Reevaluation of the holotype of *Plesiosaurus* (*Polyptychodon*) *mexicanus* Wieland, 1910 from the ?Upper Jurassic of Mexico: a thalattosuchian, not a sauropterygian

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ABSTRACT

The holotype of the first sauropterygian described from Mexico, Plesiosaurus mexicanus Wieland, 1910, was recently rediscovered and is here described and discussed for the first time in almost a century. The holotype specimen belongs to an indeterminate metriorhynchine crocodyliform. Doubts remain as to the stratigraphic origin of the specimen, whether Upper Jurassic or Lower Cretaceous. It adds a specimen to the recently recognised wealth of the Mexican Gulf in thalattosuchians.

Key words: Thalattosuchia, Metriorhynchinae, Late Jurassic, Early Cretaceous, Mexico.

RESUMEN

Se realiza la redescripción y discusión del primer sauropterigio descrito para México, Plesiosaurus mexicanus Wieland, 1910, después de casi un siglo de su descubrimiento. El holotipo corresponde a un cocodrilo metriorínquido indeterminado. Existen dudas acerca del origen de los datos estratigráficos referentes al espécimen y puede asignarse al Jurásico Tardío o Cretácico Temprano. Este espécimen incrementa la riqueza del grupo Thalattosuchia reportada recientemente para el Golfo mexicano.

Palabras clave: Thalattosuchia, Metriorhynchinae, Jurásico Tardío, Cretácico Temprano, México.

INTRODUCTION

On March 3rd, 1909, the great Yale palaeobotanist G. R. Wieland (1865-1963) embarked in Mexico City for a field trip to the region of Tlaxiaco, State of Oaxaca, Mexico (Figures 1, 2). According to his field book (Figure 2), he was accompanied by Ygnacio S. Bonillas (1886/7-?), recently graduated in geology from the Massachussets Institute of Technology in Boston, the son of Ygnacio Bonillas (1858-1944), a geologist himself, future ambassador from Mexico in Washington and future presidential candidate for Mexico (Callahan Hedden, personal communication). Wieland and Bonillas reached the train station at Parián, Oaxaca, on the evening of March 4th; then continued overland for three days, reaching Tlaxiaco in the afternoon of March 7th. The expedition appears to have been uneventful as dryly related by Wieland, until the discovery of cycads on March 13th, except for the discovery on March 8th of a partial rostrum with teeth, which Wieland immediately recognised as the first ichthyosaur or plesiosaur described from Mexico (Figure 2).

The following year, Wieland formally named the

Figure 1. Map of Mexico, and detailed maps tracing the trip of Wieland and Bonillas from Mexico City to Tlaxiaco in March, 1909 (map INEGI, 1992).

very first sauropterygian from Mexico (actually the first new fossil reptile taxon according to Reynoso, 2006) upon that specimen, as *Plesiosaurus* (*Polyptychodon*) *mexicanus* Wieland, 1910. Wieland had revisited the site on March 16th and determined the probable origin of the specimen within the briefly described section as it appears in the publication (Wieland, 1910: 361-362). The field book mentions 'Ammonites' and 'trigonal Oysters', without field determination nor the mention that samples were taken for further identification, in which case this material appears now lost. In his publication, Wieland (1910: 362) refers to the ammonites described by 'Felix y Lenk' (1891) to attribute a Neocomian or slightly older age to the rostrum (in fact, the reference is Felix [1891]). No ammonite is illustrated together with the specimen, no taxon name is given, and the finding area is geologically complex (*e.g.*, Ferrusquía-Villafranca, 1993). Hay (1930: 116) referred the specimen to the Late Jurassic without further justification and, indeed, regional geology leaves that possibility open. Only further local geological studies (with the caveat that the 'way to Putla' [Wieland, 1910: 361] likely was reframed since 1909; however, Wieland [1910] gives an account of the section at the locality, and mentions quarries, possibly in relation to his find) and possibly examination of the remaining matrix may contradict Wieland's age determination of the specimen.

