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GABRIEL S. GONÇALVES & CHRISTIAN A. SIDOR (2019). A new drepanosauromorph, *Ancistronychus paradoxus* n. gen. et sp., from the Chinle Formation of Petrified Forest National Park, Arizona, USA.

Cover: View of Kaye Quarry at Petrified Forest National Park, the site where the new drepanosauromorph genus and species, *Ancistronychus paradoxus,* was discovered.

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A new drepanosauromorph, *Ancistronychus paradoxus* n. gen. et sp., from the Chinle Formation of Petrified Forest National Park, Arizona, USA

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Drepanosauromorpha is an extinct group of reptiles known from the Middle Triassic to Late Triassic (237–212 Ma). The clade currently includes seven genera (*Avicranium*, *Dolabrosaurus*, *Drepanosaurus*, *Hypuronector*, *Kyrgzsaurus*, *Megalancosaurus*, and *Vallesaurus*) that are known from fossils collected in Europe, North America, and Asia. These discoveries have helped shape our understanding of the biology and diversity of drepanosauromorphs. Here we describe *Ancistronychus paradoxus* n. gen. et sp. from the Chinle Formation in Petrified Forest National Park, Arizona based on the ungual phalanx of the second digit of the manus. A characteristic that this taxon shares with *Drepanosaurus unguicaudatus* is the pronounced size of the ungual relative to the penultimate element. It differs significantly from *D. unguicaudatus* and the Hayden Quarry *Drepanosaurus* in the shortened proximal dorsoventral height of the claw, its great transverse breath, the presence of both a furrow on the midline of the extensor surface and a cleft on the apex, and a broad and flattened terminus. We suggest that *A. paradoxus* is likely closely related to *D. unguicaudatus* and the Hayden Quarry *Drepanosaurus*, but missing phylogenetic data precludes a more definitive assessment at this point. *Ancistronychus paradoxus* highlights unsuspected morphological variation within Drepanosauromorpha and suggests that different drepanosauromorphs used their enlarged second manual unguals for distinct functions enabling them to fill different ecological niches.

Keywords: Drepanosauromorpha, *Ancistronychus*, Triassic, Norian, ungual

INTRODUCTION

Tetrapods radiated after the Permo-Triassic mass extinction, with multiple reptilian lineages (e.g., Archosauromorpha von Huene, 1946, Lepidosauromorpha Gauthier et. al., 1988) shaping terrestrial ecosystems for much of the Mesozoic (Benton et al. 2004, Evans and Jones 2010, Pritchard and Nesbitt 2017, Ezcurra and Butler 2018, Peecook et al. 2019). One of the best examples of this is seen in archosauromorphs, which were able to diversify within both terrestrial and marine ecosystems to occupy empty ecospace and niches left by the extinction of many non-mammalian synapsids and parareptiles (e.g., pareiasaurs) (Nesbitt et al. 2010, Brusatte et. al. 2011, Sidor et al. 2013, Ezcurra and Butler 2018, Peecook et al. 2019). In North America, large-bodied archosauriforms (e.g., phytosaurs, aetosaurs, rauisuchids, trilophosaurs, etc.) dominated Late Triassic terrestrial ecosystems, while many of the surviving non-mammalian therapsids were either the smaller cynodonts or herbivorous dicynodonts (Parker 2005). Much of the research over the past century has focused on these large archosauriforms, whereas study of the smaller-bodied tetrapods has lagged behind (Parker 2005, Lessner et al. 2018). One group, however, has been the focus of significant work in recent years, the drepanosauromophs (Renesto et al. 2010, Pritchard et. al. 2016, Pritchard and Nesbitt 2017).

Drepanosauromorpha Renesto et. al. (2010) is a clade of diapsid reptiles known from the Middle to Late Triassic. The clade currently includes the following seven genera: *Avicranium* Pritchard and Nesbitt (2017), *Dolabrosaurus* Berman and Reisz (1992), *Drepanosaurus*

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LSID: urn:lsid:zoobank.org:pub:3E1BA514-C21C-4DA1-94BF-64653E429F2F

