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Synopsis of Late Jurassic Marine Reptiles from Cuba¹

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ABSTRACT

In western Cuba there are well-developed Late Jurassic deposits that yield important and insufficiently studied marine vertebrate faunas. The middle Oxfordian fossil-bearing rocks are calcareous concretions embedded in black shales of the Jagua and Francisco formations. The fossil biota includes plesiosaurs, pterosaurs, crocodyliforms, ganoid fishes, and several invertebrates. Tithonian plesiosaurs, fishes, and several invertebrates are found in well-bedded limestones of the Artemisa Formation.

Because the information concerning these fossils

is dispersed in hard-to-find publications and several collections, a catalog is presented here, which includes the most important reptile fossil localities, along with brief descriptions of the fossil material and information on their ages, stratigraphic positions, and associated fossils. A discussion concerning the validity of several of the published Jurassic reptilian taxa from Cuba is also provided. The Western Cuban Oxfordian fauna is important because it is associated with the initial Mesozoic marine transgression on the North American continental margin within the Caribbean area.

RESUMEN

En Cuba occidental están bien desarrollados los depósitos del Jurásico Superior que contienen una fauna de vertebrados marinos muy importante e insuficientemente estudiada. Las rocas fosilíferas del Oxfordiano medio son concreciones calcáreas lenticulares embebidas en argilitas negras de las formaciones Jagua y Francisco. Dicha biota fósil incluye plesiosaurios, pterosaurios, cocodrili-formes, peces ganoideos y diversos invertebrados. Las calizas bien estratificadas de la Formación Ar-

temisa del Tithoniano, contienen plesiosaurios, peces ganoideos y variados invertebrados.

Debido a que la información concerniente a estos fósiles estaba dispersa en publicaciones difíciles de localizar y depositada en diversas colecciones en Cuba y los Estados Unidos, se decidió compilar el presente catálogo. Este contiene el listado de las localidades más importantes que contienen restos fósiles de reptiles, así como una breve descripción del material fosilífero junto a ciertos

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datos sobre la edad, posición estratigráfica y fósiles asociados. Se discute la validéz de los taxones de saurios cubanos jurásicos publicados en el pasado.

La importancia de la fauna oxfordiana encontrada en Cuba occidental consiste en el hecho de

que está relacionada con la primera transgresión marina del Mesozoico que cubrió el margen continental meridional de América del Norte en el Caribe.

INTRODUCTION

The Late Jurassic marine rocks of Cuba have produced an interesting but relatively unstudied assemblage of vertebrate fossils (De la Torre and Cuervo, 1939; De la Torre and Rojas, 1949; Judoley and Furrázola, 1965; Pszczolkowski, 1978; and many others). Surprisingly these papers are not often referred to in contemporary studies of marine saurians or Mesozoic biogeography. With the exception of the pterosaur *Nesodactylus hespericus* (Colbert, 1969), Jurassic fossil reptilian remains from Cuba have been described on the basis of very fragmentary materials and often optimistically placed within known taxa.

Despite the fact that Late Jurassic sedimentary rocks are known from several lo-

calities in Cuba, vertebrate fossils have been found only in the Sierra de los Organos and Sierra del Rosario in western Cuba, mostly in the region around the town of Viñales. Reptilian fossils have been known from this area since very early in this century when they were first collected by Carlos de la Torre y Huerta from the University of Havana (fig. 1). Slightly later, Barnum Brown, from the American Museum of Natural History, collected fossils during two expeditions to the Viñales area (fig. 2). As he pointed out later ". . . in many outcrops near the copper mine Constancia, the black limestones concretions are abundant and they contain ammonites, pelecypods, gastropods, fishes and marine reptiles" (Brown and O'Connell, 1922). Cu-

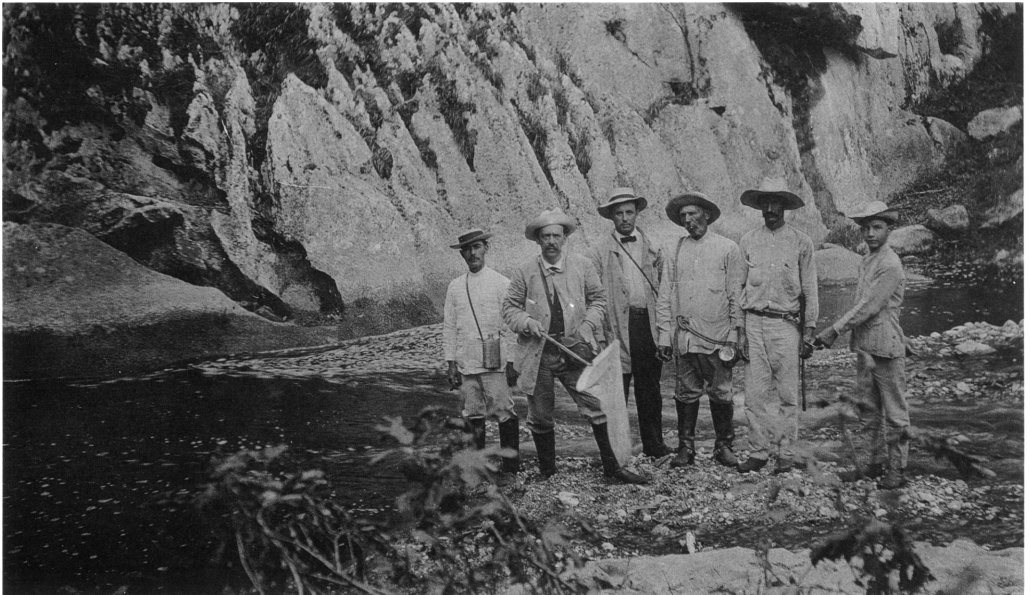


Fig. 1. Carlos de la Torre (second from left, holding insect net) was a pioneer of Cuban vertebrate paleontology. This photo was taken by Barnum Brown about 1908 on one of his initial collecting trips to Cuba.

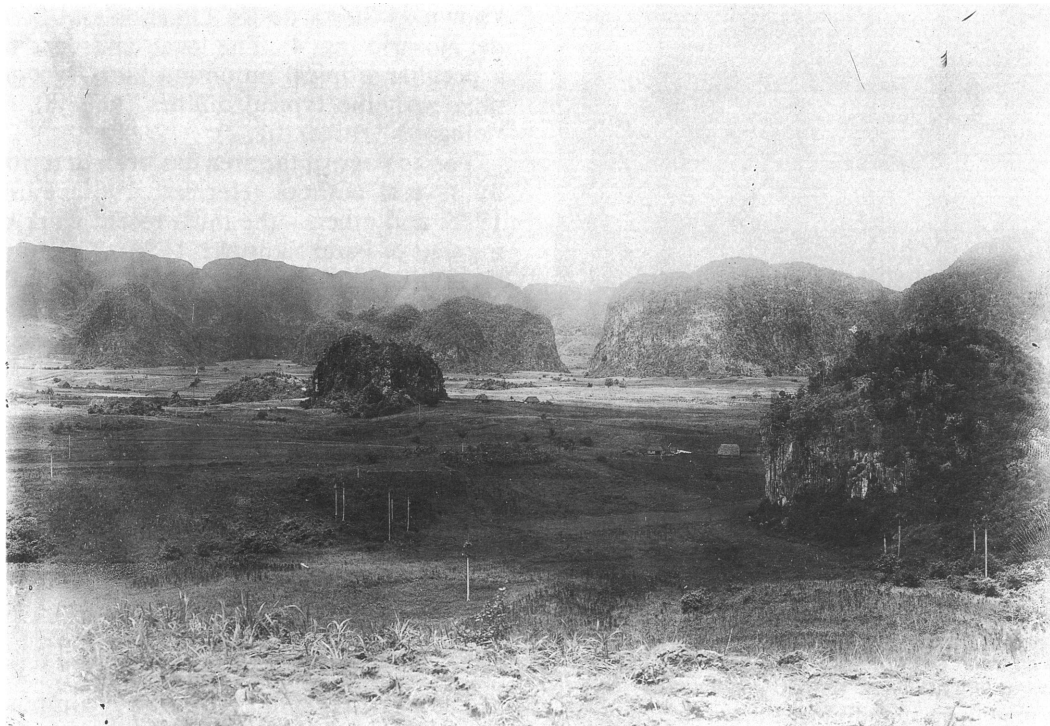


Fig. 2. Mogotes landscape in the Valle de Viñales, Pinar del Rio, Cuba. Photo by Barnum Brown about 1908.

