

FIRST DATA ON THE HADROSAURID DINOSAURS (ORNITHISCHIA, DINOSAURIA) FROM THE UPPER CRETACEOUS OF VALENCIA, SPAIN.

Julio COMPANY^{1,2}, Angel GALOBART³ and Rodrigo GAETE³

¹ Colegio Universitario C.E.U. San Pablo. Avenida seminario s/n, 46113 Moncada, Valencia, España.

² Universidad de Valencia. Departamento de Geología, 46100 Burjassot, Valencia, España.

³ Institut de Paleontologia "M. Crusafont". Escola Industrial 23, 08201 Sabadell, España.

Abstract : Recently, remains of dinosaurs assigned to the family Hadrosauridae have been recovered from the Upper Cretaceous locality of La Solana, Spain. The material presented here consists of a lower jaw and several fragmentary isolated teeth. Diagnostic features of bones place the hadrosaurs from Spain closer to the hadrosaurid dinosaurs from southern France than to *Telmatosaurus transsylvanicus* from the Maastrichtian of Romania.

Keywords. - Upper Cretaceous, hadrosauridae, dentary, La Solana locality, Spain.

Premières données sur les dinosaures hadrosauridés (Dinosauria, Ornithischia) du Crétacé supérieur de Valence, Espagne.

Résumé : Des restes de dinosaures du Crétacé supérieur de Valence (Espagne) sont rapportés à la famille des Hadrosauridae. Le matériel comprend un fragment de dentaire et plusieurs dents isolées. Les caractéristiques de ces os les rapprochent de ceux du Maastrichtien du sud-ouest de la France; ils sont clairement différents de ceux de *Telmatosaurus transsylvanicus* de Roumanie. (traduit par la rédaction)

Mots clés. - Crétacé supérieur, dinosaures hadrosauridés, dentaire, La Solana, Espagne.

INTRODUCTION

Different localities in Europe have provided remains of hadrosaurid dinosaurs (fig. 1) (Le Lœuff *et al.*, 1993). At present, some of these specimens have been assigned to three different genera: *Telmatosaurus*, *Orthomerus* and *Pararhabdodon*, although several authors consider a possible synonymy between *Telmatosaurus* and *Orthomerus* (Paris & Taquet, 1973; Brinkmann, 1984; Mulder 1984).

The most complete specimens belong to *Telmatosaurus transsylvanicus* from the Hateg Region in Romania (Nopcsa, 1900, 1903; Weishampel *et al.*, 1991, 1993). *Orthomerus dolloi*, from the Maastrichtian of Belgium (Buffetaut *et al.*, 1985; Brinkmann, 1988), and *Pararhabdodon isonensis* (Casanovas *et al.*, 1993, 1997; Laurent, 1996), from the Tremp Basin (Spain) and southern France, are two other hadrosaurid dinosaurs, but they are actually known only by scarce cranial and post-cranial elements.

Other specimens are referred to Hadrosauridae indet. (Laurent, 1996; Le Lœuff *et al.* 1993; Wellnhofer, 1994; Mulder *et al.*, 1997)

GEOGRAPHIC AND GEOLOGIC SETTING

The vertebrate locality of La Solana is located near the village of Carlet, in Tous County, about 40 km. to the SW of Valencia, Spain (fig. 1).

The outcrop is placed in the southeastern margin of the Iberian Chain and comprises the uppermost member of the continental sediments of the Limestones and Marls of the Sierra Perenchiza Formation (Campanian-Maastrichtian : Gutiérrez *et al.*, 1984). In the area studied, these beds are folded in a syncline with nearly continuous exposures along a E-W trend. Bones were collected from continental beds arranged in a sequence of fine-grained sandstones, silty marls and dark clays. This unit is overlain by fluvial Paleogene deposits.

