ELSEVIER

Cretaceous Research 29 (2008) 40–64

CRETACEOUS RESEARCH

www.elsevier.com/locate/CretRes

The calcareous nannofossil record across the Late Cretaceous Turonian/Coniacian boundary, including new data from Germany, Poland, the Czech Republic and England

Jackie A. Lees

Department of Earth Sciences, University College London (UCL), Gower Street, London, WC1E 6BT, UK

Received 1 February 2003; accepted in revised form 22 March 2007
Available online 22 October 2007

Abstract

The proposed definition of the Turonian/Coniacian boundary, at the first occurrence of the inoceramid bivalve *Cremnoceramus deformis erectus* (Meek) (= *Cremnoceramus rotundatus* (*sensu* Tröger *non* Fiege)), prompted a rigorous study of the calcareous nannofossil events through this interval, both for calibration of the calcareous nannofossil biostratigraphy, and to provide an assessment of the suitability, in calcareous nannofossil terms, of the proposed stratotype section. New calcareous nannofossil data are presented here, detailing the biostratigraphy of the boundary interval from four locations. These include the candidate boundary-stratotype, the Salzgitter-Salder Quarry section (northern Germany), as well as the Slupia Nadbrzezna outcrop (central Poland), a potential secondary reference section. Also included is the Brezno Pd-1 Borehole and outcrops in the Brezno Formation (= Priesener Schichten) type-area (north-western Czech Republic), which represents an original boundary candidate (Copenhagen Stage Boundaries Meeting, 1983), and the Langdon Stairs coastal section (south-eastern England), part of the British Chalk succession. The calcareous nannofossil events derived from each section provide a sequence across the boundary of (in stratigraphical order): below the boundary, the first occurrence of *Lithastrinus septenarius* followed by that of *Broinsonia parca expansa*; above the boundary, the last occurrence of *Helicolithus turonicus* followed by the first occurrence of *Micula staurophora* (= *Micula decussata* of some authors). This places the boundary within Nannofossil Subzone UC9c. A similar sequence of events has previously been determined from sections in north-eastern England and in the south-eastern Indian Ocean. The presented data and correlations suggest that either the Salzgitter-Salder Quarry section or the Slupia Nadbrzezna outcrop section would make a suitable Global Stratotype Section for the Turonian/Coniacian boundary, as far as calcareous nannofossils are concerned. The use of the calcareous nannofossil *Marthasterites furcatus*, widely quoted as an indicator of this boundary, is discussed and proved to be untenable.

Keywords: Turonian/Coniacian boundary; Salzgitter-Salder; Slupia Nadbrzezna; Brezno; Langdon Stairs; Boundary stratotype; Calcareous nannofossils; Biostratigraphy; Germany; Poland; Czech Republic; England

1. Introduction

The first occurrence of *Cremnoceramus rotundatus* (*sensu* Tröger *non* Fiege), an inoceramid bivalve, was recommended for defining the Turonian/Coniacian boundary by the Coniacian Working Group of the Cretaceous Subcommission on Stratigraphy (Kauffman et al., 1996). This species has since been placed in synonymy with *Cremnoceramus deformis erectus* (Meek) by Walaszczyk and Wood (1998) and Walaszczyk and Cobban (2000), and the lectotype and paralectotype have been described and illustrated in detail. The section in the Salzgitter-Salder Quarry (Lower Saxony, northern Germany) was recommended as the stage-boundary stratotype, and the base of Bed MK47a as the boundary level (Kauffman et al., 1996; for updated stratigraphical details of the boundary succession, see Walaszczyk and Wood, 1998; Wood et al., 2004).

To effect a precise calibration between calcareous nannofossil biostratigraphy and the boundary, and to assess the choice of boundary stratotype in calcareous nannofossil terms, four localities have been investigated. It is particularly important to know where to place stage-boundaries in relation to calcareous

E-mail address: j.lees@ucl.ac.uk

0195-6671/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cretres.2007.08.002

nannofossil events, because nannofossils are one of the most widely-used biostratigraphic tools, with application in both onshore outcrop and deep-sea cored sediment. Furthermore, over 30 years of ocean drilling has allowed the correlation potential of nannofossils between the oceans and the shelves to be widely tested, such that they possibly now represent the best fossil group for global correlation.

This work provides details of the calcareous nannofossil biostratigraphy in relation to the proposed inoceramid boundary-marker, as well as other macrofossil boundary indicators. This is illustrated with new calcareous nannofossil data from the key sections in Germany (Salzgitter-Salder Quarry) and Poland (Slupia Nadbrzezna). New calcareous nannofossil data are also provided for the Brezno Pd-1 Borehole and the Brezno Formation type-area (Czech Republic), representing an original boundary-stratotype candidate (Birkelund et al., 1984), in which low-latitude zonal ammonite taxa are present, but the boundary inoceramid absent. Finally, data from part of the English Chalk succession at Langdon Stairs (south-eastern England) are given for correlative purposes, since inoceramids are very rare in this section, and again the boundary inoceramid is not present. The integrated sequence of events has been compared, and a discussion is provided that emphasises palaeobiogeographical limitations on some key taxa.

