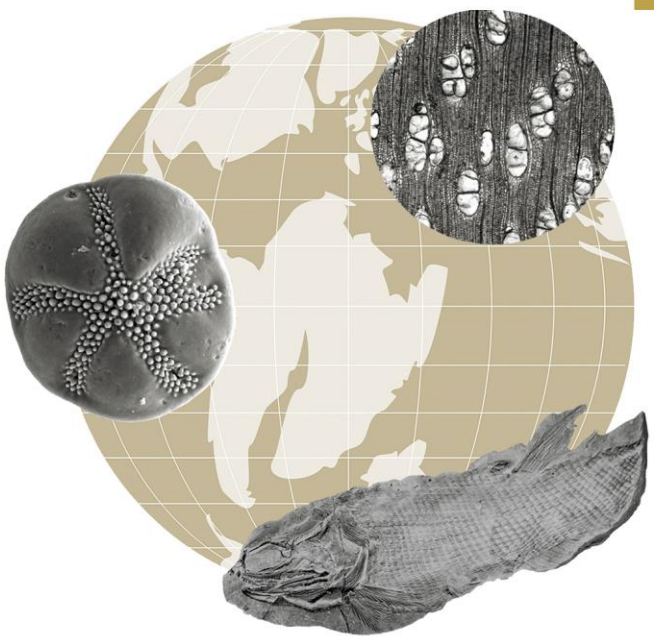
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New postcranial materials of diplodocid sauropods from the Lower Cretaceous Bajada Colorada Formation (Berriasian–Valanginian), Neuquén Province, Argentina, and comments on the last diplodocids in South America

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Short Description: New diplodocid sauropods remains are described from the Lower Cretaceous Bajada Colorada Formation, in northern Patagonia

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Abstract. Diplodocid sauropods inhabited Mesozoic terrestrial ecosystems from Middle Jurassic to Early Cretaceous times. Widely known in the Late Jurassic of North America and East Africa, the family was first recorded in South American strata just recently. Here we describe new material that was collected from the quarry that produced *Leinkupal laticauda* (Diplodocidae) a few years ago. The new specimens include remains of cervical, dorsal and caudal vertebrae as well as a tibia. In the absence of an articulated series, we consider that all material not comparable with the holotype of *Leinkupal* and found in absence of anatomical association should be treated at higher-level taxonomic taxon. South American diplodocid record shows their occurrence from the Upper Jurassic strata to the Cretaceous in different localities. However, the incompleteness of the Jurassic South American remains make their relationship with well-known taxa from other regions difficult to be established with confidence. On the other hand, the Cretaceous remains, although badly preserved, are at the time the better occurrence of the group for Gondwana and the Cretaceous. This new diplodocid material expands our knowledge on the presence and anatomy of this group for South America.

Keywords. Diplodocid sauropods. Bajada Colorada Formation. Lower Cretaceous. South American diplodocids. *Leinkupal*.

Resumen Nuevos materiales postcraneanos de saurópodos diplodócidos de la formación Bajada Colorada (Berriasiano–Valanginiano), provincia de Neuquén, Argentina, y comentarios sobre los últimos diplodócidos en América del Sur. Los saurópodos diplodócidos habitaron los ecosistemas terrestres desde el Jurásico medio al Cretácico temprano. Conocidos ampliamente en el Jurásico de Norteamérica y África oriental, la familia fue recientemente registrada en Sudamérica. Se describe nuevo material de la misma excavación donde *Leinkupal laticauda* (Diplodocidae) fue descrito

hace unos años. Los especímenes incluyen algunas vértebras cervicales, dorsales y caudales, así como también una tibia. En ausencia de series articuladas, consideramos que todo este material, que no es comparable con el holotipo de *Leinkupal*, y encontrado en ausencia de una asociación anatómica clara debiera ser tratada a un nivel taxonómico más alto. El registro sudamericano se conoce desde el Jurásico superior al Cretácico, con una amplia distribución. Lo incompleto del registro jurásico de América del Sur hace que sus relaciones con otros taxa bien conocidos de otras regiones sea difícil de establecer con confianza. Por otro lado, los restos del Cretácico, si bien mal preservados, son hasta el momento el mejor registro del grupo en Gondwana y el Cretácico. Este nuevo material de diplodócidos expande nuestro conocimiento sobre la presencia y anatomía del grupo en América del Sur.

Palabras clave. Saurópodos diplodócidos. Formación Bajada Colorada. Cretácico Inferior. Diplodócidos sudamericanos. *Leinkupal*.

Introduction

Diplodocid sauropods inhabited Mesozoic terrestrial ecosystems from Middle Jurassic to Early Cretaceous times (Tschopp et al., 2015). Diplodocids were first reported from Upper Jurassic beds of the Morrison Formation of North America and the Tendaguru Formation from Tanzania in late 1800s and early 1900s (van der Linden et al., 2025), but the group was recorded in South American strata only recently (Gallina et al., 2014; Salgado et al., 2015; Rauhut et al., 2015; Gaediner et al. 2017). *Leinkupal laticauda* (Gallina et al., 2014) represents the first occurrence of a diplodocid sauropod for South America as well as for the Cretaceous. The species was based initially on few recovered axial remains (three partial cervical, one incomplete dorsal, and four nearly complete caudal vertebrae), but additional specimens were subsequently referred from the Tithonian Toqui Formation of southern Chile (Salgado et al., 2015), the Kimmeridgian Cañadón Calcáreo Formation of Chubut Province (Rauhut et al., 2015, although new studies on these remains suggest they could belong to a macronarian sauropod, Reutter et al., 2026), and the Lower Cretaceous Mulichinco Formation of Neuquén Province (Gaediner et al., 2017).

Subsequent fieldwork in the outcrops where *Leinkupal laticauda* was found (Fig. 1) resulted in the discovery of disarticulated but associated cranial, axial, and appendicular remains of a sauropod dinosaur. In this paper we describe the postcranial remains, intrepret them in a taxonomic context, and added them to the register of South American diplodocids.

Institutional abbreviations

MNBH: Musee National Boubou Hama, Niger.

MMCh-PV: Museo Municipal ‘Ernesto Bachmann’ Colección Paleontología de Vertebrados, Villa El Chocón, Neuquén, Argentina.

Materials

The materials here described include axial and appendicular bones (mentioned in Gallina et al., 2018). Skull bones were described and figured in detail and tentatively assigned to *Leinkupal* because of their similarities (Garderes et al., 2022). In this paper, we treat all the remains from this site as isolated diplodocid bones (see below). The assignment of each vertebral element from anterior to posterior elements across the axial series is based on general morphology and proportion, because the material was found in disarticulation but associated in an area no more than 8 m^2. This assignment was also based on the arrangement of neural arch laminare and fossae (Wilson, 1999, Wilson et al., 2011), as well as comparisons with more complete diplodocid axial series (e.g., *Diplodocus*, *Apatosaurus*, *Galeamopus*). Although nearly complete, all materials are poorly preserved on one or the other side (e.g., some cervical vertebrae preserved a better left side, some caudal vertebrae preserved a better right side). Evident differences with contemporaneous dicraeosaurid sauropod remains (e.g., *Bajadasaurus*; Gallina et al., 2019) were also considered for the referral.

Systematic Paleontology

Sauropoda Marsh, 1878

Diplodocoidea Marsh, 1884

Flagellicaudata Harris & Dodson, 2004

Diplodocidae Marsh, 1884

Gen et sp. indet.

