

**OCCURENCE OF THE CROCODILIAN
DOLICHOCHAMPSA MINIMA
(EUSUCHIA, DOLICHOCHAMPSIDAE)
IN THE EL MOLINO FORMATION OF BOLIVIA**

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ABSTRACT

A right dentary of a small crocodilian from the presumably late Cretaceous El Molino Formation of La Palca, near Potosi (southern Bolivia) is referred to *Dolichochoampsia minima* Gasparini & Buffetaut, 1980, a species originally described from the supposedly late Cretaceous Yacoraite Formation of northern Argentina and referred to a particular family of eusuchians, the Dolichochoampsidae. The new specimen is closely similar to the material from Argentina. Its good preservation reveals some interesting features not clearly observable on the specimens from the Yacoraite Formation, notably the apparently very short mandibular symphysis, a very unusual character in a longirostrine crocodilian. The occurrence of *Dolichochoampsia minima* in Bolivia extends the known geographical range of the species, but is not unexpected, as the El Molino Formation and the Yacoraite Formation have apparently been deposited in the same general basin. The presence of the same peculiar kind of small crocodilian in both formations strengthens the evidence for a biostratigraphic correlation of the Yacoraite and El Molino Formations.

RESUME

Le dentaire droit d'un petit Crocodilien provenant de la Formation El Molino présumée Crétacé supérieur, à La Palca, près de Potosi (Sud de la Bolivie), est attribuée à *Dolichochoampsia minima* Gasparini & Buffetaut, 1980, espèce décrite à l'origine dans la Formation Yacoraite (attribuée au Crétacé supérieur) du Nord de l'Argentine, et placée dans une famille particulière des Eusuchia, les Dolichochoampsidae. Le nouveau spécimen ressemble étroitement au matériel argentin. Sa bonne conservation révèle quelques caractères intéressants qui n'étaient pas clairement observables sur les spécimens de la Formation Yacoraite, notamment la symphyse mandibulaire apparemment très courte, caractère très inhabituel chez les Crocodiliens longirostres. La présence de *Dolichochoampsia minima* en Bolivie augmente la répartition géographique de l'espèce, mais elle n'est pas inattendue, car dans les formations El Molino et Yacoraite se sont apparemment déposées dans le même bassin. La présence de la même espèce de petit Crocodilien dans les deux formations renforce les données en faveur d'une corrélation biostratigraphique entre les formations Yacoraite et El Molino.

Key-words - Crocodylia, Eusuchia, Bolivia, Argentinian, Cretaceous, correlation.

Mots-clés - Crocodylia, Eusuchia, Bolivie, Argentine, Crétacé, corrélation.

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INTRODUCTION

The species *Dolicho-champsa minima* was erected in 1980 by Gasparini & Buffetaut on the basis of small crocodylian remains from the Salta Group of northern Argentina. The abundant but fragmentary remains available at the time had led to place *Dolicho-champsa minima* in a family of its own, the Dolicho-champsidae. This group was hitherto known only from the supposedly late Cretaceous Yacoraite Formation, Salta Group, of Salta Province in northern Argentina (Gasparini & Buffetaut, 1980). The specimen described in the present paper demonstrates the occurrence of dolicho-champsids farther north, in the Puca Group of southern Bolivia.

The Bolivian specimen was found by Bolivian oil geologists of the Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.) near the village of La Palca, about 8 km north-west of the city of Potosi, in southern Bolivia (see map in Branisa, Hoffstetter & Signeux, 1964, fig. 1). It comes from fine-grained sandstone layers referred to the El Molino Formation, itself part of the Puca Group, which is well developed in the Miraflores syncline north-west of Potosi (Branisa, Hoffstetter & Signeux, 1964; Branisa, Hoffstetter, Freneix, Roman & Sornay, 1966). Although its exact position within the late Cretaceous has been the subject of some controversy, the El Molino Formation is now usually referred to the Maastrichtian (Muizon, Gayet, Lavenu, Marshall, Sigé & Villaroel, 1983), as both charophytes (Branisa, Grambast & Hoffstetter, 1969) and selachians (Cappetta, 1975) suggest such an age.

DESCRIPTION

The *Dolicho-champsa* remain found at La

Palca (collection n° : Y.P.F.B. Pal. 61-16) is a nearly complete, fairly well preserved right dentary; contrary to several of the specimens from Argentina described in 1980, it has suffered no deformation. Only the anteriormost end of the bone and part of the posterior region of the lateral surface are missing. As shown by the following measurements, the specimen indicates a small crocodylian:

Total length	135 mm
Maximum width (at level of anterior break)	8 mm
Maximum height (in the posterior part)	10 mm

This small size of the fossil is very reminiscent of the material from the Yacoraite Formation, which was interpreted by Gasparini & Buffetaut (1980) as belonging to a small species of crocodylian rather than to young individuals of a large form. The fact that the only known specimen from Bolivia is also quite small strengthens this conclusion.

