

# **PS A Lithostratigraphic Examination of the K-PG Boundary in Northwestern South Dakota\***

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## **Abstract**

The Hell Creek Formation has been described and largely studied near the type section in eastern Montana and extensively in southwestern North Dakota. Little work, however, has been done to characterize the Hell Creek deposits in northwestern South Dakota. As the last terrestrial rock unit of the Cretaceous period in northwestern South Dakota, the Hell Creek Formation represents the sediments below the Cretaceous-Tertiary (K-T) boundary. This boundary represents a period of time when a large number of Earth's organism went extinct; the debate over the biotic effects of the K-T boundary endures between both scientists and lay people, with some questioning the existence of a major K-T extinction of terrestrial biota. The Ludlow Formation is the basal formation of the Fort Union Group, the oldest Tertiary sedimentary unit in the region, representing the strata above the K-T contact in northwestern South Dakota. To date, although a K-T "contact" has tentatively been identified above marine units in the White River Badlands of southwestern South Dakota, its terrestrial equivalent is yet un-described in South Dakota.

This research examines the Hell Creek and Ludlow formations and the boundary between, as they outcrop in northwestern South Dakota. Outcrops were studied stratigraphically, sedimentologically and, to a limited extent, paleobotanically. By including an examination of the fossil flora, we gain a measurement of the scale of the K-T extinction and a method to infer paleoclimate. The lithostratigraphy of the Hell Creek Formation in South Dakota is in need of further study so that it can be compared to Hell Creek outcrops across the extent of the entire deposit, from eastern Montana to southwestern North Dakota. It is hoped that this study will help to provide a more complete picture of the late Cretaceous terrestrial environment of western North America.



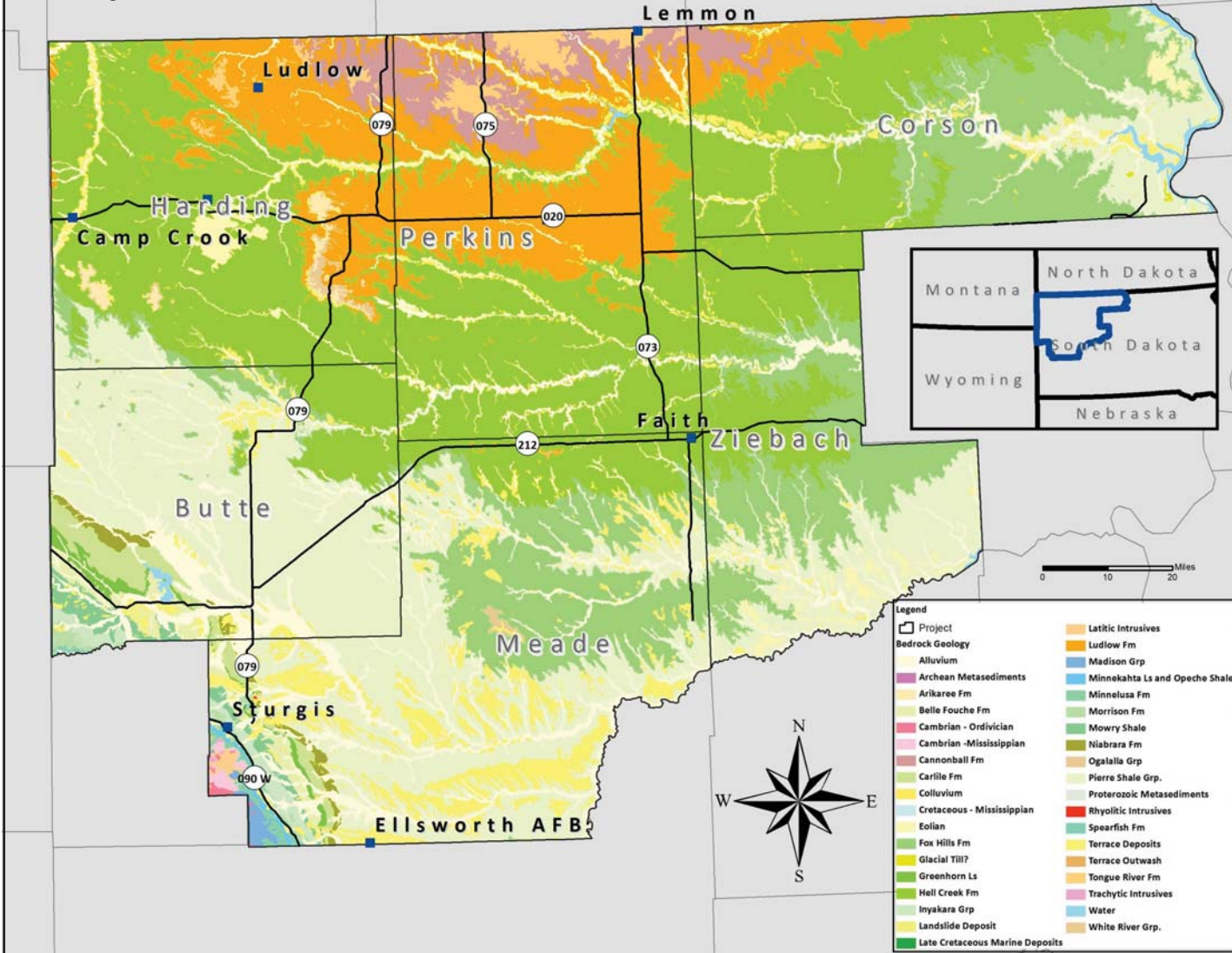
# A LITHOSTRATIGRAPHIC EXAMINATION OF THE K-Pg BOUNDARY IN NORTHWESTERN SOUTH DAKOTA

