Reconstructing the Triassic Crime Scene of West Texas

Madison R. Crowns and John Holbrook
Department of Geological Sciences, Texas Christian University
m.r.crowns@tcu.edu m.r.crowns@outlook.com

Introduction

Hypothesis

The fossilized remains found in the Dockum Group's lakes and rivers are often-fragmentary. The sedimentary structures present in the river channels, including ones that suggest upper flow, could explain why the fossils tend to be so fragmented.

Predictions

- Periods of higher flow postmortem is responsible for the fragmentary state of the fossilized remains.
- Lakes will have terrestrial vertebrate remains due to massive floods washing the remains in.
- More articulated fossils will be found in areas of lower energy.

WHOSE ALL HERE

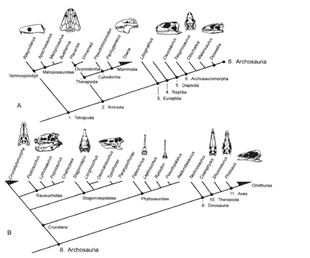


Figure 1. Cladogram illustrates the diversity of the Dockum Group's vertebrate fossils. From Lehman and Chatterjee, 2005.

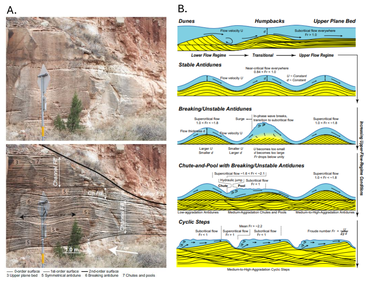


Figure 2. (A) Shows an outcrop in Palo Duro Cayon with preserved upper flow structures. **(B)** A Diagram showing the different types of Upper Flow Regime structures. Modified from Walker and Holbrook, 2023.

Background

Vertebrate Fossils

- A whose who of Late Triassic Vertebrates (Figure 1)

Sedimentary Environment

- Dockum Group is a freshwater system that largely gets broken down into Fluvial, Lacustrine and Floodplain Facies
- Variety of sedimentary structures including upper flow regime structures illustrated in Figure 2.

Localities

Areas of focus are fossil quarries in Lubbock, Boren Ranch (Figure 4), McCarty Ranch (Figure 3) and OC Ranch (Figure 5), as well as the greater Palo Duro Canyon Area.

Taphonomy Observations

- Fossils tend to be disarticulated and in mixed species assemblages that are in bone horizons made up of mudstone as observed at Boren Ranch.
- The mudstones are typically believed to have been deposited during a flooding event.
- Fossils tend to be fragmented with smaller fragments found in the gravel bars of lakes and in river channels.
- The disarticulated nature of the fossils suggest scavenging and decomposition prior to burial.

Methods

Sample collection has occurred at each sight to better define grain size and to run geochemical analysis. Some hand samples have been collected to make thin sections and to cut to see the structure better. Arial images have been collected using a Mini Pro 4 DJI Drone to create detail maps of the depositional environment for each site that can then later be overlayed with collection maps to better understand what fossils are being dug up in each environment.

OC RANCH LOCALITY

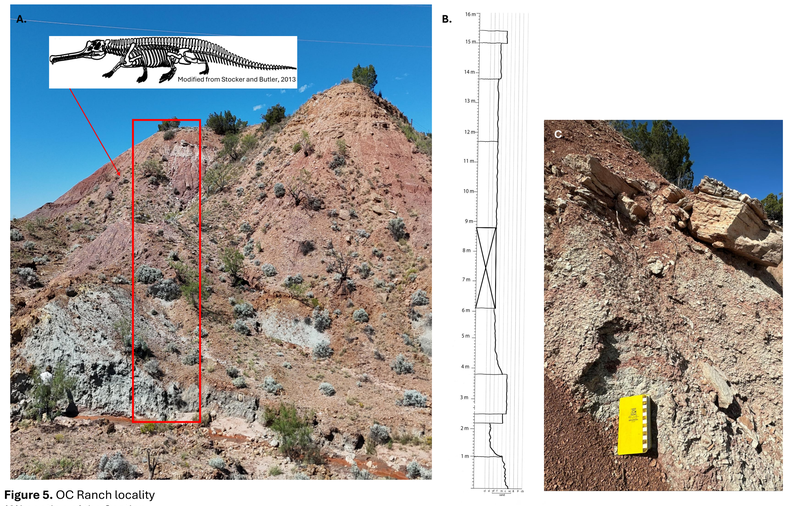


Figure 5. OC Ranch locality
(A) Location of the Section
(B) Section OC 1 At the base of the section is an accretion bar. Beds with channel characteristics are occasionally observed and have secondary burrowing. Yellow mottled reddish-purple beds occur on below and above the channel beds. Above the cover are beds laterally equivalent to beds that yielded phytosaur left of the section. Closer to the top of the section gray mottling reacts to HCL and there is a shift from mudstone to sandstone
(C) Top sandstone unit with crossbedding.

