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Kholumolumo ellenbergerorum, gen. et sp. nov., a new basal sauropodomorph from the Lower Elliot Formation (Late Triassic) of Maphutseng, Lesotho

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3 *Kholumolumo ellenbergerorum*, gen. et sp. nov., a new basal
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6 sauropodomorph from the Lower Elliot Formation (Late Triassic) of
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9 Maphutseng, Lesotho
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33 RH: PEYRE DE FABRÈGUES AND ALLAIN—*KHOLUMOLUMO ELLENBERGERORUM*
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3 ABSTRACT—A dozen basal sauropodomorph genera are currently known from
4 Southern Africa. The vast majority of the specimens were unearthed in South Africa,
5
6 but a few were found in Lesotho. We provide here the first complete anatomical
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8 description of a historical specimen from Lesotho: “the Maphutseng dinosaur.” The
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10 first rests of this animal were uncovered in 1955 and cited in a scientific publication
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12 just one year after that, in 1956. Since then, the Maphutseng assemblage has been
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14 mentioned in several papers and named on two occasions but was never formally
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16 published. The bone bed has delivered a huge amount of material from all the regions
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18 of the skeleton, of which a small part is described herein. Based on these skeletal
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20 elements, and given the unique anatomy of this basal sauropodomorph, the new
21
22 species *Kholumolumo ellenbergerorum* gen. nov., sp. nov. is erected. Although the
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24 rests come from a large number of individuals, the species is the most complete to date
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26 in the lower Elliot Formation. Considering all the material known from the upper
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28 Triassic of Gondwana, it is also one of the longest specimens (adults could probably
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30 reach 10m long). Despite this important size, the anatomy supported by the
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32 phylogenetic results remove any doubts concerning a putative quadrupedality of the
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34 animal, and thus a possible link with the origin of sauropoda.
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INTRODUCTION

Historical Background

Paul Ellenberger was, at first, a Protestant missionary like both his grandfathers and his father before him. Like his father, he was most curious about life and evolution. He worked in Lesotho for 17 years, from 1953 to 1970, period during which he prospected a lot looking for fossils. As a result, he published more than 15 papers on the paleontology of Lesotho. In 1930, scattered remains were discovered by Samuel Motsoane, principal of the Paris Evangelical Mission School in Bethesda. He communicated their location to P. Ellenberger much later, in 1955. Following these indications, P. Ellenberger prospected near a fossiliferous lens in Maphutseng, not far from the Protestant mission, in August 1955 (Fig. 1A-B). He was assisted by his brother, François Ellenberger, geologist, and their research was in part financed by the CNRS (the French National Center for Scientific Research). In September 1955, they uncovered a pile of well-preserved bones at the place called “Thotobolo ea 'Ma-Beata.” They will write later on it: “The bones of this pile (femora, tibias, various long bones, ribs, phalanges, claws, vertebrae, etc.) are distributed without order nor connection, in mass or trail, within a bed of 20 to 30 cm... [...]. This deposit displays a previously unseen richness in the South African Stormberg.” (Ellenberger and Ellenberger, 1956b: 100). The extent of the Maphutseng deposit being beyond the material and technical means of the brothers Ellenberger, they asked for the help of two South African colleagues, A.W. Crompton, head of the paleontology department at the National Museum of Bloemfontein, and R.F. Ewer from Rhodes University in Grahamstown. Their first collaboration, in November 1955, was the very first paleontological field campaign in Lesotho (Table 1). The same year, P. Ellenberger published a preliminary note, in which Maphutseng and the ongoing fieldwork, are quoted (Ellenberger, 1955). The following year,

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3 in 1956, the same four-man team continued the excavations in Maphutseng (Table 1). Very
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5 soon, the Ellenberger brothers realized they were dealing with a very rich deposit (Ellenberger
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7 and Ellenberger, 1956a, 1956b). Overall, these first two field campaigns led to 683 collected
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9 pieces, of which approximately 450 complete bones, in a 35 m² surface (Fig. 1C). In 1957, the
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11 whole of the material was brought back to the Iziko Museum (formerly South African
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13 Museum), Cape Town, in temporary storage. Nowadays, it has been moved to the University
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15 of Cape Town, where part of it is under study (E. Krupandan, pers. comm., 2014). After this
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17 first joint experience, the relationships between the Ellenberger brothers and Crompton began
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19 to deteriorate, probably because the preparation and, therefore, the study of the 1955-56
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21 material sent in Bloemfontein were not completed in time and the material not returned to
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23 Lesotho. In a 1964 letter to L. Ginsburg, Paul Ellenberger complained that the Maphutseng
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25 material was “cromptonized” (Supplementary Data Figure 1S).

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30 The deposit being far from drained, another field campaign took place in Maphutseng in
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32 1959. It was funded by the CNRS, and the team included not only the brothers Ellenberger,
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34 but also Léonard Ginsburg and Jean Fabre, two researchers from the National Museum of
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36 Natural History in Paris (MNHN), as well as Hélène Ellenberger, the wife of F. Ellenberger
37
38 (Table 1). The exact quantity of fossils collected during this campaign is unknown, but
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40 according to the excavation plan drawn by F. Ellenberger (Fig. 1C), it probably comes close
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42 to two hundred pieces. A small part of it was housed in Morija Museum & Archives, and
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44 some vertebrae were lent to the Iziko Museum in Cape Town. Most of the material was sent
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46 to Paris MNHN, in temporary storage. In 1960, F. and P. Ellenberger published an article
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48 about a slab found in Maphutseng and exhibiting dozens of tracks. According to them, the
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50 70 m² slab displayed at least eight different trackways (Ellenberger and Ellenberger, 1960).
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56 Several other tracks were found in Maphutseng. At least three original tracks were brought to
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58 Montpellier University, as well as 18 other tracks, presumably casts. Most of it is indicated as
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3 “missing” in the inventory, the whereabouts of this material is thus currently unknown (pers.
4 obs., 2016). The following excavations in Maphutseng occurred in 1963. The team consisted
5 of P. Ellenberger, L. Ginsburg, J. Fabre and Christiane Mendrez (MNHN) (Table 1). The
6 expedition was followed by the first description of the bones of the Maphutseng dinosaur, and
7 their attribution to *Euskelosaurus browni* (Ellenberger and Ginsburg, 1966).
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12 In September 1970, P. Ellenberger oversaw the last expedition in Maphutseng, with the
13 assistance of L. Ginsburg, J. Fabre and Bernard Battail (MNHN) (Table 1; Fig. 2). The bones
14 collected were brought to Paris. Between 1959 and 1970, based on the excavation plan of
15 1959 and the total number of excavated pieces given by P. Ellenberger (Ellenberger, 1970:
16 345), we estimate to approximately 400 the number of Maphutseng fossils sent to France. The
17 brothers Ellenberger attributed a field number to each excavated bone between 1959 and
18 1970. Given that the numbers range from 684 to 1303, the number of fossils is extended to
19 600. However, only 210 are nowadays housed in the MNHN, in Paris. This significant
20 difference can be explained if we consider that, on the field, several numbers can be attributed
21 to fragments of the same bone. Consequently, some subcomplete bones of the collections
22 display until 4 field numbers. The Ellenberger themselves wrote in 1956: “The second
23 [fieldwork], in February 1956, increased this number to almost 700 (which should represent
24 more than 450 complete and distinct bones), [...]” (Ellenberger and Ellenberger, 1956b: 100).
25
26 In 1970, Paul Ellenberger returned for good to France, and continued his work on Lesotho
27 fossils in Montpellier (Southern France). The same year, he wrote a review about Lesotho
28 stratigraphy, in which appear all the fossils, ichnofossils and deposits he discovered during his
29 expeditions. In this paper appears the first name attributed to the Maphutseng dinosaur, which
30 was, at that time, no longer considered as a specimen of *Euskelosaurus*. Indeed, P.
31
32 Ellenberger wrote: “A new type of ‘Euskelosauridae’, perhaps closer to sauropods: ‘The
33 Maphutseng Beast’ or ‘*Thotobolosaurus mabeatae*’ (under study), 1150 bones extracted with
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3 various rests of lower jaws and skulls from a *Dicroidium* marl of this age, in Maphutseng.”
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5 (Ellenberger, 1970: 345). This proposed binomen was inspired by the Sesotho name of the
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7 place where the first pile of bones was found, not far from the huts of the village of
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9 Maphutseng (“Thotobolo ea ’Ma-Beata”, meaning “Beata’s mother’s trash heap”). This new
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11 species was never formally published, even if numerous publications have dealt with this
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13 material (Ellenberger, 1955; Ellenberger and Ellenberger, 1956a, 1956b; Ellenberger and
14
15 Ginsburg, 1966; Ellenberger et al., 1970; Ellenberger, 1970). It is thus currently considered as
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17 a nomen nudum. Gauffre (1993) coined the name *Kholumolumosaurus ellenbergerorum* for
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19 the Maphutseng dinosaur and described the material in more details in his PhD Thesis
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21 (Gauffre, 1996). The latter, too, was never formally published, and this second binomen is
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23 thus also considered as a nomen nudum.
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31 **Stratigraphical Overview and the Age of the “Maphutseng Dinosaur”**

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33 Maphutseng is a mission located in the Mphahlele District, in the southwest of Lesotho
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35 (Fig. 3). Many outcrops, corresponding to different stratigraphic levels, have yielded numerous
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37 fossils, including mainly footprints, but also plants and dinosaur bones in the vicinity of
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39 Maphutseng (Ellenberger, 1970).
40

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42 As for most sauropodomorphs taxa from the Elliot Formation of southern Africa (McPhee et
43
44 al., 2017), uncertainties remain on the exact stratigraphic provenance of the Maphutseng
45
46 dinosaur. In the first three articles mentioning the latter, the Ellenberger brothers stated that
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48 the bones come from the base of Red Beds (Ellenberger, 1955; Ellenberger and Ellenberger,
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50 1956a; 1956b), i.e. the base of the lower Elliot Formation (LEF) (SACS, 1980; Johnson et al.,
51
52 1996; Bordy et al., 2004). According to the Ellenberger brothers, the bone bed presents
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54 sedimentary facies typical of the top of the Molteno Formation. It is mainly composed of grey
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56 to yellowish-green sandy clays and soft gritty sandstones that contain abundant plant fossils,
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3 with the foliage species *Dicroidium odontopteroides* dominating the assemblage. Laterally,
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5 the bone bed grades into red sandstones typical of the LEF (Ellenberger and Ellenberger,
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7 1956b). In their subsequent publications (Ellenberger and Ginsburg, 1966; Ellenberger et al.,
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9 1970), the same authors changed their mind and referred the bone bed of Maphutseng to the
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11 top of the Molteno Formation. In 1970, Paul Ellenberger established a subdivision for the
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13 Molteno, Elliot and Clarens Formations in Lesotho, and precised the stratigraphic position of
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15 the Maphutseng bone bed, which is placed in the Zone A/4 (“Molteno supérieur b du
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17 Lesotho”). The zone A/4 is now considered to form part of the LEF (e.g. Kitching and Raath,
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19 1984; Gauffre, 1993, 1996; Bordy et al., 2004). Based on lithostratigraphic assessments (van
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21 Gend et al., 2015), it has been recently suggested that the Maphutseng bone bed is in the
22
23 uppermost part of the LEF, and thus is of a latest Triassic age (around 205 Myr). This has
24
25 been contradicted by other lithostratigraphic observations (Ellenberger and Ellenberger,
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27 1956b; Battail, pers. comm., 2018) and a magnetostratigraphic study (Scissio et al., 2017)
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29 which place the site in the lower part of the LEF, suggesting a Norian age (around 210 Myr)
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31 for the bone bed.
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40 **Abbreviations**

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42 **Institutional Abbreviations**—**BP**, Evolutionary Studies Institute, Johannesburg,
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44 South Africa (formerly Bernard Price Institute); **CM**, Carnegie Museum, Pittsburgh, USA;
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46 **CPSGM**, Collections Paléontologiques du Service Géologique du Maroc, Rabat, Morocco;
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48 **ISEM**, Institut des Sciences de l'Évolution Montpellier, Montpellier, France; **MB**, Museum
49
50 für Naturkunde, Berlin, Germany; **MNHN**, Muséum National d'Histoire Naturelle, Paris,
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52 France; **NM QR**, National Museum, Bloemfontein, South Africa; **OUMNH**, Oxford
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54 University Museum of Natural History, Oxford, England; **PVL**, Universidad Nacional de
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3 Tucumán, San Miguel de Tucumán, Argentina; **SAM-PK**, Iziko South African Museum,
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5 Cape Town, South Africa; **YPM**, Peabody Museum of Natural History, New Haven, USA.
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10 SYSTEMATIC PALAEONTOLOGY

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12 DINOSAURIA Owen, 1842

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14 SAURISCHIA Seeley, 1887

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16 SAUROPODOMORPHA Huene, 1932

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21 *KHOLUMOLUMO*, gen. nov.
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26 **Etymology**—The Kholumolumo [xodumodumo] is a mythological creature of the
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28 sotho folklore. It is often described as a type of dragon, an enormous monster, or sometimes a
29
30 big lizard or crocodile. When referring to dinosaurs, Basotho frequently use this term.
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33 **Type species**—*Kholumolumo ellenbergerorum*.

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35 **Diagnosis**—As for the species.
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40 *KHOLUMOLUMO ELLENBERGERORUM*, sp. nov.

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42 (Figs. 4–22)
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47 “forme nouvelle de Prosauropode”: Ellenberger and Ellenberger, 1956a: 100.

48
49 “Prosauropode quadrupède (voisin de *Melanorosaurus* ou *Euskelosaurus*)”: Ellenberger and
50
51 Ellenberger, 1960: 236.

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53 *Euskelosaurus* Huxley, 1866: Ellenberger et al., 1964: 326.

54
55 Melanosauridae indet: Charig et al., 1965: 201.

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58 *Euskelosaurus browni* Huxley, 1866: Ellenberger and Ginsburg, 1966: 1944.
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3 *Thotobolosaurus mabeatae* Ellenberger, 1970, nomen nudum: Ellenberger, 1970: 345.

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5 *Euskelosaurus* Huxley, 1866: Gauffre, 1993: 147.

6
7 *Kholumolumosaurus ellenbergerorum* Gauffre, 1996, nomen nudum: Gauffre, 1996: 3.

8
9 *Euskelosaurus* Huxley, 1866: de Ricqlès et al., 2003: 72.

10
11 Plateosauridae indet.: Knoll, 2004: 79.

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13 “Bloem Dino”: McPhee et al., 2014: 157.

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15 “Maphutseng dinosaur”: Peyre de Fabrègues and Allain, 2016: 2.

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21 **Etymology**—In honor of the brothers Ellenberger, Paul and François, who discovered
22 the Maphutseng deposit, and have done a tremendous amount for Lesotho, particularly in
23 terms of paleontology and geology.

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28 **Holotype**—MNHN.F.LES381m. A right complete tibia (Fig. 20). We consider that all
29 the specimens from the bone bed are congeneric and conspecific, but all the skeletons being
30 disarticulated, we designate this bone because of its diagnostic features. The rest of the
31 material is relegated to the status of paratype.

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37 **Paratypes and referred material**—The bones from multiple individuals figured
38 herein are considered as paratypes: an incomplete left postorbital (MNHN.F.LES153); an
39 incomplete right postorbital (MNHN.F.LES54); a posterior cervical vertebra
40 (MNHN.F.LES169); an incomplete anterior dorsal neural arch (MNHN.F.LES397); an
41 incomplete middle dorsal vertebra (MNHN.F.LES32); a sacral vertebra (MNHN.F.LES155);
42 two incomplete anterior caudal vertebrae (MNHN.F.LES168, 376); a left scapula
43 (MNHN.F.LES386); a left humerus (MNHN.F.LES379); a right ulna (MNHN.F.LES159); a
44 right radius (MNHN.F.LES147); a right metacarpal I (MNHN.F.LES26); a left metacarpal II
45 (MNHN.F.LES92); a right metacarpal III (MNHN.F.LES93); an incomplete right metacarpal
46 IV (MNHN.F.LES76); a left phalanx I-1 (MNHN.F.LES29); a right ilium
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(MNHN.F.LES375a); a left pubis (MNHN.F.LES378); an incomplete left ischium (MNHN.F.LES152); a right femur (MNHN.F.LES394); a right fibula (MNHN.F.LES374); a left metatarsal I (MNHN.F.LES89); a left metatarsal II (MNHN.F.LES81); a left metatarsal III (MNHN.F.LES82); a left metatarsal V (MNHN.F.LES77).

The rest of the material housed in the MNHN is referred to *Kholumolumo ellenbergerorum*, as well as the Maphutseng remains stored in the University of Cape Town. A complete list of the material stored in Paris is available in supplementary data (Supplementary Data Table 1S).

Type locality—Maphutseng, Mophale's Hoek District, Lesotho (Fig. 3).

Type horizon—Lower Elliot Formation, Upper Triassic.

Diagnosis—A basal sauropodomorph with the following unique combination of characters on the holotype: very short and stout tibia (circumference/length ratio = 53%. All the other basal sauropodomorphs have ratios < 49%, except *Antetonitrus* and *Blikanasaurus*) with a diaphysis becoming finer distally in lateral and medial views and showing straight anterior and posterior margins, unlike in *Antetonitrus*. By contrast with *Blikanasaurus*, fourth metatarsal elongated relatively to the tibia and with a proximal extremity larger transversely and less extended anteroposteriorly. Diagnostic characters of the paratype: posterior cervical vertebra particularly short and high with a centrum elongation of 1.2. On the anterior dorsal vertebra, base of the neural spine anterior to the anterior margin of the diapophysis in dorsal view. On the sacral vertebra, centrum very short anteroposteriorly, with an elongation (ratio of the ventral length of the centrum on its anterior height) of 0.7. On the scapula, two marked posterodorsal and anterodorsal ridges on the lateral surface of the blade.

Associated fauna—Two large teeth of a carnivore have also been collected. Referred to a theropod by Ellenberger (1970: 345), they most probably belong to a rauisuchian, given their size.

DESCRIPTION

Skull

Two postorbitals were found in the Maphutseng bone bed: a left one (MNHN.F.LES153) and a right one (MNHN.F.LES54), both incomplete. According to the marked size difference, they belong to two different specimens (Fig. 4).

The postorbital is stout and triradiate. There is no marked step between the anterior and posterior processes in lateral view, as in *Coloradisaurus*, *Melanorosaurus* or *Sarahsaurus*.

However, the dorsal margin of the postorbital still appears concave in lateral and medial views. The anterior process of the postorbital is transversely wide. A part of the articular facet for the frontal is visible on its ventrolateral surface (Fig. 4A, C). The medial surface of the anterior process also bears a depression, which probably accommodated the parietal (Fig. 4B).

The lateral surface of the process is strongly convex. A small depression on the dorsomedial portion of the anterior process is indicative of the extension of the supratemporal fossa on the postorbital. The anterior margin of the postorbital constitutes the posterodorsal margin of the orbit. In anterior view, it gets wider dorsally.

In lateral view, the ventral process of the postorbital is bent forward as in most basal sauropodomorphs (Fig. 4A-B). In some genera however, the ventral process is straighter. It is the case in *Anchisaurus* or *Jingshanosaurus*. The transverse thickness of the ventral process equals 60% of its anteroposterior width. The posterior process of the postorbital is much thinner than the two other processes, both in lateral and dorsal views. The preserved part of the posterior process does not taper distally. Unlike the ventral process, the posterior process is straight and rod-like, with slightly dorsoventrally convex lateral surface (Fig. 4C-D). In some basal sauropodomorphs, such as *Melanorosaurus*, *Xixiposaurus* and *Yunnanosaurus*, the posterior process is not straight in dorsal view, but laterally convex.

Cervical Vertebrae

Middle Cervical Vertebrae (MNHN.F.LES338 & MNHN.F.LES342)—Two

incomplete middle cervical vertebrae were found in Maphutseng. Both vertebrae consist in a damaged and incomplete centrum. The lowest and most elongated one (LES342) is more complete than the other (LES338). LES342 was probably slightly anterior to LES338 in the cervical series.

The centra are amphicoelous, as well as acamerate. LES342 has been transversely compressed: its centrum elongation (ratio of the ventral length of the centrum on its anterior height) is of 2.4 (Table 3) but was probably closer to 2.7 given the compression (2.7 is the average Elongation Index: aEI as described in Chure et al., 2010). In anterior view, the transverse compression is well visible on both centra. In LES338, the anterior articular surface appears 1.2 times higher than wide. In LES342, it is 1.3 times higher than wide (Table 3). In ventral view, a keel is visible on both centra as in many other basal sauropodomorphs. It is absent in some other genera like *Coloradisaurus*, *Riojasaurus* or *Yunnanosaurus*. In lateral view, the ventral border of both centra is concave. Their lateral surface appears slightly concave dorsally. It bears the parapophysis, which is located in the anterior third of the centrum, closer to the ventral margin than to the neurocentral suture. The parapophysis on LES338 is poorly developed and oval.

On LES342, the diapophysis is not much developed, subtriangular and oriented lateroventrally. It is situated in the anterior half of the centrum.

Given the length of the centrum, the position of the diapophysis and parapophysis, and compared to *Adeopapposaurus* and *Plateosaurus*, both vertebrae are considered to be part of the middle cervical series.

Posterior Cervical Vertebra (C10?) (MNHN.F.LES169)—One complete cervical vertebra was found on the Maphutseng site (Fig. 5). The only missing parts of the bone are the distal extremities of the postzygapophyses. The centrum is both amphicoelous and

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2
3 acamerate and the neural arch displays low laminae. The centrum elongation (ratio of the
4 ventral length of the centrum on its anterior height) is of 1.2 (Table 3): that is much inferior to
5 the ratio of the middle cervical vertebra MNHN.F.LES342. These proportions are not
6 observed in many posterior cervical vertebrae of basal sauropodomorphs, as most of them
7 have very elongated and low cervicals. Some of the few other genera to present posterior
8 cervical vertebrae with high articulation surfaces compared to their length are *Plateosaurus*,
9 *Riojasaurus* and *Ruehleia*. However, as in the middle cervical vertebrae, the centrum articular
10 surfaces are slightly higher than wide (Table 3). In ventral view, the cervical vertebra displays
11 a marked median constriction and a ventral keel, of which the distal border is eroded. The
12 ventral keel extends on all the length of the centrum (Fig. 5F). This morphology is similar to
13 that observed in most basal sauropodomorphs, as in *Massospondylus*, even though in some
14 genera such as *Plateosaurus* or *Riojasaurus*, the ventral surface of the cervical vertebrae is
15 flat until the C9.

16
17 In lateral view, the ventral border of the vertebra is strongly concave. As it is the case in C9
18 and C10 of most basal sauropodomorphs, a hypapophysis is visible on the anteroventral part
19 of the centrum, in the axis of the ventral keel. The lateral surfaces of the vertebra are slightly
20 excavated and display the parapophysis in the anterior third of the centrum, centered between
21 the ventral margin and the neurocentral suture. The right parapophysis is broken, but the left
22 one is complete (Fig. 5A-B). They are rather developed dorsoventrally and form a well-
23 developed tuber on the surface of the centrum. The dorsal portion of the parapophysis is the
24 most extended laterally. More ventrally, the parapophysis gets lower and merges gradually in
25 the centrum surface. The contact surface with the capitulum is oriented laterally to
26 lateroventrally.

27
28 The diapophysis are developed, subrectangular and oriented lateroventrally (Fig. 5C-D). In
29 ventral view, the antero-centrodiapophyseal and postero-centrodiapophyseal laminae are
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3 visible. They are short and concealed by the diapophysis. The prezygodiapophyseal lamina is
4
5 well-marked on the right side of the vertebra. The postzygodiapophyseal lamina is visible on
6
7 the left side of the cervical vertebra. The prezygapophyses are still in articulation with the
8
9 postzygapophyses and the hyposphene of the preceding vertebra. They are short, rounded and
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11 anteriorly projected. Their articular surface is oriented dorsomedially and seem to be flat.
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13 There is no visible intraprezygapophyseal lamina, whereas posterior cervical vertebrae of
14
15 *Adeopapposaurus*, *Plateosaurus*, *Ruehleia* or *Massospondylus* bear this lamina. The ventral
16
17 surface of the prezygapophyses is planar to slightly convex and connected to the centrum
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19 through the centroprezygapophyseal lamina. The postzygapophyses of the preceding vertebra
20
21 project posteriorly with a lateral component in dorsal view. They are elongated, stout and bear
22
23 an extensive planar to slightly concave articular surface directed ventrolaterally. The position
24
25 of the postzygapophyses and the presence of a protuberant hyposphene make it unlikely the
26
27 presence of an intrapostzygapophyseal lamina. Although broken, the postzygapophyses
28
29 extended beyond the posterior margin of the centrum. In posterior view, the
30
31 centropostzygapophyseal laminae are well visible. The dorsal surface of the
32
33 postzygapophyses bears an epipophysis, which seems to extend on most of their length. The
34
35 epipophyses are low and merged with the postzygapophyses on all their length, without well-
36
37 delimited medial or lateral borders. The dorsal surface of the postzygapophyses of the
38
39 preceding vertebra bears a spinopostzygapophyseal lamina coming into contact with the
40
41 lateral margins of the neural spine. This lamina is also observed on the posterior cervicals of
42
43 *Adeopapposaurus*, *Mussaurus* and *Ruehleia*. The neural spine is almost as long as wide in
44
45 dorsal view and appears globulous and subcircular (Fig. 5E). In lateral view, a small posterior
46
47 projection of its posterodorsal corner is visible. The anterior margin of the neural spine is
48
49 convex, the dorsal margin is straight to slightly convex and the posterior one is concave. In
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51 anterior and posterior views, the neural spine shows a slight distal expansion.
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3 The position of the parapophysis, at mid-height of the centrum, the presence of a
4
5 hypapophysis, and the distance between the diapophysis and the postzygapophysis in lateral
6
7 view allow to identify this element as a cervical vertebra. The height of the vertebra, the
8
9 elongation of the centrum, the strongly concave ventral margin, the central rather than ventral
10
11 position of the parapophysis, the shape of the diapophysis, the presence of the
12
13 prezygodiapophyseal and postzygodiapophyseal laminae and the shape of the neural spine
14
15 allow to identify the vertebra as a posterior cervical, most likely a C10.
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21 **Dorsal Vertebrae**

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24 **Anterior Dorsal (D1?) Neural Arch [MNHN.F.LES397]**— The neural arch is well-
25
26 preserved and not deformed at all. The left postzygapophysis and the neural spine are broken
27
28 at their base, but all the remaining anatomical structures are complete (Fig. 6; Table 3).
29
30 No parapophysis, complete or partial, is visible in lateral view (Fig. 6B). It means that it was
31
32 located on the centrum and that we deal with an anterior dorsal vertebra. No beginning of
33
34 prezygoparapophyseal laminae (prpl) is visible near the prezygapophysis. The diapophyses
35
36 are not much developed relatively to what is observed in other taxa such as *Plateosaurus* or
37
38 *Ruehleia*. They are longer anteroposteriorly than large transversely. The left diapophysis is
39
40 the most complete. In dorsal view, it is subrectangular. The diapophyses project laterally with
41
42 a small posterior component in dorsal view. In anterior and posterior views, they are oriented
43
44 slightly ventrally (Fig. 6C-D). In lateral view, their extremity has a subtriangular shape. The
45
46 diapophyses are supported by four laminae (acdl or ppdl, pcdl, prdl and podl), delimiting four
47
48 associated fossae. On the lateral surface of the neural arch, ventrally to the diapophyses, a
49
50 vertical lamina, which was probably extending on the centrum of the vertebra, is visible in
51
52 anterior view. Given that the parapophysis cannot be observed, this lamina could be an
53
54 anterocentrodiapophyseal (acdl) or a paradiapophyseal lamina (ppdl). Anteriorly and
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3 posteriorly to the diapophysis, the prezygodiapophyseal (prdl) and postzygodiapophyseal
4 (podl) laminae are visible. The postzygodiapophyseal lamina (podl) is interrupted at the level
5
6 of the hyposphen (“stranded lamina”, Wilson, 2012). This interruption is observed in some
7
8 basal sauropodomorph taxa, including *Ruehleia*. In the latter, it occurs on the posterior
9
10 cervicals. *Kholumolumo* is apparently the only one in which this lamina is visible on an
11
12 anterior dorsal. On the posterior margin of the diapophysis, the postzygodiapophyseal lamina
13
14 (podl) defines, with the postero-centrodiapophyseal lamina (pcdl), a postzygapophyseal
15
16 centrodiapophyseal fossa (pocdf). In dorsal view, the postzygapophyses project more laterally
17
18 than the prezygapophyses relatively to the longitudinal axis of the vertebra.
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23
24 The prezygapophyses project anteriorly in dorsal and lateral views (Fig. 6A). In dorsal view,
25
26 they are rather short and have a rounded extremity. They present flat dorsal articular surfaces
27
28 which are dorsomedially oriented. The prezygapophyses are not interconnected by an
29
30 intraprezygapophyseal lamina (tprl), conversely to what is observed on the first dorsal
31
32 vertebra of *Massospondylus*, *Plateosaurus* or *Ruehleia*. In anterior view, the
33
34 centroprezygapophyseal lamina (cprl) is well visible on each side of the vertebra. With the
35
36 prezygodiapophyseal lamina (prdl) and the antero-centrodiapophyseal (acdl) or
37
38 paradiapophyseal lamina (ppdl), it defines a deep prezygapophyseal centrodiapophyseal fossa
39
40 (prcdf). No spinoprezygapophyseal lamina (sprl) is visible. The right postzygapophysis is the
41
42 only one preserved. It is located very high on the neural arch, thus the dorsoventral distance
43
44 between the postzygapophysis and the diapophysis is important. However, the anteroposterior
45
46 distance between these two structures is reduced in lateral view relatively to the posterior
47
48 cervical vertebra described herein. The postzygapophysis project posterolaterally in dorsal
49
50 view, with a significant lateral component contrary to *Plateosaurus*. In lateral view, its
51
52 orientation is slightly dorsal. The articular ventral surface of the postzygapophysis is flat and
53
54 ventrolaterally oriented. In dorsal view, the postzygapophysis is wider transversely than long
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3 anteroposteriorly and thus appears short and stocky. There is no intrapostzygapophyseal
4
5 lamina (tpol) visible, the small gap between the postzygapophyses being occupied by a
6
7 developed hyposphene. In posterior view, the centropostzygapophyseal lamina (cpol) is
8
9 present. In dorsal view, there is no visible epiphysis on the right postzygapophysis. On the
10
11 anterior part of the dorsal surface of the postzygapophysis, the beginning of a
12
13 spinopostzygapophyseal lamina (spol) is visible. The neural spine is broken at its base. The
14
15 location of the base of the spine is unusual: it is anterior to the anterior margin of the
16
17 diapophysis (Fig. 6A). On the anterior dorsal vertebrae of *Plateosaurus* or *Ruehleia*, the base
18
19 of the spine is located at the same level as the middle of the diapophysis or between the
20
21 middle and the posterior margin of the diapophysis. The neural spine seems to be
22
23 anteroposteriorly very short relatively to the length of the neural arch. In many basal
24
25 sauropodomorphs, neural spines of anterior dorsal vertebrae display a reduced base and widen
26
27 distally. However, the widening is usually transverse, and the anteroposterior length of the
28
29 neural spine is more or less steady from the base to the top, as it is observed in *Plateosaurus*
30
31 or *Ruehleia*.

32
33 The development of the diapophyses, and particularly the absence of epiphysis on the
34
35 postzygapophysis, show that we do not deal with a cervical vertebra. The absence of
36
37 parapophysis on the neural arch show that this is an anterior dorsal. Based on the location of
38
39 the parapophyses on the dorsal series of *Plateosaurus*, this vertebra is located between D1 and
40
41 D5. Given the development of the diapophyses (especially compared to that of the posterior
42
43 cervical vertebra MNHN.F.LES169, which is quite similar), the thick
44
45 antero-centrodiapophyseal (acd1) and postero-centrodiapophyseal (pcdl) laminae, and the
46
47 absence of intraprezygapophyseal laminae (tp1), the neural arch probably comes from one of
48
49 the first dorsals, much likely a D1.

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3 **Anterior Dorsal (D2-3?) Centrum [MNHN.F.LES172]**—One centrum from an
4
5 anterior dorsal vertebra was found in the collected material. It fits well, in size and
6
7 morphology, with the anterior dorsal neural arch described above (MNHN.F.LES397), and is
8
9 thus probably from a very close vertebra. The centrum is slightly transversely compressed and
10
11 deformed, this is particularly visible in anterior and posterior views. It is both amphicoelous
12
13 and acamerate and the visible laminae are low. The centrum elongation ratio is of 1, the
14
15 ventral length of the centrum being roughly equal to its anterior height (Table 3). In anterior
16
17 and posterior views, the articular surfaces are 1.3 times higher than wide, like for the other
18
19 vertebrae (Table 3). In ventral view, the centrum displays a marked median constriction and a
20
21 ventral keel. The ventral keel, of which the distal border is broken, extends throughout the
22
23 length of the centrum. This morphology is similar to that observed in most basal
24
25 sauropodomorphs with complete dorsal series. In *Massospondylus*, the keel is present on the
26
27 entire length of the centrum only in D1 and D2.

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33 In lateral view, the ventral border of the vertebra is slightly concave. We can infer the
34
35 presence of a hypapophysis following the ventral keel on the anteroventral part of the
36
37 centrum, even though the area is eroded. The lateral surfaces of the vertebra are slightly
38
39 excavated. They bear the parapophyses, which are located closer to the middle of the vertebra
40
41 than to its anterior border. Dorsoventrally, the parapophysis is situated on the dorsal half of
42
43 the centrum, overlying the neurocentral suture. The parapophysis is oval, almost three times
44
45 longer dorsoventrally than anteroposteriorly. It has a rough surface and forms an important
46
47 protrusion on the surface of the centrum. Laterally, the parapophysis protrudes on
48
49 approximately 1 cm.