Pinna (1980), *Hypuronector* Colbert and Olsen (2001), *Kyrgyzsaurus* Alifanov and Kurochkin (2011), *Megalancosaurus* Calzavara et al. (1980), and *Vallesaurus* Renesto and Binelli (2006) that are known from fossils collected in Europe (Italy, United Kingdom), North America (Arizona, New Mexico, New Jersey), and Asia (Kyrgyzstan). The first described drepanosauromorph, *Drepanosaurus unguicaudatus* Pinna (1980) was based on a holotype preserving most of a complete flattened skeleton, including a peculiar tail claw and strongly modified forelimb featuring a crescent-shaped ulna, elongated proximal carpal, and massive ungual phalanx on the second digit (Pinna 1986, Renesto 1994, Renesto et al. 2010). As more drepanosauromorphs were discovered, they did not seem to possess the enlarged manual ungual phalanx of *D. unguicaudatus* either because of the lack of anatomical evidence (e.g., *Vallesaurus* and *Megalancosaurus*) or because of the lack of preservation of the entire manus (*Avicranium, Dolabrosaurus, Kyrygzsaurus,* and *Hypuronector*, although the latter clearly lacks adaptations to scratching-digging in other parts of the forelimb). More recently, three-dimensionally preserved drepanosauromorph material from New Mexico was shown to possess similarly distinctive anatomy, with a forelimb containing a relatively enlarged manual ungual with a flattened, crescent-shaped ulna and elongated carpal bones (Pritchard et al. 2016). These discoveries suggest that drepanosauromorphs evolved a wide range of ecomorphologies, including likely arboreal and fossorial forms (due to the presence, for example, of an enlarged manual ungual in *Drepanosaurus*, or opposable digits and free rotating ankle and wrist bones in *Megalancosaurus*). Here we describe a new species of drepanosauromorph from the Late Triassic of Arizona. It features autapomorphic ungual morphology and broadens the stratigraphic and geographic sampling of the group.

MATERIALS AND METHODS

The holotype and referred specimens were collected during annual excavations at the Kaye Quarry, Petrified Forest National Park, Arizona (PEFO locality PFV 410) from 2014–2018. Both PEFO and University of Washington Burke Museum (UWBM) catalog numbers have been assigned, in order to comply with federal regulations. Except for the holotype, all the material is housed at the UWBM as a held-in-trust collection. The specimens were prepared with airscribes, carbide needles, and B72 as a consolidant, as needed (preparation notes on file at the UWBM). The holotype was scanned on a Skyscan 1172 Microfocus X-radiographic Scanner, but no internal structure was visible, despite several tests made with different settings. A digital surface reconstruction of the holotype is available on MorphoSource under Project 808.

Institutional Abbreviations—**GR**, Ghost Ranch Ruth Hall Museum of Paleontology, Abiquiu, New Mexico; **PEFO**, Petrified Forest National Park, Arizona; **MCSNB**, Museo Civico Scienzi Naturali Enrico Caffi, Bergamo, Italy; **UWBM**, University of Washington Burke Museum, Seattle, Washington.

SYSTEMATIC PALEONTOLOGY

DIAPSIDA Osborn, 1903
DREPANOSAUROMORPHA Renesto et al., 2010
ANCISTRONYCHUS n. gen.
ANCISTRONYCHUS PARADOXUS n. gen. et sp.
Figs. 1, 2C, 3

Diagnosis—Drepanosauromorph with autapomorphic ungual phalanx of the second digit, characterized by a broad distal tip with lack of transverse tapering and a cleft, presence of midline furrow on distal extensor surface, a ridge along the flexor surface, and a distal tip recurving strongly ventrally toward the proximal end. Distinct from *Vallesaurus*, *Dolabrosaurus*, *Megalancosaurus* based on the relative size of the claw and the orientation of the flexor tuberosities. Distinct from *Drepanosaurus unguicaudatus* and the Hayden Quarry *Drepanosaurus* (Pritchard et al. 2016) owing to its relatively short dorsoventral height proximally, asymmetrical flexor tubercle, and more medially located flexor pits. Similarities with both *D. unguicaudatus* and the Hayden Quarry *Drepanosaurus* (Pritchard et al. 2016) are based on the large size of the ungual relative to the actual or inferred size of the penultimate element (i.e., the unguals have a relatively small proximal cotyle for articulation with the penultimate element, suggesting that the latter was of normal size).

Holotype—PEFO 42805/UWBM 117331, an isolated manual ungual phalanx.

Paratypes—PEFO 39324/UWBM 108325, PEFO 39325/UWBM 108326, PEFO 39326/UWBM 108327, PEFO 39379/UWBM 108385, PEFO 39380/UWBM 108386, PEFO 42806/UWBM 117332, all isolated manual unguals.

