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Palaeontology of the Purbeck-type (Tithonian, Late Jurassic) bonebeds of Chassiron (Oléron Island, western France)

Paléontologie des bonebeds *de type purbeckien (Tithonien, Jurassique supérieur) de Chassiron (île d'Oléron, Ouest de la France)*

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ABSTRACT

The paralic flora and fauna from the Late Jurassic of Chassiron (Oléron Island, western France) are described. The Tithonian-aged bonebeds of Purbeck facies of this locality have yielded a rich and diverse vertebrate assemblage including fishes, amphibians, reptiles and mammals, alongside numerous plant and invertebrate remains. The Chassiron locality thus appears as a peculiar Konzentrat-Lagerstätte in which most of the palaeoecosystem's biological components (both aquatic and terrestrial) have been preserved. The depositional environment was probably subject to salinity fluctuations, as indicated by the co-occurrence of freshwater and euryhaline organisms. This is one of the richest localities and the first mammal-bearing site known from the Jurassic of France.

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RÉSUMÉ

La flore et la faune paraliques du Jurassique supérieur de Chassiron (île d'Oléron, Ouest de la France) sont décrites. Dans cette localité, les *bonebeds* d'âge Tithonien et de faciès purbeckien ont livré, aux côtés de nombreux restes de plantes et d'invertébrés, un assemblage de vertébrés riche et diversifié, incluant poissons, amphibiens, reptiles et mammifères. La localité de Chassiron apparaît comme un Konzentrat-Lagerstätte remarquable, dans lequel la plupart des composants biologiques du paléoécosystème ont été préservés, aussi bien aquatiques que terrestres. Le milieu de dépôt était probablement soumis à des fluctuations de salinité, comme l'indique la présence simultanée d'organismes dulçaquicoles et eurybalins. Il s'agit, pour l'ensemble du Jurassique français, d'une des localités les plus riches et du premier site à mammifères.

1. Introduction

Bonebeds are relatively uncommon in the Late Jurassic of France, where most vertebrate fossils are only isolated remains. With the exceptions of the famous Konservat-Lagerstätten of Cerin and Canjuers, the best-known vertebrate assemblages have been found in the Oxfordian of Lisieux (Buffetaut et al., 1985), the Kimmeridgian of Fumel (Sauvage, 1902) and the Tithonian of Boulogne-sur-Mer (Cuny et al., 1991; Sauvage, 1880). In the late nineties, the discovery by one of us (DA) of an accumulation of vertebrate remains in the Purbeck beds (Early Tithonian in age) of the "Phare de Chassiron" section (Oléron Island, western France) has led to the collection of a large number of specimens (Billon-Bruyat et al., 2001). This material (including both macroremains and microremains) consists of numerous bones and teeth belonging to sharks, bony fishes, amphibians, turtles, crocodilians, dinosaurs, pterosaurs, lizards, choristoderes, and mammals. Such a concentration of vertebrate remains in a few beds of the series, found in association with abundant plant and invertebrate fossils briefly described here, allows the Chassiron locality to be recognized as a Konzentrat-Lagerstätte. The fossil assemblage of the Chassiron bonebeds can be compared with that from the nearby, slightly younger (Berriasian) locality of Cherves-de-Cognac (Buffetaut et al., 1989; Colin et al., 2004; Mazin et al., 2006, 2008).

2. Geological setting

The "Pointe de Chassiron" corresponds to the extreme northern point of the Oléron Island, off the Atlantic coast of France (Fig. 1). The 80-m-thick "Phare de Chassiron" section displays a mixed siliciclastic and carbonate sedimentary succession of Late Kimmeridgian to Late Tithonian–Earliest Cretaceous age. The section is composed of four alternatively carbonate-dominated and clay-dominated informal members (Fig. 2). Carbonate-dominated intervals represent open-marine platform environments, whereas clay-dominated intervals represent more proximal, shallow-water to emergent facies (Colombié et al., 2012; Schnyder et al., 2012). The sedimentary succession reflects a long-term, regressive (progradational) sedimentary sequence of Late Kimmeridgian to Early Tithonian age, followed by a transgressive (retrogradational)–regressive (progradational) sedimentary cycle of Early Tithonian to Late Tithonian–Earliest Cretaceous age (Colombié et al., 2012; Schnyder et al., 2012) (Fig. 3).

The section begins with beige to grey nodular, irregular limestones beds with thin marly intervals representing an open-marine platform subjected to storms (Member 1, 0 to 24.2 m) (Colombié et al., 2012; Schnyder et al., 2012). This interval is precisely dated by ammonite biostratigraphy of the Late Kimmeridgian Autissiodorensis Zone and the Early Tithonian Gigas Zone (Bousquet, 1967; Hantzpergue, 1989; Hantzpergue et al., 2004) (Fig. 2). Marine influences are progressively less from base to top of Member 1, as testified by evidence of episodic emergence above 18 m (dinosaurian footprints, mudcracks and fenestrae) and occurrences of charophytes between 20 m and 24.2 m. This sedimentary sequence is terminated by a 0.4 m thick conglomerate with a clayey matrix and limestone clasts, covered in turn by an accumulation of conifer wood fragments. It separates the open-marine deposits below (Member 1) from the shallower, occasionally emergent facies, of the Purbeck beds above (Member 2 to 4, Fig. 2). Purbeck beds lack of ammonites, and their age assignment is based on ostracods (Donze, 1960; Hantzpergue et al., 2004), brachiopods (Hantzpergue et al., 2004), foraminifera (Bousquet, 1967), dinoflagellate cysts, calcareous nannofossils and magnetostratigraphy (Schnyder et al., 2012). Most Purbeck beds appear to be of Early Tithonian age (Fig. 2, Schnyder et al., 2012).

Several layers yielding rich vertebrate fauna concentrations, which are the topic of this paper, occur within black to blue clays and marls deposited at the base of the Purbeck beds between 24 and 33 m, above the conglomeratic layer (Base of Member 2, Figs. 2 and 3). The richest vertebrate assemblages come from beds 1000 and 1005 (Fig. 3). Accompanied by occurrences of charophyte gyrogonites (Martín-Closas et al., 2008), and local wood fragment accumulations, those deposits are related to shallow-water embayment and tidal facies with frequent freshwater discharges from the continent (Schnyder et al., 2012). These clay and marl packages with vertebrate concentrations were deposited at low sea-level during an early phase of a long transgression (Fig. 2).