riously, no marine reptile fossils are found in his collections at the American Museum of Natural History. We can assume that he was referring to the marine reptilian fossils found by Carlos de la Torre. Subsequently, additional collecting was accomplished by America Ana Cuervo and Ricardo De la Torre (University of Havana), Charles W. Hatten (Cuban California Oil Company), David Dunkle (Smithsonian Institution), and more recently by C. Judoley, G. Furrzola (Cuban Institute of Mineral Resources), and R. Gutierrez (Institute of Geography, former Cuban Academy of Sciences).

Although some important Jurassic reptilian fossils have been lost, the majority of specimens have found their way into collections. These repositories include the Museo Nacional de Historia Natural (Havana, Cuba), the American Museum of Natural History (New York), National Museum of Natural History (Washington, D.C.), and University

of California Museum of Paleontology (Berkeley).

Because many of the localities that produced these fossils were poorly identified, the authors revisited the region in the late 1980s and early 1990s, as part of a scientific agreement between the MNH and the AMNH. During this reconnaissance we were accompanied by the local fossil collector Juan Gallardo (fig. 3), who worked in the field with Carlos de la Torre, Barnum Brown, Ricardo De la Torre, America Ana Cuervo, David Dunkle and Charles Hatten. Guided by Sr. Gallardo's expert advice and years of experience in this region, it was possible to relocate almost every fossil locality and fix these positions on 1:50,000 scale topographic maps. These maps are deposited in the MNH. As part of this study, we examined the fossil material that could be located in collections in Cuba and in the United States and present a catalog of Cuban Jurassic fossil reptilian

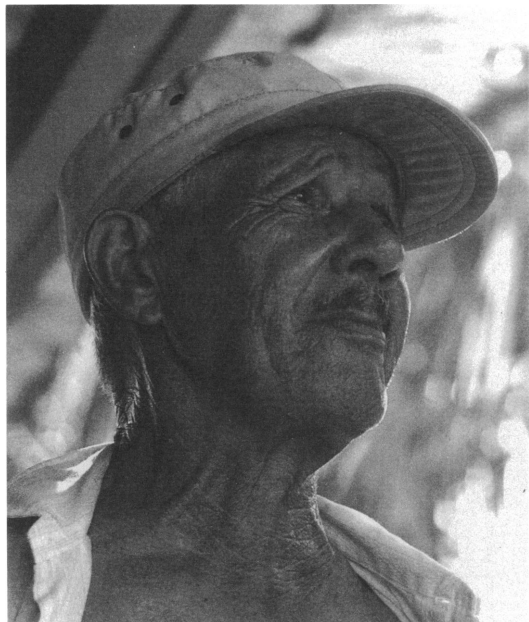


Fig. 3. Juan Gallardo (photo circa 1991) accompanied many of the early collecting trips to the mountains in the Viñales areas. Sr. Gallardo's experience was critical to completing this report.

specimens. This catalog is not a systematic revision of Cuban Jurassic marine reptiles. Rather, it is an appraisal of the status, identity, and provenance of materials collected since the early 20th century.

Abbreviations

AMNH DVP—American Museum of Natural History, Department of Vertebrate Paleontology

AT—Private collection of Alfredo De la Torre y Callejas (stored at Museo Nacional de Historia Natural, La Habana, Cuba)

IGP—Paleontological Collection of Instituto de Geología y Paleontología, La Habana, Cuba

MNHNH P—Museo Nacional de Historia Natural (Cuba), Paleontological collections

UCMP—University of California at Berkeley, Museum of Paleontology

USNM—National Museum of Natural History, Washington, D.C.

GEOLOGIC SETTINGS

The fossiliferous Late Jurassic limestones outcrop in the province of Pinar del Río (western Cuba), in the mountain ranges

known as Sierra de los Organos and Sierra del Rosario (fig. 4). The local landscape has a peculiar tropical mountain karst topography, with the typical dolines (valleys) and "mogotes" (hills) (fig. 2).

The geology of the area has been described by several authors (Herrera, 1961; Pardo, 1975; and others—the most recent work being that of Pszczolkowski, 1978). The Jurassic section is composed of three main lithostratigraphic units (fig. 5): the siliciclastic sandstones and shales of the San Cayetano Formation (Early Jurassic to Late Jurassic early Oxfordian), the sandstones, shales, and limestones of the Jagua and Francisco formations (early to late Oxfordian), and the limestones of the Guasasa and Artemisa formations (latest Oxfordian to Early Cretaceous). These sections belong to the Guaniguanico Terrain, as it was defined by Iturralde-Vinent (1994).

SAN CAYETANO FORMATION

The San Cayetano Formation is composed of well-bedded shales, sandstones, and siltstones with thin intercalations of conglomerates and limestones. The unit probably reaches 3000 m thick. These rocks are siliciclastic continental coastal plain deposits of Early Jurassic to Late Jurassic—early Oxfordian age. At different levels this unit contains scattered fossil remains described as (1) bivalves: *Trigonia (Vaugonia) kroemmelbeini*, *Gervillaria* sp., *Neocrassina* sp., *Eocallista* spp., *Vaugonia* spp.; (2) ferns: *Piazopteris branneri*; and (3) in the highest horizons some cephalopods: *Perisphinctes spathi*, *Glochiceras* cf. *subclausum*, *Ochetoceras* sp. (Judoley and Furrázola, 1965; Pszczolkowski, 1978).

JAGUA AND FRANCISCO FORMATIONS

The Jagua Formation consists of middle to early late Oxfordian shales and limestones. These deposits are approximately 160 m thick and rest conformably on top of the San Cayetano Formation. This unit has been divided into four members—Pan de Azúcar, Zacarias, Pimienta, and Jagua Vieja (Pszczolkowski, 1978). The Jagua Formation represents the first major Mesozoic marine transgression known in the western Caribbean. It has yielded abundant unidentified plant re-

