

High Tech Meets Old Bones: Accurate Location of Fossil Resources at Hagerman Fossil Beds

By Chris Force

A dilemma paleontologists and archaeologists have long faced is how to identify accurately but discretely a site's location. The staff at Hagerman Fossil Beds National Monument has found a high tech answer.

Hagerman Fossil Beds NM is located in south-central Idaho on the bluffs of the Snake River west of the town of Hagerman. These 500 foot bluffs, composed of the Glens Ferry Formation sediments, produce a wide variety of fossils (over 100 species including vertebrates, invertebrates and plants) of Pliocene age. The sediments within the monument represent a floodplain environment composed of river channel sands, overbank clays and silts, highly organic pond deposits, volcanic ashes and basalt flows. These sediments are easily eroded and contain localized concentrations of small vertebrate fossils, as well as sites with larger mammal remains.

Although this area has been known throughout the world as rich in fossils since its scientific discovery in 1929, it did not receive status as a National Monument until 1988. From 1929-1988 several academic institutions collected fossils on what is now the Monument. Today we know of over 300 recorded fossil localities identified by these various institutions.

The Monument needs a completed baseline inventory to identify the exact location of these fossil sites. This baseline information will provide the framework for the development of the legislatively mandated research program at the Monument, and for its developing resource management plan and general management plan. Knowing the precise location of sites helps in planning for visitor access by indicating where to locate trails and facilities, and how to minimize the impact to the fossil resource. To document these sites, the NPS staff and volunteers are using the latest available technology, a Global Positioning System (GPS) and a laser transit.

The Global Positioning System was developed by the military to determine the location of military vehicles or units on the earth's

Bob Willhite, Hagerman's Chief Ranger, takes a sighting using the laser transit to pinpoint accurately the fossil site.



surface. It utilizes satellites that send signals to a back-pack receiver, which computes the exact location. Using a special, high-precision Global Positioning System, surveyors from the Bureau of Land Management and NPS staff established a grid of 60 reference points throughout the Monument that are accurate within several centimeters.

A laser transit, the Criterion produced by Laser Technology Incorporated of Englewood, CO, is used to accurately survey each fossil site. It works by firing a laser beam at a mirror prism on a height-adjustable pole, and measures the reflected beam of light. A computer within the transit calculates the horizontal distance, azimuth, slope distance, percent slope, and inclination from the transit to the prism. Although the laser is designed to be hand-held, it is mounted on a tripod to capitalize on its precision limits.

Because readings can be done quickly, three replications are taken of each measurement to detect operator error. A limiting factor of the instrument is that directions are based on a magnetic azimuth. For this reason, staff has developed procedures focusing

on distances and triangulation. By sighting at the fossil locality and two of the GPS reference points, the exact position of the fossil locality is computed using trigonometric calculations. By this process, the fossil site is located in space horizontally and vertically with a margin of error in tenths of feet. The fossil locality does not have to be physically marked, thus protecting the site's integrity.

Each site is given a unique identifier and a permanent locality code, and will be entered into a GIS system along with pertinent associated data such as species present, number of specimens, and sediment type. Such an accurate baseline inventory will allow us to discover possible patterns in site locations throughout the monument. Analysis of these patterns may help explain how these fossil concentrations formed.

The hand-held attribute of this laser will save substantial time when it comes time to relocate any documented site. It has a navigation function that uses as coordinates the closest reference points, and audibly tells the operator when the instrument is sighted on the fossil locality. The operator can then direct a field crew person to the exact location.

During the course of the baseline inventory for known fossil sites, numerous new sites have been found as well as significant individual specimens. One example is the most complete *Borophagus* (hyena-like dog) known from Hagerman. It's a lower jaw that contains the canine, fourth premolar and first molar. Also discovered were several new mastodon localities and a sandstone concretion with a high concentration of frog bones. It is not yet known how many individuals are represented in this concretion, but at least two species of frogs are present.

High tech measurements, such as those possible using this system, will play a major role in managing and scientifically evaluating the fossil resources at Hagerman Fossil Beds NM.

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