

Post-Cranial Remains from a *Subhyracodon* Bonebed from the Brule Formation of Niobrara County, Wyoming, USA

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Introduction

- Rhinocerotidae (Perissodactyla):
 - Long disappeared from North America and now globally endangered
 - Previously plentiful: at least 14 genera in North America over the last 40 million years (5)
- *Subhyracodon occidentalis*:
 - Extinct genus of small hornless rhinoceros
 - Widespread across the High Plains (Fig. 1), including in the Brule Formation (White River Group):
 - 34 to 33 million years old
 - Exposures in South Dakota, Nebraska, Colorado, Wyoming
 - Represent stream and floodplain deposits that developed in savannah-like environments (2)

This study aims to describe specimens preserved in a bonebed of *Subhyracodon occidentalis* from the Brule Formation of Wyoming, and potentially draw inferences about *Subhyracodon* behavior and ecology using common taphonomic metrics.

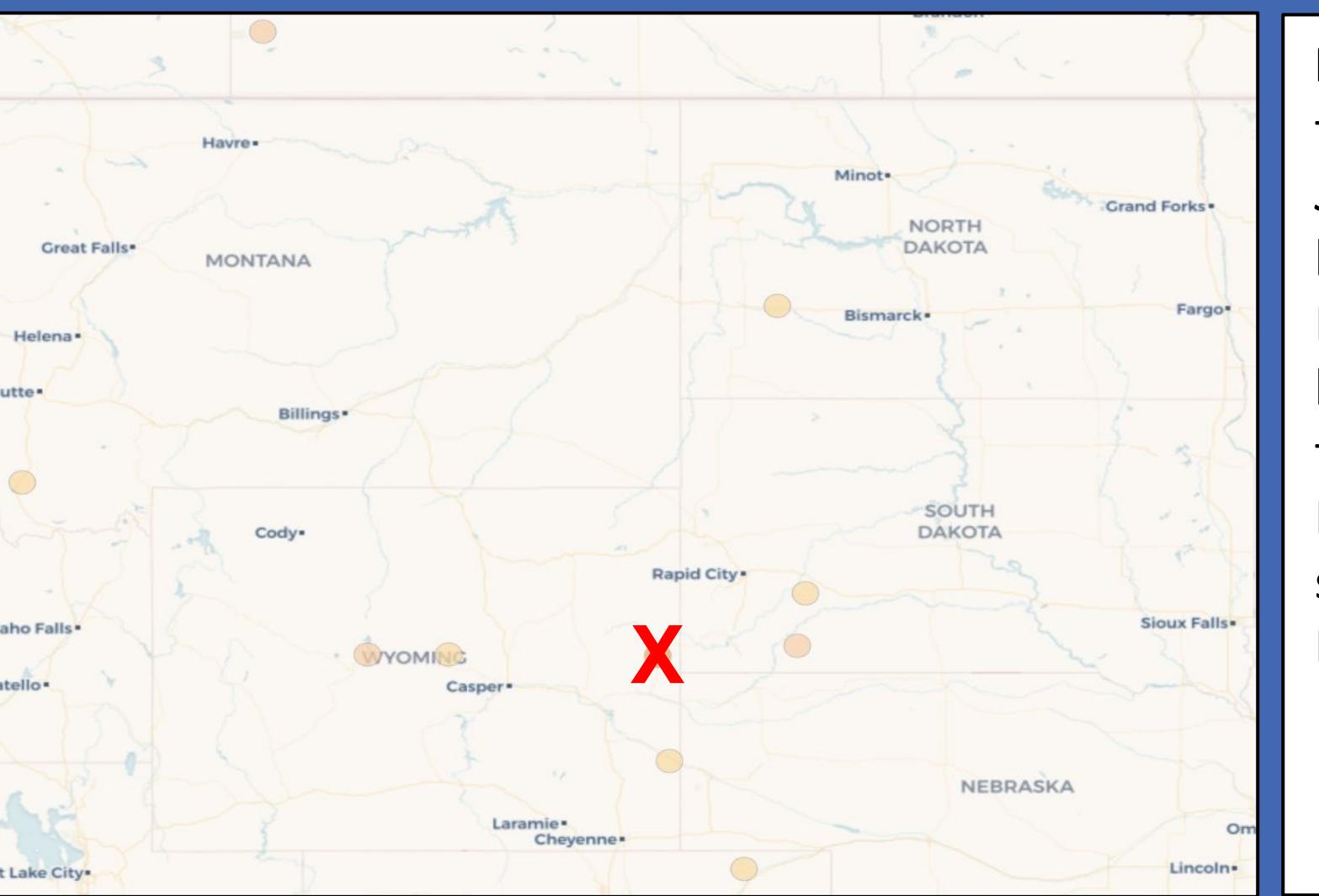


Figure 1. Localities (circles) in the High Plains where *Subhyracodon occidentalis* has been found. Red X marks Nuttal Ranch / Rhino Quarry locality where specimens for this study were collected by RAM field parties. Image source: Paleobiology Database.

Acknowledgements

