

# Love birds on the dinosaur freeway

an exploration of evidence for courtship by Cretaceous theropods.

Notes for a Colorado Scientific Society field trip June 18<sup>th</sup> 2016

by Martin Lockley

In January 2016 the CU Denver Dinosaur Trackers Research Group announced the results of a two year study of usual combinations of theropod dinosaur tracks and "scrape" traces at three sites in western Colorado, and one in the east, at Dinosaur Ridge. These scrapes, some of which are the size of bath tubs, often occur as pairs of furrows. Because the traces are interpreted as evidence of what is known as "nest scrape display" they are named *Ostenichnus bilobatus* meaning "paired or bilobed trace" associated with display or "ostentatious" display behavior.

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The traces are the first ever reported that can reasonably be interpreted as direct physical evidence of what, in the case of some modern birds, theropod descendants, are known as **display arena areas**, also known as "**leks**." All previous literature on dinosaur display has been speculative (not based on physical evidence) inferring that theropods and other dinosaur "would have" displayed, because a) they were like birds, b) they had feathers, c) they had crests, d) they had good vision, e) they were energetic .... *etcetera, etcetera*.

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To date we have found four of these scrape sites in western Colorado (including one studied since January 2016) and one in eastern Colorado (total= 5 scrape sites). All occur in the Dakota Sandstone in rocks that are about 100-95 million years old, and represent a coastal plain. Some of the sites are quite large (50-100 m long with several dozen scrapes. These finds raise many interesting questions about theropod dinosaur behavior.

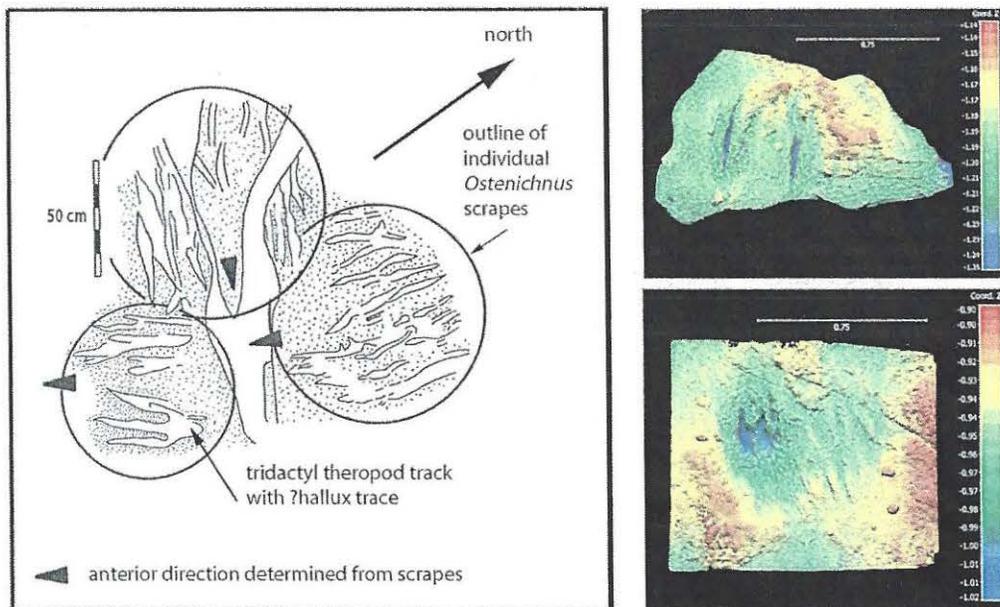
For example:

- 1) Did theropods behave just like birds 100 million years ago?
- 2) Could this be interpreted as territorial behavior, not related to courtship?
- 3) Did theropod nest near these nest scrape display arenas?
- 4) Were the traces made in the springtime breeding season?
- 5) Can we learn from these finds where to find more scrape traces?
- 6) Do the scrapes reveal the size and types of theropod dinosaurs that made them?