Occurrence—All of the specimens come from the Kaye Quarry at Petrified Forest National Park, Arizona (locality PFV 410, locality UWBM C2226), which is predominately composed of mottled purple mudstone with reduction halos commonly around fossils and occasional extra-basinal clasts. Stratigraphically, the quarry lies near the base of the Jim Camp Wash Beds (Sonsela Member,

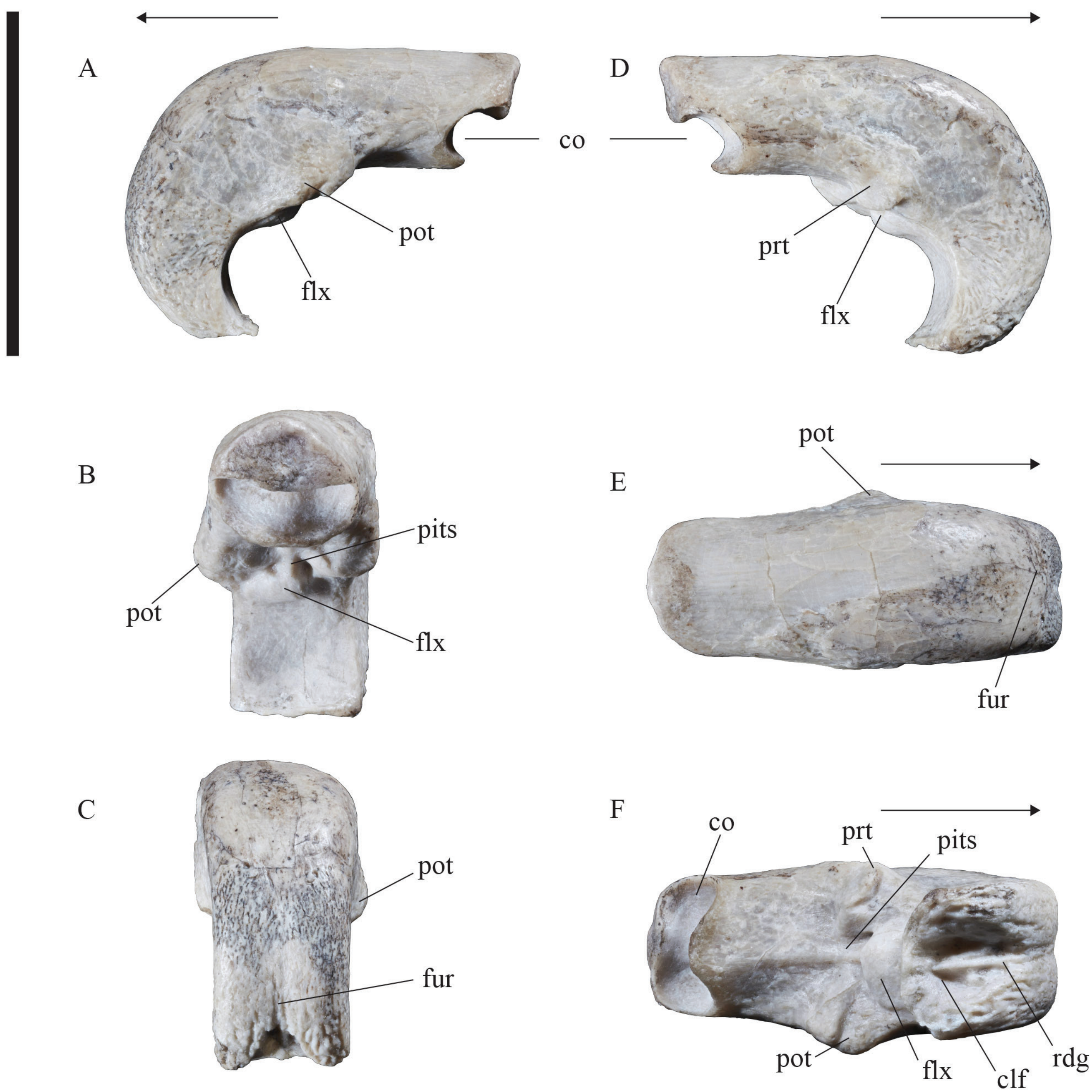

Figure 1. Holotype of *Ancistronychus paradoxus*, gen. et sp. nov. (PEFO 42805/UWBM 117331). **A.** Ungual phalanx in left lateral (postaxial) view. **B.** Proximal view. **C.** Distal view. **D.** Right lateral (preaxial) view **E.** Dorsal view. **F.** Ventral view. Abbreviations: **pot**, postaxial tuberosity; **prt**, preaxial tuberosity; **flx**, flexor tubercle; **pits**, flexor pits; **co**, cotyle; **fur**, furrow; **rdg**, ridge. Arrow points distally. Scale bar=2 cm.