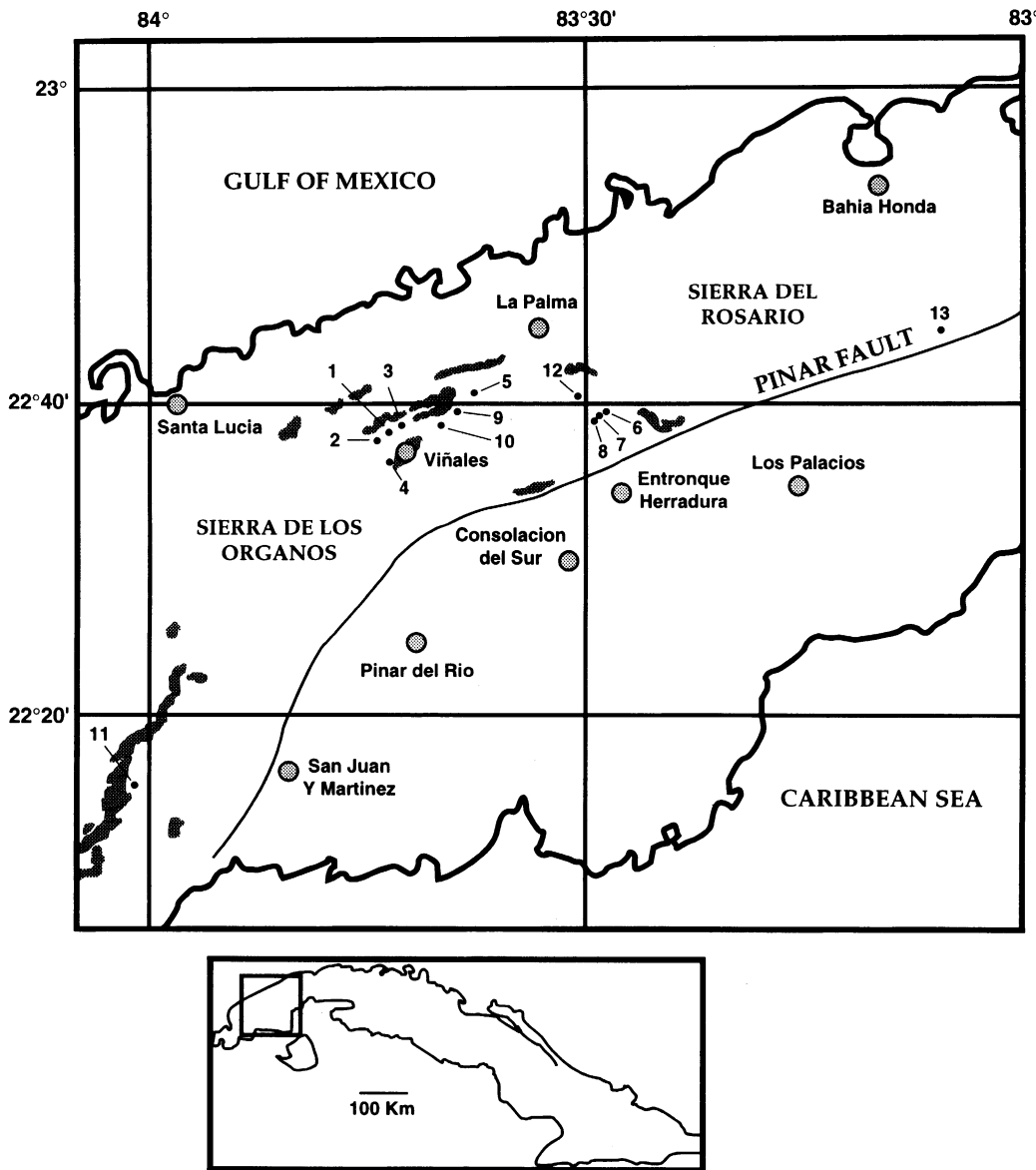


Fig. 4. Jurassic vertebrate fossil localities of western Cuba. Black strips: main outcrops of the mid-late Oxfordian Jagua and Francisco fossil-bearing formations. Numbers refer to locality numbers in text.

mains; ammonites (Wierzbowski, 1976); bivalves (*Liostrea* sp., *Ostrea* sp., *Plicatula* sp., *Exogira* sp., *Gryphaea* sp., ?*Posidonomya* sp.); foraminifera (*Conicospirillina basiliensis*); incertae sedis (*Globochaete* sp.), see Herrera, 1961; Pszczolkowski, 1978; ganoid fishes (*Lepidotes gloriae*, *Gyrodonus macrophthalmus cubensis*, *Caturus deani*, *Sauropsis* cf. *wood-*

wardi, *Eugnathides browni*, *Leptolepis* cf. *L. euspondylus*, *Luisichthys vinalesensis*, see Gregory, 1923; Arratia and Schultze, 1985; Thies, 1989); a pterosaur; a marine crocodyliform; and several plesiosaurs.

The middle Oxfordian Jagua Vieja Member (Herrera, 1961) is a 60 m thick unit composed of black shales and marly micritic to

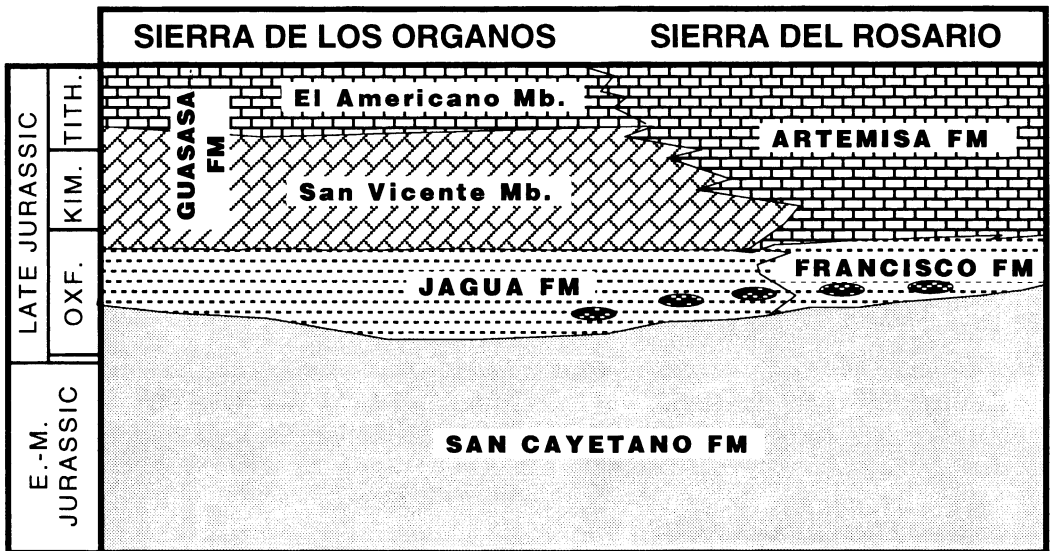


Fig. 5. Stratigraphic relationships of Jurassic rocks in the Guaniguanico Terrain (Sierra de los Organos and Sierra del Rosario). Simplified from Pszczolkowski, 1978.

biomicritic limestones, which are horizontally laminated and contain abundant, variably sized fossiliferous calcareous concretions (Wierzbowski, 1976). Laterally, toward the Sierra del Rosario, deposits that are very similar in character and composition have been named the Francisco Formation. The Francisco Formation also yields calcareous concretions (Pszczolkowski, 1978). These two names probably represent a single depositional unit.

The vertebrate fossils are found in laminated calcareous concretions that can reach up to one meter in diameter, but usually range between 20 and 40 cm. They are lenticular in shape, and usually have fractures filled with calcitic veins. In the local vernacular, these septaria are named “quesos” (cheese), “jicoteas” (tortoise), or “jocoteas” (colloquial misspelling of *jicotea*). The fishes and saurian bones are usually found in the interior of the concretions, while ammonites (the most abundant remains encountered) are found either on the surface or within the internal layers. In concretions, reptilian bones are usually broken and isolated, but two or more articulated vertebrae are often preserved. The bones are preserved as a dark black micro-

crystalline limestone, which is difficult to separate from the concretions. The ammonite shells are not eroded or compressed, and can be hollow or filled with calcareous sediment or sparry calcite. Occasionally small doubly spalled quartz crystals are found inside the ammonite shells. Fish remains may be slightly flattened, but also can be found retaining some of their three-dimensional characteristics. According to Pszczolkowski (1978), these features are characteristic of an early diagenetic origin for the concretions.