- Thank you to the Mary Stuart Rogers Foundation for their generous funding and support.
- Thank you to the Raymond M. Alf Museum for housing and providing access to these specimens.
- Thank you to Dr. Andrew Farke for the project idea.
- Thank you to the Honors Museum Research students at the Webb Schools for helping estimate body size and sexual dimorphism.

References

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Materials & Methods

- Site: Nuttal Ranch or Nuttal Rhino Quarry
 - Early Oligocene deposit in Niobrara County, Wyoming, USA (T 34 N, R 67 W, Sec. 26 N ½, NE ¼; Sec. 25 N ½, NW; Fig. 1)
 - Hundreds of preserved *Subhyracodon* bones
 - Some specimens in Frick collection at American Museum of Natural History (5)
 - Collection at Raymond M. Alf Museum likely by field parties led by Grant Meyer in the 1980s
- Sample: *Subhyracodon occidentalis* post-cranial specimens
 - n=382, excluding ribs
 - Assessment focused on forelimb and hindlimb:
 - Identified and sided bones (humerus, radius, ulna, femur, tibia)
 - Categorized as either Juvenile or Adult
 - Juvenile status determined based on the presence of unfused epiphyses (e.g., Fig. 2)
- Taphonomic abundance metrics (as in (4) and (7)):
 - Number of Identified Specimens (NISP)
 - Minimum Number of Elements (MNE)
 - Minimum Number of Individuals (MNI)