Figures 2–9

Results

Description

Cervical vertebrae. Axis. The axis (MMCh-PV 158) is complete (Fig. 2). Its neural spine is situated entirely anterior to the postzygapophyses, as in *Galeamopus* and *Diplodocus*, near mid-length of the prezygapophyses, which are not preserved. The neural spine seems to be rounded and short, thus resembling the condition of *Diplodocus* and *Galeamopus*. Rebbachisaurid sauropods as *Nigersaurus* (MNBH-GAD 512) and *Lavocatisaurus* (Canudo et al., 2018) also present axes with a short neural spine, differing from the tall spine present in the axes of most dicraeosaurid sauropods (Janensch, 1929; Calvo and Salgado, 1995, Paulina Carabajal et al., 2014; Gallina et al., 2019). Although the anterior border of the neural spine is damaged, its total height is around 1.5 times the total length of the centrum. A robust postspinal lamina is present, running along the posterior margin of the spine and bifurcating at its base towards the tiny postzygapophyses. The postspinal lamina is posteriorly projected and visible in lateral view (Fig. 2). There is no evidence of the postzygodiapophyseal lamina (podl), spinodiapophyseal fossa (sdf), or postzygapophyseal centrodiapophyseal fossa (pocdf). In the neural spine, well-marked triangular fossae are developed on both lateral surfaces. These fossae are not present in other sauropods. The centrum is laterally excavated by two large pleurocoels, the anterior one deeper than the posterior. The posterior pleurocoel is developed as a small fossa, whereas the anterior one extends over the level of parapophysis. The so-called “pleurocentral lamina” is absent between both pleurocoels, a trait similarly present in *Galeamopus* (Tschopp and Mateus, 2017). Both anterior and posterior limits of the centrum are incomplete, although an ovoidal neural canal could be observed in posterior view. In ventral view, the centrum has a well-developed ventral keel, as present in *Galeamopus* (Tshchopp and Mateus, 2017).

Cervical vertebrae. Anterior cervical neural arch (MMCh-PV 173). An anterior cervical neural arch (Fig. 3) preserves both postzygapophyses and the right prezygapophysis. Based on its proportions and morphology, it is perhaps the cervical vertebra 4 or 5. The neural spine is even shorter than that of the axis, and it is undivided. This undivided condition is widespread among anterior cervical neural spines of many diplodocids (Hatcher, 1901; Gilmore, 1936). In dicraeosaurids such as *Dicraeosaurus* (Janensch, 1929) or *Amargasaurus* (Salgado and Bonaparte, 1991), the third vertebra is bifid. As previously mentioned, the anterior cervical neural spine of MMCh-PV 173 is low, anteroposteriorly elongated, as a rugose bump. The poor state of preservation makes it difficult to identify the diapophyseal laminae, but a centropostzygapophyseal lamina (cpol) can be recognized running from the right postzygapophysis to the centrum (Fig. 3). The centroprezygapophyseal lamina (cprl) runs from the right prezygapophysis to the centrum, and a badly preserved prezygodiapophyseal lamina (prdl) is evident in the same side. In left lateral view, the prezygodiapophyseal lamina (prdl) and postzygodiapophyseal lamina (podl) run from the diapophysis anteriorly and posteriorly, respectively. Together the spinoprezygapophyseal lamina (sprl) and the spinopostzygapophyseal lamina (spol) border a shallow spinodiapophyseal fossa (sdf). The prezygapophyseal centrodiapophyseal fossa (prcdf) is delimited by the cprl, the prdl, and the diapophysis (Fig. 3F). The postzygapophyseal centrodiapophyseal fossa (pocdf) is delimited by the podl posterior to the broken diapophysis. In anterior view, the prezygapophyses are connected to the neural spine by means of a conspicuous spinoprezygapophyseal lamina (sprl), framing a triangular spinoprezygapophyseal fossa (sprf).

Posteriorly, the well-developed postzygapophyses are obliquely oriented and hang from the neural spine. Two well-marked spinopostzygapophyseal laminae (spol) border the spinopostzygapophyseal fossa (spof), which is developed as a cleft.

Dorsal vertebrae. Anterior dorsal vertebra. An incomplete anterior dorsal element (MMCh-PV 161) was preserved (Fig. 4). The right lateral face is better preserved than the left. The neural arch is relatively tall, 1.5 of the centrum length, and the neural spine is short as the posterior cervical/anterior dorsal vertebrae of other diplodocids such as *Galeamopus*. The centrum is opisthocoelous, with a length equal to two times its height. The left lateral surface bears a shallow and ovoid pneumatic fossa. The ventral surface of the centrum is markedly concave in lateral view. It bears a longitudinal fossa devoid of a median keel, as seen in other diplodocids, including the paratypic material of *Leinkupal* (MMCh-PV 63-5). The neural canal is ovoid in anterior view, although the shape is affected by distortion. The prezygapophyses are connected to one another by a well-developed intraprezygapophyseal lamina (tprl). The postzygapophysis is ovoidal and dorsoventrally enlarged. In right lateral view, the neural arch has a well-developed, deep, and triangular centrodiapophyseal fossa (cdf). The prezygapophyseal centrodiapophyseal fossa (prcdf) is subtriangular and delimited by the centroprezygapophyseal lamina (cprl), paradiapophyseal lamina (ppdl), and prezygodiapophyseal lamina (prdl). The pocdf is also subtriangular, but it is shallower than the prcdf. This pocdf is delimited by a poorly preserved cpol and a conspicuous pcdl. In dorsal view, there is no evidence of a median tubercle, although this zone is strongly damaged.

Caudal vertebrae. Anterior caudal vertebra (MMCh-PV 136). An incomplete anterior caudal vertebra preserves the centrum, the base of neural arch, an incomplete neural spine, and part of the right transverse process (Fig. 5). The centrum is

anteroposteriorly short, and the articular surfaces have a circular outline. It has a flat posterior articular surface, and concave anterior articular surface. There is no evidence of pneumatic structures on the centrum. The ventral and lateral aspects are fairly concave, without well-marked keels or ridges, as seen in anterior caudal vertebrae of *Diplodocus* (Hatcher, 1901). The neural canal is subcircular. The neural arch, the base of the prezygapophyses as well as the base of neural spine, are preserved. The pedicels of the neural arch are practically absent because the neural arch is low. The prezygapophyses are short; however, they extend beyond the anterior margin of the centrum. In anterior view, both spinoprezygapophyseal laminae (sprl) can be recognized on the neural spine. They flank a well-developed prespinal lamina (prsl). Between the sprls, a small and shallow spinoprezygapophyseal fossa (sprf) is developed. In right lateral view, a badly preserved spdl can be recognized running from the transverse process to the tip of the neural spine. A well-developed wing-like right transverse process is present as a lamina of bone, but on the left side only the base of the transverse process is preserved, which is dorsoventrally deep. The presence of wing-like process is common in other anterior caudal vertebrae of diplodocids (Gallina and Otero, 2009). On the posterior side of the vertebra, the postzygapophyses are oriented around 45 degrees, although both articular surfaces are badly damaged.

