



42



IER

Instituto
de Estudios
Riojanos

ZUBÍA

REVISTA DE CIENCIAS.

Nº 42 (2024). Logroño (España).

P. 1-429, ISSN: 0213-4306

“*MOSASAURUS*” *IEMBEENSIS* FROM THE UPPER CRETACEOUS OF ANGOLA: HISTORICAL OVERVIEW

PEDRO ALBUQUERQUE^{1*},
FRANCISCO ORTEGA²,
LILIANA PÓVOAS³,
PEDRO MOCHO^{1,2,4}

ABSTRACT

The mosasaurid record of Angola is relatively diverse and unique, including some exclusive taxa, such as *Angolasaurus bocagei* and “*Mosasaurus*” *iembeensis*. The type specimen of “*Mosasaurus*” *iembeensis* was first described by Miguel Telles Antunes in 1964, and it was considered lost after the fire of 1978 at the Museu Nacional de História Natural e da Ciência (MUHNAC, Lisbon, Portugal). Herein, we will provide a historical overview of this specimen, including aspects as its discovery and description, its alleged loss, and the more recent systematic approaches. This specimen is notified here as housed in the paleontological collections of MUHNAC, without remarkable damage. The current redescription of “*Mosasaurus*” *iembeensis*, performed by us, will be key to test the validity of this taxon and its possible assignment to the genus *Tylosaurus*.

Keywords: *Tylosaurus*, Systematics, Itombe Formation, Museum collections.

1. INTRODUCTION

The mosasaurid record of Angola, despite not being vast in numbers, shows a significant diversity, including some of the first Mesozoic reptiles to be discovered and described in that country. This mosasaurid fauna includes exclusive species such as: *Angolasaurus bocagei*, “*Mosasaurus*” *iembeensis* (sensu Antunes, 1964), and *Prognathodon kianda* (Schulp *et al.* 2008)

-
1. Departamento de Geologia, Faculdade de Ciências da Universidade de Lisboa. Lisboa, Portugal. *pedro88.albuquerque@gmail.com
 2. Grupo de Biología Evolutiva, Facultad de Ciencias, Universidad Nacional de Educación a Distancia (UNED). Las Rozas de Madrid, Spain.
 3. MUHNAC—Museu Nacional de História Natural e da Ciência, Universidade de Lisboa, Lisboa, Portugal
 4. Instituto Dom Luiz, Faculdade de Ciências, Universidade de Lisboa. Lisboa, Portugal.

alongside many other materials referred to *Mosasaurus hoffmanni*, *Prog-nathodon* cf. *saturator*, *Globidens phosphaticus*, “*Platecarpus*” *ptychodon*, *Halisaurus* sp., *Phosphorosaurus* sp. and *Halisaurinae* sp. (LeBlanc, 2012; Mateus *et al.*, 2012, 2019; Polcyn *et al.*, 2010, 2014, 2023; Schulp *et al.*, 2006, 2008, 2013; Silvano, 2022) and *Carinodens belgicus* (Schulp *et al.*, 2009, 2013). This varied fossil record demonstrates the potential of the Angolan paleofauna for understanding mosasaurs diversity. “*Mosasaurus*” *iembeensis* was transferred to the genus *Tylosaurus* as *T. iembeensis* by Lingham-Soliar (1992), a proposal subsequently supported by Mateus *et al.*, (2012). The best knowledge about this poorly known species might further expand our knowledge about the phylogeny and paleobiogeography of the Tylosaurinae in Gondwana.

2. HISTORICAL OVERVIEW OF “*MOSASAURUS*” *IEMBEENSIS*

According to Antunes (1964) the discovery of the sedimentary deposits in which both *Angolasaurus bocagei* and “*Mosasaurus*” *iembeensis* specimens were found was carried out by a geologist of the Serviços de Geologia e Minas de Angola, M.G. Mascarenhas Neto. The discovery was made north of Luanda, in Bengo Province, on a coastal cliff at 2.2 km 20° E of the vertex of Tadi. These materials belong to the Itombe Formation, considered to be of Coniacian age due to the discovery of *Protexanites* sp. (Mateus *et al.*, 2019; Silvano, 2022). The type specimen of “*Mosasaurus*” *iembeensis* was found a dozen meters away from the type materials of *Angolasaurus bocagei*. The material of “*Mosasaurus*” *iembeensis* were exposed to the surface in a more resistant strata and is therefore eroded and incomplete.

