9-1-1997

Geology of the Ponca Creek and Keya Paha River Drainage Basins in Nebraska

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AN ARCHAEOLOGICAL SURVEY OF PONCA CREEK AND THE KEYA PAHA RIVER DRAINAGES IN NEBRASKA

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Nebraska Archaeological Survey
Technical Report 97-02
University of Nebraska State Museum

Submitted to:
Historic Preservation Office
Nebraska State Historical Society

September 1, 1997

V. Geology of the Ponca Creek and Keya Paha River Drainage Basins in Nebraska

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The geology of the study area has been investigated many times over more than a century. Interested readers are directed to the report by Diffendal and Voorhies (1994), which gives a more detailed overview of the results of the investigations and lists most of the more important reports about the area's geology.

The names of the sedimentary rock strata and unlithified sediments exposed in and underlying all or parts of the study area are shown in Table V.1. These formations range in age from more than 85 million years to sediments being deposited today by winds, water, and downslope movements (landslides).

The oldest sedimentary rocks belonging to the Niobrara Formation and younger Pierre Shale were deposited on the floor of a seaway that connected the Gulf of Mexico with the Arctic Ocean near the end of the Cretaceous Period. The Niobrara Formation is exposed only along the lower valley sides at the downstream end of Ponca Creek in Boyd County and along the lower valley sides along the Missouri River. The Niobrara Formation consists primarily of gray to white chalks, shaley chalks, and limestones formed mainly of the microscopic limey skeletal debris from marine plants. Larger fossils of clams, oysters, cephalopods, fish, and marine reptiles occur in this formation. The Pierre Shale is composed principally of gray to black platey shales and limey shales. Sulfur-bearing minerals in the shale often yield a rotten-egg odor in the air above exposures. Neither of these formations yields significant materials for tools.

The Chadron and Rosebud formations of the White River and Arikaree groups (Table V.1) are exposed only in parts of Keya Paha County so far as currently known. Both were deposited in valleys carved by rivers and streams into the Pierre Shale. The Chadron Formation is composed of white sandstones and light pastel-colored clay shales. The Rosebud sandstones and siltstones are pink to light brown in color. Neither formation yields significant material for tools.

The Ogallala Group includes valley fills primarily composed of river and stream deposits. The valleys were cut into one or more of the formations described above. Three formations are recognized in the group in the study area: the Fort Randall, Valentine, and Ash Hollow Formations. The Fort Randall Formation is the least widespread of the three. It is primarily composed of brown mudstones and claystones with limey spherically shaped concretions. The Valentine Formation is the most widespread of the three and consists principally of loose sands and muddy sands. The Valentine also has some silica cemented green sandstones called quartzites, some brown cherts, and minor air-fall volcanic ash deposits. The Ash Hollow Formation is the youngest formation of the Ogallala Group. The basal part is typified by lime-cemented ledges unlike anything in the two older units. These ledges alternate with less well cemented sands and sandstones throughout most of the formation. Volcanic ash beds also occur in parts of the Ash Hollow Formation. Green quartzites, cherts, and lime-cemented sandstones have been used as tools.

The Long Pine Formation, a loose river deposit of sand and gravel derived from erosion of rocks in the Southern Rocky Mountains in north-central Colorado and southeastern Wyoming, caps the Springview Tableland in Keya Paha and westernmost Boyd counties and a few of the highest hills near and west of Gross in Boyd County.
The Long Pine was deposited in a wide river valley trending northeast across the area. Quartzite, chert, jasper, and other rocks capable of being used as tools occur in this river deposit, but they are usually no more than small cobble size and, thus, would not commonly be useful.

Throughout the history of deposition of the White River, Arikaree, and Ogallala groups and the Long Pine Formation the land surface was gradually built up by addition of sediments. After the deposition of the Long Pine Formation ceased, erosion was the more dominant process in the study area over the last 2 million years or so of geologic history. Rivers and, to a lesser extent, winds eroded the older formations producing the remnant tablelands and river valleys we see today. From time to time conditions changed and valleys were filled partially with river deposits and wind deposited sands. A fill composed mostly of sand with some gravel covers a Pierre Shale terrace primarily along the south valley sides of Ponca Creek and the Keya Paha River. This fill is probably Late

Pleistocene in age. Fills of tributaries to this ancestral Keya Paha River terrace occur along the higher parts of streams draining south from South Dakota in Keya Paha County north of Burton. These fills contain boulders of reworked Ogallala quartzites and other larger rocks.

Holocene alluvium is stored beneath the floodplains and low terraces of Ponca Creek, the Keya Paha River, and some of their tributaries (see Mandel, this volume). Holocene alluvium is also stored in the Missouri River Valley. Holocene deposits in the valleys of Ponca Creek and the Keya Paha River contain clasts reworked from the Long Pine through the Niobrara formations, while the Missouri River deposits contain large cobbles reworked from glacial deposits. Alluvial deposits in all of these streams yield rocks capable of being used as tools by prehistoric people.