The Jagua Formation deposits are characteristic of shallow, calcareous to siliciclastic-shelf setting and represent the environmental evolution during a transgression, from a siliciclastic deltaic continental plain (early Oxfordian), to a shallow marine muddy carbonate shelf (late Oxfordian). The Jagua Vieja Member and the Francisco Formation are described as low-energy, nearshore, lower shelf reducing environments with water depths less than 100 m (Wierzbowski, 1976). Under these conditions, whole carcasses of marine reptiles probably would have been preserved. Therefore, the isolated bones of the reptiles that are commonly found may be the result of predatory action.

GUASASA AND ARTEMISA FORMATIONS

The Guasasa and Artemisa formations conformably rest on the Jagua and Francisco formations. These units represent two main facies: a carbonate shelf and a slope deposit. The carbonate shelf facies in the Sierra de los Organos was named the San Vicente Member of the Guasasa Formation (Herrera, 1961; Pszczolkowski, 1978). Previously it was referred to as the "Viñales Formation" (cf. Judoley and Furrázola, 1965). It consists of a basal limestone breccia covered by massive, light gray to black, sometimes dolomitized micritic limestones and calcarenites. This section, about 300 to 650 m thick, is a latest Oxfordian to early Tithonian carbonate platform which has yielded a poor fossil assemblage (bivalves, gastropods, algae, echinoids, and forams).

The second facies is characteristic of deep shelf to slope and basinal environments, and consists of regular stratified micritic to biomicritic limestones, with cherts, shales, and sandy intercalations (fig. 5). In the Sierra de los Organos this section is late Tithonian to Valanginian age and is subdivided into El Americano, Tumbadero, and Tumbitas members of the Guasasa Formation (Pszczolkowski, 1978). In the Sierra del Rosario, the age span of this section is latest Oxfordian to Aptian, and was named the Artemisa Formation (Pszczolkowski, 1978). The units in the deep-water facies of the Sierra del Rosario and the Sierra de los Organos share the common presence of microfossils (carpionelids, radiolaria, incertae sedis), brachiopods, and ammonites. Unidentified reptilian bones have been reported from the type locality of El Americano Member, at the Hacienda El Americano, on the eastern flank of Sierra de los Organos (Judoley and Furrázola, 1965; Pszczolkowski, 1978).

In sum, the Jurassic deposits of Sierra de los Organos and Sierra del Rosario, in western Cuba, characterize a major environmental transformation that took place during the Oxfordian as a consequence of a general transgression within the North American continental margin. Tectonically, several opinions have been published regarding the original position of the Guaniguanico Terrain, but most authors agree that it was prob-

ably part of the northeastern edge of the Yucatan block (Pszczolkowski, 1987; Ross and Scotese, 1988), until the early Paleogene, when it detached and moved northeastward to its present location (Iturralde-Vinent, 1994).

CATALOG OF LOCALITIES AND SPECIMENS

The following catalog is arranged by locality (fig. 4). Descriptions of all known fossil specimens relevant to this study are included within each locality. Map names and coordinates refer to the 1:50,000 scale maps of Cuba, published by the Cuban Institute of Geodetics and Cartography. Specimen numbers in brackets might represent field numbers, previous museum catalog numbers, or be of unknown origin. Abbreviations correspond to the list following the introduction.

Most of the fossils here described from western Cuba are the remains of plesiosaurs. Because some of these specimens are fragmentary, partially prepared, or isolated bones, definitive taxonomic assignment of the majority of these elements is precluded. Nevertheless, they are noted here for future reference.

● Loc. Near Viñales (fig. 4, no. 1)

Several fossil localities have been labeled ambiguously as "near Viñales town" or as "near Viñales." Probably most of them refer to the southern slope of Sierra de Guasasa, on the northern flank of the Viñales valley, northeast of the two of Viñales. The Jagua Formation outcrops on this slope, and has been the source of many important Jurassic fossil collections, including fishes, ammonites, and reptile bones. The well-known sites of Puerta del Ancón and Laguna de Piedra are located on this slope.

No specimen number

Material: Two vertebrae. Holotype of *Cryptocleidus?* (sic) *cuervo* De la Torre and Rojas 1949. Collector: America Ana Cuervo. Disposition: Lost.

The vertebrae were described by R. De la Torre and Rojas (1949) as two nearly complete vertebrae and fragments of the more anterior and posterior ones. Each vertebral

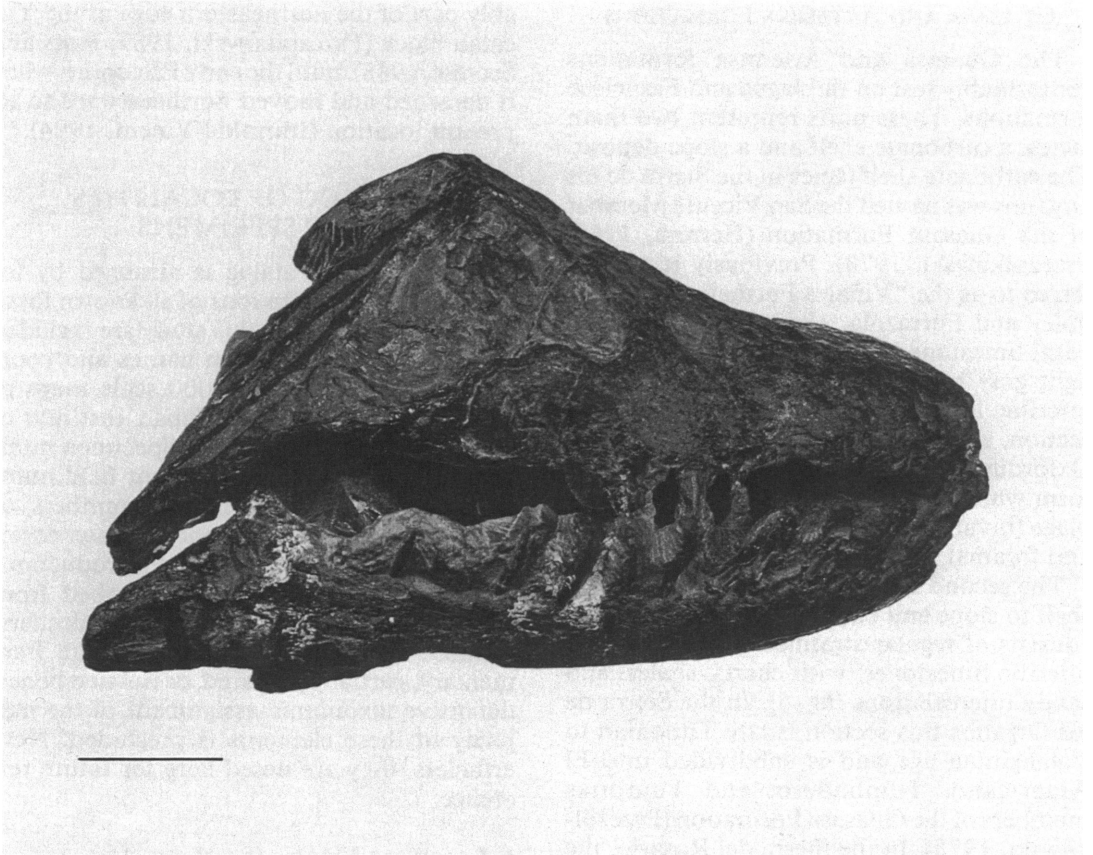


Fig. 6. The rostrum of a medium sized plesiosaur (MNHNH P3008), the holotype of *Cryptocleidus?* (sic) *cuervoii caroli* De la Torre and Rojas (1949). Right lateral view. Scale bar = 5 cm.

centrum was approximately 45 mm in length and 38 mm in height. With the inclusion of neural arch and cervical ribs, the vertebrae were nearly 85 mm in height. They are cervical elements according to the figure in R. De la Torre and Rojas (1949).

