and equipment to bring, and warned of some of the dangers inherent in any outdoor activity. As a follow up to the dig, the teachers presented an example activity that they planned to do with their own students based upon their experiences.

In addition, the museum had sponsored its first "Dino Bee" in conjunction with its "Dinosaurs of Jurassic Park" exhibition. The bee was a general dinosaur knowledge test with contestants qualifying through an on-line quiz. Those that qualified were invited to the museum for a live quiz with celebrity

judges. The first-place winners of the Dino Bee and an adult escort were invited to participate in the 2002 excavation in the Purgatory canyon. The museum was able to secure additional support for that year's excavation from Dinosaur Productions, Amblin Entertainment, and Universal Studios through the Jurassic Park exhibit tie-in.

With the success of the first year at the CNG-007 site and the location of additional promising localities in the canyon, the field crew returned in 2003. During the 2002-2003 seasons of excavation at CNG-007, enthusiastic volunteers moved a tremendous volume of rock in a quarry area of approximately 128 m² (1,378 ft²). Because we surveyed the sites in detail, we can report that a volume of 103 m³, or approximately 3,640 ft³, was removed from the quarry during excavation. This is equivalent to digging a basement with dimensions of 30 feet by 16 feet to a depth of 8 feet. Feeling confident all fossils at the site were collected, CNG-007 site was closed during the 2003 field season, and the excavation site was covered by Forest Service personnel.

The CNG-007 specimen, Woody, curated into the Sternberg Museum as specimen VP-14850, consists of several large vertebrae, a femur, ribs, and pelvic bones. Preparation of the specimen is on-going, with the work being done by volunteers and students at FHSU's Sternberg Museum of Natural History. The work is an excellent opportunity for students to learn basic preparation techniques. The majority of the work is being done in the museum's public demonstration laboratory, so the public too can see and learn from the preparation of the fossils.

It is extremely popular with the public when work of this sort is accessible to them, and they particularly like to ask questions and interact with museum staff. That interaction allows staff members to talk about continued collection activities, dinosaurs, and this project and partnership with the Forest Service.

Woody was utilized by a graduate student doing research on *Camarasaurus*, a long-necked dinosaur (sauropods) from the Jurassic Period (206-144 million years ago). The Morrison Formation, the rocks in

which the specimens were found, represents a time span of approximately 3-5 million years within the Late Jurassic, roughly 153-150 million years ago. Takehito Ikejiri finished his Master's thesis in 2004, and it is his opinion that Woody is a *Camarasaurus*, likely *Camarasaurus supremus*. Many individuals of this type of dinosaur have been found from the Jurassic of North America, but even so, the exact number of and relationship between the species is uncertain. Woody added important information about the geographic and geologic range of this common dinosaur as it is one of the eastern-most occurrences of the dinosaur within the Morrison Formation, and it has detailed stratigraphic data.

With the CNG-007 site playing out, another promising site was opened in 2003, the Herrell's



Branson Barnum, one of the "Dino Bee" winners, gets some hands-on experience digging for dinosaurs.

Road Cut Site (HRC). This site was first discovered many years ago by survey crews from Colorado State University conducting a reconnaissance survey. With a crew of excavators on hand, it was an ideal time to shift some of our team's focus to this site. The first year's excavation revealed several dinosaur bones from the carnivore *Allosaurus*. In all, the specimen consists of a femur, tibia, calcaneum, and fragmentary vertebral material. Presently, the material is in the possession of the Forest Service, but at some future

date it is destined to be curated into the Sternberg Museum.

During the excavation of this site a curious set of stones was recovered. The stones do not appear to be part of the primary sediment of the site, that is, they do not appear to have been deposited by the same natural sedimentary processes which buried the bones. It is possible that the stones are gastroliths, or stomach stones, which were carried in the digestive tract of the *Allosaurus* or some other dinosaur and buried along with the specimen.

The stones are all highly polished, average from approximately from 1 to 6 cm in diameter, and are mostly of black or red silica. The sizes of the stones are unusual compared to the rest of the sediment containing the specimen, and the polish and composition are consistent with them being used as digestive aids. Similar stones have been found in the fossil record in a wide variety of animals including dinosaurs, and marine reptiles, and they are found today in birds and crocodilians. While the suggestion that these stones are gastroliths is compelling, it is not conclusive. Additional work on the stones is planned, and as the excavation at the site continues, additional evidence to support or refute this hypothesis will be gathered.

The HRC site was opened in 2003, and revisited in 2004, but it has not been completely excavated to the satisfaction of the crew leaders. More fossils are likely to be found there, and work will continue in the future.

Another promising site was opened in 2004 and it was the focus of most fieldwork during two expedition periods for 2004, one in both May and October. All of the field notes and materials collected during 2004 are already in the possession of the Forest Service, so little can be added here.

Following are detailed accounts of the excavations and surveying methods used at both the CNG-007 and the HRC sites. All digital data, including photographic documentation and Geographic Information System data have been provided to the Forest Service on CD.