Caudal vertebrae. Anterior caudal vertebra (MMCh-PV 248). Another anterior caudal element preserves the centrum and neural arch, a nearly complete high neural spine, and the ventral portion of the left transverse process (Fig. 6). The centrum has flat anterior and posterior faces; however, this condition could be result of bad preservation. The neural arch is tall, two times the centrum height, with a tall neural spine. The neural canal is badly preserved, but an ovoid outline is visible in posterior view. The transverse process is broken, but a wing-like process, with a dorsoventral extension seems to be

present, as in other diplodocids (e.g. *Diplodocus*, *Barosaurus*, *Leinkupal*). Well-developed prezygapophyseal centrodiapophyseal (prcdf) and spinodiapophyseal (sdf) fossae are present on the left side of the neural arch. The postzygapophyses are small, with their articular surfaces facing ventrolaterally at an angle of 45°. The ventral surface of the centrum is concave both anteroposteriorly and mediolaterally. The centrum is short and flat, with a lateral support on its ventral face.

Caudal vertebrae. Anterior to middle caudal vertebra (MMCh-PV 159). An anterior to middle caudal vertebra is preserved (Fig. 7). The serial position of this vertebra is tentative but compared to the holotype of *Leinkupal* it is most likely posterior to the 7th caudal vertebra. Well-defined diapophyseal laminae, fossae, and transverse processes can be recognized, although they are partially damaged and strongly deformed by lateral compression. The centrum is procoelous, with a deep concave anterior articular surface and a markedly convex posterior articular surface. The centrum length is equal to the height of the anterior articular surface. The lateral surface of the centrum does not have pneumatic structures, although a smooth fossa is present. The centrum is markedly constricted at its mid-length as in caudal centra of *Leinkupal*, and the ventral face is markedly concave. The neural canal is circular in anterior view (Fig. 7E). The cprls are bifurcated as in the anterior caudal vertebrae of *Leinkupal* (Gallina et al., 2014). The medial rami of the cprl borders the neural canal and joins the tprl dorsally, whereas the lateral rami of the cprl contacts the dorsal margin of the centrum with the prezygapophyses. The lateral and medial rami of the cprl bound two small cprfs, as in *Apatosaurus* (Wilson et al., 2011). Two ventrolaterally oriented transverse processes extend from the base of neural arch. This condition resembles the ventrolaterally directed transverse process of the anterior to middle caudal vertebrae of *Leinkupal* and *Barosaurus* (Marsh, 1890). Both prcdfs are deep and

developed along the entire length of the transverse processes. An oblique accessory lamina divides the left prcdf into a lateral and medial fossa. The prezygapophyses are long, ovoid, and anterodorsally oriented. They reach the anterior border of the centrum. They are connected to the neural arch by two well-developed sprls. The neural spine is lost, so a prsl cannot be recognized. A deep sprf is observed anteriorly, at the base of the neural arch.

Caudal vertebrae. Mid-caudal vertebrae (MMCh-PV 137/214/165). There are three mid-caudal vertebrae (Fig. 8), of which MMCh-PV 137 represents the most anterior, followed by MMCh-PV 214 and MMCh-PV 165. The centra of these vertebrae are slightly procoelous. The neural spine of the most anterior is directed upwards, but the most posterior has a neural spine directed backwards. All middle caudal vertebrae have small ovoidal lateral pneumatic fossae and a broad, ventral longitudinal hollow with lateral ridges in their centra. This resembles caudal vertebra 20 of the paratype of *Leinkupal* (MMCh-PV 63-8). In addition, all caudal centra have well defined concave ventral borders in lateral view, as is common in diplodocids (Tshopp et al., 2015). The transverse processes are developed as lateral bumps across the different vertebrae. The neural arches rest on the anterior half of the centra. Thus, the prezygapophyses surpass the anterior end of the centra and the postzygapophyses do not extend beyond the posterior articular surface of the centra. Well-marked spinoprezygapophysial laminae (sprls) run from the spine to the prezygapophyses. Only MMCh-PV 214 preserves a sdf on the lateral side of the spine.

Hindlimb. Tibia (MMCh-PV 279). The left tibia is nearly completely preserved (Fig. 9). The distal end is mediolaterally compressed, and the distal condyles are completely eroded. As a result, neither the original circumference (including the mediolateral development) nor the degree of torsion of the proximal end can be assessed. In anterior

276 view, the tibia has a sigmoidal shape. In lateral view, the cnemial crest is slightly
277 incomplete on its dorsal extension; however, its rounded contour can be recognized
278 (Fig. 9D, E) as in *Tornieria* (Remes, 2006) and *Diplodocus* (Hatcher, 1901).
279 Conversely, dicraeosaurids such as *Dicraeosaurus* and *Amargatitanis* (Gallina, 2016)
280 have stepped and low cnemial crest. The cnemial fossa extends to the middle portion of
281 the tibia.
282
283 **Discussion**
284 **Contribution of the present material to determine phylogenetic affinities.**
285 Although all materials were found intermixed with several bones and teeth assigned to
286 flagellicaudatan sauropods (e.g., Gallina et al., 2014; Gallina et al., 2019), theropod
287 remains (Canale et al. 2016), and probable thyreophorans (Riguetti et al. 2026), the
288 remains here described were recognized as belonging to diplodocid diplodocoids based
289 on the presence of several features recognized in diverse taxa of this group (e.g.,
290 Whitlock, 2011; Tschopp et al., 2015) such as wing-like, ventrally pointed transverse
291 processes in anterior caudal vertebrae, well-developed diapophyseal laminae in anterior
292 and middle caudal vertebrae, well developed ovoidal fossae in middle caudal vertebrae,
293 and well-marked ventral hollows with lateral ridges in anterior to middle caudal centra.
294 The Bajada Colorada Formation represents one of the most diverse stratigraphic
295 units for Diplodocoidea in the Southern Hemisphere (Gallina et al., 2022). The presence
296 of *Leinkupal* and *Bajadasaurus* in the same quarry represents a challenge for taxonomy.
297 Although all studied remains fit with the former in terms of body size, general
298 morphology, and quarry provenance, we cannot assign this material to *Leinkupal*
299 *laticauda* because diagnostic features cannot be reliably observed. The short and
300 undivided neural spine present in the anterior cervical vertebra, the short bifid neural

spine in the anterior dorsal vertebra and, as previously mentioned, the distinctive wing-like transverse process with a ventrally pointed ventral bar are characters widely recognized in diplodocid sauropods. Due to the absence of anatomical association and, to avoid the erection of a chimeric taxon, the materials are not considered as a single OTU and thus not included in a phylogenetic analysis. The holotype of *Leinkupal laticauda* consists of one anterior caudal vertebra, precluding any eventual overlapping with further diplodocoid remains (e.g., the cervical elements) from the same quarry. In fact, some successive phylogenenetic analyses included only the holotypic material in the *Leinkupal* OTU (Tschopp et al., 2015). The possibility of intermixing of taxa has only increased in the successive quarry seasons in the years since the original description of *Leinkupal* (Gallina et al., 2014).

In absence of articulated series, we consider that all material not comparable with the holotype found in absence of anatomical association should be treated at higher taxonomic levels. We suggest that the material described here pertains to an indeterminate diplodocid sauropod, despite Garderes et al. (2022) tentative referral of the cranial remains to the diplodocid *Leinkupal laticauda*. We further suggest that the original remains of *Leinkupal laticauda* beyond the holotype should be revisited.

