

## ***Acanthoscaphites tridens* (Kner, 1848) (Ammonoidea) from the Vijlen Member (Lower Maastrichtian) of Gulpen, Limburg, The Netherlands**

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### **Abstract**

A specimen of the scaphitid ammonite *Acanthoscaphites tridens* (Kner, 1848) was collected *in situ* from the lower part of the Vijlen Member (Gulpen Formation, *sensu* Felder, 1975b) as exposed at a building site near the Sophianum school southwest of Gulpen, southern Limburg (The Netherlands). This species has been widely quoted as an index for the lowest ammonite zone of the Maastrichtian Stage, but its precise age was poorly known. Associated nannofossils show the Gulpen specimen to come from nannofossil zone CC 24 (*Reinhardtites levis* Zone). A calibration of nannofossil and belemnite zones indicates it to be no older than the *Belemnella occidentalis* Zone (upper part of *Belemnella sumensis* Zone of Schulz, 1979), which is well above the base of the Maastrichtian Stage. The Gulpen specimen is thus younger than the type occurrence in the Ukraine which is in nannofossil subzone CC 23B, equivalent to the upper part of the *Belemnella lanceolata* Zone (upper *Belemnella lanceolata* to basal *Belemnella sumensis* Zone of Schulz, 1979).

### **Introduction**

*Acanthoscaphites tridens* (Kner, 1848) is a large scaphitid ammonite originally described from near Lemberg in the Habsburg Kingdom of Galicia, a locality now known as Nagoryanĭ [Nagorzany] south of Lvov in the Ukraine. The species is of considerable stratigraphic significance, since Jelletzky (1951) and others used it as index for the lowest macrofossil zone of the Maastrichtian Stage. A *tridens* Zone appears in several recent syntheses of Late Cretaceous stratigraphy (e.g. Kent & Gradstein 1985, Haq et al. 1987, 1988, Harland et al. 1989).

This species has long been known from the Maastricht area; Schlüter (1872, p. 94, pl. 28, fig. 3)

figured a specimen (now in the collections of the Geologisches und Paläontologisches Institut der Universität Bonn) from the 'Mukronaten-Schichten von Vaels bei Aachen', while old collections in the Institut royal des Sciences naturelles de Belgique (Brussels), and in the Rheinisch-Westfälische Technische Hochschule (Aachen), contain more than a dozen specimens from the Gulpen Formation, mostly labelled 'Craie glauconifère, Schneeberg', the locality from which Holzapfel (1887, p. 63, pl. 5, fig. 1) figured a specimen.

The precise horizon of these specimens in the detailed lithostratigraphic sequence recognised in the Limburg area (Felder 1975a, b) remained uncertain; Kennedy (1984) thought the species might be from the Zeven Wegen Member (Gulpen For-

mation, Table 1), but this is known to be late Campanian on belemnite, ammonite and other macrofaunal evidence (Schulz & Schmid 1983, Kennedy 1986, 1987, Jagt 1988). He subsequently suggested the species might be from the overlying Beutenaken Member (Kennedy 1987, p. 207), which, according to Verbeek (1980, 1983: *Quadrum trifidum* Zone) and Keutgen & Van der Tuuk (1991; *langei* Zone) is late Campanian as well. Van der Tuuk (1987, p. 62) remarked that the species came from the Vijlen Member, but figured (fig. 16) an imprecisely localised specimen from Aachen-Schneeberg, which is stated to be from the Upper Campanian. He also showed (his fig. 3) the species to range from the top of the Beutenaken Member to the base of the Lixhe Member and he placed the Vijlen Member in the late Maastrichtian *Belemnitella junior* Zone, stating at the same time (1987, p. 62) that it must be at least partly early Maastrichtian in age. Moreover, he included in the synonymy of the species specimens of the late Campanian

*Trachyscaphites spiniger* (Schlüter, 1872) (see Kennedy 1986, fig. 8f) from the Zeven Wegen Member.

