

Introduction

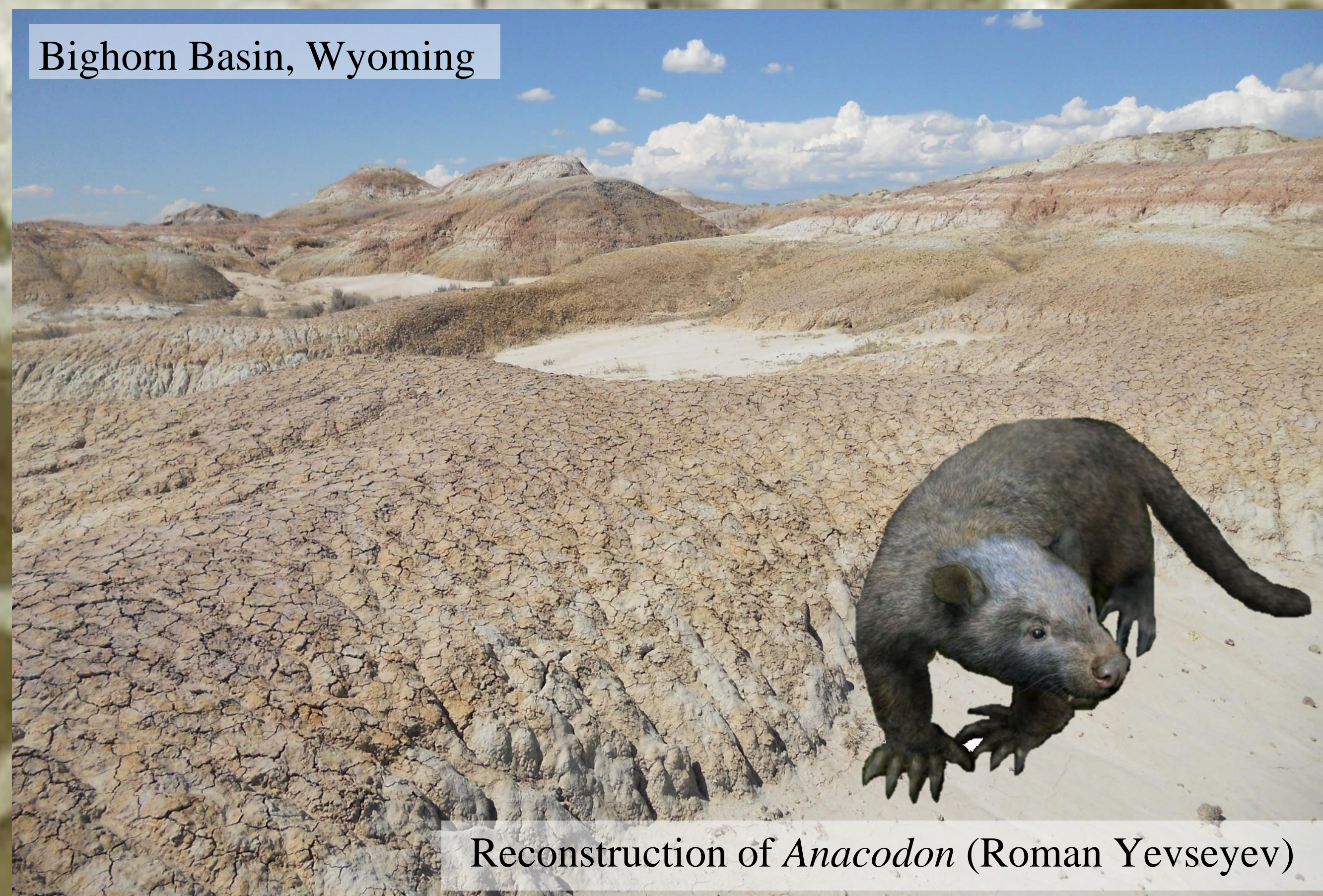
During the Paleocene and Eocene there was a large radiation of eutherian mammals. These radiations are attributed to the Paleocene-Eocene climate. This climate is described as wet or humid with tropical forests extending up into what is now present day Colorado and Wyoming (Rose, 2006).

One group that underwent a major radiation during this time period is the super-order Ungulata, or hoofed mammals (Rose, 2006). One potential member of Ungulata is Artiodactyla, the even-toed ungulates, which first appear in the beginning of the Eocene (Rose, 1996). Arctocyoniidae, is a family of Paleocene and Eocene mammals thought to be closely related to Artiodactyla, known primarily from the Paleocene of North America (Rose, 2006; Gould and Rose, 2014).

