September 28, 2016, GSA – Denver, CO
 # 315-8

DISCOVERY OF AN EXPOSED EARLY TRIASSIC NAMAKIER (SALT GLACIER) ON THE WEST FLANK OF THE ONION CREEK DIAPIR IN GRAND COUNTY, UTAH

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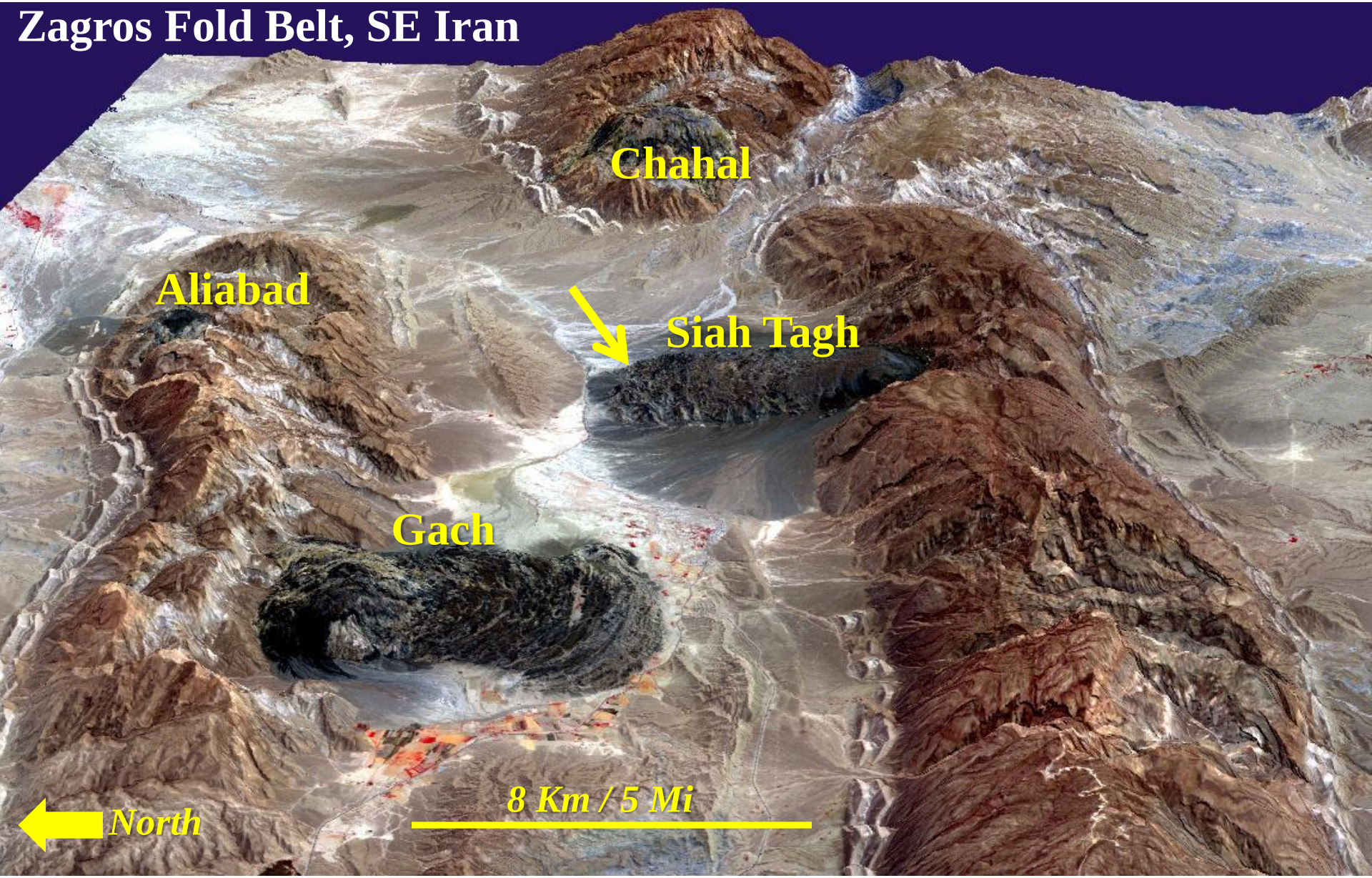
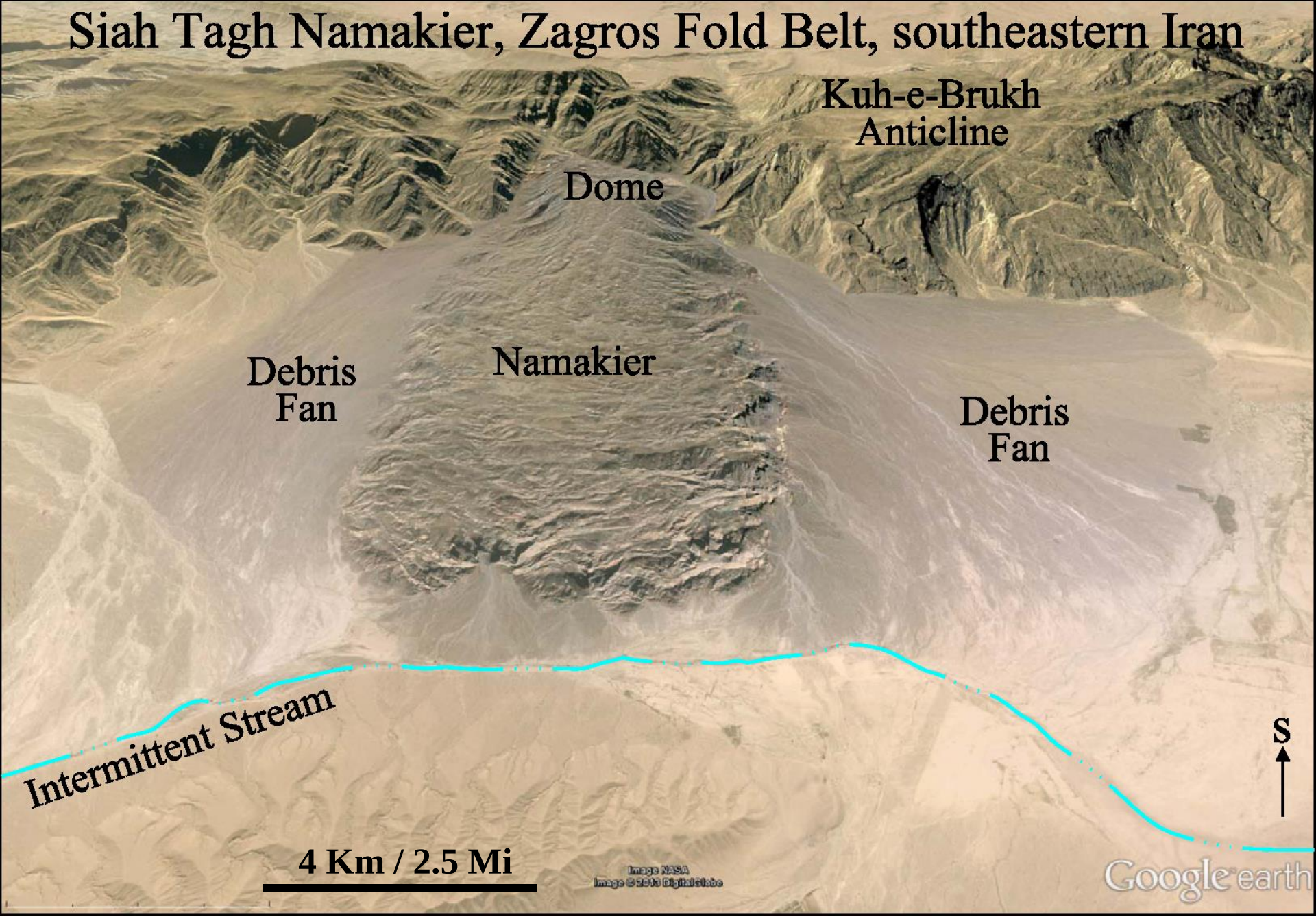
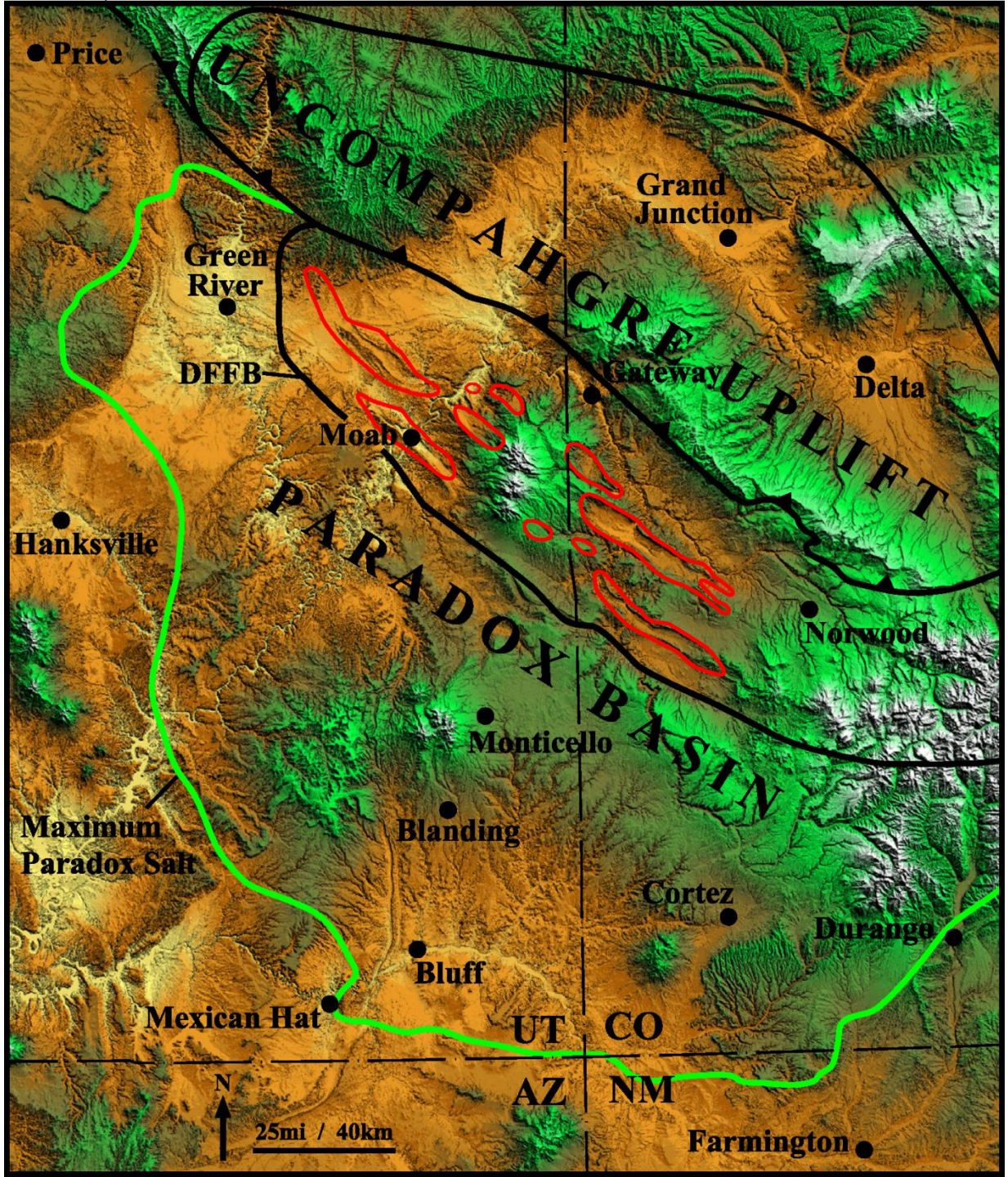


Image courtesy NASA

LOCATION OF THE SIAH TAGH NAMAKIER, IRAN



Siah Tagh Namakier is about 4 miles long and terminates near axis of syncline between folds.