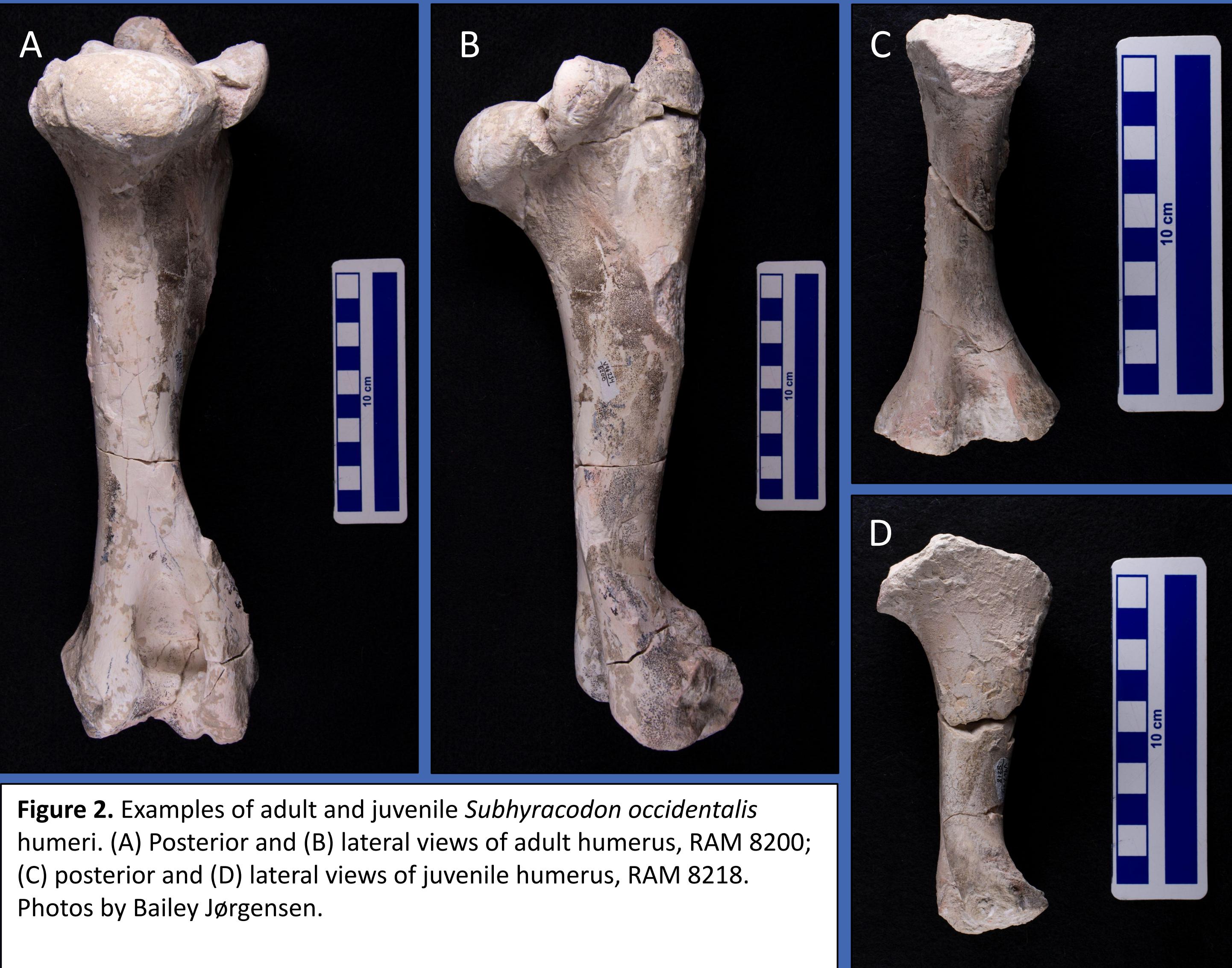


Figure 2. Examples of adult and juvenile *Subhyracodon occidentalis* humeri. (A) Posterior and (B) lateral views of adult humerus, RAM 8200; (C) posterior and (D) lateral views of juvenile humerus, RAM 8218. Photos by Bailey Jørgensen.

Results

- Most Abundant Long Bones:
 - Humerus (NISP=27, MNE=20)
 - Femur (NISP=25, MNE=17)
 - Tibia (NISP=18, MNE=18)
- Minimum Number of Individuals:
 - Total MNI across adult and juvenile = 11 (based on left humerus)
 - Juvenile MNI = 4 (based on right femur and left tibia)
 - Adult MNI = 9 (based on left and right humerus)
- Juvenile Minimum Number of Elements:
 - Forelimb elements number half as many as hindlimb elements (Fig. 3)