Comments on South American diplodocids. *Leinkupal laticauda* is the only diplodocid species described for this locality and the first recognized diplodocid for the Cretaceous (Gallina et al., 2022). Although other diplodocid remains seem to be present in Early Cretaceous beds in Gondwanan landmasses (e.g., Kirkland Formation, Mulichinco Formation), their low abundance contrasts with the abundance in Late Jurassic beds of North America (van der Linden et al., 2025). However, this scenario may change in the future, given that possible additional diplodocid species from the Bajada Colorada locality will be formally described, suggesting that Cretaceous

diplodocid diversity was greater than previously recognized (Gallina et al. in prep). As mentioned, the Jurassic Morrison Formation from North America represents the stratigraphical level where diplodocids reach the peak of forms (several specimens of *Apatosaurus*, *Supersaurus*, *Diplodocus*, *Barosaurus*, and *Galeamopus*; Tschopp et al., 2015; van der Linden et al., 2025). A similar situation occurs in the Jurassic of Tanzania, Africa, where diplodocids are important, among others (e.g., *Tornieria*, diplodocids indet.). Although diplodocid sauropods were considered extinct after the Jurassic-Cretaceous boundary (Barrett and Upchurch, 2005; Upchurch and Barrett, 2005), the South American record shows a longer distribution, from Upper Jurassic to the Lower Cretaceous (Rauhut et al., 2015; van der Linden et al., 2025). In addition, the incompleteness of the materials collected from the Upper Jurassic of South America (except for *Brachytrachelopan*) makes their relationship with well-known taxa from other regions difficult to be established with confidence. The Cretaceous remains presented here (i.e., those from the Bajada Colorada Formation), although badly preserved, represent a critical occurrence of the family for any Gondwanan landmass during this time period.

CONCLUSION

New additional diplodocid remains are described for the lower Cretaceous Bajada Colorada Formation (Berriasian–Valanginian), showing that the family was an important faunal component. The remains include several vertebral and appendicular elements. Although it cannot be certainly attributed to the only species already described for the locality, this diplodocid material expands our knowledge on the presence and anatomy of the family for South American Cretaceous strata.

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Figure captions

Figure 1. Map of the Bajada Colorada site. **A** shows the position of Neuquén Province in Argentina. **B** shows the position of the Bajada Colorada locality in Neuquén Province. **C** shows the location of the Bajada Colorada site along the Río Limay. Circles in black refer to towns. Sauropod silhouette indicates the Bajada Colorada site where remains were found. Scale bar equals 20 km (modified from Gallina et al., 2021).

Figure 2. Diplodocid axis (MMCh-Pv 158) in **A**, **B** anterior, **C**, dorsal, and **D**, **E** right lateral views. **B** and **E** are interpretative drawings. Abbreviations: cpol, centropostzygapophyseal lamina; d, diapophysis; posl, postspinal lamina; poz, postzygapophysis; tf, triangular fossa. Scale bar equals 50 mm

Figure 3. Diplodocid anterior cervical neural arch (MMCh-Pv 173) in **A**, **B**, dorsal, **C**, **D**, anterior, **E**, **F**, left lateral, **G**, **H**, posterior, and **I**, **J**, right lateral views. **B**, **D**, **F**, **H**, and **J** are interpretive drawings. Abbreviations: cpol, centropostzygapophyseal lamina; cprl, centroprezygapophyseal lamina; nc, neural canal; ns, neural spine; prcdf, prezygapophyseal centrodiapophyseal fossa; prdl, prezygodiapophyseal lamina; pocdf, postzygapophyseal centrodiapophyseal fossa; podl, postzygodiapophyseal lamina; poz, postzygapophysis; prz, prezygapophysis; sdf, spinodiapophyseal fossa; spol,

spinopostzygapophyseal lamina; spof, spinopostzygapophyseal fossa; sprl, spinoprezygapophyseal lamina; sprf, spinoprezygapophyseal fossa; tprl, intraprezygapophyseal lamina. Scale bar equals 50 mm.

Figure 4. Diplodocid anterior dorsal element (MMCh-Pv 161) in **A**, **B**, anterior, **C**, **D**, right lateral, and **E**, **F**, posterior views. **B**, **D**, and **F** are interpretive drawings. Abbreviations: cdf, centrodiapophyseal fossa; cprf, centroprezygapophyseal fossa; cpol, centropostzygapophyseal lamina; cprl, centroprezygapophyseal lamina; d, diapophysis; nc, neural canal; ns, neural spine; pcdl, posterior centrodiapophyseal lamina; prcdf, prezygapophyseal centrodiapophyseal fossa; ppdl, paradiapophyseal lamina; poz, postzygapophysis; prz, prezygapophysis; tprl, intraprezygapophyseal lamina. Scale bar equals 100 mm.

Figure 5. Diplodocid anterior caudal vertebra (MMCh-Pv 136) in **A**, **B**, anterior, **C**, **D**, right lateral, and **E**, **F**, posterior views. **B**, **D**, and **F** are interpretative drawings. Abbreviations: acdl, anterior centrodiapophyseal lamina; cprl, centroprezygapophyseal lamina; nc, neural canal; poz, postzygapophysis; spol, spinopostzygapophyseal lamina; sprl, spinoprezygapophyseal lamina; sprf, spinoprezygapophyseal fossa; tp, transverse process. Scale bar equals 100 mm.

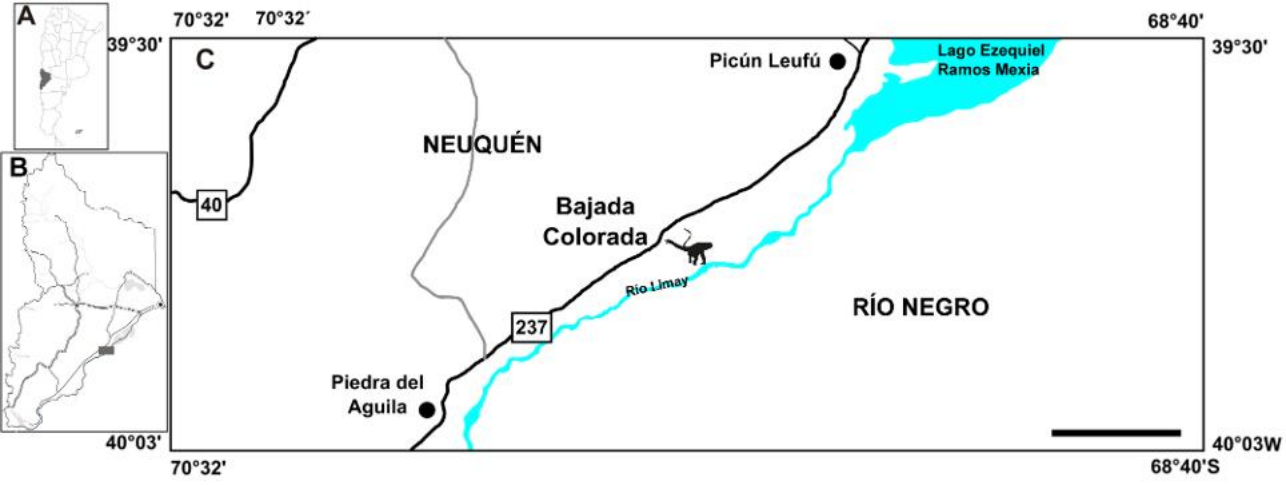
Figure 6. Diplodocid anterior caudal vertebra (MMCh-Pv 248) in **A**, **D,** anterior; **B**, **E,** left lateral, and **C**, **F**, posterior views. **D**, **E**, and **F** are interpretive drawings. Abbreviations: nc, neural canal; pocdf, postzygapophyseal centrodiapophyseal fossa; podl, postzygodiapophyseal lamina; poz, postzygapophysis; prcdf, prezygapophyseal centrodiapophyseal fossa; prz, prezygapophysis; sdf, spinodiapophyseal fossa; spol,