Chinle Formation) but its position relative to the "persistent red silcrete" approximating the Adamanian-Revueltian boundary has been difficult to establish. The vertebrate assemblage suggests that the site may be in the Adamanian land vertebrate holochronozone (Martz and Parker 2010, 2017, Sidor et al. 2018).

Etymology—The genus name combines the Greek words for fishhook and claw and the species name is in reference to the unexpected nature of this taxon and other drepanosaurs, in general.

Description—We interpret PEFO 42805/UWBM 117331 as a left manual ungual phalanx from the second digit of a close relative of *D. unguicaudatus*. The specimen is morphologically distinct from other reptilian claws,

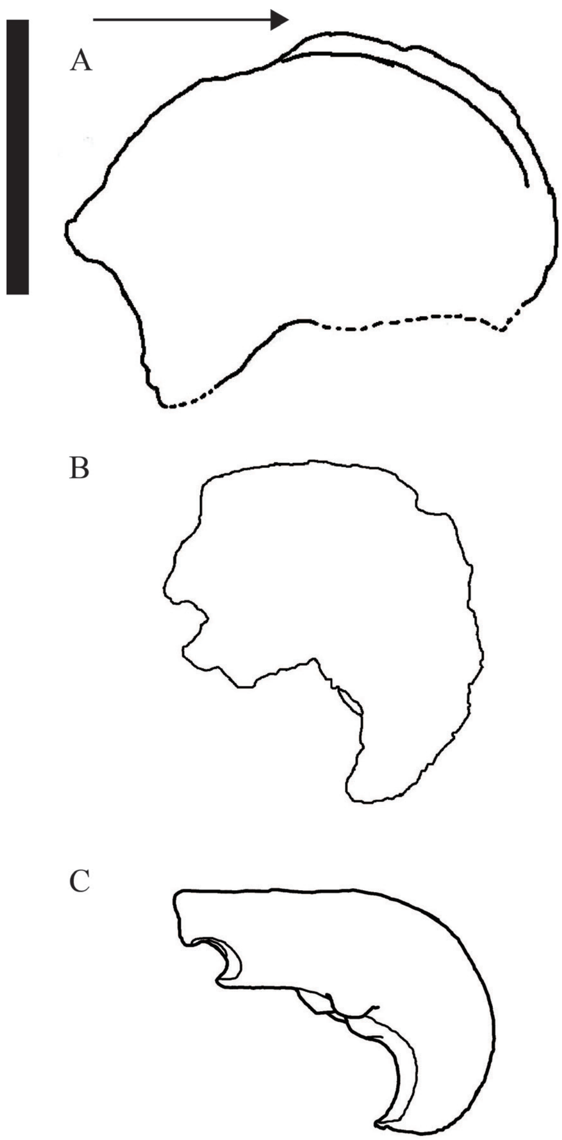

Figure 2. Comparison of the left manual unguals in *Drepanosaurus unguicaudatus* (**A**), GR 712 (**B**) and *Ancistronychus paradoxus*, gen. et sp. nov. (**C**). Scale bar=2 cm.

with a more fishhook-like appearance that has laterally oriented flexor tuberosities (Fig. 1 B, F), a cotyle located posteroventrally (Fig. 1 A, D), two facets within the cotyle for a tight connection with the more proximal element (Fig. 1 B, F), as well as the combination of both flexor pits and a flexor tubercle (Fig. 1 B, F). In medial and lateral view (Fig. 1A, D), the specimen has a flat dorsal (i.e., extensor) surface proximally that then arcs nearly 180° to its tip. A straight line from the dorsal edge of the cotyle to the distal edge of the apex of the phalanx is 2.23 cm long. The same measurement in *D. unguicaudautus* (MCSNB 5728) is 2.88 cm and the Hayden Quarry *Drepanosaurus* (GR 712) is 2.07 cm (Fig. 2). The ungual curves ventrally near the proximal margin of the lateral tuberosities 1.0 cm from the proximal end dorsally and 1.2 cm from the proximal end ventrally. This contrasts with the condition in the Hayden Quarry *Drepanosaurus* (GR 712) and *D. unguicaudatus* (MCSNB 5728), in which the curvature occurs throughout the entire length of the element or occurs much further distally, respectively.