Under these confused circumstances, the precise litho- and biostratigraphic level of this important marker fossil in the environs of the type locality of the Maastrichtian Stage is in need of clarification. Fortunately, a specimen (Figs. 1–3) has now been collected *in situ* near Gulpen, The Netherlands, c. 15 km SE of Maastricht.

### Systematic description

Genus *Acanthoscaphites* Nowak, 1911, p. 565

Type species *Scaphites tridens* Kner, 1848, p. 10, pl. 2, fig. 1, by the subsequent designation of Diener (1925, p. 205).

*Acanthoscaphites tridens* (Kner, 1848) Figs. 1–3

1848 *Scaphites tridens* Kner, p. 10, pl. 2, fig. 1

Table 1. Chrono- and lithostratigraphy of Upper Cretaceous rocks east of the River Maas (southern Limburg, The Netherlands). Belemnite zones are indicated

Lithostratigraphy		Belemnites	Chronostratigraphy			
M A A S T R I C H T	F o r m a t i o n	Meerssen Member	<i>Belemnella casimirovensis</i>	M A A S T R I C H T I A N		
		Nekum Member				
		Emael Member				
		Schiepersberg Member	<i>Belemnitella junior</i>			
		Gronsveld Member				
		Valkenburg Member			Late	
G U L P E N	F o r m a t i o n	Lanaye Member	↓	C A M P A N I A N		
		Lixhe 1–3 Members				
		Vijlen Member	<i>Belemnella cimbrica</i> <i>Belemnella obtusa</i>		Early	
		Beutenaken Member			<i>Belemnitella 'langei'</i>	Late
		Zeven Wegen Member			<i>Belemnitella mucronata</i>	Late
VAALS Formation	<i>Gonioteuthis quadrata quadrata</i>	Early				

- 1848 *Scaphites trinodosus* Kner, p. 11, pl. 2, fig. 2.  
 1850 *Scaphites quadrispinosus* Geinitz, p. 116, pl. 7, fig. 2; pl. 8, fig. 2.  
 1911 *Acanthoscaphites tridens-bispinosus* Nowak, p. 577, pl. 32, figs. 1–3; text-fig. 4.  
 1911 *Acanthoscaphites tridens trispinosus* Geinitz – Nowak, p. 578, pl. 32, figs. 5, 7.  
 1974 *Acanthoscaphites innodosus* Naidin, p. 178, pl. 62, fig. 1.  
 1986 *Acanthoscaphites tridens* (Kner, 1848) – Kennedy, fig. 7b, c.  
 1987 *Acanthoscaphites tridens* (Kner, 1848) – Kennedy & Summesberger, p. 36, pl. 4, figs. 1–3; pl. 6, figs. 1–5, 25–28; pl. 7, figs. 1–5; pl. 8, figs. 1–5; pl. 9, figs. 1–4; pl. 10, figs. 1, 2; pl. 11, figs. 1, 2; pl. 12, figs. 1, 2; pl. 13, figs. 1, 3, 4; pl. 14, figs. 1–3; pl. 15; pl. 16, figs. 1–6 (with full synonymy).  
 1987 *Acanthoscaphites tridens* (Kner, 1848) – Van der Tuuk, p. 61 (pars), fig. 16.  
 1987 *Acanthoscaphites tridens* (Kner, 1848) – Kennedy, 205, pl. 37, figs. 1–4.  
 1989 *Acanthoscaphites tridens* (Kner, 1848) – Kennedy, p. 269, fig. 11/1).

Types – The present whereabouts of Kner's original material is unknown.