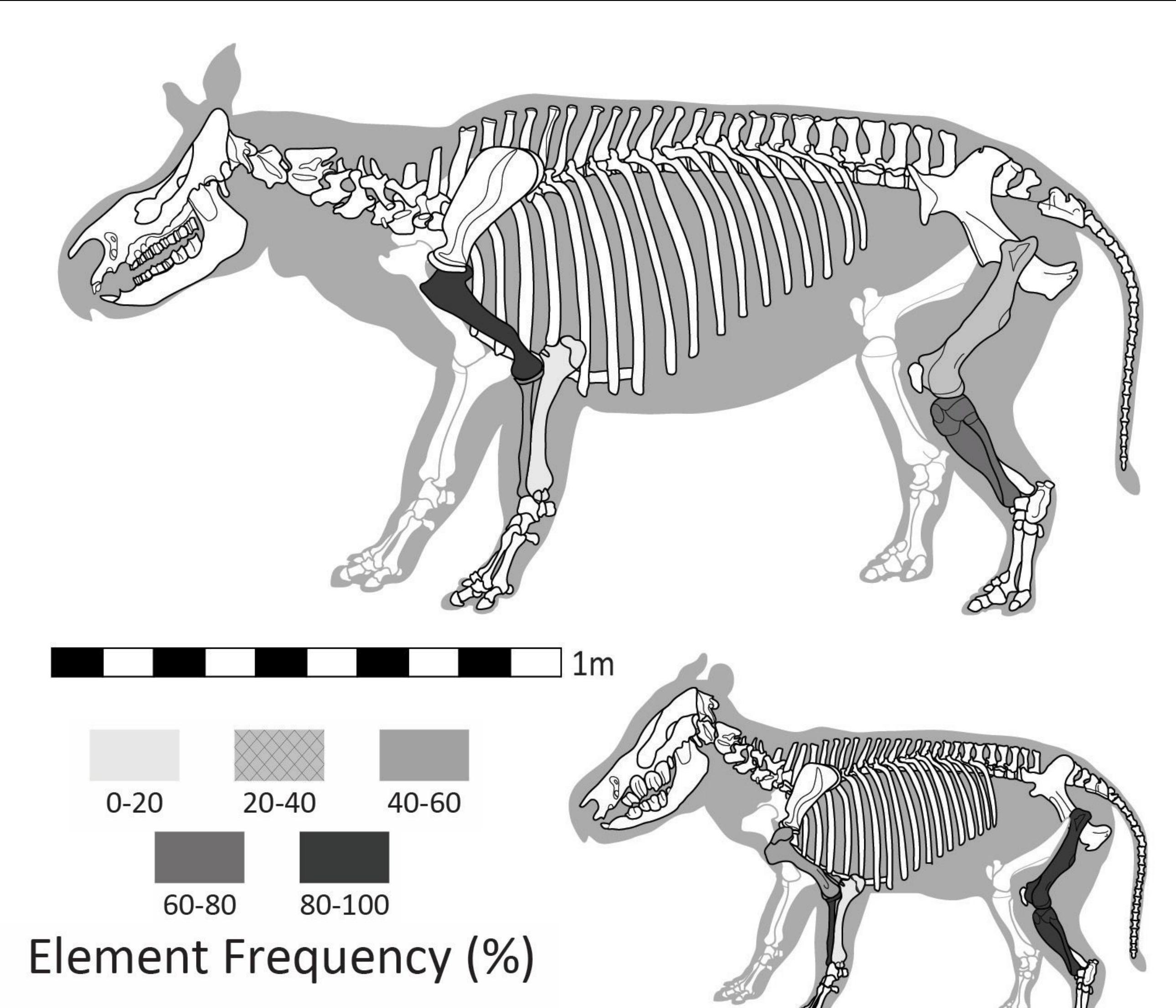


Figure 3. (A) Relative representation (% Minimum Animal Units (%MAU)) of forelimb and hindlimb elements of *Subhyracodon occidentalis* in the Raymond M. Alf Museum sample from the Nuttal Ranch bonebed. No distinction is made between left- and right-side elements. Bones in white are currently unstudied.

Discussion & Conclusion



Figure 4. Rendering of a *Subhyracodon* adult and juvenile in their likely paleoenvironment, a stream bank where fossils would have been preserved. The cooling of the Eocene saw temperate forests turning into grasslands and savannah; large sedges (*Cyperaceae*) became more prominent as well (1, 3, 8). A similar climate today can be found in Central and South America, where there are swamps, marshes, and riparian woodlands. One extant perissodactyl in this climate is the Baird's tapir (*Tapirus bairdii*), which inspired the adult and juvenile *Subhyracodon* coloration. Illustration by Nathan Michaelson.

- Adult to Juvenile Ratio (2.25 : 1):
 - Modern adult male rhinos are typically solitary, and gestation yields one calf → expected 1:1 ratio
 - Observed *Subhyracodon* adult:juvenile ratio of 2.25:1 based on MNI suggests two possibilities:
 - Male and female adults cohabitating with juveniles, or
 - Predation or scavenging of juveniles
- Juvenile Hindlimb to Forelimb Ratio (2 : 1):
 - Forelimb elements more easily disarticulated from axial skeleton - suggests predation of juveniles
- Other Brule Formation localities:
 - Big Pig Dig in Badlands National Park, South Dakota preserves *Subhyracodon* alongside:
 - Other herbivores; e.g., entelodont *Archaeotherium*, deer-like *Leptomeryx*, horse *Mesohippus*
 - Predators: e.g., amphicyonid *Daphoenus*, nimravids *Dinictis* and *Nimravus*
 - All of which could have preyed on *Subhyracodon* juveniles
- Future Directions:
 - Postcranial measurements to estimate body size and investigate sexual dimorphism (6)
 - Preliminary results: no sexual dimorphism, or too small of a sample to be conclusive
 - Body size estimates average 400 kilograms (in prep) - confirming *Subhyracodon* as a small rhino
 - Craniodental analysis as another examination of ontogeny
- Conclusion:
 - *Subhyracodon occidentalis* juveniles in the High Plains likely experienced predation
 - Social dynamics may have differed from modern rhinos, with males and females cohabitating