ANTIDUNES

Figure 8. Fossilized long bones fragments collected at 3 meters in Section BR2, indicating a continuing Bone horizon from Section BR1. 7cm Multi Tool for scale.

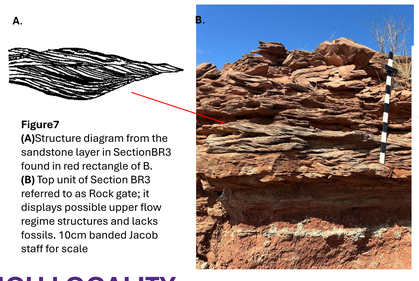


Figure7
(A) Structure diagram from the sandstone layer in SectionBR3 found in red rectangle of B.
(B) Top unit of Section BR3 referred to as Rock gate; it displays possible upper flow regime structures and lacks fossils. 10cm banded Jacob staff for scale

BOREN RANCH LOCALITY

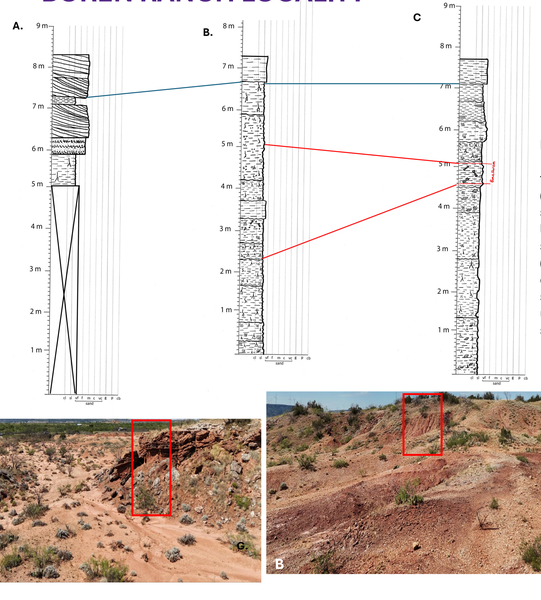
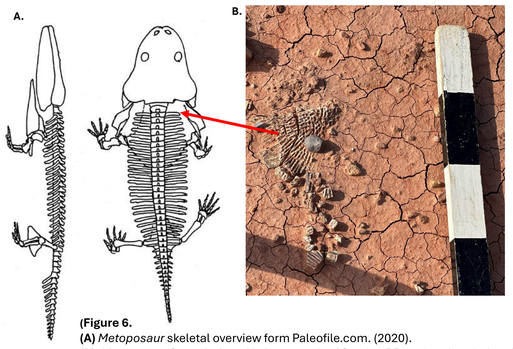


Figure 4. Boren Ranch locality; sections are measured in meters
(D) Section BR3, this section features a large channel bed with possible upper flow at the top
(E) Section BR2 is largely made up of mudstones, bone chips are observed in several units likely in relation to the bone bed. Additionally, around 3 to 3.5m larger bone fragments like in C can be found. The column is topped with a sandstone that appears to have some sedimentary structure to it.
(F) Section BR1 Mudstone soils with bone chips that react to HCL and developed up the section. Larger bones are observed at the bottom of the section. Bone bed is located from 4.6 to 5.1m in the section. The top 3m the units transition from mudstone to loam to siltstone with sedimentary structures forming.



(Figure 6.
(A) *Metoposaur* skeletal overview form Paleofile.com. (2020).
(B) *Metoposaur* Scapula found in lowest unit of Section BR1, 10cm banded Jacob staff for scale.