The ventral (i.e., flexor) surface (Fig. 1F) has a deep articular cotyle proximally and bilateral pairs of pits and tuberosities near the midline. In flexor view, the outline of the cotyle is hourglass shaped, with the lateral (i.e., postaxial) facet slightly larger (Fig. 1F). The articular surface is concave and deep, with sharp-rimmed edges suggesting a tight articulation with the more proximal element. Near the middle of the articular surface is a low ridge that runs proximodistally and divides the cotyle into two facets. When compared to the ungual phalanges of most reptiles [e.g., *Iguana* Laurenti (1768), *Alligator* Cuvier (1807)], the articular surface in *Ancistronychus paradoxus* is displaced ventrally on the proximal end of the bone and faces more proximoventrally than proximally (Renesto 1994). These characteristics are shared with the enlarged manual unguals in *D. unguicaudatus* and the Hayden Quarry *Drepanosaurus.* As is found in the other manual unguals of *Megalancosaurus*, *Vallesaurus*, and *Dolabrosaurus,* and except for the second ungual in *D. unguicaudatus,* all the manual ungual phalanges have the articular surface located proximally rather than proximoventrally (Spielmann et al. 2005, Renesto et al. 2010). Distal to the cotyle, the ventral surface of the specimen bears a pronounced ridge along its midline that connects to the proximal edge of the flexor tubercle.

In ventral view, the center of the ungual features a complicated array of pits, grooves, and tuberosities (Fig. 1F) that have not been previously reported in a drepanosauromorph. The midline ridge is paralleled by shallow troughs on either side, which each end distally at a small pit. It is unclear if these pits represent foramina, but as currently prepared the preaxial pit is slightly deeper. Three rounded tuberosities surround the flexor pits: one distally and one to either side. The preaxial and postaxial tuberosities bulge laterally as opposed to the relatively straight sides of the ungual (Fig. 1). A prominent postaxial tuberosity that is larger than the preaxial tuberosity is also present in GR 712 and PEFO 42805/UWBM 117331, which identifies each specimen as a left second manual ungual (Pritchard 2015). Slightly distal to the flexor pits and centered on the ungual is the flexor tubercle. This structure is suboval in outline and oriented transversely. It is smooth and rounded, likely as the result of the insertion of muscles and tendons. In the