Site CNG-007

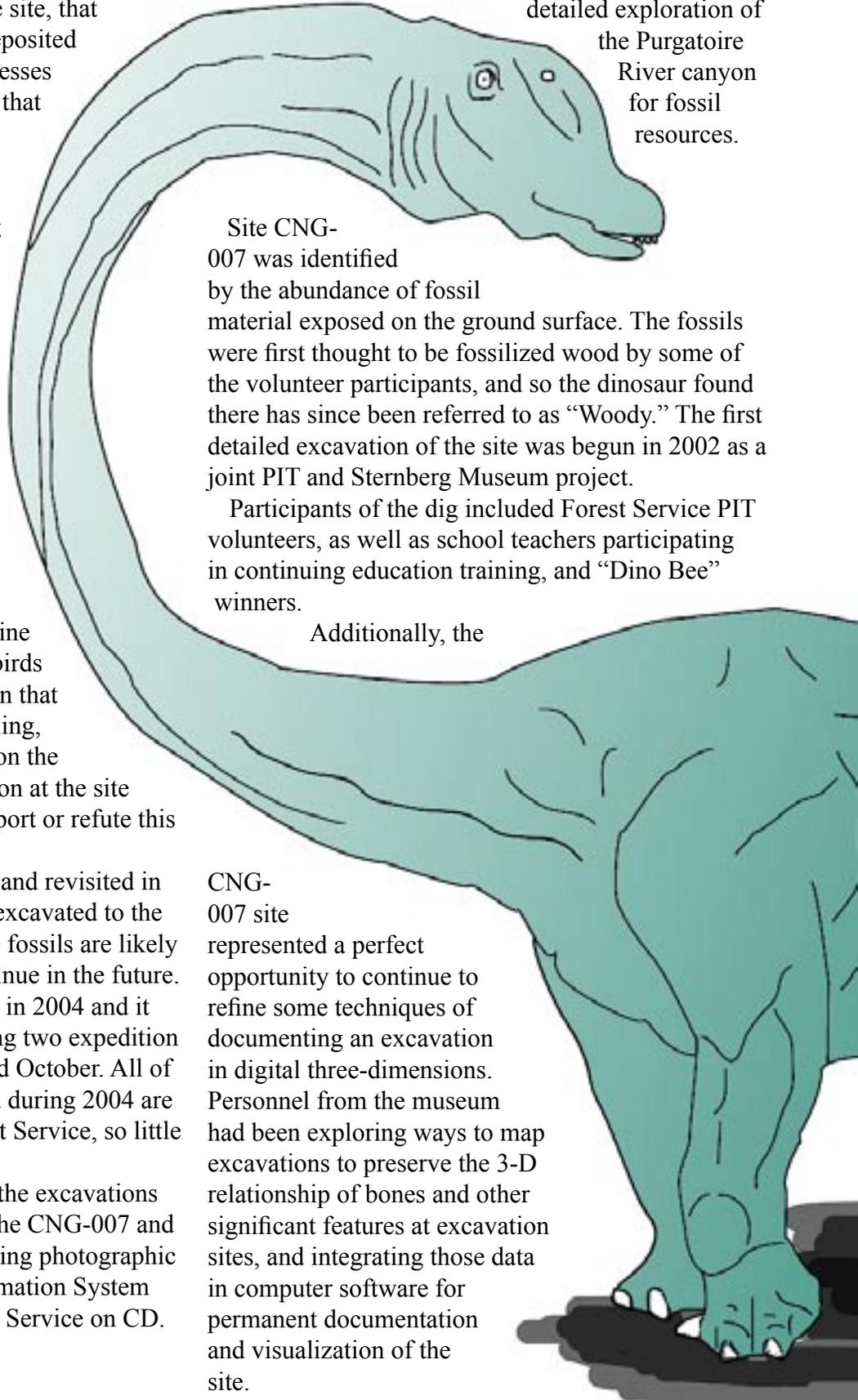
This site was discovered in 2001 during a PIT program designed to begin a detailed exploration of the Purgatoire River canyon for fossil resources.

Site CNG-007 was identified by the abundance of fossil material exposed on the ground surface. The fossils were first thought to be fossilized wood by some of the volunteer participants, and so the dinosaur found there has since been referred to as “Woody.” The first detailed excavation of the site was begun in 2002 as a joint PIT and Sternberg Museum project.

Participants of the dig included Forest Service PIT volunteers, as well as school teachers participating in continuing education training, and “Dino Bee” winners.

Additionally, the

CNG-007 site represented a perfect opportunity to continue to refine some techniques of documenting an excavation in digital three-dimensions. Personnel from the museum had been exploring ways to map excavations to preserve the 3-D relationship of bones and other significant features at excavation sites, and integrating those data in computer software for permanent documentation and visualization of the site.

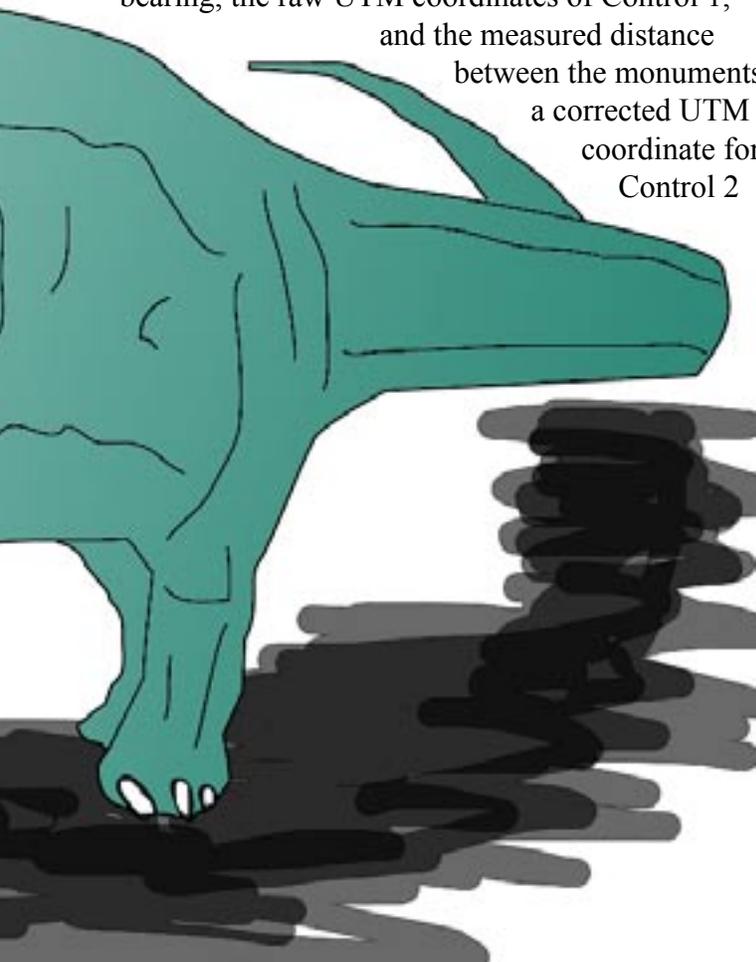


Site Monumentation

Permanent monuments were established at the CNG-007 site to allow for internal control of the site. The monuments allow for future relocation of the site, and if desirable, precise location of key points within the site. Two monuments were arbitrarily placed approximately 23 m apart. Postholes were dug and filled with cement, and ½ inch rebar was placed vertically in the cement, projecting slightly above the top of the cement. The iron rebar allows relocation of the monument by metal detector and also serves as control points. The northern-most point was designated as Control 1, and the other Control 2.