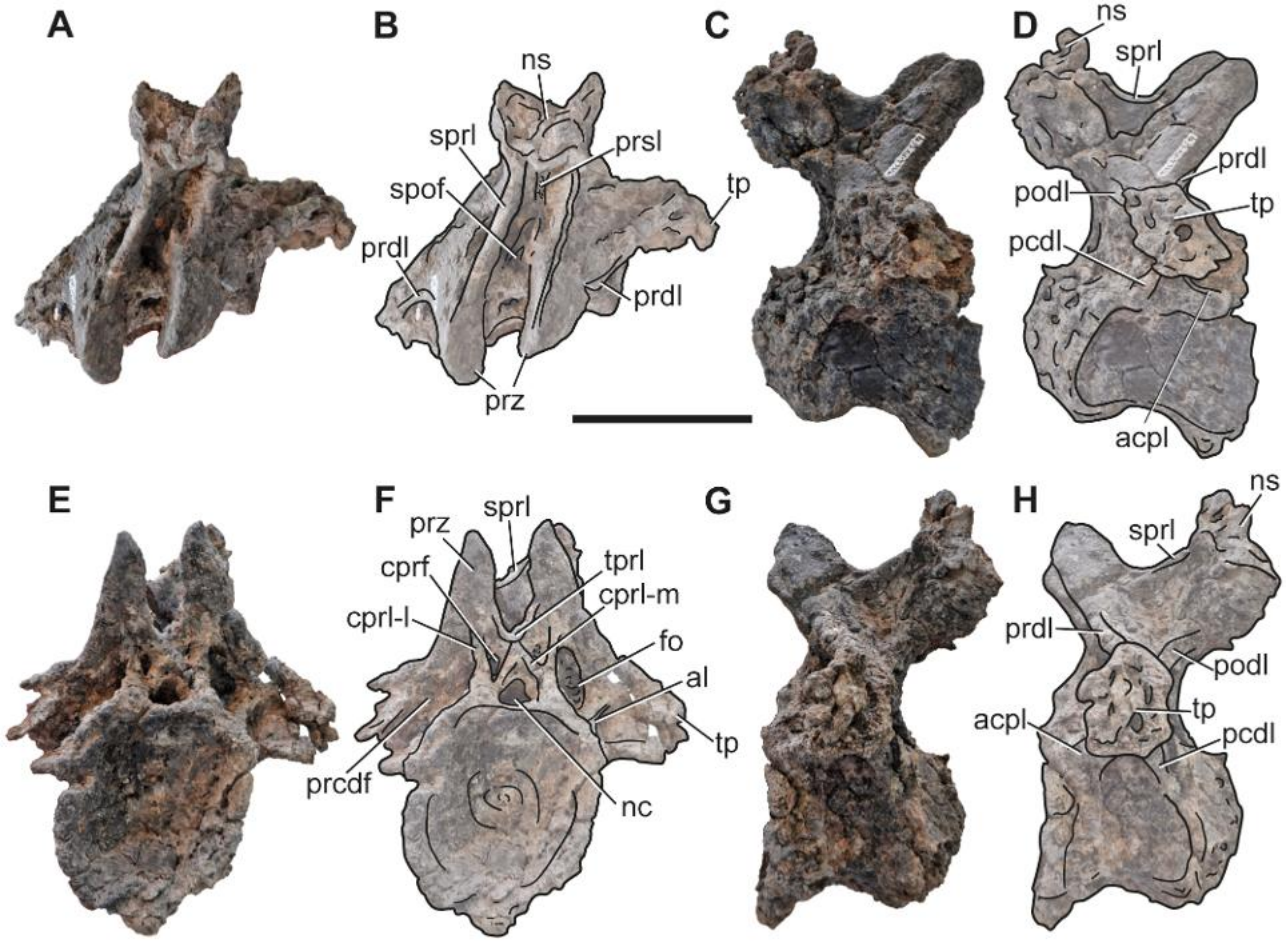
spinopostzygapophyseal lamina; spof, spinopostzygapophyseal fossa; sprl, spinoprezygapophyseal lamina; tp, transverse process. Scale bar equals 100 mm.

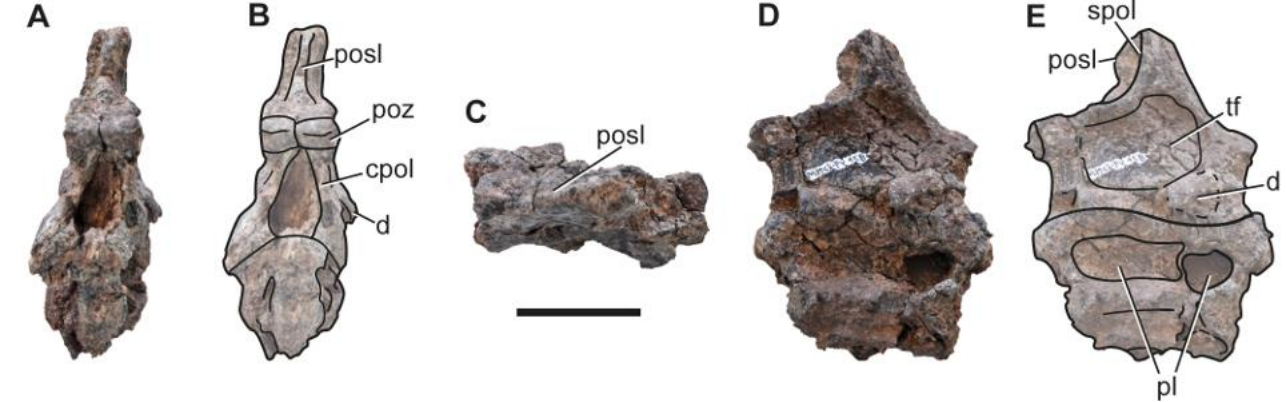
Figure 7. Diplodocid anterior to middle caudal vertebra (MMCh-Pv 159) in **A**, **B**, dorsal, **C**, **D**, right lateral, **E**, **F**, anterior, and **G**, **H**, left lateral views. **B**, **F**, **D**, and **H** are interpretive drawings. Abbreviations: acpl, anterior centroparapophyseal lamina; al, accessory lamina; cprf, centroprezygapophyseal fossa; cprl-l, lateral centroprezygapophyseal lamina; cprl-m, medial centroprezygapophyseal lamina; fo, fossa; nc, neural canal; ns, neural spine; pcdl, posterior centroparapophyseal lamina; prcdf, prezygapophyseal centrodiapophyseal fossa; prdl, prezygodiapophyseal lamina; podl, postzygodiapophyseal lamina; prz, prezygapophysis; sprl, spinoprezygapophyseal lamina; sprf, spinoprezygapophyseal fossa; tp, transverse process; tprl, intraprezygapophyseal lamina. Scale bar equals 100 mm.