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53 The proportions of the centrum and the high position of the parapophysis suggest a dorsal
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55 vertebra. The position and shape of the parapophysis combined with the presence of a ventral
56
57 keel permit to identify this element as an anterior dorsal vertebra. The parapophysis overlying
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3 the neurocentral suture and the thickness of the antero-centrodiapophyseal (acd1) and
4
5 postero-centrodiapophyseal (pcdl) laminae, which are thinner than in the anterior dorsal neural
6
7 arch MNHN.F.LES397, allow us to think that this centrum belongs to a D2 or D3.
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12 **Posterior Dorsal (D8-12?) [MNHN.F.LES32]**—Overall, this vertebra is badly
13
14 preserved. The postzygapophyses, neural spine, as well as some structures from the right side,
15
16 are missing. The anterior surface of the centrum is substantially broken and eroded.
17
18 Conversely, its posterior surface is almost complete. The neural arch is very eroded on its
19
20 lower part. On the left side, the diapophysis is broken and the parapophysis is not visible any
21
22 more. The whole of the vertebra has undergone a transverse compression (Fig. 7), as
23
24 evidenced by the articular surfaces of the centrum 1.5 higher than wide, when the ratio should
25
26 be more of 1.2 as in all the other vertebrae (Table 3).
27
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31 The posterior articular surface of the centrum is concave (Fig. 7C). The lateral surfaces show
32
33 a slight dorsal concavity. The centrum elongation (ratio of the ventral length of the centrum
34
35 on its anterior height) is of 1.2. Given the observed deformation, the real ratio (aEI) was
36
37 probably closer to 1.5. These values are slightly superior to the ratio of 1 observed on the
38
39 anterior dorsal MNHN.F.LES172, but clearly inferior to the 2.4 ratio of the middle cervical
40
41 vertebra MNHN.F.LES342 (Table 3). In ventral view, the centrum shows a median
42
43 constriction. Its ventral surface is flat and does not exhibit a keel. Even though the anterior
44
45 part of the centrum is partially broken, it does not seem to present a hypapophysis. In lateral
46
47 view, the ventral margin of the centrum is concave.
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52 The separation between the centrum and the neural arch is very clear. The neural arch shows
53
54 marked but relatively thick laminae, typical of what is usually observed in basal
55
56 sauropodomorphs. It is remarkably higher than the neural arch of the anterior dorsal
57
58 MNHN.F.LES397 described above (Table 3). The parapophysis is located on the neural arch.
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3 It is visible on the right side of the neural arch, but much damaged on the left side. It is
4
5 situated at mid-height on the anterior part of the neural arch (Fig. 7A). It is large and suboval
6
7 in shape, even though its ventral region is abraded and not much more visible. The long axis
8
9 of the parapophysis is oblique relatively to the longitudinal axis of the vertebra. On the right
10
11 side of the vertebra, the parapodiapophyseal lamina (ppdl) can be clearly distinguished. The
12
13 bone surface being much damaged under the parapophysis and on the anterodorsal part of the
14
15 centrum, it is impossible to determine if there is an anterocentroparapophyseal lamina (acpl).
16
17
18 The right diapophysis is the only one to be preserved. It is high on the neural arch and
19
20 projects posterodorsally in lateral view. It is not much developed, and the distal extremity is
21
22 broken, making it impossible to appreciate the total extension of the diapophysis. Without a
23
24 distal extremity, it appears subrectangular in dorsal view and projects strictly laterally. The
25
26 diapophysis is surrounded, ventrally and anteriorly, by three laminae (prdl, ppdl and pcdl).
27
28 Anteriorly, the prezygodiapophyseal lamina (prdl) is well developed. It borders dorsally the
29
30 prezygapophyseal centrodiaepophyseal fossa (prcdf). The parapodiapophyseal lamina (ppdl)
31
32 extends over 45 mm between the diapophysis and the parapophysis. It replaces the
33
34 anterocentrodiaepophyseal lamina (acdl), which is absent because of the high position of the
35
36 parapophysis. A posterocentrodiaepophyseal lamina (pcdl) connects the diapophysis to the
37
38 posterior part of the centrum. The ventral part of this lamina is not visible, because it is
39
40 located on the damaged part of the neural arch and centrum. A shallow centrodiaepophyseal
41
42 fossa (cdf) is present between the posterocentrodiaepophyseal lamina (pcdl) and the
43
44 parapodiapophyseal lamina (ppdl). Posteromedially to the posterocentrodiaepophyseal lamina
45
46 (pcdl), a deep postzygapophyseal centrodiaepophyseal fossa (pocdf) is visible in lateral and
47
48 posterior views. In posterior view, the beginning of a postzygodiapophyseal lamina (podl)
49
50 seems to be present on the posterior margin of the diapophysis. However, in the absence of
51
52 postzygapophyses, we cannot attest to the presence of this lamina. The prezygapophyses are
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3 elongated and project strictly anteriorly in dorsal view. In lateral view, their orientation shows
4 a dorsal component. Their dorsal articular surface is flat and oriented dorsally with a slight
5
6 a dorsal component. Their dorsal articular surface is flat and oriented dorsally with a slight
7
8 medial component. The prezygapophyses are not interconnected by an intraprezygapophyseal
9
10 lamina. The anterior part of the neural arch being damaged and poorly prepared, we cannot
11
12 state with certainty that centroprezygapophyseal laminae (cprl) extend ventrally under the
13
14 prezygapophyses, even if it appears to be the case. The dorsal surface of the neural arch is
15
16 relatively well-preserved, despite the absence of neural spine, and does not bear a
17
18 spinoprezygapophyseal lamina (sprl). The postzygapophyses were not preserved. However, a
19
20 stout and well-developed hyosphene is visible above the neural canal in posterior view. In
21
22 height, the hyosphene equals 25% of the total height of the neural arch without the neural
23
24 spine. The neural spine is broken at its base. The missing parts and the plaster added on the
25
26 dorsal surface of the neural arch prevent from locating the zone where the base of the neural
27
28 spine was situated.
29
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33 The position of the parapophysis on the neural arch and the height of the transverse process
34
35 demonstrate that we deal with a dorsal vertebra. The height of the parapophysis on the neural
36
37 arch, above the neurocentral suture, shows that it is a middle or posterior dorsal vertebra.
38
39 However, it cannot be one of the last two dorsals given that the parapophysis and the
40
41 diapophysis are well separated from each other. By comparing with the position of the
42
43 parapophysis in other basal sauropodomorphs, we can situate this vertebra between D7 and
44
45 D12.
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51 **Sacral Vertebra**

52
53 **Primordial Sacral 2? [MNHN.F.LES155]**—The sacral vertebra is almost complete,
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55 without deformation, and its bone surface is relatively well-preserved. The anterior surface of
56
57 the centrum and neural spine are eroded in some places and the prezygapophyses are missing
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3 (Fig. 8). This can be explained by the fact that another sacral vertebra was probably
4 articulated and partially fused anteriorly to this one. As a rule, prosauropod dinosaurs possess
5 two primordial sacral vertebrae associated with a dorsosacral and/or a caudosacral, depending
6 on the considered taxa (Galton, 1999; Galton and Upchurch, 2004). Because of their limited
7 number and their contribution to the sacrum, sacral vertebrae usually have quite distinct
8 morphologies from one another.
9

10 This sacral vertebra is stout, large and its centrum height equals approximately 60% of the
11 neural arch height (Table 3). The sacral ribs, projecting on each side of the vertebra, are meant
12 to meet the ilium (Fig. 8A). The centrum is very short anteroposteriorly, its elongation (ratio of
13 the ventral length of the centrum on its anterior height) is of 0.7 (Table 3), that is inferior to that
14 of the posterior cervical vertebra and dorsal vertebrae (ratios between 1 and 1.2) and much
15 inferior the elongation ratio of the middle cervical vertebra (2.4). This stocky morphology is
16 unusual among basal sauropodomorphs given that numerous taxa like *Adeopapposaurus* (1.5),
17 *Leoneosaurus* (1.6) or *Plateosaurus* (exact ratio unknown) have sacral vertebrae with much
18 higher elongation ratios. The anterior articular surface of the centrum is 1.3 times higher than
19 wide, as in most other vertebrae. In ventral view, the centrum has a quite odd morphology, its
20 anterior width equals 60% of its posterior width (Table 3). The state of preservation of the
21 anterior part of the vertebra must have an impact on this difference, but probably an
22 insignificant one, given that the bone surface is visible in some places. This width variation is
23 quite representative of the sacral vertebrae of some sauropods like *Apatosaurus*, but is not
24 observed in *Adeopapposaurus*, *Massospondylus* or *Plateosaurus*. The centrum shows a median
25 constriction and its ventral surface is flat. It is circular in posterior view, the height and the
26 width of the posterior articular surface being almost identical (Table 3), and its posterior surface
27 is concave. In lateral view, the ventral margin of the centrum is concave and its posterior border
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3 projects more ventrally than its anterior one. The lateral surface is slightly concave and partially
4 covered by the rib, which occupies the dorsal third of its height.
5
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7 The neural arch is anteroposteriorly short and located on the anterior two thirds of the
8 centrum. On the neural arch, the diapophyses are developed and subrectangular. They are
9 merged with the ribs and, taken together, their transverse width is much superior to the
10 anteroposterior length of the diapophyses at their base. In posterior view, a small bulge visible
11 on the dorsal surface of the fused diapophyses and ribs corresponds to the location where they
12 are merging. Anteroposteriorly, each diapophysis occupies the entire length of the neural
13 arch. In dorsal view, the length of the diapophyses decreases distally. The point where it is
14 thinner seems to match the location where it merges with the sacral rib. The anteroposterior
15 extension of the sacral rib is increasing towards its distal extremity. Despite this, there is no
16 marked constriction between the diapophysis and the sacral rib in dorsal view (Fig. 8C). The
17 fused diapophysis and rib show concave anterior and posterior margins and project laterally
18 with a small posterior component. The shape and the direction of the process and rib in dorsal
19 view resemble what is observed on the second primordial sacral of *Lufengosaurus* and
20 *Mussaurus*. In posterior view, the rib exhibits a marked ventral depression, of which the
21 dorsal margin is situated at the level of the neural canal and extending until the ventral border
22 of the sacral rib. The lateral margin of the fused diapophysis and rib is concave. In lateral
23 view, the extremity of the rib has a subrectangular shape and an oblique main axis (Fig. 8B).
24 It extends on more than 100 mm dorsoventrally, that is approximately two thirds of the height
25 of the centrum. The dorsal part of the rib is more extended anteroposteriorly than its ventral
26 extremity. The articular facet for the ilium is simple. In lateral view, the dorsal border of the
27 sacral rib is slightly convex, its anterior and posterior margins are concave, and its ventral
28 border appears to be flat to slightly concave. The biconcavity (anterior and posterior) is
29 mentioned by Pol et al. (2011) as being representative of the first primordial sacral among
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3 sauropodomorphs. However, the shape and dorsoventral extension of the contact area with the
4
5 ilium are inconsistent with what is observed on the first primordial sacral of *Leonerasaurus* or
6
7 *Riojasaurus*. Moreover, the shape of the anteroventral margin of the rib and the state of
8
9 preservation of the anterior surface of the sacral vertebra and rib clearly indicate that they
10
11 were fused with the previous vertebra. It then cannot be the first primordial sacral. By
12
13 comparing the shape of the contact area for the ilium with those visible on the sacral vertebrae
14
15 of *Adeopapposaurus*, *Leonerasaurus*, *Mussaurus* or *Riojasaurus*, it appears that we are closer
16
17 to the second primordial sacral. Among these three taxa, *Riojasaurus* is the one where the
18
19 shape and the orientation of the contact area for the ilium best match what is observed on the
20
21 Maphutseng specimen. The prezygapophyses of the sacral vertebra are, unfortunately, not
22
23 preserved. The postzygapophyses are short, not extended transversely and project
24
25 posterolaterally in dorsal view. Their ventral articular surfaces are flat and ventrolaterally
26
27 oriented. The postzygapophyses arise from the base of the neural spine posterior margin and
28
29 flush with the latter. They are separated by an interpostzygapophyseal notch. Underneath the
30
31 postzygapophyses there is a large hyposphene, which is approximately the same height as the
32
33 neural canal. The neural canal is circular. The neural spine is quite high and located anterior
34
35 to the sacral vertebra centrum. In lateral view, the neural spine is clearly higher than
36
37 anteroposteriorly long (its length equals 42% of its height) and shows a constant length (Table
38
39 3; Fig. 8). Its proportions remind those of the sacrum neural spines of *Plateosaurus*, most of
40
41 the other sauropodomorph taxa presenting neural spines usually anteroposteriorly longer with
42
43 respect to their height. The neural spine is oriented posterodorsally, but not as dramatically as
44
45 in *Adeopapposaurus* or *Plateosaurus*. Its anterior border is slightly convex, whereas its
46
47 posterior border is concave. Its dorsal margin is posteriorly inclined. The distal extremity of
48
49 the neural spine is oval in dorsal view. In posterior view, the lateral borders of the neural
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3 spine are concave given that the proximal and distal extremities are slightly transversely
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5 extended compared with the median part of the neural spine.
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8 Given the dorsoventral extension of the contact area for the ilium, the anterior surface of the
9
10 vertebra which was probably fused with another one, the shape and the orientation of the
11
12 fused diapophyses and ribs in dorsal view, and, considering that the majority of basal
13
14 sauropodomorphs have three to four sacral vertebrae, including two primordial sacrals, we
15
16 suggest this vertebra to be identified as a second primordial sacral.
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21 **Caudal Vertebrae**

22
23 **Anterior Caudal (Ca1-Ca5) [MNHN.F.LES168]**—The first caudal from
24
25 Maphutseng is damaged, but does not appear to have undergone important deformation. The
26
27 posterior surface of the centrum is complete, but its anterior surface is quite incomplete,
28
29 particularly on the borders. The largest missing parts are located at the base of the neural arch,
30
31 for that reason the centropostzygapophyseal ridges were replaced by plaster, and on the lateral
32
33 sides of the vertebra, where the transverse processes are absent. The left prezygapophysis and
34
35 postzygapophysis are broken, those from the right side are in part reinforced with plaster, but
36
37 complete. The neural spine is complete (Fig. 9).
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42 The centrum is very high and short, as it is the case on the anterior caudal vertebrae of some
43
44 basal sauropodomorph taxa like *Aardonyx*, *Lufengosaurus* or *Melanorosaurus* (NM QR1551).
45
46 Its aEI equals 0.56 (Table 3), that is to say well inferior to what has been measured on all the
47
48 preceding vertebrae, including the sacral vertebra. In posterior view, the centrum articular
49
50 surface is overhung by a matrix residue. The latter could give the impression that the centrum
51
52 shows a dorsal protuberance, but it is not the case and the centrum is, in reality, circular. The
53
54 posterior articular surface of the centrum is concave (Fig. 9B). Similarly, its lateral surfaces
55
56 show a slight dorsal concavity. In lateral view, the ventral margin of the centrum is strongly
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3 concave (Fig. 9A). In ventral view, the centrum shows a marked median constriction, not
4 located on a central point as it is the case on the posterior cervical (MNHN.F.LES169), but on
5 the entire length of the centrum, apart from the anterior and posterior borders. The ventral
6 surface of the centrum is smooth and does not bear a longitudinal groove as in
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12 *Adeopapposaurus*, *Eoraptor* or *Riojasaurus*. This groove is observed on the anterior caudal
13 vertebrae of several basal sauropodomorphs, but usually appears after a few vertebrae on the
14 caudal series (for instance, in *Plateosaurus*, it is well visible from the Ca6).

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19 The neural arch is badly preserved. Laterally to the neural canal, a small part of the base of
20 the neural arch is still in place on both sides. It is difficult to judge the anteroposterior
21 extension of the neural arch, given that the posterior borders are broken, but it seems to be
22 quite short, as an extension of the centrum. The neural arch is very high, almost as high as the
23 one of the sacral vertebra MNHN.F.LES155 (260 and 265 mm, respectively). The transverse
24 processes are missing. The right prezygapophysis of the vertebra, the only one preserved, is
25 projecting strictly anteriorly. It is relatively long in comparison to the anteroposterior
26 extension of the vertebra, but is not mounted on high pedicels. It has got a rounded shape in
27 dorsal view and a subtriangular one in lateral view (Fig. 9A). The dorsal articular surface of
28 the prezygapophysis is flat and oriented strictly dorsally. In dorsal view, an
29 interprezygapophyseal notch is visible. The right postzygapophysis is the only one preserved.
30 It projects strictly posteriorly in lateral view. It is robust, rounded in dorsal view and coupled
31 over its entire height to the posterior margin of the neural spine. The spinopostzygapophyseal
32 lamina is broken, but apparently exceeded the mid-height of the neural spine. The ventral
33 articular surface of the postzygapophysis is flat to slightly concave and oriented ventrally to
34 ventrolaterally (Fig. 9B). Judging by the remnants of the left postzygapophysis on the left side
35 of the posterior surface of the neural spine, the postzygapophysis articular surfaces were
36 probably very close to each other. The neural spine is complete, high and located at the same
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3 level as the centrum on an anteroposterior axis. The anteroposterior length on the top of the
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5 neural spine equals 36% of its total height (Table 3). This length is constant on the entire
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7 height of the neural spine, if we do not take into account the postzygapophysis. Transversely,
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9 the neural spine is compressed and its width goes slightly increasing towards its distal
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11 extremity. In posterior view, the lateral margins of the neural spine are straight above the
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13 postzygapophyses. In lateral view, the vertebra neural spine is oriented strictly dorsally and
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15 not posterodorsally, as on the most posterior caudal vertebra. The distal extremity of the
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17 neural spine is convex, its anterior border is slightly convex and its posterior border, dorsally
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19 to the postzygapophysis, appears slightly concave. In dorsal view, the distal extremity of the
20
21 neural spine is oval.
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26 The proportions of this vertebra, the absence of laminae or fossae on the preserved parts of
27
28 the neural arch and the height of the neural spine allow us to confirm that we deal with a
29
30 caudal vertebra. Considering the proportions of the vertebra, including the very short centrum,
31
32 the size of the vertebra, very close to the one of the sacral vertebra MNHN.F.LES155, the
33
34 absence of posterodorsal projection on the neural spine and the fact that the pedicels of the
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36 prezygapophyses and postzygapophyses are almost non-existent, we identify this vertebra as a
37
38 very anterior caudal (Ca1-Ca5).
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42 **Anterior Caudal (Ca5-Ca15) [MNHN.F.LES376]**—This anterior caudal vertebra is
43
44 well-preserved. On the neural arch, the left transverse process is broken at its extremity. The
45
46 right transverse process is broken at its base. Both postzygapophyses are broken. However the
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48 prezygapophyses are complete, as well as the neural spine, in spite of some slight damages on
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50 the anterior and posterior margins (Fig. 10).
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54 This caudal vertebra is clearly smaller than the other one (MNHN.F.LES168). Its height
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56 equals approximately 80% of the one described above (Table 3). Other differences were also
57
58 found, like a more elongated centrum, much more developed pedicels bearing the
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3 prezygapophyses and a posterodorsally projecting neural spine. It is unlikely that these two
4
5 caudal vertebrae had belonged to the same individual, but we can affirm that this second
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7 vertebra was situated more posteriorly in the caudal series than the previous one. The caudal
8
9 centrum is amphicoelous and its lateral surfaces are flat. The aEI is 0.91 that is superior to the
10
11 ones of the sacral and the more anterior caudal vertebrae. The articular surfaces are oval, their
12
13 long axis being dorsoventral. The width of the centrum equals approximately 85% of its
14
15 height (Table 3). In lateral view, the ventral margin of the centrum is concave, but in a much
16
17 less marked way than on the previous caudal vertebra (Fig. 10C). In ventral view, the centrum
18
19 does not show a median constriction, but lateral borders are concave all the same. On the
20
21 median area of the centrum, a slight longitudinal groove is visible (Fig. 10E).
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24 The neural arch equals approximately 60% of the entire height of the vertebra (Table 3). The
25
26 neural canal, visible in posterior view, is circular. The left transverse process is the only one
27
28 to be partially preserved. Its base is quite wide dorsoventrally and extends slightly on the
29
30 dorsal part of the centrum. The base quickly sharpens dorsoventrally, thus imparting a
31
32 subtriangular shape to the transverse process in anterior and posterior views (Fig. 10A-B). In
33
34 dorsal view, the transverse process is thin and seems to be subrectangular, even though it is
35
36 not complete. It is projecting posterolaterally. On the caudal series of *Plateosaurus* or
37
38 *Riojasaurus*, we can observe that the transverse processes oriented posterolaterally are usually
39
40 situated on the most anterior caudal vertebrae. In *Riojasaurus*, for instance, the processes
41
42 recover a strictly lateral orientation between Ca10 and Ca15. The prezygapophyses are
43
44 located further from the median axis of the vertebra than the postzygapophyses (Fig. 10D).
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46 The prezygapophyses of the vertebra are projecting anteriorly with, in lateral view, a dorsal
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48 component. They are small, but seem to be mounted on pedicels, which was not the case on
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50 the previous caudal vertebra. They bear flat dorsal articular surfaces, which are dorsomedially
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52 oriented. The postzygapophyses are broken. As on the previous caudal vertebra, they arise
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3 from the base of the neural spine, on the posterior margin of the latter (Fig. 10C). The neural
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5 spine is complete and projects posterodorsally. The angle of the main axis of the neural spine
6
7 relatively to the longitudinal axis of the vertebra is sometimes fairly important from the first
8
9 caudal vertebra. It is, for example, the case in *Lufengosaurus* or *Mussaurus*. In some other
10
11 basal sauropodomorph taxa, the neural spine is not angled at all on the first caudals and
12
13 switches to a more and more posterodorsal orientation along the anterior part of the caudal
14
15 series. It is the case in the Maphutseng specimen, but also in *Melanorosaurus*. The neural
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17 spine is very high and located at the level of the posterior half of the centrum. The
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19 anteroposterior length of the top of the neural spine equals 35% of its total height, that is
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21 almost the same value as on the more anterior caudal vertebra (Table 3). In lateral view, the
22
23 anteroposterior extension of the neural spine is constant along its entire height (Fig. 10C). In
24
25 anterior or posterior view, the neural spine is transversely compressed. Its lateral borders are
26
27 straight and its distal extremity, although eroded, appears to be slightly superior in width than
28
29 the rest of the neural spine. In anterior or posterior view, the distal part of the neural spine is
30
31 slightly deflected towards the right side of the vertebra, arguably because of breakages and
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33 fossilization process of the vertebra (Fig. 10A-B). In lateral view, the distal extremity of the
34
35 neural spine is convex, but slightly eroded. The anterior margin of the neural spine is
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37 somewhat damaged, but seems straight, and its posterior margin is concave. In dorsal view,
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39 the top of the neural spine is clearly longer than wide and oval (Table 3, Fig. 10D).
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42 The proportions of this vertebra, the absence of laminae or fossae on its neural arch, the
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44 height of the neural spine and the arrangement of the postzygapophyses help to conclude that
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46 we deal with a caudal vertebra. As already said, it is, without doubt, more posterior than the
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48 caudal vertebra MNHN.F.LES168. We deduce this mainly by looking at the elongation of the
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50 centrum, the position of the neural arch relatively to the latter, and the orientation of the
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52 neural spine. Considering the elongation of the centrum on this caudal vertebra, the presence
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3 of a very light ventral longitudinal groove, the orientation of the transverse processes, the
4 elongation of the prezygapophyses, and comparing with a few complete caudal series, it is
5 most likely that we deal with an anterior caudal vertebra, probably located between Ca5 and
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10 Ca15.

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12 **Middle Caudal (Ca15-Ca25) [MNHN.F.LES177]**—This middle caudal vertebra is
13 particularly well-preserved. The centrum is subcomplete, having just a few fragments missing
14 on the borders. It is the only middle caudal vertebra to have most of its neural arch preserved.
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19 On the latter, the right prezygapophysis is broken and the left postzygapophysis is missing.
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22 The neural spine is broken at its base. This vertebra shows a typical “middle caudal
23 morphology”, that is anteroposteriorly elongated and quite low in height.

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26 The centrum is amphicoelous and its lateral surfaces are flat. The aEI is quite important, as it
27 equals 1.5. One of the most anterior caudal vertebrae (MNHN.F.LES168) has the same
28 anteroposterior length (90 mm), but a much superior width, and hence a 0.56 aEI. In anterior
29 and posterior views, the articular surfaces are rounded, very slightly wider than high. The
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42 The neural canal, visible both in anterior and posterior views, is subcircular. The
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3 The proportions and morphology of this vertebra, the absence of laminae or fossae on its
4 neural arch, and the arrangement of the prezygapophyses and postzygapophyses allow to
5 conclude that we deal with a caudal vertebra. Considering the proportions of the centrum on
6 this caudal vertebra, the absence of transverse processes, the presence of a faint ventral
7 longitudinal groove, and the location and shape of the zygapophyses, it is most likely that we
8 deal with a middle caudal vertebra, probably located between Ca15 and Ca25.
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17 **Posterior Caudals (Ca25 and beyond) [MNHN.F.LES35&37]**—These vertebrae are
18 among the few well-preserved posterior caudals. For most of them, the centrum is the only
19 preserved part and is often damaged. The centra of these two vertebrae are subcomplete,
20 having just a few fragments missing on their extremities. It is practically the only posterior
21 caudals in which a part of the neural arch is preserved. On MNHN.F.LES35, the lower part of
22 the neural arch as well as the base of the postzygapophyses and neural spine are preserved. On
23 MNHN.F.LES37, the anterior part of the neural arch is preserved, along with the right
24 prezygapophysis. The following description is based on both vertebrae. Measurements are
25 made on MNHN.F.LES35. These vertebrae exhibit a morphology close to that of the middle
26 caudal vertebra, with an anteroposteriorly elongated and dorsoventrally low centrum.
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40 The centrum is amphicoelous and its lateral surfaces are flat. The aEI is more important than
41 in the middle caudal vertebra, as it equals 1.9. In anterior and posterior views, the articular
42 surfaces are circular. On these surfaces, the width of the centrum equals approximately 100%
43 of its height (Table 3). In lateral view, the ventral margin of the centrum is slightly concave.
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49 In ventral view, the centrum shows a slight median constriction. On its median area, a wide
50 but shallow longitudinal groove is visible.
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At the interface between the centrum and the neural arch, the neural canal is subcircular. The
prezygapophyses are located more laterally than the postzygapophyses relative to the median
axis of the vertebra. The prezygapophysis is projecting anteriorly with a slight lateral

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3 component in dorsal view. In lateral view, it has a dorsal component. It is mounted on a short
4
5 pedicel and terminated by an oval articular surface which is medially, and slightly dorsally,
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7 oriented. The postzygapophyses are located at the base of the neural spine. They are at the
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9 level of the last posterior quarter of the centrum.
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12 The proportions and morphology of these vertebrae, the absence of laminae or fossae on their
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14 neural arch, and the unique morphology of the centrum, allow to conclude that we deal with
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16 caudal vertebrae. Considering the proportions of the centra, the absence of transverse
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18 processes, and the arrangement of the neural arches, it is most likely that we deal with
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20 posterior caudal vertebrae, probably located beyond Ca25.
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26 **Ribs and Chevrons**

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28 **Ribs**—No complete ribs could be reconstructed from the many rib sections found in
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30 the collected material. A single middle dorsal rib (MNHN.F.LES138) has been identified with
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32 confidence, based on the circular to triangular proximal cross section of the rib shaft, and on
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34 the well-differentiated tuberculum and capitulum. In articulation with its corresponding
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36 dorsal vertebra; this rib should have a posterolateral orientation.
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40 **Chevrons [MNHN.F.LES53]**—Several isolated haemapophyses (chevrons), more or
41
42 less complete, were recovered in Maphutseng. The description will focus on
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44 MNHN.F.LES53, which is the more complete and better-preserved element. The chevron is a
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46 robust Y-shaped bone. It is 320 mm long. Both its proximal and distal extremities are
47
48 damaged and, all along the chevron, six fractures are visible, but the structure is nonetheless
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50 subcomplete.
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53 The proximal extremity of the chevron consists of an eroded and partially broken arch. The
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55 arch is dorsally concave and corresponds to the articular surface for the caudal vertebrae.
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58 Beneath this surface is located the haemal canal. It has a pronounced oval shape, with a
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3 dorsoventral long axis. More ventrally, the chevron sharpens distally and, therefore, appears
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5 V-shaped in anterior and posterior views. Transversely, the haemal spine is 2.6 times thicker
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7 proximally than at its distal end. Following the haemal canal, the anterior surface of the
8
9 chevron bears a marked groove extending on the median axis of the bone for about one third
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11 of its entire length. On both sides, small ridges frame the longitudinal groove. The posterior
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13 surface of the haemal spine is flat beneath the haemal canal, but being more sharpened than
14
15 the anterior surface, it exhibits a marked ridge on its distal half. In lateral view, the anterior
16
17 and posterior margins of the chevron are subparallel. The thinnest part of the chevron is
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19 located at the level of the haemal canal. The haemal spine is anteroposteriorly more extended
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21 distally than proximally. Its distal extremity is about 1.7 wider than its proximal part. The
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23 distal extremity of the haemal spine is not entirely preserved, but its distal margin seems to be
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25 straight in lateral view.
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30 We identify this chevron as a very proximal one (around the fourth and fifth caudal vertebrae
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32 or so), based on its size and global morphology, and on what is observed in *Plateosaurus*
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34 (Huene, 1926, Taf. III: Fig. 1).
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40 **Pectoral Girdle**

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42 **Left Scapula [MNHN.F.LES386]**—The scapula described hereinafter is considered
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44 with its long axis positioned vertically. Following this orientation, the contact surface with the
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46 coracoid is ventral, the acromion is on the anterior part of the scapula and the glenoid is
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48 posterior. We assume that, in vivo, the scapula was oriented obliquely with respect to the
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50 longitudinal axis of the animal, with the contact surface bearing the coracoid directed
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52 anteroventrally.
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56 The scapula is almost complete, its distal extremity being the only part of the bone not fully
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58 preserved. The preserved dorsal and ventral margins present a relatively marked wear. The
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3 bone surface of the scapula is damaged, and the bone exhibits multiple fractures, particularly
4 on the blade. Nonetheless, the scapula does not show any deformation. It is not articulated
5 with the coracoid (Fig. 11). The Maphutseng specimen scapula is quite short and stout, like
6 the one of *Antetonitrus*. Its proximal extremity is clearly anteroposteriorly extended with
7 respect to the blade. The distal extremity of the scapula seems to be widened too, but the lack
8 of the distal part of the bone prevents the estimation of its anterior projection.
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12 The distal part of the scapular blade is incomplete, but judging by the orientation of its
13 anterior border, by the crack, it was fan-shaped, as in most basal sauropodomorph taxa
14 (Remes, 2008:figs. 7-3). The posterodorsal corner of the scapula is incomplete too, but
15 probably did not project behind the posteroventral corner.
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19 The scapular blade represents 65% of the total length of the bone. In posterior view, the
20 lateral margin of the blade is convex, and its medial margin is concave. In lateral view, the
21 blade is straight, with distally concave and proximally subparallel anterior and posterior
22 borders (Fig. 11A). Anteroposteriorly, the minimal width of the blade equals approximately
23 45% of the maximal anteroposterior extension of the proximal end of the scapula, and 24% of
24 the dorsoventral length of the bone. Transversely, the blade is 40 mm wide at mid-length, that
25 is 38% of the transverse width of the scapula at the level of the glenoid (Table 4). In
26 transverse section, the blade has a suboval shape, with a slightly convex lateral margin and a
27 flat medial margin. The lateral and medial surfaces of the blade merge to form anterior and
28 posterior bulges. Besides this blunt edge, no real anterior and posterior surfaces are visible on
29 the blade of the scapula. The lateral surface of the blade is smooth, apart from two small
30 posterodorsal and anterodorsal ridges, which are extending on the distal part of the blade and
31 which probably delimit the area of origin of the muscle *deltoideus scapularis* (Remes,
32 2008:figs.7-12) (Fig. 11A). The medial surface of the blade is flat and smooth. A blunt ridge,
33 located on its posteroventral part, is poorly visible (Fig. 11B).
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3 The proximal part of the scapula seems more extended anteroposteriorly than the distal part,
4 even though it is impossible to declare with certainty. It equals half (53%) of the total length
5 of the bone. In lateral view, the proximal extremity is subrectangular, its anteroposterior
6 extension being clearly superior to its dorsoventral height. On the lateral surface of the
7 proximal extremity, the acromion fossa extends for two thirds of the extremity length. The
8 acromion fossa is anteroposteriorly longer than high, its height being of, approximately,
9 120 mm. It is a shallow fossa, with a marked anterior margin and a very light wrinkle
10 outlining its anterodorsal border. The acromion is poorly developed anteroposteriorly, its
11 extension (from the anterior border of the acromion to the anterior border of the scapular
12 blade) equals 50% of the anteroposterior length of the blade (at mid-length). The height of the
13 anterior margin of the acromion represents 19% of the entire length of the scapula (Table 4).
14
15 The dorsal border of the acromion is oblique and extends from the anterior margin of the
16 blade, following a gently slope, to merge with the anterior border of the acromion, without
17 visible angle. In lateral view, the dorsal margin of the acromion is at approximately 40 ° to the
18 main (dorsoventral) axis of the scapula. In lateral and medial views, the anterior border of the
19 acromion is also slightly oblique. Its ventral extremity is a bit more anterior than its dorsal
20 extremity (Fig. 11). In anterior view, the anterior margin of the acromion follows the anterior
21 border of the scapula. The ventral part of the acromion is extremely thin transversely, it is the
22 thinnest part of the bone. The glenoid is on the posterior border of the scapula proximal
23 extremity. Conversely to the acromion, the glenoid is the largest part of the bone, transversely
24 (Table 4). The glenoid cavity has a slightly coarse texture. The latter is particularly visible on
25 the medial surface of the scapula, where the bone surface appears to be better preserved. In
26 posterior view, the glenoid cavity is oval, dorsoventrally higher than transversely wide. In
27 lateral view, the posterodorsal corner of the glenoid cavity is sharp and projects quite far
28 posteriorly. A similar degree of projection is observed in *Antetonitrus*, *Lufengosaurus* or
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3 *Sefapanosaurus*. On the ventral margin of the scapula, the contact area for the coracoid is
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5 sigmoid in lateral and medial views. In *Kholumolumo*, we also observe a rounded projection,
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7 located anteroventrally with respect to the glenoid, on the ventral border of the scapula (Fig.
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9 11). This structure is also visible, although less pronounced, in *Antetonitrus*.

14 **Anterior Member**

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17 **Left Humerus [MNHN.F.LES379]**—The left humerus is complete and well-
18
19 preserved. It does not exhibit any distortion and the bone surface is relatively well-preserved,
20
21 aside from the more abraded proximal and distal extremities. The proximolateral margin of
22
23 the humerus and its distolateral corner are incomplete. On the posterior surface of the bone,
24
25 the bone surface is cracked and slightly depressed in some places. The humerus also shows
26
27 several fissures on its diaphysis (Fig. 12). The humerus is 685 mm long and is not particularly
28
29 robust for its size. The deltopectoral crest has a limited anterior projection. The proximal and
30
31 distal extremities are clearly extended with respect to the diaphysis, giving the humerus an
32
33 hourglass shape in anterior and posterior views (Table 5). The proximal half of the humerus
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35 has been rotated of approximately 30 ° clockwise relative to its distal half.

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40 The proximal part of the humerus has a concave anterior surface and a relatively flat posterior
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42 surface, with light lateral and medial concavities. The head of the humerus is thick and shows
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44 a convex dorsal margin (Fig. 12A-D). It bears a strong bulge anteroposteriorly thicker than
45
46 the rest of the proximal articular surface. On this bulge, the bone surface is rough. In proximal
47
48 view, the thickest part of the humeral head is located on its medial half. The lateral third of
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50 the humeral head is two to three times thinner than its medial part. In proximal view, the
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52 anterior margin of the humerus is flat to slightly concave, whereas its posterior margin is
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54 convex (Fig. 12E). The deltopectoral crest arises from the lateral border of the humerus. It
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56 extends anteriorly on approximately 5 cm and is projecting at nearly 90 ° of the anterior
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3 surface of the humerus in proximal view. In anterior view, the main axis of the deltopectoral
4 crest is oriented strictly dorsoventrally. The length of the deltopectoral crest (measured from
5 the dorsalmost point in its alignment) equals 48% of the total length of the humerus. The
6
7 distal margin of the deltopectoral crest bears a coarse bulge which appears straight in anterior
8 view (Fig. 12A). In lateral view, the distal border of the deltopectoral crest is convex. The
9
10 crest arises very gradually from the proximal end of the humerus. Proximally, the crest
11 reaches a plateau, after a few centimeters, where its distal margin becomes straight in lateral
12 or medial view. Distally, the deltopectoral crest ends quite abruptly at the level of the
13
14 diaphysis. In lateral view, the distal dorsoventral axis of the crest is at approximately 130° of
15
16 its ventral margin merging with the diaphysis (Fig. 12B).

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19 The humerus diaphysis is not much extended with respect to the entire length of the bone. It is
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21 relatively thin; its transverse width equals approximately 30% of the maximum proximal
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23 extension of the humerus and 40% of the distal one. In anterior and posterior views, the
24
25 medial and lateral borders of the diaphysis are both concave (Fig. 12A, C). In lateral and
26
27 medial views, the anterior and posterior borders of the diaphysis are curved and subparallels,
28
29 the anterior being concave and the posterior convex (Fig. 12B, D). In transverse section, the
30
31 diaphysis is subcircular.