Precise measurement of the relationship (distance and elevation) between the monuments was obtained with a total station. A commercial GPS unit was used to obtain raw Universal Transverse Mercator (UTM) coordinates on both monuments. The precision of the handheld GPS unit is only to about 20 feet, so the following correction was done. The bearing between the raw UTM coordinates of the monuments was calculated, and that bearing was assumed to be the true bearing between the monuments. Using that assumed bearing, the raw UTM coordinates of Control 1,

and the measured distance
between the monuments
a corrected UTM
coordinate for
Control 2



was calculated. Thus, a reasonably accurate real world coordinate system was established for the control monuments, and therefore the rest of the site

Grid

Using the line between the control monuments as a baseline, a meter grid was established over the site. Each meter square was given an address consisting of a letter (running roughly west to east) and number (running roughly south to north). Control 1 was set as a grid corner (between grid rows 24 and 25 and grid columns P and Q), and Control 2 therefore fell on a grid line, but not exactly on a grid corner. On the ground, 2 meter grid squares were marked so each 2 meter grid had a designation like EF 17-18.

The grid served two basic functions: 1) to allow an address to be placed on some of the float bone picked up to preserve their relative relationships and 2) to help control the progress of the site excavation by delineating areas to be dug. This second purpose helped to focus the efforts of the excavation team and maintain orderly progress at the site. Detailed location of bones and other elements important to the excavation were made with the total station.

Surface Topography

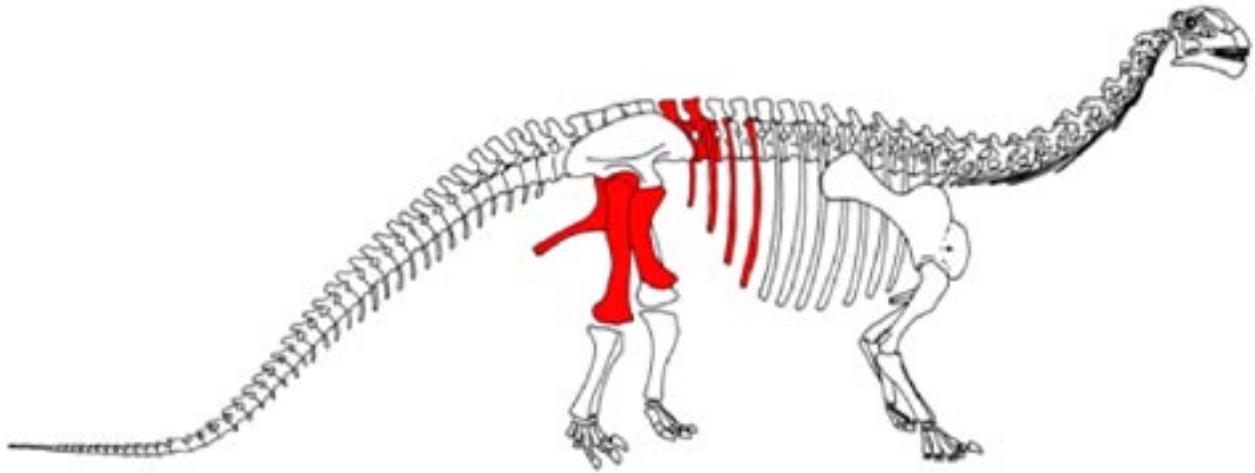
The topography of the general area of the excavation was mapped so that the relationship of excavated elements could be shown with regard to the present-day surface.

Excavation

Prior to actual excavation, the area was examined for bone float. The majority of the float was collected and bagged as coming from either the north or south part of the site. Closer to the excavation area the float was bagged according to its grid address. During the excavation, fossils were exposed and stabilized using standard excavation techniques. Butvar (B-98) in an isopropyl solvent was used as both glue and hardener and super glue was also sparingly used.

Bone Locations

Before the bones were removed, each bone was assigned a field number, beginning at 1 and progressing consecutively through bone 66, and their positions were mapped using a total station. (The femur was the only bone not assigned a field number, and is just referred to as “femur”). Typically, the total station was set up over Control 1, back sighted on Control 2, and its elevation measured or calculated for vertical control. Points around the bones were



A skeleton outline highlights the bones collected and identified from CNG-007, the site that yielded the Camarasaurus "Woody."

shot from the instrument by turning angles right, measuring the distance, and obtaining the vertical difference read from the instrument. Prism pole height was also recorded for each shot. The number of points shot for each bone varied. For example, if the bone

was a linear fragment, perhaps only two points were sufficient to give its relative position, with points being shot at the middle of either end. Sometimes, if the bone was more complex, or additional detail required, additional shots were taken to give a rough



Volunteers work in their grid squares during the excavation of "Woody."



The discovery of dinosaurs in the Purgatoire River Canyon and the excavation of “Woody” attracted media attention. Television news crews from around Colorado toured the area to share the finds with the public.

outline around the bone. Descriptive data for each point was recorded by hand in the field notes.

Photo Documentation

Digital photos of both the site and dig participants were taken throughout the field seasons (2002 and 2003). All photos have been provided to the Forest Service on CD.