While the broader relationships of Arctocyoniidae are still debated, the method of locomotion within this family is even more heavily debated. For instance, *Arctocyon mumak* has a pes that indicates semi-fossorial behavior, whereas its forelimb possesses features more similar to arboreal mammals (Gould & Rose, 2014). On the other hand, *Arctocyon primaevus* has evidence of posterolateral extension of the femoral head, which is characteristic of arboreal and scansorial locomotion.

This present study describes postcranial remains, specifically of the foot and ankle, of the arctocyoniid genus *Anacodon*. This extremely well-preserved and partially complete specimen present an exceptional opportunity to examine the locomotion of *Anacodon* in comparison to other members of Arctocyoniidae.

Bighorn Basin, Wyoming



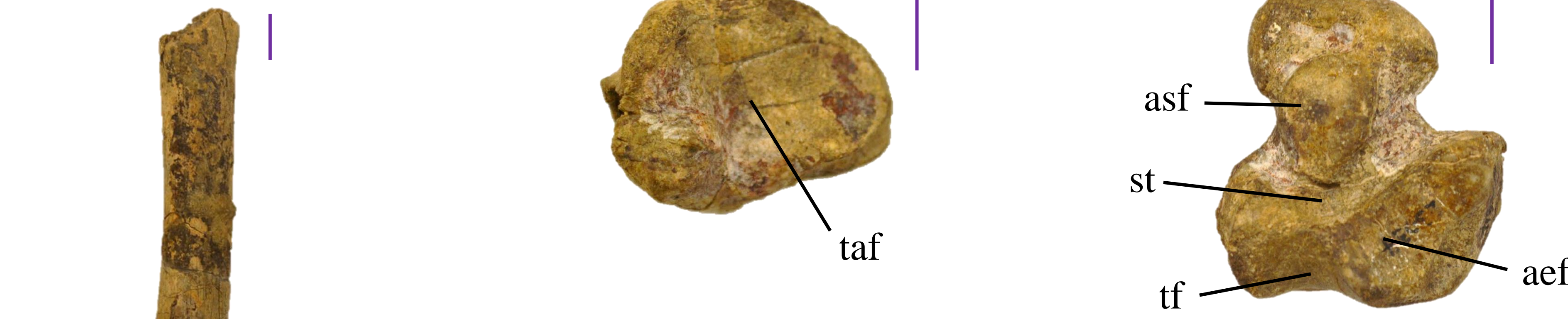
Reconstruction of *Anacodon* (Roman Yevseyev)

Materials

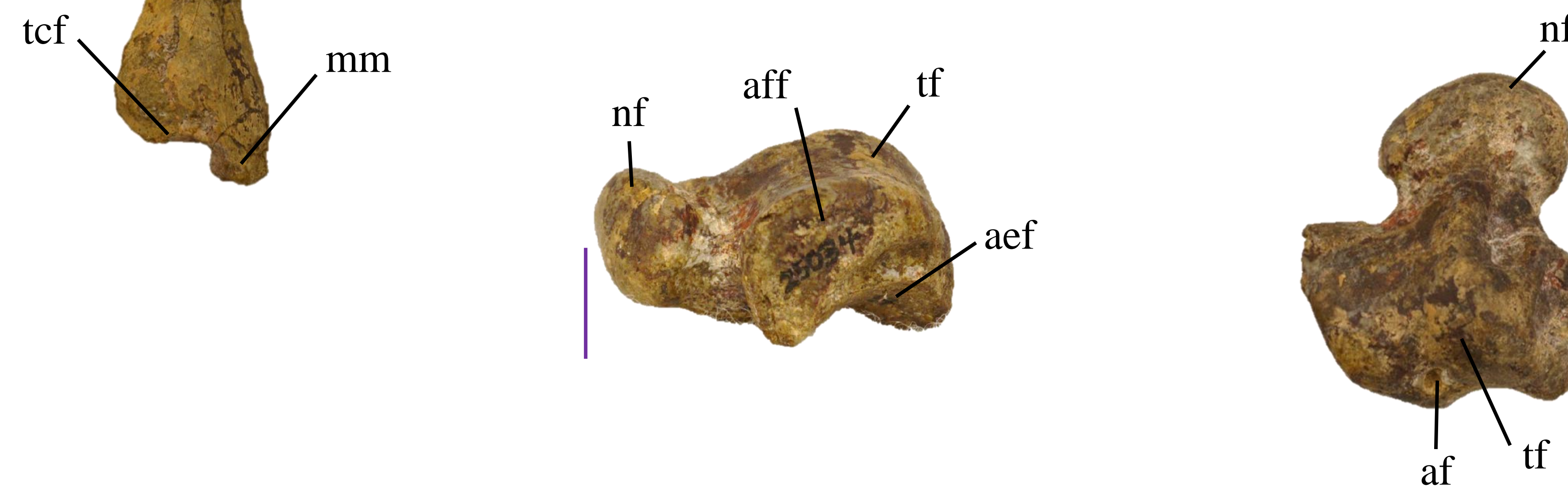
A single, associated specimen of *Anacodon* (USGS 25034) from the Bighorn Basin of Wyoming is described. Post-cranial material includes a distal right tibia, left astragalus, left calcaneus, partial right calcaneus, right cuboid, left navicular, cuneiforms, metatarsals, and phalanges, including unguals. Material was compared with species of *Arctocyon* and *Galecyon*.