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34 In posterior view, the distal half of the humerus is subtriangular. It is transversely extended,
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36 and its transverse width equals approximately 70% of the proximal width (Table 5). The
37
38 ventral margin of the distal extremity is slightly concave in anterior and posterior views. The
39
40 anterior surface of the distal extremity exhibits a well-marked median cuboid fossa (Fig.
41
42 12A). The posterior surface is also concave on its median part because of the presence of the
43
44 olecranon fossa, but this fossa is still shallower than the cuboid fossa (Fig. 12C). The distal
45
46 condyles of the humerus are preserved, but their posterior surface is abraded. In anterior view,
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48 the condyles appear poorly developed, as it is usually the case in prosauropod dinosaurs. The
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3 anteroposterior thickness of the distal medial condyle is very close to the anteroposterior
4
5 thickness of the proximal end of the humerus (Table 5). In distal view, the cuboid and
6
7 olecranon fossae are well visible and demarcate, on both sides, the ovoid condyles. There is a
8
9 small lack on the posteroventral part of the lateral condyle. Despite this lack, the ulnar
10
11 (lateral) condyle seems to be a little more extended transversely than the radial (medial)
12
13 condyle (Fig. 12F).
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17 **Right Ulna [MNHN.F.LES159]**—The right, complete, *Kholumolumo* ulna is well-
18
19 preserved. The only small missing part of the bone is located anteriorly, on the distal
20
21 extremity. The proximal and distal articular surfaces of the ulna are complete, even though a
22
23 bit abraded. The bone surface is, for the most part, rather well-preserved. The surface layer of
24
25 the bone is still removed in some small patches on the lateral surface of the ulna. The bone
26
27 shows multiple fractures on the entire length of the diaphysis (Fig. 13). For the following
28
29 description, the ulna is positioned with the long axis of its distal extremity horizontal and
30
31 oriented anteroposteriorly. The radial fossa is oriented anteriorly to anterolaterally and the
32
33 two processes surrounding it are projecting anterolaterally and anteromedially.
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35
36
37 The maximum length of the ulna is 390 mm (Table 5). The Maphutseng bone bed having
38
39 delivered rests from several disarticulated specimens, it is not possible to associate this ulna to
40
41 a particular humerus and, therefore, to calculate a length ratio. The ulna is a robust bone, with
42
43 proximal and distal extremities extended both anteroposteriorly and transversely with respect
44
45 to the diaphysis, the proximal extremity being more extended than the distal one (Table 5).
46
47
48 The main axes of the extremities of the ulna are not parallel, but oriented following an angle
49
50 of approximately 40 °. The ulna has a morphology very similar to that of the other basal
51
52 sauropodomorphs, but appears less stout than some forms, like *Antetonitrus*, in which the ulna
53
54 is shorter and stockier. The anteroposterior extension of the proximal extremity of the ulna
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56 equals 36% of the total length of the bone. In proximal view, the articular surface has a
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3 subtriangular outline (Fig.13E), close to what is observed in *Antetonitrus* or *Melanorosaurus*
4 (NM QR3314 and SAM-PK-3449). The posteromedial border of the proximal extremity is
5
6 (NM QR3314 and SAM-PK-3449). The posteromedial border of the proximal extremity is
7
8 concave and its lateral border is convex. The anterolateral margin of the proximal extremity
9
10 bears a concavity, the radial fossa, which is shallower than the posteromedial concavity. The
11
12 radial fossa is less marked than in *Aardonyx*, *Melanorosaurus* (SAM-PK-3449) or
13
14 *Sefapanosaurus*. It is bordered by both the anterolateral and anteromedial processes of the
15
16 ulna. The anteromedial process is, like in many prosauropod dinosaurs, oval. Therefore, its
17
18 distal extremity appears rounded. The process is well developed and exhibits a quite
19
20 important width relative to its length. In *Antetonitrus* and *Sefapanosaurus*, the anteromedial
21
22 process is much thinner. The anterolateral process is not much developed and is less
23
24 protruding than in most basal sauropodomorph genera. On its posterior part, the proximal
25
26 extremity of the ulna bears a rounded projection, of which the posterior margin is convex in
27
28 proximal view. Ahead of this projection, the olecranon is visible, in a little more posterior
29
30 position than the anterolateral process. The olecranon is not much developed, but remains
31
32 visible in medial and lateral views. The dorsalmost point of the olecranon is some 3 cm above
33
34 the lowest point of the proximal surface of the bone, on the anteromedial process surface (Fig.
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41 13B).

42
43 The diaphysis is much less stout than that of *Antetonitrus*, which has an ulna of equivalent
44
45 size. The transverse section of the diaphysis is elliptical. The anteroposterior extension of the
46
47 diaphysis equals 35% of the one of the proximal extremity and 45% of the extension of the
48
49 distal extremity (Table 5). In lateral and medial views, the proximal portion of the diaphysis is
50
51 narrowing distally. The diaphysis appears waisted around two thirds of the length of the bone,
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53 and then widens distally. Therefore, the diaphysis has an anteroposterior length of 125 mm on
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55 the proximal part of the bone, but is merely 56 mm at its, more distal, thinnest point. The
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57 anterior and posterior margins of the diaphysis are concave. In anterior and posterior views,
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3 the lateral border of the ulna diaphysis is sigmoid and its medial border is slightly concave.
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5 The medial surface of the diaphysis is concave on its proximal half and flat on the distal half
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7 (Fig. 13D). The lateral surface of the ulna diaphysis is slightly convex on the proximal portion
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9 of the bone and flat on the distal part.
10
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12 The anteroposterior extension of the distal extremity of the ulna equals 85% of that of the
13
14 proximal extremity. It is also equivalent to 28% of the entire length of the ulna (Table 5). The
15
16 distal articular surface is simple and convex. The anterior surface of the distal extremity
17
18 seems to bear a tuber, but the bone being broken, the structure cannot be observed in its
19
20 entirety. The articular surface is subrectangular in distal view. The long axis of the distal
21
22 extremity is oriented anteroposteriorly. The medial and lateral margins are straight, and the
23
24 anterior and posterior borders appear convex (Fig. 13F).
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28 **Right Radius [MNHN.F.LES147]**—The right radius is complete and well-preserved.
29
30 The only damaged part of the bone is its proximal extremity, of which two margins are
31
32 broken. The bone surface of the radius is well-preserved, even though it is not entirely
33
34 prepared on the extremities of the bone. The diaphysis of the radius is cracked in two different
35
36 spots (Fig. 14).
37
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39
40 The radius is straight and relatively thin. Its proximal extremity is transversely extended. In
41
42 lateral view, it also appears slightly anteroposteriorly extended with respect to the extension
43
44 of the diaphysis. In proximal view, the extremity is not complete, but was, in all likelihood,
45
46 oval. The transverse width of the proximal articular surface equals approximately 1.2 times its
47
48 anteroposterior expansion (Table 5). The anterior border of the proximal extremity is straight,
49
50 its posterior border is slightly convex and its lateral border convex. The lateral part of the
51
52 proximal articular surface seems to be slightly shorter anteroposteriorly than the medial part
53
54 (Fig. 14E). In anterior and posterior views, the lateral part of the proximal articular surface
55
56 has a convex margin, more developed dorsally than the medial part of the surface. The medial
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3 part of the proximal articular surface is slightly concave for the radial condyle of the humerus
4
5 (Fig. 14A, C).
6

7 The diaphysis of the radius represents approximately three quarters of the entire length of the
8
9 bone. In transverse section it is elliptical, the transverse width being superior to the
10
11 anteroposterior expansion. The transverse width of the diaphysis equals approximately 45%
12
13 of the transverse width of the radius proximal extremity and 55% of that of the distal
14
15 extremity (Table 5). In anterior and posterior views, the diaphysis is straight. Its lateral and
16
17 medial margins are subparallel and exhibit a slight concavity (Fig. 14A, C). In lateral and
18
19 medial views, the diaphysis appears slightly curved with a straight anterior border and a
20
21 slightly concave posterior border. The diaphysis starts widening both transversely and
22
23 anteroposteriorly 8 cm above the distal extremity (Fig. 14B, D). On the distal part of the
24
25 diaphysis, the lateral area of the radius bears a flat and rough tuber, situated 4 cm above the
26
27 distal margin of the bone, which probably matches the contact point with the ulna.
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32 The distal extremity of the radius is extended both transversely and anteroposteriorly with
33
34 respect to the diaphysis. As it is usually the case in basal sauropodomorphs, the ventral margin
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36 of the distal extremity projects much further on the medial side than on the lateral side. In
37
38 anterior and posterior views, the distal margin of the radius therefore appears slanted. The distal
39
40 articular surface is flat. In distal view, the distal extremity is subcircular, its transverse width is
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42 slightly superior to its anteroposterior extension (Table 5). The posterior margin is the only one
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44 roughly straight in distal view, the other borders appear convex (Fig. 14F).
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3 **Manus**—We were only able to identify with certainty four metacarpals (the
4 metacarpal V was the only one not recovered) and two phalanges of *Kholumolumo* manus (the
5 phalanges I.1 and IV.2) in the collected material. Given that the elements of the metacarpus
6 have been found disarticulated, and belong to several individuals, they cannot be compared in
7 size. Overall, the metacarpals are well-preserved, even though they exhibit some fractures.
8 Their bone surface is eroded in some places and the proximal part of the metacarpal IV is
9 incomplete (Fig. 15).

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The first right metacarpal (MNHN.F.LES26) is, as in all basal sauropodomorphs, slightly longer than wide (Table 5). It is a very robust bone, quadrangular in shape. In dorsal view, the proximal margin is slightly concave, and the medial and lateral margins are strongly concave. In lateral view, the proximal border of the metacarpal I is straight, and its dorsal and ventral borders are strongly concave. A marked concavity on the proximolateral surface of the metacarpal allows the articulation with metacarpal II, which is located, not in the alignment of metacarpal I, but slightly anteriorly to the latter, as in most basal sauropodomorph dinosaurs. In proximal view, the articular surface of the metacarpal I appears subrectangular. The torsion between the bone proximal and distal extremities is slightly marked. The distal condyles are large and dorsoventrally well developed. The distal lateral condyle is projecting much more anteriorly than the medial (Fig. 15).

The second left metacarpal (MNHN.F.LES92) is an elongated element, of which the proximal transverse width equals 54% of its entire length (Table 5). This value supports the important difference of morphology of the proximal articular surfaces. Indeed, in proximal view, the proximal articular surface of metacarpal II is subrectangular with a long-axis oriented dorsomedially to ventrolaterally. In dorsal view, the metacarpal II is hourglass-like with concave lateral and medial borders. The transverse proximal width equals 1.7 times the minimum width of the metacarpal and is equivalent to its distal transverse width. In medial

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3 view, the proximal margin of metacarpal II appears straight, whereas its ventral and dorsal
4 margins are concave. The distal condyles are dorsoventrally less developed than the proximal
5 extremity of the bone (Fig. 15).
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10 The third metacarpal (MNHN.F.LES93) is also elongated and, compared to the second
11 metacarpal, presents a thinner diaphysis with respect to its proximal and distal extremities.
12
13 Thus, the transverse width of the metacarpal III proximal extremity equals 47% of the entire
14 length of the bone and represents 2.5 times the minimum width of the diaphysis, as well as 1.2
15 times the transverse width of the distal extremity (Table 5). In dorsal view, the medial and
16 lateral borders of the bone are concave. In medial view, the proximomedial area of the bone is
17 slightly coarse on the contact surface for metacarpal II. The dorsal and ventral margins of the
18 bone are concave. The proximal extremity of the third metacarpal shows a relatively flat
19 surface and, in lateral view, is clearly more developed dorsoventrally than the distal
20 extremity. The lateroventral surface of the bone bears a concavity in which metacarpal IV
21 articulates. In proximal view, the articular surface of metacarpal III is subrectangular and
22 dorsoventrally high (Fig. 15).
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37 The fourth metacarpal (MNHN.F.LES76) is incomplete. In dorsal view, the medial and lateral
38 borders of the bone are concave. The proximal extremity is broken, but seems to extend more
39 transversely than the distal one. With respect to metacarpals II and III, the distal extremity of
40 metacarpal IV is less developed than its diaphysis both transversely and dorsoventrally. In
41 medial view, the beginning of a slight proximomedial concavity where metacarpal III
42 articulates can be guessed. The dorsal and ventral borders of the bone are slightly concave
43 (Fig. 15). A proximomedian prominence is visible on the metacarpals II to IV.
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53 The first phalanx of digit I (MNHN.F.LES29) is one of the few elements of the manus, with
54 the metacarpals, that we were able to identify with certainty. It is a short and stout bone, of
55 which the maximum length and width are roughly equivalent. The proximal articular surface
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3 of phalanx I-1 bears two concavities separated by a bulge, where the distal condyles of
4
5 metacarpal I. The lateral concavity is considerably more marked than the medial one.
6

7 Phalanx I-1 presents intercondylar dorsal and ventral processes, the ventral being the more
8
9 developed. The diaphysis is very short, almost absent. It has undergone a torsion of
10
11 approximately 40 °. In medial view, the dorsal and ventral margins of the bone are strongly
12
13 concave. Distally, the ginglymus is more extended ventrally than dorsally. The distal condyles
14
15 are rather large and bear clearly visible collateral fossae (Fig. 15).
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18
19 The second phalanx of the manual digit IV (MNHN.F.LES101, LES105) have been identified
20
21 based on its small size and on the asymmetry of its proximal and distal articular surfaces. The
22
23 proximal articular surface is trapezoidal in outline and its width is almost equal to its height.
24
25 The distal condyles are deeply divided with shallow collateral pits and extend ventrally.
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30 **Pelvic Girdle**

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32
33 **Right Ilium [MNHN.F.LES375a]**—The right ilium is complete, although very
34
35 cracked. Its bone surface is very damaged, not to say, completely removed. A bone fragment
36
37 of several centimeters is missing on the supracetabular crest, in the posterodorsal area of the
38
39 pubic peduncle. Another fragment is missing at the junction between the posterodorsal border
40
41 of the ischial peduncle and the ventral border of the postacetabular process (Fig. 16). The
42
43 ilium is robust, large and typical, in morphology, of what is usually observed in prosauropod
44
45 dinosaurs. It is 590 mm long, from the extremity of the preacetabular process to the one of the
46
47 postacetabular process. The minimum anteroposterior length of the ilium is above the
48
49 acetabulum and equals approximately 60% of the maximum length of the bone. The
50
51 maximum height of the ilium is 370 mm (Table 6).
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55 The dorsal border of the ilium is sigmoid in lateral view. The dorsalmost point is practically at
56
57 the center of the anteroposterior axis of the ilium, above the anterior margin of the ischial
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3 peduncle. The lowest point of the dorsal margin is at the level of the preacetabular process
4 (Fig. 16A). In dorsal view, the medial border of the ilion is convex and its lateral border is
5 concave (Fig. 16C). Transversely, the iliac blade is 3 to 4 cm wide, measured on its dorsal
6 border. The thinnest part of the blade is at the level of the concavity occupying the central part
7 of the iliac blade and extending ventrally until a point close to the acetabulum. Some basal
8 sauropodomorphs, like *Lufengosaurus* or *Riojasaurus*, show the same concavity on their
9 ilium, located much more dorsally. Above the acetabulum, the iliac blade height equals
10 approximately half of the entire height of the ilium. It is less extended dorsoventrally than in
11 *Meroktenos*. The medial surface of the iliac blade is flat, both ventrally and dorsally, but
12 presents a marked concavity on its central part, where the insertion of the sacral vertebrae is
13 located (Fig. 16B).

14
15 The preacetabular process is suboval with a rounded extremity in lateral view. It is the most
16 common shape in prosauropod dinosaurs, although in some genera, like *Adeopapposaurus* or
17 *Anchisaurus*, the extremity is sharper. Here the process is as high as long, its height
18 representing approximately 90% of its length. The length of the preacetabular process equals
19 18% of the ilium entire length and 53% that of the postacetabular process (Table 6). The
20 lateral surface of the preacetabular process is flat and its medial surface concave. In lateral
21 view, the dorsal and ventral margins are slightly convex and meet at the rounded extremity.
22 The preacetabular process is oriented at approximately 50 ° of the pubic peduncle, and its
23 distal margin is posterior to the anterior projection of the latter (Fig. 16A, B).

24
25 The postacetabular process is subtriangular with a rounded distal extremity. In several genera
26 like *Jingshanosaurus*, *Lessemsaurus* or *Yunnanosaurus*, the process has a subrectangular
27 shape. Its minimum height (at the level of the extremity) equals approximately 55% of its
28 maximum height. It is longer than the preacetabular process and represents 34% of the ilium
29 length (Table 6). The lateral surface of the postacetabular process is convex on its dorsal part
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3 and flat on its ventral part. The medial surface is flat to very slightly concave. In lateral view,
4
5 the dorsal margin of the postacetabular process is slightly concave, its ventral margin is
6
7 straight and oblique, following an angle of approximately 45 °, relative to the horizontal. As
8
9 in most sauropodomorphs else than *Eoraptor*, *Panphagia* or *Saturnalia*, there is no brevis
10
11 crest and, by extension, no visible brevis fossa on the ventral surface of the postacetabular
12
13 process (Fig. 16D).
14
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16
17 The acetabulum is completely open, in contrast of what can be observed in *Chromogisaurus*,
18
19 *Panphagia* or *Saturnalia*, and shows similar proportions than in most prosauropod genera.
20
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22
23 The acetabulum is semicircular and slightly longer than high (Fig. 16A-B). It presents an
24
25 intermediate structure between the very low and elongated acetabulum of some basal forms as
26
27 *Eoraptor* or *Panphagia* and those, narrower, observed in *Lessemsaurus* or *Sarawsaurus*. The
28
29 supracetabular crest rises quite abruptly on the dorsal area of the pubic peduncle and runs
30
31 along the dorsal border of the acetabulum (Fig. 16A). It extends posteriorly until the base of
32
33 the ischial peduncle, where it merges gradually with the lateral bone surface. The
34
35 supracetabular crest is eroded, but does not seem to have been laterally developed. It is
36
37 approximately 2 cm at its widest point, that is to say on the dorsal area of the pubic peduncle.
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40
41 The acetabular wall is very wide transversely, a bit wider at the base of the pubic peduncle
42
43 than at the one of the ischial peduncle. The anterior and anterodorsal surfaces of the wall are
44
45 concave. More posteriorly, in the area where the supracetabular crest loses thickness, the
46
47 acetabular wall gets flatter. It is completely flat at the level of the ischial peduncle. As in
48
49 many sauropodomorph dinosaurs, the acetabular wall is oriented ventrolaterally, particularly
50
51 on its posterior part.
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54
55 The pubic peduncle extends anteroventrally on 195 mm. It is trapezoidal, robust, and clearly
56
57 longer than the ischial peduncle. In lateral view, its anterior and distal margins appear
58
59 straight. Its posterior margin is concave both laterally and medially (Fig. 16A). In distal view,
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2
3 the pubic peduncle has a subtriangular shape, with a strongly convex anterior border and a
4
5 concave posterior border. The posteromedial corner of the articular surface bears a projection
6
7 which, probably due to erosion, appears slightly rounded. Taking this projection into account,
8
9 the transverse width of the articular surface of the pubic peduncle equals approximately 75%
10
11 of its maximum anteroposterior length (Table 6).
12
13

14 The ischial peduncle is projecting ventrally and slightly posteriorly on approximately
15
16 110 mm. It is stout and relatively developed and represents a little more than half the length of
17
18 the pubic peduncle (Table 6). This morphology is widespread among basal sauropodomorphs,
19
20 as opposed to that of sauropod dinosaurs, in which the ischial peduncle usually shows an
21
22 extreme reduction (Upchurch et al., 2004). The ischial peduncle, despite its broken
23
24 posterodorsal margin, appears subrectangular. In lateral view, its anterior margin is straight
25
26 and its incomplete posterior border is slightly concave. This concavity induces a posterior
27
28 projection of the posteroventral corner of the peduncle (Fig. 16A-B). This morphological trait
29
30 is observed in many prosauropod genera, in a more or less marked manner. It is in
31
32 *Plateosaurus* (Moser, 2003) and *Riojasaurus* that the projection is the most visible. In distal
33
34 view, the ischial peduncle is almost square, the length and the width of the articular surface
35
36 being nearly equivalent (Table 6). The anterior and medial margins of the peduncle are
37
38 straight, whereas its posterior and lateral margins are slightly convex (Fig. 16D).
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3 **Left Pubis [MNHN.F.LES378]**—For the need of the description, the pubis is
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5 described with its long axis oriented horizontally. Following this orientation, the flat surfaces
6
7 of the pubic apron are oriented strictly dorsally and ventrally, and the iliac peduncle is
8
9 oriented posteriorly. In vivo, the pubes were oriented at a slant angle with respect to the
10
11 longitudinal axis of the animal, with the surface of the pubic apron oriented anterodorsally.
12
13 The left pubis of *Kholumolumo* is practically complete, but very badly preserved. The bone
14
15 exhibits numerous fractures, a part of the obturator plate is missing and the medial border of
16
17 the pubic apron is not entirely preserved (Fig. 17). The extreme fragility of the pubic apron
18
19 prevented us from taking photos in lateral or medial views; nevertheless, one illustration is
20
21 available in the work of Gauffre (1996, annexe 2). The pubis, in spite of its robust aspect, is
22
23 elongated and has a total length of 665 mm (Table 6). In dorsal and ventral views, the pubis is
24
25 subrectangular with a straight lateral margin, which has a slight concavity on the proximal
26
27 part of the bone (Fig. 17). This morphology is very similar to the one of *Meroktenos* or
28
29 *Melanorosaurus* (NM QR1551) and is different from specimens in which a marked concavity
30
31 is visible on the lateral border at the distal extremity of the pubis, and from specimens in
32
33 which even the central part of the lateral border is concave, as in *Coloradisaurus* or
34
35 *Lessemsaurus*.

36
37 The pubis obturator plate is incomplete, but still retains a visible obturator foramen, iliac and
38
39 ischial peduncles, as well as the acetabular area. It is 215 mm long, 32% of the total length of
40
41 the pubis, and its maximum width under the obturator foramen equals 37% of the total length
42
43 of the bone (Table 6). The iliac peduncle is much more developed than the ischial peduncle.
44
45 Its main axis is oriented dorsolaterally to ventromedially. There is no dorsal marked
46
47 protrusion visible on the dorsolateral area of the obturator plate. The iliac peduncle is twice as
48
49 long as large (Table 6). Its articular surface is flat and appears suboval with convex borders in
50
51 proximal view. The pubic component of the acetabulum is complete and is 75 mm long,
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3 following its main axis. It is located in the continuity of the iliac peduncle and is oriented
4 dorsolaterally to ventromedially. It is short and thin. Its proximal surface is slightly concave.
5
6 In dorsal view, the pubic component of the acetabulum is at right angles to the ischial
7
8 peduncle (Fig. 17A). The ischial peduncle is subcomplete, it lacks some centimeters on its
9
10 most distal part. It has a length almost equivalent to that of the iliac peduncle (Table 6). The
11
12 articular surface of the ischial peduncle is oriented medially to ventromedially. The
13
14 subtriangular ischial peduncle is considerably thinner than the iliac peduncle. The maximum
15
16 width of the peduncle is on its proximal extremity, and is tapering to the distal tip (Fig. 17B).
17
18 The obturator foramen is located on the medial side of the obturator plate, a few centimeters
19
20 anteriorly to the proximal border of the pubis. Its borders appear a bit damaged, but it is
21
22 almost complete, the only bone fragment missing is on the anteromedial margin of the
23
24 foramen. In dorsal and ventral views, the obturator foramen has a subrectangular shape. The
25
26 approximate anteroposterior length of the obturator foramen is 80 mm, that is 37% of the
27
28 length of the obturator plate, and his width equals 63 mm. In dorsal view, the lateral borders
29
30 of the obturator plate and the pubic apron are aligned. Regarding the medial margin of the
31
32 pubis, the junction between the obturator plate and the pubic apron is lacking.
33
34
35 The pubic apron extends, distally to the obturator plate, on 450 mm, that is almost 70% of the
36
37 entire length of the bone. The blade reaches a maximum width of 148 mm a few centimeters
38
39 prior to the distal extremity (Table 6). On the center of the blade, the medial margin of the
40
41 pubic apron is approximately 10 mm high, which is dorsoventrally thinner than the 35 mm
42
43 lateral margin. The dorsal and ventral surfaces of the pubic apron are flat, no bulge nor ridge
44
45 is visible. In dorsal and ventral views, the lateral and medial borders are straight and
46
47 subparallel (Fig.17A). This morphology is similar to what is observed in *Antetonitrus*,
48
49 *Melanorosaurus* (NM QR1551) or *Meroktenos*. In lateral view, the dorsal margin of the pubic
50
51 apron is slightly concave and the ventral margin slightly convex (annexe 2).
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3 In dorsal or ventral views, the distal extremity of the pubis is not laterally widened, unlike in
4 *Yunnanosaurus*. Therefore, the transverse width of the distal extremity is almost equivalent to
5 that of the one taken at the center of the pubic apron. It equals approximately 23% of the
6 pubis total length (Table 6). In lateral or medial views, however, the club-shaped distal
7 extremity gets dorsoventrally wider. Its dorsoventral height is twice the height of the pubic
8 apron, measured on the lateral margin of the latter. In lateral view, the dorsal expansion of the
9 distal extremity is faint. Most of the dorsoventral expansion of the extremity comes from a
10 marked ventral projection, quite like what is observed in *Coloradisaurus*. In lateral view, the
11 distal margin of the pubis appears strongly convex. In ventral and dorsal views, the distal
12 margin of the pubis is also convex, although to a lesser extent. In distal view, the distal
13 extremity has a suboval shape and convex borders.

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31 **Left Ischium [MNHN.F.LES152]**—For the need of the description, we consider here
32 that the ischium pubic peduncle is oriented strictly anteriorly and that the iliac peduncle is
33 oriented anterodorsally.

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37 There is only the proximal part of a left ischium of *Kholumolumo* preserved. It is rather badly
38 preserved and presents several fractures. The bone surface is badly preserved too. The ischial
39 component of the acetabulum is medially damaged (Fig. 18).

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44 The proximal part of the ischium is transversely thin and dorsoventrally expanded. It is
45 usually the thinnest part of the bone which represents, in prosauropod dinosaurs,
46 approximately 30% of the ischium total length. The proximal extremity as it has been
47 preserved, that is broken at the base of the ischium diaphysis, is almost as high dorsoventrally
48 than anteroposteriorly long (Table 6). This ischial plate bears the pubic peduncle, the
49 acetabular area and the iliac peduncle. In lateral view, the dorsal border of the proximal part is
50 strongly convex, the anterior border shows a concavity due to the acetabulum, and the ventral
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3 border is incomplete. The lateral surface of the bone is flat posteriorly to the pubic peduncle,
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5 slightly concave in the area surrounding the acetabulum component, and slightly convex
6
7 behind the iliac peduncle (Fig. 18B). The medial surface of the bone presents a dorsal
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9 convexity just behind the iliac peduncle and a marked concavity on the rest of the surface
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11 (Fig. 18A). The pubic peduncle is located on the anterior part of the proximal extremity of the
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13 ischium (Fig. 18). It is dorsoventrally elongated and, in anterior view, subtriangular and very
14
15 similar in shape to the ischial peduncle of the pubis with which it is articulating. The
16
17 maximum width of the pubic peduncle is located on its dorsal part, and tapers ventrally. This
18
19 maximum transverse width equals approximately 32% of the maximum length of the pubic
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21 peduncle (Table 6). Posteriorly to the pubic peduncle, the ischium ventral margin is damaged
22
23 and broken. It is therefore impossible to determine if a ventral obturator notch was present
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25 between the pubic peduncle and the ischium diaphysis, as it is the case in *Lufengosaurus*,
26
27 *Massospondylus* or *Ruehleia*. The ischial component of the acetabulum constitutes a deep
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29 notch between the pubic peduncle and the iliac peduncle. It is approximately 5 cm deep, with
30
31 respect to the articular surface of the pubic peduncle, but 2 cm deep with respect to the one of
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33 the iliac peduncle (Fig. 18). It represents approximately 45% of the length of both the pubic
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35 and iliac peduncles, and shows almost the same extension as the pubic component of the
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37 acetabulum (70 and 75 mm, respectively) (Table 6). The iliac peduncle is located in the dorsal
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39 area of the ischium proximal extremity. It is approximately the same length as the pubic
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41 peduncle, but its maximum transverse width is more important. The latter equals roughly 44%
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43 of the maximum length of the peduncle (Table 6). In dorsal view, the iliac peduncle shows a
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45 suboval outline, with slightly convex lateral and medial margins (Fig. 18C). Distally to the
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47 iliac peduncle, the posterodorsal border of the ischium proximal extremity shows a marked
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49 concavity merging with the diaphysis of the bone.
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Posterior Member

Right Femur [MNHN.F.LES394]—Several femora, more or less complete, are part of the material referred to *Kholumolumo*. The following description is based on a right, complete, and relatively well-preserved, femur. The most damaged area of the femur is its laterodistal corner, where a bone fragment has been torn off. Several centimeters thick bone fragments are also missing on the anterior surface of the diaphysis, which is covered with numerous cracks. The bone surface is not very well preserved, particularly on the anterior surface of the bone (Fig. 19).

The femur is 755 mm long and is relatively stout. Its robustness index is 2.36, that is quite close to those of some specimens like *Massospondylus*, *Melanorosaurus* (NM QR1551) and *Plateosaurus* (Table 7). In anterior and posterior views, the femur has a slightly sigmoid shape (Fig. 19A, C). In lateral and medial views, the femur is curved at the level of its distal extremity. On the first three quarters of its length, the anterior and posterior margins of the femur are straight. On its distal extremity, the anterior margin is convex and the posterior one is concave (Fig. 19B, D). The femoral head has undergone a rotation of approximately 30 ° relatively to the transverse axis of the distal condyles.

In anterior and posterior views, the femoral head is rounded and projects at approximately 90 ° with respect to the main axis of the bone. The head of the femur is higher dorsoventrally than transversely elongated. In proximal view, it is oval, all its margins are convex and its transverse length equals twice its anteroposterior width (Table 7). The long transverse axis of the head is oriented strictly transversely (Fig. 19E).

The femur diaphysis is subcircular and more robust than in most other basal sauropodomorphs that have a similar morphology. It has an eccentricity of 1.16. The diaphysis is slightly thinner transversely on its center than on its proximal and distal extremities (Fig. 19A). The lesser trochanter is located on the anterior surface of the femur, in

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3 the proximal area of the diaphysis. It is a low ridge extending proximodistally, at the center of
4 the transverse axis of the diaphysis. In comparison, *Lessemsaurus* or *Riojasaurus* display very
5 high lesser trochanters. The lesser trochanter is not visible in posterior view. Its proximal
6 extremity is lower than the ventral margin of the femoral head. The lateral border of the lesser
7 trochanter is higher and better defined than the medial border (Fig. 19A). On the posterior
8 surface of the diaphysis, the fourth trochanter is quite developed. Its proximal extremity is
9 located 280 mm under the proximal margin of the bone and is 145 mm long, that is 19% of
10 the entire length of the femur (Table 7). The fourth trochanter extends beyond the median
11 point of the femur proximodistal axis. In posterior view, it is straight, as in *Coloradisaurus*,
12 *Lessemsaurus* or *Melanorosaurus* (NM QR1551). The proximal extremity of the fourth
13 trochanter is slightly curved medially with respect to the rest of the structure. This extremity
14 is located in the medial quarter of the diaphysis transverse axis. The distal extremity of the
15 fourth trochanter is in the mediocentral quarter of the diaphysis (Fig. 19C). In lateral view, the
16 fourth trochanter is asymmetrical and subrectangular. Its proximal margin rises gradually
17 from the diaphysis, whereas its distal margin is steep and straight (Fig. 19B). In between, the
18 apical border of the trochanter is straight. It is, however, oblique with respect to the long axis
19 of the femur, because its proximal height is more important than its distal one. Regarding the
20 shape, the closest fourth trochanter is observed in *Riojasaurus*, even if in the latter, the apical
21 margin of the trochanter is subparallel to the femur main axis instead of being oblique. In
22 cross-section, the fourth trochanter of *Kholumolumo* is subtriangular in its proximal part and
23 suboval in its distal part.

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51 The distal extremity of the femur is incomplete. Its transverse width equals approximately 1.5
52 times that of the center of the diaphysis (Table 7). In anterior view, the bad preservation of the
53 fossil prevents us from checking the presence of an extensor groove (Fig. 19A). In posterior
54 and distal views, a marked popliteal fossa is visible between the distal condyles (Fig. 19C, F).

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3 The femur distal condyles are rounded. In medial view, the medial condyle has a strongly
4 convex posterior border and a straight to slightly convex ventral border (Fig. 19D). The
5 tibiofibular crest is rather marked and well visible in lateral view. The transverse width of the
6 distal extremity of the femur is superior to its anteroposterior extension (Table 7). The medial
7 condyle appears to be approximately the same size as the lateral and fibular condyles put
8 together, even though we cannot say it with certainty because of the deformation (Fig. 19F).

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17 **Right Tibia [MNHN.F.LES381m]**—The *Kholumolumo* tibia is complete, but not
18 particularly well-preserved. Its bone surface is damaged and depressed in some areas,
19 particularly on the lateral surface of the bone. The tibia diaphysis is covered in numerous
20 fractures and cracks. The proximal and distal extremities of the bone are not completely
21 prepared and the posteromedial corner of the proximal articular surface is broken (Fig. 20).
22 The tibia exhibits a short and stocky morphology. It is straight, with widened proximal and
23 distal extremities in anterior and posterior views (Fig. 20A, C). The proximal extremity also
24 appears slightly extended in lateral and medial views (Fig. 20B, D). It is clearly more robust
25 than the distal extremity, and is not in the same axis as the latter due to a torsion at the level of
26 the diaphysis.

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40 The proximal articular surface of the tibia seems flat and bears, as in all the prosauropod
41 dinosaurs, a cnemial crest as well as two condyles. In proximal view, without considering the
42 cnemial crest, the articular surface is subcircular. Considering the cnemial crest, the surface is
43 suboval and appears 1.6 times more extended anteroposteriorly than transversely (Table 7). In
44 *Kholumolumo*, the long axis of the proximal articular surface is oriented anteroposteriorly and
45 slightly laterally. In proximal view, the anterior margin of the proximal articular surface is
46 strongly convex. The lateral margin is sigmoid as a result of the depression adjacent to the
47 cnemial crest. The posterior and medial margins are convex (Fig. 20E). The cnemial crest is
48 oriented anterolaterally and measures on its most proximal part 50 mm, that is 24% of the
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3 total anteroposterior length of the articular surface (Table 7). In lateral view, the dorsalmost
4 point of the cnemial crest is near its proximal extremity. On the anterior part of the bone, the
5 cnemial crest is not well defined. Nonetheless, it seems to extend on 10 to 15 cm
6
7 proximodistally, on which it is losing height. The depression visible in proximal view is also
8 exposed in lateral view, and separates the cnemial crest from the proximal lateral condyle.
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10 The latter, which is oval, clearly appears in proximal view and seems to extend on almost all
11 the length of the surface, posteriorly to the cnemial crest. The lateral condyle represents
12 approximately 65% of the anteroposterior length of the proximal surface. In proximal view,
13 the proximal medial condyle is extending as posteriorly as the lateral condyle, but its anterior
14 extension is more limited. The intercondylar groove, which usually defines the two condyles,
15 is not visible in proximal view (Fig. 20E). In medial and lateral views, the medial condyle
16 seems to be projecting less dorsally than the lateral one. In anterior and posterior views, the
17 medial and lateral margins of the tibia proximal extremity are convex and, more ventrally,
18 slightly concave at the level of the transition with the diaphysis.

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The tibia diaphysis is large and stocky. It is cylindrical with parallel margins in anterior and
posterior views (Fig. 20A, C). In medial and lateral views, the diaphysis borders are getting
closer distally. Hence, the anteroposterior extension of the diaphysis is reduced from 120 mm
proximally to 90 mm near the distal extremity of the bone (Fig. 20B, D). At mid-length, the
cross-section of the tibia is oval, the anteroposterior extension of the bone being superior to its
transverse width (Table 7).

The distal extremity of the tibia is approximately the same transverse width as its proximal
extremity, and therefore appears transversely extended. However, its anteroposterior
extension is considerably inferior to that of the proximal extremity, given that the distal
extremity exhibits practically the same extension as the diaphysis in medial and lateral views.
The distal extremity is 2.3 times larger transversely and 1.2 times more extended

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3 anteroposteriorly than the diaphysis (Table 7). As in all sauropodomorph dinosaurs, the distal
4 processes of the tibia are projecting laterally. On this *Kholumolumo* specimen, their distal
5 extremities are slightly weathered. Le processus postérodistal s'étend plus ventralement que
6 l'antérodistal. En vue antérieure, le processus antérodistal dissimule en grande partie le
7 postérodistal (Fig. 20A) et en vue postérieure, l'inverse se produit (Fig. 20C). Les deux
8 processus ont une forme subtriangulaire avec un bord dorsolatéral droit. The distal articular
9 surface of the tibia is flat to slightly convex. In distal view, it appears suboval with convex
10 medial and posterior margins, a slightly concave anterior border, and a strongly concave
11 lateral margin due to the presence of distal processes. The anteroposterior extension of the
12 distal surface equals 78% of its transverse width (Table 7). The maximum anteroposterior
13 extension of the distal extremity is located at the center of the articular surface. Despite all
14 this, the lateral margin is more extended anteroposteriorly than the medial one. The
15 anteromedial corner of the distal extremity is rounded, it forms an angle of approximately 100
16 ° (Fig. 20F).