Objective

- Clearly define the taphonomic setting of the Dockum Group
- Increase the understanding of the environment and ecosystem of the Late Triassic in the Texas Panhandle and West Texas
- Reconstruct the prehistoric "crime scene"

What's Up Next

- Creating and analyzing thin sections of limey sandstone
- Creating a complex map of the depositional environment to be overlayed with past fossil localities
- More Stratigraphic columns to better describe where the bone horizon lays in the section across the outcrops

Figure 9. Location overview of Section **(A)** BR3, **(B)** BR2 and **(C)** BR1 respectively

References

1. Heckert, A.B., Lucas, S.G., Rinehart, L.F., Spielmann, J.A., Hunt, A.P. and Kahle, R., 2006, Revision of the archosauromorph reptile Trilophosaurus, with a description of the first skull of Trilophosaurus jacobsi, from the Upper Triassic Chinle Group, West Texas, USA. Palaeontology, v. 49(3), pg.621-640, https://doi.org/10.1111/j.1475-4983.2006.00556.x
2. Hégron, A., Stocker, M.R., Marsh, A.D. and Nesbitt, S.J., 2020, Archosauromorphs (Reptilia: Diapsida) from the Lamy Quarry, Garita Creek Formation (Adamanian, Late Triassic), New Mexico, USA. Palaeodiversity v. 13(1), pg.135-149, https://doi.org/10.18476/pale.v13.a11
3. Lehman, T., and Chatterjee, S., 2005, Depositional setting and vertebrate biostratigraphy of the Triassic Dockum Group of Texas. J Earth Syst Sci v. 114, pg. 325–351, https://doi.org/10.1007/BF02702953
4. Martz, J.W., 2008. Lithostratigraphy, chemostratigraphy, and vertebrate biostratigraphy of the Dockum Group (Upper Triassic) of southern Garza County, West Texas.
5. Martz, J.W., Mueller, B., and Nesbitt, S.J., et al., 2013, A taxonomic and biostratigraphic re-evaluation of the Post Quarry vertebrate assemblage from the Cooper Canyon Formation (Dockum Group, Upper Triassic) of southern Garza County, western Texas: Earth and Environmental Science Transactions of the Royal Society of Edinburgh v. 103(3-4) pg. 1-26, https://doi.org/10.1017/S1755691013000376
6. McGowen, J.H., Granata, G.E. and Seni, S.J., 1983. Depositional setting of the Triassic Dockum Group, Texas Panhandle and eastern New Mexico. Rocky Mountain Section (SEPM).
7. Michelle R. Stocker, Richard J. Butler, 2013. "Phytosauria", Anatomy, Phylogeny and Palaeobiology of Early Archosaurs and their Kin, S. J. Nesbitt, J. B. Desojo, R. B. Irmis
8. Paleofile.com. (2020). *Untitled Document*. [online] Available at: http://www.paleofile.com/Labyrinthodons/Anaschisma.asp [Accessed 16 Oct. 2025].
9. Reyes, W.A., Martz, J.W. and Small, B.J., 2024. Garzapelta muelleri gen. et sp. nov., a new aetosaur (Archosauria: Pseudosuchia) from the Late Triassic (middle Norian) middle Cooper Canyon Formation, Dockum Group, Texas, USA, and its implications on our understanding of the morphological disparity of the aetosaurian dorsal carapace. The Anatomical Record, 307(4), pp.1271-1299. https://doi.org/10.1002/ar.25379
10. Sarigul, V., Agnolin, F. and Chatterjee, S., 2018, Description of a multitaxic bone assemblage from the Upper Triassic Post Quarry of Texas (Dockum Group), including a new small basal dinosauriform taxon
11. Walker, S. and Holbrook, J., 2023. Structures, architecture, vertical profiles, palaeohydrology and taphonomy of an upper-flow-regime-dominated fluvial system, the Triassic Dockum Group of the Palo Duro Canyon, Texas. Sedimentology, 70(3), pp.645-684. https://doi.org/10.1111/sed.13041
12. Weinbaum, J. C., 2011, The skull of Postosuchus kirkpatricki (Archosauria: Paracrocodyliformes) from the Upper Triassic of the United States. PaleoBios, v. 30(1), http://dx.doi.org/10.5070/P9301021795
13. Zeigler, K.E., Heckert, A.B. and Lucas, S.G., 2003, The vertebrate fauna of the Upper Triassic (Revueltian) Snyder quarry. New Mexico Museum of Natural History and Science Bulletin, 24, pp.71-79