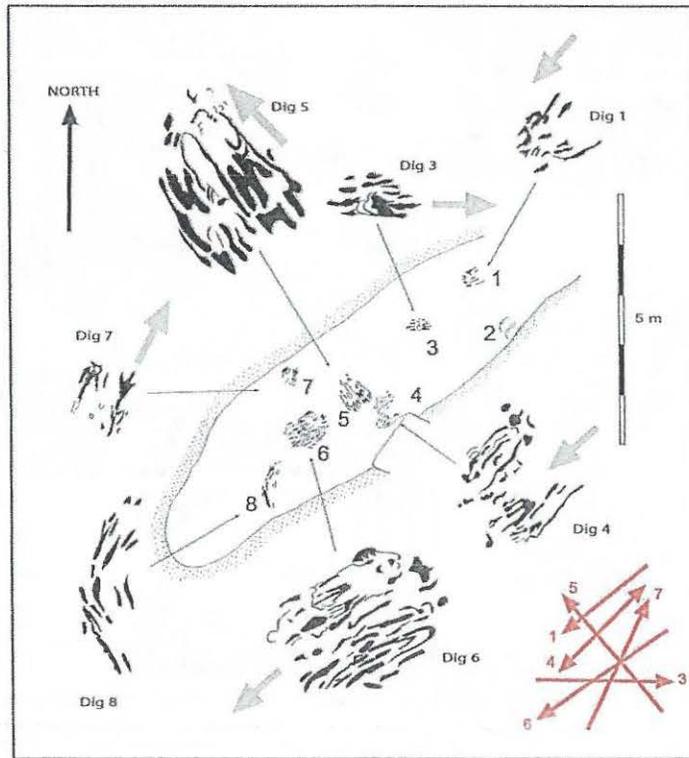
The Dakota Sandstone was known as a Dinosaur Freeway before the discovery of the scrapes. What does this label mean? And what do the new discoveries tell us that we did not know previously.



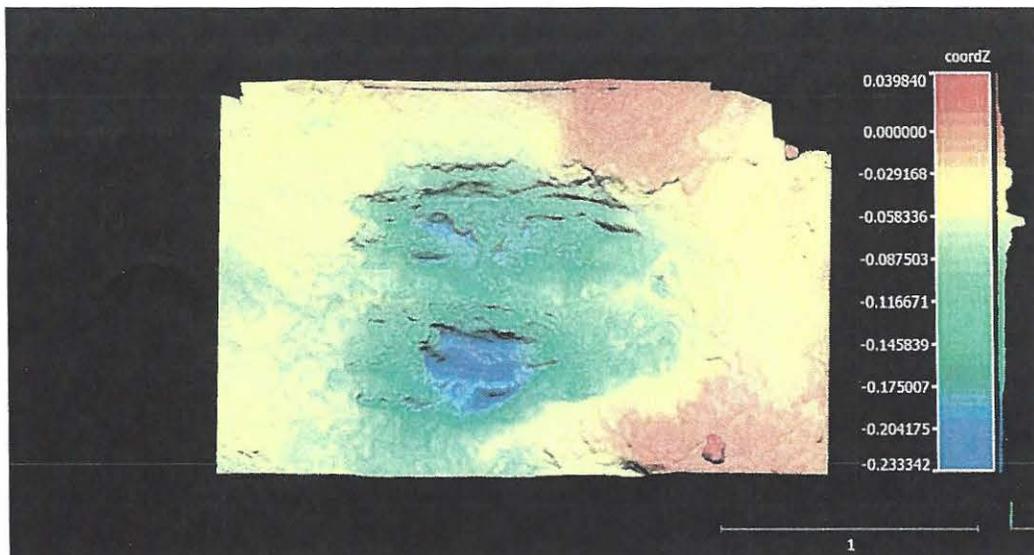
Picture of two large scrapes: Dakota Group. Western Colorado