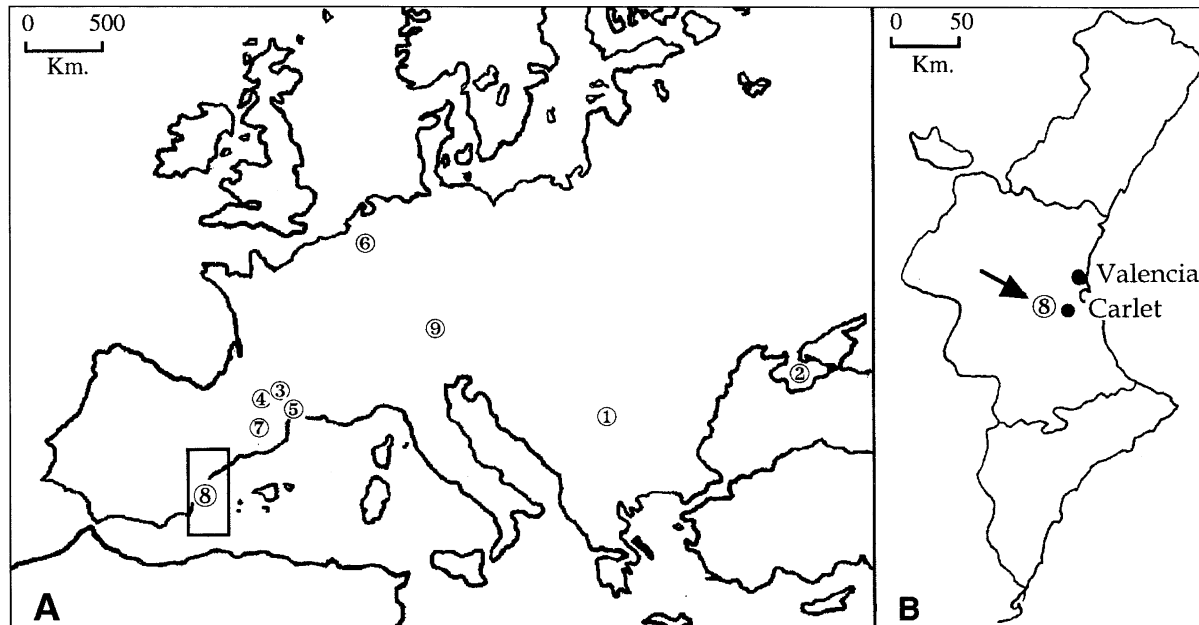


Fig.1 - Geographic distribution of hadrosaur material. A: location map of Europe showing the main Late Cretaceous dinosaur localities where remains of hadrosaurs have been collected. 1: Hateg Basin (Transylvania, Romania); 2: Bakhtchisarai (Crimea, Ucraina); 3: Localities of Le Jadet, Auzas, Tricouté and Lestailats (Haute Garonne, France); 4: Mèrigon (Ariège, France); 5: Le Bexen (Aude, France); 6: Maastricht area (Limburg, Belgium and Netherlands); 7: Els Nerets and Sant Romà d'Abella (Tresp basin, Spain); 8: La Solana (Valencia, Spain); 9: Bad Adelholzen (Bavaria, Germany). B: location of La Solana locality, near the village of Carlet, in the province of Valencia (Spain).

Fig.1 - Distribution géographique des hadrosauridés. A: carte d'Europe montrant les principaux gisements à hadrosauridés du Crétacé supérieur. B: localisation du gisement de La Solana, près du village de Carlet, province de Valencia (Espagne)

A preliminary list of the findings includes plant microfossils and carbonaceous plant remains, fresh-water gastropods, ostracods and bivalves, abundant fish scales, fragments of bones of chelonians and small amphibians, crocodilian teeth, and fragmentary remains of hadrosaurid dinosaurs. The fossil assemblage and the sedimentological features suggest a lacustrine or a swamp environment.

MATERIAL

The material collected consists of fragmentary cranial and postcranial elements (an incomplete left dentary, several isolated teeth, fragmentary ribs, several fragmented vertebral centra, the proximal end of the left humerus and a fragment of the right femoral shaft). The specimens described here are a left dentary (MGUV 2200), a single dentary tooth (MGUV

2201) and two fragmented maxillary teeth (MGUV 2232, MGUV 2233). These teeth vary considerably in dimensions, so we believe that they belong to individuals of different size.

DESCRIPTION

Dentary. MGUV 2200 is a 182 mm long, left dentary which preserves several tooth families and part of the bony plate that originally covered them (fig. 2). This specimen is not complete, as the rostral end is not preserved.

The body of the dentary is rectangular, with the dorsal margin almost straight and the ventral side slightly convex. The coronoid process, highly developed, arises from the caudal end of the lateral surface of the dentary. It extends outward and upward, perpendicularly to the main body of the dentary.

The lateral surface of the dentary is strongly convex in its posterior portion, where the base of the coronoid process is formed, and concave in its anterior part. It presents five small foramina that are directed backwards.