Results

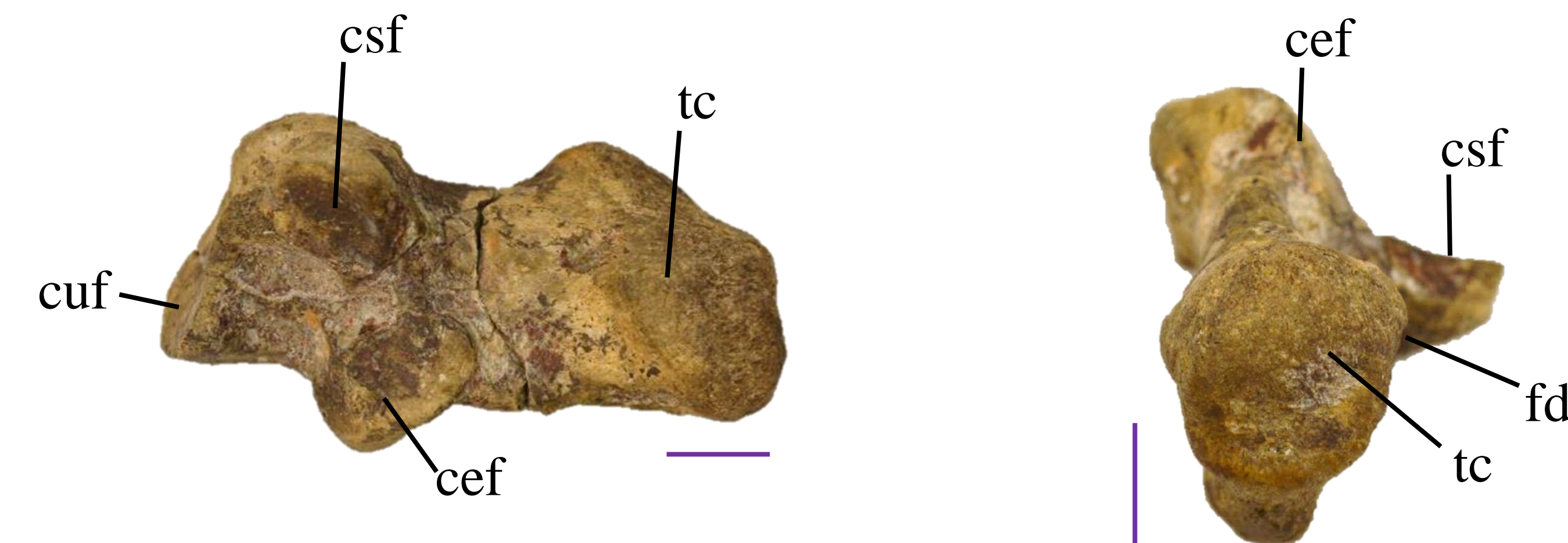
A Right tibia in posterior view **B** Right tibia in distal view **C** Left astragalus in ventral view



