



General palaeontology, systematics and evolution (Vertebrate palaeontology)

A strange new chelonioid turtle from the Latest Cretaceous Phosphates of Morocco



Une étrange nouvelle tortue chélonioïde du Crétacé terminal des Phosphates du Maroc

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ABSTRACT

A new genus and species of huge marine turtle (superfamily Chelonoidea, epifamily Dermochelyoidea) is described from the Maastrichtian Phosphates of the Oulad Abdoun Basin of Morocco. A new type of feeding apparatus, adapted for a powerful crushing pattern, illustrates the noteworthy diversity of fossil vertebrates of the Maastrichtian-Ypresian Phosphates of Morocco. No other crushing cryptodire or bothremydid pleurodire has this morphology. During the Maastrichtian, the known crushing pattern of chelonioids was different, close to that of modern cheloniids, as illustrated in Morocco in the Maastrichtian Ganntour Basin and the Palaeogene Oulad Abdoun Basin. This new taxon exhibits unusual cranial characters (fusion of premaxillae associated with a backward and dorsal retraction of the naris, horizontal stretching of the dorsal *meatus quadrati*), that are shared only with another new turtle, known also from the same Maastrichtian Phosphates of Morocco.

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RÉSUMÉ

Un nouveau genre et une nouvelle espèce de grande tortue marine (superfamille Chelonoidea, épifamille Dermochelyoidea), des Phosphates maastrichtiens du Bassin des Oulad Abdoun, Maroc, sont décrits. Un nouveau type d'appareil alimentaire, conçu pour un régime broyeur puissant, est représenté, illustrant la remarquable diversité en vertébrés fossiles des Phosphates maastrichtiens-ypresiens du Maroc. Aucun autre cryptodire ou pleurodire bothrémydidé broyeur n'a cette morphologie. Au Maastrichtien, le seul mode broyeur de chélonioïde connu était différent, proche de celui des Cheloniidae modernes, tel qu'illustré au Maroc à la fois dans le Bassin des Ganntour au Maastrichtien et dans le Bassin des Oulad Abdoun au Paléogène. Ce nouveau taxon présente des caractères crâniens inhabituels (fusion des prémaxillaires, associée au recul dorsal de la narine, étirement à l'horizontale de la partie dorsale du *meatus quadrati*) qu'il ne partage qu'avec une autre nouvelle tortue, elle aussi connue dans les mêmes Phosphates maastrichtiens du Maroc.

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1. Introduction

The great diversity of fossil vertebrates in the Phosphates of Morocco has been known since [Arambourg \(1952\)](#) and has been enhanced these last fifteen years by new palaeontological studies undertaken by French-Moroccan collaborations.

In these Maastrichtian-Ypresian phosphatic deposits that crop out mainly in the Oulad Abdoun and Ganntour basins, intensively exploited for economic resources (see [Bardet et al., 2010](#) for details), turtles are particularly well represented by both cryptodirans and pleurodirans ([Bardet et al., 2010, 2013, in press; Gaffney et al., 2006; Gmira, 1995; Hirayama and Tong, 2003; Jalil et al., 2009; Lapparent de Broin, 2000; Tong and Hirayama, 2002, 2004, 2008; Tong and Meylan, 2013](#)).

Most turtle specimens have been unearthed from Palaeogene phosphatic deposits; Maastrichtian discoveries remain rare up to now. The new turtle here described is the fourth taxon from the Maastrichtian levels, along with *Euclastes* sp. from Ben Guérir (Ganntour Basin) ([Gmira, 1995; Jalil et al., 2009](#)), an indeterminate chelonoid from the Oulad Abdoun Basin ([Tong and Hirayama, 2004](#)) based only on a palstral fragment that could correspond to the present new taxon (only known by a skull up to now), and a new astonishing giant longirostrine taxon from the Maastrichtian of Sidi Chennane (Oulad Abdoun Basin) ([Bardet et al., 2013](#)).