Welles (1952: 106) was the last expert to discuss the specimen (not having seen it though) who, mislead by the erroneous interpretation of the remains given by Wieland (1910: Pl. LII), regarded it as an elasmosaur, whose remains, although 'unsatisfactory' are not 'indeterminate and topo-

typic material could establish the species'.

The long-lost holotype (Buchy *et al.*, 2006a; Reynoso, 2006) was recently rediscovered at the Instituto de Geología of the Universidad Nacional Autónoma de México (UNAM) and a cast sent for study to the Museo del Desierto, Saltillo, Coahuila, Mexico. The holotype is here re-described and referred to an indeterminate metriorhynchine crocodyliform.

SYSTEMATIC PALAEONTOLOGY

Infraorder Thalattosuchia Fraas, 1901
Family Metriorhynchidae Fitzinger, 1843
Subfamily Metriorhynchinae Fitzinger, 1843

Metriorhynchinae indet.
IGM 9026 (Figure 3)

1910 *Plesiosaurus* (*Polyptychodon*) *mexicanus* Wieland, p. 361, pl. LII
1930 *Plesiosaurus (Polyptychodon) mexicanus* Burckhardt, p. 99
1930 *Plesiosaurus mexicanus* Hay, p. 116
1935 *Plesiosaurus mexicanus* Kuhn, p. 67
1952 "*Plesiosaurus*" *mexicanus* Wieland, 1910, *nomen vanum*; Welles, pp. 106-107
1963 *Plesiosaurus mexicanus* Persson, pp. 38, 43
2003 *Plesiosaurus* (*Polyptychodon*?) *mexicanus* Buchy *et al.*, p. 276
2006a *Plesiosaurus* (*Polyptychodon*?) *mexicanus* Buchy *et al.*, p. 242
2006 *Plesiosaurus mexicanus* Reynoso, pp. 211, 216, 218, 222, *nomen dubium* p. 221

Material. The specimen is housed at the Instituto de Geología of the UNAM (Colección Nacional de Paleontología) under accession number IGM 9026. It represents a portion of occluding mandibular and maxillary rostra with teeth, better visible in right lateral view (note that in pl. LII of Wieland, 1910, the specimen is upside down). The left side of the specimen requires preparation; it seems that the rostrum was split longitudinally at some point, as no tooth (nor tooth root) attributable to the left series is visible.

Origin. According to Wieland (1910: 361-362), the specimen was collected by himself on March, 8th, 1909, at a point north of the way to Putla, about 6 km south-southwest of Tlaxiaco, Oaxaca, Mexico (Figures 1, 2).

Preservation. The specimen probably represents a fragment caudal to the mandibular symphysis, although preparation