The dentary from La Palca is much elongated and very slender, and it does not show any marked curvature; its lateral edge, as preserved, is almost completely straight, with the exception of the projecting edges of some alveoli. The anterior part of the bone is very shallow (4 mm); its height increases gradually toward the rear.

In dorsal view, the specimen shows a well preserved alveolar row comprising 18 alveoli. Obviously, no alveolus is missing at the posterior end. The most anterior alveoli, however, are missing where the anterior end of the jaw is broken. The second preserved alveolus from the front, the diameter of which is relatively large (2.5 mm), may be the fourth alveolus, to judge from the aspect of this region on the holotype from Argentina (Gasparini & Buffetaut, 1980, fig. 2);



Figure 1. Right dentary of *Dolicho-champsa minima* Gasparini & Buffetaut from the El Molino Formation of La Palca (Bolivia), collection Yacimientos Petroliferos de Bolivia Pal 61-16. A: medial view; B: dorsal view; C: lateral view. Photograph: C. Abrial.

if this interpretation is correct, two alveoli are missing at the anterior end, and the total number was 20 (the material from the Yacoraite Formation only permitted to say that there were at least 14 alveoli in the dentary). The alveoli are fairly small (with a diameter of about 2 mm); they open upward in the posterior part of the jaw, more laterally in the anterior part. As on the specimens from Argentina, the posterior alveoli open below the level of the medial part of the bone, which forms a nearly flat buccal floor; the width of this medial part decreases from front to back. Between the openings of the alveoli, there are well marked notches, definitely longer than the diameter of an alveolus; posterior to the tenth alveolus, they form a few true pits which probably accommodated the tips of upper teeth. Remains of teeth are present in the first, third, fourth, seventh, ninth, twelfth and thirteenth preserved alveoli. These teeth are long, slender and pointed, as those from the Yacoraite Formation; however, the fluting which is visible on the latter is not observable on the Bolivian specimen, in which the preservation of the enamel is not very good.

The ventrolateral surface of the bone seems to have been ornamented with longitudinal grooves; in cross-section, its outline is regularly rounded in the anterior region, but farther backward there is a definite angle between the lateral surface and the ventral surface. Posteriorly, the lateral surface of the bone is much damaged, so that it cannot be determined whether there was an external mandibular fenestra.

The medial face of this dentary clearly shows, posteriorly, the surface for the contact of the splenial. The splenial seems to have reached very far forward, as the Meckelian canal, which is normally hidden by this bone medially, is visible as an open groove which reaches the level of the anterior break. No sutural surface corresponding to the contact between the dentaries can clearly be seen. However, just behind the anterior break there is a slight medial curvature of the edge of the bone, which is reminiscent of what is seen at the posterior end of the symphysis in many crocodylians. This suggests that the suture between the dentaries did not extend farther backward than the level of the fourth teeth. Whether there was a splenial symphysis, and, if so, how long it was, cannot be determined.

IDENTIFICATION AND RECONSTRUCTION

There is no doubt that the dentary from La Palca can be referred to a dolichochoampsid crocodylian and, more accurately, to the species *Dolichochoampsia minima* Gasparini & Buffetaut, 1980. The morphology of the Bolivian fossil agrees very well with what was known of the form from the Yacoraite Formation, especially in the general shape of the dentary, the proportions of the alveoli and the appearance of the teeth. Although

the material from Argentina is more abundant and includes cranial and postcranial elements, the specimen from La Palca provides interesting data concerning the morphology of the lower jaw, which were not available from the less well preserved fossils from Salta Province. Because of the peculiar shape of the very long and straight dentary, it seems likely that the mandibular symphysis was very short. If a union of the mandibular rami along a considerable length is postulated, it must be admitted that the space between the posterior parts of the rami was very narrow (because the dentary is almost straight), and it is difficult to imagine how this narrow space could accommodate the width of the posterior part of the skull. It is more likely that the mandibular rami were attached to each other only in the most anterior part, by a short suture, and that farther backward the nearly straight dentaries diverged at a relatively open angle (Fig. 2). The shortness of the symphysis would also explain why the dentaries of *Dolichochoampsia minima* are found in isolation, in Argentina as well as in Bolivia; in most crocodylians with a long mandibular symphysis, the dentaries are strongly attached to each other, if not fused in old individuals, and they often do not separate after death. If this reconstruction (Fig. 2) is correct, the shortness of the symphysis can be considered as an additional diagnostic feature of *Dolichochoampsia minima*. It is a very unusual condition in a longirostrine crocodylian, one of the few known similar cases being that of *Crocodyleimus robustus*, a Jurassic mesosuchian known by a single specimen from the lithographic limestones of Cerin (France) (Lortet, 1892; Buffetaut, 1982).