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35 **Right Fibula [MNHN.F.LES374]**—The right fibula is subcomplete. The proximal
36 extremity is incomplete, the anteroproximal and posteroproximal corners are broken. The
37 distal extremity of the fibula is also damaged, its lateral surface being eroded and the
38 posterodistal corner being broken. The bone diaphysis shows seven fractures and some
39 cracks. The bone surface is relatively well-preserved, even though it has been removed in
40 some places (Fig. 21). The fibula is 575 mm long, it is elongated and relatively thin (Table 7).
41 The main axis of the bone exhibits a torsion of approximately 20 °.
42 The proximal extremity of the fibula is incomplete, but still remains the most
43 anteroposteriorly extended part of the bone. In medial and lateral views, it is subtriangular
44 (Fig. 21B, D). The lateral surface of the proximal extremity is slightly convex, and its medial
45 surface is slightly concave. The latter exhibits a rough texture, due to the articulation surface
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3 for the tibia. On the medial surface, a poorly defined proximomedial tubercle, which is only a
4 few millimeters high, is visible. This structure is also observed in *Aardonyx*, *Antetonitrus*,
5 *Coloradisaurus* or *Ruehleia*. In proximal view, the articular surface is crescentic. Its
6 transverse width equals 33% of its anteroposterior extension. The lateral border of the
7 articular surface is convex in proximal view, and its medial border is concave (Fig. 21E). The
8 proximal articular surface is smooth and slightly convex in lateral view.
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17 The diaphysis is straight with subparallel margins in medial and lateral views. The
18 anteroposterior extension of the fibula diaphysis decreases distally, going from 58 mm
19 underneath the proximal extremity, to 38 mm above the distal extremity (Fig. 21B). In
20 anterior and posterior views, the margins of the diaphysis are also subparallel, even though
21 the lateral one appears slightly convex and the medial one slightly concave. The diaphysis
22 tapers slightly between the proximal extremity and the distal one (Fig. 21A). At mid-length,
23 the cross-section of the fibula is elliptical, with a long axis directed anteroposteriorly (Table
24 7). In the anterolateral area of the diaphysis, at approximately twenty centimeters distally to
25 the proximal extremity of the bone, a poorly defined bulge probably corresponding to the
26 fibular trochanter is present. On the medial surface of the diaphysis, two longitudinal
27 concavities are visible. The most proximal one is at approximately twenty centimeters of the
28 proximal border of the fibula. It is about 5 cm long proximodistally and is surrounded by a
29 posterior bulge. The second concavity appears under the preceding one, and extends on more
30 or less 10 cm. It is bordered by a bulge posteriorly and a ridge anteriorly (Fig. 21D).
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49 The distal extremity of the fibula exhibits a subtriangular shape in lateral view. It is less
50 extended anteroposteriorly than the proximal extremity and should represent approximately
51 70% of the latter. With respect to the anteroposterior extension at mid-diaphysis, the distal
52 extremity is practically twice more extended (Table 7). The medial surface of the distal
53 extremity bears an anterior shallow concavity, posteriorly surrounded by a small bulge. The
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3 distal articular surface of the fibula articulates with the calcaneum and astragalus and appears
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5 flat to slightly convex in lateral and medial views (Fig. 21B, D). In distal view, the extremity
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7 is oval, and its transverse width equals approximately 50% of its anteroposterior extension
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9 (Fig. 21F).

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12 **Pes**—The pes of *Kholumolumo* is known by several metatarsals and phalanges. A
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14 complete right pes is stored in Cape Town (obs. pers., 2014). Unfortunately, the MNHN
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16 material only comprises a very incomplete pes (MNHN.F.LES381), as well as isolated
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18 metatarsals and phalanges, coming from several individuals. The phalanges are not easily
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20 identifiable, we will therefore propose in what follows a description of the metatarsus only.
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22 The metatarsals are subcomplete and present some cracks. The quality of preservation differs
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24 from bone to bone. On the whole, however, the bone surface is rather badly preserved (Fig.
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27 22).

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30 As in all basal sauropodomorphs, the metatarsals articulate via the proximolateral surface of
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32 the most medial element recovering partially the proximomedial area of the following
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34 metatarsal. *Kholumolumo* metatarsus is one of the stockiest among prosauropod dinosaurs. It
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36 is, more or less, as robust as the metatarsus of *Antetonitrus* or *Melanorosaurus* (NM QR1551
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38 & NM QR3314), but still remains more elongated than the one of *Blikanasaurus*. Thus, the
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40 ratio of the proximal transverse width on the length of the metatarsal I is 47% in
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42 *Kholumolumo* and 87% in *Blikanasaurus*.

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45 The left metatarsal I of *Kholumolumo* (MNHN.F.LES89), despite its robust appearance,
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47 remains longer than wide (Table 7). In dorsal view, the proximal margin of the metatarsal I is
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49 straight, its lateral and medial borders are concave and its distal margin is convex. In lateral
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51 view, its dorsal and ventral margins are concave. The proximal articular surface of the
52
53 metatarsal I is eroded and appears flat to slightly convex. In proximal view, the extremity is
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55 subquadrangular with relatively straight borders. The diaphysis of metatarsal I shows a
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3 strongly elliptical cross-section and convex margins. The minimum width of the diaphysis
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5 equals 66% of the proximal width of the bone. The distal extremity of metatarsal I bears two
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7 distal condyles, one of which (the medial one) is broken. It, however, seems that the condyles
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9 were asymmetrical, the lateral projecting more distally than the medial. The lateral part of the
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11 distal lateral condyle is damaged and does not exhibit a collateral ligament fossa. On the distal
12
13 lateral condyle, the ginglymus is not more developed ventrally than dorsally. Ventrally, a
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15 marked groove separates the two distal condyles (Fig. 22).

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18 The left metatarsal II (MNHN.F.LES81) is subcomplete. Its proximal extremity is incomplete
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20 and its distal extremity is eroded, however, the total length of the bone seems to have been
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22 preserved. In dorsal view, the lateral and medial borders of the metatarsal II are slightly
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24 concave, while its distal margin is convex. In lateral view, the dorsal and ventral borders of
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26 metatarsal II are concave. The diaphysis of metatarsal II is straight with concave margins. The
27
28 cross-section is elliptical, being more extended transversally than dorsoventrally. At the level
29
30 of the distal extremity, both distal condyles are separated by a small distal depression and a
31
32 shallow ventral groove. The collateral fossa is not visible on the medial side of the metatarsal,
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34 and is shallow on its lateral side. In medial view, the ginglymus appears more extended
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36 ventrally than dorsally (Fig. 22).

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39 The metatarsal III is usually the longest element of the metatarsus. On the left metatarsal III
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41 of *Kholumolumo* (MNHN.F.LES82), the proximal width of the bone equals 36% of its entire
42
43 length (Table 7). In dorsal view, the lateral and medial borders of the metatarsal are concave.
44
45 On the proximomedial part of the bone, we can see the articulation facet receiving the
46
47 metatarsal II. In medial view, the proximal part of the bone is more extended dorsoventrally
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49 than its distal part. The proximal area is damaged, especially on the edges. The proximal
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51 articular surface is concave, and in proximal view it appears subtriangular with an oblique
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53 long axis. The metatarsal III diaphysis is straight with concave margins and an elliptical
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3 cross-section. Distally, the distal condyles are not well developed and separated by a slight
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5 groove. The collateral fossa is not visible on the medial side of the bone and is shallow on its
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7 lateral side. On the dorsal surface of the metatarsal III, posteriorly to the distal condyles, a
8
9 small crescentic fossa is visible (Fig. 22). This fossa is also visible in other genera, like
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11 *Coloradisaurus* or *Mussaurus*.
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14 The metatarsal IV is usually a bit longer than the metatarsal II. Here, the transverse width of
15
16 the proximal extremity of the left metatarsal IV (MNHN.F.LES381c) equals 44% of the entire
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18 length of the bone (Table 7). In dorsal view, the proximal extremity is much more extended
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20 transversely than the distal one. The lateral and medial borders of the metatarsal IV are
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22 concave, the lateral being more concave than the medial one. In medial view, the dorsal and
23
24 ventral margins are concave too. The proximal and distal extremities show the same
25
26 dorsoventral extension. The proximomedial area of the metatarsal IV presents an articulation
27
28 facet receiving the metatarsal III, bordered by a thin dorsal ridge which merges with the
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30 proximal articular surface of the bone. The latter is flat. In proximal view, it exhibits a
31
32 subtriangular outline with a long transverse axis and a concave ventral margin. The diaphysis
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34 has concave margins, it is straight, and is transversely extending towards the proximal
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36 extremity of the metatarsal. The minimum transverse width of the diaphysis is a few
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38 centimeters away from the distal extremity of the bone. The cross-section of the diaphysis is
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40 strongly elliptical. In dorsal view, the distal extremity of the metatarsal IV is very slightly
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42 asymmetrical, the medial distal condyle projecting a little more distally than the lateral one.
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44 The two distal condyles are separated by a groove, as observed in the preceding metatarsals.
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46 The medial distal condyle does not bear a visible collateral fossa, while the distal lateral
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48 condyle exhibits a marked one (Fig. 22).
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55 The metatarsal V is a vestigial element, and consequently, the shortest element of the
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57 metatarsus. The metatarsal V of *Kholmolumo* (MNHN.F.LES77) is strongly asymmetrical,
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3 unlike in *Adeopapposaurus*, *Coloradisaurus* or *Mussaurus*. Based on the comparison with
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5 other asymmetrical metatarsals V, we suppose that this is a left element. The metatarsal V is
6
7 stout and almost as wide as long, its proximal width representing 83% of its length (Table 7).
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9 In lateral view, the dorsal and ventral margins of the bone are concave and the dorsoventral
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11 extension of both extremities is almost the same. In medial view, the distal extremity is more
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13 developed dorsoventrally than the proximal one. In dorsal view, the metatarsal V exhibits
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15 concave medial and lateral margins, the medial one being much more concave than the lateral.
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17 The proximal articular surface of the bone is slightly damaged but appears slightly convex. In
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19 proximal view, it is subtriangular. The diaphysis of the bone is very short. Distally, the
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21 metatarsal V extremity equals 37% of its proximal extremity in width. The distal extremity is
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23 convex and shows no condyles nor collateral fossae (Fig. 22).
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32 ANATOMICAL COMPARISONS

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35 Among basal sauropodomorphs, twelve genera other than *Kholumolumo* are known from the
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37 Late Triassic of southwestern Gondwana (southern Africa and South America). Of these,
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39 *Euskelosaurus*, which is currently considered a nomen dubium by most authors (Yates, 2004),
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41 is not included in the following comparisons. Given their very dissimilar anatomy, the small
42
43 and gracile forms such as *Eoraptor* (Serenó et al., 2013), *Pampadromeus* (Cabreira et al.,
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45 2011), *Saturnalia* (Langer et al., 1999) and the like are not taken into account in this amount.
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52 **Comparison with Large Basal Sauropodomorphs from the Upper Triassic of Southern** 53 54 **Africa**

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57 The main differences between *Blikanasaurus* and *Kholumolumo* are located on the tibia. The
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59 excavation of the proximal part and the curvature of the posterior edge of the tibia of
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3 *Blikanasaurus* are not considered here, both being presumably pathological (Galton and Van
4 Heerden, 1998:164). In *Blikanasaurus*, the shaft of the tibia is triangular in cross-section,
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6 whereas it is oval in *Kholumolumo*. In lateral view, the tibia of *Blikanasaurus* is more curved,
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8 with a proximal extremity more extended anteroposteriorly relatively to the shaft. The distal
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10 articular surface of the fibula is asymmetrical in lateral view in *Blikanasaurus*, whereas it is
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12 subsymmetrical in *Kholumolumo*. Finally, the metatarsals of *Blikanasaurus* are stockier (with
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14 a superior width/length ratio at midshaft), especially the metatarsals II and III.
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18 In *Eucnemesaurus*, the posterior tubercle and the lesser trochanter of the femur are much
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20 more developed than in *Kholumolumo*. The rounded fourth trochanter is part of the generic
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22 diagnosis of *Eucnemesaurus* (McPhee et al., 2015). It is rounded and subsymmetrical in
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24 profile, whereas it is both angular and asymmetrical in *Kholumolumo*. Furthermore, a fourth
25
26 trochanter with a curved and oblique long axis is diagnostic of *E. fortis* (Yates, 2007a:96). In
27
28 *Kholumolumo*, it appears straight in posterior view.
29
30

31
32 The syntype series of *Melanorosaurus readi* originally included several elements of the
33
34 members, pelvis, as well as some vertebrae (Haughton, 1924). Unfortunately, some of these
35
36 pieces are currently lost. The femur and the proximal half of a humerus were found in a
37
38 higher stratigraphic layer than the remaining type materials. They are thus excluded from the
39
40 syntype series. The tibia (SAM-PK-3449) of *M. readi* shows a more curved diaphysis in
41
42 lateral view and its posterodistal process extends further distally (relatively to the anterodistal
43
44 process) than in *Kholumolumo*. In proximal view, the cnemial crest is less developed in *M.*
45
46 *readi* than in *Kholumolumo*. Considering the ulnae, the olecranon is more developed
47
48 proximally and the radial fossa is deeper in *M. readi* than in *Kholumolumo*.
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50

51
52 The material referred to *Melanorosaurus readi* catalogued under the accession number NM
53
54 QR1551 includes vertebrae (mostly caudals), some bones from the pectoral and pelvic girdles
55
56 and many bones from both members (Van Heerden and Galton, 1997). The centrum of the
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1
2
3 posterior cervical vertebrae is much anteroposteriorly longer than dorsoventrally high in NM
4 QR1551, whereas it is almost as long as high in *Kholumolumo*. The neural arch is
5
6
7 dorsoventrally lower: its height is inferior to what is observed in *Kholumolumo* relatively to
8
9
10 the total height of the vertebra. The scapula is stouter in *Kholumolumo* than in *M. readi*. In the
11
12
13 latter, the blade appears longer relative to the total length of the bone, and its lateral borders
14
15 are straight and subparallel in lateral view. Conversely, the lateral borders are curved in
16
17 *Kholumolumo*. The articular surface of the proximal end of the ulna of *M. readi* is triangular
18
19 in proximal view, with the anteromedial and anterolateral processes subequal in length. In
20
21 *Kholumolumo* the articular surface is more pear-shaped, with an anteromedial process much
22
23 more developed than the anterolateral one. The postacetabular process of the ilium of *M.*
24
25 *readi* is anteroposteriorly elongated and exhibits a subrectangular extremity, while the
26
27 extremity is shorter and more rounded in *Kholumolumo*. The dorsal margin of the ilium is
28
29 straight in lateral view of *M. readi*, but sigmoid in *Kholumolumo*. In dorsal view, the dorsal
30
31 border of the iliac blade is much thinner, at its central point, in NM QR1551. The lateral
32
33 margin of the pubis is more curved throughout its length in anterior view in *M. readi* than in
34
35 *Kholumolumo*. Finally, the femur of *M. readi* differs from that of *Kholumolumo* in various
36
37
38 ways: in anterior view, the main axis of the femur is straight and its femoral head is projecting
39
40
41 less medially. On the anterior surface, the lesser trochanter of *M. readi* is laterally located and
42
43 more developed with a marked proximal extremity. On the posterior surface, the fourth
44
45 trochanter is located more medially than in *Kholumolumo* and, in lateral view, it is low and
46
47 rounded. In distal view, the articular surface is wider transversely than anteroposteriorly long
48
49
50 in *M. readi*, whereas it is almost as wide as long in *Kholumolumo*.

51
52
53 The second specimen referred to *Melanorosaurus readi* NM QR3314 is represented by a
54
55 poorly preserved but articulated skeleton. On the skull, the postorbital of NM QR3314
56
57
58 presents a marked step between its anterior and posterior processes in lateral view, step not
59
60

1
2
3 visible in *Kholumolumo*. In dorsal view, the posterior process of the postorbital is laterally
4
5 convex in NM QR3314, but appears straight in *Kholumolumo*. The radial fossa of the ulna of
6
7 NM QR3314 is deeper and the anterolateral process is more developed than in *Kholumolumo*.
8
9 Also, the posteromedial corner of the proximal articular surface appears more elongated and
10
11 sharper than in *Kholumolumo*.
12
13

14 The genus *Meroktenos* is known from an incomplete skeleton, including a femur and two
15
16 elements of the pelvis. The material referred to *Meroktenos* strongly differs from
17
18 *Kholumolumo* in terms of size and proportions. A comprehensive comparison between the
19
20 two taxa is available in the original publication of *Meroktenos thabanensis* (Peyre de
21
22 Fabrègues and Allain 2016:21).
23
24

25
26 The material referred to *Plateosauravus* (Van Heerden, 1979) might be among the most
27
28 resembling *Kholumolumo*. On the anterior dorsal vertebra of *Plateosauravus* (SAM-PK-
29
30 3345a) the postzygapophyses are at the same level as the prezygapophyses. In *Kholumolumo*,
31
32 the articular surface of the postzygapophyses are more dorsally located than the
33
34 prezygapophyses. In *Plateosauravus*, the anterior border of the neural spine is posterior to the
35
36 anterior margin of the diapophyses, whereas it is anterior to the anterior margin of the
37
38 diapophyses in *Kholumolumo*. The humeri of *Plateosauravus* (SAM-PK-3350 and 3342) are a
39
40 bit stockier and their humeral head is less marked than in *Kholumolumo*. The ilium of
41
42 *Plateosauravus* (SAM-PK-3609) is more elongated than the one of *Kholumolumo* (H/L ratio
43
44 = 0.53 versus 0.63, respectively). Its dorsal margin appears straight in lateral view and the
45
46 postacetabular process is subrectangular in *Plateosauravus*. In *Kholumolumo*, the dorsal
47
48 margin is sigmoid and the postacetabular process is more rounded.
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57 **Comparison with Massive Basal Sauropodomorphs from the Upper Triassic of Southern** 58 59 **America** 60

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3 Several cranial (Apaldetti et al., 2014) and postcranial elements of *Coloradisaurus* (Apaldetti
4 et al., 2013) can be compared with the material referred to *Kholumolumo*. In *Coloradisaurus*,
5 the posterior process of the postorbital is thicker and shorter, the scapula is much slender with
6 a gracile outline, the deltopectoral crest of the humerus projects more anteriorly and is more
7 rectangular in lateral view. On the pubis, the lateral border of the bone is strongly concave in
8 *Coloradisaurus*, whereas it is straight in *Kholumolumo*. In lateral view, the distal extremity of
9 the pubic apron is more developed anteroposteriorly in *Coloradisaurus*. The femur is straight
10 in posterior view with a fourth trochanter located in the proximal half and rounded in lateral
11 view. In *Kholumolumo*, it is slightly sigmoid in posterior view, with a fourth trochanter more
12 distally located and subrectangular. The tibia is much stockier in *Kholumolumo*. Finally, the
13 metatarsal V of *Kholumolumo* is strongly asymmetrical, unlike in *Coloradisaurus* in which it
14 is subsymmetrical.

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31 *Lessemsaurus* is known by numerous postcranial elements (Pol and Powell, 2007). The
32 acromion process of the scapula of *Lessemsaurus* is subrectangular, when it is rounded in
33 *Kolumolumo*. The posterodorsal corner of the scapular blade projects much more posteriorly
34 compared to *Kholumolumo*. The distal and proximal ends of the humerus are more expanded
35 transversely, relatively to the shaft, in *Lessemsaurus*. In *Kholumolumo*, the humeral head also
36 presents a distinctive bump in anterior view which is not visible in *Lessemsaurus*. There are
37 several main discrepancies in the pelvic girdle. The postacetabular process of the ilium is
38 subrectangular in *Lessemsaurus*, whereas it is subtriangular with a rounded distal extremity in
39 *Kholumolumo*. The acetabulum is higher and narrower in *Lessemsaurus*. In dorsal view, the
40 pubis exhibits a strongly concave lateral border in *Lessemsaurus*. In *Kholumolumo*, the lateral
41 border is straight with a slight concavity on the proximal part of the bone. The lesser
42 trochanter of the femur appears high and well-developed in *Lessemsaurus*, whereas it is very
43 low in *Kholumolumo*. The fourth trochanter of *Lessemsaurus* is located near the medial
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3 margin of the diaphysis in posterior view, whereas it is at the center of the diaphysis in
4
5 *Kholumolumo*. Finally, the distal extremity of the tibia is much more extended relatively to its
6
7 width at midshaft in *Lessemsaurus*, in lateral view.
8

9
10 Quite a few postcranial elements are known from *Mussaurus* (Otero and Pol, 2013). The
11
12 postzygapophyses of the anterior dorsal vertebrae are larger and project more laterally in
13
14 *Kholumolumo* than in *Mussaurus*. In posterior view, the postzygapophyses are very high
15
16 compared to the position of the diapophyses in *Kholumolumo*, whereas they are practically at
17
18 the same height in *Mussaurus*. The scapulae differ a lot from each other. The scapula of
19
20 *Mussaurus* is slender and gracile, while the one of *Kholumolumo* is stout and large. In
21
22 *Mussaurus*, the ratio of the minimal transverse width at midshaft of the scapula relatively to
23
24 its maximum transverse width on the proximal extremity is much inferior. The metacarpal I of
25
26 *Mussaurus* is longer than large, while it is almost as long as large in *Kholumolumo*. The
27
28 phalanx I.1 of the manus exhibits discreet condyles in dorsal and ventral views, while they are
29
30 bulging and bulbous in *Kholumolumo*. The ilia referred to *Mussaurus* are incomplete but their
31
32 ventral part is preserved (Otero and Pol, 2013). In lateral view, the ventral margin of the
33
34 postacetabular process is straight and the ischial peduncle appears subtriangular in
35
36 *Mussaurus*. In *Kholumolumo*, the ventral margin of the postacetabular process is oblique and
37
38 the ischial peduncle is subrectangular. The lateral margin of the pubic apron of *Mussaurus* is
39
40 slightly concave, whereas it is straight in *Kholumolumo*. In *Mussaurus*, the femur is less
41
42 sigmoid in anterior and posterior views. In anterior view, the lesser trochanter is more
43
44 developed and more laterally located. In lateral view, the fourth trochanter is less developed
45
46 and is much shorter proximodistally. In posterior view, the fourth trochanter is more medially
47
48 located. In distal view, the extensor and popliteal fossae are more marked. Finally, the
49
50 metatarsal I is longer and more gracile in *Mussaurus* than in *Kholumolumo*, while the
51
52 proportions of the other metatarsals do not vary much.
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3 *Riojasaurus* preserves most of its cranial and postcranial elements (Bonaparte, 1971). The
4 skull material having not been studied first-hand, the comparison between the two postorbitals
5 has not been performed. The height of the neural arch of the most posterior cervical vertebra
6 of *Riojasaurus* is much inferior to the height of the centrum, conversely to what is observed in
7 *Kholumolumo*. The diapophysis is less developed both anteroposteriorly and laterally in
8 *Riojasaurus*. The posterior margin of the proximal articular surface of the humerus of
9 *Riojasaurus* bears a distinct tubercle, which is not present in *Kholumolumo*. The deltopectoral
10 crest is sigmoid and thick in *Riojasaurus*, while it is straight and thinner in *Kholumolumo*.
11 The diaphysis appears much shorter, relatively to the total proximodistal length of the
12 humerus, in *Riojasaurus*. The proportions of the ilium are slightly different: in *Riojasaurus*
13 the acetabulum is higher, relatively to the total height of the ilium than in *Kholumolumo*. The
14 preacetabular process is sharp in *Riojasaurus*, whereas it is rounded in *Kholumolumo*. On the
15 pubis, the obturator foramen is smaller in *Riojasaurus*. The pubic apron is transversely wider,
16 relatively to the maximum transverse width of the pubis, in *Riojasaurus*. The femur of
17 *Riojasaurus* is straight in anterior view, whereas in *Kholumolumo* it is slightly sigmoid. The
18 lesser trochanter is more developed and protruding in *Riojasaurus*. In posterior view, the
19 fourth trochanter is oblique in *Riojasaurus*, whereas it is straight in *Kholumolumo*. In distal
20 view, the lateral condyle of the femur is more developed in *Riojasaurus* and the depression
21 between the fibular and lateral condyles is much more marked than in *Kholumolumo*. The
22 tibia of *Riojasaurus* has a slenderer morphology than the tibia of *Kholumolumo*. In lateral and
23 medial views, the proximal end of the bone is more developed anteroposteriorly in
24 *Riojasaurus* than in *Kholumolumo*. In distal view, the anteroposterior length of the lateral
25 margin is inferior to the same length measured on the medial margin in *Riojasaurus*, whereas
26 the opposite is observed in *Kholumolumo*.

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3 Although a considerable number of new basal sauropodomorph taxa have been described over
4 the past 15 years in southern Africa, it seems that the material from Maphutseng cannot be
5 referred to any known taxon. Even if detailed nomenclatural and taxonomic revisions, allied
6 with clear diagnoses based on associated material and works on the intraspecific variation are
7 required for numerous southern gondwanan taxa (e.g. *Massospondylus*, *Euskelosaurus*,
8 *Melanorosaurus*), the type material of *Kholumolumo ellenbergerorum* is diagnostic (see
9 above) and the erection of a new genus and species is justified.
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23 RESULTS

24 **Characterization of the Maphutseng Bone Bed**

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27 The Maphutseng locality is the only basal sauropodomorph bonebed ever discovered in
28 southern Africa. Nearly 470 pieces have been collected in 1959, 1963 and 1970 at
29 Maphutseng, but only 225 pieces are currently housed in the MNHN collections in Paris. This
30 is undoubtedly a consequence of the attribution, on the field, of several numbers to fragments
31 of the same bone (see the introduction for more details). Among the 225 identifiable bones
32 and fragments, several fragments fit together, leading to 212 fossilized remains. Of the 212,
33 99% (210) are considered to belong to *Kholumolumo ellenbergerorum*, classifying this a
34 monotaxic bone bed (Eberth et al., 2007). The remaining two are two large teeth of a
35 raurisuchian. Based on the number of right radii present in the collections, the minimum
36 number of individuals (MNI) in the bone bed can be estimated at 5. Given that the 1955 and
37 1956 excavations yielded nearly 650 bones, the number of *Kholumolumo* individuals
38 preserved in the Maphutseng bone bed is probably twice as large.
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56 The Maphutseng bone bed is distinct from most of the *Plateosaurus* bonebeds of the Late
57 Triassic of Europe which preserved articulated skeletons and are interpreted as mire traps
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3 (Sander, 1992), except for the Ellingen locality (Moser 2004). Miring can not definitively be
4
5 excluded for the *Kholumolumo* specimens of Maphutseng, as the presence of small bones
6
7 (distal caudal vertebrae and distal phalanges), vertebrae and ribs suggests very little scattering
8
9 within the assemblage. Skull material is very rare, but it could be a sampling bias on the field.
10
11 However, all the skeletons are disarticulated indicating post-mortem displacement and more
12
13 likely a bone accumulation area. The latter interpretation is more consistent with the
14
15 meandering river environment with associated floodplain areas depicted for the lower Elliot
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17 Formation (Bordy et al., 2004).
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23 **Phylogenetic Analysis**

24
25 Here, we include *Kholumolumo* to a comprehensive cladistic analysis of basal
26
27 sauropodomorphs. We amended the data matrix from Apaldetti et al. (2018) to carry out the
28
29 phylogenetic analysis. The original matrix consists of 372 characters and 63 terminal taxa,
30
31 including *Kholumolumo*, which was scored based on all the available material. We carried out
32
33 three consecutive parsimony analyses, all performed with Winclada (Nixon, 2002) running
34
35 over NONA (Goloboff, 1993), using a heuristic search with a random stepwise-addition of
36
37 100 replicates and an unconstrained search strategy of multiple TBR + TBR branch swapping.
38
39 The first analysis includes all the original taxa and resulted in a 1491 steps consensus tree
40
41 (Supplementary Data Figure 2S). In the second one, we pruned three taxa a priori:
42
43 *Barapasaurus*, *Isanosaurus* and *Gongxianosaurus*. *Gongxianosaurus*, given the uncertainty
44
45 surrounding its anatomy. *Isanosaurus* because of the uncertainty about the age of the material.
46
47 Indeed, a part of the Nam Phong Formation, where was collected the type material of
48
49 *Isanosaurus*, has been recently dated as Late Jurassic on the basis of its palynoflora (Racey,
50
51 2009; Racey and Goodall, 2009). It is very likely that *Isanosaurus* is Late Jurassic in age and
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53 that its basal position in sauropodomorph phylogeny is only the reflect of the incompleteness
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3 of the known material for this taxon. This second analysis resulted in a 1472 steps consensus
4 tree (Supplementary Data Figure 3S).
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7 For the third analysis, we removed from the sampling all the taxa presenting more than 70%
8 of missing data, leaving only 47 taxonomic units. The analysis resulted in 24 most
9 parsimonious trees (length=1402 steps, CI=0.30, RI=0.61). Based on this analysis, we
10 produced a strict consensus tree (length=1451 steps; Fig. 23) where *Lessemsaurus*,
11 *Antetonitrus* and the Sauropoda (sensu Salgado, Coria & Calvo, 1997; Peyre de Fabrègues et
12 al., 2015) pertain to the same clade, *Antetonitrus* being the sister group of Sauropoda. The
13 Massospondylidae (*Adeopapposaurus*, *Coloradisaurus*, *Leyesaurus*, *Lufengosaurus* and
14 *Massospondylus*) is the clade recovered in the most “apical” (i.e., close to Sauropoda)
15 position. The Plateosauridae (*Unaysaurus*, *Plateosaurus*) are also recovered. In between,
16 *Kholumolumo* is retrieved as sister group of *Sarhsaurus*, within a clade also comprising
17 *Xingxiulong*. This clade is diagnosed by the following unambiguous synapomorphies:
18 epiphyses not overhanging the rear margin of the postzygapophyses in the cervical
19 vertebrae (character 137, state 0), transversely expanded plate-like summits of posterior dorsal
20 neural spines (character 174, state 1), length of first caudal centrum inferior to its height
21 (character 183, state 1), anteroposterior width of the lateral side of the distal articular surface
22 of the tibia as wide as the anteroposterior width of its medial side (character 307, state 0),
23 transverse width of the calcaneum less than 30% of the transverse width of the astragalus
24 (character 324, state 1).
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48 The clade comprising *Kholumolumo* and *Sarhsaurus* is diagnosed by the following
49 unambiguous synapomorphies: centra of the anterior cervical vertebrae approximately 1.25
50 times higher than wide (1) (character 130, state 1), flattened epiphyses (character 136, state
51 1), strongly convex dorsal margin of the ilium (character 245, state 1), preacetabular process
52 of the ilium blunt and rectangular (character 247, state 0), length of the ischial peduncle of the
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3 ilium much shorter than pubic peduncle (character 254, state 1), anterior margin of the pubic
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5 apron smoothly confluent with the anterior margin of the iliac pedicel in lateral view
6
7 (character 261, state 0), lesser trochanter forming just a scar upon the femoral surface
8
9 (character 287, state 0), transverse width of the distal tibia subequal to its anteroposterior
10
11 length (character 306, state 0), anteromedial corner of the distal articular surface of the tibia
12
13 forming a right angle (character 310, state 0).
14

15
16 As a result, *Kholumolumo* is nested among the basal sauropodomorphs with an ancestral
17
18 morphotype and a bipedal bauplan and, despite its large size, is not recovered close to
19
20 “sauropod-like” forms like *Antetonitrus* or *Lessemsaurus*.
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23 24 25 DISCUSSION

26 27 28 **Phylogenetic Relationships and Paleobiogeography**

29
30 The phylogenetic tree (Fig. 23) exhibits a particular topology consisting of *Sarhsaurus* and
31
32 *Xingxiulong*, two Jurassic taxa, in the same clade as *Kholumolumo*. The latest study of
33
34 *Sarhsaurus* (Marsh and Rowe, 2018) showed the North American taxon with more or less
35
36 the same affinities as in this paper. It was recovered among Massospondylidae in two
37
38 phylogenetic trees out of three, the authors having considered three different datasets (Marsh
39
40 and Rowe, 2018:figs. 47–49). In the only dataset, also including *Xingxiulong* (Marsh and
41
42 Rowe, 2018:fig. 49), the latter appears just before Massospondylidae, closer to the base of the
43
44 tree. However, in the phylogenetic analysis published with the original description of
45
46 *Xingxiulong* (Wang et al., 2017), the Chinese taxon does not show the same phylogenetic
47
48 affinities. It is not close to the Massospondylidae, but sister taxon of *Jingshanosaurus* and
49
50 rather at the base of the Sauropodiformes (Wang et al., 2017:fig. 5). This phylogenetic result
51
52 led the authors to assume an Asian origin for the Sauropodiformes clade. Our phylogenetic
53
54 analysis does not corroborate this hypothesis, *Xingxiulong*, *Sarhsaurus* and *Kholumolumo*
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3 being not recovered among Sauropodiformes. It is the first time that one clade includes taxa
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5 from China, North America and Africa. It was suggested that *Sarhsaurus*'s lineage most
6
7 likely originated and dispersed from Gondwana between the end of the Norian and the
8
9 Pliensbachian (Marsh and Rowe, 2018). The affinities with *Kholumolumo* could be explained
10
11 by such an occurrence. An initial concentration of the sauropodomorph populations in
12
13 Gondwana could have resulted in a geographic dispersal during the Late Triassic and
14
15 vicariance during the Early Jurassic, with new taxa arising from the Triassic forms, including
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17 in North America and China.
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24 **Size and Body Mass Estimation**

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26 We used the relation between the femur length and the overall body length in *Plateosaurus*
27
28 *engelhardti* which evaluates the body length to ten times the femur length (Sander and Klein,
29
30 2005) to estimate the size of *Kholumolumo*. Using the longest femur found in Maphutseng
31
32 (Table 7), we estimate the body length of the largest *Kholumolumo* specimen around 9 meters
33
34 long (Table 8). Compared to other Norian basal sauropodomorphs, it is the genus with the
35
36 most important size just before *Lessemsaurus* (PVL 4822:8.4 m).
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40 It has been established that there is a correlation between the long-bones circumference and
41
42 the weight in dinosaurs (Anderson et al., 1985). In quadrupeds, the circumferences of the
43
44 femur and humerus of one species are correlated to its body mass (Campione and Evans,
45
46 2012). In bipeds, the equation is linking only the circumference of the femur to the body mass
47
48 (Campione et al., 2014). The stance is therefore crucial to estimate the body mass of a given
49
50 genus, but uncertainties remain concerning the stance of numerous basal sauropodomorphs
51
52 (Bonnar and Senter, 2007; Bonnar and Yates, 2007; Otero et al., 2017; McPhee et al., 2018).
53
54 Hence, we propose different estimations of the body mass of *Kholumolumo ellenbergerorum*
55
56 using both the quadrupedal and bipedal equations (Benson et al., 2018:16), as well as the
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2
3 regression equations given by Apaldetti et al. (2018) (Table 8). Based on the largest femur
4 available (MNHN.F.LES371), the bipedal equation gives a body mass of 1754 kg for
5
6 *Kholumolumo*. Other prosauropod specimens known from the Late Triassic range from
7
8 438 kg (*Coloradisaurus*) to 1963 kg (*Lessemsaurus*) (Table 8). The quadrupedal equation
9
10 requires the circumferences of the humerus and femur of a same individual. The remains from
11
12 Maphutseng coming from several individuals, we chose to calculate the body mass based on
13
14 the biggest humerus (MNHN.F.LES379) and femur (MNHN.F.LES371) available, the
15
16 proportions of which are consistent. The quadrupedal equation gives a result of 3334 kg for
17
18 *Kholumolumo*, that is roughly double the calculated weight with the bipedal equation. The
19
20 same result is observed in other taxa, except *Lessemsaurus* for which the body mass is
21
22 roughly equivalent regardless of the equation used. The body mass ranges between 757 kg
23
24 (*Coloradisaurus*) and 3334 kg (*Kholumolumo*). In that case, *Kholumolumo* is heavier than
25
26 *Lessemsaurus* (Table 8).
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33 The correlation between the size of the girdle elements and the body mass among
34
35 Sauropodomorpha (Apaldetti et al., 2018) give an even more significant estimation of the
36
37 weight of basal sauropodomorphs. Using the maximum length of the scapula
38
39 (MNHN.F.LES386) and ilium (MNHN.F.LES375a) of *Kholumolumo* we obtain, respectively,
40
41 3864 kg and 3963 kg. *Unaysaurus*, of which the scapula is known, is the smallest specimen
42
43 (88 kg) from the Late Triassic. It is followed by *Coloradisaurus* (307 kg). In both cases,
44
45 *Kholumolumo* is one of the largest basal sauropodomorphs, with *Lessemsaurus* 1. The
46
47 recently described *Lessemsaurus* 2 (CRILAR) appears to be the heaviest (Table 8).
48
49
50 Considering a larger temporal scale, *Kholumolumo* is still one of the biggest basal
51
52 sauropodomorphs, being only lighter than the Jurassic taxa *Antetonitrus* (Apaldetti et al.,
53
54 2018) and *Ledumahadi* (McPhee et al., 2018).
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3 Three equations out of four give an estimated body weight of more than 3000 kg for
4
5 *Kholumolumo*. Therefore, *Kholumolumo* was among the heaviest terrestrial animals in
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7 gondwanan wildlife at the end of the Triassic. However, the significant gap between the
8
9 results of the bipedal and quadrupedal equations is a prime example of the uncertainties
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11 surrounding the weight estimates in fossil organisms, particularly in groups such as
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13 Sauropodomorpha, including bipedal and quadrupedal animals, as well as transitional forms.
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15 These results should therefore be interpreted cautiously. In any case, *Kholumolumo* appears to
16
17 be the biggest known basal sauropodomorph in the Triassic of Southern Africa. It is, however,
18
19 not linked to the origin of Sauropoda, as supported by the proportions and anatomy of its
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21 anterior and posterior members and by its phylogenetic position.
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29 CONCLUSIONS

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33 The complete anatomical description of the Late Triassic *Kholumolumo*
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35 *ellenbergerorum*, discovered in Lesotho in 1955 and hosted in the collections of the MNHN
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37 during more than 50 years, is provided here. The remains, pertaining to at least five different
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39 specimens, form a virtually subcomplete skeleton, one of the most complete in the lower
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41 Elliot Formation. The only parts not maintained in the collections are the skull (with the
42
43 exception of the postorbital), the coracoids and the complete ischium. The 210 bones unveiled
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45 in the Maphutseng bone bed present an exclusive morphology as well as a unique
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47 combination of characters and are therefore attributed to a new genus and new species.
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51 The phylogenetic reconstruction replaces the new genus between two well-known clades of
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53 basal sauropodomorphs: Plateosauridae and Massospondylidae. The exact position of the
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55 Triassic *Kholumolumo* is intriguing, as it is recovered within the same clade as *Xingxiulong*, a
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57 Jurassic form from China and *Sarhsaurus*, another Jurassic form from North America. This
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3 topology might be a testimony of the prosauropods biogeographic history by illustrating the
4 effects of Late Triassic geographic dispersals and Early Jurassic vicariance.
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7 The total body length of *Kholumolumo* is estimated at 9 meters. Based on the long-bones
8 circumference and the size of the girdle elements, we calculated a body mass ranging between
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10 1754 kg and 3963 kg, making of *Kholumolumo* one of the heaviest terrestrial animals at the
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12 end of the Triassic.
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22

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45 FIGURE CAPTIONS 46 47 48

49 FIGURE 1. Maphutseng bone bed location and excavation plan. **A**, Geological map drawn by
50
51 F. Ellenberger situating the Maphutseng bone bed (“Gisement”, F) relative to the trackways
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53 (“Pistes”) and to the Protestant mission (“PEMS”) (Ellenberger archives, ISEM); **B**, Satellite
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55 view framed in a similar way than the drawing, showing the exact location of the Maphutseng
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57 bone bed (F) and the river as a reference (Image © 2018 DigitalGlobe); **C**, Excavation plan of
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3 the 1955/56 and 1959 campaigns drawn by F. Ellenberger (Ellenberger archives, ISEM). The
4 location of the 1963 and 1970 excavations were deduced thanks to a more comprehensive
5 excavation plan figured in Gauffre (1996:fig. 21). [planned for page width]
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12 FIGURE 2. Photographs of the excavations on the Maphutseng bone bed during the last
13 campaign, in 1970. **A**, The excavation site. The photography was taken by P. Ellenberger. On
14 the right side of the photography, from right to left: B. Battail and L. Ginsburg (Ellenberger
15 archives, ISEM); **B**, Bones in situ. This photography was taken by B. Battail and illustrates
16 perfectly the status of bone bed attributed to Maphutseng. From left to right and top to bottom
17 appear: a caudal vertebra, a tibia, a right femur, an ischium, an ilium, a left femur, several
18 metatarsals and phalanges. [planned for 2/3 width]
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31 FIGURE 3. Geological map of Lesotho showing the five geological Formations outcropping
32 and the Maphutseng bone bed as part of the Elliot Formation, based on the Geological map of
33 Lesotho of the Department of Mines and Geology of Lesotho (1982). [planned for page
34 width]
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42 FIGURE 4. *Kholumolumo ellenbergerorum* postorbitals. Left postorbital (MNHN.F.LES153)
43 in lateral (**A**) and medial (**B**) views; Right postorbital (MNHN.F.LES54) in lateral (**C**) and
44 medial (**D**) views. **Abbreviations:** **apr**, anterior process; **cfr**, contact with frontal; **cpa**,
45 contact with parietal; **csq**, contact with squamosal; **ppr**, posterior process; **ru**, orbital
46 rugosity; **vpr**, ventral process. Scale bar equals 1 cm. [planned for page width]
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55 FIGURE 5. *Kholumolumo ellenbergerorum* posterior cervical vertebra (C10?)
56 (MNHN.F.LES169). **A**, right lateral view; **B**, left lateral view; **C**, posterior view; **D**, anterior
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3 view; **E**, dorsal view; **F**, ventral view. **Abbreviations:** **di**, diapophysis; **hpo**, hyposphene; **hy**,
4 hypapophysis; **nc**, neural canal; **ns**, neural spine; **poz**, postzygapophysis; **pp**, parapophysis;
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6 **prz**, prezygapophysis; **vk**, ventral keel. Scale bar equals 5 cm. [planned for page width]
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12 FIGURE 6. *Kholumolumo ellenbergerorum* anterior dorsal (D1?) neural arch

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14 (MNHN.F.LES397). **A**, dorsal view; **B**, right lateral view; **C**, posterior view; **D**, anterior view.