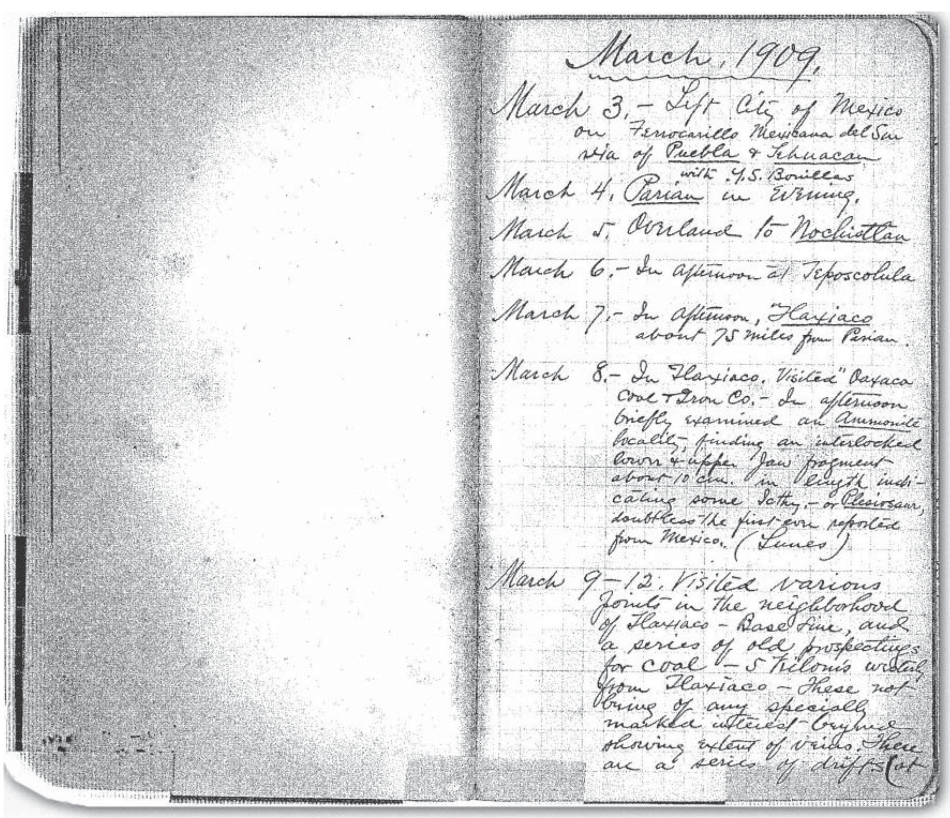
March, 1909.
March 3.– Left City of Mexico on Ferrocarillo Mexicana del Sur via of Puebla & Tehuacan with G.S. Bonillas
March 4. Parian in Evening.
March 5. Overland to Nochistlan
March 6.– In afternoon at Teposcolula
March 7.– In afternoon, Tlaxiaco about 75 miles from Parian.
March 8.– In Tlaxiaco. Visited "Oaxaca Coal + Iron Co.– In afternoon briefly examined an Ammonite locality, finding an interlocked lower + upper jaw fragment about 10 cm. in length indicating some Ichthy.– or Plesiosaur, doubtless the first ever reported from Mexico. (Lunes)
March 9–12. Visited various points in the neighborhood of Tlaxiaco – Base Line, and a series of old prospectings for coal – 5 kilom's westerly from Tlaxiaco – These not being of any specially marked interest – beyond showing extent of veins. There are a series of drift-cut

Figure 2. Copy of the first page of Wieland's 1909 fieldbook (Division of Paleobotany, Yale Peabody Museum. © Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA. All rights reserved).

