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New gadiform fishes (Teleostei, Gadiformes) from the Miocene of Algeria

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Abstract

As part of the completion of studies on the Miocene fishes of the Chelif Basin (north-western Algeria), this paper represents a contribution to the knowledge of the Messinian gadiform diversity of this western Mediterranean, semi-enclosed, Neogene basin. A new genus and species of the family Macrouridae is erected (*Razelainia paradoxa* n. gen. et sp.), two specimens are tentatively referred to already existing taxa (*Gadiculus* cf. *jonas*; *Merluccius* cf. *merluccius*), and a species formerly assigned to the gadid genus *Brosme* is transferred to the genus *Gaidropsarus* (*Gaidropsarus murdjadjensis*). The macrourid *Razelainia paradoxa* n. gen. et sp. is characterized by an unusual combination of: plesiomorphic gadiform features, such as low vertebral number (presumed), well-developed caudal-fin rays, presence of a single continuous dorsal fin originating just posterior to the neurocranium, anal-fin rays slightly longer than dorsal-fin rays; and derived, typically macrourid features, such as the presence of spinoid scales and the anterior anal-fin pterygiophores extending forward over the abdominal wall. A paleoecological analysis reveals that the Messinian gadiform assemblage of the Chelif Basin had a subtropical/warm temperate affinity, with a marked north-eastern Atlantic-Mediterranean biogeographic character.

Keywords: Teleostei; Gadiformes; Miocene; Messinian; Chelif Basin; Algeria

1. Introduction

In 1927 Camille Arambourg, then Professor of Geology at the Institut agricole d'Algérie, published an extensive monograph in which he described fish remains from five Miocene (Messinian) localities (Gambetta, Les Planteurs, Raz-el-Aïn, Saint Denis du Sig, Sidi-Brahim) located near the city of Oran, in the Chelif Basin, north-western Algeria. Since its publication, this highly influential monograph, titled "Les Poissons Fossiles d'Oran", has represented one of the main reference for generations of researchers involved in the study of Tertiary fishes of the Tethyan realm. This is mostly due to the very detailed anatomical descriptions, and to the rigorous and accurate comparative analyses accomplished by Arambourg (1927), which make his monograph the first modernistic treatise on the paleomediterranean ichthyodiversity. Two years after the publication of "Les Poissons Fossiles d'Oran", Arambourg (1929) published a short note on an hatchetfish collected from an additional Messinian locality (Renault) of the Chelif Basin. More recently, because of the broad interest concerning the fossil record of living teleostean clades and Mediterranean biogeographical evolution, a new era of studies on the Messinian fishes of the Oran region has begun, with a reinterpretation of several taxa (Carnevale, 2003; Carnevale, 2006b; Baciu et al., 2005a; Baciu et al., 2005b) and the description of new taxa (Chanet, 1996; Carnevale, 2004a; Carnevale, 2004b; Carnevale, 2006a; Carnevale and Bannikov, 2006; Carnevale and Pietsch, 2006; Carnevale and Santini, 2006) based on material found in the collection of Miocene fishes from Algeria housed in the Laboratoire de Paléontologie of the Muséum national d'Histoire naturelle, Paris (MNHN). Arambourg (1927) described two gadiforms from the Messinian of the Oran

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region, the codlet *Bremaceros albyi* (Sauvage) and the tusk *Brosme* (=*Brosmius*) *murdjadjensis* Arambourg. During a June 2006 visit to the collections of the MNHN, undescribed and unidentified gadiforms were discovered in the collection of Miocene fishes from Algeria, including a new grenadier (Macrouridae), and what appear to be an European hake (Merlucciidae) and a Miocene silvery pout (Gadidae). The purpose of this paper is to describe these three gadiform taxa recently found among the unstudied material of the MNHN, and to present a redescription and taxonomic reinterpretation of the material formerly described by Arambourg (1927) and referred to the species *Brosme murdjadjensis*.

The order Gadiformes consists of more than 500 living species, ranging in all oceans from polar to tropical waters, and occurring in deep-sea, neritic, estuarine and freshwater habitats (see Cohen et al., 1990). Several gadiforms are important commercial fishes that comprise over one quarter of the world's marine fish catch. Gadiforms are relatively common as fossils (Cohen, 1984). In particular, the otolith-based record is very rich (Nolf and Steurbaut, 1989b), mostly thanks to efforts of a few paleontologists (e.g., Gaemers, 1976; Gaemers, 1978) that performed extensive explorations of the Tertiary terrigenous marine deposits of the North Sea Basin, a region historically characterized by abundant and rather diversified gadiform populations. Even though the first steps of the evolutionary history of this group remain obscure, a Cretaceous origin has been hypothesized based on their sister-group relationships (e.g., Nolf and Steurbaut, 1989b).