Over the medial dentary face, 18 complete or fragmentary teeth are preserved, arranged in 12 vertical rows and partially covered by a thin bony plate (tooth description below). About 17 dental alveoli are present too, although the rostral ones are incompletely preserved. Consequently, there are approximately 29 tooth positions. The alveoli, about 3-5 mm wide, bend forwards and decrease in size rostrally. Along the medial side of the dentary, below the alveoli, a row of foramina, partially preserved, opens through the bony plate. A large cavity, the mandibular fossa, opens posteriorly in the caudal side of the dentary. This cavity extends forwards as an elliptical foramen within the dentary: the supra-Meckelian foramen. The greater axis of this opening is oblique, while it is vertical in *Telmatosaurus transsylvanicus* (Le Lœuff *et al.*, 1993). On the other hand, the mandibular fossa continues downwards as a narrow groove, the Meckelian canal, that runs forwards through the ventral margin of the dentary.

The angular and splenial, which form the floor of the Meckelian canal, are missing.

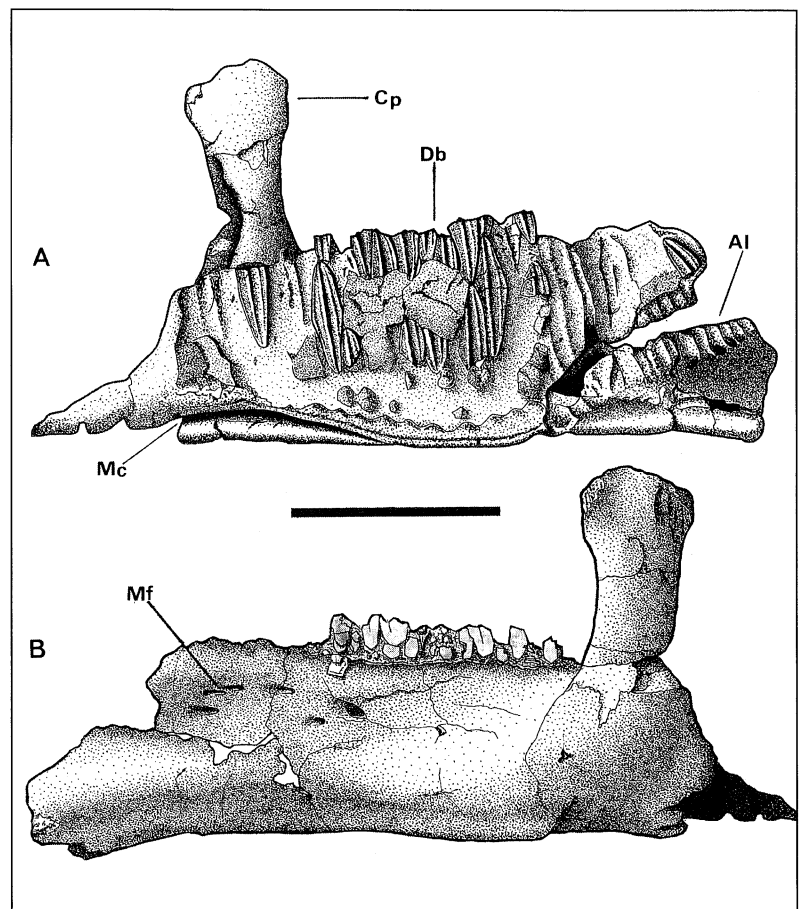
Dentition. MGUV 2201 is an unworn small-sized hadrosaur dentary tooth (8 mm wide) that includes one-third of the apex end of a crown. It presents the same features than those of the teeth preserved in MGUV 2200 (fig. 3). The crown is enameled only on the lingual face and is ornamented by a sharp median carina and by a faint secondary ridge, mesially placed.

Fig.2 - Left dentary of Hadrosauridae indet. (MGUV 2200) from La Solana locality. A: medial view. B: lateral view. Abbreviations: Cp, coronoid process; Db, dental battery; Al, alveoli; Mc, Meckelian canal; Mf, mental foramina. Scale bar = 50 mm.

Fig.2 - Dentaire gauche MGUV 2200 du gisement de La Solana. A: vue médiale. B: vue latérale. Abréviations: Cp, processus coronoïde; Db, batterie dentaire; Al, alvéoles; Mc, canal de Meckel; Mf, foramens mentonniers. Barre d'échelle = 50 mm.

The crown is lanceolate in lingual view and is almost straight in mesiodistal view. The crown flanks are flat, and the edges bear small marginal denticles not supported by ridges. This feature differs clearly from that of *T. transsylvanicus* (Weishampel *et al.*, 1991, 1993).