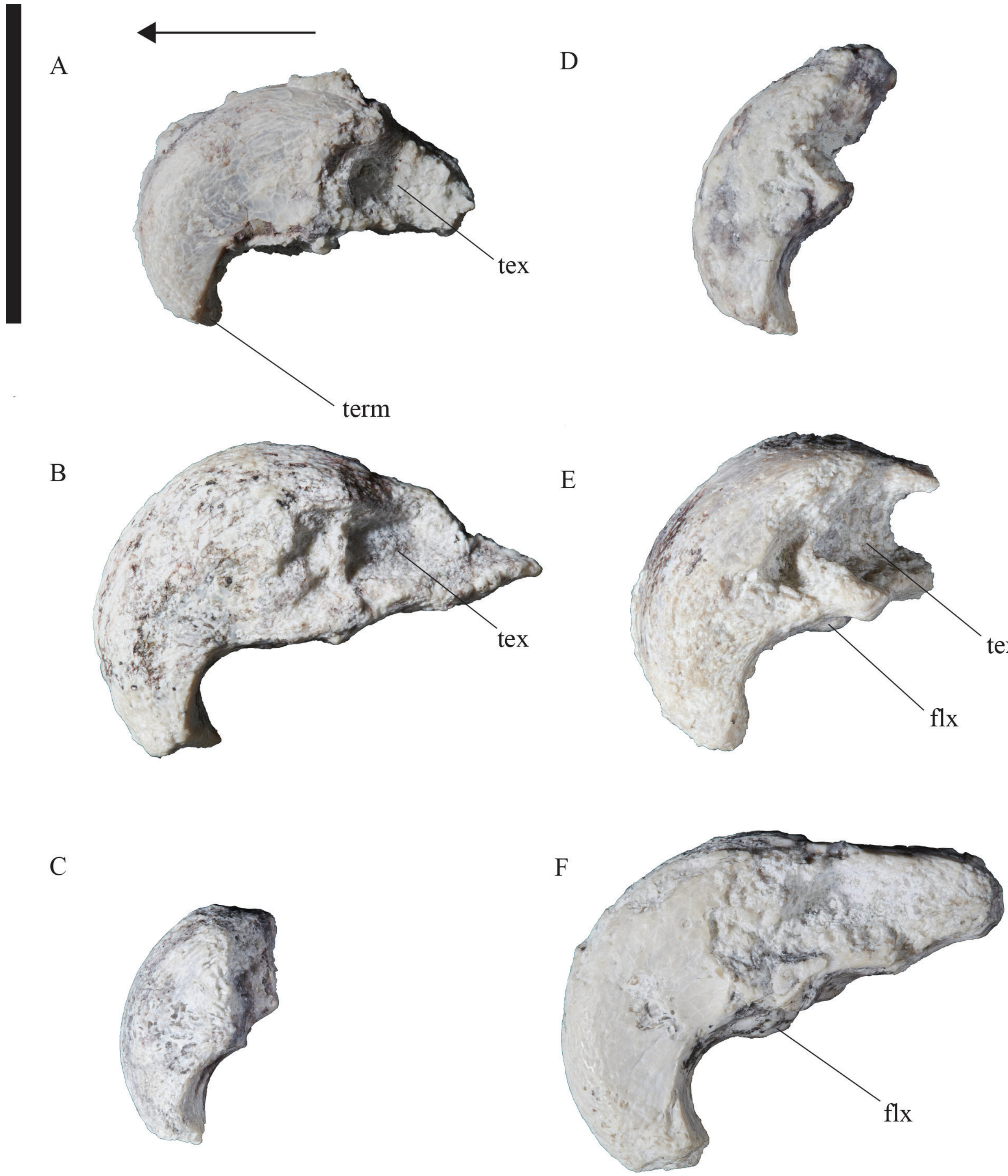

Figure 3. Paratypes of *Ancistronychus paradoxus*, gen. et sp. nov., in left lateral (postaxial) view that show varying degrees of completeness. **A.** PEFO 42806/UWBM 117332. **B.** PEFO 39324/UWBM 108325. **C.** PEFO 39325/UWBM 108326. **D.** PEFO 39326/UWBM 108327. **E.** PEFO 39379/UWBM 108385. **F.** PEFO 39380/UWBM 108386. Abbreviation: **tex**, triangular excavation on side of unguals; **flx**, flexor tubercle; **term**, terminus. Arrow points distally. Scale bar=2 cm.

Hayden Quarry *Drepanosaurus,* the flexor tubercle of the second manual ungual (GR 712) is hemispherical. This difference in morphology could be owing to taphonomic processes that distorted the original morphology of the tubercle in the holotype of *A. paradoxus*, but we believe it more likely indicates a somewhat different function of the ungual in each taxon because in some of the paratypes the flexor tubercle is present (Fig. 3A, B, E, F) and is similar in morphology to the holotype (see Discussion).

Distal to the flexor tubercle, the flexor surface of the ungual curves strongly ventrally, such that the tip of the ungual points nearly proximally. Uniquely among drepanosaurs, the distal half of the holotype retains a wide transverse breadth in both flexor and extensor views. This contrasts with what is seen in GR 712, which is more similar to a typical reptilian ungual in which the bone tapers distally in both mediolateral and dorsoventral planes. Also, uniquely among drepanosaurs, a furrow is present on the extensor surface of the holotype that gradually becomes deeper distally and a narrow ridge along the midline becomes more prominent (Fig. 1C). Eventually, the ventral furrow divides the tip of the ungual to form a V-shaped cleft, with the ridge present within the cleft terminating 3 mm before the distal end of specimen (Fig. 1F). Within the cleft, both sides of the ridge are marked by deep oval fossae. The distal extremity of the holotypic ungual of *A. paradoxus* is very broad and flat in proximal and distal view (resembling a shovel), which contrasts with most reptilian claws (including drepanosaurs) in which the ungual tapers distally to a sharply pointed apex.

DISCUSSION

Ecomorphology of Drepanosauromorphs

Interpretations of the ecology of drepanosauromorphs have changed substantially over the past few decades, with many hypotheses proposed. For example, *Megalancosaurus preonensis* was first described as being an arboreal climber owing to the presence of opposable digits on its hand (Calzavara et al. 1980). In contrast, Berman and Reisz (1992) argued that *Dolabrosaurus aquatilis* was an aquatic swimmer based on: 1) the presence of a dorsoventrally elongated tail that could have been used for carangiform locomotion (Kambe 1978) within the water, 2) the paddle-shaped manus and pes; and 3) a barrel-shaped chest possibly adapted for diving in deep water in order to counteract high pressures at those depths. *Hypuronector limnaios* was also argued as representing an aquatic swimmer based on the presence of elongated chevrons on the caudal vertebrae, making for a very flattened and large tail, which the authors compared to living aquatic tetrapods such as crocodilians and newts (Colbert and Olsen 2001). *Vallesaurus cenensis* was considered to be scansorial owing to the presence of modifications on the wrists and ankles for the ability of a wider range of motion, as is found in *Megalancosaurus*, which also had a prehensile manus and pes with opposable digits, a *Drepanosaurus*-like tail claw, dorsoventrally elongated caudal neural spines for a muscular tail, restricted motion of the tail along the ventral plane and the morphology of the phalanges, among other features (Renesto and Binelli 2006). Pritchard and Nesbitt (2017) considered the orbital anatomy and braincase of *Avicranium renestoi* to be consistent with an arboreal habitat. However, the most recent hypothesis is that all of these taxa were scansorial, with the aquatic hypothesis for some taxa having been rejected due to the inferred lack of mediolateral flexibility of the tail (Renesto et al. 2010).