When the material was sent to the Museu Nacional de História Natural (currently named Museu Nacional de História Natural e da Ciência, MUHNAC), in Lisbon, the box in which it was stored fell and was further fragmented. The material was then sent to the Institut de Paléontologie of the Muséum National d’Histoire Naturelle, in Paris, where the technician Sr. R. Sonilhac put the fragments back in their original place. Miguel Telles Antunes published a comprehensive work (Antunes, 1964), in which he described these finds, provided maps, photographic record, and place the visited localities in geological and stratigraphic context. He figured the most diagnostic and complete materials collected and described their anatomical characters performing detailed comparisons with putative related taxa. “*Mosasaurus*” *iembeensis*, was described and diagnosed based on an incomplete skull associated to the atlas and its axis up to the third cervical vertebra. After anatomical comparisons with several other species, Antunes (1964) concluded that this individual represented a new taxon and should be included in the genus *Mosasaurus*. Then, he established the new species *Mosasaurus iembeensis*.

In the early morning of March 18, 1978, a fire spread through part of the Museu Nacional de História Natural which, at the time, shared the facilities with the Faculdade de Ciências de Lisboa. Several items from the geological

and paleontological collections, books and equipment, were damaged and lost in this fire. From this point on, many researchers considered that the type material of "*Mosasaurus*" *iembeensis* was lost (e.g., Jacobs *et al.*, 2006; Mateus *et al.*, 2012; Jiménez-Huidobro & Caldwell, 2019). Fortunately, part of the paleontological collection was moved weeks before the fire to another area of the museum. A large part of this collection was not very badly affected by the fire and the associated damages, including the type specimen of "*Mosasaurus*" *iembeensis*, although this was not known until now.

Since the first description of the type specimen of "*Mosasaurus*" *iembeensis*, no further work based on *in situ* observations has been published. Some authors have discussed the specimen based on the information published by Antunes (1964) or by describing additional materials referred to "*Mosasaurus*" *iembeensis* (Mateus *et al.*, 2012). These referred remains, labeled as MGUAN-PA64 (deposited in University Agostinho Neto, Luanda), were not fully described and figured, being simply referred as "fragmentary skull elements". The quadrate of this specimen is the only material directly described. The material was considered part of the genus *Tylosaurus* by Lingham-Soliar (1992), who proposed the new combination *Tylosaurus iembeensis*. Some authors mention the type specimen in studies centered in the reassessment of the Angolan fossil record, including brief descriptions (e.g., Jacobs *et al.*, 2006; Mateus *et al.*, 2019; Silvano, 2022) and supporting the tentative systematic approaches of Lingham-Soliar (1992) (e.g., Jacobs *et al.*, 2009; Mateus *et al.*, 2012). Others assume a more cautious systematic position and avoid providing further details on its systematics as they are unable to work with the material that was supposedly lost in the fire (e.g. Jiménez-Huidobro & Caldwell, 2019).

Decades after the fire, one of us (P. M.) visited the paleontological collections of MUHNAC, and accessed the material of "*Mosasaurus*" *iembeensis*, until then considered as lost, recognizing the need to review the systematics of it thanks to the possibility of being available to carry out its first-hand review. The fossil materials and the original plaster holders showed no signs of fire, smoke or water damage, and the overall state of the material had not changed significantly since it was firstly described.

3. CURRENT WORK

The current state of the specimen is unchanged overall since it was firstly described, but some pieces, mainly the left portion of jaw, show some evidence of desalination. The reason for this can be related to the change in moisture content in the current environment during storage. The third cervical vertebra and the left quadrate were not found together with the type specimen, and still need to be found. The assessment of the holotype of "*Mosasaurus*" *iembeensis* in the paleontological collections of the MUHNAC constitutes an opportunity to re-open the systematic study of this poorly known taxon described by Antunes (1964), testing its validity and previous taxonomic approaches, and proposing an updated description and

diagnosis. This will also include a detailed figuration and 3D reconstruction. The anatomical comparison with other mosasaurid taxa will be performed, especially, with the ones represented in the Upper Cretaceous of Angola, including *Angolasaurus bocagei*. Despite the reassignment to *Tylosaurus iembeensis* by previous authors (Lingham-Soliar, 1992; Mateus *et al.*, 2012), a phylogenetic analysis including the type specimen of “*Mosasaurus*” *iembeensis* has not yet been performed to support this statement. The future phylogenetic study of “*Mosasaurus*” *iembeensis* will also be important to analyze the evolutionary history of the mosasaurids of Angola, in the context of the Subsharian realm during the Late Cretaceous, and to improve our knowledge on the paleobiogeographic distribution of some mosasaurid lineages, especially the members of Tylosaurinae.

4. ACKNOWLEDGMENTS

We would like to thank Judite Alves (Deputy Director of MUHNAC) for allowing us to access specimens in her care.

