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LARGE ICHTHYOSAURIAN REMAINS FROM THE LA CASITA TYPE LOCALITY (TITHONIAN, UPPER JURASSIC), COAHUILA, MEXICO

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ABSTRACT

The specimen described here (CPC 306) is the first and only vertebrate from the Tithonian La Casita type locality in southern Coahuila, Mexico. The specimen comprises at least 42 centra from the posterior trunk and anterior tail, as well as neural arch and rib fragments, of an ophthalmosaurid ichthyosaur. The size of the centra are comparable to *Ophthalmosaurus natans*, but the pattern of variation in the centrum height/centrum length ratio and the values of that ratio are more similar to *O. icenicus*. The preservation prevents a more precise taxonomic identification. *Ophthalmosaurus* has been reported from Gomez Farias, a site further south in Coahuila. The Mexican Gulf ichthyosaurs show no signs of endemism and have a lower diversity than elsewhere in the world at the time. Thus every specimen from the Gulf at present is important, pending futher discoveries in the region.

INTRODUCTION

A decade of investigation of Upper Jurassic outcrops in northeast Mexico has yielded a rich assemblage of marine reptiles that populated the Mexican Gulf (e.g. Buchy 2007). Based on the study of invertebrates and microfossils, the Gulf appears to have been isolated from the opening Atlantic until the Berriasian (e.g. Goldhammer 1999; Goldhammer and Johnston 2001). The study of marine reptiles tends to confirm some endemism (see a review in Buchy 2007), however, many specimens are yet to be studied to confirm and characterize the peculiarity of the vertebrate assemblage. Furthermore, elucidation of the phylogenetic affinities of the specimens is pending the results of preparation and anatomical studies. Fish remains are also known from the same sites, but their study has not been initiated yet.

During the last decade of investigation, fieldwork was undertaken revealing new material, however various institutional and private collections also yielded specimens of value that had gone ignored for years. Among those is the presently described specimen, now CPC 306 (at MUDE). CPC 306 was reported as coming from the La Casita type locality in southern Coahuila (Imlay 1936; Aguirre Garza et al. 2000:fig. 1) and to our knowledge, it is indeed the first and only vertebrate remains described from this locality. It was discovered by a field party of UANL-FCT, and then excavated with the help of MUDE and UNAM personnel in spring 2000. The specimen was partly prepared and subsequently attributed by its discoverers to the genus *Ichthyosaurus* (Aguirre Garza et al. 2000); after this preliminary report, preparation was never completed.

In July 2008, the senior author was allowed by COECYT to excavate and prepare the large ichthyosaur now numbered CPC 307 (Buchy and López Oliva 2009; Buchy et al. 2009). Due to the absence at MUDE of a catalogue of unpublished specimens, the origin of many specimens in the collection is known only if the person who found them or someone who heard about it is available for consultation. When the project was submitted to COECYT, confusion occurred between the locality of CPC 307 and that of CPC 306. Only when the project was granted was the senior author made aware of the confusion, that was clarified by a first visit to the excavation site of CPC 307 (of a late Tithonian age according to Buchy and López Oliva 2009), located a few kilometers south of the site of CPC 306. Preparation of CPC 306 was completed and the student exchange program Verano de la Ciencia from CONACYT provided the opportunity to study it.

Systematic examination of the marine reptiles from the Late Jurassic Mexican Gulf conducted during the last decade yielded various ichthyosaurs, and therefore a (still in nascent stage) taxonomical framework within which the specimen herein described can now be assessed.

Abbreviations—COECYT, Consejo Estatal de Ciencia y Tecnologia Coahuila; CONACYT, Consejo Nacional de Ciencia y Tecnología; MUDE, Museo del Desierto, Saltillo, Coahuila; UANL-FCT, Universidad Autónoma de Nuevo León, Facultad de Ciencias de la Tierra, Linares, Nuevo León; UNAM, Universidad Nacional Autónoma de México.