According to Welles (1962: 9) the cervical vertebrae of *Cryptocleidus?* (sic) *cuervoii* "seems to be quite different from *Cryptocleidus*, and very similar to *Muraenosaurus leedsii*." Later in the same paper, citing the common presence of hatchet-shaped cervical ribs and similar measurements, Welles (1962) stated that the Cuban material "should be included in the genus *Muraenosaurus*. Furthermore, since it is inseparable from *M. leedsii* Seeley (1874), it is here referred to that species."

This specimen is remarkably similar to the

specimens MNHNH P3003 from Laguna de Piedra, designated as the unpublished taxon *Cryptocleidus?* (sic) *vignalensis* R. De la Torre and Cuervo. As will be discussed later, they are probably just components of the same specimen. The name *Cryptocleidus* (sic) *cuervoii* is nomen dubium because of loss of the type material and because it is so incomplete that this specimen is probably not diagnosable as either *Cryptocleidus* or a new species.

MNHNH P3007

Material: Isolated plesiosaur vertebrae. Holotype of *Cryptocleidus* (sic) *cuervoii quesadai* De la Torre and Rojas (1949).

Collector: Julio de Quesada.

Disposition: MNHNH.

This specimen, MNHNH P3007, was des-

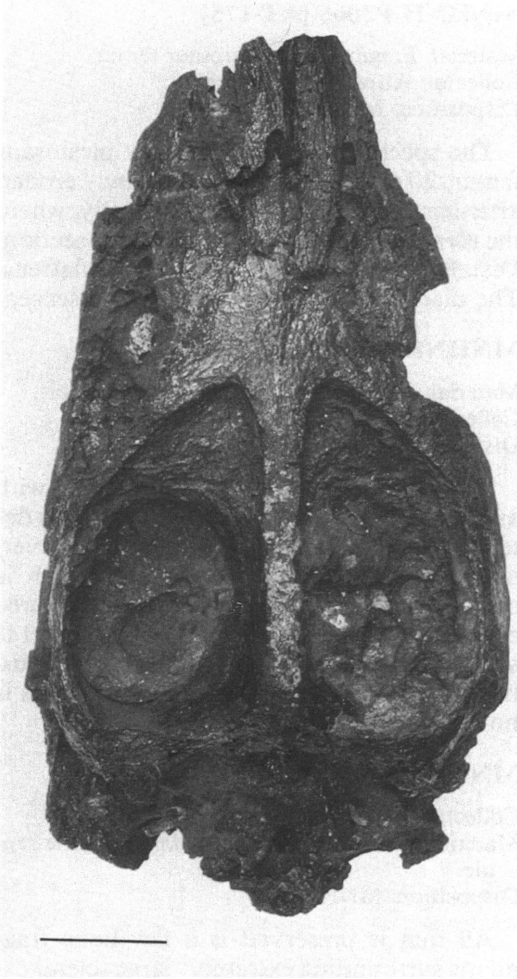


Fig. 7. Dorsal view of a small metriorhynchid skull (MNHNH P3009) from an unidentified locality near the village of Viñales. Scale bar = 5 cm.

ignated as a distinct subspecies of *Cryptocleidus?* (sic) *cuervoi* (the two lost vertebrae mentioned above). Because that designation is totally hypothetical and lacks any support, the name *Cryptocleidus?* (sic) *cuervoi quesdaí* is invalid.

The vertebrae are 160 mm in height; the centrum is 45 mm in length, 45 mm high, and 40 mm wide. Little can be said beyond stating that they are typical of plesiosaurian dorsal vertebrae in having a spindle-shaped centrum, weak anterior and posterior zygapophyses, a small neural canal, a laterally

plate like neural spine, paired ventral foramina, and transverse processes that broaden laterally and are transversely concave ventrally. According to Welles (1962) the specimen, whose vertebral indices are 53:100:100, is similar to *Muraenosaurus leedsii*. However, it also cannot be differentiated from *Tricleidus seeleyi*, illustrated by Andrews (1910).

MNHNH P3008

Material: Fragmentary plesiosaur cranium (fig. 6).

Holotype of *Cryptocleidus?* *cuervoi* and *caroli* De la Torre and Rojas (1949).

Collector: Carlos de la Torre.

Disposition: MNHNH.

Before preparation, the specimen supported several middle Oxfordian ammonites identified by R. Myczyński (Polish Academy of Sciences) as *Perisphinctes* sp., *Perisphinctes* (*Antilloceras*) sp., *Discosphinctes* sp., and *Discosphinctes* aff. *Discosphinctes aguayoi*. The specimen was further prepared mechanically at the AMNH during 1991 and 1992. The preparation of the specimen destroyed the ammonites, but a cast is preserved in the collection of the Museo Nacional de Historia Natural (Cuba).

The specimen is 25 cm long and is composed of a rostrum with the mandible articulated. The surface of the bones are abraded and sutures are almost impossible to discern. The mandibular rami are shifted laterally with respect to the skull, and lack the posterior ends. The taxon was named without diagnosis, but the generic identification can provisionally be considered correct, as it has similarities with *Cryptocleidus*. According to Welles (1962: 9), *Cryptocleidus?* (sic) *cuervoi caroli* is similar to other long-necked Jurassic plesiosaurs and "there seems to be no reason why the Cuban skull should be separated from *Muraenosaurus*." We disagree with this opinion.

The skull and mandible are morphologically like those of *Cryptocleidus*. The teeth, although most are broken, are conical, and 2.5 to 3.5 cm in length above the alveoli. Unlike *Muraenosaurus* and like *Cryptocleidus*, the labial enamel surfaces are smooth, with only a slight degree of fluting present near the lingual tooth bases. Most general features of the skull are obscured; however, small elliptical nares are present on the dorsal surface

of the rostrum, just anteromedial to the large orbit. The mandibular symphysis is long, about 4.1 cm. Posteriorly on the ventral surface of the block, several elements probably represent pieces of the fragmented basicranium.

A nomenclatural problem with this taxon is that the specimen was named *Cryptocleidus?* (sic) *cuervoi caroli*, as a subspecies of *Cryptocleidus?* (sic) *cuervoi*. But *Cryptocleidus?* (sic) *cuervoi* is not a valid name, because the type specimen was improperly described and then lost. Also the supposed relationships among *Cryptocleidus?* (sic) *cuervoi caroli*, *Cryptocleidus?* (sic) *cuervoi quesadai* and *Cryptocleidus?* (sic) *cuervoi* are entirely hypothetical, as the three specimens were not found associated and correspond to different parts of the plesiosaurian body. Therefore, if it proves to be diagnosable as a distinct species, the specimen MNHNH P3008 will have to be named *Cryptoclidus caroli* De la Torre and Rojas.