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16 **Abbreviations:** **cdf**, centrodiapophyseal fossa; **cpol**, centropostzygapophyseal lamina; **cpri**,
17 centroprezygapophyseal lamina; **di**, diapophysis; **hpo**, hyposphene; **nc**, neural canal; **ns**,
18 neural spine; **pcdl**, posterocentrodiapophyseal lamina; **pocdf**, postzygapophyseal
19 centrodiapophyseal fossa; **podl**, postzygodiapophyseal lamina; **poz**, postzygapophysis; **prcdf**,
20 prezygapophyseal centrodiapophyseal fossa; **prdl**, prezygodiapophyseal lamina; **prz**,
21 prezygapophysis. Scale bar equals 5 cm. [planned for page width]
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32 FIGURE 7. *Kholumolumo ellenbergerorum* middle dorsal vertebra (D7-12?)

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34 (MNHN.F.LES32). **A**, right lateral view; **B**, anterior view; **C**, posterior view; **D**, anterior

35 view. **Abbreviations:** **di**, diapophysis; **hpo**, hyposphene; **nc**, neural canal; **pcdl**,
36 posterocentrodiapophyseal lamina; **pp**, parapophysis; **ppdl**, paradiapophyseal lamina; **prdl**,
37 prezygodiapophyseal lamina; **prz**, prezygapophysis. Scale bar equals 5 cm. [planned for page
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48 FIGURE 8. *Kholumolumo ellenbergerorum* primordial sacral vertebra (2?)

49 (MNHN.F.LES155). **A**, posterior view; **B**, left lateral view; **C**, dorsal view. **Abbreviations:**

50 **di**, diapophysis; **hpo**, hyposphene; **nc**, neural canal; **ns**, neural spine; **poz**, postzygapophysis;
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52 **sr**, sacral rib. Scale bar equals 10 cm. [planned for page width]
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3 FIGURE 9. *Kholumolumo ellenbergerorum* anterior caudal vertebra (Ca1-5?)
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5 (MNHN.F.LES168). **A**, right lateral view; **B**, posterior view. **Abbreviations:** **nc**, neural
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7 canal; **ns**, neural spine; **poz**, postzygapophysis; **prz**, prezygapophysis. Scale bar equals 10 cm.

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14 FIGURE 10. *Kholumolumo ellenbergerorum* anterior caudal vertebra (Ca5-15?)
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16 (MNHN.F.LES376). **A**, anterior view; **B**, posterior view; **C**, left lateral view; **D**, dorsal view;
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18 **E**, ventral view. **Abbreviations:** **di**, diapophysis; **gr**, longitudinal groove; **nc**, neural canal;
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20 **ns**, neural spine; **poz**, postzygapophysis; **prz**, prezygapophysis. Scale bar equals 5 cm.

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28 FIGURE 11. *Kholumolumo ellenbergerorum* left scapula (MNHN.F.LES386). **A**, lateral
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30 view; **B**, medial view. **Abbreviations:** **ac**, acromion; **acf**, acromial fossa; **adr**, anterodorsal
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32 ridge; **gl**, glenoid; **nc**, neural canal; **ns**, neural spine; **pdr**, posterodorsal ridge; **rss**, ridge
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34 surrounding the attachment area of the muscle *serratus superficialis*; **sb**, scapular blade. Scale
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36 bar equals 10 cm. [planned for 2/3 width]
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42 FIGURE 12. *Kholumolumo ellenbergerorum* left humerus (MNHN.F.LES379). **A**, anterior
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44 view; **B**, lateral view; **C**, posterior view; **D**, medial view; **E**, proximal view; **F**, distal view.
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46 **Abbreviations:** **cuf**, cuboid fossa; **dpc**, deltopectoral crest; **hh**, humerus head; **mt**, medial
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48 tuberosity; **olf**, olecranon fossa; **rc**, radial condyle; **uc**, ulnar condyle. The arrow indicates the
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50 anterior surface of the bone for E and F. Scale bar equals 10 cm. [planned for page width]
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56 FIGURE 13. *Kholumolumo ellenbergerorum* right ulna (MNHN.F.LES159). **A**, anteromedial
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58 view; **B**, lateral view; **C**, posterolateral view; **D**, medial view; **E**, proximal view; **F**, distal
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3 view. **Abbreviations:** **alp**, anterolateral process; **amp**, anteromedial process; **ol**, olecranon;
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5 **rf**, radial fossa. The arrow indicates the anterior surface of the bone for E and F. Scale bar
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7 equals 5 cm. [planned for page width]
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12 FIGURE 14. *Kholumolumo ellenbergerorum* right radius (MNHN.F.LES147). **A**, anterior
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14 view; **B**, lateral view; **C**, posterior view; **D**, medial view; **E**, proximal view; **F**, distal view.

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16 The arrow indicates the anterior surface of the bone for E and F. Scale bar equals 5 cm.

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24 FIGURE 15. *Kholumolumo ellenbergerorum* elements of the manus (from top to bottom:
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26 metacarpals I to IV and phalange I-1. Respectively: MNHN.F.LES26, MNHN.F.LES92,
27
28 MNHN.F.LES93, MNHN.F.LES76, MNHN.F.LES29). **A, F, K, P, T**, dorsal views; **B, G, L,**
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30 **Q, U**, ventral views; **C, H, M, R, V**, lateral views; **D, I, N, W**, proximal views; **E, J, O, S, X,**
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32 **distal views.** Scale bar equals 5 cm. [planned for page width]
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37 FIGURE 16. *Kholumolumo ellenbergerorum* right ilium (MNHN.F.LES375a). **A**, lateral
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39 view; **B**, medial view; **C**, dorsal view; **D**, ventral view. **Abbreviations:** **ibl**, iliac blade; **isp**,
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41 ischial peduncle; **mwa**, medial wall of the acetabulum; **pop**, postacetabular process; **prp**,
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43 preacetabular process; **pup**, pubic peduncle; **sac**, supracetabular crest; **svi**, sacral vertebrae
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45 insertion. Scale bar equals 10 cm. [planned for 2/3 width]
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51 FIGURE 17. *Kholumolumo ellenbergerorum* left pubis (MNHN.F.LES378). **A**, dorsal view;
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53 **B**, ventral view. **Abbreviations:** **ac**, acetabulum; **ilp**, iliac peduncle; **isp**, ischial peduncle; **of**,
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55 obturator foramen; **pa**, pubic apron; **pp**, pubic plate. Scale bar equals 10 cm. [planned for 2/3
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FIGURE 18. *Kholumolumo ellenbergerorum* incomplete left ischium (MNHN.F.LES152). **A**, medial view; **B**, lateral view; **C**, dorsal view. **Abbreviations:** **ac**, acetabulum; **ilp**, iliac peduncle; **pup**, pubic peduncle. Scale bar equals 10 cm. [planned for page width]

FIGURE 19. *Kholumolumo ellenbergerorum* right femur (MNHN.F.LES394). **A**, anterior view; **B**, lateral view; **C**, posterior view; **D**, medial view; **E**, proximal view; **F**, distal view. **Abbreviations:** **ef**, extensor fossa; **fc**, fibular condyle; **fh**, femoral head; **lc**, lateral condyle; **lt**, lesser trochanter; **mc**, medial condyle; **pf**, popliteal fossa; **4t**, fourth trochanter. The arrow indicates the anterior surface of the bone for E and F. Scale bar equals 10 cm. [planned for page width]

FIGURE 20. *Kholumolumo ellenbergerorum* right tibia (MNHN.F.LES381m). **A**, anterior view; **B**, lateral view; **C**, posterior view; **D**, medial view; **E**, proximal view; **F**, distal view. **Abbreviations:** **adp**, anterodistal process; **cnc**, cnemial crest; **lc**, lateral condyle; **lco**, lateral concavity; **mc**, medial condyle; **pdp**, posterodistal process. The arrow indicates the anterior surface of the bone for E and F. Scale bar equals 10 cm. [planned for page width]

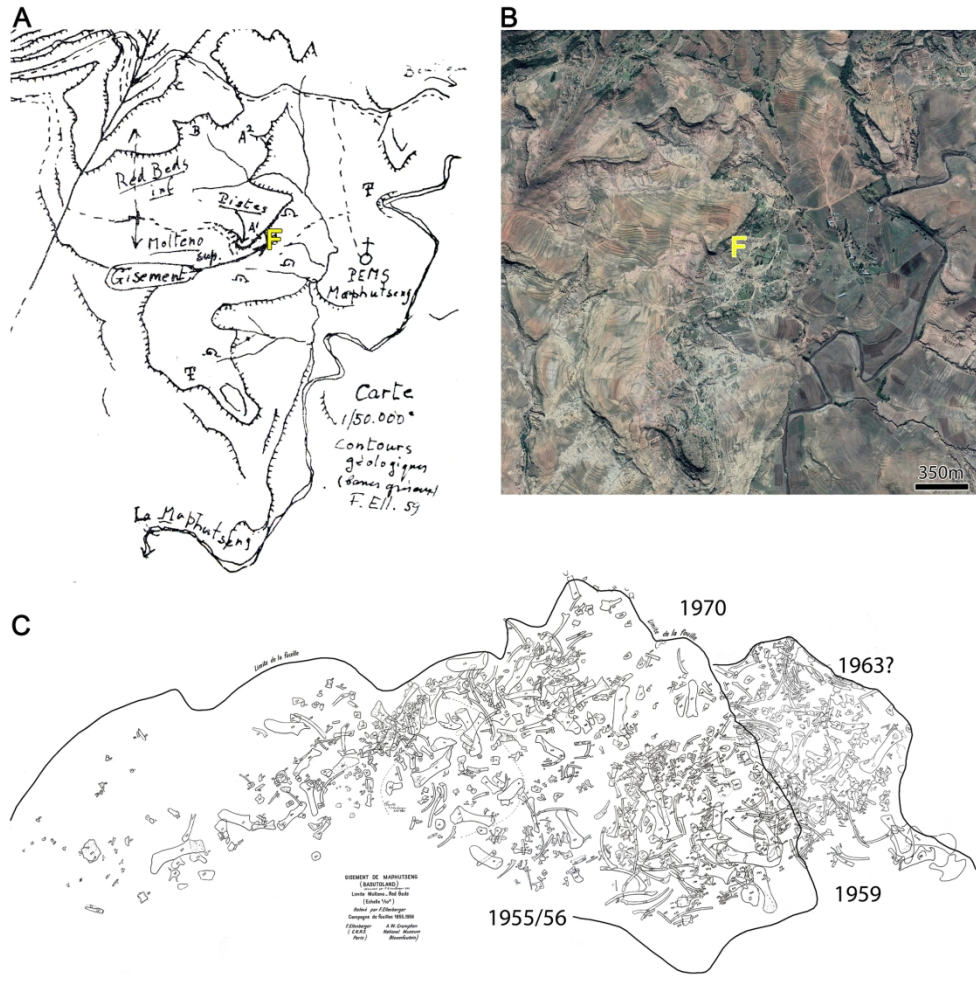
FIGURE 21. *Kholumolumo ellenbergerorum* right fibula (MNHN.F.LES374). **A**, anterior view; **B**, lateral view; **C**, posterior view; **D**, medial view; **E**, proximal view; **F**, distal view. **Abbreviation:** **pmt**, proximomedial tubercle. The arrow indicates the anterior surface of the bone for E and F. Scale bar equals 10 cm. [planned for 2/3 width]

FIGURE 22. *Kholumolumo ellenbergerorum* elements of the pes (from top to bottom: metatarsals I to V. Respectively: MNHN.F.LES89, MNHN.F.LES81, MNHN.F.LES82,

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3 MNHN.F.LES381c, MNHN.F.LES77). **A, F, K, P, T**, dorsal views; **B, G, L, Q, U**, ventral
4 views; **C, H, M, R, V**, lateral views; **D, I, N, S, W**, proximal views; **E, J, O, S, X**, distal
5 views. Scale bar equals 10 cm. [planned for page width]
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12 FIGURE 23. Strict consensus tree (length=1451 steps) of the phylogenetic analysis conducted
13 with 47 taxa and 372 characters and based on the matrix and scorings of Apaldetti et al., 2018
14 (except for *Kholumolumo*). The consensus is based on 24 MPTs of 1402 steps each. [planned
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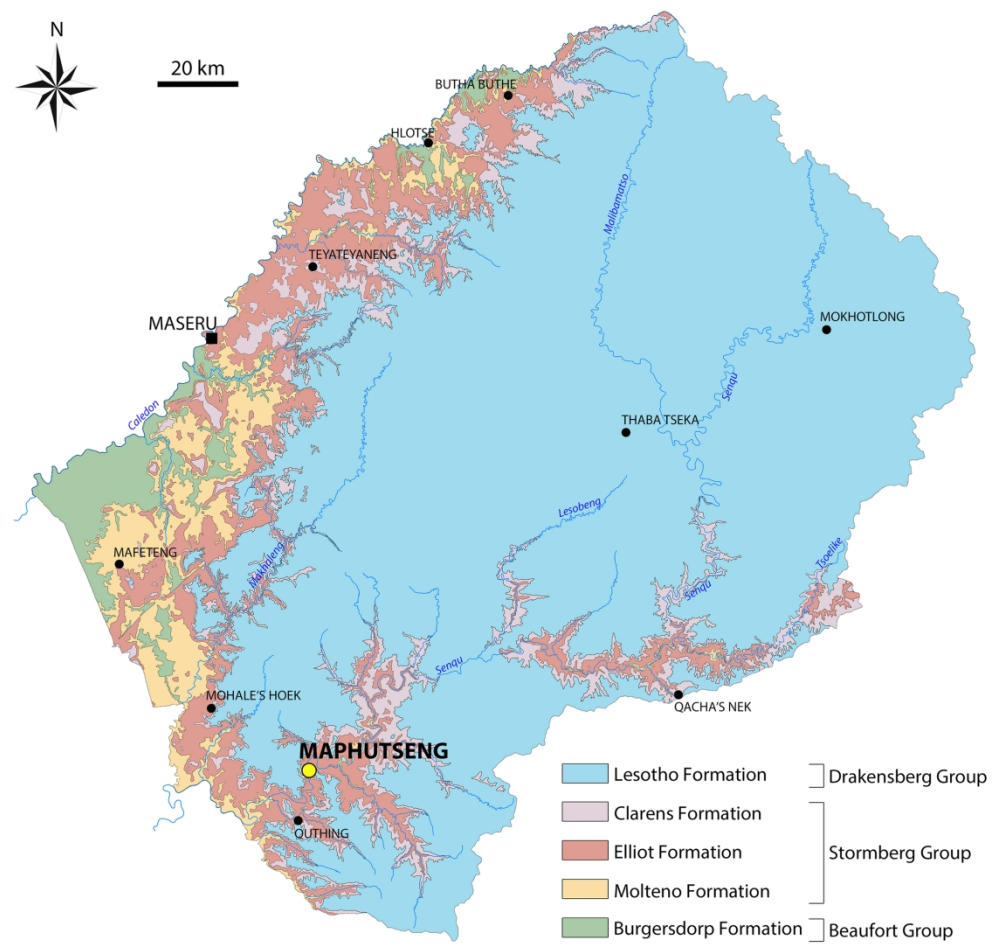
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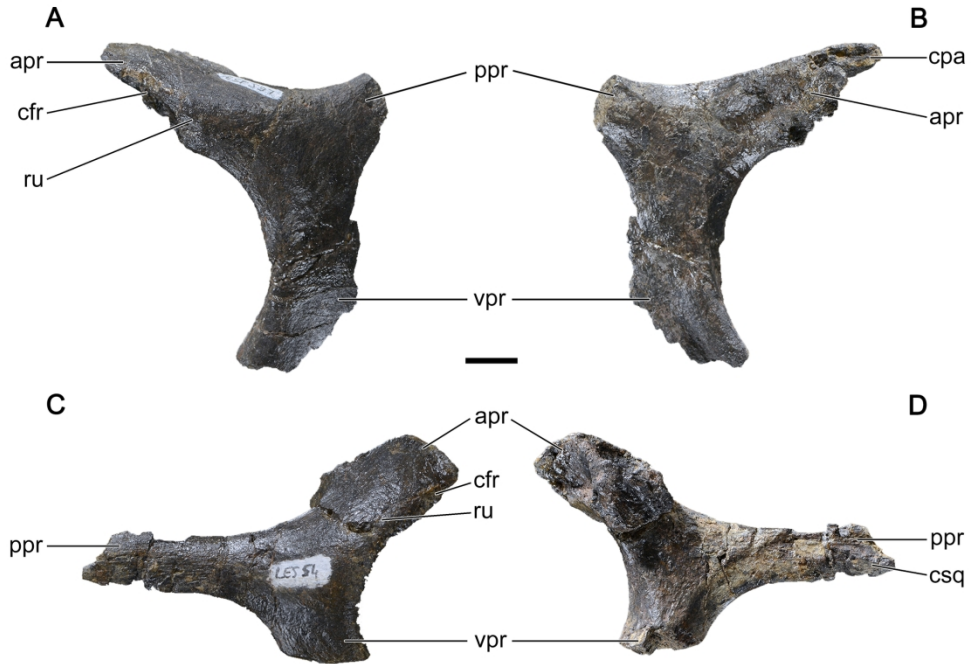


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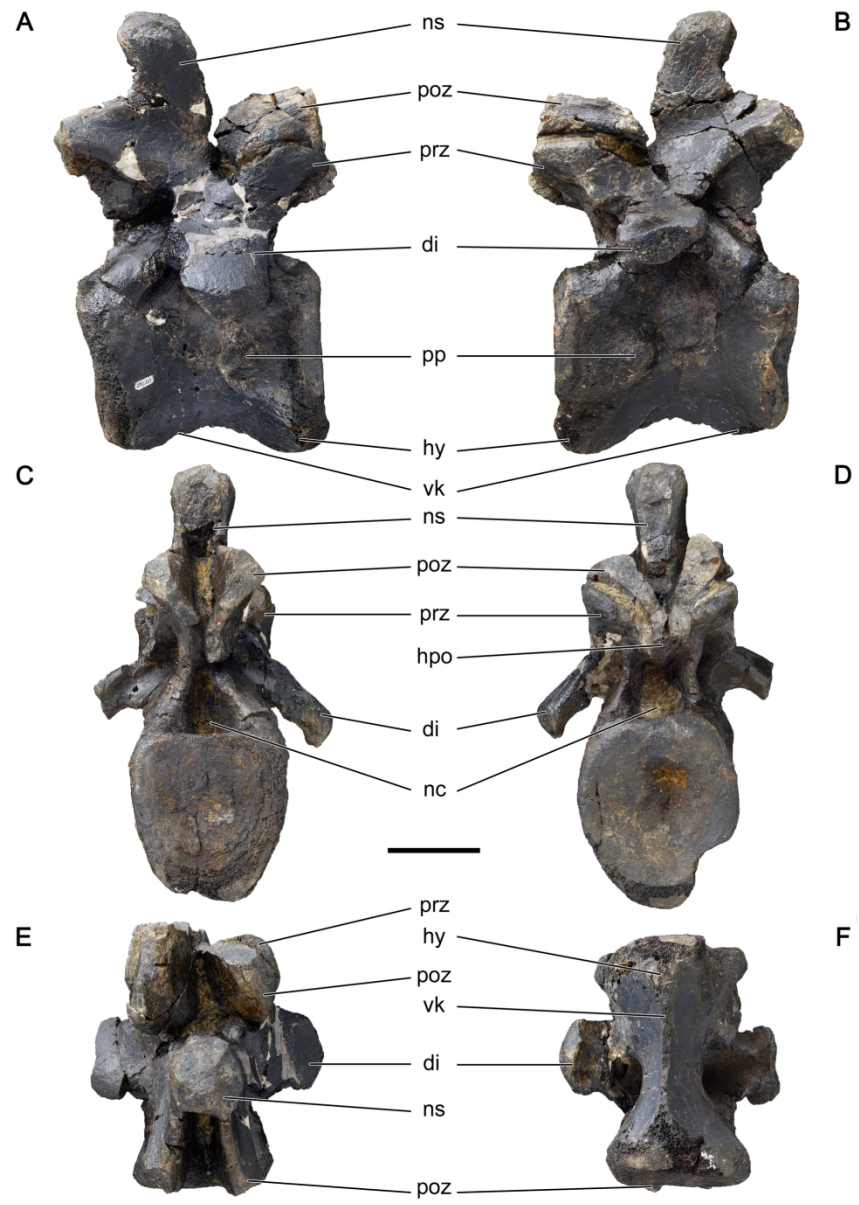
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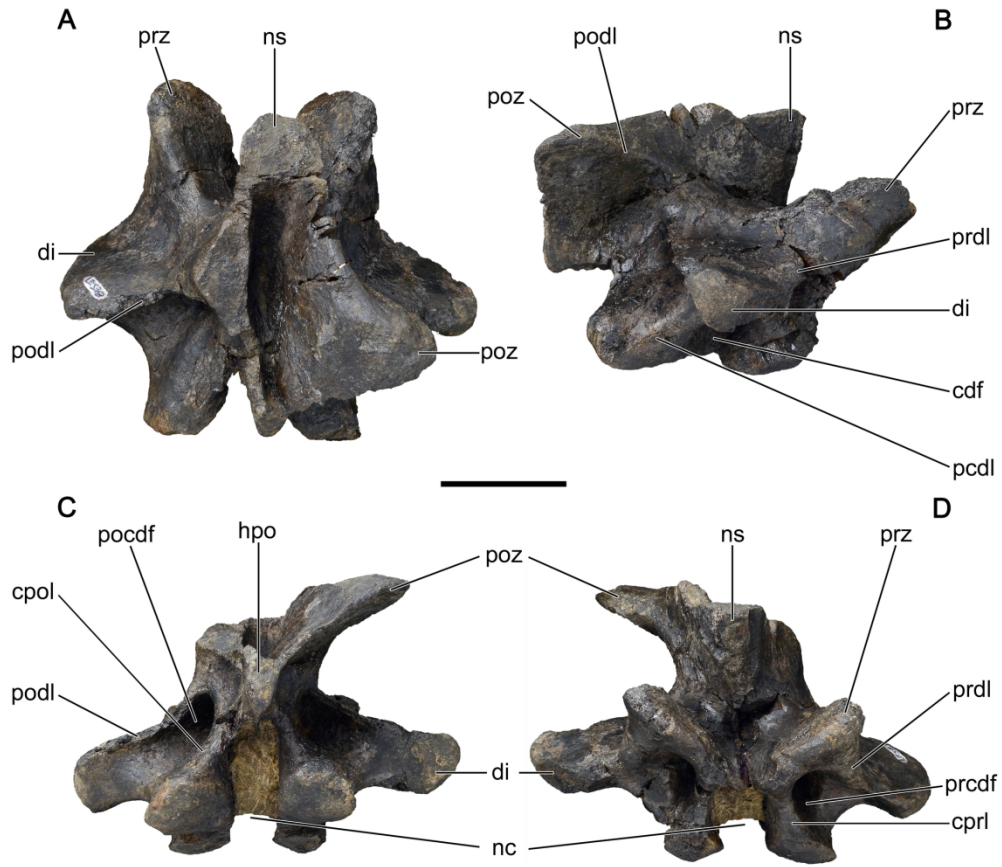
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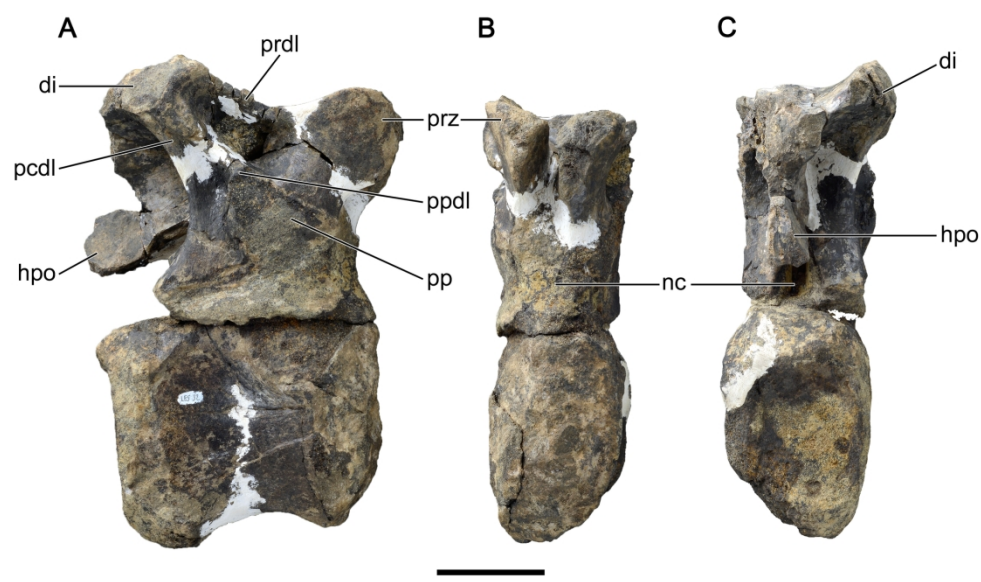


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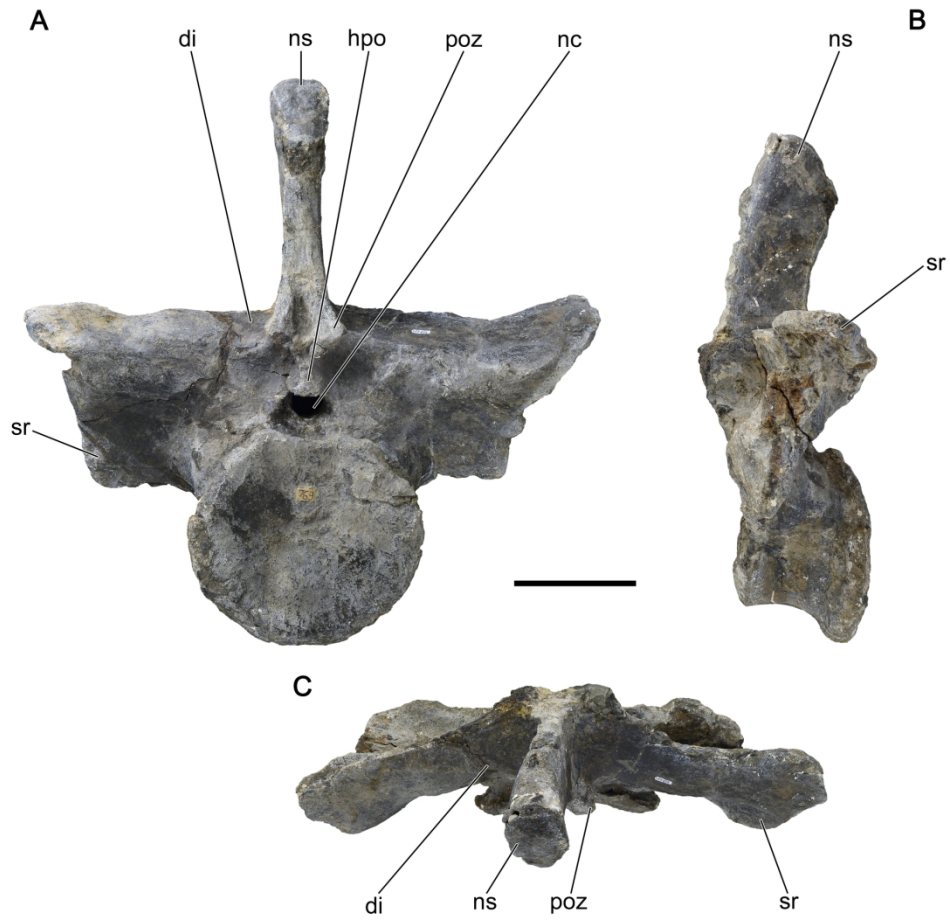


