Appendix D

Paleontological Survey

Paleontological Resource Survey for select portions of the Heartland Expressway

Proposed alignments at the Junction of L62A and US-385
Morrill County, Nebraska

Project Number NH-385-5(118)

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Background

Paleontological resources have been discovered in the vicinity of the three proposed alignments of the Heartland Expressway at the Junction of L62A and US-385. The University of Nebraska State Museum (UNSM) has six vertebrate fossil localities within 3 miles of the study area. In the 1930s, Works Progress Administration (WPA) crews collected more than 5,000 specimens from an 18.5 million-year-old river deposit. Ancient three-toed horse, camel, dromomerycid deer, rhinoceros, rodent, and carnivore remains were recovered from these quarries. In the 1980s, fossils were found in gravel pits near the north end of the proposed project. These gravels were deposited by a different river system between 6 and 9 million years ago.

Field Methods

I conducted a pedestrian survey of the proposed alignment alternatives, backslopes along the current alignment of L62A, and drainages north of L62A from December 6-9, 2011. Short grasses cover more than 90% of the slopes on the Loomis and Bullock properties (Figure 1). In contrast, the Glau property (Section 5, T21N, R50W) is enrolled in the CRP program and covered with taller prairie grasses (Figure 2). Snow drifts obscured some areas and additional snow fell during the survey.

Despite the snowfall and vegetative cover, I was able to inspect barren patches of soil, animal burrows, anthills, cattle trails, roads, paths, fence lines, and rock exposures along the intermittent drainages for fossils. Unfortunately, these rock outcrops are small, vertically-weathered, and non-extensive.

Survey Results

Local Geology

Swinehart and Diffendal (1995) mapped three different rock layers (Brown siltstone, Harrison/Monroe Creek, and Camp Clarke) in the survey area. I observed one additional unit (Angora sand and gravel) on the Glau property. The Brown siltstone beds consist of a brown to yellow-brown silty sandstone and sandy siltstone with numerous calcareous concretions (Figure 3). In this area, these vertically-weathered exposures are 10-20’ thick but I was only able to prospect the lower-most portions of this unit. I found a rabbit partial jaw, tortoise shell fragment, and three unidentifiable bone fragments (Figure 4). All of these finds were isolated from each other as is typical of this rock layer. It is the stratigraphically lowest unit and may not be impacted depending on the depth of cuts.

The Harrison/Monroe Creek Formations consist of a light gray to brown friable sandstone with interbedded calcium carbonate ledges (Figure 5). These sandstones overlie the Brown siltstone beds and commonly crop out in the upper portions of the ravines. This layer will be impacted during construction but I did not find any bones in it during the survey. Fossils have been recovered from the Harrison/Monroe Creek Formations at other locations in the Panhandle.

The Camp Clarke beds are located on the upper flats and not well exposed. It will be impacted by construction on all alignment alternatives. Due to the lack of exposure, I cannot determine its fossil yield potential within the survey area. However, the aforementioned UNSM quarries occur within this rock layer with fossils concentrated in

fluvial channels. Of the four rock units, the Camp Clarke beds are the most likely to contain significant paleontological resources.

The uppermost unit, the Angora sand and gravel, consists of a crystalline sand and gravel and is exposed in barren patches of soil on the CRP land (Figure 6). I found a piece of rhinoceros tooth enamel and two unidentifiable bone fragments on the surface near station 980. Additional bones, including a rhinoceros jaw, have been recovered from this layer in gravel pits (now inactive) near the north end of the project. This unit will be impacted during construction.

Table 1. Names, ages, and fossil potential for rock units exposed in the survey area.

Rock Unit	Age (in years)	Observed during survey	Fossil Yield Potential
Angora sand and gravel	5-9 million	Yes	Moderate to high
Camp Clarke beds	18.5 million	Present but covered	Moderate to locally very high
Harrison/Monroe Creek	20-28 million	Yes	Low
Brown siltstone beds	29-30 million	Yes	Low

Fossil Mitigation

As with most projects, it is impossible to determine exactly where fossils will be located prior to construction. Vegetative cover and random distribution hinder pre-construction salvage operations. Additional pre-construction paleontological surveys will be conducted to monitor erosion within the survey area. Grass removal and minor excavations in selected areas may help evaluate overall fossil yield potential for each rock unit. The prospective contractors should be notified by NDOR that fossils may be uncovered on the project. Informal on-site training for equipment operators and NDOR personnel will be provided by the Highway Paleontology Program.

Most of our fossil mitigation efforts will be concentrated during construction. Close communication with the district engineer, project manager, and contractor for start dates, status reports, and seeding dates will facilitate work in areas with the highest paleontological potential. Field work includes active site monitoring, collecting impacted fossil resources, prospecting completed yet unseeded roadcuts, and documenting fossil resources and local geology. If fossil resources are discovered, the highway paleontologist will coordinate with the construction project manager and contractor to temporarily shift grading operations from paleontologically sensitive areas until all specimens are removed. If warranted, the highway paleontologist may request an area be left open for additional erosion to occur provided erosion protective measures are in

place. Surface prospecting and site surveys may continue after seeding. In some situations, excavation and salvage may continue after construction if significant fossil resources were recovered.

Recommendations

There are no previously-reported vertebrate fossil localities that will be directly impacted by highway construction on this stretch of the Heartland Expressway. However, there are several paleontological sites within a five-mile radius of the project. In addition, the rock layers exposed in the survey area have produced fossils at other locations throughout the Panhandle. The overall potential for paleontological resources is moderate to high for this project. Additional field surveys and test excavations should be conducted prior to construction. The Highway Paleontology Program should be informed throughout the planning process with regard to alignment choice, grading details, and borrow pit locations. On-site monitoring and the fossil mitigation plan mentioned above will be implemented throughout all phases of construction.

References

Swinehart, J.B. and Diffendal, Jr., R.F., 1995, Geologic map of Morrill County, Nebraska, U.S. Geological Survey, Miscellaneous Investigations Map I-2496, Scale 1:62,500, one sheet.

Frontispiece – Rhinoceros ankle bones housed in the University of Nebraska State Museum's Vertebrate Paleontology Research Collections. In the 1930s, these specimens were collected from the Bridgeport Quarries, located less than three miles from the proposed project.

Figure 1. The intermittent drainages on the Loomis and Bullock properties are covered with vegetation and small rock outcroppings.

Figure 2. Taller prairie grasses obscure exposures on the Glau property.

Figure 3. The Brown siltstone beds, the oldest stratigraphic unit in the survey area, weather vertically.

Figure 4. Typically, fossil remains are isolated in the Brown siltstone beds. This unidentifiable bone fragment (arrow) occured at the same elevation as the rabbit jaw.

Figure 5. Small exposures of the Harrison/Monroe Creek Formations crop out on all three properties. Resistant calcium carbonate ledges, deposited by ancient groundwater flow, occur throughout this friable sandstone.

Figure 6. Bone fragments and tooth enamel were found in the Angora sand and gravel. This unit is sparsely exposed in the survey area but may contain significant fossil material. Further investigation is needed.