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## Abstract Summary:

- The Hell Creek Formation has been studied most extensively near the type section in eastern Montana and also in southwestern North Dakota.
- Comparably, little work has been done to characterize the Hell Creek deposits in northwestern South Dakota.
- The Maastrichtian age Hell Creek Formation is below the Cretaceous-Paleogene (K-Pg) boundary in northwestern South Dakota.
- The Ludlow Formation, the basal formation of the Fort Union Group, is the oldest Tertiary sedimentary unit in the region, representing the strata above the K-Pg boundary in northwestern South Dakota.
- To date, although a K-Pg “contact” has tentatively been identified above marine units in the White River Badlands of southwestern South Dakota, its terrestrial equivalent is yet un-described in South Dakota.
- This research examines the Hell Creek and Ludlow formations and the boundary between, as they outcrop in northwestern South Dakota.
- Outcrops were studied stratigraphically, sedimentologically and, to a limited extent, paleobotanically.
- The lithostratigraphy of the Hell Creek Formation in South Dakota is in need of further study so that it can be compared to Hell Creek outcrops across the extent of the entire deposit, from eastern Montana to southwestern North Dakota.

## Study Area:



The Hell Creek and Ludlow formations are exposed in the northwestern portion of South Dakota, as part of the southern extent of the Williston Basin. In particular, the Hell Creek and Ludlow Formations are exposed in the counties that form the northwestern corner of the state, along the border with Montana and North Dakota: Harding, Butte, Perkins, Meade, Corson and Ziebach.