MNHNH P3009

Material: Cranium of crocodyliform (Metriorhynchidae) (fig. 7).

Collector: Unknown.

Disposition: MNHNH.

This is the second Jurassic crocodyliform reported from the Caribbean area (Stinnesbeck et al., 1993). The skull is nearly complete with both lower jaws in articulation with the cranium. Only the anterior part of the rostrum is missing. Although not completely prepared, scleral ossicles are preserved in the orbits and hyoid bones lie between the lower jaws. The skull measures 13.5 cm across the quadrates, 15 cm at its widest point (across the temporal fenestrae), and 8 cm across the frontal (posterior to the enlarged prefrontal). The supratemporal fossae measure 11.5 cm long by 5.5 cm wide.

Metriorhynchid crocodyliforms are ubiquitous fossils where Jurassic marine sediments are found. A plethora of taxa have been described from European and American deposits. Although almost certainly monophyletic (Clark, 1986), many of these specimens have received little attention and the entire group is badly in need of revision. The Cuban specimen is very well preserved and may be of extreme importance in such a review.

MNHNH P3065 [AT-175]

Material: Fragmentary plesiosaur femur.

Collector: Alfredo De la Torre.

Disposition: MNHNH.

The specimen is a fragmentary plesiosaur femur, 20 cm in length. An extremely eroded articular surface is present proximally, where the element is subcylindrical in cross section. Distally the element broadens and flattens. The distal articular surface is not preserved.

MNHNH P3066 [AT-654]

Material: A fragmentary plesiosaur mandible.

Collector: Alfredo De la Torre.

Disposition: MNHNH.

The specimen is predominantly a mold with associated teeth. Originally eight teeth (as determined by molds) were present; however, only a single, 6 cm long, anterior tooth is completely preserved. Fragments of three other teeth are present. The tooth enamel is smooth and lacks longitudinal striations; however, the tooth regions near the bases is not well preserved.

MNHNH P3068

Collector: Unknown.

Material: A skull fragment of a large marine reptile.

Disposition: MNHNH.

All that is preserved is a few bone fragments surrounding extremely large scleral ossicles. Apparently partial sclerotic rings from both orbits are crushed on top of each other. The estimated diameter of the sclerotic ring is 15 cm. This specimen represents the largest marine saurian specimen yet recovered from the Cuban Jurassic. Large scleral plates have an extensive distribution in marine reptiles, therefore on the basis of such fragmentary material it cannot be determined to which marine reptile group MNHNH P3068 is referable.

MNHNH P3070 [AT-175]

Material: Fragmentary plesiosaur vertebrae.

Collector: Alfredo De la Torre.

Disposition: MNHNH.

The specimen comprises four fragmentary vertebrae preserved in a single concretion. The vertebrae are part of the cervical series and possess hatchet-shaped fused cervical ribs

like those of *Cryptocleidus?* (sic) *cuervo*. The specimen is 11.5 cm in height, 5 cm of which is neural spine. Although from a different vertebral region, this specimen corresponds in size and proportions to MNHNH P3002.

● **Loc. Puerta del Ancón** (fig. 4, no. 2)

Sheet Consolación del Sur, coordinates x 221,100 y 316,000. Jagua Formation. This was the first locality in Cuba to produce Jurassic fossils. However, no marine reptile fossils from these early collections have found their way into collections. The fossils are from the southern and southwestern slope of the hills, where the Jagua Formation is exposed.

USNM 18699

Material: Plesiosaur cranium and mandibular fragments.

Collector: David Dunkle and Juan Gallardo, February 17, 1950.

Disposition: USNM.

The material, partially acid-prepared, includes a fragment of a mandibular ramus without teeth, an isolated orbital bone, and a fragmentary skull without the braincase. The skull is typical of Plesiosauria. The specimen is extremely fragmentary, and fragility has added to its deterioration.

● **Loc. Laguna de Piedra** (fig. 4, no. 3)

Sheet Consolación del Sur, coordinates x 222,900 y 316,300. Jagua Formation. This locality corresponds to the southern slope of the Sierra de Guasasa, a few kilometers east of Puerta del Ancón. Fossil-bearing concretions are found in lag deposits or in outcrops within small creeks.

MNHNH P3001

Material: Cranium. Designated as holotype of *Ichthyosaurus torrei* De la Torre and Cuervo (1939).

Collector: America Ana Cuervo (University of Havana).

Disposition: MNHNH.

The specimen was figured as number 2 by R. De la Torre and Cuervo (1939). Although the cranium was only provisionally referred to Ichthyosauridae, probably because of the presence of conical teeth, those authors designated it as a new species with diagnostic characters: "conducto del nervio dentario su-

perior corriendo por el grueso de la pared alveolar interna del maxilar y premaxilar superior cerca del borde alveolar interno" (R. De la Torre and Cuervo, 1939: 9).

This specimen is a fragmentary cranium in black limestone with only a small amount of exposed bone and a few very fragmentary teeth visible anterolaterally. Two thick (2–3 cm) calcite veins traverse the skull. During the original preparation the specimen suffered extensive damage. Furthermore, it is so fragmentary that even with additional preparation identification is unlikely. The holotype material of *Ichthyosaurus torrei* is in no way referable to the Ichthyosauria, and, in fact, cannot be referred to any higher-level group of Sauropterygia. Therefore *Ichthyosaurus torrei* is indeterminate.

MNHNH P3002 [ZII 294 (3612)]

Material: Four articulated vertebrae. The specimen has been labeled as holotype of *Cryptocleidus? vignalensis* by Ricardo De la Torre and America Ana Cuervo.

Collector: Unknown.

Disposition: MNHNH.

This taxon was never published. However, these vertebrae are very similar to those designated as holotype of *Cryptocleidus?* (sic) *cuervo* by R. De la Torre and Rojas (1949). Furthermore, comparison of the illustration of *C.? cuervo* and the vertebrae MNHNH P3002 suggests that they are part and counterpart of the same specimen. In reviewing the history of the specimens, De la Torre and Rojas (1949) indicate that the right side was deposited in the Ricardo De la Torre collection and the left side in the Museum of Geology and Paleontology of the University of Havana. The Ricardo De la Torre collection has been lost, and collections from the University of Havana were split between the University of Oriente in eastern Cuba and the Museo Nacional de Historia Natural in Havana. We assume that the specimen labeled as *Cryptocleidus?* (sic) *vignalensis* is the left side originally housed in the University of Havana. Therefore, *Cryptocleidus?* (sic) *vignalensis* and *Cryptocleidus?* (sic) *cuervo* represent two names given to the same specimen, although *Cryptocleidus?* (sic) *vignalensis* was never formally used in a publication. Needless to say, neither of these names is considered valid.

MNHNH P3003

Material: Long bone fragment contained in a small 200 × 140 mm concretion.

Collector: Unknown.

Disposition: MNHNH.

The specimen is labeled as paratype of *Cryptocleidus? vignalensis* by Ricardo De la Torre and America Ana Cuervo.

A small, oval cross section of a bone fragment, about 110 mm long, lacks any articulating surfaces. In general proportions, it is similar to the ribs of many plesiosaurs; however, the extremely fragmentary nature of the material makes even that comparison tentative. Adding to the confusion, this specimen was designated the paratype of *Cryptocleidus? (sic) vignalensis*. This name was never used in the literature.

No specimen number

Material: External tooth molds. Holotype of *Sphaerodontes caroli* De la Torre and Cuervo (1939).

Collector: Carlos de la Torre.

Disposition: Lost.