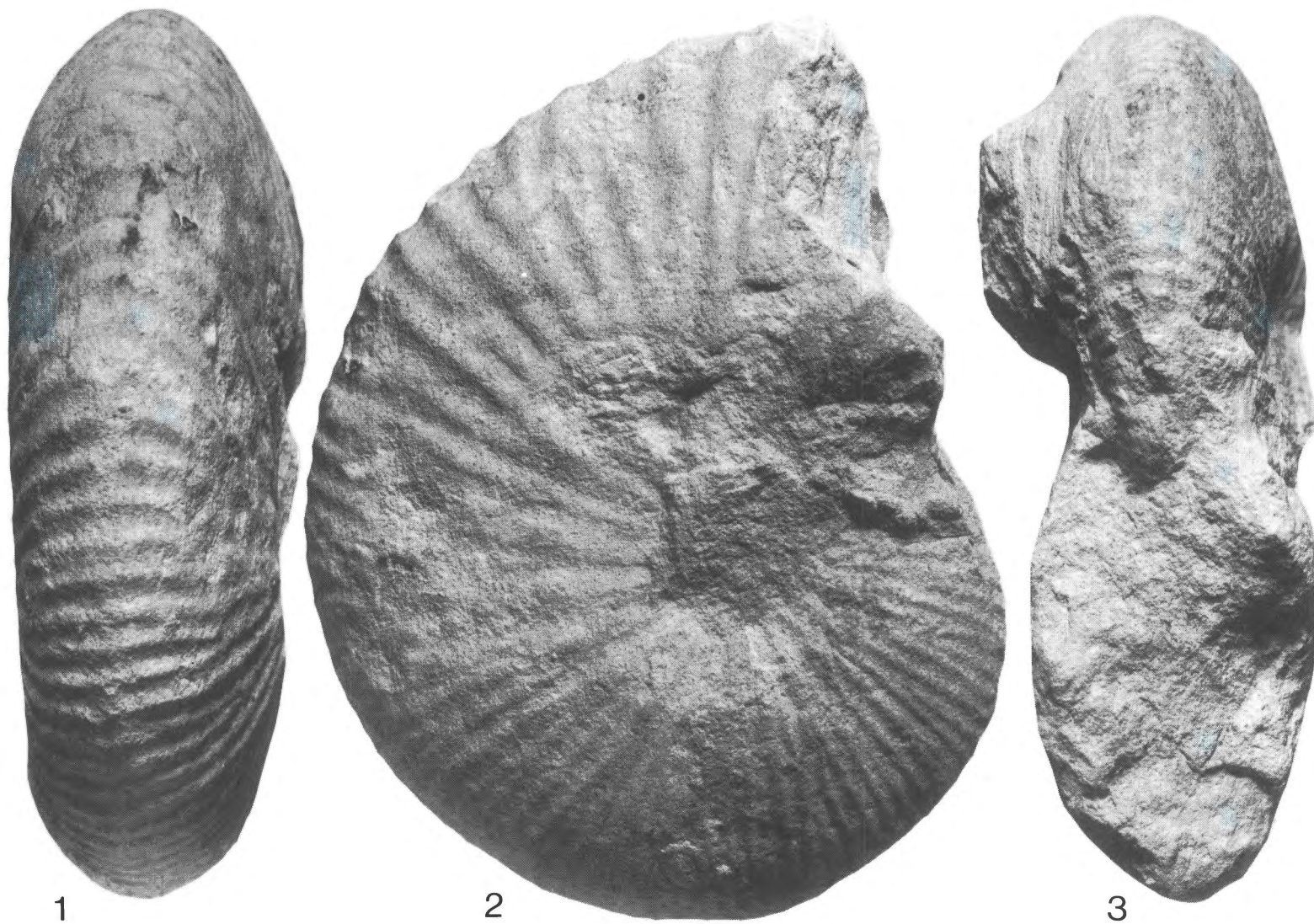
Discussion – Kennedy & Summesberger (1987) and Kennedy (1987) have reviewed this species at length and provided complete synonymies, which are not repeated here. They show *Acanthoscaphites tridens* to be a very large, markedly dimorphic species. Macroconchs are in excess of 250 mm in diameter, and encompass forms named *tridens*, *trispinosus*, *bispinosus* and *innodosus* by previous authors (see synonymy). Microconchs are up to 130 mm in diameter, and encompass forms named *trinodosus* and *quadrispinosus* by previous authors (see synonymy). The present specimen (Figs. 1–3) is crushed and just over 140 mm in diameter, and is preserved as a composite mould in calcarenitic chalk. It was collected *in situ* in July 1989 by Mr H.M.J.T. Roymans of Mechelen-Höfke from the lower part of the Vijlen Member of the Gulpen Formation, c. 20 metres above the base of this member (with Vaals Formation disconformably underlying it) at a building site known as 'bouwput