3-D Imaging

Between the first field season of 2002 and the next season of 2003, a new technique for capturing 3-D images of the bones in situ was learned about and the technique was applied on just two bones from the CNG-007 site (bones 63 and 66). The basic idea is to map the surface of the bone in situ and take an “aerial” photograph of the bone. The surface map is used to create a topography model (TIN) of the bone surface, and the digital photograph is georeferenced and draped over its topography. The effect is to create a pseudo-three dimensional representation of the bone in its original field position. This technique was applied to several bones from the Herrell’s Road Cut site also. This technique is proving to be an interesting way to capture and reproduce excavation sites digitally, but more experimentation with the technique is required to fully utilize its potential.

Data Transformation

The raw data were entered into the program Field

Survey by AutoDesk, and transformed into 3-D point coordinates (North, East, and Elevation) using the UTM coordinates established for the control monuments as baseline. Thus, all the survey data is reasonably accurate with regard to external real world coordinates, and very accurate with regard to points within the site.

The points were then imported into the ArcGIS package as a point data shape files. All the shape files for the project were assigned the coordinate system of UTM Zone 13N. Grid corner coordinates were calculated and imported into ArcMap as well, grid square shape files were created with a data field for the grids’ address. The original surface topography of the site was imported and reproduced as a TIN file. A shape file was created for each bone collected and located in the field. The bone outlines shape file basically shows the bones’ original geographic location within the site as rough geometric shapes connecting the points mapped for each bone. The database for the shape file contains the field numbers for each bone and the year it in which it was collected. Thus, any individual bone can be relocated within the site, and plots of the excavation by year can be made.

Preparation of Fossils

Fossils collected from the site are currently being prepped. To date, several plaster jackets have been opened and worked on (field numbers 47, 55, and



Excavation begins at the Herrell's Road Cut Site, about 1 mile from the CNG-007 site. Here, volunteers uncover remains of a carnivorous dinosaur, *Allosaurus*, and mysterious polished stones.

61) and several jackets still remain to be opened (field numbers 48, 60, 63, 66 and the femur). Float bone was examined, and in many cases pieces could be reassembled. All the material is curated into the Sternberg Museum. Their original field numbers are still associated with each specimen.

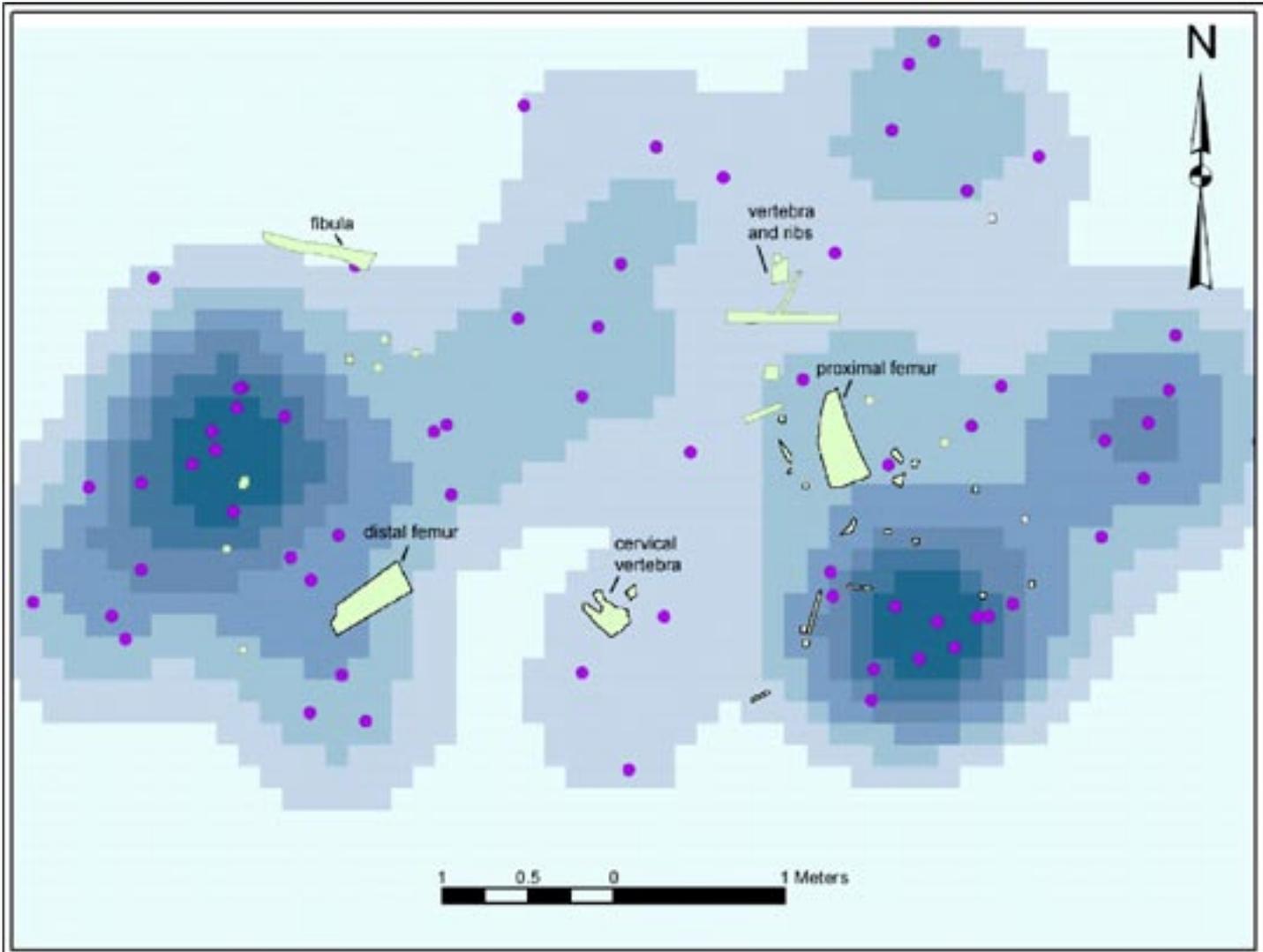
Herrell's Road Cut Site

Herrell's Roadcut Site (HRC) was discovered many years before these expeditions and has been known to Forest Service personnel for sometime. During 2003, this site was opened by the excavation crew.