This specimen was illustrated by De la Torre and Cuervo (1939: 5) as number 1. Although diagnosis was not provided, De la Torre and Cuervo (1939) described it as a new ichthyosaurian taxon based on the spherical character of the tooth molds, a fairly unusual condition for Ichthyosauria. Ganoid fishes from localities near Viñales yield the same type of teeth, like the one identified from Cuba by W. K. Gregory as Euagnathidae, and labeled UCMP 105716. Therefore, *Sphaerodontes caroli* is probably a fish, and, since the type is lost, it is a nomen dubium.

- **Loc. Viñales Town** (fig. 4, no. 4)

Sheet Consolación del Sur, coordinates x 220,800 y 310,900, 1 km SW of the town of Viñales. The Jagua Formation is poorly exposed in this area.

UCMP-105703, 105704, 105720, 105725

Material: Very fragmentary plesiosaur vertebrae.

Collector: Charles W. Hatten [field number 31 CH-3].

Disposition: UCMP.

The best specimen, 105703, could not be found in the Museum of Paleontology and

may be lost. The remaining vertebrae are apparently plesiosaurian; however, they are too fragmentary to allow more specific reference to a taxon.

- **Loc. Jagua Vieja** (fig. 4, no. 5)

Sheet La Palma, coordinates x 228,800 y 320,900. Jagua Formation. Slopes of mogote Jagua Vieja.

No specimen number

Material: Large limb bone.

Collector: Carlos de la Torre.

Disposition: Lost.

The bone is about 40 cm long and between 6 and 12 cm in diameter, lacking articulating surfaces. It was described and figured by A. De la Torre (1949), who referred it to a large sauropod dinosaur (*Brontosaurus* or *Diplodocus*), obviously because of its large size. An ammonite mold is attached to the fossils.

The occurrence of sauropod fossils in the Jagua Formation would be a great discovery. But the material described by A. De la Torre cannot be considered definitive evidence for the occurrence of a Cuban Jurassic dinosaur because large size is not a definitively diagnostic character of sauropods. Marine reptiles, large enough to possess bones more than 40 cm long, are found in the same beds. The specimen has been lost.

No specimen number

Material: Small plesiosaur cranium and articulated mandible.

Collector: Unknown.

Disposition: IGP.

This is the smallest plesiosauroid skull and mandible recovered from Cuban fossil-bearing Jurassic formations. The specimen is well preserved and was partially mechanically prepared. The authors have been unable to properly examine the material, but preliminary observations indicate that it is different from any other specimen known from Cuba.

- **Loc. Caiguanabo** (fig. 4, no. 6)

Sheet Herradura, coordinates x 244,200 y 316,900. Jagua Formation. Northern slope of the Sierra de Caiguanabo.

MNHNH P3004 [5117/300]

Material: Femur.
 Collector: Unknown.
 Disposition: MNHNH.

A fragmentary distal femur of a small plesiosaur about 20 cm in length. The bone is fairly nondescript, with a shaft that is circular in cross section with a flattened distal extremity. Along the shaft, the element is 3.2 cm across at its narrowest point; the distal expansion is 9.7 cm at its widest point. This bone is typical of a small plesiosaur, but no more precise identification is possible. Because the material is so fragmentary, lower-level taxonomic appraisal is not possible.

MNHNH P3005 [3364]

Material: Large cranium and articulated mandible.
 Collector: Juan Gallardo, 1946.
 Disposition: MNHNH.

This is probably the best specimen of a marine reptile yet recovered from the Cuban Oxfordian. It lacks a locality label, but according to Juan Gallardo, it was collected in Caiguanabo. This specimen, 42 cm long, lacking most of the rostrum and anterior mandible, is the largest marine reptile cranium found in the region. It has been partially mechanically prepared. The bones are extremely worn; however, the general form of the major skull openings and osseous elements can be determined. In dorsal view, large polygonal supratemporal fenestrae are visible just posterior to the large orbits. In lateral view, the lower jaws are in articulation with the quadrates. Anteriorly, sharply pointed teeth with smooth enamel are present on both the dentary and the maxilla anterior to the orbits.

Superficially, this specimen generally resembles the taxon *Pliosaurus ferox* Sauvage (Andrews, 1913: pl. 1): however, no definitive assignment can be made until the skull is adequately prepared. Undoubtedly, this taxon will be identifiable at a lower level following detailed preparation.

- **Loc. Hoyo de la Sierra** (fig. 4, no. 7)

Sheet Herradura, coordinates x 243,550 y 316,800. Jagua Formation. The locality is along the slope surrounding the small valley.

MNHNH P3069 (AT 73-1-24)

Material: Fragments of plesiosaur mandible and skull with molds of teeth and two isolated teeth.
 Collector: Alfredo De la Torre.
 Disposition: MNHNH.

One dentary fragment is 10.5 cm long and has five empty alveoli. A second fragment is composed of two conical, slightly recurved, teeth about 1.2 cm in length. The other fragment is 10.5 cm long with four teeth, the largest 3 cm long. The tooth enamel lacks longitudinal striations. This material is extremely fragmentary, unprepared, and cannot be identified to lower taxonomic levels.

USNM 18712

Material: Two bone fragments labeled as plesiosaur.
 Collector: Juan Gallardo and David Dunkle, March 14, 1950.
 Disposition: USNM.

The lack of characteristic features in these bone fragments precludes any further identification.

- **Loc. Hoyo del Palmar** (fig. 4, no. 8)

Sheet La Palma, coordinates x 227,800 y 321,000. The fossiliferous Jagua Formation outcrops on the slopes of a small valley. Fragmentary bones of marine reptiles were observed during the authors' visit to this locality, although none were complete enough to catalog into the collection of the Museo Nacional. Nevertheless, because it is the probable locality of the pterosaur *Nesodactylus hespericus*, Hoyo del Palmar is an important fossil site. The locality as described by Colbert (1969: 3) is "about 4½ miles, or about 7 kilometers east of a mine known as Constanca, which in turn is about 5 miles, approximately 8 kilometers north of Viñales." According to Juan Gallardo, this place is probably Hoyo del Palmar, a locality that he visited with Barnum Brown.

AMNH DVP 2000

Material: Skeleton, holotype of *Nesodactylus hespericus* Colbert 1969.
 Collector: Barnum Brown.
 Disposition: AMNH.

This beautiful specimen of a rhamphorhynchoid pterosaur was not immediately

recognized as such. Instead, it was considered a fish until acid preparation revealed its true identity. Later it was described and illustrated by Colbert (1969). Additional figures of this specimen are given in Wellnhoffer (1991). Like all of the reptilian fossil bones from western Cuba, the skeleton was disarticulated before preservation. The presence of a pterosaur in these deposits is important because it raises the possibility that fossil remains of other terrestrial or volant animals (like early birds) may be recovered from the Jagua Formation.

● **Loc. Mina Constancia** (fig. 4, no. 9)

It is doubtful that this published locality exists because no Oxfordian sediments are present in the mine. Probably it represents the slope of Mogote La Mina, located just south of the old copper mine. Sheet La Palma, coordinates x 226,300 y 320,800. Jagua Formation. This locality yielded ganoid fishes (AMNH-DVP 7927, 7939) according to Gregory (1923) and probable marine reptiles (Brown and O'Connell, 1922). However, no marine reptile bones are cataloged into any collection surveyed here.

● **Loc. Hoyo de San Antonio** (fig. 4, no. 10)

Sheet La Palma, coordinates x 226,300 y 320,800. This locality is probably the same, or nearly the same, as Mogote La Mina, or Mina Constancia. Here the fossiliferous Jagua Formation outcrops in low hills and in the valley.