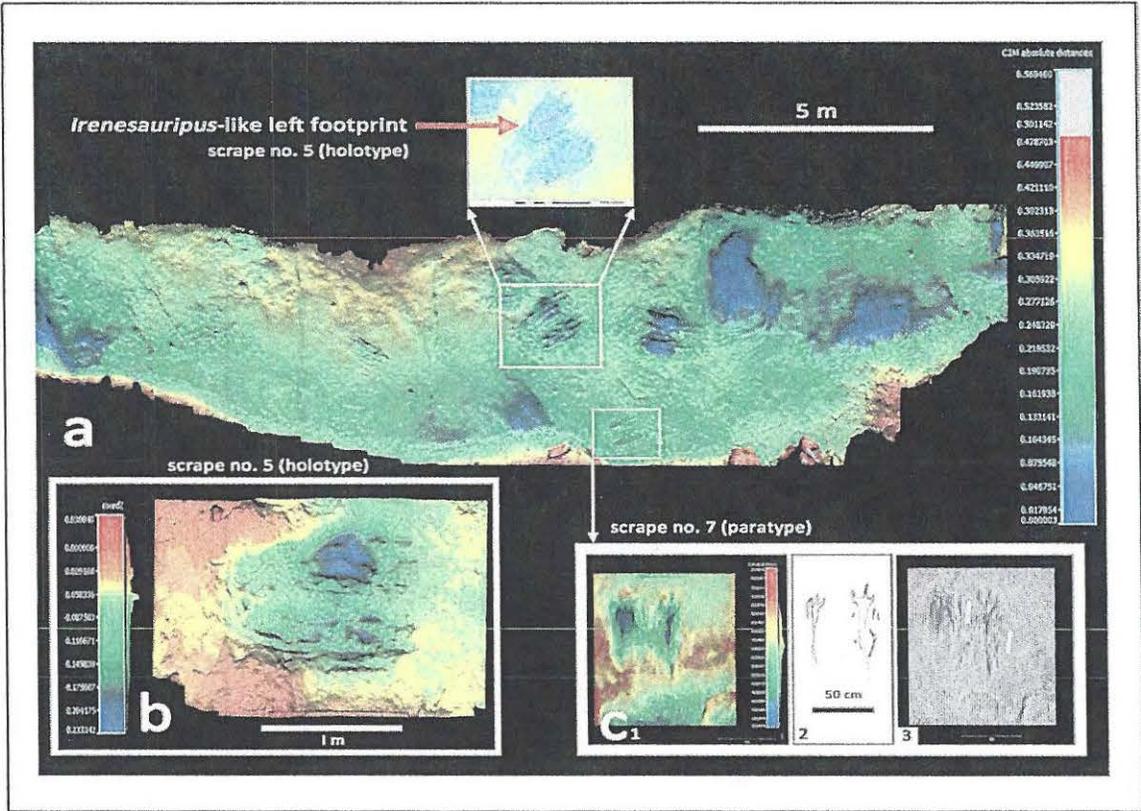
Map of theropod scrapes (left) and 3D photogrammetric images from a new site in western Colorado. These are just 3 of more than 20 scrapes. Cretaceous Dakota Group.



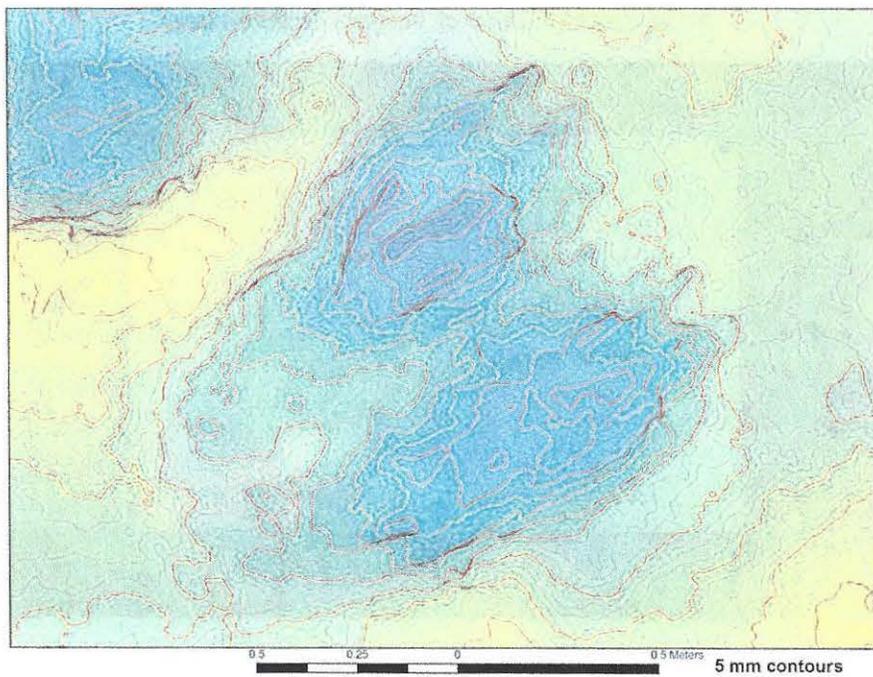
Map of eight scrapes at a site in western Colorado. Note the variable orientation of scrapes  
 Note concentration of scrapes in small area