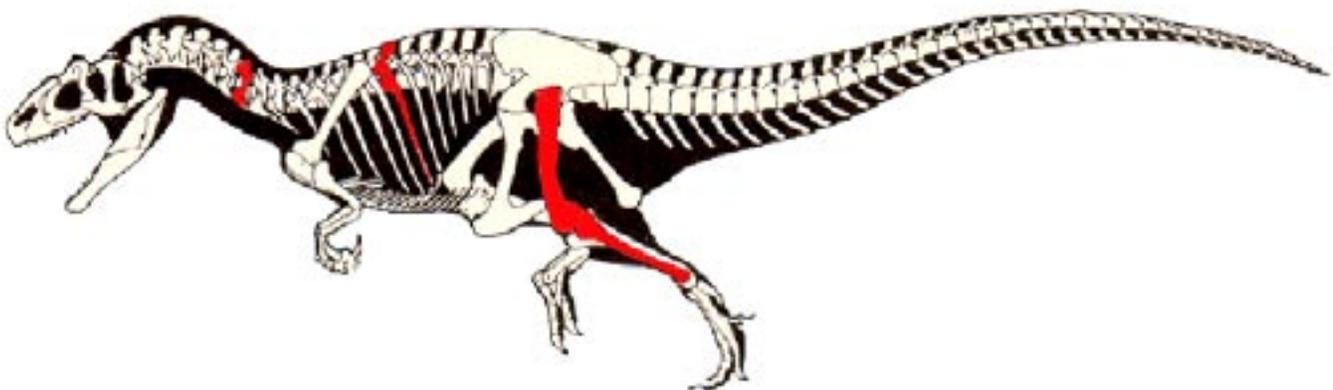
Monumentation

The monumentation for the HRC is different than for CNG-007. Two ½ inch iron rebars were driven into the ground on the south side of the road, one just

off the road south of the excavation, and one about 40 m to the east, near the base of a large rock on the south side of the road. However, since the bars were not set into concrete they could easily be disturbed or knocked by vehicles. So in addition to the rebar monuments, X marks were cut into large rocks by the side of the road as additional control points, the east one chiseled into the top of a large Dakota Sandstone block and the west one into a triangular-shaped sandstone block about 0.75 m in diameter. If need be, future excavation at the site can tie back into the original coordinate system by placing a temporary point to work from, then measuring to both of the chiseled control points for a distance-distance inverse to calculate the coordinate of the new point. Real-world UTM coordinates for the two rebar monuments were obtained using a similar method as described



A quarry map shows the bones from Herrell's Road Cut Site excavated to date in green. The purple dots are the locations of the polished stones, perhaps gastroliths from dinosaurs. The shading provides a density guide for the stones, with darker areas showing a higher concentration of stones than lighter-colored areas. Below, the bones recovered to date are colored red on a skeleton of the carnivorous dinosaur *Allosaurus*.



for the CNG-007 site, and subsequently applied to the entire site.

Grid

No excavation grid was established at this site during the 2003 or 2004 field seasons. Naturally, all points located at the site have a UTM coordinate, so they are controlled in 3-D space, but an on-site meter grid was not established. However, if it is deemed necessary, a grid could easily be laid from the UTM system or a completely arbitrary grid could be established. Such a grid could be used to help control the excavation, but has not been found to be necessary to date.

Surface Topography

Like at CNG-007, the surface topography of the site was mapped to allow the visualization of the fossils' relationship to the ground surface.

Excavation

Excavation of the site progressed using standard methodology, similarly to CNG-007.

Bone Locations & 3-D Imaging

Bones were given field numbers from this site beginning with 1 and ending with 22. Many subrounded, polished stones which are much larger than the general matrix of the sediments were mapped in situ and collected as potential gastroliths. They were numbered from 1 to 23 in the 2003 excavation. During the 2004 excavation, all specimens, regardless of being bone or stone, were number sequentially. In all, 67 stones have been mapped at the site. Whenever practical, all the bones from this site were mapped by recording the bone's topography in situ and taking an aerial photograph as described in the 3-D imaging section of site CNG-007. Therefore, the maps in ArcMap and ArcScene can feature pictures of the bones in their original field relationships. There is also a bone outlines shape file which shows geometric polygons that correspond to the bones, including bones that we do not have field photos for, so that layer includes a few more elements. For example, the bone with field number 1 was not well enough



Mark Vishnefske shows off some of “Woody’s” bones as they are prepared in the Sternberg Museum’s demonstration laboratory. Here, he holds one of the ischia (bones from the hip) (field number 63). The lab is available to the public so they can observe the process, and learn that research is an on-going activity at the museum.



A great diversity of rocks, showing a range of sizes and mineral compositions, have been recovered from the HRC site. These stones do not look like the rest of the rock, and could be gastroliths, or stomach stones from dinosaurs.

preserved to allow for detailed mapping, so two location shots were taken. Those location shots were used to draw a polygon representing bone number 1 in the shape file. The database for the bone outlines layer can be expanded to include additional fields as needed for future database queries.

Bones identified to date from this site include an *Allosaurus* femur, tibia, and vertebra. The stone locations are preserved in their own shape file as well.

Data Transformations

Data from the survey data was transformed exactly as described for CNG-007.

Fossil Preparation

At this time, all of the fossils from this site are currently in the possession of the Forest Service, and some of the prep work has been done there. The polished stones from the 2003 excavation were in the possession of the Sternberg Museum, and stones from

2004 are currently with the Forest Service.