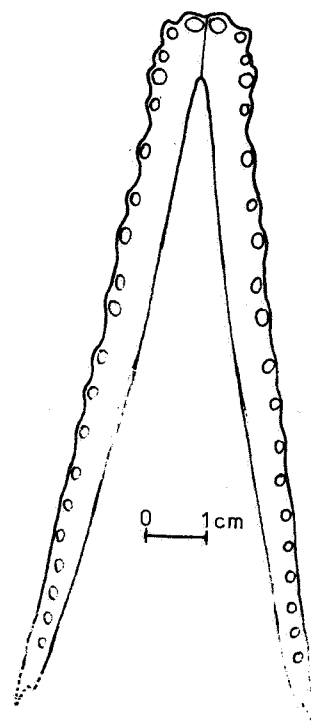


Figure 2. A possible reconstruction of the dentaries of *Dolichochoampsia minima*, assuming that the dentary symphysis was very short. The splenials are not shown.

This peculiarity of *Dolichochoampsa minima*, which was not clearly apparent on the specimens from Argentina, would confirm that this form belongs to a very peculiar group of eusuchians, and that a distinction at the family level, as proposed by Gasparini & Buffetaut (1980), is justified.

BIOGEOGRAPHICAL AND STRATIGRAPHIC CONCLUSIONS

Beyond new data on the osteology of *Dolichochoampsa minima*, the specimen from La Palca yields new informations about the geographical distribution of this species and the stratigraphic correlations between the formations of the Salta and Puca Groups of Argentina and Bolivia.

As mentioned above, *Dolichochoampsa minima* and, more generally, the Dolichochoampsidae had hitherto been reported only from the Yacoraite Formation of Salta Province, in northern Argentina. The Bolivian specimen has been found nearly 500 km farther north, thus extending the known geographical range of the species. However, it should be realised that the Argentinian and Bolivian localities which have yielded dolichochoampsid remains are all located in the same general sedimentary basin, the so-called "Cuenca Andina", even though they are in different sub-basins (Reyes & Salfity, 1973 ; Bonaparte, 1978). The known occurrences of dolichochoampsid crocodylians thus remain restricted to a relatively limited palaeogeographical domain, and it may still be argued that the Dolichochoampsidae are an endemic South American group of relatively early eusuchians (Gasparini & Buffetaut, 1980).

The occurrence of the same species of dolichochoampsid, *Dolichochoampsa minima*, in both the Yacoraite and the El Molino Formations provides evidence in favour of a biostratigraphic correlation of these formations. Present evidence, which is admittedly scanty, suggests that the Dolichochoampsidae had a restricted geographical and chronological distribution, and that they may therefore be of some use for correlation purposes. Correlation of the Yacoraite Formation with part of the El Molino Formation has already been suggested by workers trying to assess the geological age of the former (see discussion in Gasparini & Buffetaut, 1980). The occurrence of identical vertebrates, such as the fish *Gastroclupea branisai* Signeux, 1964 (Leanza, 1969), adds much weight to purely lithological correlations. The new find from Bolivia certainly suggests that such a correlation attempt is legitimate. However, it does not give much information about the exact age of either the Yacoraite or the El Molino Formation. As mentioned by Gasparini & Buffetaut (1980), various opinions have been expressed concerning the age of the Yacoraite Formation, ranging from Campanian to Palaeocene (for the middle and upper parts). As to the El Molino Formation, it is referred to the Maastrichtian by several authors (see above). Pascual, Vucetich & Fernandez (1978) have reported the discovery of notoungulates (*Simpsonotus*) of Palaeocene (Riochican) age in the Mealla Formation (Salta Group,

Santa Barbara Subgroup) some metres above the Yacoraite Formation in northern Argentina, and have argued that the Cretaceous-Tertiary boundary may in fact be located in the middle part of the Yacoraite Formation. If this interpretation is confirmed, the age of parts of the El Molino Formation may have to be reassessed, as faunal resemblances between the Yacoraite and El Molino Formations do suggest that they are at least partly contemporaneous.

The depositional environment of both the Yacoraite and the El Molino Formations has also been the subject of some controversy, concerning the relative importance of continental and marine influences (Branisa, Hoffstetter & Signeux, 1964 ; Gasparini & Buffetaut, 1980). According to Moreno (1970), the Salta Group of northern Argentina was deposited as a result of an extensive transgression of Pacific origin which reached the territory of Argentina via what is now Bolivia. A marginal environment has been suggested for the El Molino Formation (Schaeffer, 1963). It seems likely that a variety of environments, ranging from shallow marine to littoral and to continental, is represented in the sedimentary rocks of the Yacoraite and El Molino Formations. In any case, as already remarked by Gasparini & Buffetaut (1980), the Dolichochoampsidae cannot be considered as useful environmental indicators : these small, presumably piscivorous crocodylians may have lived in shallow marine waters near the coast, in littoral lagoons, or in freshwater lakes and rivers.

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