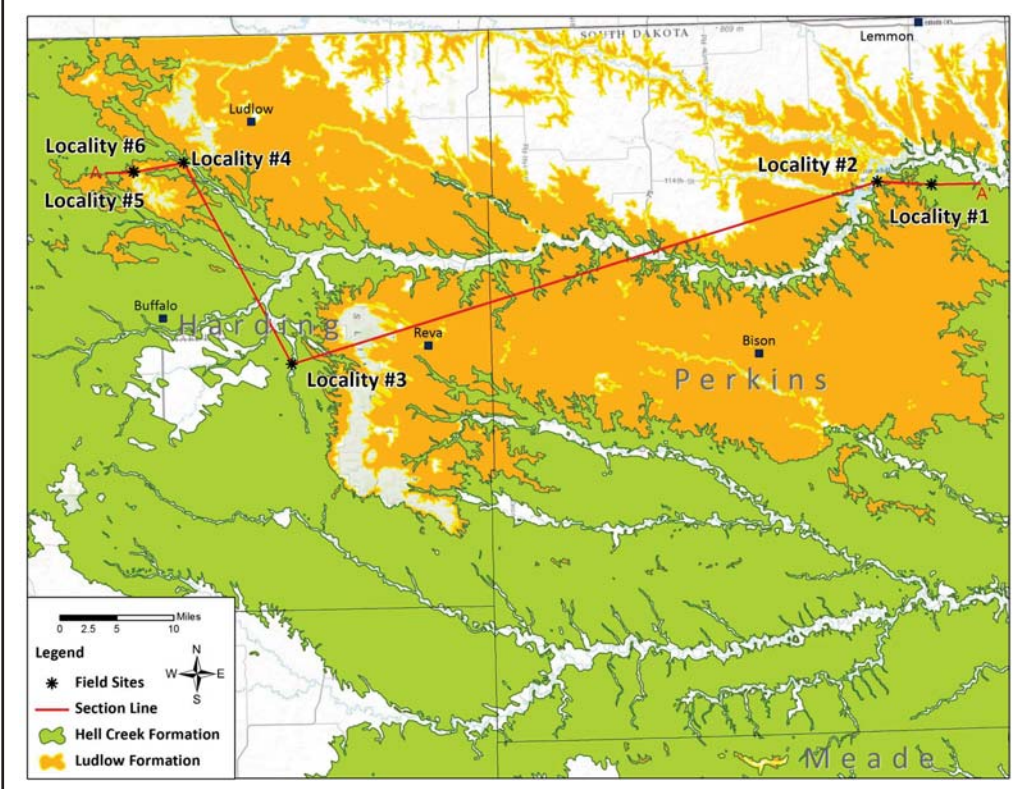
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## Objectives:

- To identify exposures in northwestern South Dakota containing the Hell Creek and Ludlow formations and the boundary between.
- To determine if the lithostratigraphic boundary between the Hell Creek and Ludlow formations is equivalent to the chronostratigraphic K-Pg boundary.
- To correlate strata in South Dakota above and below the K-Pg boundary with that in Montana and North Dakota.
- To measure and describe the lithostratigraphic sequence exposed at each chosen locality.
- To begin to identify and describe the nature of the K-Pg contact in northwestern South Dakota.
- To obtain and analyze samples for an iridium anomaly and shock metamorphosed quartz across the proposed K-Pg boundary.