2. Geological and stratigraphical settings

The phosphatic deposits of Morocco are part of the Mediterranean Tethyan phosphogenic province, which extends from North Africa to the Middle-East ([Lucas and Prévôt-Lucas, 1996](#)). They crop out in four basins, the most important and only economically exploited ones being the Oulad Abdoun and Ganntour ones (see [Bardet et al., 2010](#) for details) ([Fig. 1A](#)). Stratigraphically, they extend from the Late Cretaceous (Maastrichtian) to the base of the Middle Eocene (Lutetian), spanning the largest interval of time of all Tethyan Phosphates ([Lucas and Prévôt-Lucas, 1996](#)).

The Maastrichtian phosphatic series of the Oulad Abdoun Basin (“Couche III” of the miners, or Level III) is very condensed in the Grand Daoui zone, northeastern part of the basin (near Oued Zem city), being only about 2–5 m thick. It is composed from the bottom to the top of a basal grey bone-bed, soft yellow (Lower Level III) and soft grey (Upper Level III) exploited Phosphates, separated by a yellow marly level ([Fig. 1B](#)).

The type specimen of the new taxon, a complete skull with its associated mandible, was discovered in 2006 by local people in the Upper Level III (Upper Maastrichtian) of the Sidi Daoui area of Grand Daoui zone, northeastern part of the Oulad Abdoun Basin.

Institutional Abbreviations: CNRS, Centre National de la Recherche Scientifique (France); MEMEE, Ministère de l'Énergie, des Mines, de l'Eau et de l'Environnement (Rabat, Morocco), MNHN, Muséum National d'Histoire Naturelle (Paris, France), RA–AC, Reptiles and

Amphibians – Comparative anatomy; OCP, Office Chérifien des Phosphates, Service géologique (Khouribga, Morocco).

3. Systematic palaeontology

Order: CHELONII Latreille, 1800

Suborder: CRYPTODIRA Cope, 1868

Superfamily: CHELONIOIDEA Oppel, 1811

Epifamily: DERMOCHELYOIDEA Fitzinger, 1843

Genus *Alienochelys* nov.

Alienochelys selloumi nov. sp.

Holotype: OCP DEK/GE 393, a complete large skull with its associated lower jaw and the axis lying in the orbit; the left neural arch of atlas. OCP collections, Khouribga (Morocco) ([Figs. 2 and 3](#)). No referred material known up to now.

Derivatio nominis: Genus name from *aliena*: stranger in latin, and *chelys*: turtle in latin (issued from greek χελύς); species name in honor to Mr. Omar Selloumi, OCP technician geologist (now retired) at the Geological Survey in Khouribga, in acknowledgement of his constant help and friendship since fifteen years during our fieldwork and stays in Khouribga.

Type locality and horizon: Trench TS, Sidi Daoui area, Grand Daoui zone, Northeastern part of the Oulad Abdoun Basin near the city of Oued Zem, Khouribga Province, Morocco, ([Fig. 1A](#)). Phosphatic deposits, near the base of the Upper Level III (ULIII) ([Fig. 1B](#)), Upper Maastrichtian (Uppermost Cretaceous) ([Cappetta, 1987](#)).

Diagnosis: For genus and species, by monotypy. *Alienochelys selloumi* nov. gen. nov. sp. is a gigantic chelonoid turtle (holotype maximal skull length without lower jaw: 41,5 cm) belonging to the epifamily Dermochelyoidea notably by full reduction of the medial ventral process of the jugal beneath the orbit, not contacting the pterygoid and the maxilla, as well as by palatines meeting medially ventroposteriorly to the vomer. It differs from all other turtles by its lower and upper jaw triturating surfaces, considerably developed and constituting a powerful crushing apparatus that forms a half circle arch with rounded extremities, developed as follows:

- lower jaw: wide and dorsoventrally flattened fused dentaries, with surface barely wider at the coronoid-dentary suture level than at the symphysis area one, dorsally barely undulated with a small tomial rolled border;
- upper jaw: anteroposteriorly gently inclined, very widely protruding snout, with a low triturating surface poorly concave, also nearly as wide medially as laterally and with a narrowly rounded tomial border; wide and long triturating surfaces, anterolaterally constituted by both long and wide maxillae and fused premaxillae and medially by the vomer and palatines that are linked anteriorly to the choanae; but, unlike other crushing chelonoids, no secondary palate, the external naris being pushed backward so that it is superimposed to the choanae and the air conduct being vertical between the naris and the choanae;

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