MGUV 2232 and MGUV 2233 are two large, hadrosaur maxillary teeth. MGUV 2232 includes the apex end of a crown and MGUV 2233 (fig. 4) is an almost complete tooth with a well-preserved crown (maximum width, 11 mm; length, 32 mm) and a broken root. Teeth show no sign of wear. Both teeth are square to subrhomboidal in cross section. In mesiodistal view, the crown of each individual tooth is strongly curved lingually. The crown is elongate and only its buccal face is enameled. It presents a high longitudinal carina that is offset distally, and two short secondary ridges at the base of the mesial region of the crown. Between the median carina and the marginal rims, the crown flanks are curved. The margins of the crown are elevated and display smooth papillations.



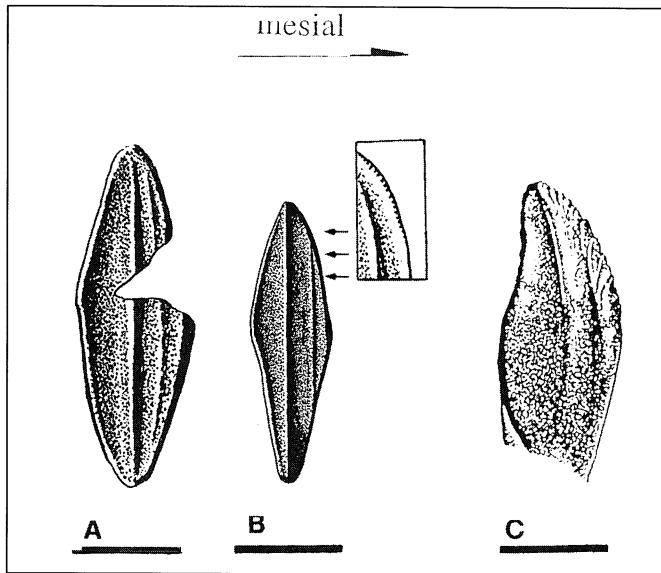


Fig.3 - Comparison of dentary teeth of Late Cretaceous hadrosaurs from Europe. A: lingual view of dentary tooth of Hadrosauridae indet. (MDE-Ma1-01) from Tricouté (Fr), (Redrawn from Laurent, 1996). B: lingual view of left dentary tooth of Hadrosauridae indet. (MGUV 2200; *in situ* tooth) from La Solana (Sp) with an enlargement of mesial denticles. C: lingual view of dentary tooth of *T. transsylvanicus* from Hateg Basin (Ro), (After Weishampel *et al.*, 1993). Scale bar for A-D = 10 mm.

Fig.3 - Dents dentaires d'hadrosauridés des gisements d'Europe. A: dent dentaire d'Hadrosauridae indet. (MDE-Ma1-01) de Tricouté (France). Vue linguale (d'après Laurent, 1996). B: dent dentaire, Hadrosauridae indet (MGUV 2200) du gisement de La Solana (Espagne) avec un agrandissement des denticules distaux (vue linguale). C: dent dentaire de *T. transsylvanicus* du Bassin du Hateg Basin, Roumanie (d'après Weishampel *et al.*, 1993). Barres d'échelle = 10 mm.