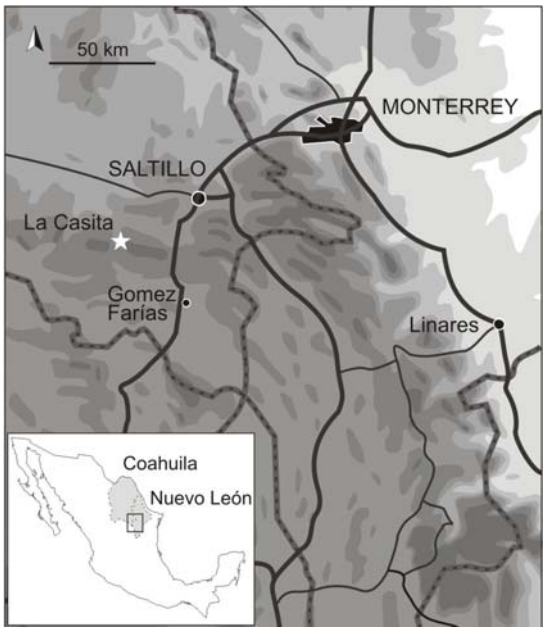

FIGURE 1: Map of Mexico (insert) and detail of southeast Coahuila and central Nuevo León; the area of the find is shown by a star.

SYSTEMATIC PALEONTOLOGY

Order Ichthyosauria de Blainville, 1835
Family Ophthalmosauridae Baur, 1887
Ophthalmosauridae indet.

Material—CPC 306 (Figures 2, 3). At present, the specimen comprises at least 42 centra from the posterior part of the trunk and anterior part of the tail and numerous non-matching fragments. The anterior-most centra are partly obscured by rib and neural arch fragments.

Origin—Tithonian La Casita type locality, Municipio de General Cepeda, Coahuila, Mexico (Aguirre Garza et al. 2000:fig. 1).

Preservation—The specimen was collected as isolated fragments and at least one plaster jacket which still houses the posterior-most part of the specimen (21 centra included in the count of 42). It was partly prepared then stored in that condition at MUDE for some years, during which time it was moved around according to space requirements. It is unknown if any of the specimen was lost during these movements. At least 21 additional centra (Table 1) are documented outside this plaster jacket. The original publication (Aguirre Garza et al. 2000) mentioned 30 centra. The posterior-most part of the specimen was still partly unprepared in its (open) plaster jacket when it was 'rediscovered' in 2008, but it remains unclear whether the published 30 centra correspond only to the centra outside of the jacket (in this case, several were lost subsequently or are now preserved as non-matching fragments), or are a very rough estimate of these plus what was inside the jacket.

The centra are partly articulated (see Table 1 and Figure 2). The bone is very weathered, and to prevent further damage it was coated with transparent epoxy resin; it is unclear whether this resin is stable over time. Owing to the poor standards of the collection of fossils at MUDE under the present administration, and the risk of the fossil being further damaged by being moved or when being sent for exhibition, it was considered the only option to stabilize and preserve it.

Description—The centra are typically ichthyosaurian in shape (e.g. McGowan and Motani 2003). The disarticulated centra of CPC 306 were ordered by comparison with CPC 307, and were consequently numbered, knowing that some centra may be missing in between (Table 1). As is visible on the articulated specimen CPC 307 (currently under study), in the anterior part of the vertebral column, the dia- and parapophyses are clearly separated; in the pelvic region, they migrate ventrally and toward one another. They fuse on centrum 47 and constitute a high oval articular facet for the rib, whereas further posteriorly (serial position unknown, some vertebrae missing in between) the facet becomes subcircular or long oval. The dia- and parapophyses of CPC 306 fuse on the 10th preserved centrum. The articular facet becomes long oval on the 16th preserved centrum.

The centrum of CPC 306 where the fusion occurs is about 44 mm long and 100 mm high; that of CPC 307 is about 50 mm long and 125 mm high. Taking into account the slight distortion the latter underwent, both centra share the same length to height proportion (about 0.4).