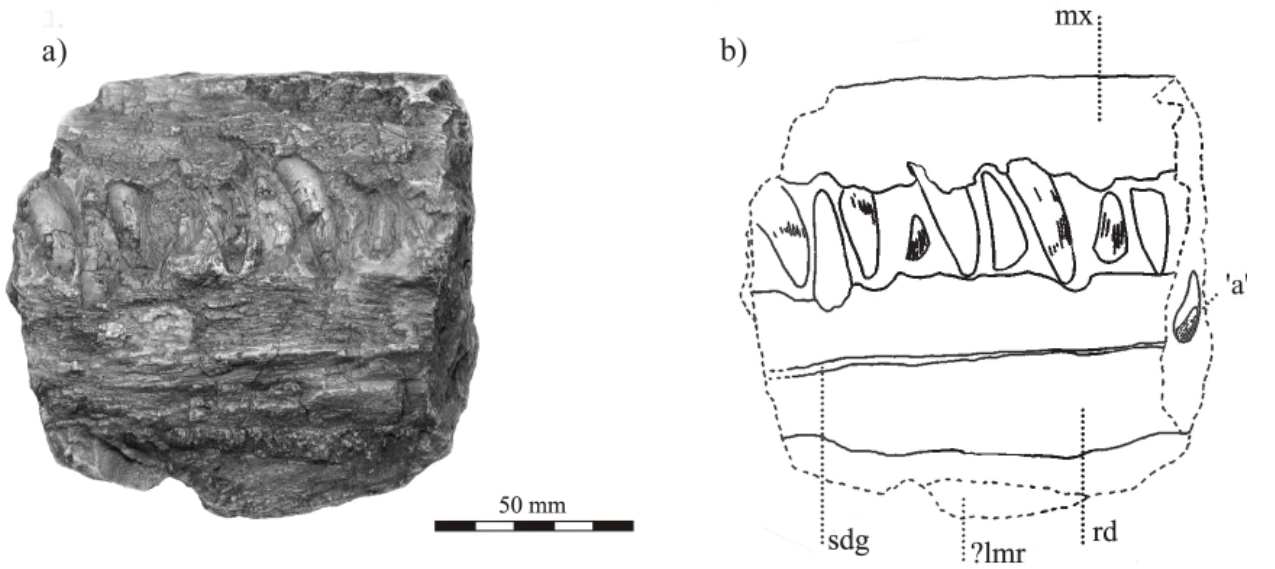

Figure 3. IGM 9026, Metriorhynchinae indet., holotype of *Plesiosaurus mexicanus*. a: Specimen in right rostrolateral view (similar to Wieland's 1910 plate LII –but upside down– to show replacement tooth 'a'); b: interpretative line drawing. Abbreviations: 'a': replacement tooth labelled 'a' by Wieland (1910); ?lmr: possible fragment of the left mandibular ramus; mx: maxilla; rd: right dentary; sdg: surangulodentary groove. Scale bar 50 mm.

of the left side is necessary to confirm it. A poorly preserved bone fragment ventral to the right mandible might represent a portion of the left mandibular ramus. Both rostral and caudal extremities of the specimen are subvertical 'fresh' breaks, as was recognized by Wieland, who could not find more pieces (1910: 362). The rostrocaudal length of the specimen is 90 mm; its rostral height is 75 mm, its caudal height, 80 mm.

The maxilla preserves five teeth, regularly alternating with six dentary teeth (of which the rostral- and caudal-most ones are better visible along the breaks). The tooth outlined and labeled 'b' by Wieland (1910: pl. LII) is not a tooth but a triangular area of bone bounded by two breaks.

As mentioned by Wieland (1910), the bone surface and teeth are poorly preserved. However, tooth ornamentation is clearly visible where enamel is preserved.

Description (Figure 3).

Maxilla. The dorsal margin of the maxilla parallels its ventral margin. Little of the original surface of the bone is preserved, and no ornamentation pattern can be deduced.

Mandible. As far as can be judged, the dorsal margin of the dentary parallels the ventral margin of the maxilla. A seam of sediment raised against the weathered surrounding bone surface runs sub-horizontally at about mid-height of the dentary. This likely represents the infill of the groove described on the lateral surface of the dentary and surangular *e.g.*, by Frey *et al.* (2002) in *Geosaurus vignaudi* and by Gasparini *et al.* (2006) in *Dakosaurus andiniensis*. According to the data provided by Gasparini *et al.* (2006, online supporting material), this surangulodentary groove appears to be present in *Pelagosaurus typus* (see also Pierce and Benton, 2006), but absent in *Steneosaurus bollensis*, *Metriorhynchus superciliosus*, *M. casamiquelai* and *Geosaurus araucanensis*. However, Young (2006; pers. com.) confirms the presence of the groove in all examined specimens adequately preserved attributed to *Steneosaurus*, *Teleosaurus*, *Metriorhynchus* and *Geosaurus*. The groove is present in *Dakosaurus* where it terminates rostrally as a foramen within the dentary (Gasparini *et al.*, 2006; Young, 2006, pers. com.). A similarly situated groove, although shorter both rostrally and caudally and lacking a rostral foramen, is present in Recent crocodyliformes, and houses a cutaneous branch of the mandibular nerve (Salisbury, pers. com.; see Holliday and Witmer, 2007).

