SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY

ABSTRACTS

SYMPOSIUM

ON

CRETACEOUS STAGE BOUNDARIES

COPENHAGEN, OCTOBER 18 - 21, 1983

ABSTRACTS - Symposium on Cretaceous Stage Boundaries
Copenhagen, October 18 - 21, 1983.

Edited by Tove Birkelund, Richard Bromley, Walter Kegel Christensen, Eckart Håkansson, Finn Surlyk.

Issued by
Institute of historical Geology and Palaeontology
Øster Voldgade 10, 1350 Copenhagen K, Denmark.

Printed by
Geologisk Centralinstitut, University of Copenhagen,
Øster Voldgade 10, 1350 Copenhagen K, Denmark.

THE CENOMANIAN–TURONIAN AMMONITE SUCCESSION OF SERGIPE, BRAZIL, AND THE QUESTION OF THE STAGE BOUNDARY

Peter Bengtson
Paleontologiska museet
Uppsala universitet
Box 558
S-751 22 Uppsala
Sweden

INTRODUCTION

The position of the Cenomanian–Turonian stage boundary has for some time been a matter of debate. Alcide d'Orbigny's (1843, 1847, 1850, 1852) original "definitions" of the two stages – the term *stage* is used here in its original, biostratigraphical sense – are based on overlapping ammonite successions in the environs of Le Mans (Cenomanian) and in the area between Saumur and Montrichard in Touraine (Turonian), chosen by him as the type areas of his two stages. The stage boundary was not defined in unambiguous terms by d'Orbigny, but from the palaeontological data given, the boundary can be confidently interpreted as lying above the *Metoicoceras geslinianum* Zone and below the *Mammites nodosoides* Zone (Wright & Kennedy 1981). However, outside the type areas, additional ammonite zones are now recognized between these two zones. The position of the stage boundary within this boundary succession – absent in the type areas – is consequently a matter for international agreement. There is as yet no such agreement and, to make matters worse, specialists on different fossil groups often discuss the stage boundary in terms of zonation schemes which have little or no relation to the current ammonite zonations and even to d'Orbigny's original ammonite subdivision.

A prime prerequisite for sound biostratigraphical work is that *zonal* boundaries be well defined and that zonal schemes based on different fossil groups can be reasonably well integrated, such as has recently been attempted for the Turonian Stage of the type area (Robaszynski *et al.* 1982). If this can be achieved, then arguments concerning the position of the stage boundary become more of a nomenclatorial question. Nevertheless, a consistent nomenclature is important for effective communication; for stratigraphy and interpretations of historical geology, stage boundaries must be unambiguous.

A useful stage boundary should mark a point of global, major faunal turnover within the fossil group originally used for subdivision, i.e. in this case the ammonites. Such a boundary may be indicative of a major eustatic, climatic or other palaeoenvironmental change and so is likely to coincide, or nearly coincide, with zonal boundaries for other fossil groups. For groups that do not exhibit these synchronous faunal or floral changes, zonal boundaries should, where possible, be related to the original ammonite zonation to form an integrated zonal scheme for the boundary succession.

In this paper, the ammonite succession across the Cenomanian–Turonian boundary (*sensu* d'Orbigny) of the Sergipe Basin in northeastern Brazil is discussed and compared with other areas, particularly the type areas. The desirability of efforts to reach rapid international agreement on the position of the boundary is emphasized.

Sergipe Basin, Brazil	Equivalent zones in NW Europe
Watinoceras "assemblage zone"	*Mammites nodosoides* Zone — 4
	Watinoceras coloradoense Zone — 3
Paravascoceras "assemblage zone"	(*Neocardioceras juddii* Zone?) — 2
Euomphaloceras (Kanabiceras) "assemblage zone"	*Metoicoceras geslinianum* Zone — 1
Acanthoceras "assemblage zone"	*Calycoceras naviculare*–*Eucalycoceras pentagonum* Zone

Fig. 1. Upper Cenomanian to lower Turonian "assemblage zonation" for Sergipe, Brazil, based on ammonite genera. Standard zonation for northwestern Europe from Kennedy & Odin (1982). Figures on boundary lines refer to alternative positions for the Cenomanian–Turonian stage boundary, as explained in text.