2. Localities, stratigraphy and age

The material was collected in the 1920s from the diatomaceous and marly deposits outcropping in two peripheral districts of the city of Oran, Gambetta and Raz-el-Aïn, Algeria (Fig. 1). These localities are located at the margin of the Djebel Murdjadjo, a coastal massif that limits the Chelif Basin to the north. The Chelif Basin is an ENE-WSW orientated basin characterized by a narrow and elongate physiography that occupies the coastal region of north-western Algeria (Perrodon, 1957). Messinian deposits extensively outcrop in the basin, providing a large amount of data about the paleogeographic and paleobiotic characteristics of this Neogene semienclosed enclave of the western Mediterranean region. As in other parts of the Mediterranean, during the Messinian the marginal areas of the Chelif Basin recorded widespread shallow-water carbonate deposits (Anderson, 1936; Perrodon, 1957), characterized by abundant coral reef complexes and other biogenic buildups (red algae, large foraminifers) (Saint Martin, 1990; Saint Martin and Rouchy, 1990; Rouchy and Saint-Martin, 1992). Marls and diatomites accumulate in the central deeper sectors of the basin, representing the peripheral expression of the carbonate platforms (Perrodon, 1957; Rouchy, 1982; Roger et al., 2000), which are often interposed by thick *Halimeda*-rich slope deposits (e.g., Moisette and Saint Martin, 1992). In a recent sequence stratigraphic model for Messinian carbonate platforms, Cornée et al. (2004) suggested that the carbonate/diatomite deposits in the western Mediterranean basins represent prograding units interpreted as a highstand system tract. In this context, the basinward deposition of diatomites and diatomitic marls may be interpreted as the sedimentary result of oceanic influences and upwelling in subtropical sea-waters. Based on large scale correlations, Cornée et al. (2004) stated that, near the edges of the Djebel Murdjadjo carbonate platform, the diatomaceous sedimentation occurred between 6.73 Ma and 5.95 Ma.

3. Materials and methods

The specimens are deposited in the Laboratoire de Paléontologie (Département Histoire de la Terre) of the Muséum national d'Histoire naturelle, Paris. The fossils are preserved on massive diatomites (Gambetta) or laminated diatomitic marls (Raz-el-Aïn) with bones that appear dark brown–orange. The specimens were examined using a

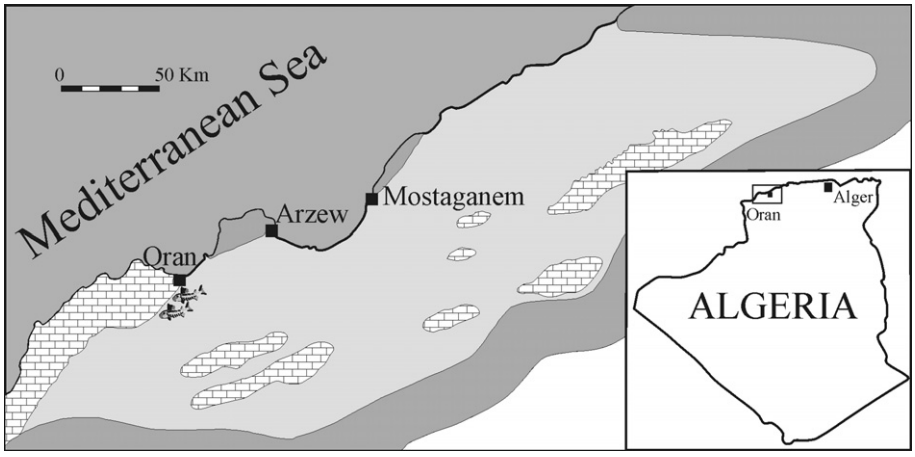

Fig. 1. Sketch map of the Chelif Basin, Algeria. The fish skeletons indicate the location of the fossiliferous localities (Gambetta and Raz-el-Aïn) at the margin of the Djebel Murdjadjo carbonate platform.