If present, the splenial cannot be distinguished from the dentary due to poor surface preservation.

Dentition. Tooth implantation is thecodont, as is visible along the breaks. The right dentary tooth visible along the rostral-most break preserves a replacement tooth within the pulp cavity (as is also visible in pl. LII of Wieland, 1910, tooth 'a'). Replacement is therefore vertical. As far as can be judged, the teeth are subcircular in basal cross-section. The tooth crowns are almost straight (the dentary ones more so than the maxillary ones), while the roots are curved. Possibly, the distal convexity of especially the maxillary teeth as is now visible results from mediolateral compression, and the maxillary teeth were originally convex more labially than distally. The preserved replacement tooth as well as the fourth preserved maxillary tooth exhibit a discreet distal carina, which, at least in the case of the replacement tooth (which preserves the only intact apex), runs until the apex. Ornamentation wherever enamel is present is made up of fine ridges, irregular in extent and spacing. On the replacement tooth, few irregular ridges reach the apex.

DISCUSSION

Identification

The tooth replacement pattern proves the specimen belongs to a crocodyliform, and not a sauropterygian. The architecture of the rostrum and constituting bones, as well as the tooth morphology clearly designate a metriorhynchine thalattosuchian. The tooth ornamentation is reminiscent of longirostrine members of the genus *Metriorhynchus* (*e.g.*, Vignaud, 1995, 1997; pers. obs.). However, dentition of those species referred to *Geosaurus* known from the Late Jurassic Mexican Gulf is poorly known (see a review in Buchy, 2007); pending further discoveries of more complete specimens, IGM 9026 is therefore considered an indeterminate metriorhynchine.

Historical note

Wieland (1910) claims IGM 9026 to be the first determinable reptile remains from Mexico (most likely meaning of large Mesozoic reptiles; see also Reynoso, 2006). Wieland (1910: 361) notes that Mr. Aguilera, director of the Instituto Geológico Nacional, had previously found in Chihuahua a weathered vertebral centrum attributable to a 'reptile', from layers equivalent to the North American Pierre Formation; this reference could not be found and is ignored in recent listing of reports of historical finds of Mexican Mesozoic reptiles (*e.g.* see Reynoso, 2006; it may refer to a personal or oral communication). *Plesiosaurus mexicanus* was long considered the first (and only) sauropterygian described from the country (*e.g.*, Buchy *et al.*, 2003). IGM 9026 actually represents the first Mexican thalattosuchian (see Gasparini, 1992; Frey *et al.*, 2002). The partial dentary mentioned by Ferrusquía-Villafranca and Comas (1980) attributed to an indeterminate pliosaur represents the first mention of a sauropterygian from Mexico, while the giant pliosaur first described by Hähnel (1988) as a dinosaur and reassessed by Buchy *et al.* (2003) is the second of the currently known seven Mexican pliosaurs and few poorly diagnostic elasmosaurs (Buchy, 2007).

Thalattosuchians of the Late Jurassic Mexican Gulf

The wealth of thalattosuchians of the Late Jurassic (and possibly Early Cretaceous) Mexican Gulf has only been recently revealed (Frey *et al.*, 2002; Buchy *et al.*, 2006b, 2006b, 2006c, 2006d; Buchy, 2007, 2008). Additional specimens awaiting preparation and study most likely will add at least one taxon to the assemblage (Buchy, 2007), while Upper Jurassic and Lower Cretaceous outcrops of Mexico still consist of a wide, unexplored territory for marine reptiles in general.

As emphasised by the indeterminate status of the holotype of *P. mexicanus*, taxonomy and affinities of Mexican thalattosuchians can only be resolved when material is prepared and proper studies are completed. In turn, then, their bearing upon the elucidation of origin and affinities of the Mexican marine reptiles assemblage and palaeobiogeography could be evaluated.

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