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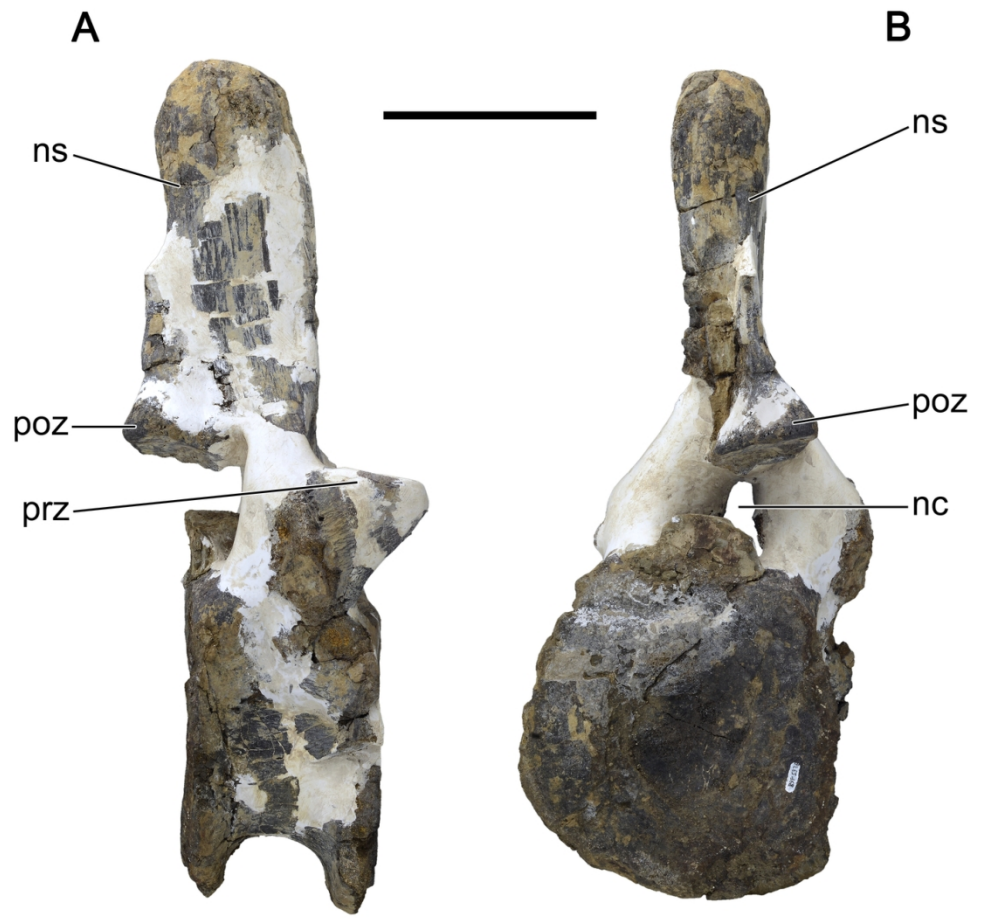
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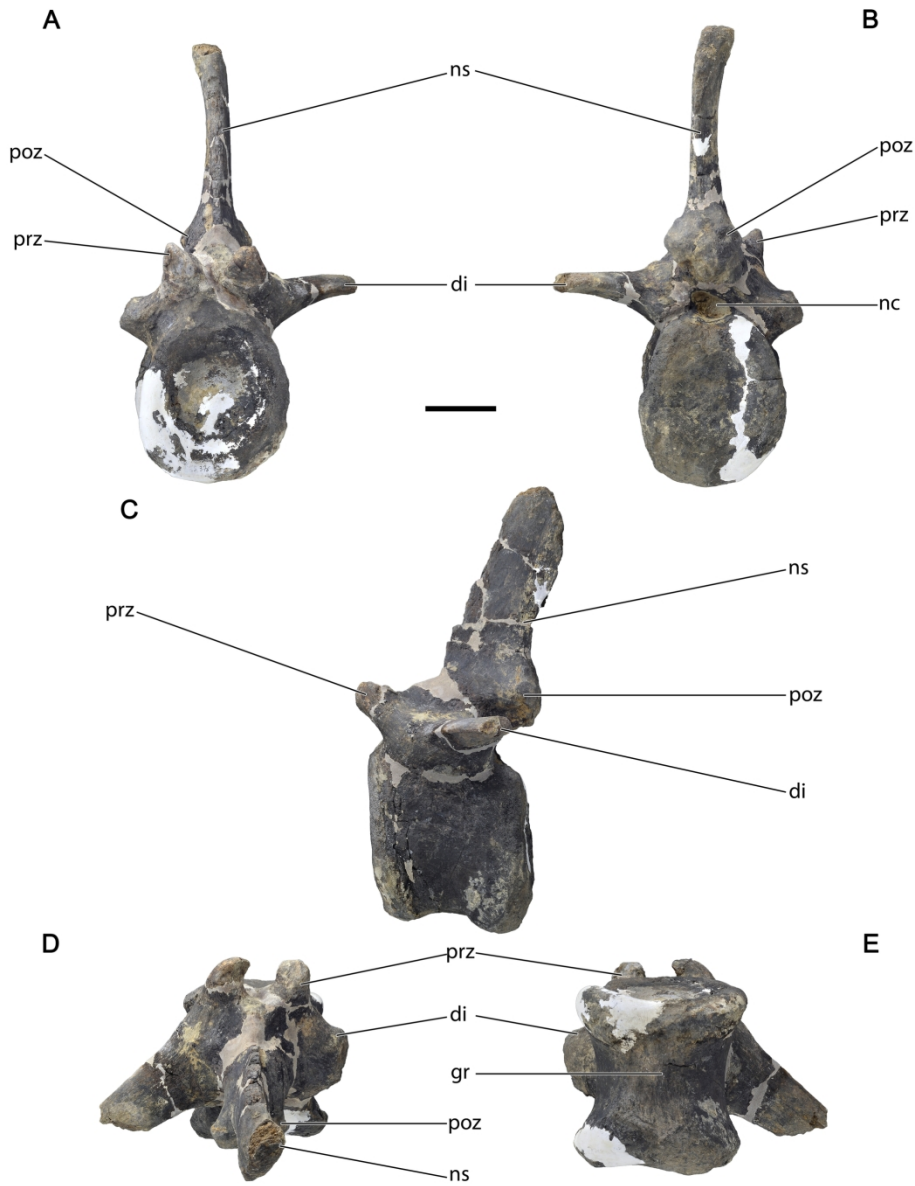
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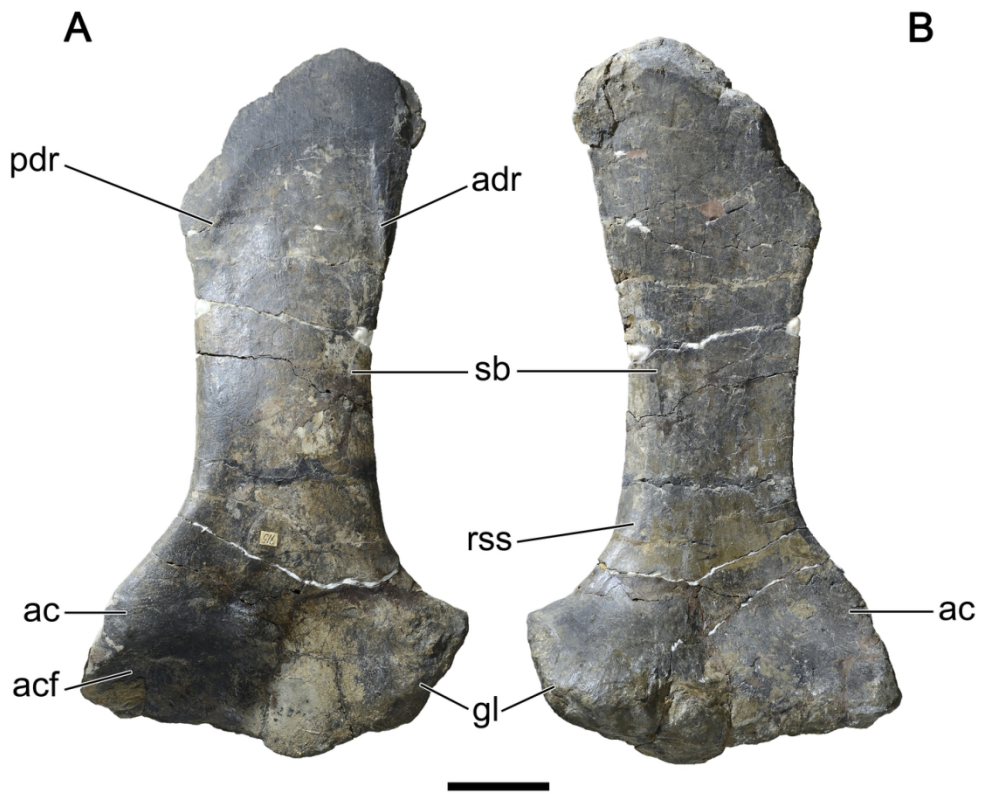
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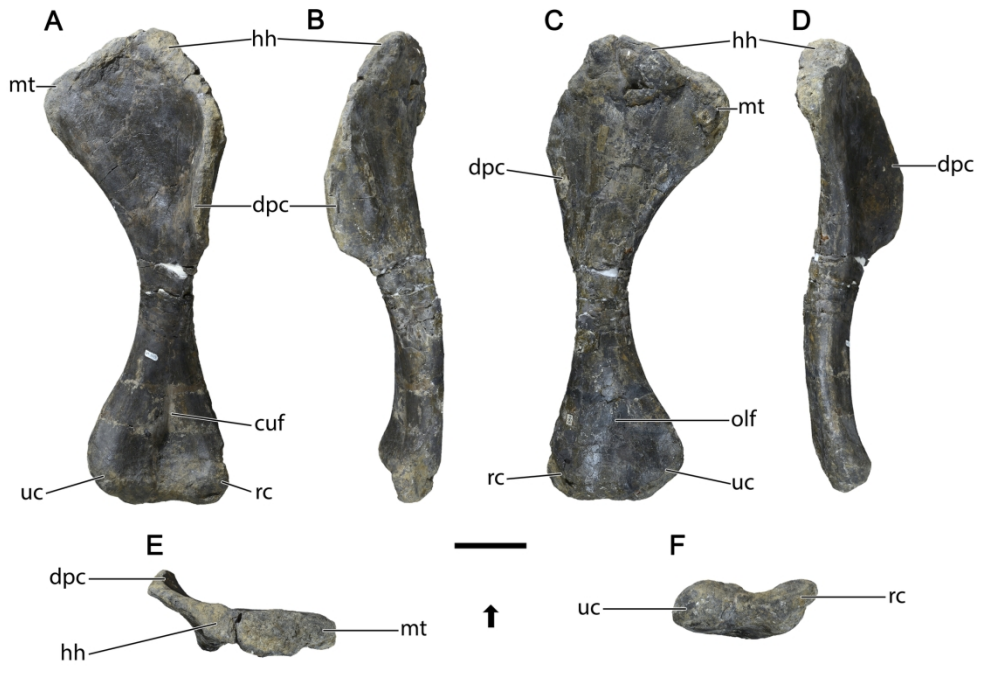
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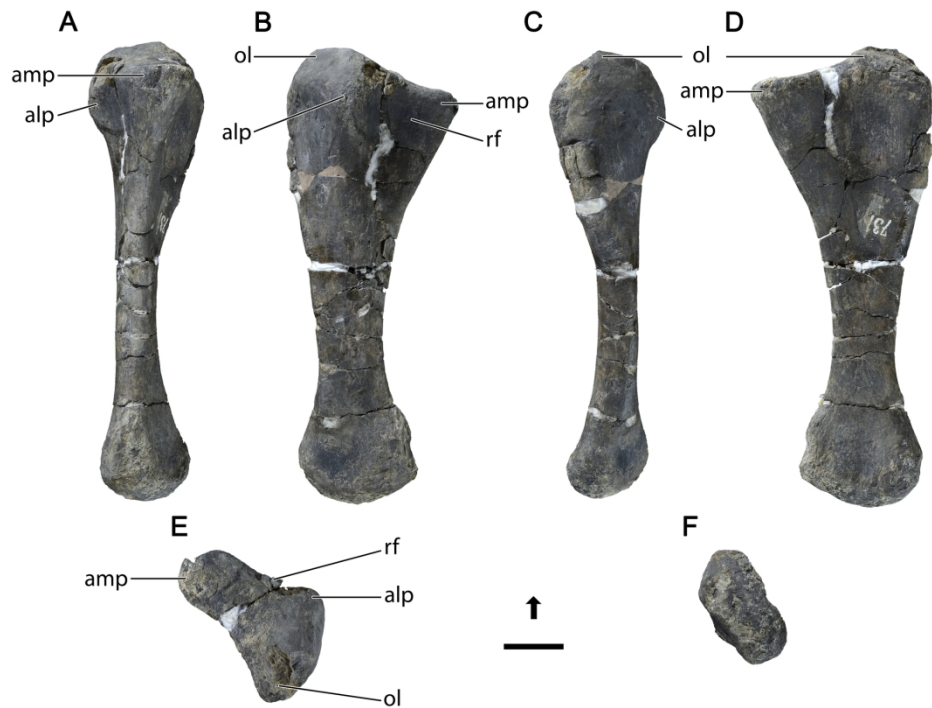
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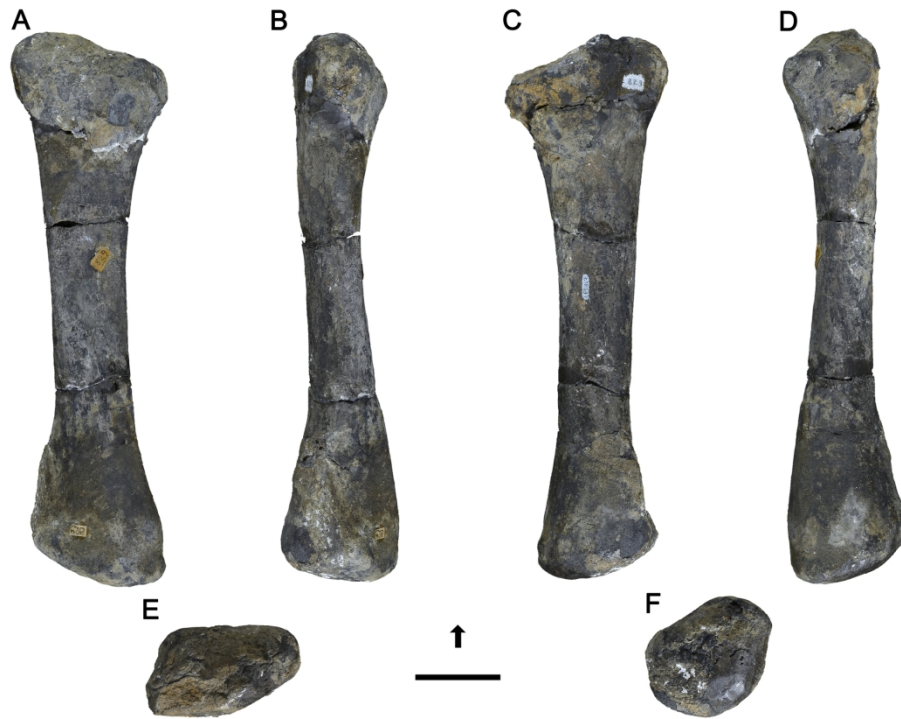


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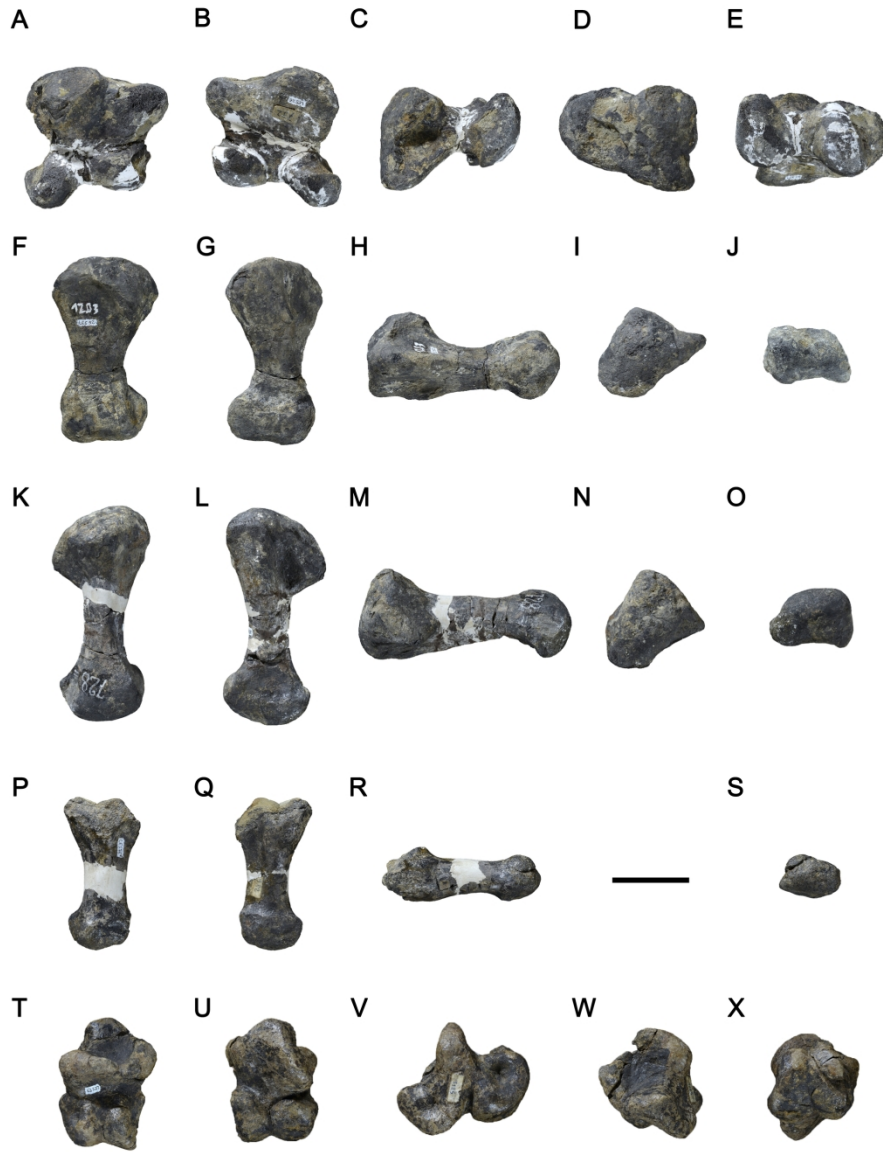


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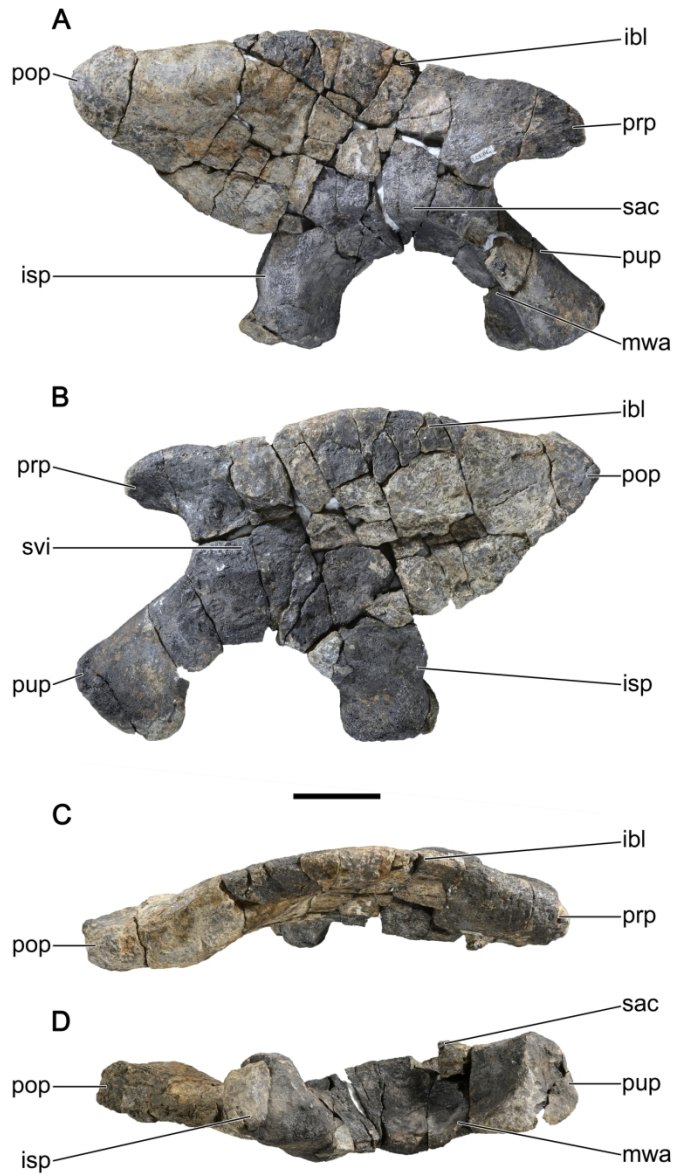


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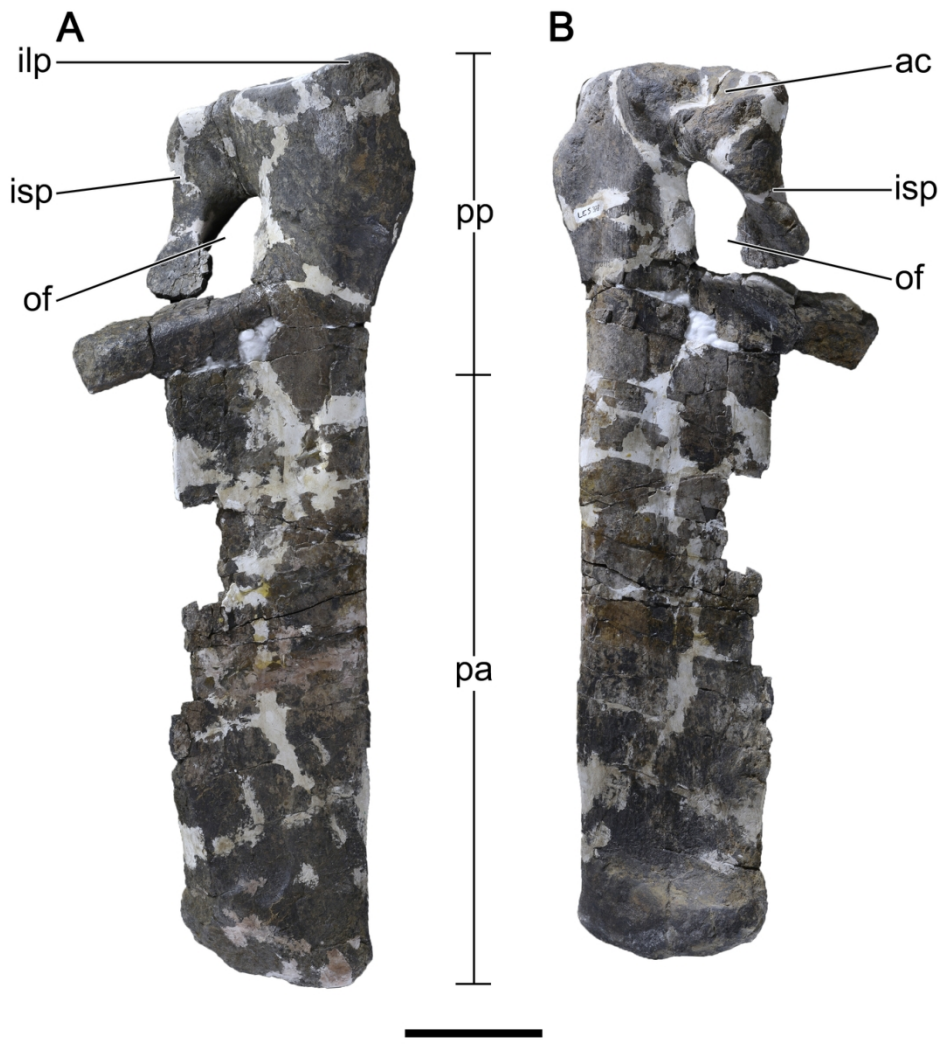
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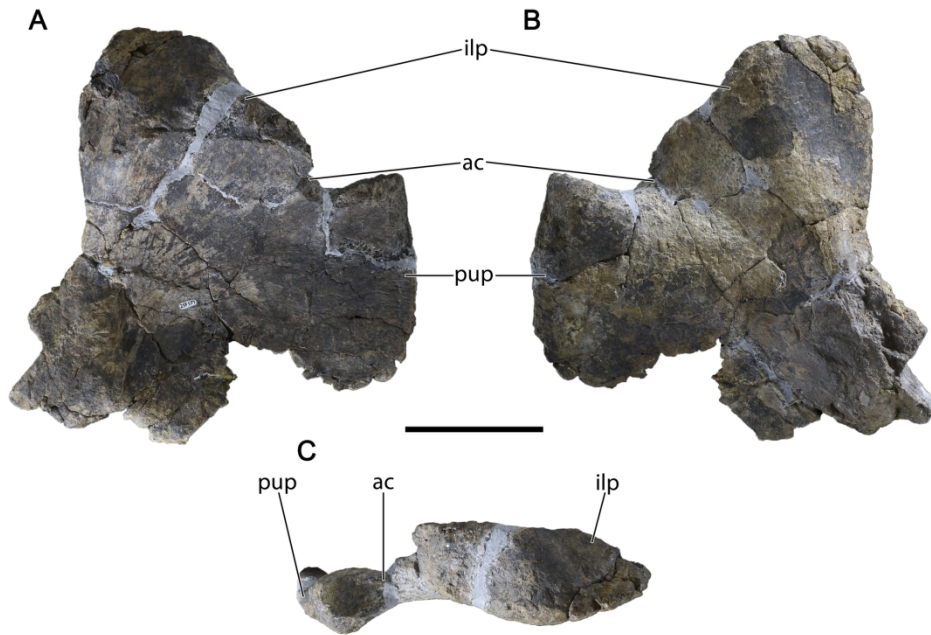
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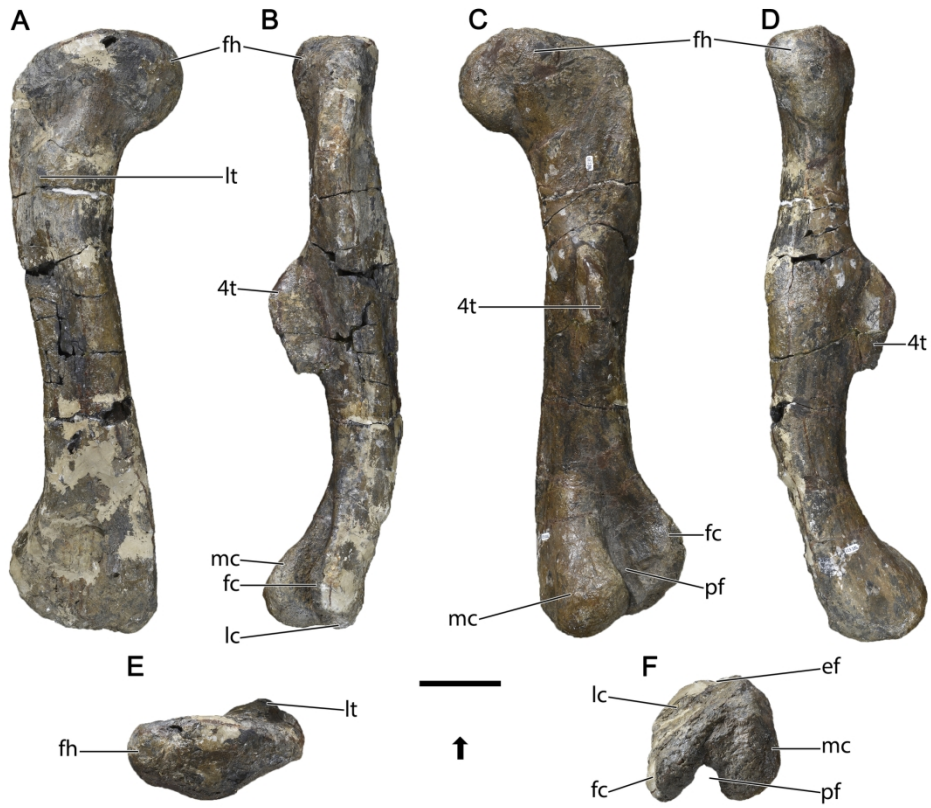
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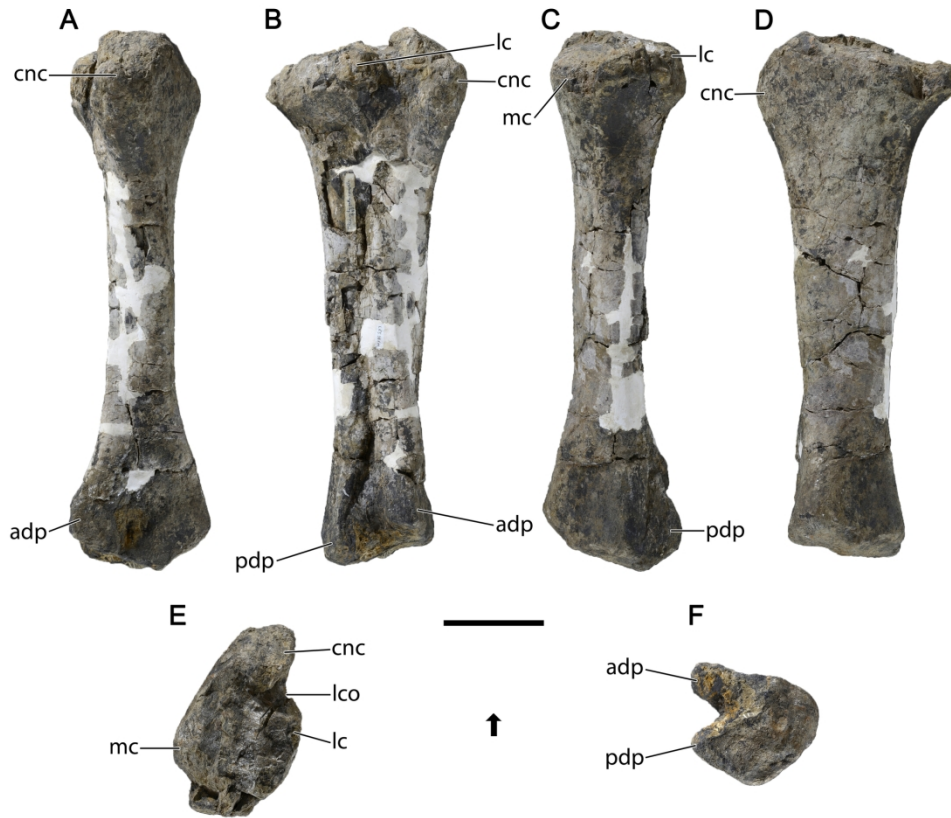
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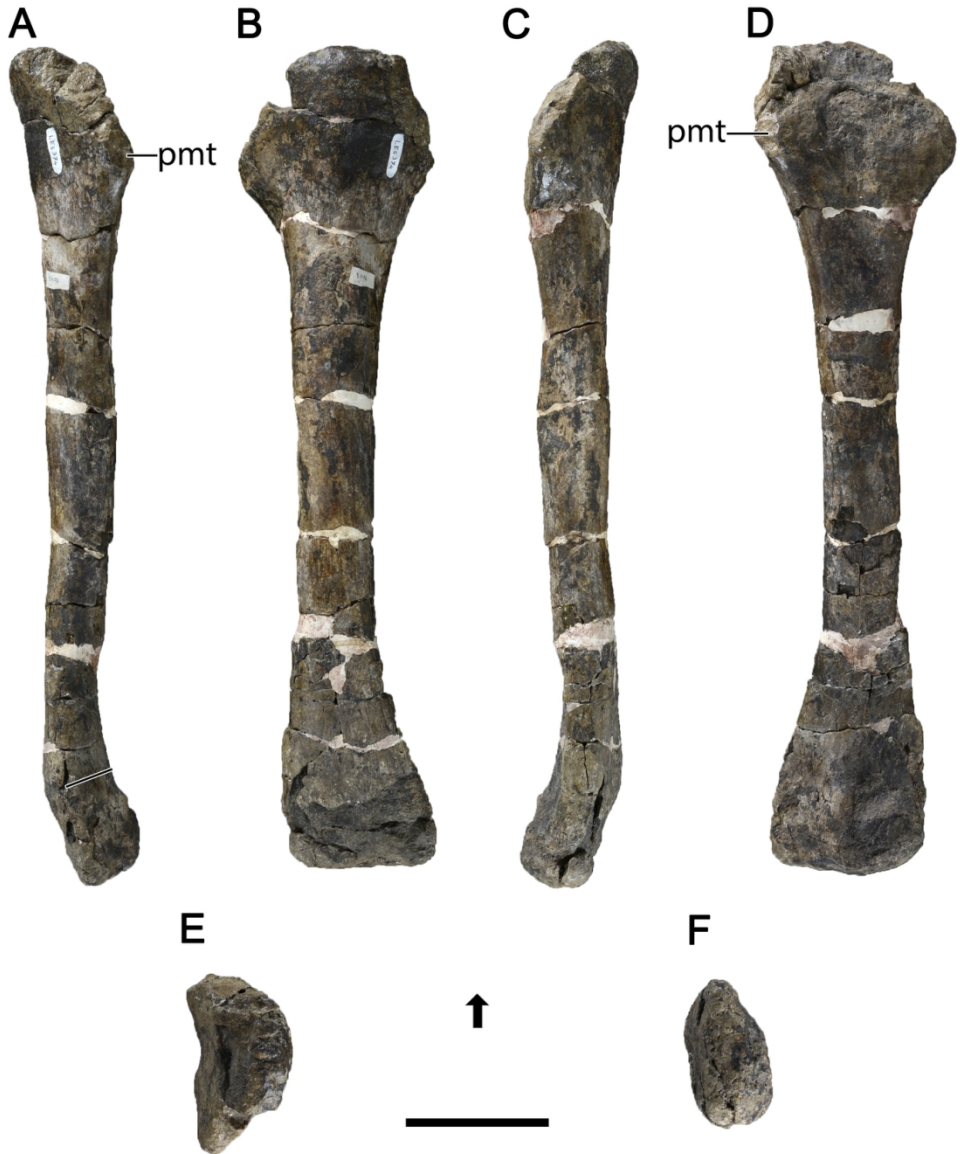


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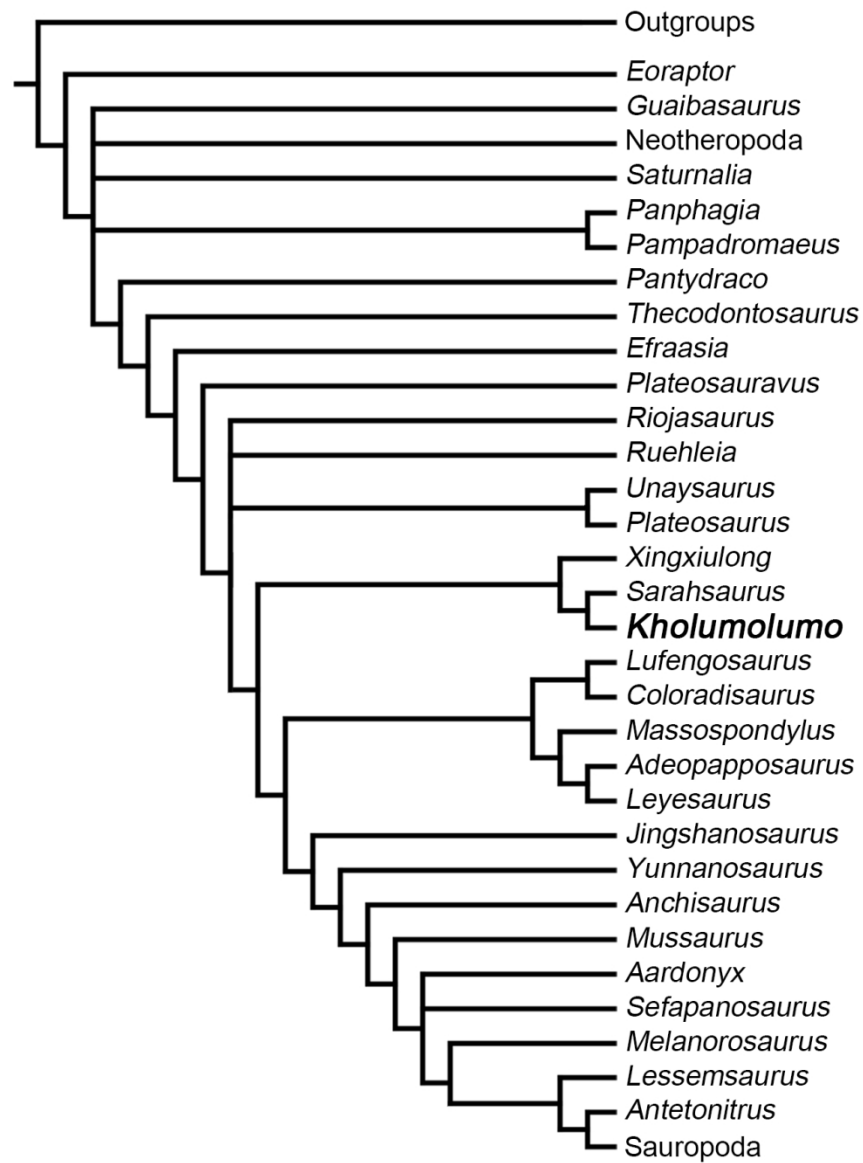


TABLE 1. List of the five field campaigns in the Maphutseng bone bed, with the approximate number of attributed numbers on the field and the team involved in each campaign. In bold: MNHN researchers.

1955 August & September	1955 November 300 numbers attributed	1956 February 400 numbers attributed	1959 ? 200 numbers attributed	1963 Month? 100 numbers attributed	1970 September 300 numbers attributed
P. Ellenberger F. Ellenberger	P. Ellenberger F. Ellenberger A.W. Crompton R.F. Ewer	P. Ellenberger F. Ellenberger A.W. Crompton R.F. Ewer	P. Ellenberger F. Ellenberger H. Ellenberger L. Ginsburg J. Fabre	P. Ellenberger L. Ginsburg J. Fabre C. Mendrez	P. Ellenberger L. Ginsburg J. Fabre B. Battail

TABLE 2. Source of comparative data used in the anatomical descriptions. The underlined specimens were studied first-hand by the first author of this work.

<i>Aardonyx celestae</i>	<u>BP/1/6254</u> ; Yates et al., 2010
<i>Adeopapposaurus mognai</i>	<u>PVSJ 610</u> ; <u>PVSJ 568</u> ; PVSJ 569; Martínez, 2009
<i>Anchisaurus polyzelus</i>	AM 41/109; YPM 208; YPM 1883; Galton, 1976; Fedak and Galton, 2007; Yates, 2010
<i>Antetonitrus ingenipes</i>	<u>BP/1/4952</u> ; McPhee et al., 2014
<i>Blikanasaurus cromptoni</i>	<u>SAM-PK-K403</u> ; Galton and Van Heerden, 1985, 1998
<i>Camelotia borealis</i>	Galton, 1998
<i>Chromogisaurus novasi</i>	<u>PVSJ 845</u> ; Ezcurra, 2010; Martínez et al., 2013
<i>Coloradisaurus brevis</i>	<u>PVL 3967</u> ; <u>PVL 5904</u> ; Apaldetti et al., 2013, 2014
<i>Efraasia minor</i>	Galton, 1984; Yates, 2003
<i>Eoraptor lunensis</i>	<u>PVSJ 512</u> ; Sereno et al., 2013
<i>Eucnemesaurus entaxonis</i>	McPhee et al., 2015
<i>Jingshanosaurus xinwaensis</i>	Zhang and Yang, 1994
<i>Lamplughsaura dharmaramensis</i>	Kutty et al., 2007
<i>Leoneriasaurus taquetrensis</i>	MPEF-PV 1663; Pol et al., 2011
<i>Lessemsaurus sauropoides</i>	<u>PVL 4822</u> ; Pol and Powell, 2007
<i>Leyesaurus marayensis</i>	<u>PVSJ 706</u> ; Apaldetti et al., 2011
<i>Lufengosaurus huenei</i>	IVPP V15; Young, 1941; Barrett et al., 2005
<i>Massospondylus carinatus</i>	<u>BP/1/4934</u> ; <u>BP/1/5241</u> ; <u>BP/1/4779</u> ; <u>BP/1/5247</u> ; <u>BP/1/4924</u> ; <u>BP/1/4693</u> ; Sues et al., 2004; <u>MNHN.F.LES15</u>
<i>Melanorosaurus readi</i>	<u>NM QR3314</u> ; <u>NM QR1551</u> ; <u>SAM-PK-3449</u> ; <u>SAM-PK-3450</u>
<i>Meroktenos thabanensis</i>	MNHN.F.LES16; MNHN.F.LES351
<i>Mussaurus patagonicus</i>	<u>MLP 61-III-20-22</u> ; <u>MLP 61-III-20-23</u> ; <u>MLP 68-II-27-1</u> ; Pol and Powell, 2007; Otero and Pol, 2013
<i>Pampadromaeus barberenai</i>	Cabreira et al., 2011; Müller et al., 2016
<i>Panphagia protos</i>	<u>PVSJ 874</u> ; Martínez and Alcober, 2009; Martínez et al., 2013
<i>Plateosaurus longiceps</i>	<u>MB.R.1937</u> ; <u>MB.R.4402</u> ; <u>MB.R.4404</u> ; <u>MB.R.4416</u>
<i>Pulanesaura eocollum</i>	McPhee et al., 2015
<i>Riojasaurus incertus</i>	<u>PVL 3808</u>
<i>Ruehleia bedheimensis</i>	<u>MB.R.4718</u> ; <u>MB.R.4430</u> ; Galton, 2001
<i>Sarhsaurus aurifontanalis</i>	MCZ 8893; TMM 43646-2; Rowe et al., 2010
<i>Saturnalia tupiniquim</i>	MCP 3845-PV; MCP 3846-PV; Langer et al., 1999; Langer 2003; Langer et al., 2007
<i>Sefapanosaurus zastronensis</i>	<u>BP/1/386</u> ; <u>BP/1/7409–7455</u> ; Otero et al., 2015
<i>Seitaad ruessi</i>	Sertich and Loewen, 2010
<i>Thecodontosaurus antiquus</i>	Benton et al., 2000
<i>Unaysaurus tolentinoi</i>	UFSM11069; Leal et al., 2004
<i>Xixiposaurus suni</i>	Sekiya, 2010

TABLE 2. (Continued)

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3 *Yunnanosaurus huangi*

4 IVPP V20; IVPP V505; Young, 1942; Barrett et al., 2007
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TABLE 3. Selected measurements (mm) of the vertebrae of *Kholumolumo ellenbergerorum*. Abbreviations following the order of the table: **L**, maximum anteroposterior ventral length; **antW**, anterior width; **medW**, medial width; **postW**, posterior width; **antH**, anterior height; **postH**, posterior height; **naH**, neural arch height; **nsH**, maximum neural spine height; **nsL**, maximum neural spine length; **nsW**, maximum neural spine width measured at its distal end; **przD**, distance between the lateral borders of the prezygapophyses; **H**, total height; *, deformation.