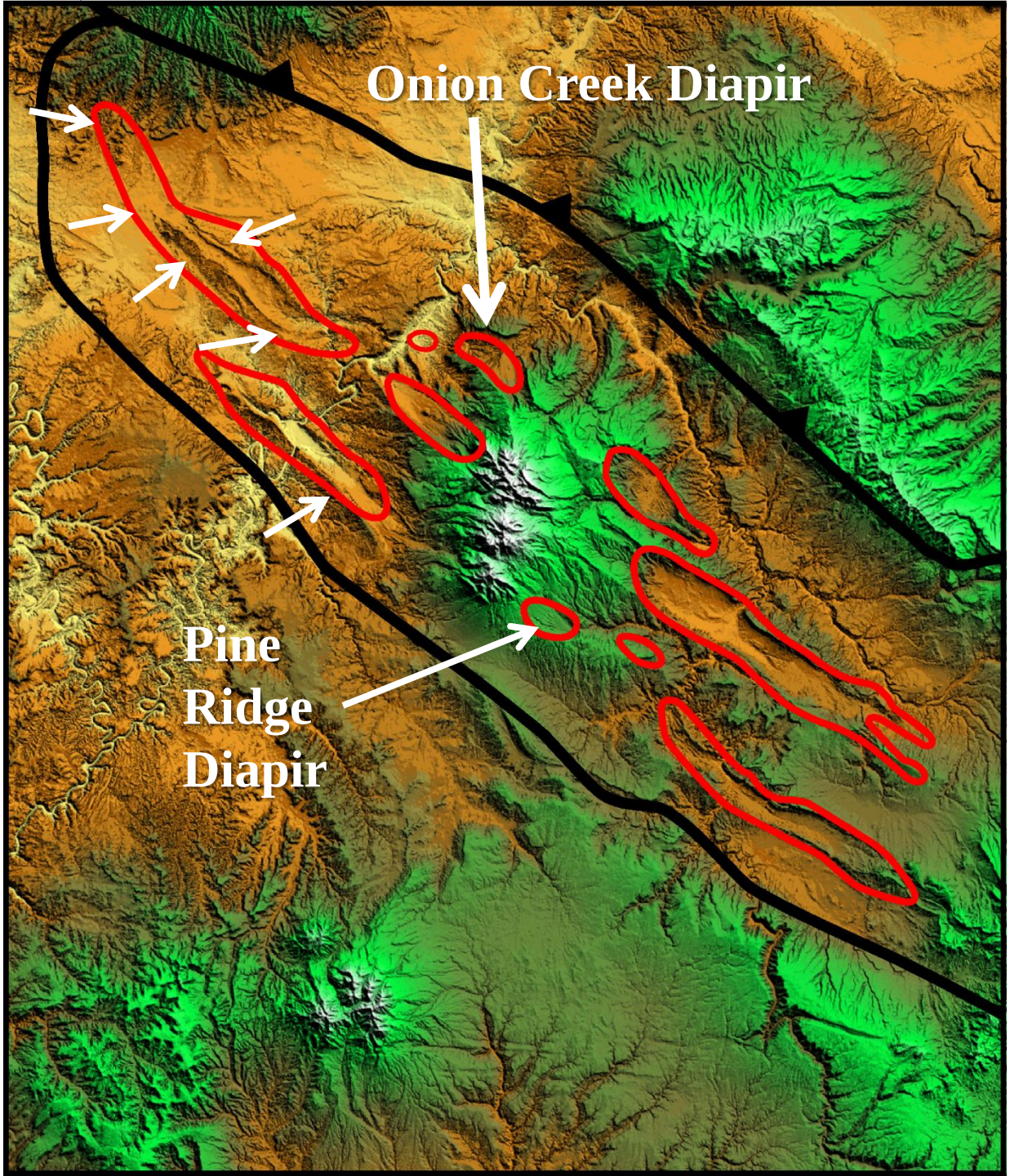


DEM map showing tectonic features and salt diapirs (red).

Most structures formed during the Laramide Orogeny.

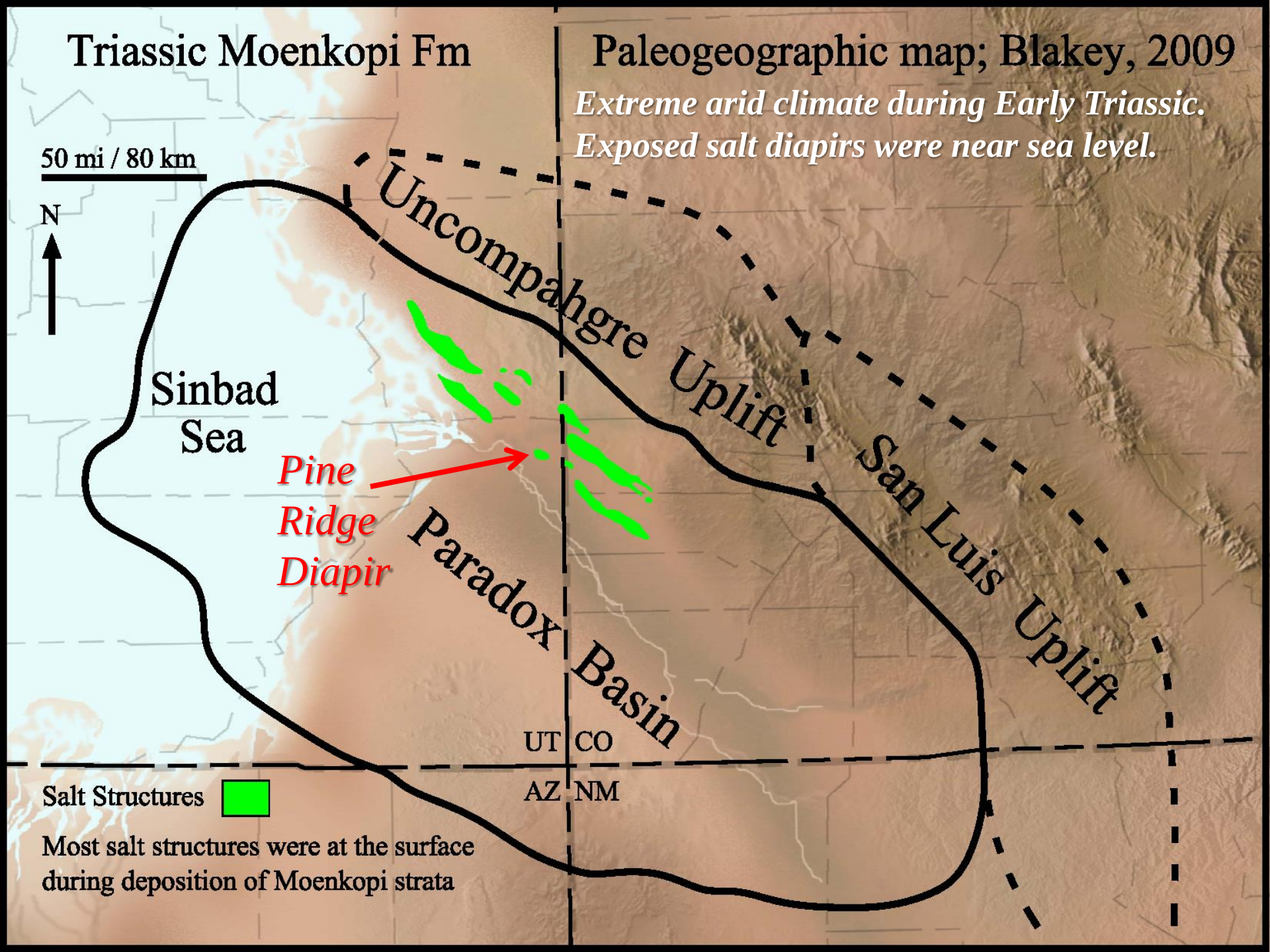
Volcanism during the Paleogene.

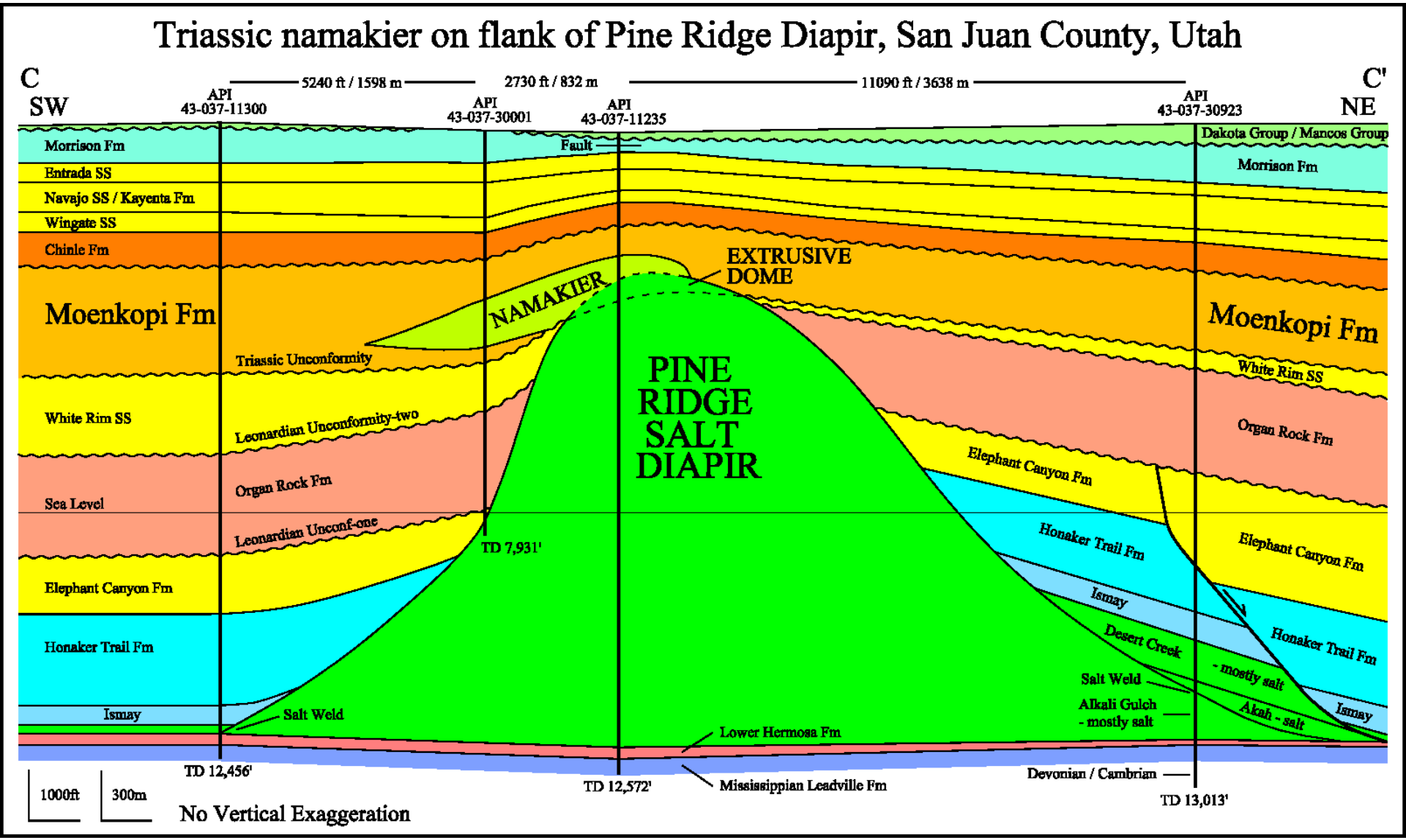
Extensive erosion started during the Neogene (Miocene).



