

Sedimentology, taphonomy, and palaeoecology of a laminated plattenkalk from the Kimmeridgian of the northern Franconian Alb (southern Germany)

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Abstract

At Wattendorf in the northern Franconian Alb, southern Germany, centimetre- to decimetre-thick packages of finely laminated limestones (plattenkalk) occur intercalated between well bedded graded grainstones and rudstones that blanket a relief produced by now dolomitized microbialite-sponge reefs. These beds reach their greatest thickness in depressions between topographic highs and thin towards, and finally disappear on, the crests. The early Late Kimmeridgian graded packstone–bindstone alternations represent the earliest plattenkalk occurrence in southern Germany. The undisturbed lamination of the sediment strongly points to oxygen-free conditions on the seafloor and within the sediment, inimical to higher forms of life. The plattenkalk contains a diverse biota of benthic and nektonic organisms. Excavation of a 13 cm thick plattenkalk unit across an area of 80 m² produced 3500 fossils, which, with the exception of the bivalve *Aulacomyella*, exhibit a random stratigraphic distribution. Two-thirds of the individuals had a benthic mode of life attached to hard substrate. This seems to contradict the evidence of oxygen-free conditions on the sea floor, such as undisturbed lamination, presence of articulated skeletons, and preservation of soft parts. However, palaeoecological and taphonomic analyses indicate that the benthic faunal elements are allochthonous having settled out of suspension and thus must have been derived from hard substrate areas of neighbouring topographic highs. Solely the bivalve *Aulacomyella*, which occurs concentrated on a single bedding plane, may have colonised the plattenkalk depression during brief periods of oxygenation. Alternatively, a pseudoplanktonic mode of life, attached to floating sea weed, is envisaged for the bivalve. The formation of the plattenkalk is related to local and global factors: a drop in relative sea level caused the death of the microbialite-sponge reefs. Restricted circulation in depressions between the crests of the former reefs led to anoxic conditions and the formation of finely laminated sediments stabilised by microbial mats. The small depressions received sediment and skeletal elements of benthic organisms that were swept off neighbouring topographic highs by storms and that entered the depressions partly as turbidity currents, partly as suspension clouds. A rise in the relative sea level finally terminated the restricted circulation in the depressions and closed the taphonomic window that led to the preservation of the plattenkalk biota.

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1. Introduction

Thinly laminated limestones, so-called plattenkalk, are classical fossiliferous sites. Assumed to have formed

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under anoxic conditions in lagoons or small restricted basins (e.g., Barthel et al., 1990; Swinburne and Hemleben, 1994; Viohl, 1998; Dietl and Schweigert, 2004), they preserve articulated skeletons and soft-bodied organisms and thus provide exceptionally rich information on fossil ecosystems. The late Jurassic appears to have been a time particularly prone to the formation of plattenkalk deposits, most of them to be found along the northern margin of the Tethyan Ocean (e.g., Cerin in the French Jura Mountains; Nusplingen on the Swabian Alb, and Solnhofen-Eichstätt on the Franconian Alb; Bernier and Gaillard, 1990; Gaillard et al., 1994; Dietl and Schweigert, 1999, 2004; Barthel et al., 1990; Viohl, 1998; Viohl and Zapp, 2005; Röper, 2005a,b). In the case of the last occurrence, we do not deal with a single lagoon, but rather an extensive lagoonal system consisting of a number of sub-basins which partially also differ in age (Schweigert, 2005; Röper, 2005a). Although apparently only of limited lateral extent and thickness, the Wattendorf plattenkalk adds another facet to the known plattenkalk occurrences, differing from other plattenkalks by its abundant benthic macrofauna.

As early as 1891 Gümbel mentioned white, platy limestones with occasional remains of crustaceans from an area between the villages of Wattendorf, Mährenhüll, and Rothmannsthal in the northern Franconian Alb, and regarded them as equivalents of the Solnhofen lithographic limestones. However, subsequently these occurrences received no further attention and little else is known about plattenkalks in the northernmost part of the Franconian Alb. Following its renewed discovery in a quarry near Wattendorf (Fig. 1) in 2002, where it forms thin intercalations within a package of carbonates that unconformably overlies massive, dolomitized microbialite-sponge reefs, an excavation campaign was undertaken in August 2004. The results from these field investigations not only provides information on the northernmost occurrence of the plattenkalk facies on the Franconian Alb, but ammonites recovered during the field work also show that it is the oldest plattenkalk in southern Germany, representing the early Late Kimmeridgian (Fig. 2; Fürsich et al., in press). The aim of the paper is the documentation and analysis of the facies and biota of the Wattendorf plattenkalk. In particular palaeoecological and taphonomic analysis of the fauna based on quantitative data allow

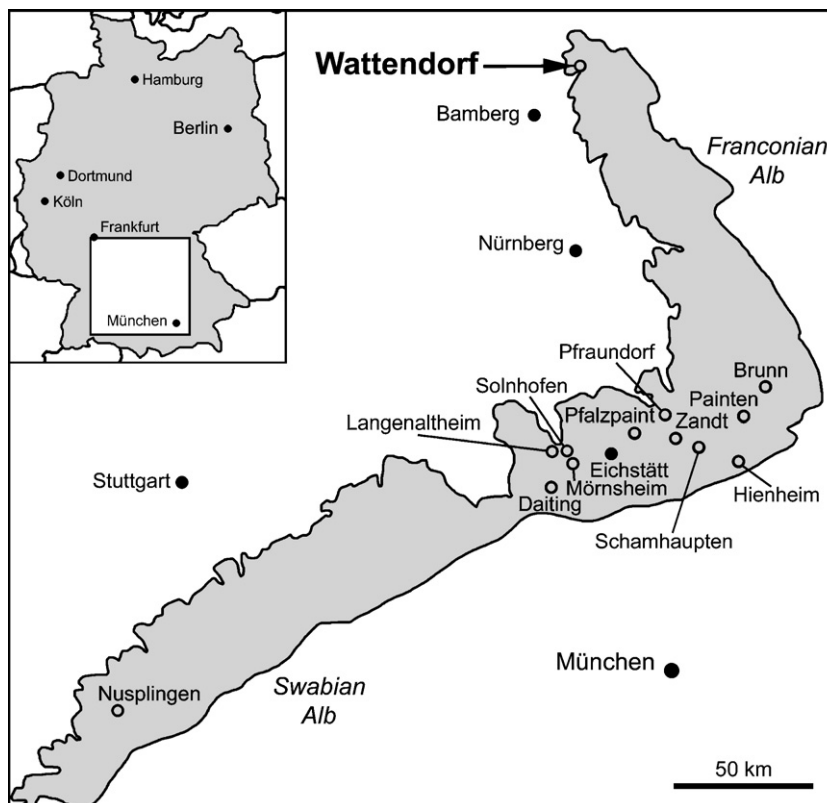


Fig. 1. Upper Jurassic plattenkalk localities of the Franconian and Swabian Alb (shaded) and location of Wattendorf.

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