USNM 18688

Material: "plesiosaur vertebrae."

Collector: Juan Gallardo and David Dunkle, March 14, 1950.

Disposition: USNM.

This specimen, labeled "plesiosaur vertebra," can hardly be recognized as bone and is probably an inorganic mold. Obviously it cannot be referred to any recognized taxon.

USNM 18721

Material: Plesiosaur vertebra.

Collector: Juan Gallardo and David Dunkle, March 14, 1950.

Disposition: USNM.

The vertebra is 12.5 cm high, with a circular centrum 5.5 cm in diameter. It represents a posterior cervical vertebra, which can be determined by the presence of a ventral keel flanked by two small nutrient foramina and by the shape and orientation of the rib facets. Referral to any taxon more specific than Plesiosauria is impossible on the basis of such fragmentary material.

● **Loc. Punta de la Sierra** (fig. 4, no. 11)

Sheet San Juan y Martínez, coordinates x 191,500 y 280,000. Jagua Formation. Isolated blocks of limestone in a small river (Gutiérrez, 1981).

No specimen number

Material: Two large bone fragments.

Collector: Unknown.

Disposition: Lost.

Gutiérrez (1981) described two large bone fragments, the largest of which is 34 cm long. He referred these bones to Saurischia or Ornithischia. It is unlikely that this reference is appropriate, given the fragmentary nature of the fossil material. Furthermore, the specimens have been lost, making confirmation of Gutiérrez's referral impossible.

● **Loc. Hacienda del Americano** (fig. 4, no. 12)

Sheet La Palma, coordinates x 240,300 y 321,400. Outcrops of the Tithonian El Americano member of Guasasa Formation are found north and northeast of the "bungalow." We visited this locality, but were unable to find further reptilian fossils. This is a very important locality for future work, as it is the only place where Tithonian marine reptiles have been reported from Cuba.

No specimen number

Material: Skull and fragmentary skeleton of a marine reptile.

Collector: C. Judoley and G. Furrázola in 1964.

Disposition: Lost.

The skeleton reported from this locality (Judoley and Furrázola, 1965; Pszczolkowski, 1978) was probably destroyed during a mining operation. According to G. Furrázola-Bermúdez (personal commun., 1993) subsequently a plesiosaur skull was also re-

covered. Unfortunately, this specimen has been lost.

● **Loc. Puerta de la Muralla** (fig. 4, no. 13)

Sheet San Cristobal, coordinates x 284,600 y 325,300. Sierra del Rosario, NW of San Cristobal, along the road known as "Camino de Cinco Pesos." Outcrops of the late Oxfordian to Lower Cretaceous Artemisa Formation.

MNHNH P3006 [3370]

Material: Fragmentary plesiosaur limb girdle.
Collector: Unknown.
Disposition: MNHNH.

This specimen is a thin veneer of bone surrounding two large, circular openings (9.5 cm in diameter). This element may represent a pelvic girdle fragment, in which case the two large fenestrae are the obturator foramina. Because of the difficulty in determining the identity of this element, no further taxonomic determination beyond Plesiosauria can be made.

● **Loc. Finca Grau, near La Palma**

Precise locality unknown. Described as Jagua Formation.

USNM 18697

Material: Two plesiosaur vertebrae.
Collector: David Dunkle and Juan Gallardo, February 26, 1950.
Disposition: USNM.

The vertebrae, 8.5 cm in total height, with the centrum 45 to 50 mm long and 50 mm high. The specimen is typically plesiosaurian in having shallow zygapophyses on the tall neural spines.

DISCUSSION

Within the Caribbean basin, the only Jurassic marine reptilian fossil locality is within the Guaniguanico Terrain in western Cuba. Curiously, few references to this important site are found in the paleontological literature except for Colbert's (1969) description of a pterosaur and several little known Cuban publications.

After a preliminary revision of the fossil material, we can draw the following conclusions about previously published taxa:

No indisputable ichthyosaurian remains have been recovered in the Jurassic limestone deposits of western Cuba. R. De la Torre and Cuervo (1949) described two taxa as Ichthyosauria, but neither can be definitively allocated to this group. *Sphaerodontes caroli* De la Torre and Cuervo is a fish, and *Ichthyosaurus torrei* De la Torre and Cuervo is a plesiosaur. R. De la Torre and Rojas (1949) named three new taxa as Ichthyosauria but, surprisingly, they classified these specimens as species of *Cryptocleidus* (sic), a plesiosaurian genus.

Plesiosaur bones are frequent in the Cuban collections, demonstrating that these marine reptiles were abundant in the area. But, the taxa *Cryptocleidus* (sic) *cuervoi*, and *Cryptocleidus* (sic) *cuervoi quesadai* proposed by R. De la Torre and Rojas (1949) and the unpublished *Cryptocleidus*? (sic) *vignalensis* (R. De la Torre) are nomina dubia because they are based on very fragmentary material. The quality of this material is insufficient for detailed comparison with valid plesiosaurian taxa and are therefore hardly appropriate for designation as type specimens.

This is not the case with *Ichthyosaurus torrei* and *Cryptocleidus* (sic) *cuervoi caroli*, because the types are well preserved, albeit incomplete, plesiosaur skulls. *Ichthyosaurus torrei* is an invalid name, as previously discussed. *Cryptocleidus* (sic) *caroli* may be a valid taxon, but requires further description of the type. Important material includes three additional plesiosaur skulls (USNM 18699, MNHNH P3005, and the uncataloged specimen housed in the IGP). Detailed preparation and description of these materials are outside the scope of this survey paper. However, future identification of these materials will be an important contribution in understanding the relationships of this fauna to those of Europe, South America, and elsewhere.

The discovery of a metriorhynchid in Guaniguanico is very interesting, as these crocodyliforms are also known from the Jurassic of Mexico (Stinnesbeck et al., 1993), South America, and Europe (Gasparini, 1985).

Dinosaur remains have been reported from the Jagua Formation (A. De la Torre, 1949; Gutierrez, 1981), but the described material is too fragmentary for such referral. Furthermore, the fossil material reported by both authors has been lost. In fact, the only "non-marine" reptile properly identified is the pterosaur *Nesodactylus hespericus* Colbert, 1969.

Unfortunately, all Cuban Tithonian marine reptile remains have been destroyed or lost, but according to the observations of G. Furrázola-Bermúdez, these specimens included a plesiosaur skull.

The middle Oxfordian Cuban fauna comprises pterosaurs, crocodyliforms, and plesiosaurs associated with abundant ammonites, ganoid fishes, and less common pelecypods, gastropods, benthic foraminifera, and other microfossils. Most of the identifiable Cuban plesiosaur specimens strongly resemble European material and the only published taxon that can be provisionally recognized at the generic level is *Cryptoclidus*, a common marine reptile in European Late Jurassic deposits (Andrews, 1910).

Elsewhere, Late Jurassic (Oxfordian) marine reptiles are known from Great Britain (Brown, 1981), the western interior of North America (Person, 1963), Puebla (Stinnesbeck et al., 1993) and Sierra Madre (Mexico), Chile, and Argentina (Gasparini, 1985). North American Late Jurassic plesiosaur fossils are very fragmentary, and taxonomic relation-

ships with European taxa are problematic. Gasparini and Fernández (1993) and Gasparini and Spalletti (1993) have reported Plesiosauria from the Middle Jurassic of the Neuquen Basin (Argentina). The taxa reported by these authors are similar to those found in Cuba and Europe.

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