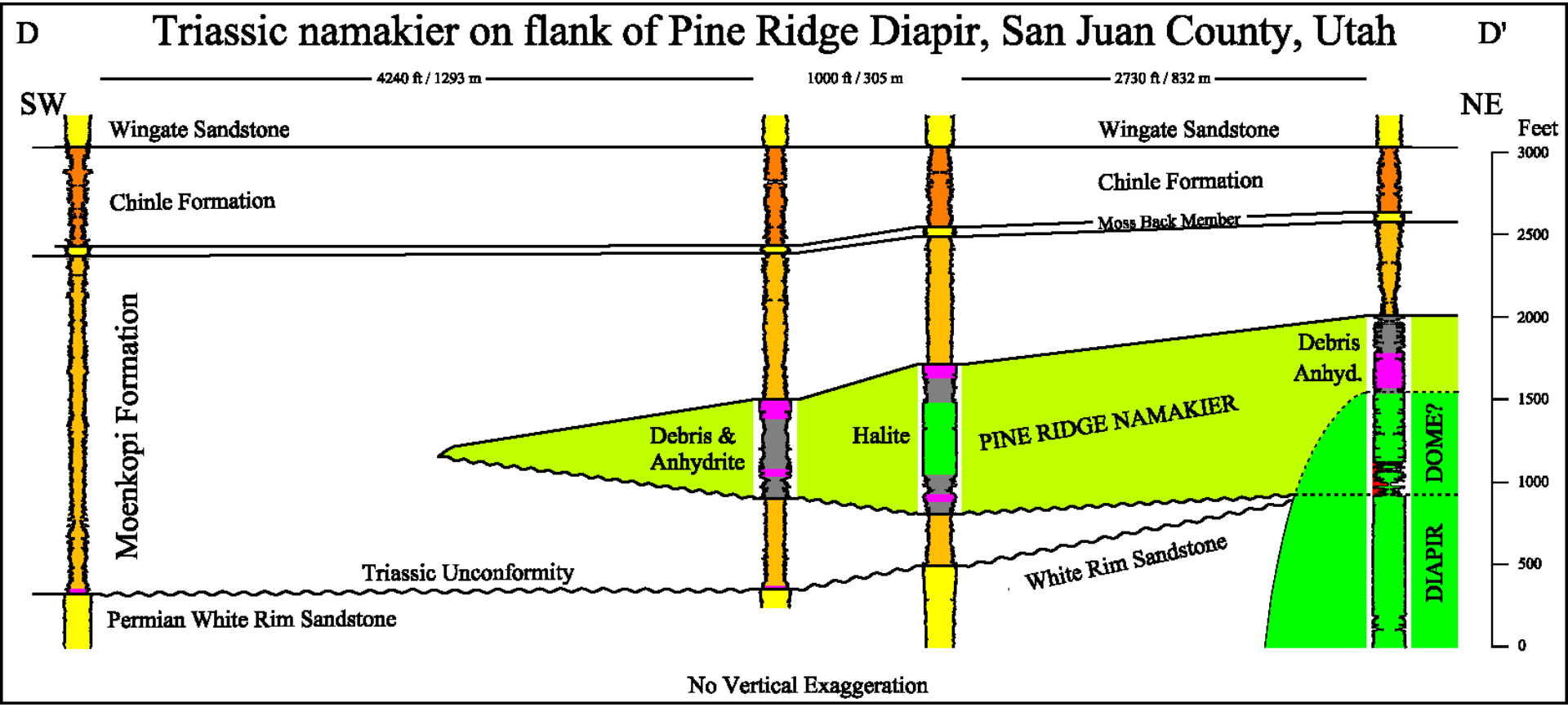
Small arrows are for 7 Early Triassic Namakiers in the subsurface.

Large arrow is for Early Triassic Namakier exposed at the surface on Onion Creek Diapir.


Triassic Moenkopi Fm
Paleogeographic map; Blakey, 2009
Extreme arid climate during Early Triassic.
Exposed salt diapirs were near sea level.
50 mi / 80 km
N
Uncompahgre Uplift
San Luis Uplift
Sinbad Sea
Pine Ridge Diapir
Paradox Basin
UT
CO
AZ
NM
Salt Structures
Most salt structures were at the surface during deposition of Moenkopi strata

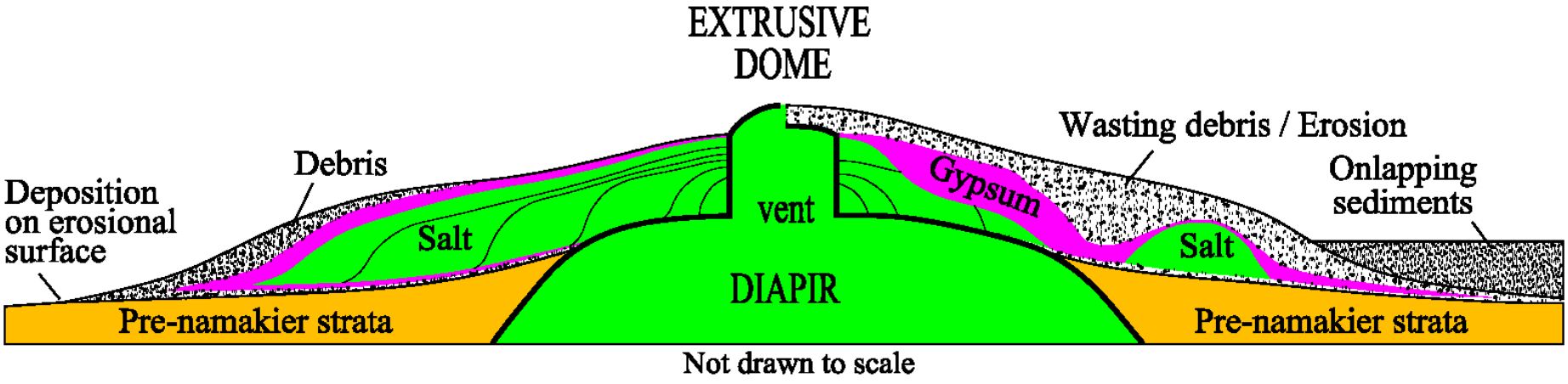


Modified from Rasmussen, 2014 (UGA).



Modified from Rasmussen, 2014 (UGA).

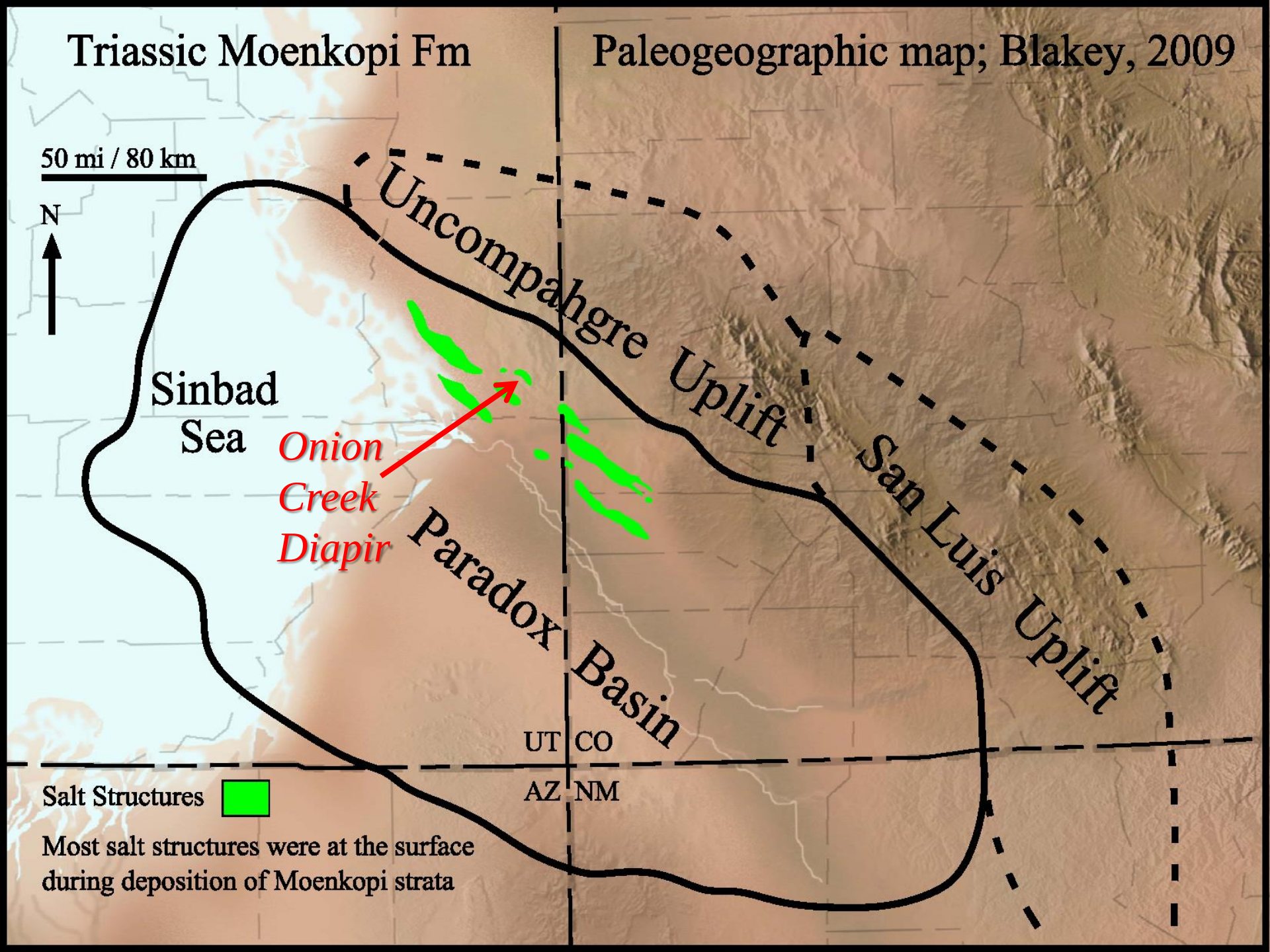
Hypothetical Paradox Basin subaerial namakiers



Models are based on extensively studied namakiers in SE Iran, in particular models by Christopher Talbot (Example A), and subsurface well control and data in the Paradox Basin (Example B).

Extrusive dome is a "salt fountain" on a breached diapir.

Modified from Rasmussen, 2014 (UGA).