	CENTRUM						NEURAL ARCH				VERTEBRA	
	L	antW	medW	postW	antH	postH	naH	nsH	nsL	nsW	przD	H
Cmid MNHN.F.LES338	?	65	30	?	78	?	?	?	?	?	?	?
Cmid MNHN.F.LES342	127	41*	20*	?	54*	?	?	?	?	?	?	?
C10? MNHN.F.LES169	132	90	34	85	105	92	150	46	39	37	88	255
D1? MNHN.F.LES397	?	?	?	?	?	?	>110	?	?	?	91	?
D2-3? MNHN.F.LES172	115	90*	33*	82*	117*	105*	?	?	?	?	?	?
D8-12? MNHN.F.LES32	120	63*	38*	71*	97*	108*	>120	?	?	?	68	>233
Sp2? MNHN.F.LES155	101	105	73	175	137	155	265	175	75	45	?	420
Ca1-5 MNHN.F.LES168	90	?	102	155	141	165	260	180	65	41	?	425
Ca5-15 MNHN.F.LES376	105	108	68	107	125	124	210	155	55	23	75	335
Ca15-25 MNHN.F.LES177	90	60	46	59	53	52	?	?	?	?	?	?
Ca25+ MNHN.F.LES35	65	35	25	34	34	29	?	?	?	?	?	?

TABLE 4. Selected measurements (mm) of the scapulae of *Kholumolumo ellenbergerorum*.

Abbreviations following the order of the table: **L**, maximum dorsoventral length; **dW**, maximum distal width; **bW**, blade minimal anteroposterior width; **bT**, blade transversal thickness measured at midpoint on the posterior border; **pW**, maximum proximal width; **amxH**, acromion maximum height measured at the level of the point of divergence with the anterior border of the blade; **amnH**, acromion minimum height measured on its distal extremity; **aW**, acromion anteroposterior width measured at the level of the anterior border of the blade; **aT**, acromion transversal thickness; **nsW**, maximum neural spine width measured at its distal end; **gcT**, glenoid cavity maximum thickness.

	BLADE					ACROMION				
	L	dW	bW	bT	pW	amxH	amnH	aW	aT	gcT
Scapula (right) MNHN.F.LES133	?	?	?	35	?	?	?	?	?	?
Scapula (left) MNHN.F.LES134	?	?	132	34	?	?	?	?	?	?
Scapula (right) MNHN.F.LES135	?	?	164	35	?	?	?	?	?	?
Scapula (right) MNHN.F.LES158	?	?	76	34	?	?	?	?	?	?
Scapula (left) MNHN.F.LES386	720	?	172	30	385	265	140	85	40	106

TABLE 5. Selected measurements (mm) of the bones from the anterior member of *Kholumolumo ellenbergerorum*. Abbreviations following the table order: **L**, maximum proximodistal length; **dpcl**, deltopectoral crest dorsoventral length (measured from the proximal border of the humerus); **W**, maximum transverse width; **T**, maximum anteroposterior thickness; **C**, circumference of the diaphysis (measured beneath the deltopectoral crest on humeri); **>**, length measured given that one or both extremities of the bone are broken.

	PROXIMAL				DIAPHYSIS			DISTAL	
	L	dpcl	W	T	W	T	C	W	T
Humerus (left) MNHN.F.LES379	685	330	300	70	82	80	262	220	68
Humerus (right) MNHN.F.LES385	630	280	?	?	77	70	235	225	?
Humerus (right) MNHN.F.LES390	610	265	233	64	85	72	257	214	60
Ulna (right) MNHN.F.LES145	>305	-	?	?	50	44	-	54	?
Ulna (right) MNHN.F.LES156	370	-	120	150	53	50	-	50	100
Ulna (right) MNHN.F.LES159	390	-	126	142	52	48	-	56	108
Radius (left) MNHN.F.LES140	>264	-	112	65	47	45	-	?	?
Radius (right) MNHN.F.LES142	>235	-	?	?	42	39	-	?	58
Radius (left) MNHN.F.LES144	320	-	97	54	42	42	-	?	65
Radius (left) MNHN.F.LES147	320	-	99	58	46	38	-	85	64
Metacarpal I (right) MNHN.F.LES26	97	-	95	69	66	33	-	85	53
Metacarpal II (left) MNHN.F.LES92	125	-	68	60	32	27	-	60	38
Metacarpal III (right) MNHN.F.LES93	142	-	67	64	26	29	-	57	40
Metacarpal IV (right) MNHN.F.LES76	>103	-	?	?	28	21	-	43	27
Phalanx I.I (left) MNHN.F.LES29	94	-	65	-	-	-	-	-	-

TABLE 6. Selected measurements (mm) of the ilia, pubes and ischium of *Kholumolumo ellenbergerorum*. Abbreviations following the table order: **L**, maximum anteroposterior length; **La**, anteroposterior length above the acetabulum (at the level of the notch); **H**, maximum dorsoventral height; **Hibl**, maximum dorsoventral height of the iliac blade (measured on the lateral surface above the supracetabular crest); **Dac**, maximum diameter of the acetabulum (measured on the medial side); **Lprp**, length of the preacetabular process measured from its extremity to the level of the notch; **Lpop**, length of the postacetabular process measured from its extremity to the level of the notch of the ischial peduncle; **Lpup**, length of the pubic peduncle following its main axis; **Lepup**, anteroposterior length of the extremity of the pubic peduncle measured in ventral view; **Wepup**, transverse width of the extremity of the pubic peduncle measured in ventral view; **Lisp**, length of the ischial peduncle following its main axis; **Leisp**, anteroposterior length of the extremity of the ischial peduncle measured in ventral view; **Weisp**, transverse width of the extremity of the ischial peduncle measured in ventral view; >, length measured given that one or both extremities of the bone are broken; *, deformation.

	L	La	H	Hibl	Dac	Lprp	Lpop	Lpup	Lepup	Wepup	Lisp	Leisp	Weisp
Ilium (right) MNHN.F.LES375a	610	390	385	205	180	95	200	185	155	117	110	117	122
Ilium (right) MNHN.F.LES396	550	360	350	180	177	85	160	160	113	90	75	102	105
	L	Lpp	Wpp	Hepp	Lilp	Lac	Lisp	Lpa	Wpa	Wde	Hde		
Pubis (right) MNHN.F.LES373	660	180	?	>160	136	45	?	≈430	155	?	?		
Pubis (left) MNHN.F.LES378	665	215	243	74*	160	75	>155	450	148	152	75		
	L	La	H	Hibl	Dac	Lprp	Lpop	Lpup	Lepup	Wepup	Lisp	Leisp	Weisp
Ischium (left) MNHN.F.LES152	315	300	160	51	70	31	155	68					

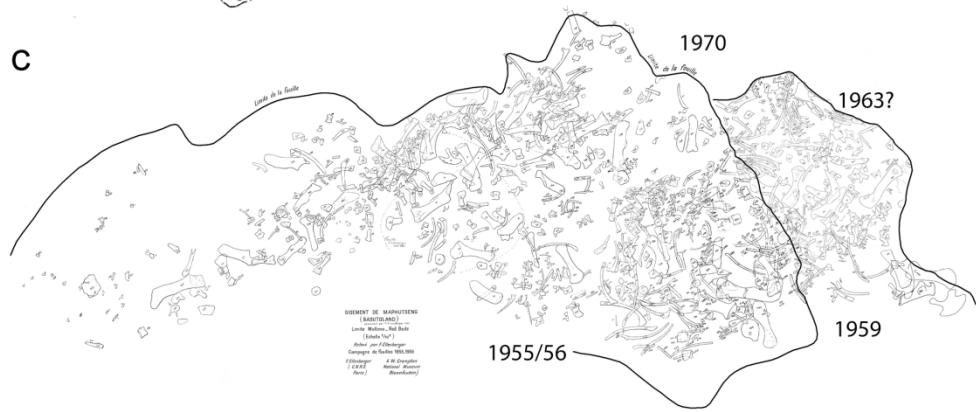
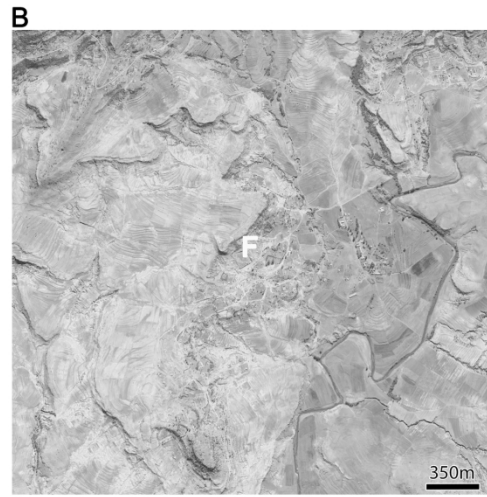
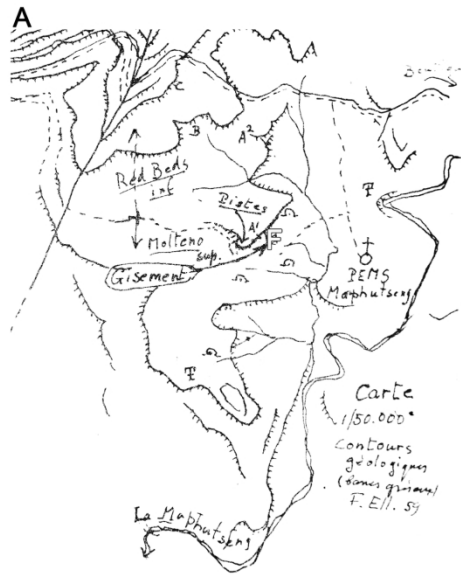
TABLE 7. Selected measurements (mm) of the femora, tibiae and fibulae of *Kholumolumo ellenbergerorum*. Abbreviations following the table order: **L**, maximum proximodistal length; **W**, maximum transverse width; **T**, maximum anteroposterior thickness; **C**, circumference of the diaphysis (measured beneath the fourth trochanter on femora, at midpoint on tibiae and fibulae); **dp**, distance between the proximalmost point of the fourth trochanter and the proximal extremity of the femur; **IR**, robustness index (L/C); **E**, eccentricity of the diaphysis (W/T); **>**, length measured given that one or both extremities of the bone are broken; *****, deformation.

	PROXIMAL			DIAPHYSIS			DISTAL		4 th TROCH.		RATIOS	
	L	W	T	W	T	C	W	T	dp	L	IR	E
Femur (left) MNHN.F.LES371	860	235	140	102	109	333	198	195	300	165	2,58	0,94
Femur (right) MNHN.F.LES394	755	220	107	108	93	320	172	140	280	145	2,36	1,16
Tibia (left) MNHN.F.LES148	345	?	?	50	51	165	99	67	-	-		
Tibia (right) MNHN.F.LES167	>410	128	173	78	88	267	?	?	-	-		
Tibia (right) MNHN.F.LES381m	510	130	205	63	100	270	148	116	-	-		
Tibia (right) MNHN.F.LES387	580*	218*	110*	90*	85*	275*	156*	90*	-	-		
Tibia (left) MNHN.F.LES389	515	145	200	70	95	255	138	105	-	-		
Fibula (right) MNHN.F.LES149	>460	?	?	40	48	146	60	104	-	-		
Fibula (right) MNHN.F.LES150	>400	?	?	46	54	163	?	?	-	-		
Fibula (right) MNHN.F.LES374	575	40	>141	45	54	162	52	107	-	-		
Metatarsal I (left) MNHN.F.LES89	134	92	43	61	34	-	81	50	-	-	-	-
Metatarsal II (left) MNHN.F.LES81	180	?	?	48	35	-	70	47	-	-	-	-
Metatarsal III (left) MNHN.F.LES82	219	78	50	45	34	-	73	50	-	-	-	-
Metatarsal IV (left) MNHN.F.LES381c	228	100	40	43	27	-	55	50	-	-	-	-
Metatarsal V (left) MNHN.F.LES77	111	92	41	39	29	-	36	31	-	-	-	-

TABLE 8. Size and body mass estimations for *Kholumolumo ellenbergerorum* compared to those of other gondwanan basal sauropodomorphs from the Norian or Rhaetian. The parameters were defined by Campione & Evans, 2012 and the linear regression curve is from Apaldetti et al., 2018. Material used for *Kholumolumo* measurements: MNHN.F.LES371 (femur); MNHN.F.LES379 (humerus); MNHN.F.LES386 (scapula); MNHN.F.LES375a (ilium). Specimens considered for the comparison: *Coloradisaurus* PVL 5904; *Lessemsaurus* 1 PVL 4822; *Lessemsaurus* 2 CRILAR PV-303 (scapula), CRILAR PV-302 (ilium); *Melanorosaurus* NM QR 1551; *Plateosauravus* SAM PK 3602 (femur), SAM PK 3609 (ilium); *Riojasaurus* PVL 3808; *Ruehleia* MB.R.4718; *Unaysaurus* UFSM11069. All were measured first-hand, except *Unaysaurus*.

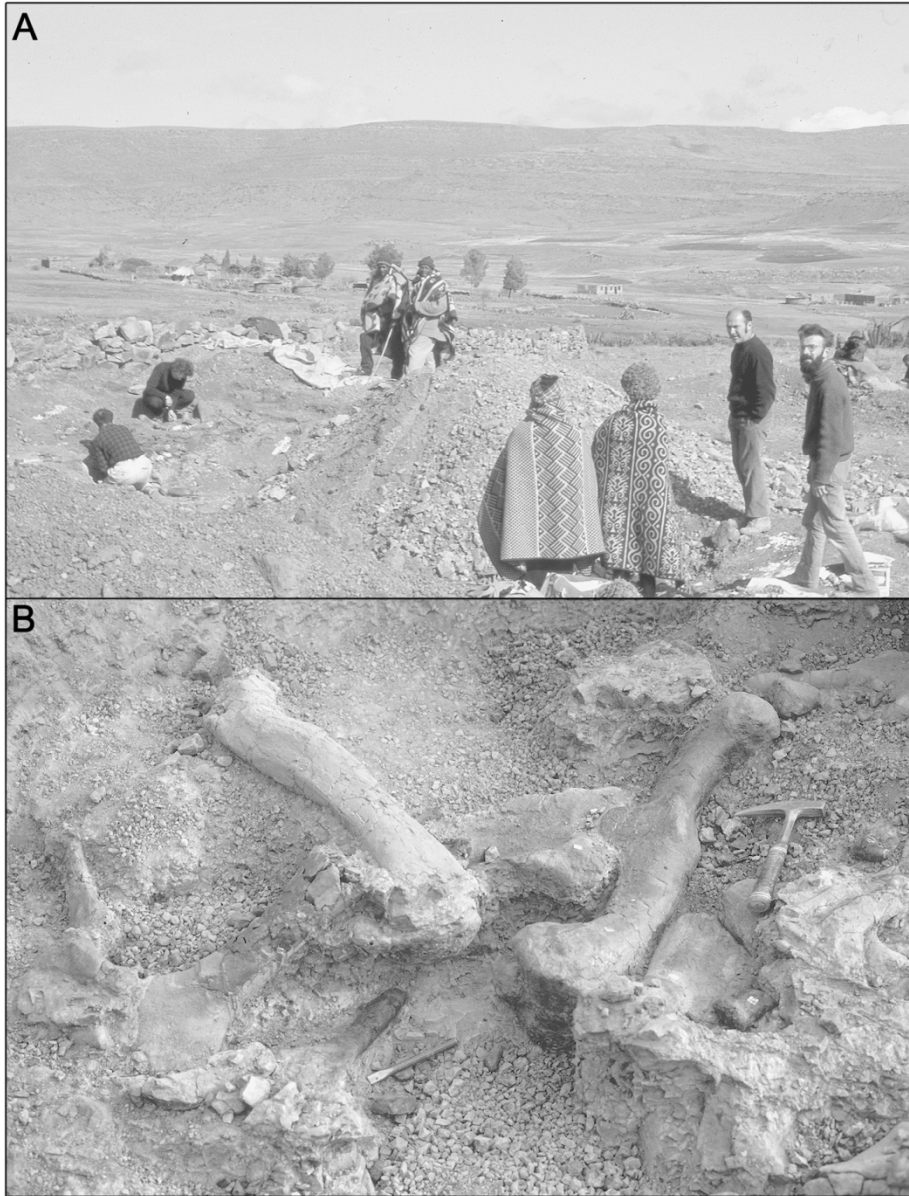
Genera	Size	Body mass			
		Size estimation (Sander and Klein, 2005)	Bipedal equation (Benson et al., 2018)	Quadrupedal equation (Benson et al., 2018)	Scapula equation (Apaldetti et al., 2018)
<i>Kholumolumo</i>	8.6 m	1754 kg	3334 kg	3864 kg	3963 kg
<i>Coloradisaurus</i>	5.0 m	438 kg	757 kg	307 kg	?
<i>Lessemsaurus</i> 1	8.4 m	1963 kg	2208 kg	1746 kg	2792 kg
<i>Lessemsaurus</i> 2	?	?	?	5268 kg	7165 kg
<i>Melanorosaurus</i>	6.2 m	946 kg	1603 kg	1396 kg	1656 kg
<i>Plateosauravus</i>	8.0 m	824 kg	?	?	2792 kg
<i>Riojasaurus</i>	6.1 m	1005 kg	1923 kg	?	1552 kg
<i>Ruehleia</i>	7.6 m	986 kg	?	?	2371 kg
<i>Unaysaurus</i>	?	?	?	88 kg	?

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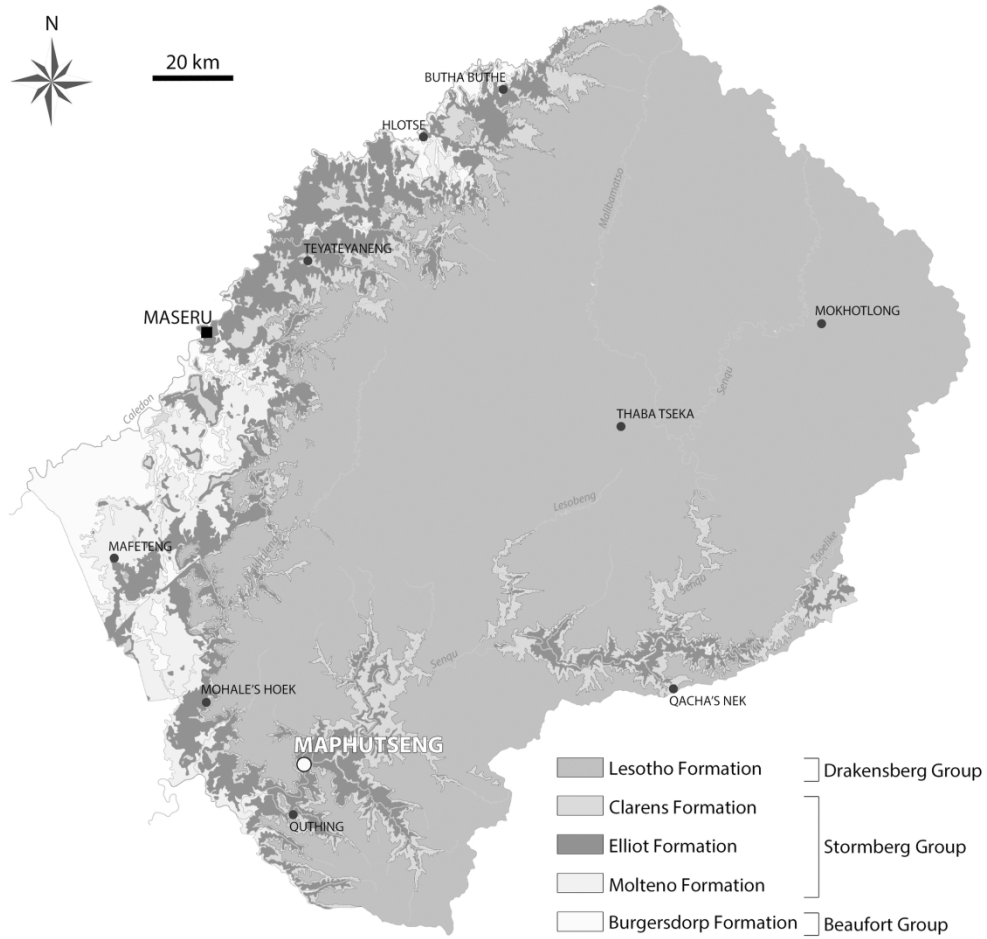
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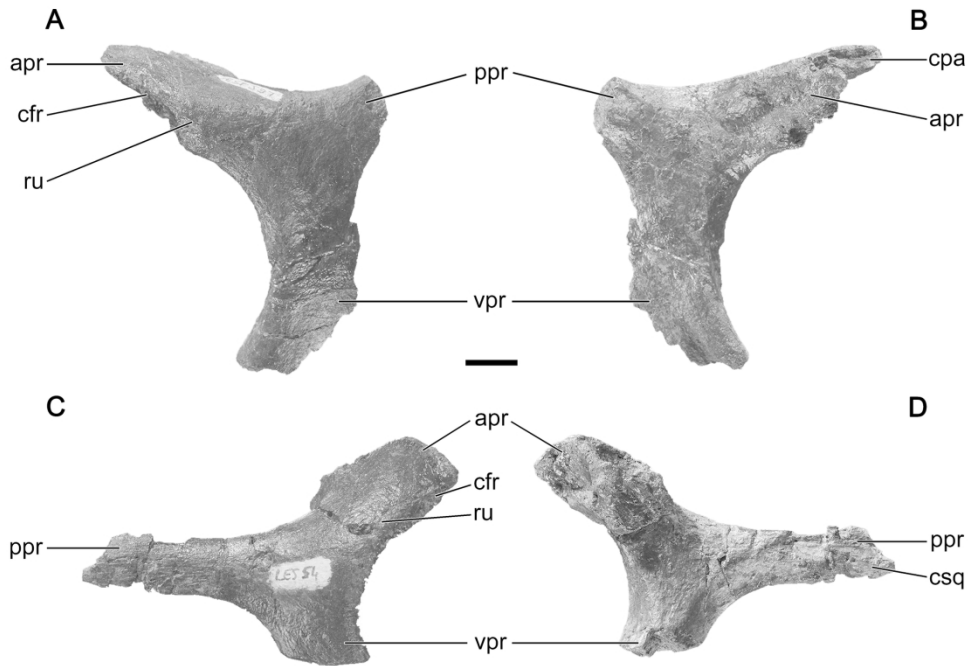


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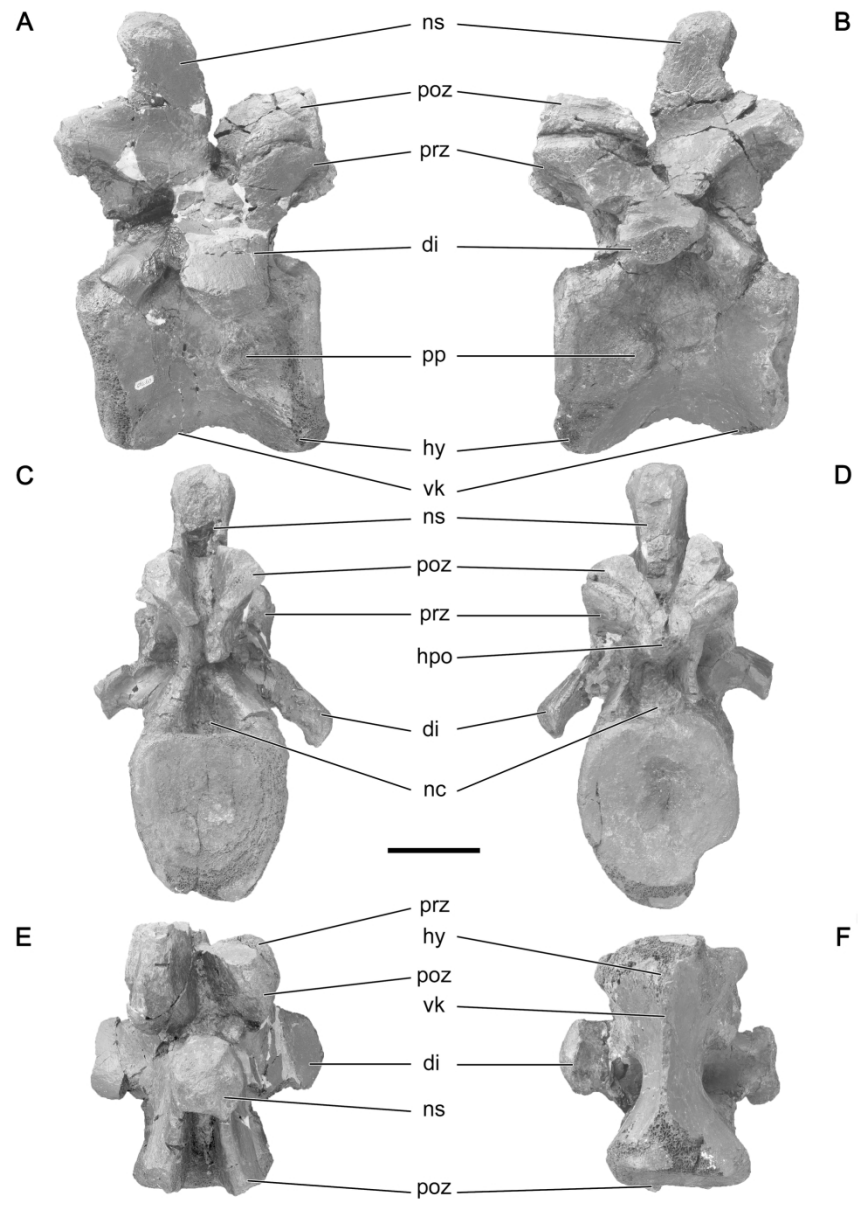
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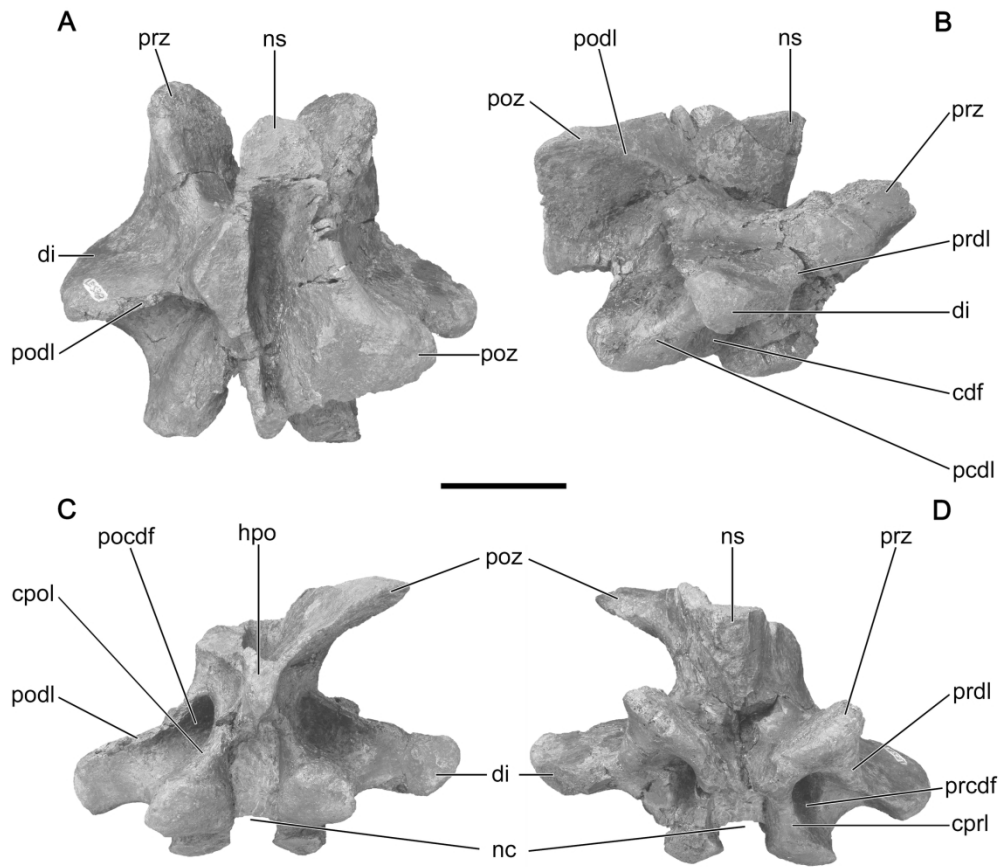
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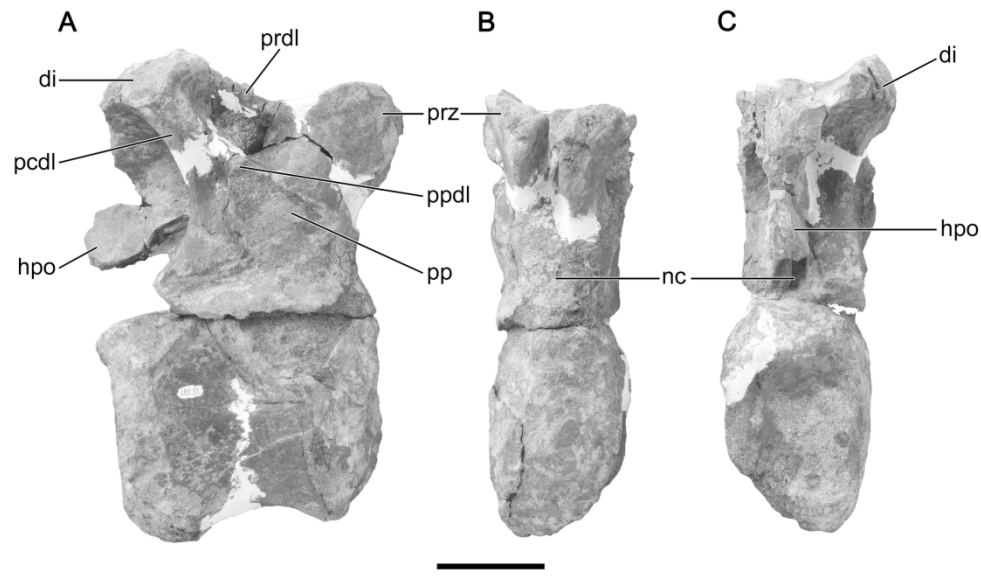


181x232mm (300 x 300 DPI)

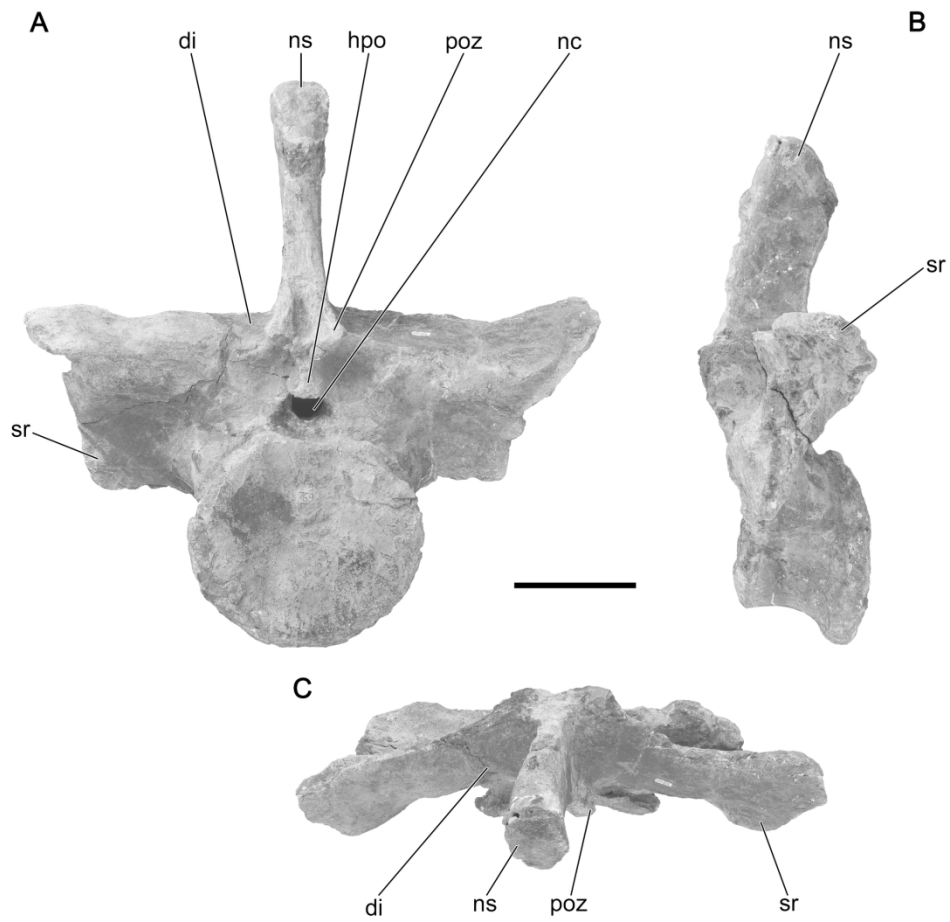


181x159mm (300 x 300 DPI)

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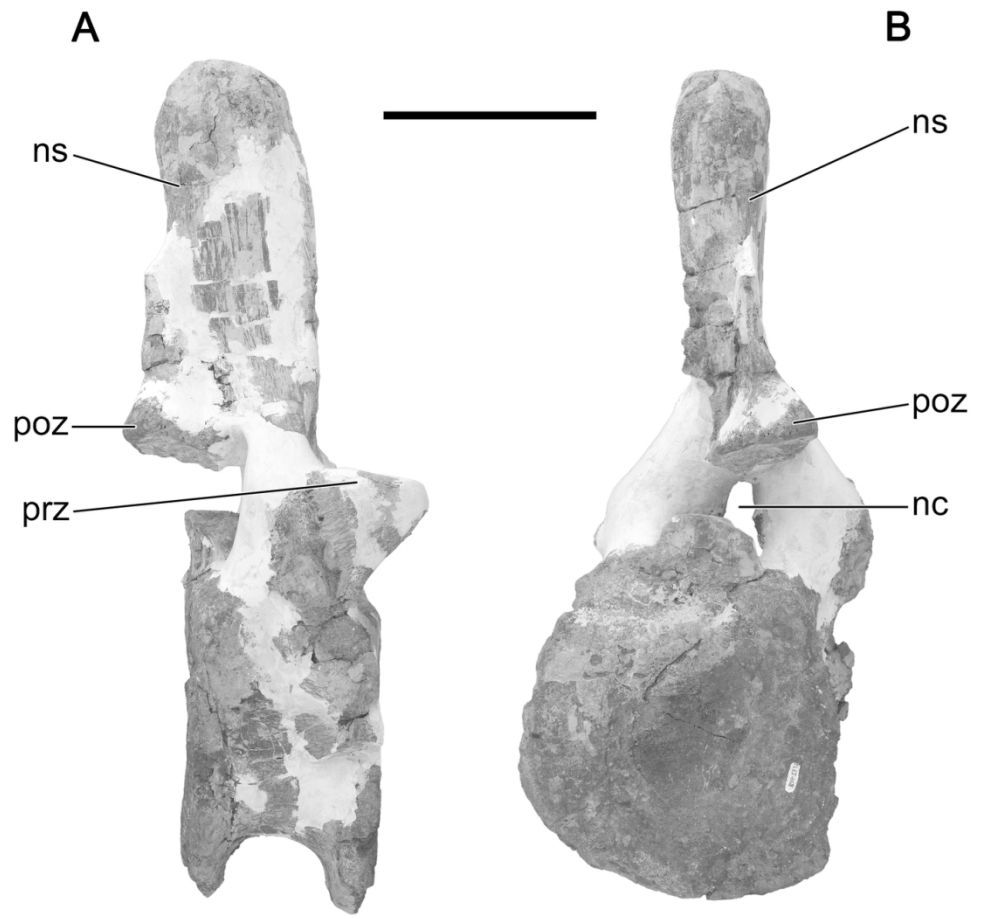
181x105mm (300 x 300 DPI)