Sophianum' (topographical map of The Netherlands, 1:25,000, sheet 62B, co-ordinates x = 190.550, y = 313.620, pers. comm. W.M. Felder) southwest of Gulpen. It is an incomplete macroconch, differing in no significant respects from topotypes described by Kennedy & Summesberger (1987). Associated with this find was a specimen of the holasterid echinoid *Cardiaster granulatus* (Goldfuss, 1829), which is a long-ranging species and not age-diagnostic. There was no evidence to suggest that the ammonite specimen was reworked.

#### Age and occurrence of *Acanthoscaphites tridens*

We have noted above the problems associated with the precise dating of *Acanthoscaphites tridens* in southern Limburg. The belemnite evidence for the age of the Vijlen Member is complex in this area, not least because the records of Van der Tuuk & Bor (1980) and Van der Tuuk (in Robaszynski et al. 1985) and those of Schulz & Schmid (1983) are incompatible. Our own observations support the results of the latter authors, which we follow here. The Beutenaken Member, below the Vijlen Member that yielded our *Acanthoscaphites tridens*, is characterised by belemnite shells (*Belemnitella* cf. *najdini* Kongiel, 1962; see Keutgen & Van der Tuuk 1991). Schulz & Schmid (1983, p. 34) remarked that *Belemnella obtusa* Schulz, 1979 dominates these assemblages. Where the Beutenaken Member has been eroded and the Vijlen Member rests directly on the Zeven Wegen Member, as at Haccourt and Lixhe (CPL and CBR quarries, Liège, NE Belgium) it contains reworked elements of the *obtusa* Zone, plus *Belemnella cimbrica* Birçelund, 1957 and indigenous *Belemnitella* ex gr. *junior* Nowak, 1913. Schulz & Schmid (1983) demonstrated that the correlatives of the Vijlen Member in Liège extend down to the *cimbrica* Zone of the upper Lower Maastrichtian.

To test the dating of the present ammonite specimen, the matrix was examined for nannoflora. It yielded the following assemblage (21 species): *Arkhangelskiella cymbiformis* Vekshina, 1959



Figs. 1–3. *Acanthoscaphites tridens* (Kner, 1848). Incomplete macroconch from the Vijlen Member (Gulpen Formation), c. 20 m above base, Sophianum building site, Gulpen, The Netherlands. Lower Maastrichtian. Approximately natural size (diameter just over 140 mm). Natuurhistorisch Museum Maastricht Collections, reg. no. 1991028, leg. H.M.J.T. Roymans. Photographs by P.H. Kessels. 1: ventral view, 2: lateral view, 3: apertural view.

*Broinsonia enormis* (Shumenko, 1968) Manivit, 1971

*Broinsonia* sp. 1

*Cretarhabdus conicus* Bramlette & Martini, 1964

*Cribrosphaerella ehrenbergii* (Arkhangelsky, 1912) Deflandre in Piveteau, 1952

*Discorhabdus ignotus* (Górka, 1957) Perch-Nielsen, 1968

*Eiffellithus gorkae* Reinhardt, 1965

*E. turriseiffelii* (Deflandre, 1954) Reinhardt, 1965

*Helicolithus anceps* (Górka, 1957) Noël, 1970

*Kamptnerius magnificus* Deflandre, 1959

*Lithraphidites carniolensis* Deflandre, 1963

*Lucianorhabdus cayeuxii* Deflandre, 1959

*Micula staurophora* (Gardet, 1955) Bramlette & Martini, 1964

*Neocrepidolithus cohenii* (Perch-Nielsen, 1968) Perch-Nielsen, 1984

*Prediscosphaera majungae* Perch-Nielsen, 1983

*P. stoveri* (Perch-Nielsen, 1968) Shumenko, 1974

*Reinhardtites levis* Prins & Sissingh in Sissingh, 1977?