Triassic Moenkopi Fm
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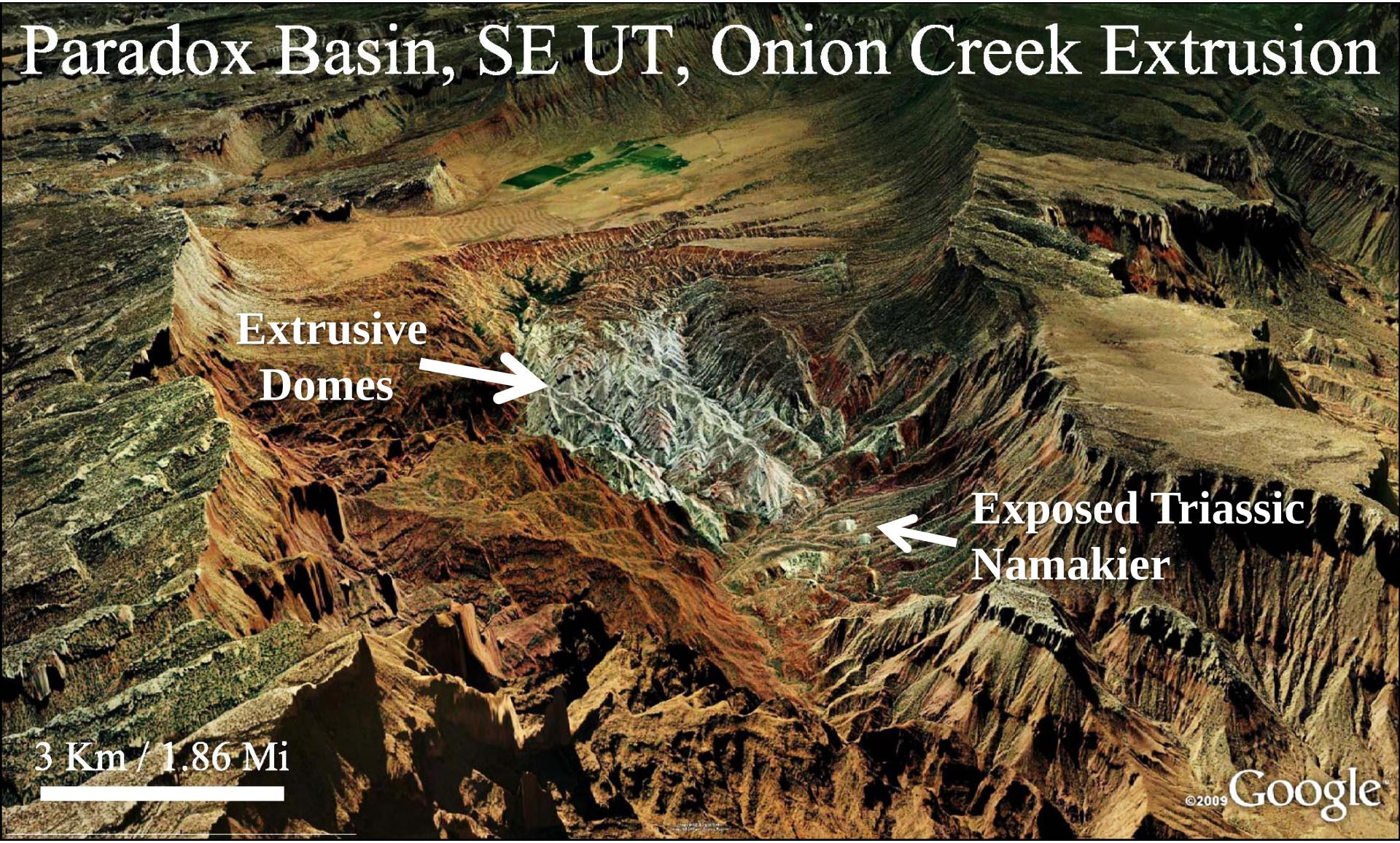
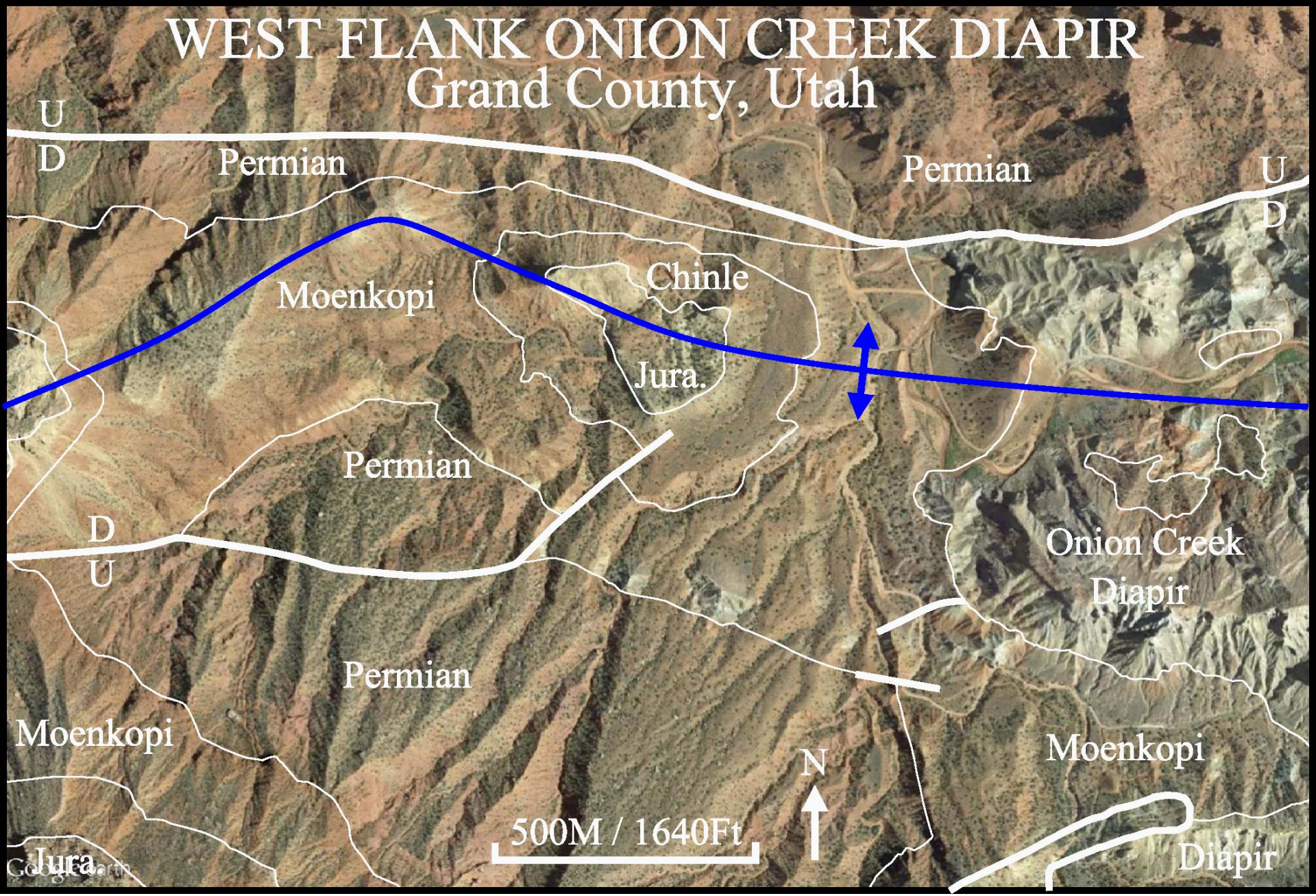
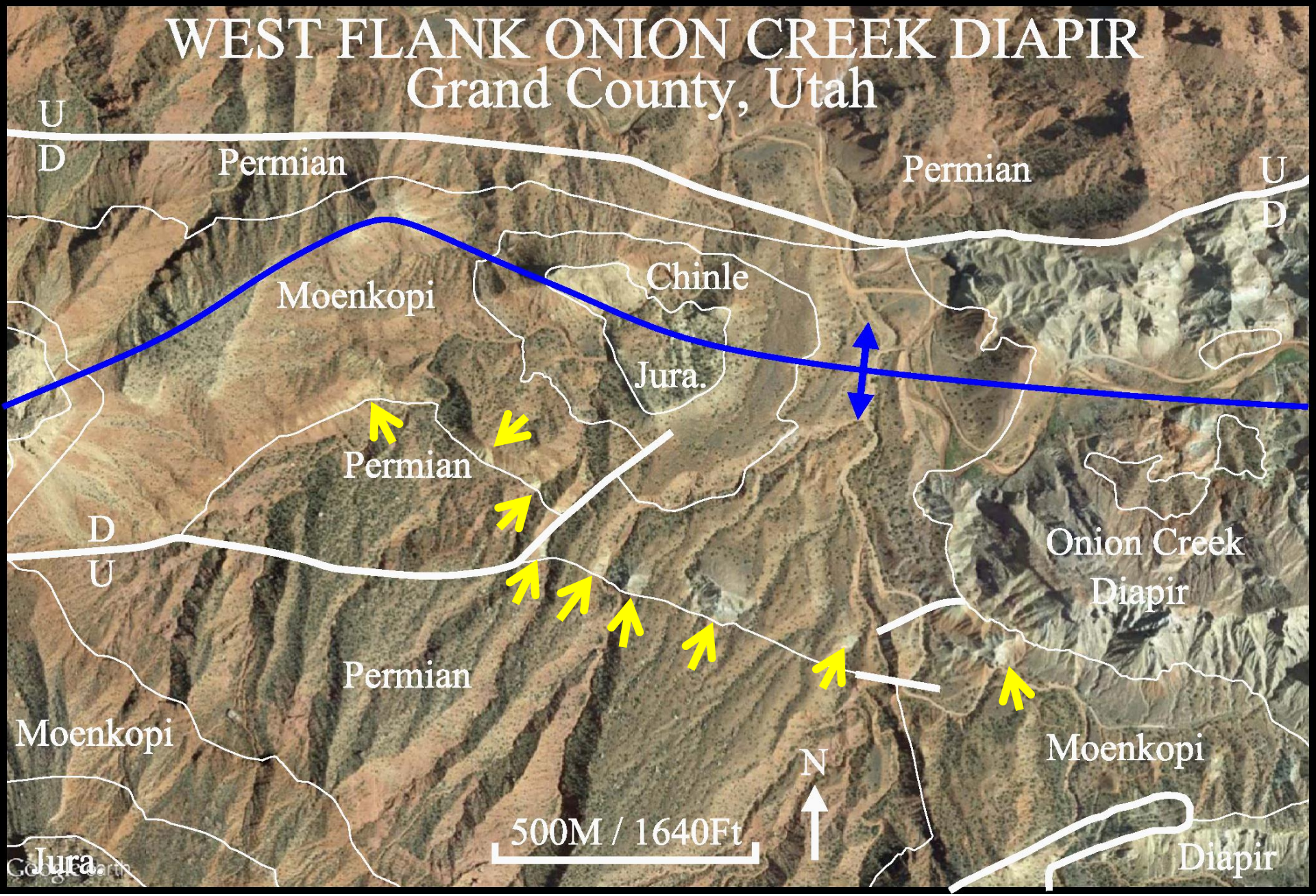


Looking SE into the core of the highly eroded Onion Creek extrusion. Neogene collapse.
Vertical exaggeration X3.