DISCUSSION

The original attribution of CPC 306 to *Ichthyosaurus* (Aguirre Garza et al. 2000) cannot be sustained; CPC 306 likely represents an ophthalmosaurid on stratigraphic grounds (McGowan and Motani 2003). The dimensions of CPC 306 (Table 1) exceeds in size that of specimens attributed to *Ophthalmosaurus icenicus* (e.g. Motani 1999; Massare et al. 2006), but compare closely in that respect to specimens referred to *O. natans* by Massare et al. (2006). Few adequately preserved centra of CPC 306 allow to determine the ratio centrum height/centrum length (CH/CL, see Massare et al. 2006; Table 1). The values of this ratio for centra from the posterior dorsal region (anterior to the 10th preserved centrum) are lower than those documented for *O. icenicus* by Massare et al. (2006), coming closer to the values for *O. natans* as given by these authors. In contrast, the high value of CH/CL for the 18th preserved centrum (3.14; centrum from the anterior caudal region) and pattern of variation of CH/CL along the specimen (Table 1) is more similar

TABLE 1. Type of preservation and dimensions of the centra of CPC 306 in mm. All measurements are approximate due to poor preservation. Dia- and parapophyses fuse on the 10th preserved centrum.

centrum number	comments	height at the level of the neural canal	ventral length	centrum height / length
1	isolated	/	43	
2	three clusters of respectively four, six and two articulated centra	/	45	
3		/	45	
4		/	/	
5		108	46	2.34
6		108	46	2.34
7		/	44	
8		/	44	
9		/	43	
10		100	44	2.27
11		100	44	2.27
12		100	41	2.43
13		104	42	2.47
14	isolated	/	45	
15	cluster of four articulated centra	/	42	
16		/	38	
17		/	38	
18		107	34	3.14
19	cluster of three articulated centra	/	38	
20		/	38	
21		/	40	
22	centra still in plaster jacket; centra 29, 30 and 34 are documented as imprints on the jacket but are now fragments	100	/	
23		100	45	2.22
24		/	40	
25		/	39	
26		/	42	
27		/	40	
28		95	40	2.37
29		/	/	
30		/	/	
31		95	40	2.37
32		/	40	
33		/	39	
34		/	/	
35		100	37	2.7
36		/	/	
37		83	37	2.24
38		/	36	
39		/	33	
40		/	34	
41		/	31	
42		/	/	

FIGURE 2: CPC 306, right lateral view of the 42 centra that can be ordered in the vertebral series (see text and Table 1). Scale bar 50 mm.