*Retecapsa crenulata* (Bramlette & Martini, 1964) Grün in Grün & Allemann, 1975

*R. madingleyensis* Black, 1971

*Watznaueria manivitae* Bukry, 1973

*Zeugrhabdotus compactus* (Bukry, 1969).

Taken together, this assemblage indicates nannofossil zone CC 24 (*Reinhardtites levis* Zone). Schönfeld & Burnett (1991) have recently integrated Maastrichtian nannofossil and macrofossil zones on the basis of the succession at Lägerdorf and Hemmoor (Niederelbe, northwestern Germany, c 400 km NE of Gulpen). Their results are shown in Fig. 4. Although they were unable to differentiate nannofossil zones CC 24 and 25 at this locality, their results show that zone CC 24 can be no older than the *sumensis* belemnite zone. This is compatible with the belemnite evidence for the base of the Vijlen Member, which belongs to the *cimbrica* Zone, which we take to be the level of the present specimen of *Acanthoscaphites tridens*.

The type occurrence of *A. tridens* has also been dated via associated belemnites and nannofossils. Christensen (1987) showed the belemnites from Nagoryan̄ to be *Belemnella (Pachybelemnella) inflata* (Arkhangelsky, 1912), a species that is re-

standard nannofossil zones	Macrofossil biozones	sub-stages
CC26	<i>baltica/danica</i> - zone	U.Maastrichtian (part)
	<i>danica/argentea</i> - zone	
CC 24-25	<i>argentea/junior</i> - zone	
	<i>tegulatus/junior</i> - zone	
	<i>fastigata</i> - zone	
	<i>cimbrica</i> - zone	
<i>sumensis</i> - zone		
CC23B	<i>obtusa</i> - zone	L.L.Maastr.
	<i>pseudobtusa</i> - zone	
CC23A	<i>lanceolata</i> - zone	U.Campanian
	<i>grimmensis/granulosus</i> - zone	
CC22C	<i>langei</i> - zone	

Fig. 4. Correlation of Campanian-Maastrichtian nannofossil and macrofossil zones (belemnites, echinoids and bivalves) at Lägerdorf-Hemmoor, Niederelbe, northern Germany (based on Schönfeld & Burnett, 1991, fig. 7).

stricted to the early Maastrichtian *lanceolata* to *pseudobtusa* Zones of Schulz (1979) (Fig. 4). The associated nannoflora, studied by Wagreich (1987) indicated nannofossil zone CC 23B, which Schönfeld & Burnett (1991) showed to be equivalent to the uppermost *lanceolata* to basal *sumensis* Zones (*sensu* Schulz 1979).

Taking the nannofossil and belemnite evidence from the Netherlands and the Ukraine, it will be seen that *A. tridens* may first appear high in the *lanceolata* Zone of Schulz, some way above the base of the Maastrichtian, and range to the *cimbri-ca* Zone of the upper Lower Maastrichtian. The species is also known from Denmark (Birkelund, in press), where a number of specimens from Møns Klint are dated as *obtusa* or lowermost *sumensis* belemnite zone. Occurrences at Lüneburg (Germany, see Schlüter 1872, p. 94, pl. 28, figs. 1–4) seem to be in the *obtusa* Zone (Schulz 1979, fig. 66). Other records in Poland (Blaszkiwicz 1980) and the USSR (Donbass and elsewhere in European Russia, Naidin 1974) are imprecisely dated within the Lower Maastrichtian.