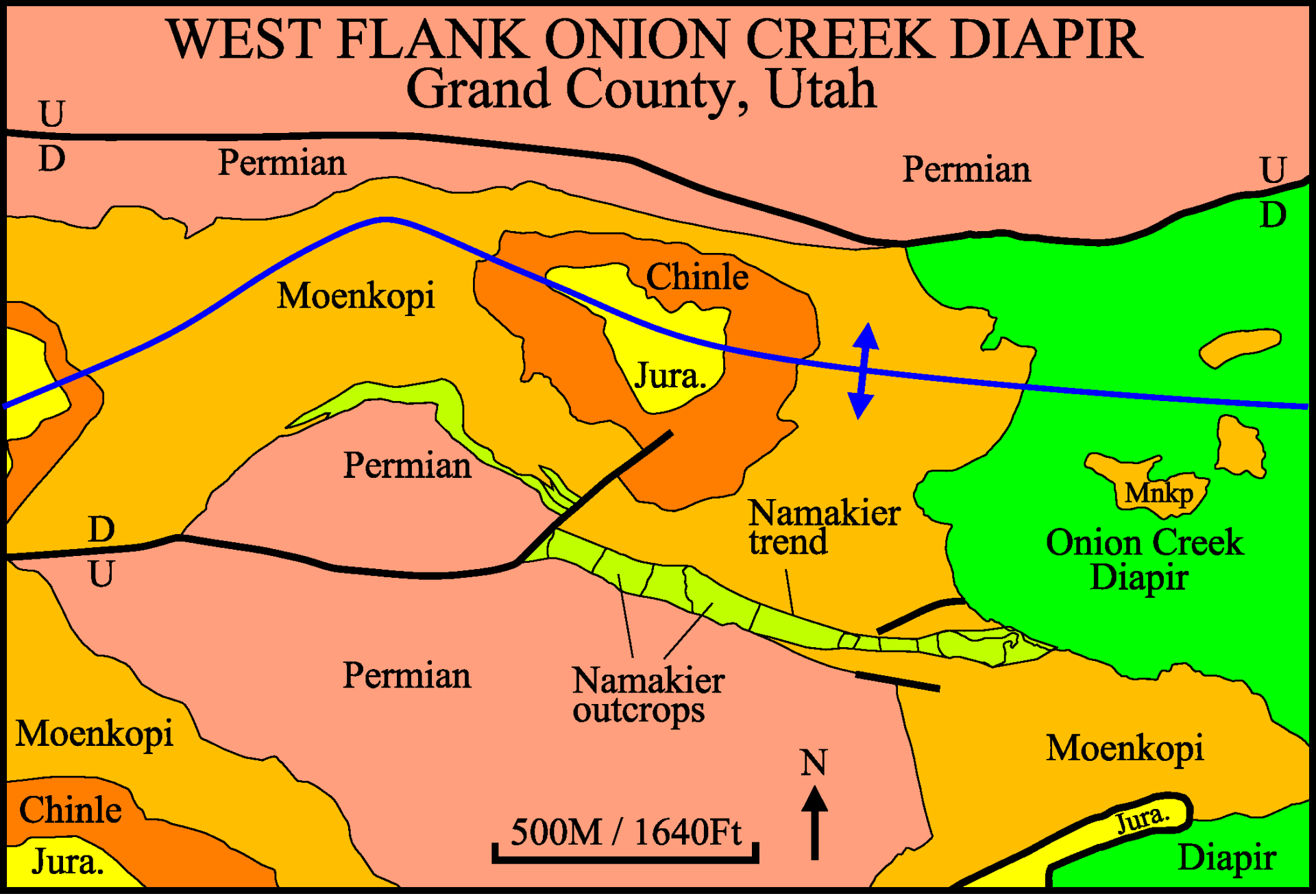


Geology overlay on Google Earth image. Modified from Shoemaker and Doelling.



Geology overlay on Google Earth image. Modified from Shoemaker and Doelling.

Arrows indicate Namakier outcrops.



West Onion Creek namakier trend exposed in outcrops along south flank of syncline.