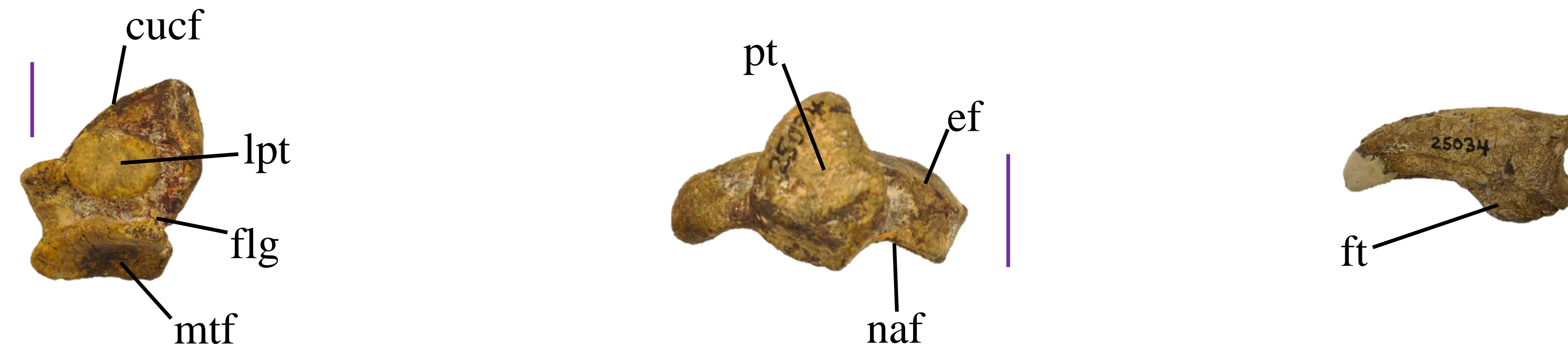
D Left astragalus in lateral view **F** Left astragalus in dorsal view



G Left calcaneus in dorsal view **H** Left calcaneus in proximal view



I Right cuboid in ventral view **J** Right navicular in ventral view **K** Ungual in lateral view



Scale bar: 1 cm. **Abbreviations:** **af**, astragalus foramen; **aff**, astragalus fibular facet; **aef**, astragalus ectal facet; **asf**, astragalus sustentacular facet; **cef**, calcaneal ectal facet; **csf**, calcaneal sustentacular facet; **cucf**, cuboid calcaneal facet; **cuf**, calcaneal cuboid facet; **ef**, ectocuneiform facet; **fdl**, groove for tendon of m. flexor digitorum lateralis; **flg**, groove for the tendon of m. fibularis longus; **ft**, flexor tubercle; **lpt**, long plantar tubercle; **mm**, medial malleolus; **mtf**, cuboid metatarsal facet; **naf**, navicular astragalus facet; **nf**, astragalus navicular facet; **pt**, plantar tubercle; **st**, sulcus tali; **taf**, tibial astragalus facet; **tc**, tuber calcanei; **tcf**, tibial check facet; **tf**, astragalus tibial facet.

Discussion

The tibia's trochlear ridge is low and broad in *Anacodon*, which is less prominent than in *Arctocyon ferox* (Gould & Rose, 2014), but similar to that of *Arctocyon mumak* (Gould & Rose, 2014). The less prominent ridge indicates more surface area for muscles to run between the tibia and astragalus. However, *Anacodon* has a greater medial malleolus in the medial direction than in *Arctocyon mumak* (Gould & Rose, 2014).

The *Anacodon* astragalus sustentacular facet has a different shape than in *Galecyon* due to *Anacodon* having more prominently raised borders. Rather, the facet is more similar to *Arctocyon primaevus* and indicates increased mobility of the joint. Just as in *Arctocyon primaevus* the astragalus head is not continuous with the sustentacular facet (Argot, 2013), creating a ridge for ligament and muscle attachment.

The calcaneal sulcus in *Anacodon* is wider than *Arctocyon mumak* due to the difference in the shape of the ectal facet (Gould & Rose, 2014). The calcaneal cuneiform facet and the plantar tubercle are both more prominent than in *Galecyon* (Zack & Rose, 2015). The lack of raised edges on the calcaneal tubercle of *Anacodon* is due to muscle movement along its surface.

The unguals of this specimen are strongly curved. The proximal portion of this curve rounds to create a broad flexor tubercle. This ungual shape is associated with fossorial (Rose, 2006), as there is a strong ventral curve present with no proximodorsal prominence present.

Within the *Anacodon* fossil examined there are significantly mobile joints. *Anacodon* exhibits morphology similar to those of semi-fossorial and terrestrial species. Semi-fossorial is exhibited by strongly developed processes for muscle attachment, short and robust bones, strongly curved unguals, and narrow astragalus head extending medially resulting in more supination. Terrestrial is exhibited by features of a shallow astragalus trochlea leading to instability and low flexion-extension.

Currently, the anatomy supports multiple possible conclusions. Further quantitative analysis of *Anacodon* compared to other specimens with known locomotor behaviors, including a MANOVA, would likely provide a more definitive conclusion of whether *Anacodon* was semi-fossorial or terrestrial.

References

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