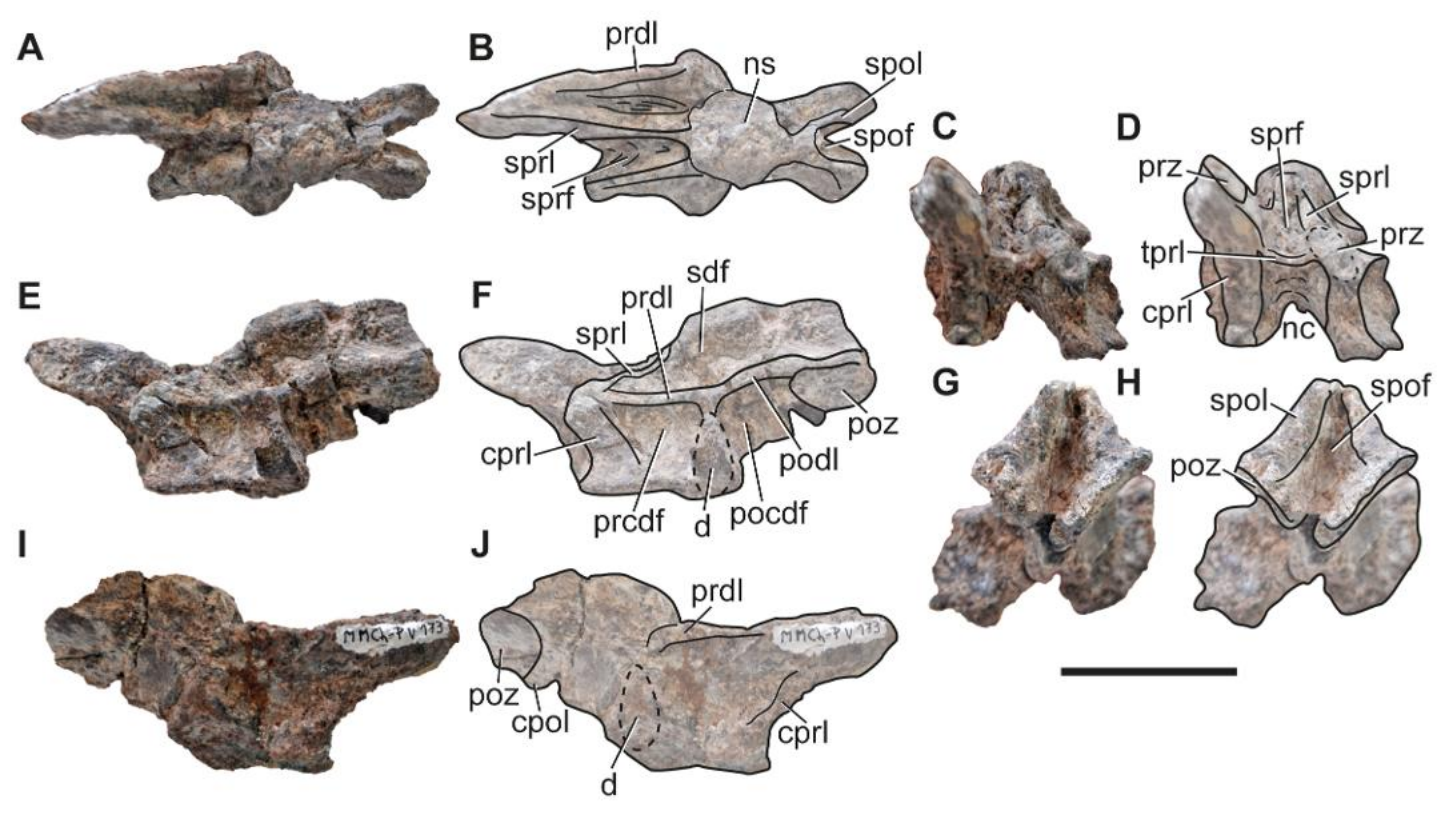
Figure 8. Diplodocid mid-caudal vertebrae (MMCh-Pv 137/214/165) in **A** and **B** right lateral and ventral views of MMCh-PV 137. **C,** left lateral view of MMCh-PV 214. **D–F,** left lateral, right lateral, and ventral views of MMCh-PV 165. Abbreviations: pf, pneumatic fossa; poz, postzygapophysis; prz, prezygapophysis; sdf, spinodiapophyseal fossa; sprl, spinoprezygapophyseal lamina; tp, transverse process; tprl, intraprezygapophyseal lamina, vh, ventral hollow. Scale bar equals 100 mm.

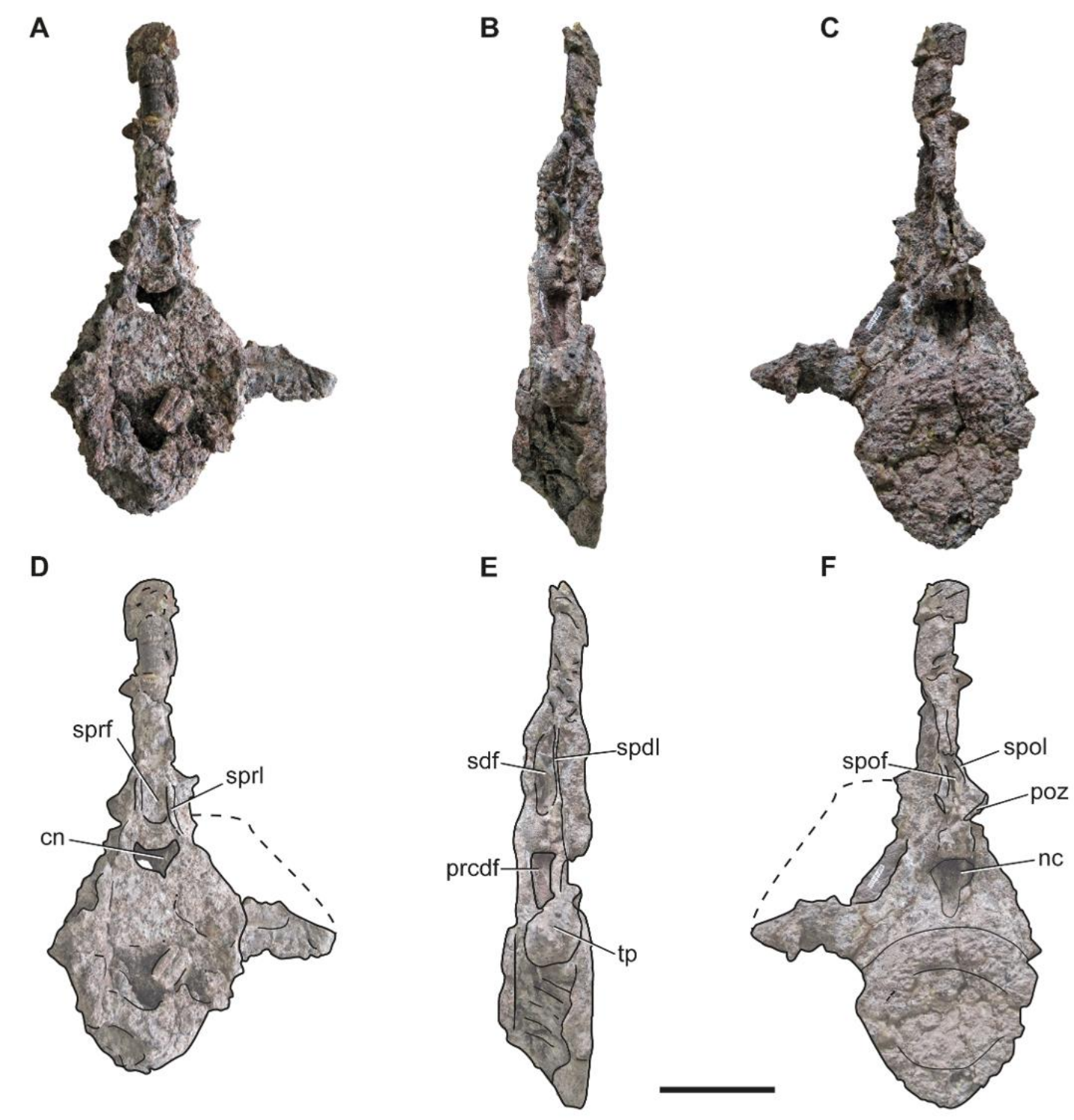
Figure 9. Diplodocid left tibia (MMCh-Pv 279) in **A**, anterior, **B**, proximal, **C**, medial, and **D**, **E,** lateral views. **E** is an interpretive drawing. Abbreviations: cc, cnemial crest; cf, cnemial fossa. Scale bar equals 100 mm.