Drepanosaurus unguicaudatus was initially considered to have fossorial habits owing to the presence of a large manual ungual phalanx (Pinna 1986), but most recent researchers agree that this species was most likely an arboreal scratch digging organism (Renesto et. al. 2010, Pritchard et. al. 2016). The latter interpretation is supported by features indicative of a prehensile tail such as: 1) vertically oriented zygopophyses constraining any lateral movement, and 2) haemapophyseal connections positioned posteriorly along the ventral margin of the caudal vertebrae (Renesto et. al. 2010). Other traits, such as the presence of a large manual ungual phalanx, as well as a crescent-shaped ulna for the attachment of flexor and extensor muscles, are suggestive of scratch-digging or hook-and-pull digging in *D. unguicaudatus* (Pritchard et. al. 2016, 2018). These functional interpretations are primarily based on comparisons with the silky anteater, *Cyclopes didactylus* Linnaeus (1758), which has a large manual ungual phalanx and uses it forelimb for hook-and-pull digging, as well as to sloths, *Manis* Linnaeus (1758) (pangolin), *Myrmecophaga* Linnaeus (1758) (anteater), *Priodontes* F. Cuvier (1825) (armadillo), and the pterosaur *Peteinosaurus* Wild (1978) (Renesto 1994, Renesto et al. 2010, Pritchard et al. 2016). Arboreal anteaters, such as the silky anteater *Cyclopes didactylus*, have strongly curved claws used for climbing along branches as well as piercing the nests of ants, while the giant anteater, *Myrmecophaga tridactyla* Linnaeus (1758), has longer, less recurved claws that are used primarily to dig into the nests of termites and ants (Desbiez and Medri 2010, Hayssen et al. 2012).

We expect that the pronounced differences in the shape of the unguals in *Ancistronychus paradoxus* and *D. unguicaudatus* connote ecological differences between these two taxa. The main morphological difference between these two taxa, in terms of their hypertrophied manual unguals that might have corresponded to ecological differences, is the shape of the distal terminus and the transverse breadth of the whole ungual. In *D. unguicaudatus*, the claw comes to a sharpened apex (Renesto et. al. 2010), while in *A. paradoxus*, the distal terminus has a broad and flattened shape in proximal and distal view (resembling a shovel). The morphology of the distal terminus in *A. paradoxus* is similar to that found in the fossorial taxon *Philodota* Weber (1904) (pangolin), in which the unguals bifurcate into two distinct distal processes and a fissure exists in between the processes (Gaudin et al. 2009). In frogs that dig with their forelimbs (i.e., head-first burrowers) both the whole manus and the phalanges of each digit are wide and stout, giving the manus a spatulate (i.e., shovel-like) shape that can be used to excavate into a substrate. Taxa like the Namibian web-footed gecko have feet that have a large surface area that can be used to dig through sand. Manual unguals that are wide and spatulate in shape occur in other taxa like moles and pangolins, with the later being the best comparison to *A. paradoxus* because of morphological similarities between the claws (e.g., fissured ungual phalanges) (Kley and Kearney 2007, Gaudin et al. 2009). In the fossorial taxon *Gopherus* Rafinesque (1832), all of the manual unguals are flattened along the flexor surface and marginally curved on the extensor surface (Fowler and Hall 2011). Bramble (1982) describes the manual morphology of *Gopherus* in some detail and demonstrates that, due to the flattened and wide nails with a manus that is short and large, the manus of *Gopherus* is well suited for digging through soft and easily friable sandy soils. Taxa like the *Tamandua* Gray (1825) have large claws that are similar in shape to *A. paradoxus* (i.e., spatulate in shape) and use their claws to tear into the nests of insects or to tear through insect infested soft wood (Taylor 1978). Sloths have claws that taper towards a sharp apex and recurve at an obtuse angle throughout their entire length in order to bring down and hold fruit suspended from trees (Britton 1941). Regarding *A. paradoxus*, we suggest that because of the distinct morphology of the distal terminus of the enlarged manual ungual, this taxon was possibly an arboreal/fossorial organism, similar to modern day pangolins, that either used its claw to dig into soft substrates (e.g., soft soil, rotten wood, etc.) or to help climb through trees in order to search for food. However, without more complete skeletal material, the ecology of *A. paradoxus* is difficult to evaluate further.