THE SERGIPE SUCCESSION

For study of the ammonite succession of the Cenomanian–Turonian boundary in Sergipe, 155 surface sections were sampled (for additional data, see Bengtson 1983). A broad zonation based on distinct generic assemblages of ammonites has been established (Fig. 1).

The following taxa occur in each of the four assemblages ("assemblage zones") in the boundary succession studied:

Acanthoceras *"assemblage zone"*

Acanthoceras aff. *jukesbrownei* (Spath), *Eucalycoceras pentagonum* (Jukes-Browne), *Pseudocalycoceras harpax* (Sharpe), *Thomelites* aff. *sornayi* (Thomel), rare *Metoicoceras geslinianum* (d'Orbigny), and puzosiines.

Euomphaloceras (Kanabiceras) *"assemblage zone"*

Euomphaloceras (Kanabiceras) septemseriatum (Cragin), *E. (K.)* aff. *septemseriatum* (Cragin), *Pseudaspidoceras pseudonodosoides* (Choffat), *Pseudaspidoceras* aff. *footeanum* (Stoliczka), *Vascoceras gamai* Choffat, and sparse *Gombeoceras gongilense* (Woods).

Paravascoceras *"assemblage zone"*

Paravascoceras hartti (Hyatt), *Pseudaspidoceras footeanum* (Stoliczka), *Pseudotissotia nigeriensis plana* Barber, *P. gabonensis* Lombard, *Wrightoceras* sp., *Thomasites* sp., *Vascoceras*? *globosum* (Reyment), and, locally, *Mitonia* sp. and *Nannovascoceras* sp.

Watinoceras *"assemblage zone"*

Watinoceras amudariense (Arkhangel'skij), *W. jaekeli* (Solger), *Neoptychites cephalotus* (Courtiller), *Kamerunoceras seitzi* (Riedel), *Hoplitoides ingens* (von Koenen), *H. gibbosulus* (von Koenen), *Coilopoceras* spp.; sparse *Watinoceras coloradoense* (Henderson), *W. guentherti* Reyment, *Benueites*? sp., *Pachydesmoceras* sp. and hamitids; very rare *Romaniceras deverianum* (d'Orbigny) and *Spathites (Spathites)* sp. Locally *Mitonia reesidei* (Maury) occurs. High in the zone there are *Mammites nodosoides* (Schlüter), *Kamerunoceras turoniense* (d'Orbigny), *Fagesia bomba* Eck and *F. involuta* Barber.

The sharpest turnover in the succession of ammonite genera is at the *Paravascoceras–Watinoceras* "assemblage zone" boundary, where only *Mitonia* persists. The subjacent boundary, between the *Euomphaloceras (Kanabiceras)* and *Paravascoceras* "assemblage zones", appears to correspond to the boundary position currently used by most ammonite workers; however, in Sergipe this boundary shows a less conspicuous faunal turnover, with the common genus *Pseudaspidoceras* present in both assemblages.

DISCUSSION

In the ammonite literature, the Cenomanian–Turonian boundary has been diversely located (cf. Fig. 1):

(1) at the base of the *Metoicoceras geslinianum* Zone (lower *Sciponoceras gracile* Zone),
(2) at the base of the *Neocardioceras juddii* Zone,
(3) at the base of the *Watinoceras coloradoense* Zone (above the *S. gracile* Zone) – currently the most widely accepted position – and
(4) at the base of the *Mammites nodosoides* Zone.

In d'Orbigny's work on the type areas, there are no ammonite indications to place the *Neocardioceras juddii* or *Watinoceras coloradoense* zones in either stage (Wright & Kennedy 1981). This means that, without violating d'Orbigny's initial definitions, the Cenomanian–Turonian boundary can be placed at (2), (3) or (4).