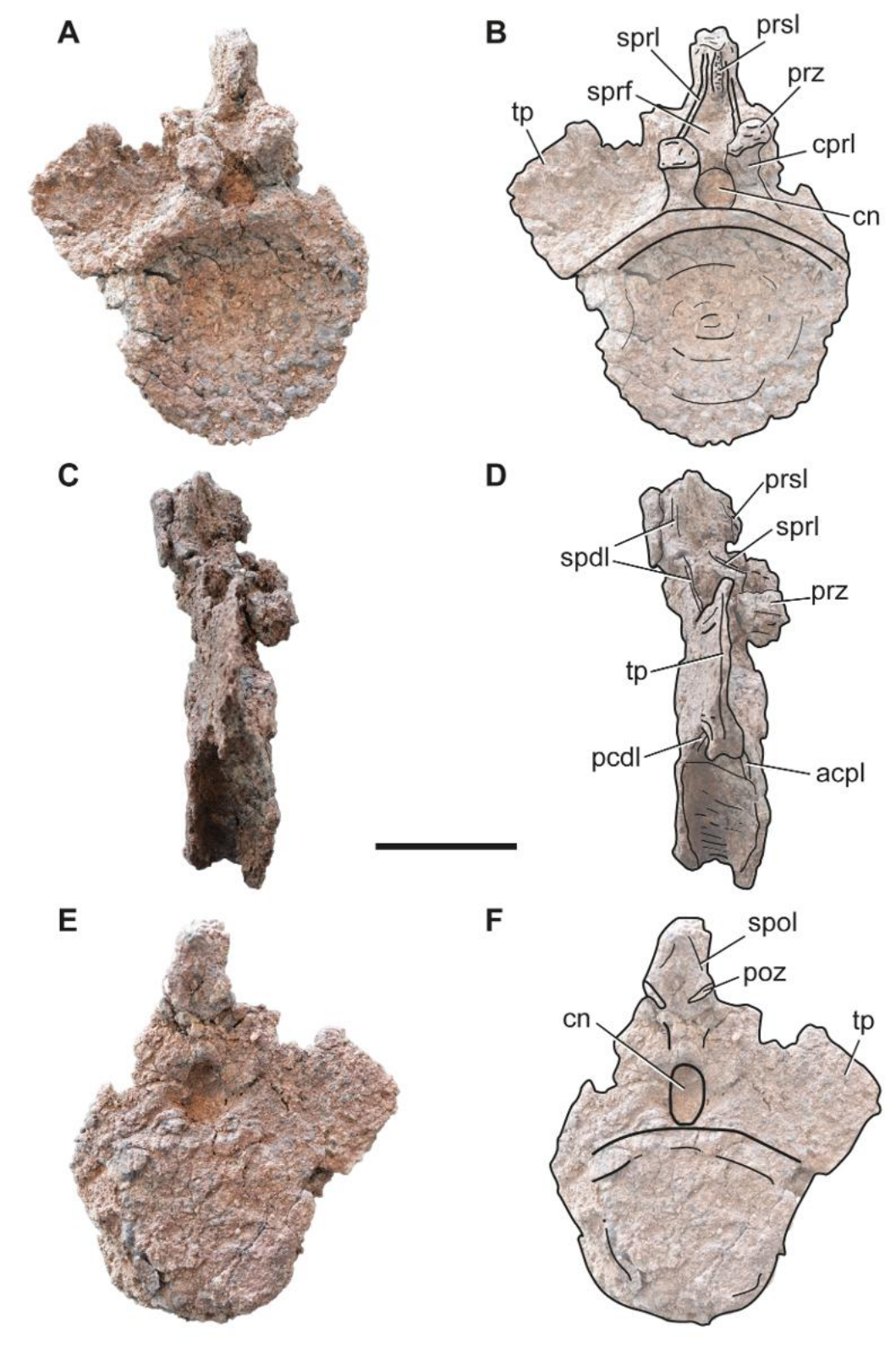

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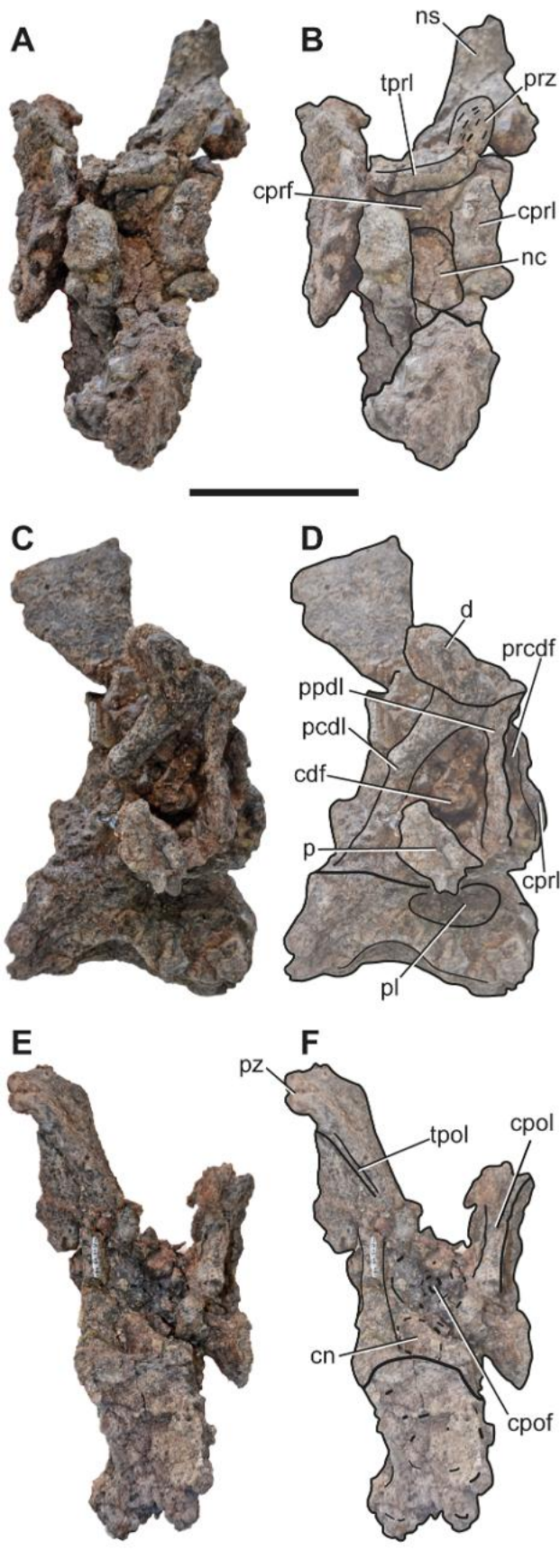