ONION CREEK EARLY TRIASSIC NAMAKIER
Grand County, Utah

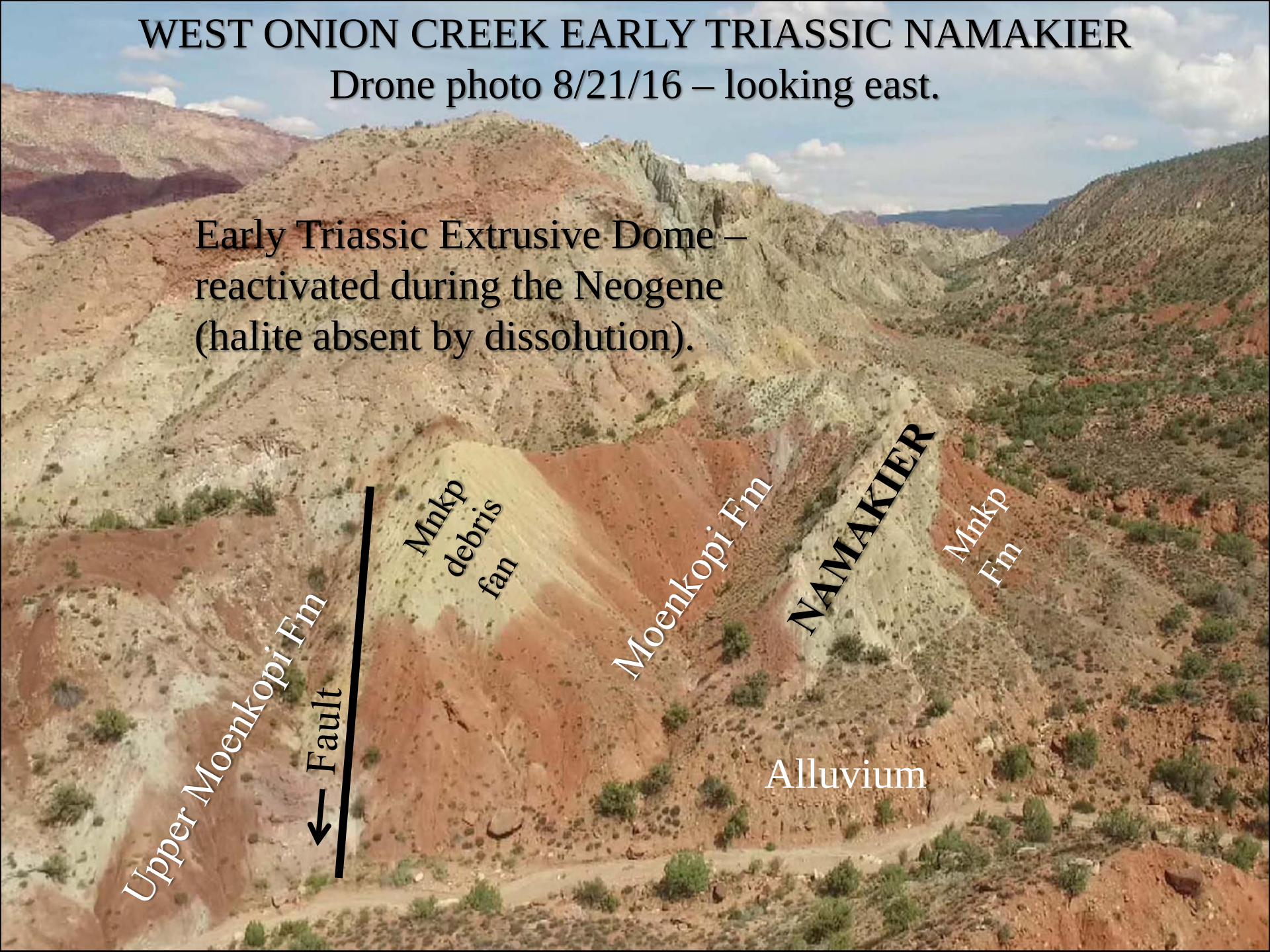
NAMAKIER OUTCROP TREND

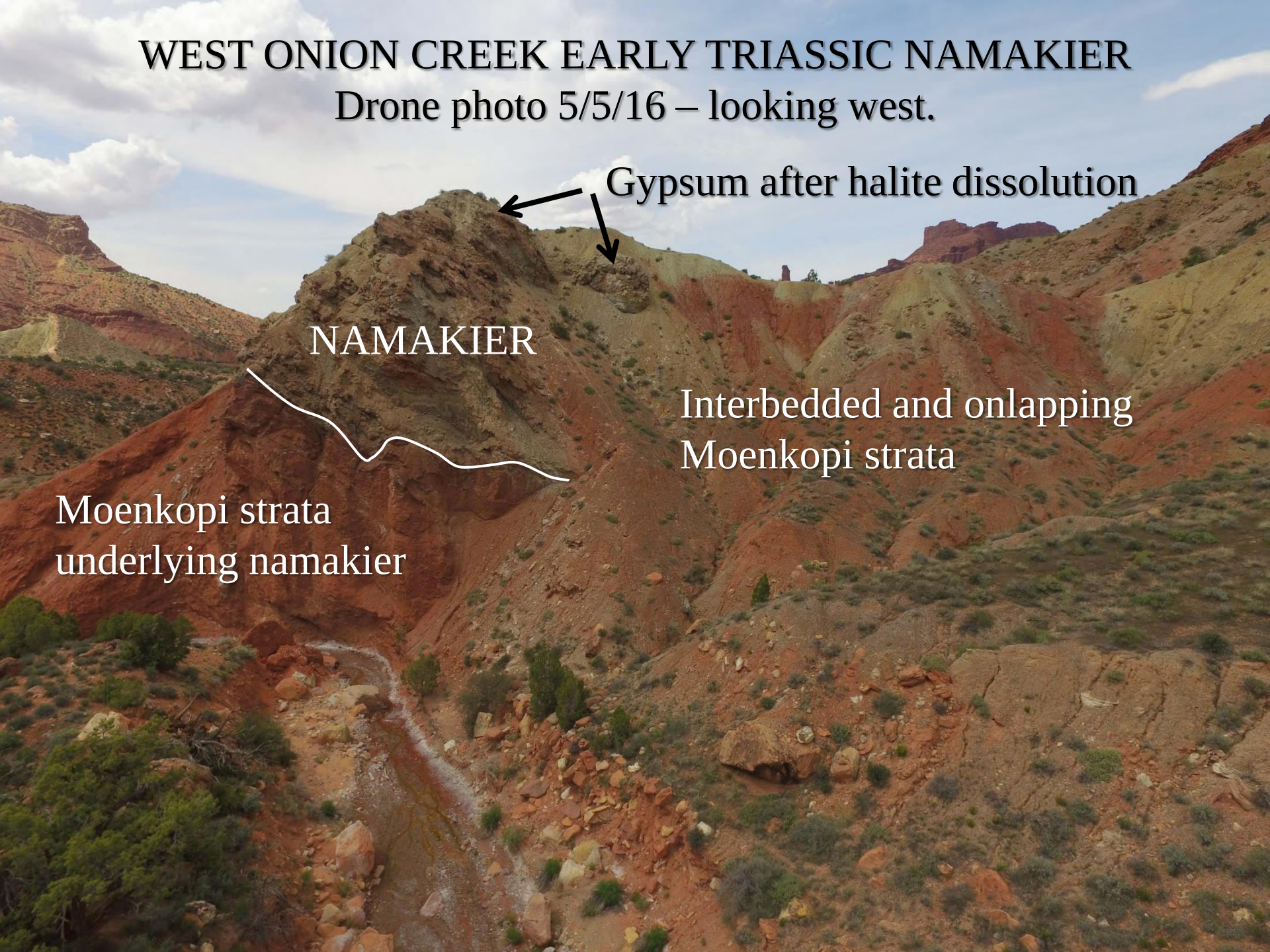
TRIASSIC EXTRUSIVE DOME

PHOTO

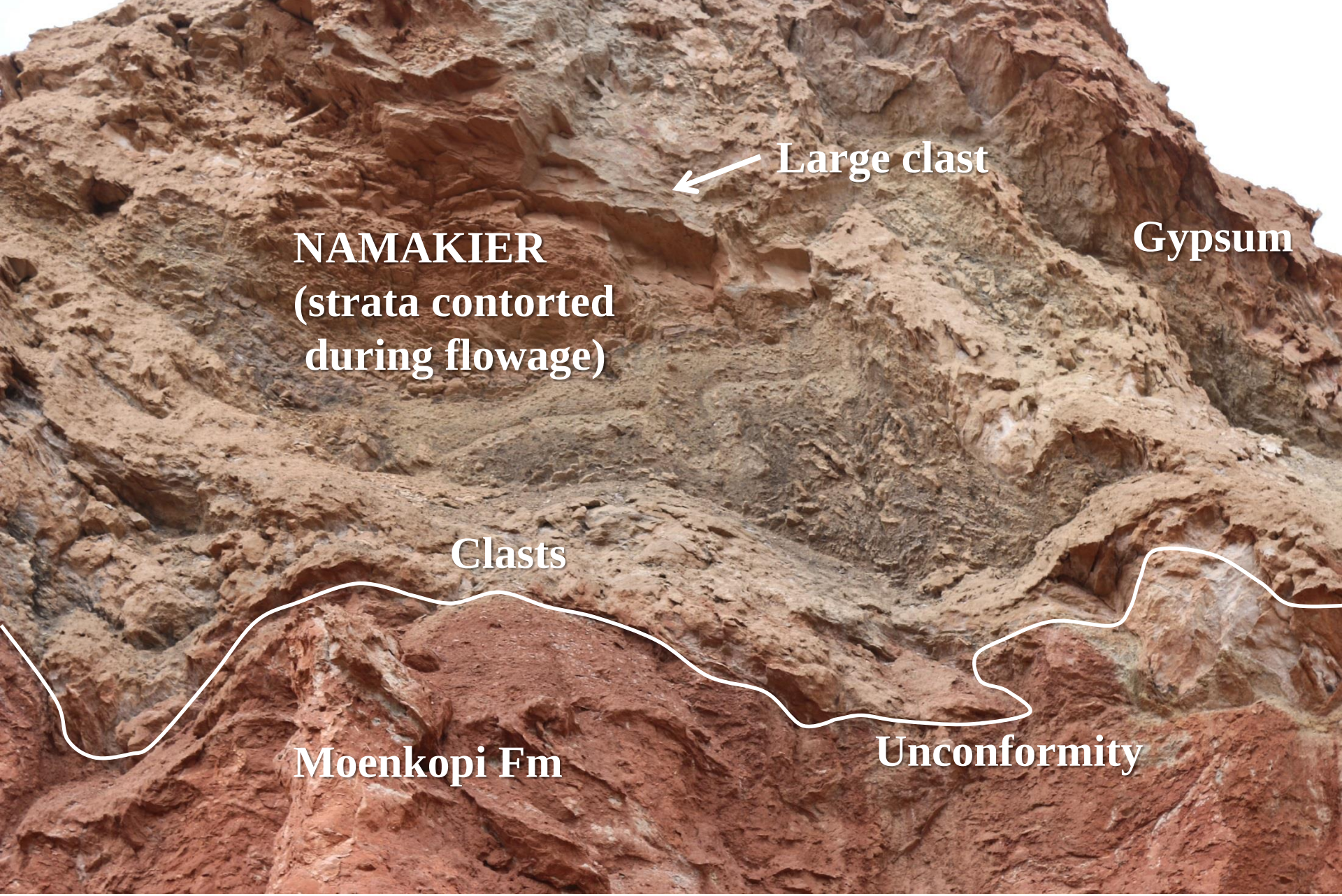
N

500M / 1640Ft

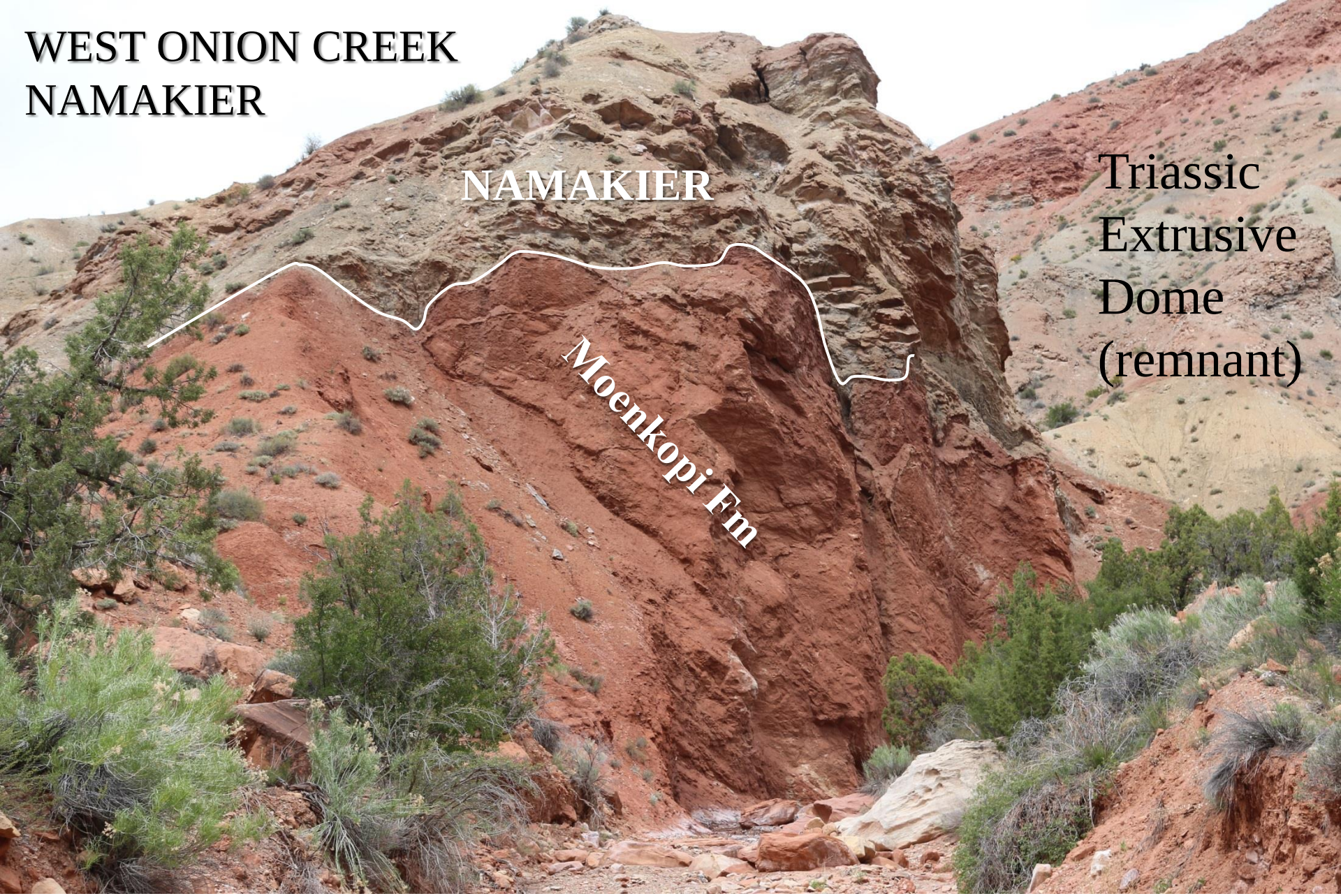

WEST ONION CREEK EARLY TRIASSIC NAMAKIER
Drone photo 8/21/16 – looking east.
Early Triassic Extrusive Dome – reactivated during the Neogene (halite absent by dissolution).
Upper Moenkopi Fm
Fault
Mnkp debris fan
Moenkopi Fm
NAMAKIER
Mnkp Fm
Alluvium


WEST ONION CREEK EARLY TRIASSIC NAMAKIER
Drone photo 5/5/16 – looking west.
Gypsum after halite dissolution
NAMAKIER
Interbedded and onlapping
Moenkopi strata
Moenkopi strata
underlying namakier

WEST ONION CREEK NAMAKIER; photo 5/5/16 - looking northeast



Base of Early Triassic Namakier unconformably on Moenkopi Fm.
Namakier here is gypsum cemented debris with small-to-large clasts.



Another view of the Early Triassic Namakier unconformably on deformed Moenkopi strata.