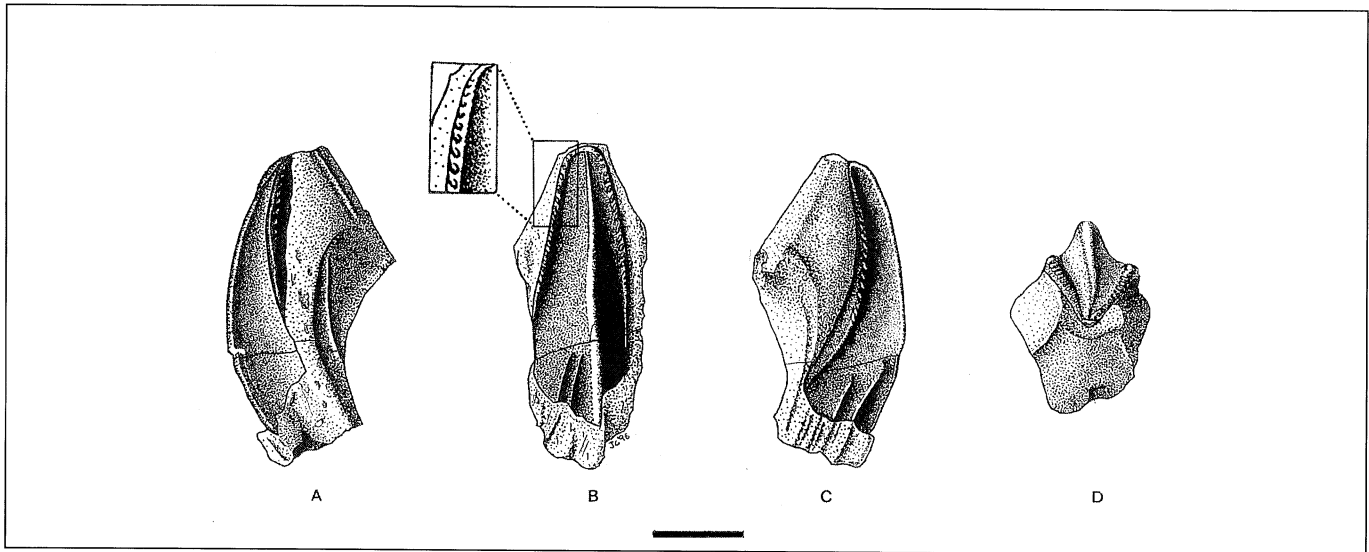


Fig.4 - Right maxillary tooth of Hadrosauridae indet. (MGUV 2233) from La Solana Locality. A: distal view; B: buccal view with an enlargement of marginal papillations; C: mesial view; D: occlusal view. Scale bar = 10 mm.

Fig. 4 - Dent maxillaire d'Hadrosauridae indet (MGUV 2233) du gisement de La Solana avec un agrandissement des denticules marginaux. Barre d'échelle = 10 mm.

DISCUSSION

MGUV 2200 and MGUV 2201. The general morphology of the lower jaw, the large number of alveoli, the presence of dental batteries of packed tooth families, the lanceolate crown of teeth with a large median carina and the presence of small marginal denticles are typical characters of the family Hadrosauridae (Lull and Wright, 1942; Weishampel, 1984; Weishampel and Horner, 1990).

These specimens differ from the European hadrosaurid dinosaur *T. transsylvanicus* in dental morphology: dentary teeth of *Telmatosaurus* are recurved distally, and mesial denticles are supported by secondary ridges (Weishampel *et al.*, 1993: text-fig. 3G). These features are not present neither in MGUV 2201 nor *in situ* dentary teeth.

On the other hand, dentition is very similar to the specimen MDE-Ma1-01 described and figured by Laurent (1996) -collected from Tricouté, France- and classified as Hadrosauridae indet. (Fig. 3).

Likewise the positioning and orientation of the supra-Meckelian foramen, the disposition of the dental alveoli and the general morphology of the dentary are characters that place the hadrosaurids from La Solana locality closer to those from southern France (Laurent, 1996; Le Lœuff *et al.* 1993) than to *T. transsylvanicus* from the Maastrichtian of Romania.

The type species of *Pararhabdodon* and *Orthomerus* are based on fragmentary specimens that do not include teeth, so it is not possible to refer these specimens to those genera.

MGUV 2232 and MGUV 2233. Both isolated and fragmentary maxillary teeth present the morphological characteristics of hadrosaurid dentition. The shape of the enameled surface and the absence of numerous ridges on the crown distinguish clearly these specimens from other Late Cretaceous ornithopods like *Rhabdodon* (see Brinkmann, 1988; Weishampel *et al.*, 1991).

The maxillary teeth from La Solana can be distinguished from those of *T. transsylvanicus* by the absence of denticles on the margins of the crown and by the presence of upturned and papillated (not denticulated) marginal rims.

Therefore, these remains belong to an hadrosaurid dinosaur different from *Telmatosaurus transsylvanicus* and similar to the specimens collected in southern France. Until a more complete and careful analysis of postcranial elements, they have been provisionally attributed to Hadrosauridae indet.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Miquel De Renzi (Universidad de Valencia) for his comments on an earlier version of this paper. We specially appreciate the valuable suggestions made by reviewers Dr. David Weishampel (John Hopkins University, Baltimore), Dr. Jean Le Lœuff and Yves Laurent (Musée des Dinosauriens d'Espérasa). We also acknowledge the technical assistance of Francisco Periago (Universidad de Valencia).

Financial support for the excavation tasks was provided by the Direcció General de Patrimoni Artístic (Generalitat Valenciana). Additional financial assistance was provided by Institució Valenciana d'Estudis i investigació (I.V.E.I., grant CPE/098).

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Note reçue le 31-08-1997

acceptée après révision le 15-03-1998