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### References

Blaszkiwicz, A. 1980 Campanian and Maastrichtian ammonites of the Middle Vistula River Valley, Poland: a stratigraphic-paleontological study – Pr. Inst. Geol. 92: 1–63, 56 pls

- Christensen, W.K. 1987 *Belemnella (Pachybelemnella) inflata* (Arkhangelsky) from Nagoryanĭ, USSR – Beitr. Paläont. Österr. 13: 79–84, 1 pl
- Diener, C. 1925 Ammonoidea neocretacea. In: Pompeckji, F.J. (ed.): Fossilium Catalogus 1. Animalia 29: 244 pp. Berlin (Junk)
- Felder, W.M. 1975a Lithostratigraphische Gliederung der Oberen Kreide in Süd-Limburg (Niederlande) und den Nachbargebieten. Erster Teil: Der Raum westlich der Maas, Typusgebiet des ‘Maastricht’ – Publ. Natuurhist. Genootsch. Limburg 24: 34 pp
- Felder, W.M. 1975b Een nieuwe lithostratigrafische indeling van het Boven-Krijt en de Dano-Montien kalksteen in Zuid-Limburg en het aangrenzende gebied. In: Engelen, F.H.G. (ed.): Tweede Internationale Symposium over Vuursteen, 8–11 mei 1975, Maastricht – Starvingia 3: 11–15
- Geinitz, H.B. 1849–1850 Das Quadersandsteingebeirge oder Kreidegebirge in Deutschland. Craz und Gerlach (Freiberg), 1–96, pls 1–6 (1849); 97–293, pls 7–12 (1850)
- Haq, B.U., J. Hardenbol & P.R. Vail 1987 The chronology of fluctuating sea levels since the Triassic – Science 235: 1156–1167
- Haq, B.U., J. Hardenbol & P.R. Vail 1988 Mesozoic and Cenozoic chronostratigraphy and cycles of sea level change. In: Wilgus, C.K., H. Posamentier, C.A. Ross & C.G. St.C. Kendall (eds.): Sea-level changes: an integrated approach – Society of Economic Paleontologists and Mineralogists, Special Publication 42: 73–108
- Harland, W.B., R.L. Armstrong, A.V. Cox, L.E. Craig, A.G. Smith & D.G. Smith 1989 A geologic timescale. Cambridge, New York, Port Chester, Melbourne, Sydney (Cambridge University Press), 263 pp
- Holzapfel, E. 1887–1889 Die Mollusken der Aachener Kreide – Palaeontographica 34, 29–72, pls 4, 5 (1887); 73–180, pls 6–21 (1888); 35, 139–268, pls 8–29 (1889)
- Jagt, J.W.M. 1988 Some stratigraphical and faunal aspects of the Upper Cretaceous of southern Limburg (The Netherlands) and contiguous areas. In: Streel, M. & M.J.M. Bless (eds.): The Chalk District of the Euregio Meuse-Rhine. Selected papers on Upper Cretaceous deposits, Natuurhistorisch Museum Maastricht/Laboratoires de Paléontologie, Université de Liège, pp. 25–39, 3 pls
- Jeletzky, J.A. 1951 Die Stratigraphie und Belemnitenfauna des Obercampan und Maastricht Westfalens, Nordwestdeutschlands und Dänemarks sowie einige allgemeine Gliederungs-Probleme der jüngeren borealen Oberkreide Eurasiens – Beih. Geol. Jb. 1: 1–142, 7 pls
- Kennedy, W.J. 1984 Ammonite faunas and the ‘standard zones’ of the Cenomanian to Maastrichtian Stages in their type areas, with some proposals for the definition of stage boundaries by ammonites – Bull. geol. Soc. Denmark 33: 147–161
- Kennedy, W.J. 1986 The Campanian-Maastrichtian ammonite sequence in the environs of Maastricht (Limburg, the Netherlands), Limburg and Liège provinces (Belgium) – Newsl. Stratigr. 16: 149–168
- Kennedy, W.J. 1987 The ammonite fauna of the type Maastrich-

