

Santonian ammonites from the Köpingsberg-1 borehole, Sweden

WILLIAM JAMES KENNEDY AND WALTER KEGEL CHRISTENSEN



Kennedy, W.J. & Christensen, W.K.: Santonian ammonites from the Köpingsberg-1 borehole, Sweden. *Bull. geol. Soc. Denmark*, vol. 40, pp. 149–156, Copenhagen, June 3th, 1993.
<https://doi.org/10.37570/bgsd-1993-40-05>

A 510 meter succession of siltstones and fine sandstones in the Köpingsberg-1 borehole, Sweden yielded a distinctive suite of Santonian ammonites; ammonites of this age are otherwise known in significant numbers in Scandinavia only on Bornholm. The assemblage is dominated by taxa best known from North Germany, and includes *Hauericeras* cf. *pseudogardeni* (Schlüter, 1872), *Scalarites* sp., *Baculites* sp. group of *capensis* Woods, 1906, *Baculites* sp. 1, *Boehmoceras krekeleeri* (Wegner, 1905), *Boehmoceras arculus* (Morton, 1834), and *Scaphites kieslingswaldensis fischeri* Riedel, 1931.

W.J. Kennedy, *Geological Collections, University Museum, Oxford OX1 3PW, England*. W.K. Christensen, *Geological Museum, Øster Voldgade 5–7, DK-1350 Copenhagen, Denmark*. 3 June 1991.

Introduction

A series of cores from the Köpingsberg-1 borehole, Sweden (Fig. 1), cut in grey, sometimes glauconitic micaceous siltstones and sandstones yielded a small suite of ammonites of Santonian age. In view of the paucity of ammonite assemblages of this age in Scandinavia, where they are otherwise known mainly from Bornholm: (Kennedy & Christensen, 1991), the present material, though limited, merits description. The borehole was drilled in 1967 and described or commented upon by Anderegg, Norling & Skoglund (1968), Norling (written comm. January 12 1970) and Chatziemmanouil (1982). It is situated in the southeastern part of the Vomb Trough in Scania, Sweden about 9 km eastnortheast of Ystad (Fig. 1). The trough is a narrow, elongated, asymmetrical graben initiated in the Early Mesozoic (Norling 1982, Chatziemmanouil 1982). The length of the trough is about 80 km and its width is about 7 km towards the northwest and 11 km towards the southeast. The Herrestad Uplift, an east-west trending horst in the southeastern part of the trough, divides the trough into two parts.

About 1000 m of Cretaceous rocks, consisting mainly of glauconitic, calcareous, clayey siltstones spanning the Hauterivian-Maastrichtian, were recorded from the borehole. The thickness of the Upper Cretaceous sedimentary strata is a little less than 800 m, and all Upper Cretaceous stages are represented. The stratigraphical dating

of the borehole was made mainly on the basis of foraminifera (Norling op. cit., Chatziemmanouil 1982). On the basis of these studies the borehole was subdivided in the following way: Pleistocene 0–20 m, Lower Maastrichtian 20–71 m, Campanian 71–230 m, Santonian 230–600 m, Coniacian 600–670 m, Turonian 670–742 m, and Cenomanian 742–805 m.

Christensen (1986) described the Upper Cretaceous belemnites from five classic outcrops and one borehole in the through, and these were placed in the international stratigraphic framework on belemnite evidence.

Chatziemmanouil (1982) analysed the Upper Cretaceous of the trough on the basis of five boreholes, including Köpingsberg-1, placed along the axis of the trough. The analysis was based upon seismic methods, sedimentological analysis, and palaeontological/ecological studies of foraminifera.

The fossils are all crushed and fragmentary composite moulds, a few with traces of powdery phosphatized shell. The assemblage is dominated by *Baculites*, mostly indeterminate, which range from depths of 132.35–132.44 m down to 642.62–642.69 m.

Detailed records are as follows:

- 132.35–132.44 m *Baculites* sp.?
- 251.70–251.75 m *Baculites* sp. group of *capensis*
- 314.80–314.86 m *Baculites* sp.?
- 315.18–315.23 m *Baculites* sp.?