ONION CREEK EARLY TRIASSIC NAMAKIER
Grand County, Utah

NAMAKIER OUTCROP TREND

TRIASSIC EXTRUSIVE DOME

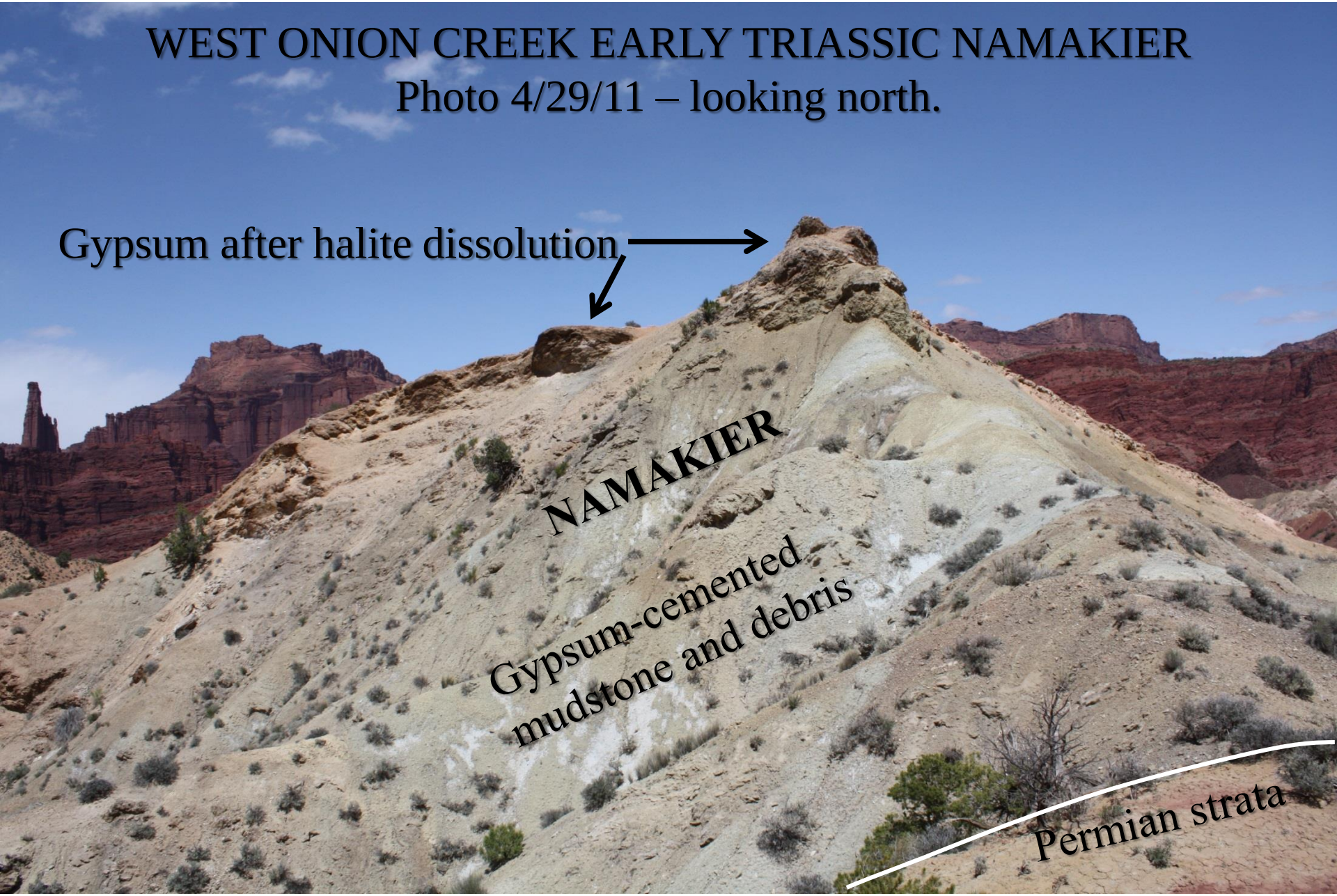
PHOTO

N

500M / 1640Ft

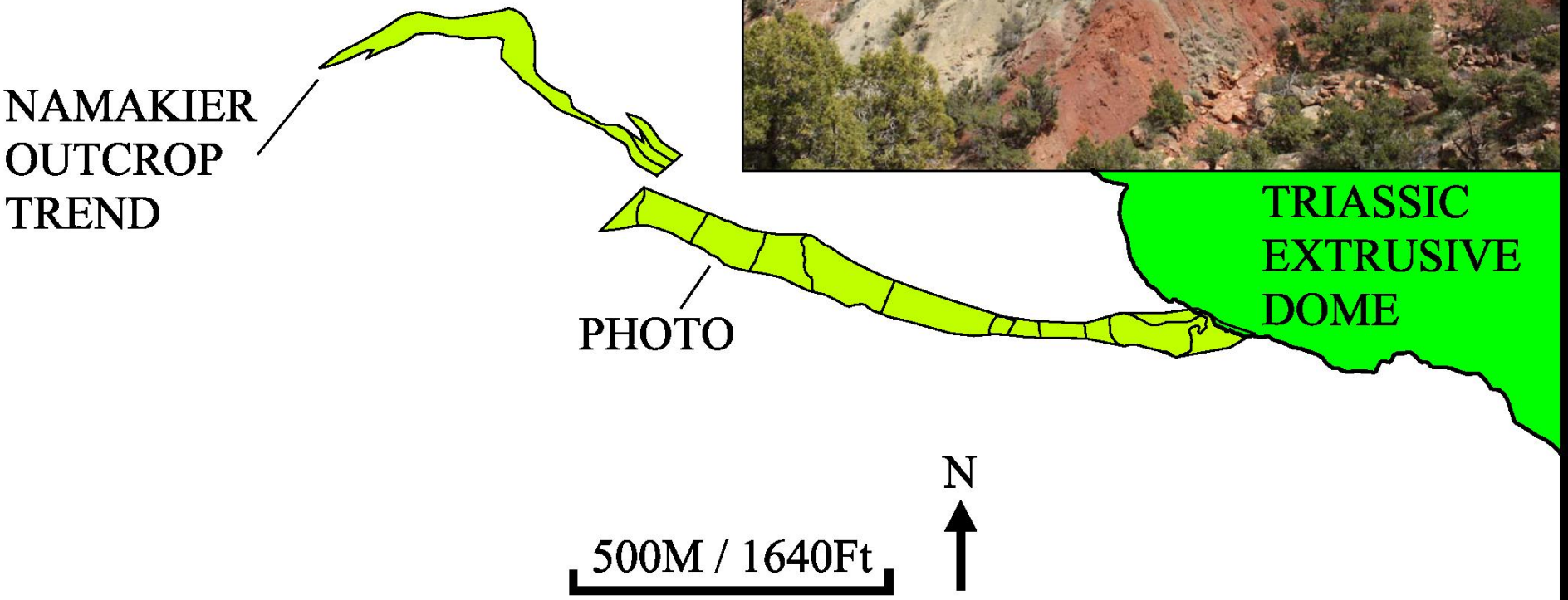
WEST ONION CREEK EARLY TRIASSIC NAMAKIER

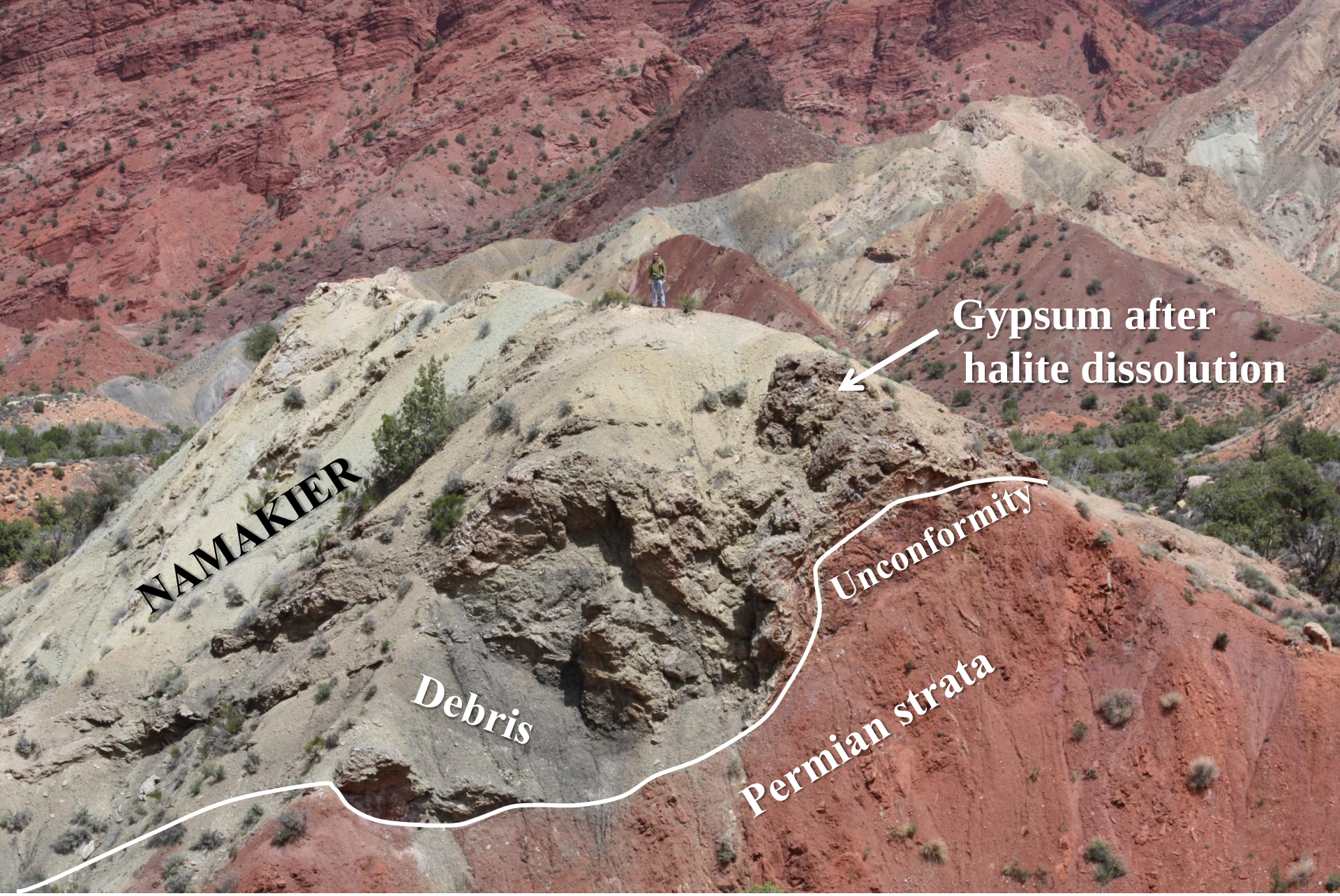
Photo 4/29/11 – looking north.



Namakier debris and gypsum approximately one-half mile west of extrusive dome; unconformably on folded and eroded Permian strata.

ONION CREEK EARLY TRIASSIC NAMAKIER
Grand County, Utah

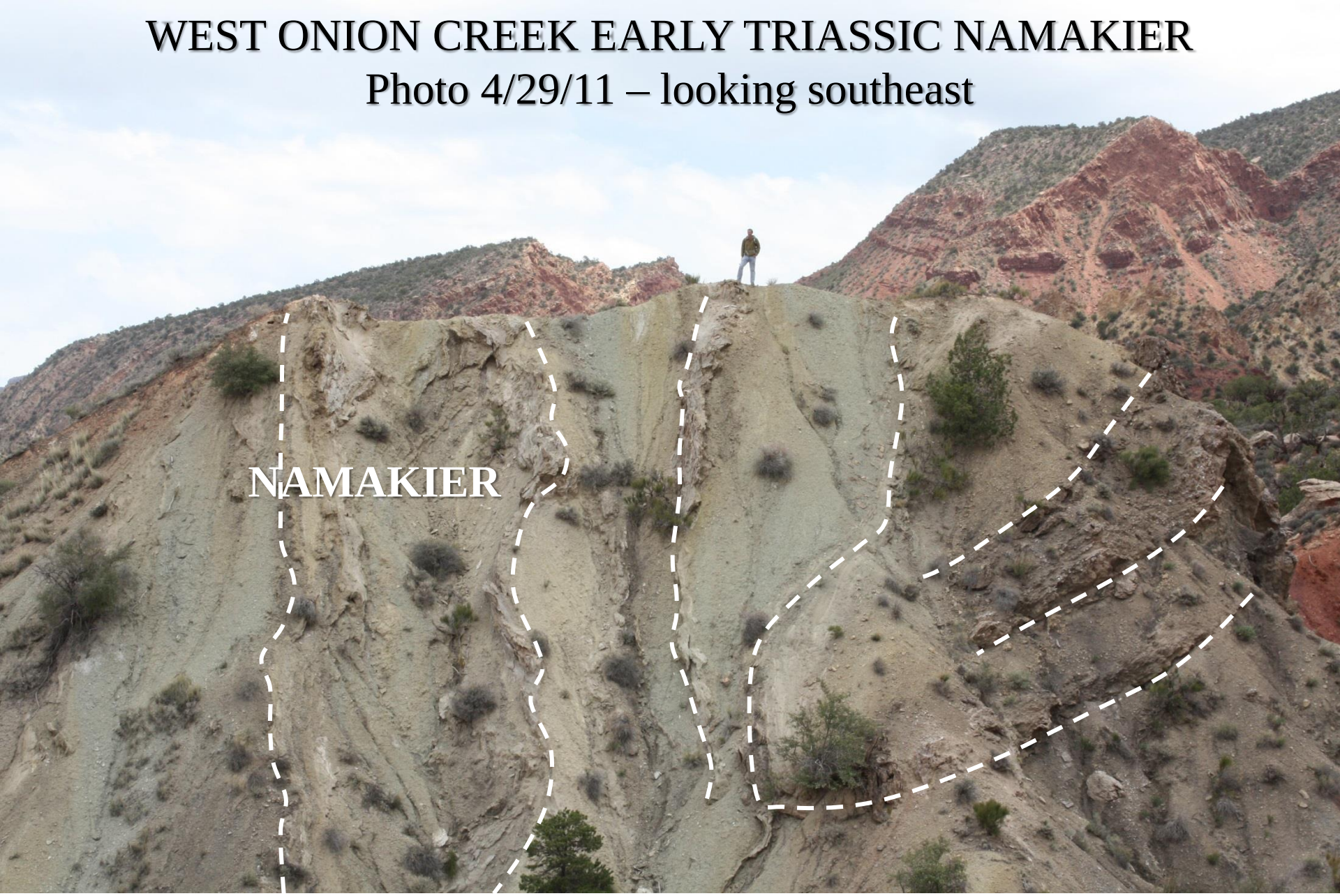




Namakier gypsum (after halite) and debris unconformably on Permian strata.