Students and volunteers who have worked with the project are David Aschwage, Debbie Ashida, Marsha Barnum, Branson Barnum, Elaine Bradford, Dan Caspary, Pam Channell, Peggy Colgate, Doug Crandall, Pete Doumit, Mark Ellis, Kathy Ellis, Rebecca Farr, Terri Fields, Matt Forir, Michael Foster, Carol Foster, Jon Frazier, Leroy Frazier, Mar Frazier, Ruth Goddard, Jon Graff, Tanya Gray, Jerry Horton, Jim Huenergarde, Takehito Ikejiri, Joshua Janzen, Jackie Jordon, Steve Kimball, Reira Konuki, Anita Landiss, Rita Liggett, Greg Liggett, Cameron Liggett, Ulli Limpitlaw, Yoshiko Matsumoto, Frances Mayse, Carol McClure, Marilyn McComber, John McRaven, Pat Monaco, Sue Morgan, Dennis Newell, Lynette Nolan, Tom Nolan, Bill Ramsey, Nicole Reynaud, Lydia Rinke, Steve Roberts, Steve Rowley, David Schmidt, Bruce Schumacher, Doug Springer, Kendra Staats, George Sweeney, Samantha Terhune, Jon Vincent, Mark Vishnefske, Bill Wahl, Lucas Warren, Wendy Warren, Ruth Ann White, Alan White, Robert Williams, Trevor Williams, Lee Wilson, and Richard Zakrzewski



A single, large vertebra from "Woody," a long-necked dinosaur, as it is being restored provides some sense of the immense size of the Jurassic dinosaurs.

PRELIMINARY LIST OF THE SPIDERS OF COMANCHE NATIONAL GRASSLAND PURGATOIRE RIVER CANYON

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Sternberg Museum of Natural History
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Introduction

Spiders are an integral part of ecosystems throughout the world. Although this group and other terrestrial arthropods have often been neglected by resource managers (Wilson 1992), spiders possess characteristics that make biodiversity assessments particularly valuable in conservation decisions, for example, as rapid assessment indicators of overall diversity of different tropical forest sites (Coddington et al. 1991). These characteristics include: abundance, ease of sampling, ubiquity, diversity of prey strategies and niches, high within-habitat taxonomic diversity, and guild-specific responses to environmental change (Toti et al. 2000).

Spider biodiversity within the continental United States has been least studied in the Central Great Plains. For example, a one-month pitfall trap survey in the vicinity of prairie dog towns in the shortgrass prairie of western Kansas revealed the presence of seven species of spiders not previously recorded in Kansas (Guarisco et al. 2004). A Nature Conservancy assessment of the status of biodiversity of the Great Plains stated: "Despite their high level of diversity, adequate information is not available to assess the current status of insects in the Great Plains." Since basic information is lacking, spiders were not even mentioned in this regard (Ostlie et al. 1997).

A field survey of the spiders of the Purgatoire River Canyon in Comanche National Grassland was conducted 2-10 May 2004, to develop a preliminary list of the species in this area and record natural history observations. A total of 37 spider species belonging to 11 different families were collected. This list includes an undescribed species in the jumping

spider genus *Habronattus* as well as six new state records for Colorado.

Methods

After meeting forest service personnel and members of the Comanche National Grassland Dinosaur Excavation Project in La Junta on 2 May, the author and a field assistant, Cameron Liggett, accompanied the group into the canyon. We camped in tents near the Rourke Ranch bunkhouse which contained kitchen and bathroom facilities. During the next nine days, we made collecting forays during the day and night. A variety of collecting methods were used to obtain spiders in the Purgatoire River Canyon, including: hand-collecting, turning rocks and debris, live pitfall trapping, sweeping and beating vegetation, and the eyeshine method.

Live pitfall traps (32-oz plastic cups) were placed in the ground approximately 30 paces apart at a variety of locations between the ranch house and the river. The traps were created by digging a hole, then placing the cup so that the rim was flush with the ground. An inch or two of soil and small rocks were put inside the cup to create hiding places and retard desiccation. Cups were checked almost daily. The spiders were removed and any other invertebrates were released. A sweep net was used to sample grassy vegetation and a beating net was used to sample shrubs and trees. The beating net consisted of a canvas sheet stretched across a wooden frame, similar to a kite. This was placed beneath a branch which was struck sharply with a heavy stick. Then the sheet was examined for spiders knocked from the branches. The eyeshine method involves going out after dark with a flashlight next to your head and looking for reflections from

the eyes of hunting spiders, especially wolf spiders (family Lycosidae) (Wallace 1937). This is a good collecting method because the blue-green reflections can be detected up to 15 meters away.

When spiders were found, they were placed individually in small vials and jars and most were kept alive until we returned home. Spiders are cannibalistic and cannot safely be kept together in the vials. Because species identification can adequately be determined for adult specimens, but rarely for juveniles, attempts were made to rear immature spiders to adulthood before preservation. Some adult females were also kept alive so that fecundity data

could be collected. As specimens matured, they and their data labels were placed in glass vials filled with 80% ethanol. Identifications were made by examining spiders under a dissecting microscope and comparing them with illustrations and descriptions in various taxonomic references.

Results

This preliminary list of the spiders of Purgatoire River Canyon comprises 37 species, including six new Colorado records and an undescribed species of jumping spider, *Habronattus* (*H. clypeatus* species group) (pers. com. Wayne Maddison, 2004). The



This male jumping spider belongs to the genus *Habronattus*. The species is undescribed and therefore new to science.

nomenclature follows Platnick (2004). The scientific name is followed by the original describer and the year it was described. Seven spiders were identified only to the level of genus, and tentative species identifications are indicated by a question mark (?) following each name. Some juveniles could not be successfully reared to adulthood and they could not be identified to species. In other cases, more specimens of both sexes are needed to determine the range of variation in key characters used to separate closely related species. New state records are indicated by an asterisk before the names.

Annotated Preliminary List of the Spiders of Purgatoire River Canyon

Family Pholcidae

Psilochorus sp.

Several adults and juveniles were found in small webs on the underside of rocks. This genus contains at least 15 undescribed species and needs to be revised.