2. Methodology

Estimated calcareous nannofossil relative abundance data were generated from simple smear-slides (made following the methodology described in Bown and Young, 1998). These slides were viewed at 1250x magnification, using an oil-immersion objective lens on an Olympus BH-2 transmitting light-microscope.

Relative abundances of the species were estimated over three traverses of each slide. The complete data are presented as range-charts. A fully-authored, fully-referenced taxonomic listing appears in Bown (1998), and the species names used here are those used and illustrated by Burnett (1998).

On the charts, abundances are recorded as common (C = 1–10 specimens/field of view (s/fov)), few (F = 1s/<20fov), rare (R = 1s/>20fov), and questionable (? = identification uncertain). Fields of view examined were generally of comparable thickness, although the thicker areas of the slides were examined to ensure larger taxa had not been overlooked. An estimate of overall nannofossil abundance versus background sediment is included on the range-charts, comprising very low (VL = ~<3s/fov), low (L = ~3–10 s/fov; background sediment overwhelms the nannofossil component, but specimens are present in every field of view), and moderate (M = approximately equal abundance of nannofossils to background sediment) categories.

Preservation varies between the sections, and a qualitative estimate of this is provided on the range-charts: moderate (M = virtually all specimens are easily identifiable, but secondary calcite overgrowth and/or calcite dissolution has modified the appearance of certain solution-prone taxa/features. This is considered to be the average state of preservation of Mesozoic nannofloras by the author); poor (P = depleted assemblage due to calcite dissolution and/or an appreciable proportion of specimens are difficult to identify due to calcite dissolution or secondary overgrowth); very poor (VP = a significant proportion of the assemblage is dissolved and/or a large proportion of specimens are difficult to identify).

Species richness (including heterococcoliths and nannoliths, but excluding holococcoliths) was tallied for each sample for comparative purposes. This appears on the range-charts and is discussed below. All sample material and slides are stored in the Micropalaeontology Unit, Department of Earth Sciences, UCL.

3. Material

The palaeogeographic locations of all of the sections discussed here in detail are shown in Fig. 1.

3.1. Salzgitter-Salder Quarry (Fels-Werke Peine Salzgitter GmbH), Lower Saxony, northern Germany

The Salzgitter-Salder Quarry is located at TK 25 Lebenstedt-West, No. 3827, R: 3591000, H: 577775, south of Autobahn 39,

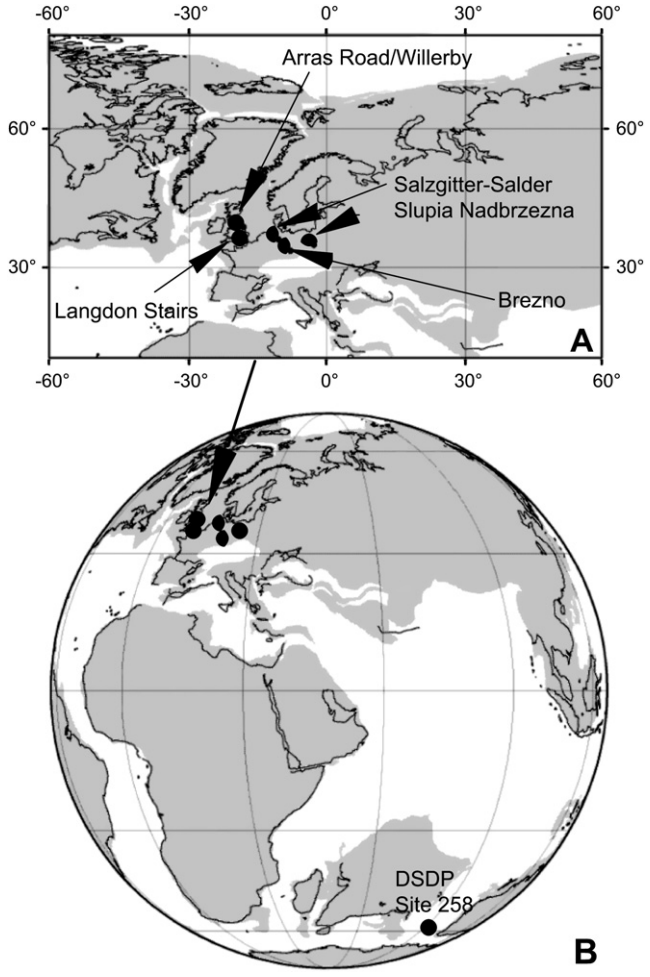

Fig. 1. Palaeogeographical locations of (A) featured northern European Turonian/Coniacian boundary sections, in relation to (B) DSDP Site 258.