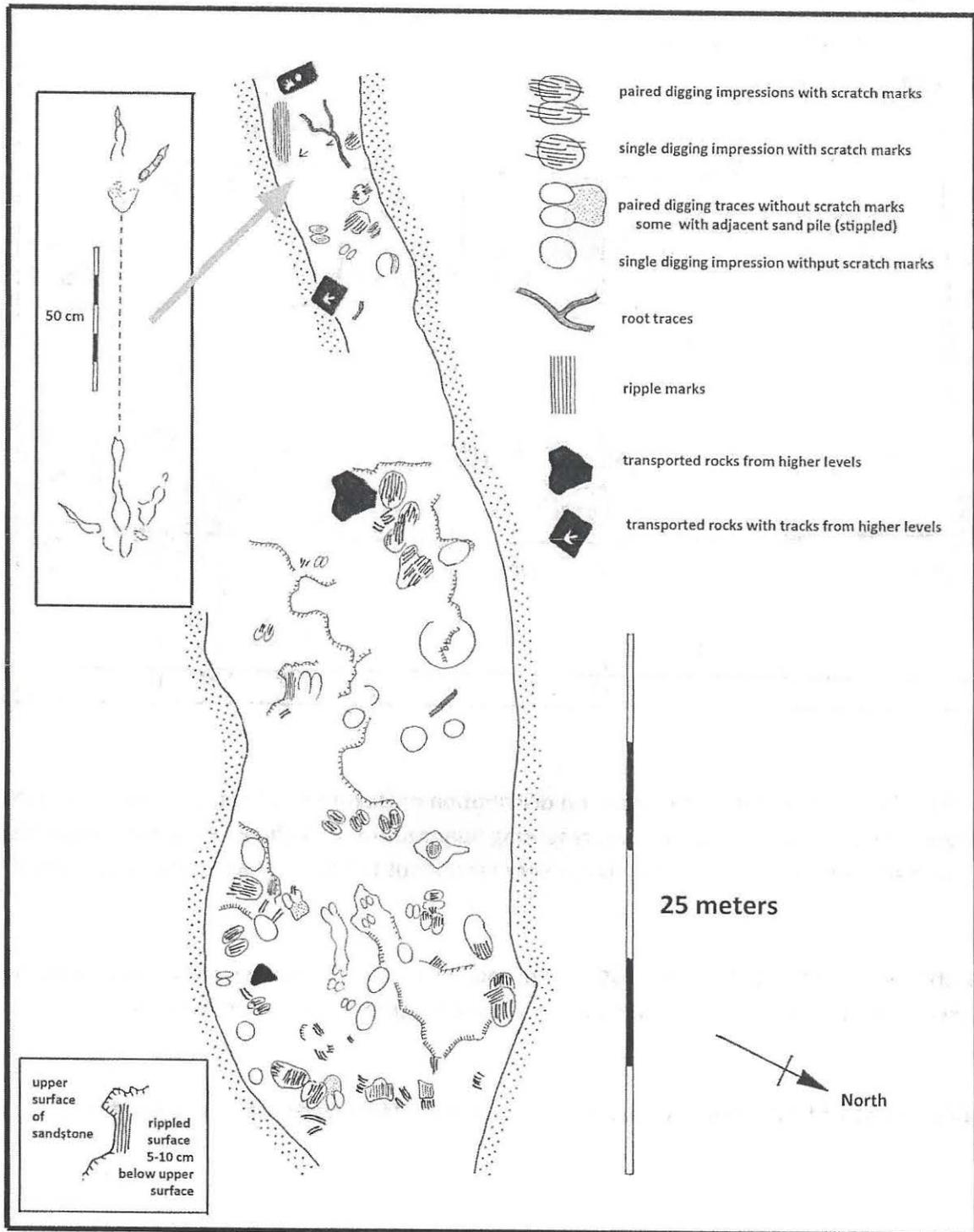


3D image of scrape set number 5

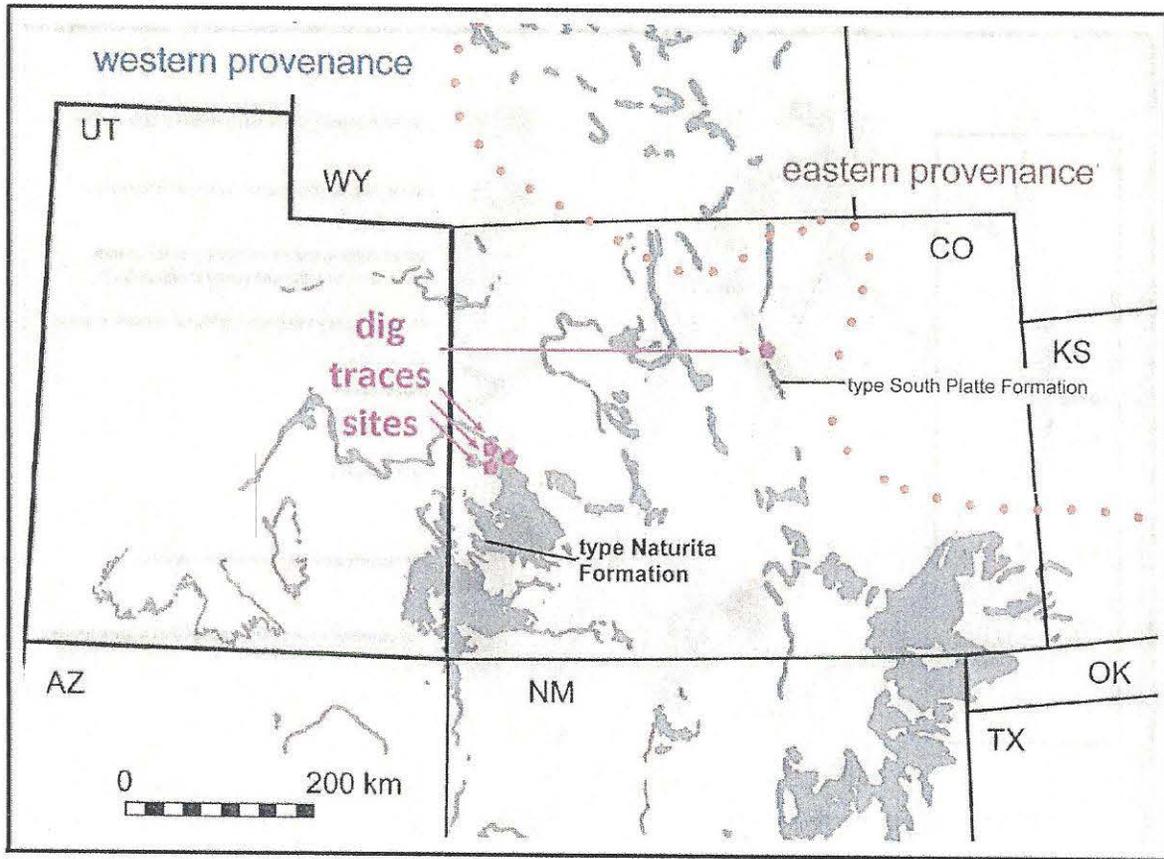


Evidence for theropod trackmakers is clear in scrapes 5 and 7





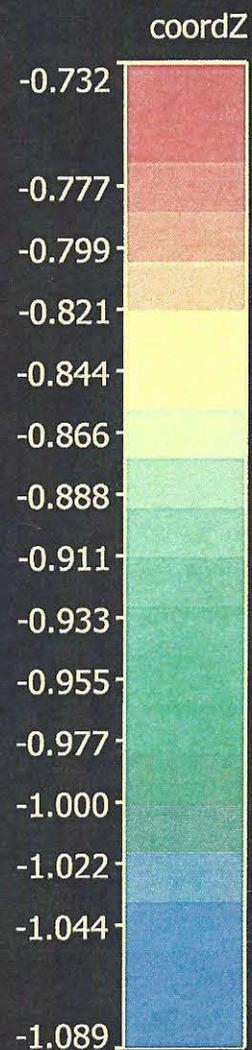
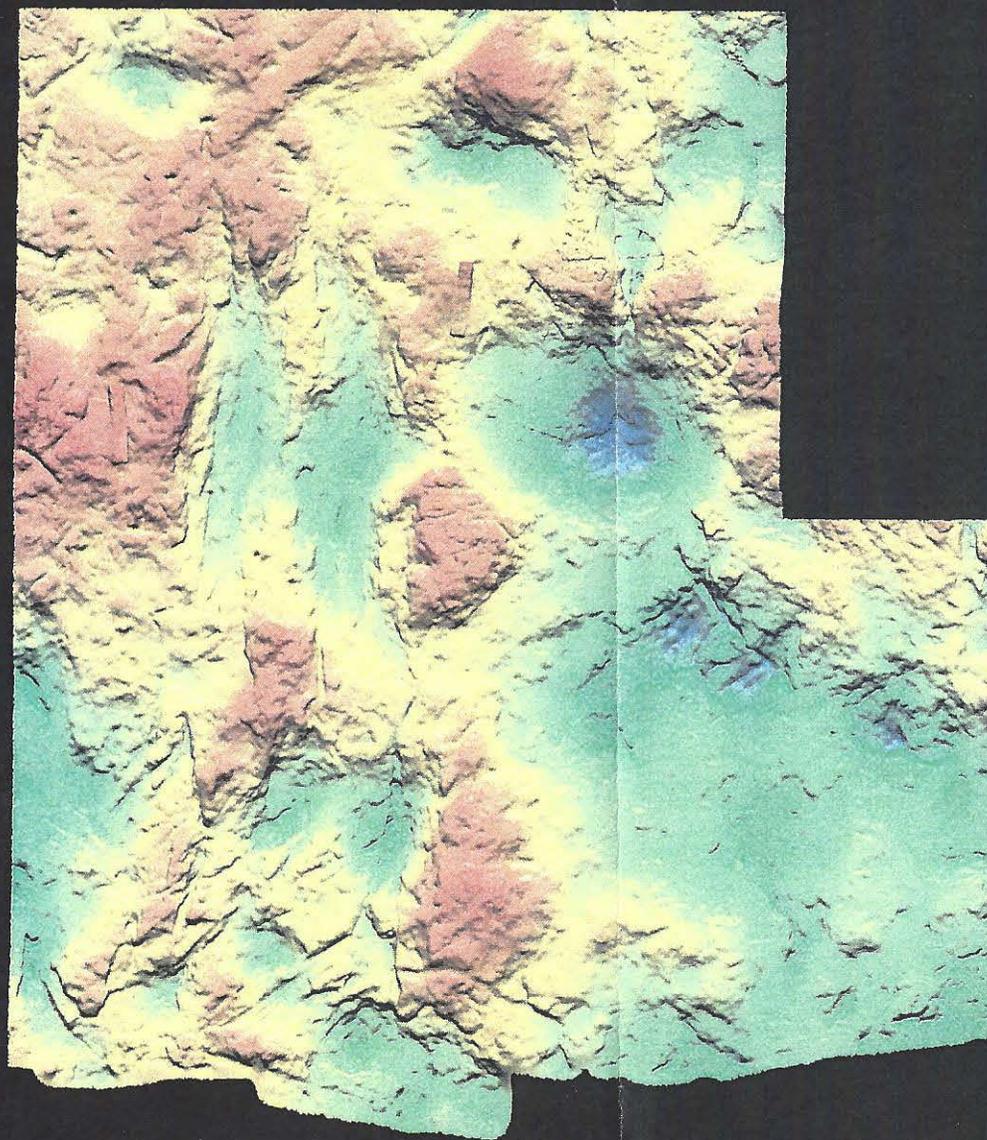
The largest site so far documented has more than 60 scrape sets in an area of  $\sim 750 \text{ m}^2$



The Dinosaur Freeway area, based on distribution of Dakota Sandstone outcrops. To date more than tracksites are known, representing hundreds of individuals. However, body fossils of dinosaurs and other tetrapods are very rare. Plant fossils and local coal are common.

**Animals known from trace fossils:** theropod dinosaurs (2-3 types), ornithopod dinosaurs, ankylosaurs, crocodiles, pterosaurs, turtles, horseshoe crabs many other invertebrates.

**Animals known from body fossils:** crocodiles, turtles, a few invertebrates and plants.



DINOSAUR RIDGE SCRAPES  
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