Family Segestriidae

Ariadna bicolor (Hentz 1827)

A female was collected from a thin, tubular

resting sac (55 mm long) at the base of a juniper tree on the hillside north of the bunkhouse on 7 May. This species ranges from Maine to Florida, westward into Colorado, New Mexico and Arizona (Beatty 1970).

Family Mimetidae

Mimetus hesperus Chamberlin 1923

A penultimate female was found in the bunkhouse bathroom in the corner between the ceiling and wall. She shed to adulthood in captivity. Members of this family, called “pirate spiders,” feed almost exclusively on other spiders. This species ranges throughout most of the western US, including Colorado (Mott 1989).

Family Theridiidae

Euryopsis scriptipes Banks 1908

A female was found under a rock on NE side of Bravo Canyon on 3 May. She laid an egg sac containing 18 eggs before 15 May. It ranges throughout much of Arizona, New Mexico, Utah, and Colorado (Levi 1954).

Steatoda fulva (Keyserling 1882)

A juvenile male found 2 May between the ranch and the river shed to adulthood before 11 May. It ranges from Florida to Washington and is found in Colorado (Gertsch 1960).



Long front legs with distinct spines characterize pirate spiders, which make up the family Mimetidae. Like all other pirate spiders, this *Mimetus hesperus* female feeds only on other spiders.

Latrodectus mactans (Fabricius 1775) or *Latrodectus hesperus* Chamberlin & Ivie 1935

Several black widows were found in webs under loose bark at the base of trees in the floodplain. Females were found 2 May near the river due south of the bunkhouse, 3 May under a rock in Bravo Canyon, and 7 May on the alluvial valley floor southwest of the ranch. Presently, it is not possible to distinguish females of these species from each other, and some taxonomists believe that these are actually one species. Molecular work currently underway will help resolve the issue.

Theridion sp.

One female with an eggsac was found under a rock on hillside north of the bunkhouse on 7 May. Additional specimens of both sexes are needed to establish species identity.

Family Araneidae

Eustala sp.

A juvenile female was found at night in an orb web near the dinosaur trackway on the north side of the river on 7 May. More specimens are needed.

***Metepeira foxi* Gertsch and Ivie 1936**

A female found in a web at night near the river on 7 May laid an eggsac the next day (size = 6x4 mm, # eggs = 35). This species ranges throughout the western states, including southwestern Colorado (Levi 1977), but this is the first record for southeastern Colorado.

Family Lycosidae

****Allocosa morelosiana?* (Gertsch and Davis 1940)**

A juvenile male, which shed to adulthood in early June, was taken in a live pitfall trap south of the ranch. More specimens of both sexes are needed to confirm its specific identity. This is a new Colorado record (even if it belongs to a closely related species) (Dondale and Redner 1983).

****Pardosa mercurialis* Montgomery 1904**

On 6 May, 3 males and a female with an egg sac (35 young + 15 infertile eggs) were found near the river at night by the eyeshine method. The next evening, a second female with an egg sac (diameter = 5.3 mm, # larvae = 39) was found at the same site. This is a new record for Colorado. The species is known from Texas and the Oklahoma panhandle (Barnes 1959).

Hogna sp.

Several juveniles and 1 adult, belonging to several different species in the genus, were collected. This genus needs to be revised. There are about 7 undescribed species known from Texas and Colorado (pers. comm. Alan Brady, 2004). More field

work is needed.

Family Dictynidae

Dictyna sp.

On 9 May a female was collected in a wooded area near the river ford. An eggsac 3 mm in diameter with 15 eggs was produced in captivity. Securing males and associated females would help determine their specific identity.

***Dictyna bellans* Chamberlin 1919**

On 2 May, 2 males and a juvenile female were found south of the ranch. It ranges throughout most of the eastern and central US, and is known from Colorado (Chamberlin and Gertsch 1958).

Family Titanoecidae

Titanoeca sp.

A juvenile was found in a web under a rock on northeast side of Bravo Canyon on 3 May. It died in captivity before reaching maturity and could not be identified to species.

Family Liocranidae

Phrurotimpus sp.

A female was found under a rock near the mission area on 4 May. More specimens of both sexes would help species determination.

Family Gnaphosidae

***Drassodes saccatus* (Emerton 1890)**

Two females were taken under debris between the ranch and the river on 2 May. It is found throughout most of Colorado and the western



The best-known cobweb weaver is the black widow with its distinctive warning coloration. This female was captured in the Puratoire River Canyon and belongs to either *Latrodectus mactans* or *L. hesperus*.

states into the northeast (Platnick and Shadab 1976).

***Drassyllus dromeus?* Chamberlin 1922**

Two females were found between the ranch and river and the mission site on 2 and 4 May, respectively. They are tentatively identified as this species, which ranges throughout Utah, New Mexico, Arizona, Texas and Colorado (Platnick and Shadab 1982).

***Gnaphosa clara* (Keyserling 1887)**

A male was found between the ranch and the river on 2 May. It occurs in most western states, including Colorado (Platnick and Shadab 1975a).

***Haplodrassus chamberlini?* Platnick and Shadab 1975**

A female probably belonging to this species was found on 2 May between the ranch and the river. It is known from southern Canada to Mexico, including Colorado (Platnick and Shadab 1975b).

***Herpyllus bubulcus* Chamberlin 1922**

A female guarding an egg sac was found under a rock in Bravo Canyon on 3 May. The egg sac, preserved on 19 May, contained 96 spiderlings and 15 infertile eggs. It ranges from Kansas (Guarisco and Kinman 1990) through Colorado, New Mexico and Texas (Platnick and Shadab 1977).

***Herpyllus hesperolus* Chamberlin 1928**

A male was found between the ranch and the

river on 2 May. On 7 May, a female was taken on the hill north of the ranch. It ranges throughout the western US, including a record from Mesa, Colorado (Platnick and Shadab 1977). The present record extends its range to southeastern Colorado.

***Herpyllus propinquus* (Keyserling 1887)**

A female found at the mission site laid an egg sac with a diameter of 15 mm containing 57 eggs on 15 May. It ranges throughout the western US, including Colorado (Platnick and Shadab 1977).