REFERENCES

Diffendal, R.F., Jr., and M.R. Voorhies

1994 Geologic framework of the Niobrara River drainage basin and adjacent areas in South Dakota generally east of the 100th meridian west longitude and west of the Missouri River: University of Nebraska, Conservation and Survey Division, Nebraska Geological Survey, Report of Investigations No. 9, 13 p.

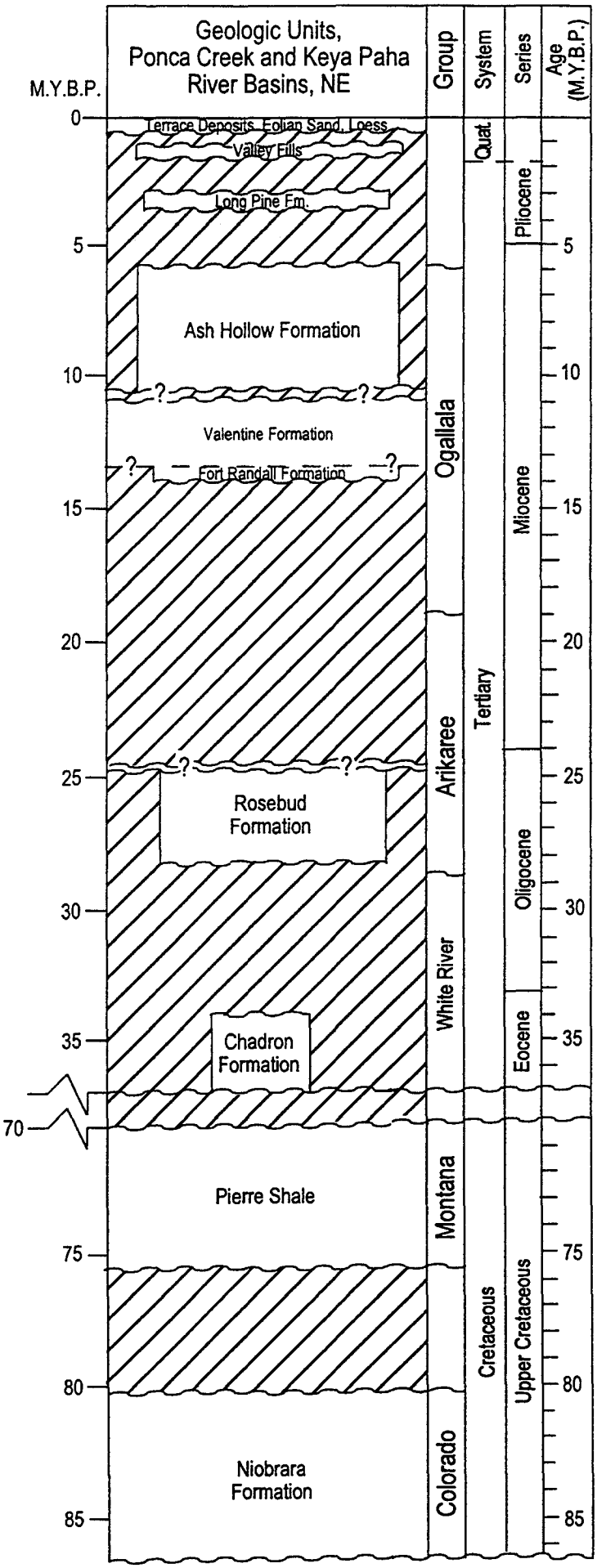

Table V.1:

GENERAL GEOLOGIC COLUMN OF STUDY AREA

Ruled Diagonal Areas Show Gaps in Stratal Sequence.

Width of Formation Box Shows Area Covered.

Addendum: This paragraph is from a later chapter in this technical report written by Steven R. Holen. He describes exotic specular hematite identified in these drainage basins by Robert F. Diffendal, Jr.

Other exotic materials include pieces of specular hematite from the Mary Kelley collection, which originated from Initial Coalescent sites 25BD1, 25BD16, and 25BD139. Some pieces appear to have been ground and one from site 25BD139 is very symmetrical. This material was identified by a geologist, Robert Diffendal, of the University of Nebraska Conservation and Survey Division. He states the two closest sources for this material are the iron mining area near Duluth in northern Minnesota and in the Sunrise Mine area in the Hartville Uplift in eastern Wyoming. Based on the presence of other lithic materials from the Hartville Uplift area, this lithic material probably comes from the Sunrise Mine area. This material may have been used as red pigment according to Diffendal. Roger Pabian, also of the Conservation and Survey Division, suggests that it may also have been used to strike sparks to start fires. This interesting idea should be tested.