Faunal provincialism is a major difficulty in correlation of remote regions with the type areas in northwestern Europe. The ammonite fauna of the Cenomanian–Turonian boundary interval of Sergipe is of pronounced Tethyan affinity, being composed largely of elements which are normally extremely rare in the Boreal type areas. Similarly, Boreal ammonites are absent from the Sergipe sequences. From the material available, the abundance of the pandemic *Euomphaloceras (Kanabiceras) septemseriatum* in the *Euomphaloceras (Kanabiceras)* "assemblage zone" of Sergipe permits correlation with the *Metoicoceras geslinianum* Zone of northwestern Europe (although rare *M. geslinianum* may show up also at the top of the subjacent *Acanthoceras* "assemblage zone"). A crucial point is the dating of the typically Tethyan *Paravascoceras* assemblage. It may turn out to be correlatable, at least in part, with the *Neocardioceras juddii* Zone, which cannot at present be identified in Sergipe. The only genus in common seems to be *Thomasites*, admittedly meagre evidence for correlation. If, however, the *Paravascoceras* "assemblage zone" should appear to be of *Neocardioceras juddii* Zone age, then, as a consequence, all *Vascoceras*, *Paravascoceras* and *Pseudaspidoceras* in Sergipe would be referred to the Cenomanian, using the currently most widely accepted boundary position (alternative 3 above). The *Watinoceras* "assemblage zone" comprises the *Watinoceras coloradoense* and *Mammites nodosoides* zones of Europe, and, as expected, *Mammites nodosoides* itself occurs in Sergipe only in the middle and upper parts of the *Watinoceras* "assemblage zone".

STEPS PROPOSED

The frequent use of other fossil groups than ammonites for identification of the Cenomanian–Turonian boundary has led to some biostratigraphical confusion and drifting away from the original concepts of the two stages. However, in the present case, when there is a choice between three apparently equally valid alternatives for the stage boundary, it is of additional importance

to pick out the one which represents the greatest *overall* faunal turnover. Even if zonal boundaries for different fossil groups do not all coincide at this point – and this is to be expected, since organisms react differently to changes in environmental conditions – for practical biostratigraphical work, this position will be the most useful stage boundary. Data are now available from so many areas over the world that further argumentation over the position of the boundary appears a waste of effort and time. Instead, work should be concentrated on bringing together the available biostratigraphical information to arrive at the most suitable boundary position and, then, to reach international agreement on this position.

REFERENCES

Bengtson, P. 1983: The Cenomanian–Coniacian of the Sergipe Basin, Brazil. *Fossils and Strata 12*, 1-78, one fold-out map.

Kennedy, W.J. & Odin, G.S. 1982: The Jurassic and Cretaceous time scale in 1981. *In* G.S. Odin (ed.): *Numerical dating in stratigraphy 1*, 557-592. John Wiley & Sons, Chichester.

d'Orbigny, A. 1843: *Paléontologie française; Terrains crétacés, 2. Gastéropodes.* Pp. 225-456, Pls. 149-236. Victor Masson, Paris.

d'Orbigny, A. 1847: *Paléontologie française; Terrains crétacés, 4. Brachiopodes.* Pp. 1-32. Victor Masson, Paris.

d'Orbigny, A. 1850: *Prodrome de Paléontologie stratigraphique universelle des animaux mollusques et rayonnés.* 428 pp. Victor Masson, Paris.

d'Orbigny, A. 1852: *Cours élémentaire de Paléontologie et de Géologie stratigraphiques, 2.* Pp. 383-847. Victor Masson, Paris.

Robaszynski, F. (coord.) 1982: Le Turonien de la région-type: Saumurois et Touraine. Stratigraphie, biozonations, sédimentologie. *Bulletin des Centres de Recherches Exploration-Production Elf-Aquitaine 6(1)*, 119-225.

Wright, C.W. & Kennedy, W.J. 1981: The Ammonoidea of the Plenus Marls and the Middle Chalk. *Palaeontographical Society Monographs 560* [part of Vol. 134 for 1980], 1-148, Pls. 1-32.

A contribution to
MID-CRETACEOUS EVENTS