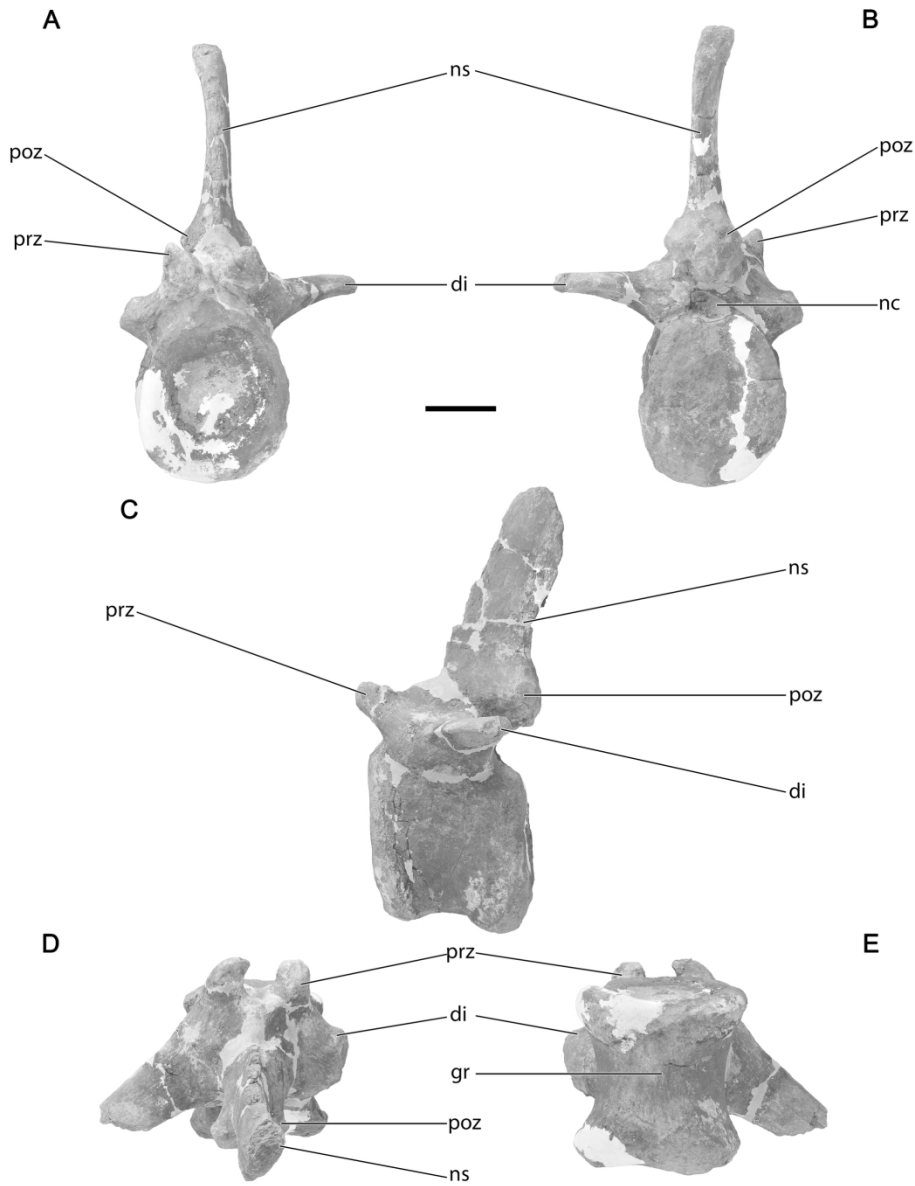
181x168mm (300 x 300 DPI)

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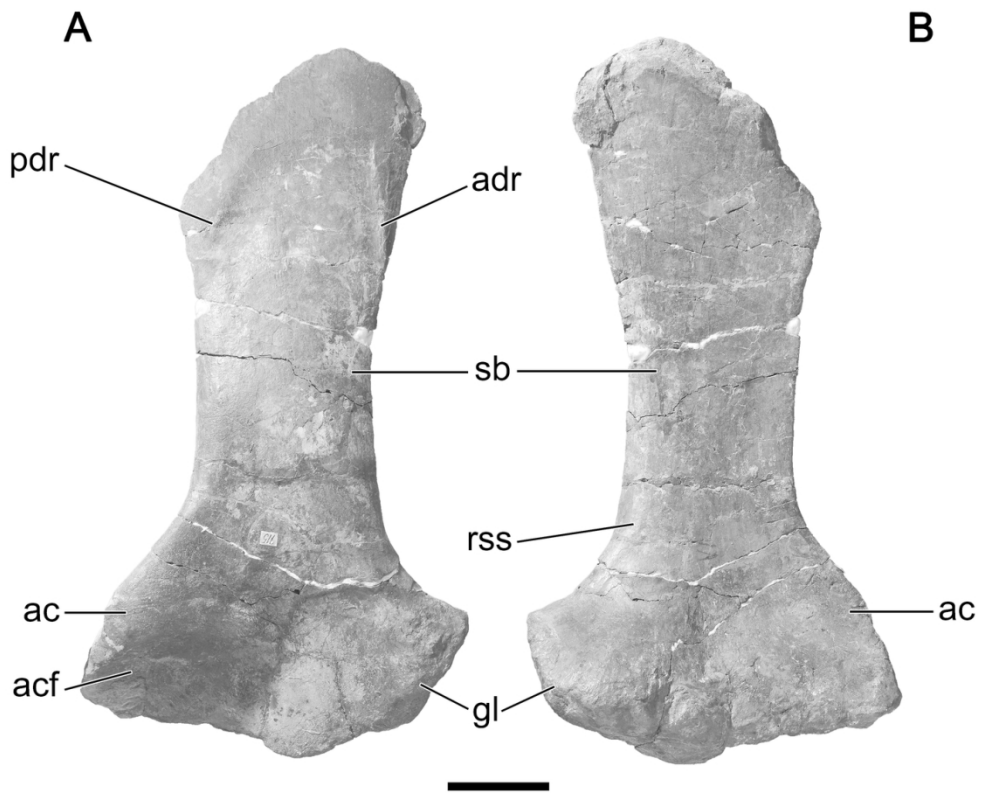
122x113mm (300 x 300 DPI)



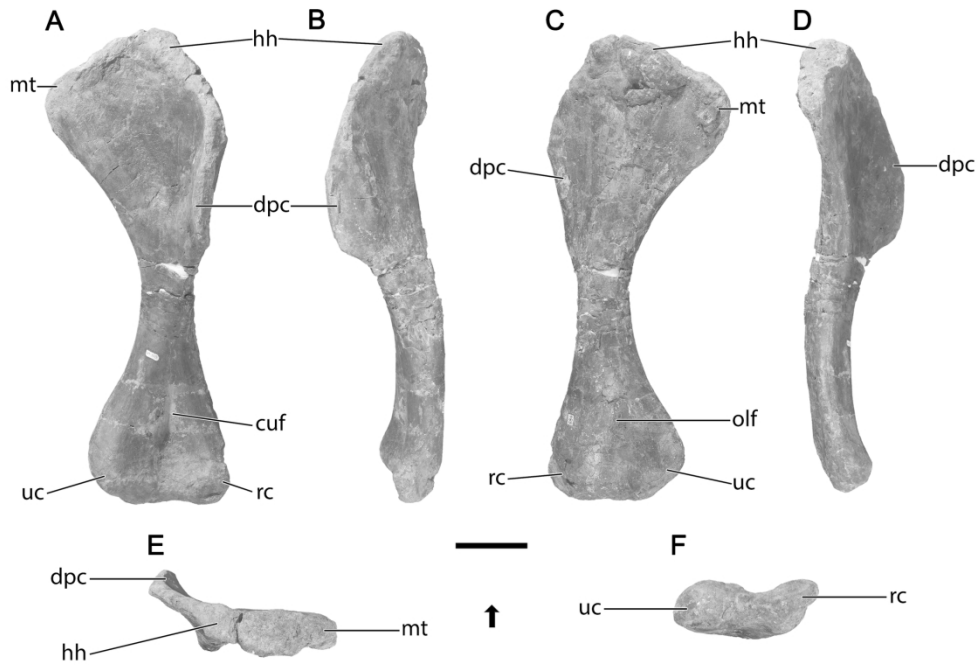
181x232mm (300 x 300 DPI)

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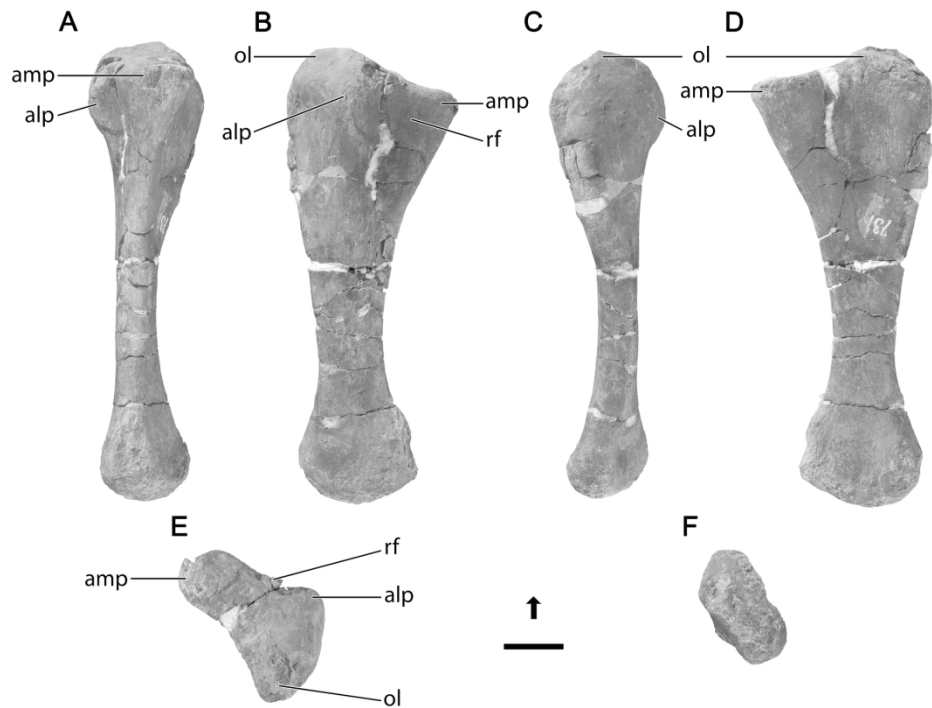


122x98mm (300 x 300 DPI)

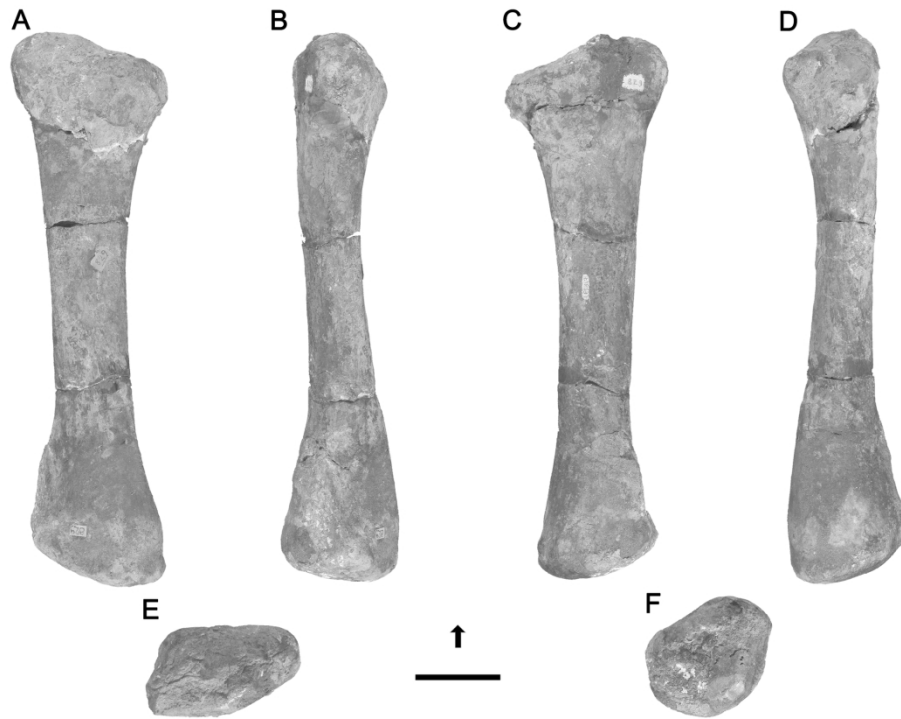


181x121mm (300 x 300 DPI)

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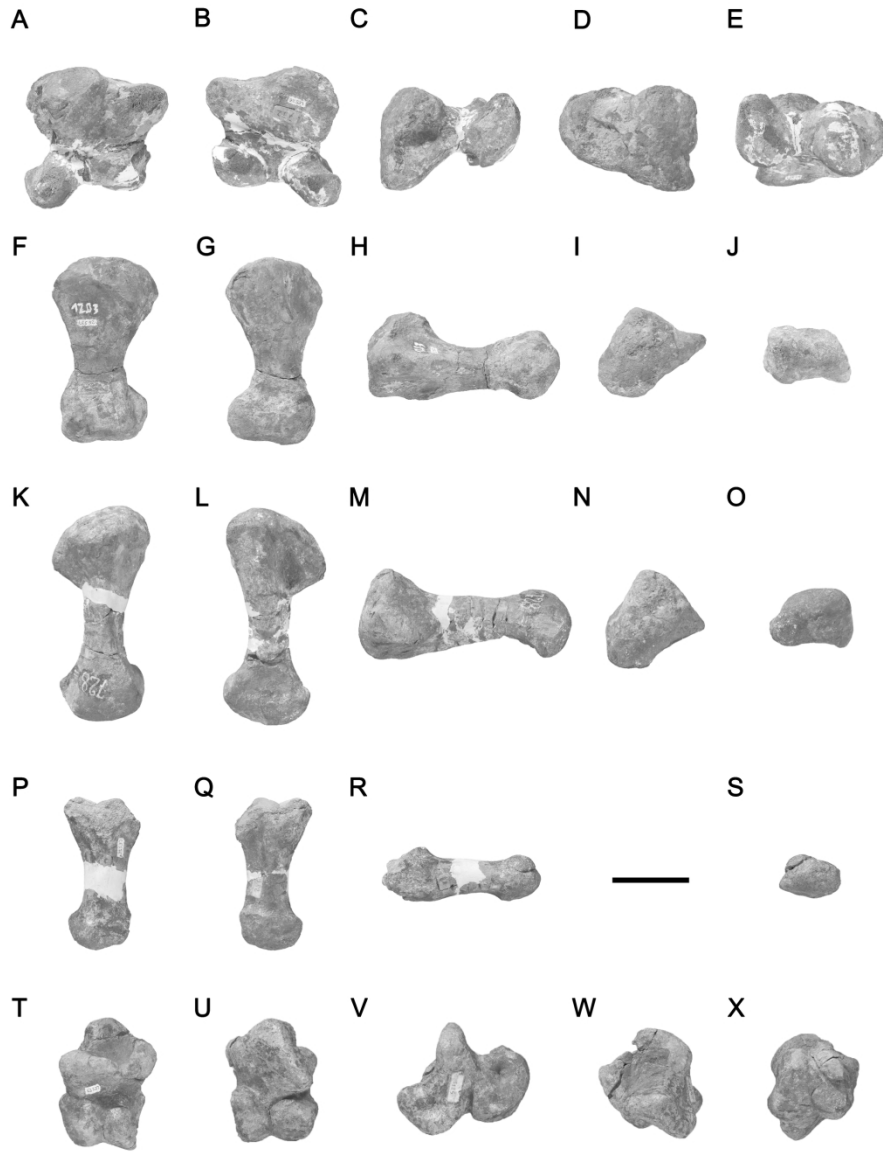
181x131mm (300 x 300 DPI)



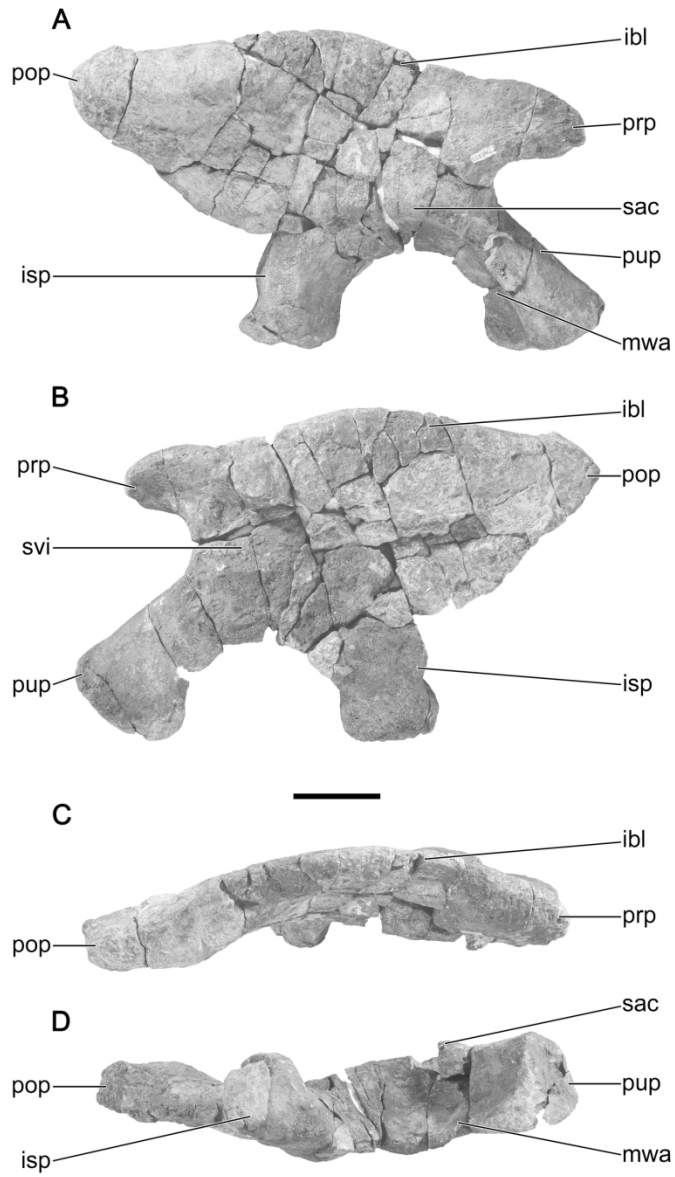
181x131mm (300 x 300 DPI)

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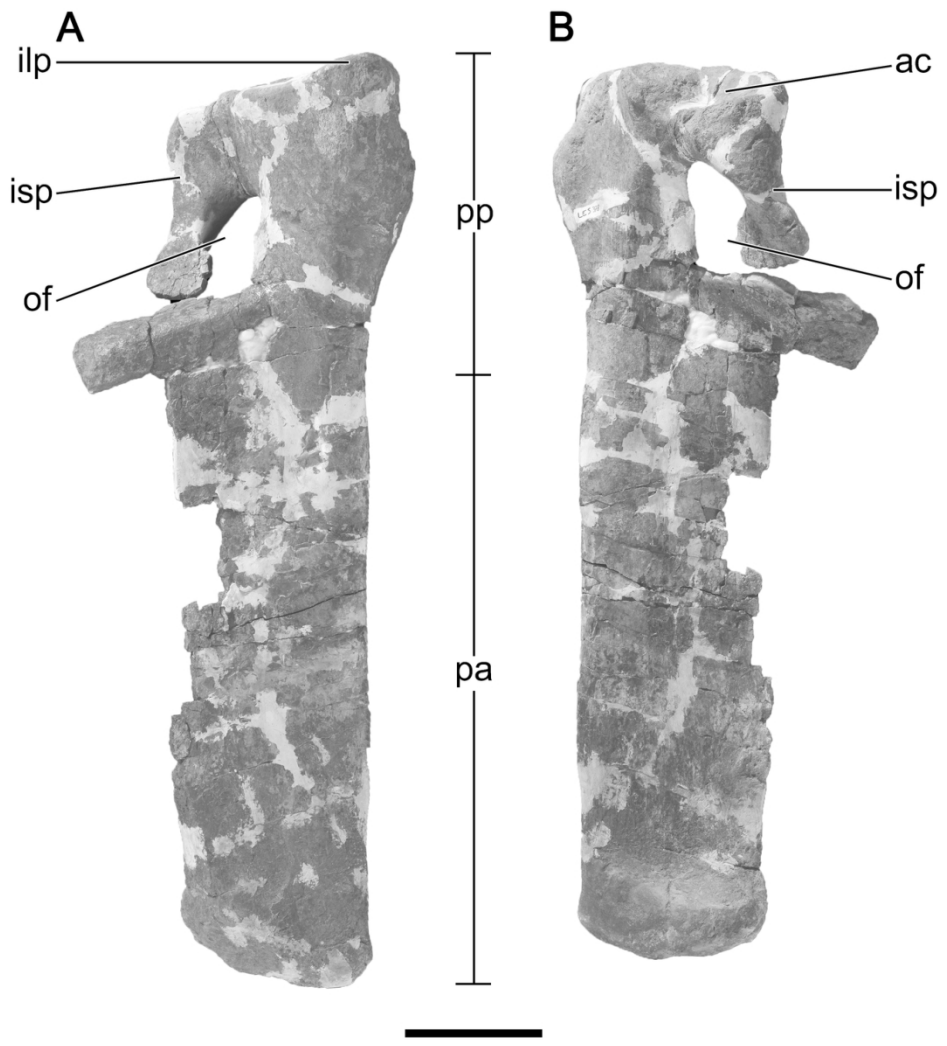
181x232mm (300 x 300 DPI)



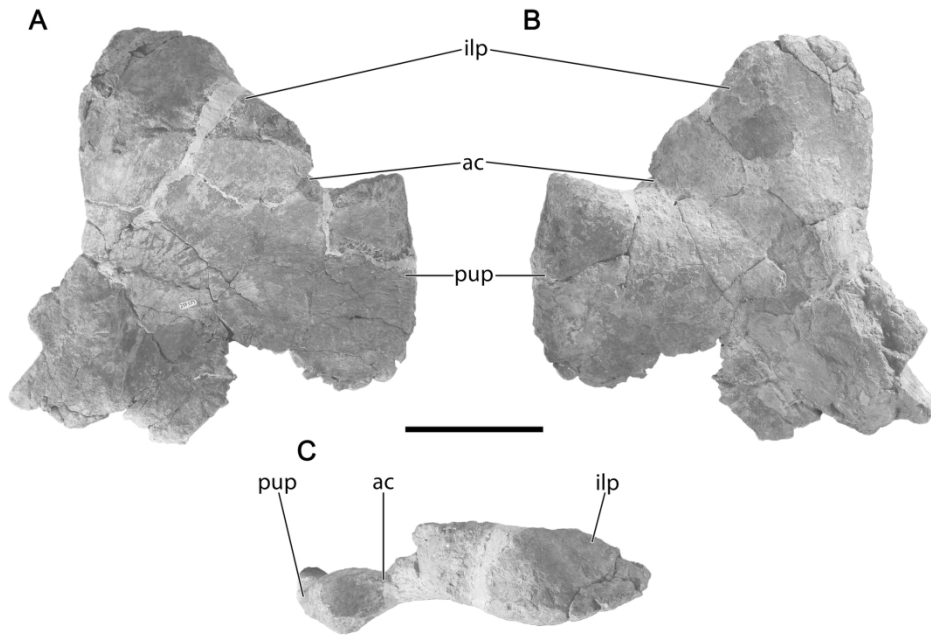
122x214mm (300 x 300 DPI)

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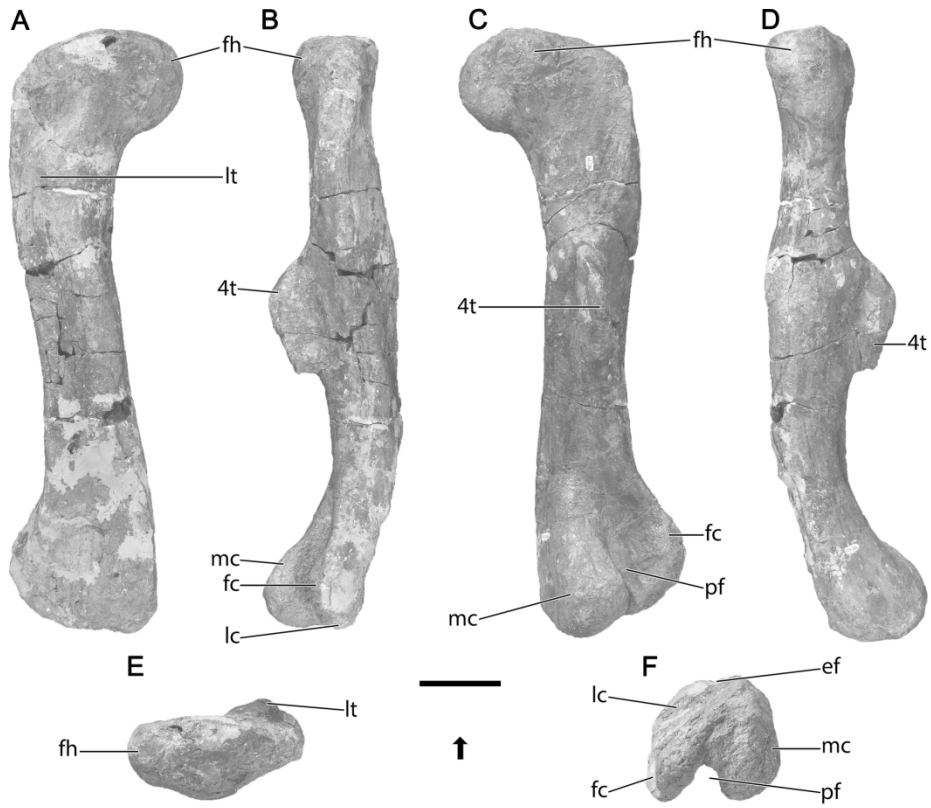
122x130mm (300 x 300 DPI)



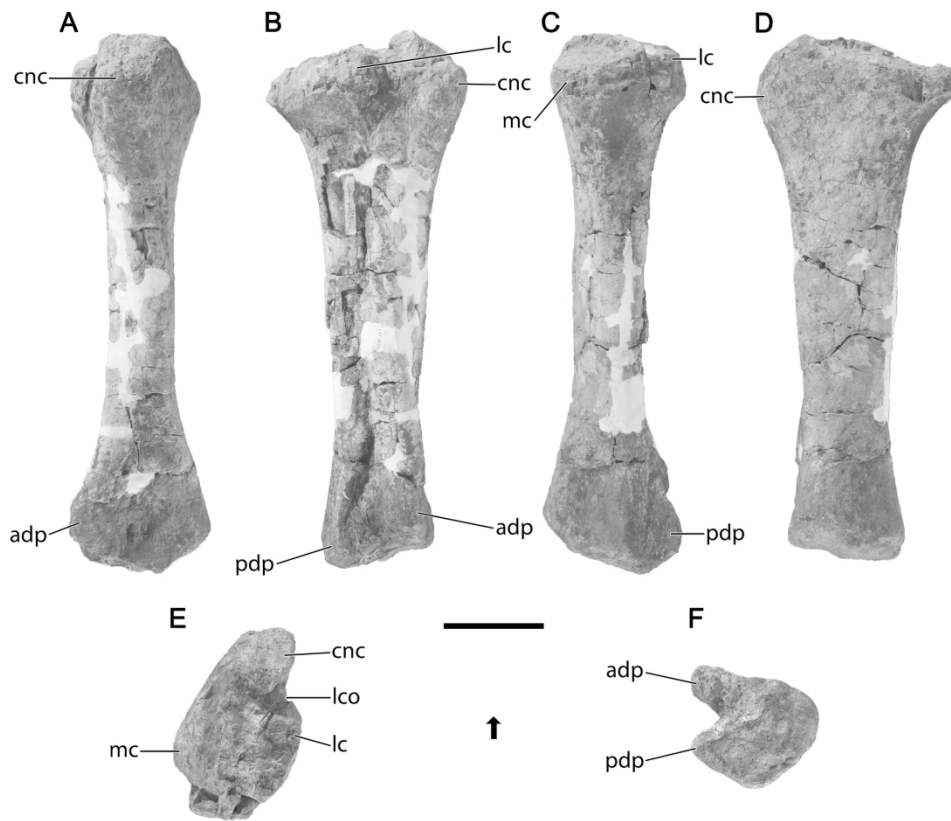
181x120mm (300 x 300 DPI)

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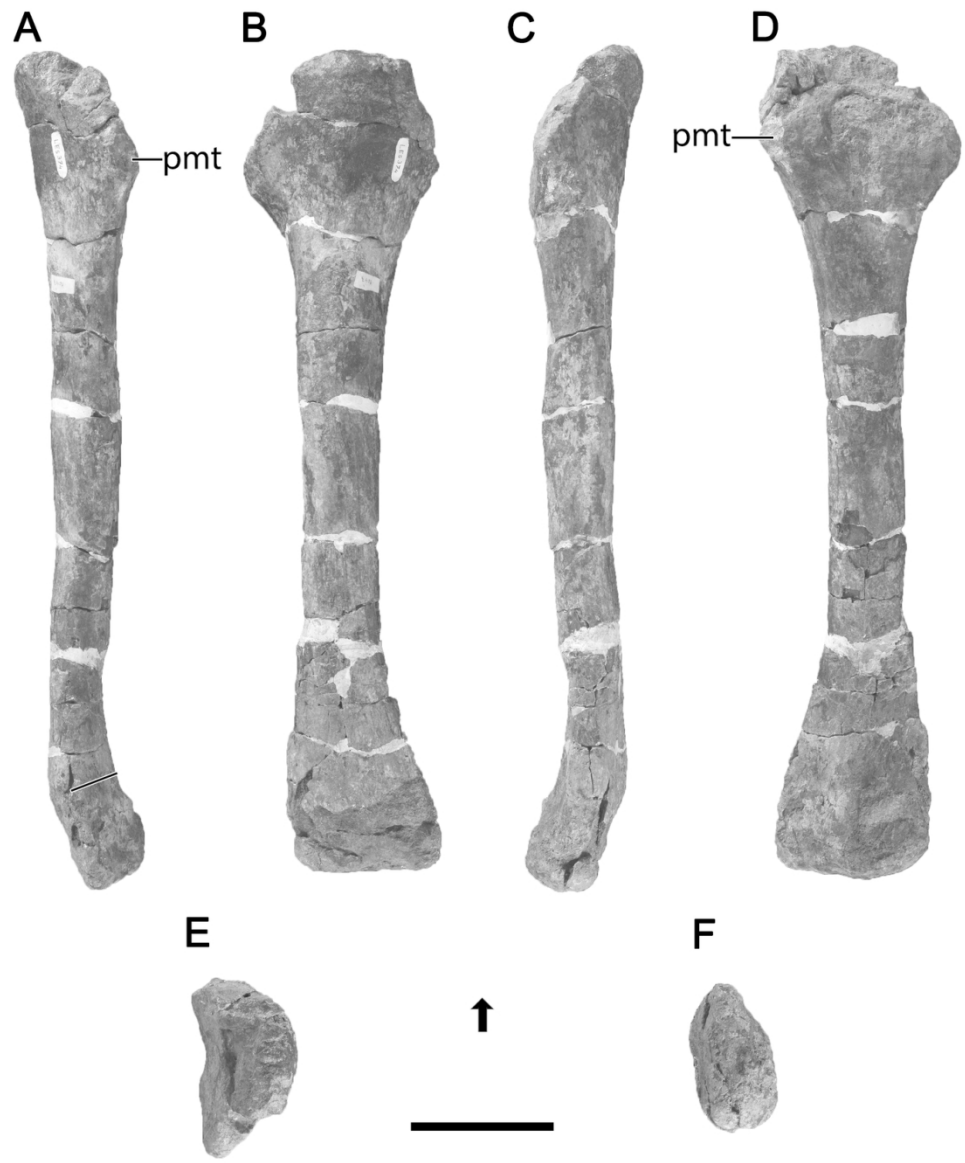


181x149mm (300 x 300 DPI)

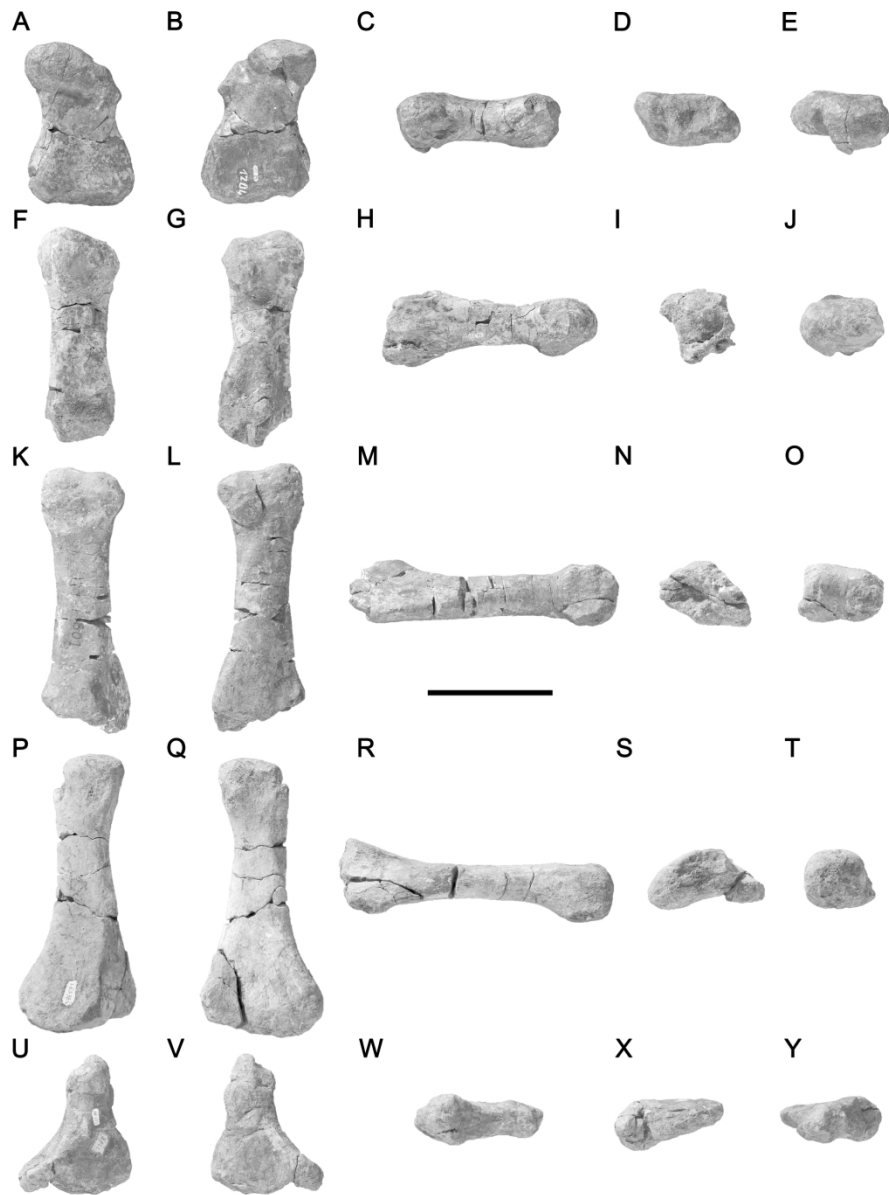


181x149mm (300 x 300 DPI)

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122x142mm (300 x 300 DPI)



181x232mm (300 x 300 DPI)

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