- tian, with a revision of *Ammonites colligatus* Binkhorst, 1861 – Bull. Inst. r. Sci. nat. Belg., Sci. Terre, 56 (1986): 151–267, 37 pls
- Kennedy, W.J. 1989 Thoughts on the evolution and extinction of Cretaceous ammonites – Proc. Geol. Ass. 100: 251–279
- Kennedy, W.J. & H. Summesberger 1987 Lower Maastrichtian ammonites from Nagoryan̄y (Ukrainian SSR) – Beitr. Paläont. Österr. 13: 25–78, 16 pls
- Kent, D. & F. Gradstein 1985 A Cretaceous and Jurassic geochronology – Bull. geol. Soc. Am. 76: 1419–1427
- Keutgen, N. & L.A. van der Tuuk 1991 Belemnites from the Lower Maastrichtian of Limburg, Aachen and Liège – Meded. Rijks Geol. Dienst 44 (1990): 1–39, 4 pls
- Kner, R. 1848 Versteinerungen des Kreidemergels von Lemberg und seiner Umgebung – Haidinger's naturwiss. Abh. 2: 1–42, 5 pls
- Naidin, D.P. 1974 Ammonoidea. In: Krymgolts, G.J. (ed.): Atlas verkhnemelovoj fauny Donbassa, NEDRA, Moskva, pp. 158–195, pls 53–70
- Nowak, J. 1911 Untersuchungen über die Cephalopoden der oberen Kreide in Polen. II. Teil: Die Skaphiten – Bull. int. Acad. Sci. Lett. Cracovie, Cl. Sci. math. nat., B. Sci. nat. (Année 1911): 547–589, pls 32, 33
- Robaszynski, F., M.J.M. Bless, P.J. Felder, J.-C. Foucher, O. Legoux, H. Manivit, J.P.M.T. Meessen & L.A. van der Tuuk 1985 The Campanian-Maastrichtian boundary in the chalky facies close to the type-Maastrichtian area – Bull. Centres Rech. Explor.-Prod. Elf-Aquitaine 9: 1–113, 22 pls
- Schlüter, C. 1871–1876 Cephalopoden der oberen deutschen Kreide – Palaeontographica 21, 1–24, pls 1–8 (1871); 21, 25–120, pls 9–35 (1872); 24, 1–114 (121–264) + x, pls 36–55 (1876)
- Schönfeld, J. & J.A. Burnett 1991 Biostratigraphical correlation of the Campanian-Maastrichtian boundary: Lägerdorf-Hemmoor (northwestern Germany), DSDP Sites 548A, 549 and 551 (eastern North Atlantic) with palaeobiogeographical and palaeoceanographical implications – Geol. Mag. 128: 479–503
- Schulz, M.-G. 1979 Morphometrisch-variationsstatistische Untersuchungen zur Phylogenie der Belemniten-Gattung *Belemnella* im Untermaastricht NW-Europas – Geol. Jb. A 47: 3–157, 12 pls
- Schulz, M.-G. & F. Schmid 1983 Das Ober-Maastricht von Hemmoor (N-Deutschland): Faunenzonen-Gliederung und Korrelation mit dem Ober-Maastricht von Dänemark und Limburg – Newsl. Stratigr. 13: 21–39
- Van der Tuuk, L.A. 1987 Scaphitidae (Ammonoidea) from the Upper Cretaceous of Limburg, The Netherlands – Paläont. Z. 61: 57–79
- Van der Tuuk, L.A. & T.J. Bor 1980 Zonering van het Boven Krijt in Limburg met behulp van Belemnitidae – Grondbooren Hamer 4: 121–132
- Verbeek, J. 1980 Het nannoplankton uit het Krijt van Zuid Limburg en het aansluitende Belgische grensgebied (Nannoplanktonrapport 31). Rijks Geologische Dienst, Haarlem, 8 + 1 pp. (unpublished)
- Verbeek, J. 1983 The calcareous nannofossils from the Campanian and Maastrichtian rocks of southern Limburg (The Netherlands) and the adjacent Belgian area. In: Birkelund, T., R. Bromley, W.K. Christensen, E. Håkansson & F. Surlyk (eds.): Abstracts Symposium on Cretaceous Stage Boundaries, Copenhagen, October 18–21, 1983, Institute of Historical Geology and Palaeontology, Copenhagen, pp. 197–200
- Wagreich, M. 1987 A contribution to the nannoflora of Nagoryan̄y (Ukrainian SSR; Upper Cretaceous) – Beitr. Paläont. Österr. 13: 85–86