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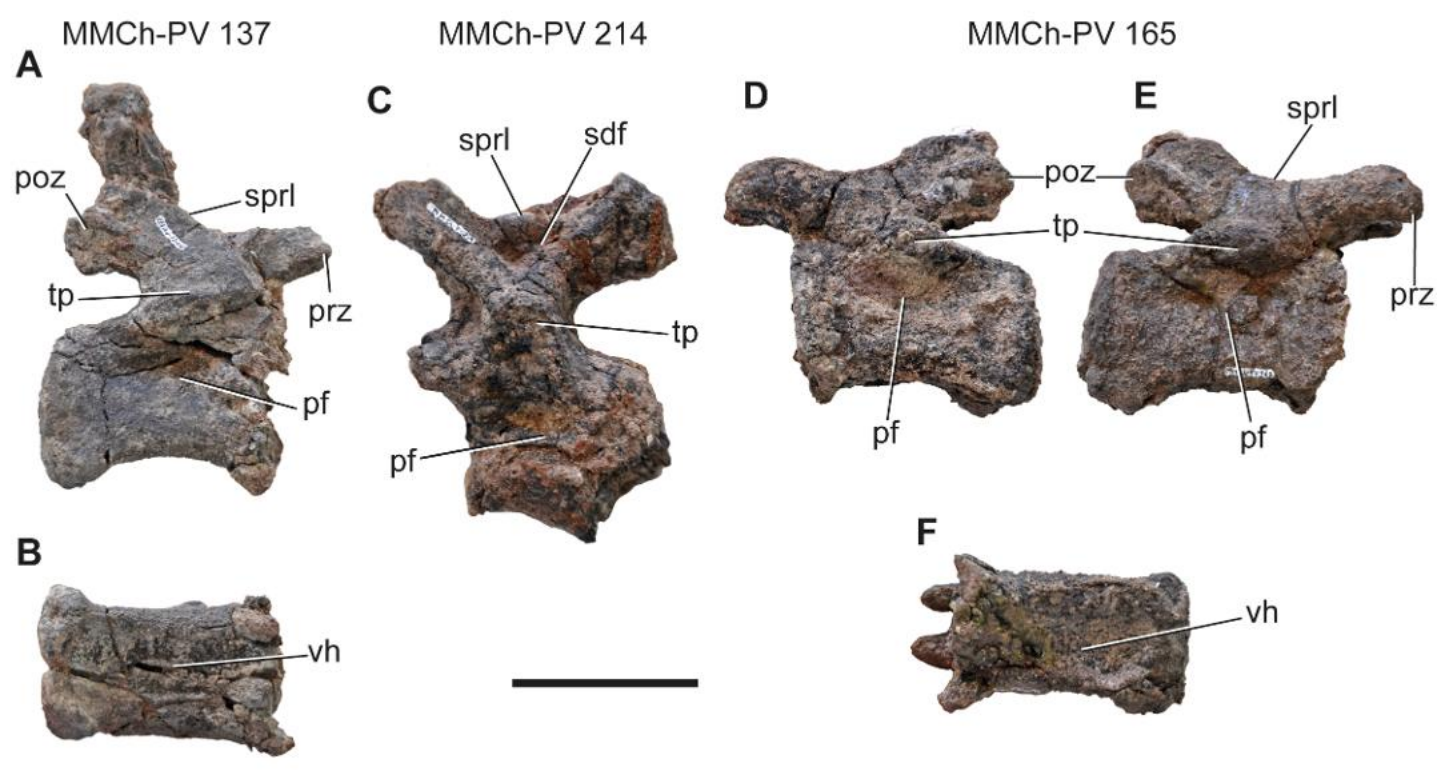

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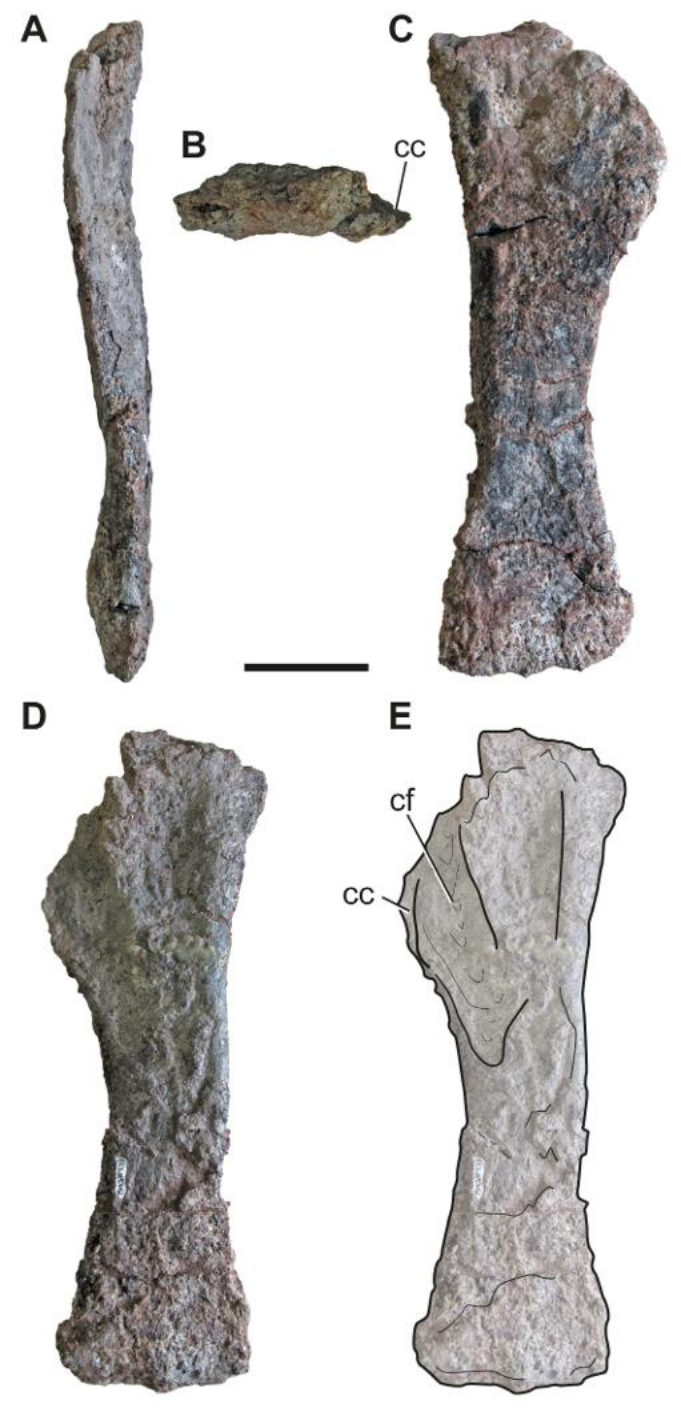

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