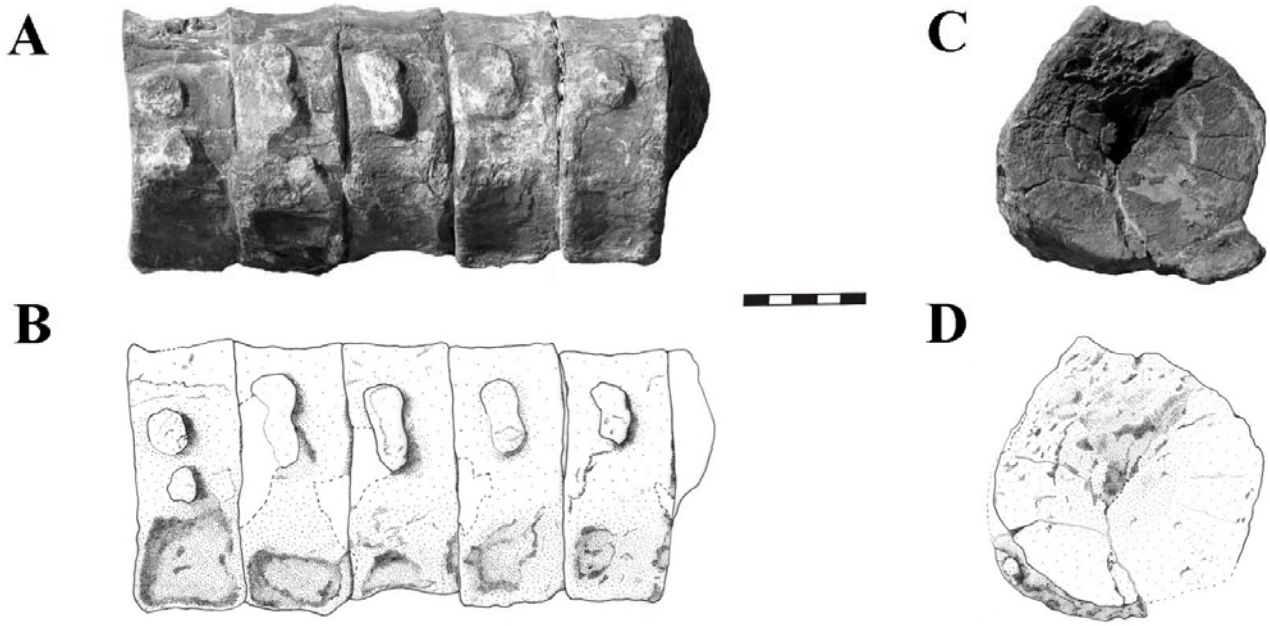

FIGURE 3: CPC 306, A, detail of centra 6 to 11 (see text and Table 1) in right ventrolateral view and B. interpretative drawing. C. centrum 6 in cranial view and D interpretative drawing. Scale bar 50 mm

to the values and variation of CH/CL for *O. icenicus* (Massare et al. 2006), despite size similarity to *O. natans*. The nature and poor preservation of CPC 306 prevents a more precise taxonomic identification at present.

From the Late Jurassic Mexican Gulf, CPC 307 represents a large form, close to *Brachypterygius* according to the anatomy of its forefin (Buchy and López Oliva 2009; material under study). The genus *Ophthalmosaurus* has been documented, likely represented by the ubiquitous, type species *O. icenicus* (Buchy 2010), coming from near Gomez Farías, a site further south in Coahuila that is considered a Lagerstätte owing to its richness in marine vertebrates (Buchy et al. 2006a). Additionally, from Gomez Farías a unique, isolated centrum from the posterior part of the dorsal region (having separated dia- and parapophyses located ventrally on the centrum) exhibits dimensions that also exceed those commonly attributed to *O. icenicus*. This specimen, CPC 488 (at MUDE), has a height of 92 mm and a length of 35 mm, with a length to height ratio of 0.38, and is therefore similar to CPC 306 and CPC 307. CPC 488 likely indicates the presence in Gomez Farías of a second type of ichthyosaur possibly close (at least in size) to CPC 306 and 307.

The individual age of CPC 306 compared to that of CPC 307 cannot be determined; based on its smaller size CPC 306 could indeed represent a juvenile of the taxon documented by CPC 307.

Thus the diversity of ichthyosaurs from the Late Jurassic Mexican Gulf is much lower than what is reported from the rest of the world at the time (McGowan and Motani 2003; Fernández 2007). Compared to other groups of marine reptiles, e.g. thalattosuchians (see a review in Buchy 2007; Buchy et al. 2006b, 2007; Buchy 2008), the Mexican Gulf ichthyosaurs show no obvious sign of endemism, despite being (relatively) abundant. The current scarceness of diagnostic ichthyosaurian material from the Gulf is likely the reason (Buchy 2007).

It should be noted that it was suggested that the Late Jurassic Mexican Gulf may have represented a 'nursery' for ubiquitous ichthyosaurs (Buchy 2010), in order to explain the preliminary observation that ichthyosaurs apparently do not show the same

endemism as other marine reptile groups, invertebrates and microfossils.

In any case, CPC 306, its finding and curation history do plead for a more thorough and professional search for ichthyosaurian remains from the Late Jurassic Mexican Gulf, as well as generally for more competent preparation and curation skills devoted to such fossils in Mexican Institutions in the future. It is essential to assess the actual diversity of ichthyosaurs there at the time, and to investigate whether or not the Gulf represented a 'nursery'. It is also essential to determine the origin, pattern, timing and dynamic of the population of the Gulf by the various groups of marine reptiles compared to what was deduced from (relatively) abundant invertebrates and microfossils. In this respect, awaiting further fieldwork, it should be considered that every marine reptile from the Gulf at present is important, keeping in mind what future research will hopefully yield as comparative material.

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