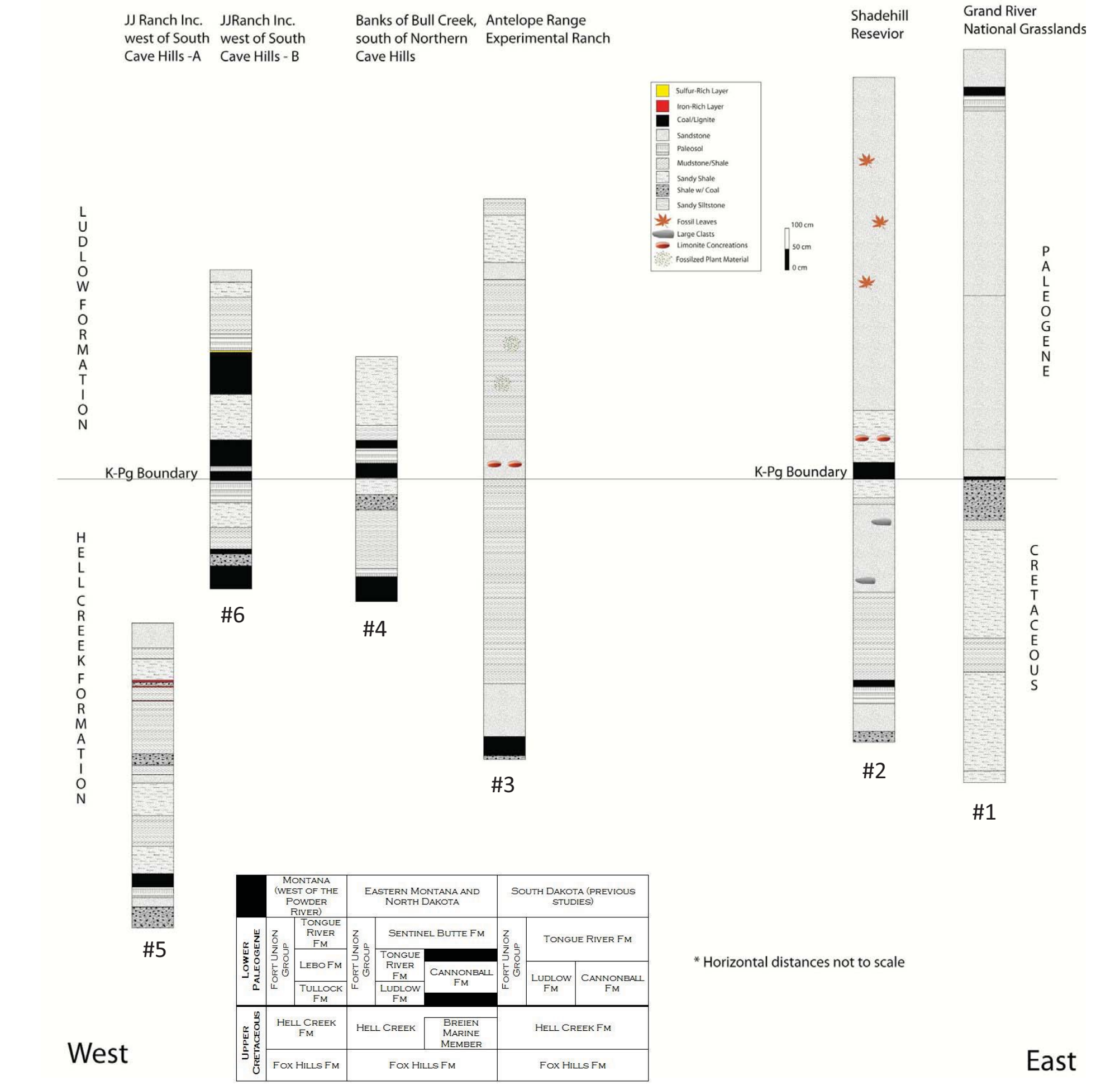
## Field Sites:



## Field Locality #1 –Near Lemmon, SD



## Results:



|                  | MONTANA (WEST OF THE POWDER RIVER) |                  | EASTERN MONTANA AND NORTH DAKOTA |                   | SOUTH DAKOTA (PREVIOUS STUDIES) |                 |
|------------------|------------------------------------|------------------|----------------------------------|-------------------|---------------------------------|-----------------|
|                  | LOWER PALEOGENE                    | FORT UNION GROUP | TONGUE RIVER FM                  | SENTINEL BUTTE FM | FORT UNION GROUP                | TONGUE RIVER FM |
| UPPER CRETACEOUS | HELL CREEK FM                      | HELL CREEK FM    | HELL CREEK FM                    | HELL CREEK FM     | HELL CREEK FM                   | HELL CREEK FM   |
|                  | FOX HILLS FM                       | FOX HILLS FM     | FOX HILLS FM                     | FOX HILLS FM      | FOX HILLS FM                    | FOX HILLS FM    |

\* Horizontal distances not to scale

## Identifying the K-Pg Boundary in the Field:

- 1) The top of the highest swelling “popcorn weathered” claystone.
- 2) A color change from gray, somber tones of the Hell Creek to light brown/yellowish tones of the Ludlow Formation.
- 3) At a distinct, break in the slope.
- 4) An increase in vegetative cover.
- 5) The base of laterally extensive and observable beds.
- 6) The base of the first variegated siltstone and claystone beds.
- 7) Widespread, “persistent”, lignite at the base of the Ludlow Formation.
- 8) Hell Creek strata exhibits a “dumped” look compared to the moderately flat and laterally continuous strata of the overlying Ludlow Formation.

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