WEST ONION CREEK EARLY TRIASSIC NAMAKIER

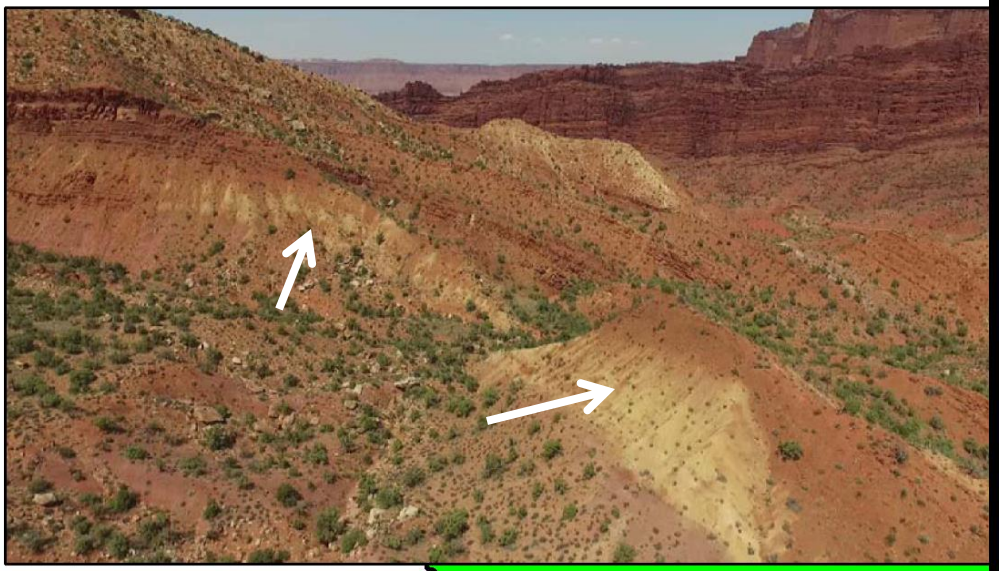
Photo 4/29/11 – looking southeast



Contorted gypsum, mudstone and shale beds
within erosional remnant of Early Triassic Namakier.

Cemented gypsum clasts within fan debris of the West Onion Creek Namakier. Photo 4/29/11

ONION CREEK EARLY TRIASSIC NAMAKIER
Grand County, Utah



NAMAKIER OUTCROP TREND

PHOTO

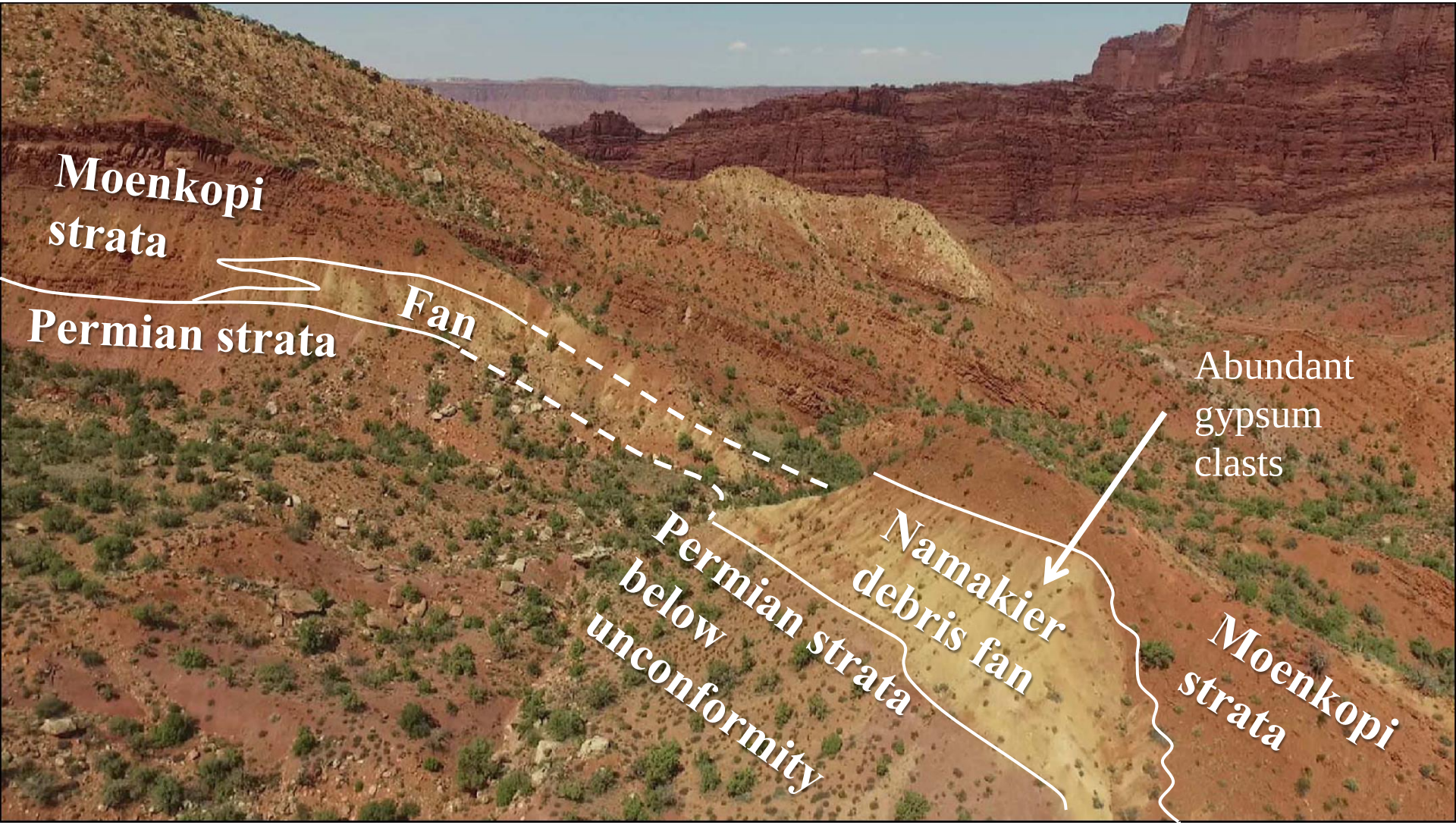
TRIASSIC EXTRUSIVE DOME

N

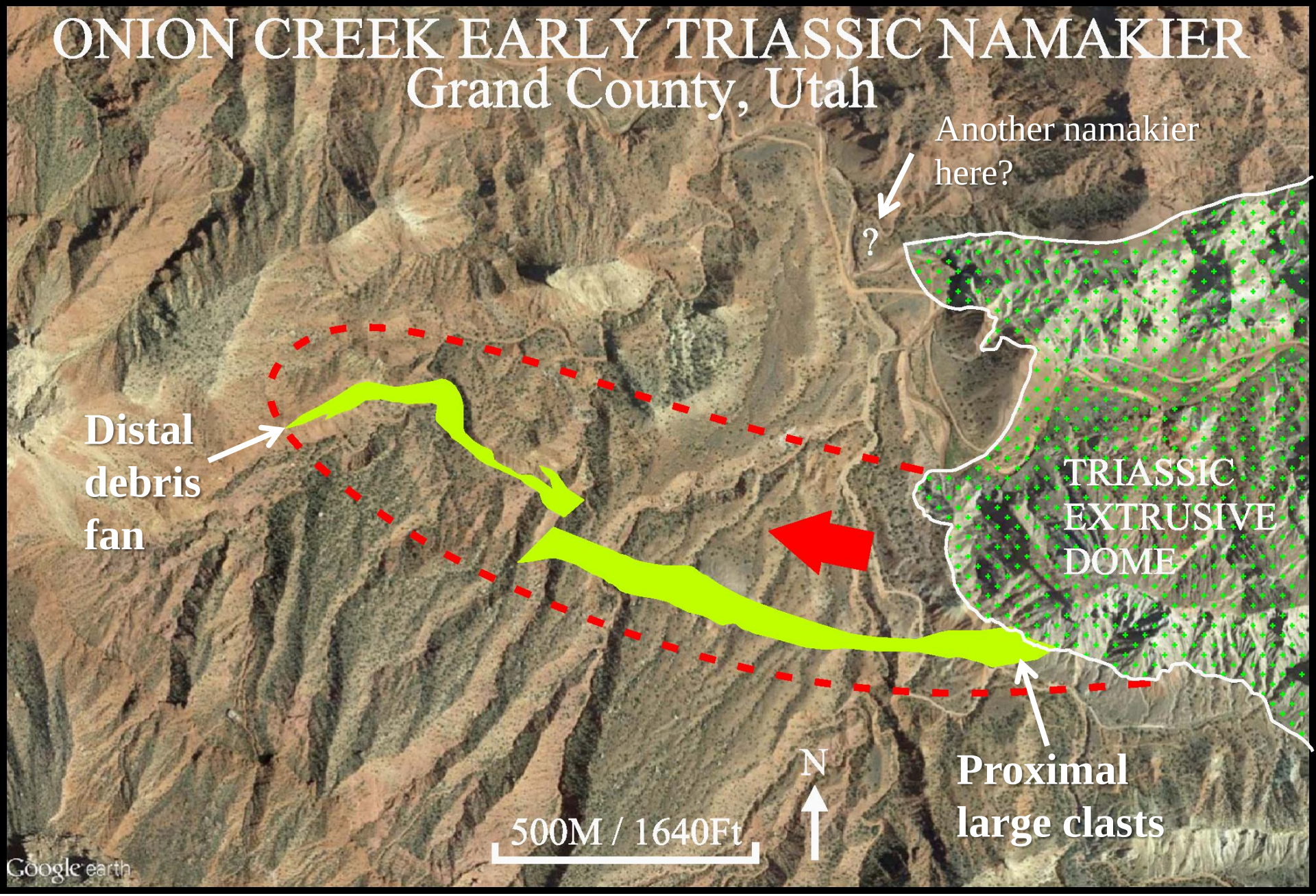
500M / 1640Ft

WEST ONION CREEK EARLY TRIASSIC NAMKIER

Drone photo 8/21/16 – looking northwest



Distal debris fan of the Namakier interbedded with E. Triassic basal Moenkopi strata.



Postulated outline (red) for the West Onion Creek Namakier during the Early Triassic.

VIDEO: RASMUSSEN_GSA_DJI_0083_NAMAKIER.MP4

DJI Phantom 3 Professional Drone – photo by Kirk Branson