Ungual Taphonomy

Based on their distinctive broad distal tip with a central furrow and lack of lateral compression, we interpret the specimens shown in Figure 3 as second manual ungual phalanges of *Ancistronychus paradoxus* that are missing some to all of their proximal portion. These specimens vary in size from being proportionately larger than the holotype to subequal in size. Some of these specimens are highly incomplete, preserving just the distal tip of the phalanx (Fig. 3A–F). Several of the more complete specimens display a characteristic triangular excavation on either side of the ungual. The symmetry of these excavations and their occurrence on four specimens suggests that they represent real anatomy and not a taphonomic artifact (Fig. 3A, B, E, F). We are unaware of previous reports of this type of feature but suggest that they could represent planes of weakness where two elements fused to form the complete ungual phalanx. Unfortunately, CT scans of the holotype were unsuccessful at visualizing internal morphology that could support the hypothesis of an internal plane of weakness, possibly due to high iron content within the fossil. However, in the anteater *Tamandua*, the joint between the penultimate phalanx and the ungual phalanx has a semi-lunate shape in flexor view, much like what is visible in some of the unguals described here (Taylor 1978).

Although ontogeny seems like a reasonable explanation for the variation in preservation seen in this sample of unguals (i.e., the least complete unguals represent the youngest individuals that did not have the entire ungual ossified), there are problems with this interpretation. Namely, while some of the incomplete unguals are relatively small, unguals that are proportionately larger than the holotype are also incompletely preserved (Fig. 3A–F).

Using the fusion of structures in a specimen and the size of the individual as a proxy for understanding of the ontogeny of a species is not always the most reliable assumption (Griffin and Nesbitt 2016). An alternative explanation is that the paratypic specimens vary in completeness due simply to differing degrees of preservation. For example, there are several shuvosaurid limb bones from the Kaye Quarry that are perfectly preserved at one end but are shattered or incomplete at the other end. In addition, though some work has been done to better understand the ontogeny of basal reptiles, it is still poorly constrained in the skeletal system and more work on other taxa needs to be done in the future (Barta et al. 2018, Griffin 2018). More work on the taphonomy of the Kaye Quarry will be required to more completely understand the preservation of the unguals shown in Figure 3.

Phylogenetic Position of *Ancistronychus*

Establishing the phylogenetic position of *Ancistronychus paradoxus* among drepanosauromorphs is difficult because of the limited anatomical information available from the holotype and paratypes. However, several derived features suggest that *Ancistronychus paradoxus* is likely closely related to *Drepanosaurus* *unguicaudatus* and the Hayden Quarry *Drepanosaurus* discussed by Pritchard et al. (2016). In particular, the shared presence of an enlarged manual ungual phalanx with flexor pits and flexor tubercle, lateral tuberosities and a proximoventrally located cotyle, argues that *A. paradoxus*, *D. unguicaudatus*, and the Hayden Quarry *Drepanosaurus* form a clade. Sister-taxon relationships within that hypothesized clade are difficult to determine. *Drepanosaurus unguicaudatus* and the Hayden Quarry *Drepanosaurus* share a number of features of the ungual (e.g., transverse compression, proportionally deeper) that *A. paradoxus* lacks, but some of these features are likely plesiomorphies (Pritchard 2015). The lack of articulated material for *A. paradoxus* and several other drepanosauromorphs (e.g., *Avicranium renestoi*) suggests that establishing a comprehensive phylogeny for the clade will be problematic and plagued by missing data. Excavations at the Kaye Quarry have yielded additional cranial and postcranial material that is likely drepanosauromorph in origin (Goncalves et al. 2018), but until articulated material demonstrates that they can be referred to *A. paradoxus*, they are currently of limited phylogenetic utility.

The recognition of *A. paradoxus* as a previously unrecognized species of drepanosauromorph from the Norian of North America demonstrates unsuspected morphological (and likely ecological) variation existed within the clade and helps to reconstruct its evolutionary history. Future studies and discoveries of drepanosauromorphs will help researchers to understand the biology of these organisms more in depth and their roles within Late Triassic ecosystems.

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