***Zelotes puritanus* Chamberlin 1922**

A penultimate female which shed to adulthood in late May was taken on 9 May at the river fording site. Ranging from Alaska to Maine, it occurs in most of the western US, with many records from the mountain region of Colorado (Platnick and Shadab 1983). This is the first record in Colorado from the plains region.

Family Philodromidae

****Ebo mexicanus?* Banks 1898**

A juvenile female (shed to adult in captivity) was found between the ranch and the river on 2 May. On 9 May, a male was taken from juniper. Although I am fairly certain of my determination, more specimens would confirm the identity of these specimens. This species ranges from California to Texas, and this appears to be a new state record for Colorado (Sauer and Platnick 1972).

***Philodromus* sp.**

A juvenile which died in captivity was collected during this trip. More collecting would reveal the presence of several species in this genus.

Thanatus coloradensis

Keyserling 1880

A female was flushed from short grass near a ranch outbuilding on 10 May. This species ranges from Alaska into Arizona and New Mexico and is known from Colorado (Dondale et al. 1964).

***Tibellus duttoni* (Hentz 1847)**

or *T. chamberlini* Gertsch 1933

A juvenile male which died in captivity was captured at the river fording site on 9 May. Examination of adults from this location will establish its identity (Dondale and Redner 1978).



Although the male of this jumping spider species, *Phidippus asotus*, was first described in 1933, the female was not described until 2004. This female was captured in the canyon.

Family Thomisidae

**Xysticus gosiutus?* Gertsch 1933

A female tentatively assigned to this species was collected guarding an eggsac on 3 May in Bravo Canyon. Both were preserved on 19 May and the egg sac contained 110 spider larvae. This represents a new state record, since it is known from Canada, California and inland only to Utah (Dondale and Redner 1978). More specimens (especially males) are needed.

Family Salticidae

Habronattus cognatus (G & E Peckham 1901)

This is a common jumping spider found throughout the canyon, either active on rock or in resting silk sacs beneath rocks on rock. It ranges throughout the central region of the US, including Colorado (Griswold 1987).

Habronattus n. sp. (*H. clypeatus* group)

A male, recognized as undescribed by Bruce Cutler, was taken near the mission area. It is known from Canon City, Colorado and the Davis Mountains in Texas (pers. comm. Wayne Maddison). More field work is needed to acquire more specimens of both sexes.

Metacryba taeniola? (Hentz 1845)

A juvenile which died in captivity was found in Bravo Canyon on 3 May. This is a distinctive, elongated jumping spider ranging throughout most of the southern US, from Delaware to California, but apparently has not been recorded in Colorado. Therefore, it is a new state record (Barnes 1958). It has recently been recorded in the Chautauqua Hills of southeastern Kansas (Guarisco et al. 2001).

Pelegrina proterva (Walckenaer 1837)

A juvenile female which shed to adulthood by 15 May was collected in Bravo Canyon on 3 May. It ranges through most of the eastern US into Colorado and Montana (Maddison 1996).

Phidippus asotus Chamberlin & Ivie 1933

Five females were found at various localities in the canyon. Three were guarding egg sacs. Two were found in a side canyon near the mission on 4 May. One on juniper (egg sac preserved 24 May contained 78 larvae) and one under a rock (egg sac contained 78 larvae). On 3 May, one was found in Bravo Canyon with 82 prelarvae. It ranges from California into Colorado, western Texas and the Oklahoma panhandle. The female



A large portion of North American spider species guard their egg sacs. This crab spider, *Xysticus gosiutus*, significantly increases the likelihood that her offspring will emerge from their eggs by protecting them from predators and parasites.

of the species has only recently been described (Edwards 2004). Therefore, the egg sac records presented here are the first recorded for this species.

**Phlegra hentzi* Marx 1890

A female guarding an eggsac containing 8 eggs was found near the mission site on 4 May. A male was taken on 9 May in Bravo Canyon, on the path to the *Diplodocus* site. It is widely distributed in the US, east of the Rocky Mountains (Comstock 1948). It has been reported only as far west as Minnesota, Kansas and Texas (Richman and Cutler 1978). Therefore, the current record may be the first for Colorado.

***Sassacus vitis* (Cockerell 1894)**

On 9 May, a male was taken while beating trees and shrubs in the floodplain. It has been reported from Kansas, Colorado, Utah, Arizona, New Mexico, Texas and California (G & E Peckham 1909).

****Terralonus* cf. *T. unicus* (Chamberlin & Gertsch 1930)**

A female was taken on 4 May in the mission area. This species is known from Utah, Wyoming, New Mexico and Arizona (Richman and Cutler 1978). Therefore, this record may be the first for Colorado. However, the genus is in need of revision.

Discussion and Conclusions

This brief (9 days) survey of the spiders of Purgatoire River Canyon revealed the following: the presence of six species not previously recorded within the state of Colorado; the presence of an undescribed species of jumping spider (*Habronattus* n. sp.); and the first fecundity data for *Phidippus asotus*. Much more field work is clearly needed to obtain a fairly complete checklist of the spiders and their natural history in this region.

One potential focus of this project, which would involve several trips over the next few years, would be to determine the influence of prairie dogs on spider diversity and numbers. The black-tailed prairie dog (*Cynomys ludovicianus*) is often cited as a keystone species in North American prairies, although its influence on arthropod populations is poorly understood (Miller and Ceballos 1994; Hoogland 1995; Desmond, Savidge and Eskridge 2000). Simultaneous pitfall trapping within and outside prairie dog towns and use of the eyeshine method should uncover interesting relationships.

A long term goal of this project is to obtain a greater understanding of spiders and the ecological roles they play in the shortgrass prairie ecosystem. In addition to one or more scientific publications on these findings, it would be of interest to produce a small color guide to the spiders of Comanche National Grasslands for the public highlighting spider diversity, behavior and ecological roles

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