REFERENCES

- Antunes, M. T. (1964). O neocretácico e o cenozóico do litoral de angola. Junta de Investigações do Ultramar, Lisboa pp. 255
- Jacobs, L. L., Mateus, O., Polcyn, M. J., Schulp, A. S., Antunes, M. T., Morais, M. L., and da Silva Tavares, T. (2006). The occurrence and geological setting of 18 Cretaceous dinosaurs, mosasaurs, plesiosaurs, and turtles from Angola. *Journal of the Paleontological Society of Korea* 22: 91–110.
- Jacobs, L. L., Mateus, O., Polcyn, M. J., Schulp, A. S., Scotese, C. R., Goswami, A., Ferguson, K. M., Robbins, J. A. & Buto Neto, A. (2009). Cretaceous paleogeography, paleoclimatology, and amniote biogeography of the low and mid-latitude South Atlantic Ocean. *Bulletin de la Société Géologique de France*, 180(4), 333–341.
- Jiménez-Huidobro P, Caldwell MW. (2019). A New Hypothesis of the Phylogenetic Relationships of the Tylosaurinae (Squamata: Mosasauroidae). *Frontiers in Earth Science*, 7: 47. <https://doi.org/10.3389/feart.2019.00047>
- Leblanc, A. R., Caldwell, M. W., and Bardet, N. (2012). A new mosasaurine from the Maastrichtian (Upper Cretaceous) phosphates of Morocco and its implications for mosasaurine systematics. *Journal of Vertebrate Paleontology* 32 (1): 82–104.
- Lingham-Soliar, T. H. (1992). The tylosaurine mosasaurs (Reptilia, Mosasauridae) from the Upper Cretaceous of Europe and Africa. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre* 62: 171–94.
- Mateus, O., Polcyn, M. J., Jacobs, L. L., Araújo, R., Schulp, A. S., Marinheiro, J., Pereira, B., and Vineyard, D. (2012). Cretaceous amniotes from Ango-

- la: dinosaurs, pterosaurs, mosasaurs, plesiosaurs, and turtles. *Actas de V Jornadas Internacionales sobre Paleontología de Dinosaurios y su Entorno*, Salas de los Infantes, Burgos 71–105.
- Mateus, O., Callapez, P.M., Polcyn, M.J., Schulp, A.S., Gonçalves, A.O., Jacobs, L.L. (2019). The Fossil Record of Biodiversity in Angola Through Time: A Paleontological Perspective. In: Huntley, B., Russo, V., Lages, F., Ferrand, N. (eds) *Biodiversity of Angola*. Springer, Cham. https://doi.org/10.1007/978-3-030-03083-4_4
- Polcyn, M. J., Jacobs, L. L., Schulp, A. S., and Mateus, O. (2010). The north African mosasaur *Globidens phosphaticus* from the Maastrichtian of Angola. *Historical Biology* 22: 175–185.
- Polcyn, M. J., Jacobs, L. L., Araújo, R., Schulp, A. S., and Mateus, O. (2014). Physical drivers of mosasaur evolution. *Palaeogeography, Palaeoclimatology, Palaeoecology* 400: 17–27.
- Polcyn, M. J., Schulp, A. S., & Gonçalves, A. O. (2023). Remarkably well-preserved in-situ gut-content in a specimen of *Prognathodon kianda* (Squamata: Mosasauridae) reveals multispecies intrafamilial predation, cannibalism, and a new mosasaurine taxon. *Windows into Sauropsid and Synapsid Evolution, Essays in honor of Prof. Louis L. Jacobs*, pp. 66–98.
- Schulp, A. S., Polcyn, M. J., Mateus, O., Jacobs, L. L., Morais, M. L., and da Silva Tavares, T. (2006). New mosasaur material from the Maastrichtian of Angola, with notes on the phylogeny, distribution and palaeoecology of the genus *Prognathodon*. in A. S. Schulp (eds.), *On Maastricht Mosasaurs*. Publicaties Van Het Natuurhistorisch Genootschap in Limburg. Vrije Universiteit, Amsterdam 57–67 pp. 17
- Schulp, A. S., Polcyn, M. J., Mateus, O., Jacobs, L. L., and Morais, M. L. (2008). A New species of *Prognathodon* (Squamata, Mosasauridae) from the Maastrichtian of Angola, and the affinities of the mosasaur genus *Liodon*. *Proceeding of the 2nd Mosasaur Meeting*: 1–12.
- Schulp, A., Bardet, N., and Bouya, B. (2009). A new species of the durophagous mosasaur *Carinodens* (Squamata, Mosasauridae) and additional material of *Carinodens belgicus* from the Maastrichtian phosphates of Morocco. *Netherlands Journal of Geosciences* 88: 161–167.
- Schulp, A., Polcyn, M., Mateus, O., and Jacobs, L. (2013). Two rare mosasaurs from the Maastrichtian of Angola and the Netherlands. *Netherlands Journal of Geosciences* 92: 3–10.
- Silvano, C. G. P. (2022). *Geossítios de vertebrados fósseis de Angola*. Universidade NOVA de Lisboa (Doctoral dissertation).



ZUBÍA

42



IER

Instituto de
Estudios Riojanos