- 316.78–316.8 m *Baculites* sp. 1
 338.70–338.74 m *Baculites* sp. 1
 339.71–339.77 m *Baculites* sp. 1
 341.68–341.71 m *Baculites* sp. 1
 397 m *Scaphites kieslingswaldensis fischeri*
 433.84–433.86 m *Hauericeras* cf. *pseudogardeni*
 481.26–481.35 m *Boehmoceras arculus*
 491.91–491.96 m *Baculites* sp. group of *capensis*
 494.13–494.18 m *Baculites* sp.
 511.25–511.33 m indeterminate juvenile ammonite
 524.74–524.78 m *Boehmoceras* sp. juv. cf. *krekeleri*
 524.87–525.03 m *Boehmoceras krekeleri*, *Baculites* sp. group of *capensis*, *Scalarites*? sp.
 525.18–525.29 m *Boehmoceras krekeleri*
 526.08–526.17 m *Boehmoceras krekeleri*
 526.58–526.66 m *Boehmoceras krekeleri*
 527.12–527.23 m *Boehmoceras krekeleri*
 530.11–530.13 m *Boehmoceras krekeleri*
 532.11–532.16 m *Baculites* sp. 1
 559.77–559.80 m *Baculites* sp. 1
 561.13–561.16 m *Scaphites* cf. *kieslingswaldensis fischeri*
 572.46–577.58 m *Baculites* sp. 1
 581.92–581.97 m *Baculites* sp. 1
 588.92–588.97 m *Baculites* sp. 1
 604.60–604.66 m *Baculites* sp.?

- 611.75–611.76 m *Baculites* sp.?
 624.87–624.95 m *Scaphites kieslingswaldensis fischeri*
 642.62–642.69 m *Baculites* sp. 1

Age of the Assemblage

The interval between 132.35 and 481.26 m cannot be dated precisely. The nodose *Baculites* present are of the *B. capensis* (Woods, 1906) group, which range from Upper Coniacian to Upper Santonian (Klinger & Kennedy, 1977), suggesting, given the Upper Santonian age of the underlying sediments, that these too are Upper Santonian. The presence of *Scaphites* (*Scaphites*) *kieslingswaldensis fischeri* Riedel, 1931, at 397 m is compatible with such an age; this species ranges from Lower Santonian to Lower Campanian in Germany (see discussion in Kennedy & Christensen, 1991).

The presence of *Boehmoceras arculus* (Morton, 1834) at 481.26–481.35 m, and *Boehmoceras krekeleri* (Wegner, 1905) between 527.74 and 530.13 m provide a precise dating, for Schönfeld (1985) has refined previous records, showing the species to occur in association with the pelagic crinoid *Marsupites* in the *Marsupites/granulata* Zone in the Münster Basin. This same zone yields *Hauericeras pseudogadeni* (Schlüter, 1872), a possible example of which is present at 433.84–433.86 m. Poorly preserved *Scaphites* (*Scaphites*) *kieslingswaldensis fischeri* at 624.87–624.95 m suggest that the interval to this depth is also Santonian, although foraminiferal data (Chatziemmanouli 1982) placed the Coniacian-Santonian boundary at a depth of 600 m. This may simply reflect differing definitions of the boundary.

Systematic Palaeontology

- Order Ammonoidea Zittel, 1884
 Suborder Ammonitina Hyatt, 1889
 Superfamily Desmocerataceae Zittel, 1895
 Family Desmoceratinae Zittel, 1895
 Subfamily Hauericeratinae Matsumoto, 1938
 Genus *Hauericeras* de Grossouvre, 1984
 [= *Schlueteria* Rollier, 1922, p.359, non Fritsch in Fritsch & Kafka, 1887, p.33; *Pseudogartneria* Tomlin, 1930, p.23; *Gardeniceras* Matsumoto & Obata, 1955, p.134]

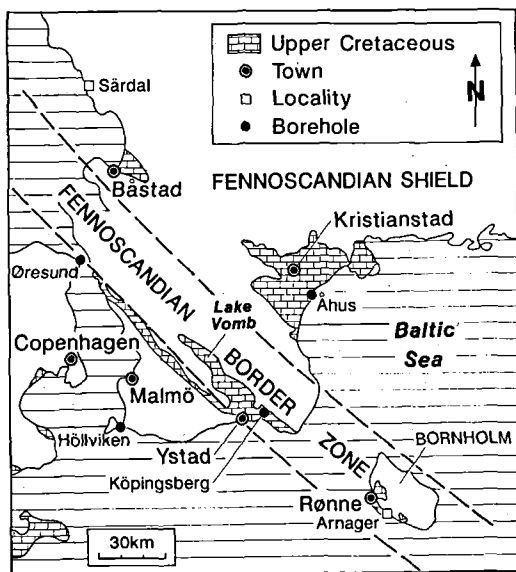


Fig. 1. The location of the Köpingsberg-1 borehole in the Vomb Trough (modified after Christensen 1985).

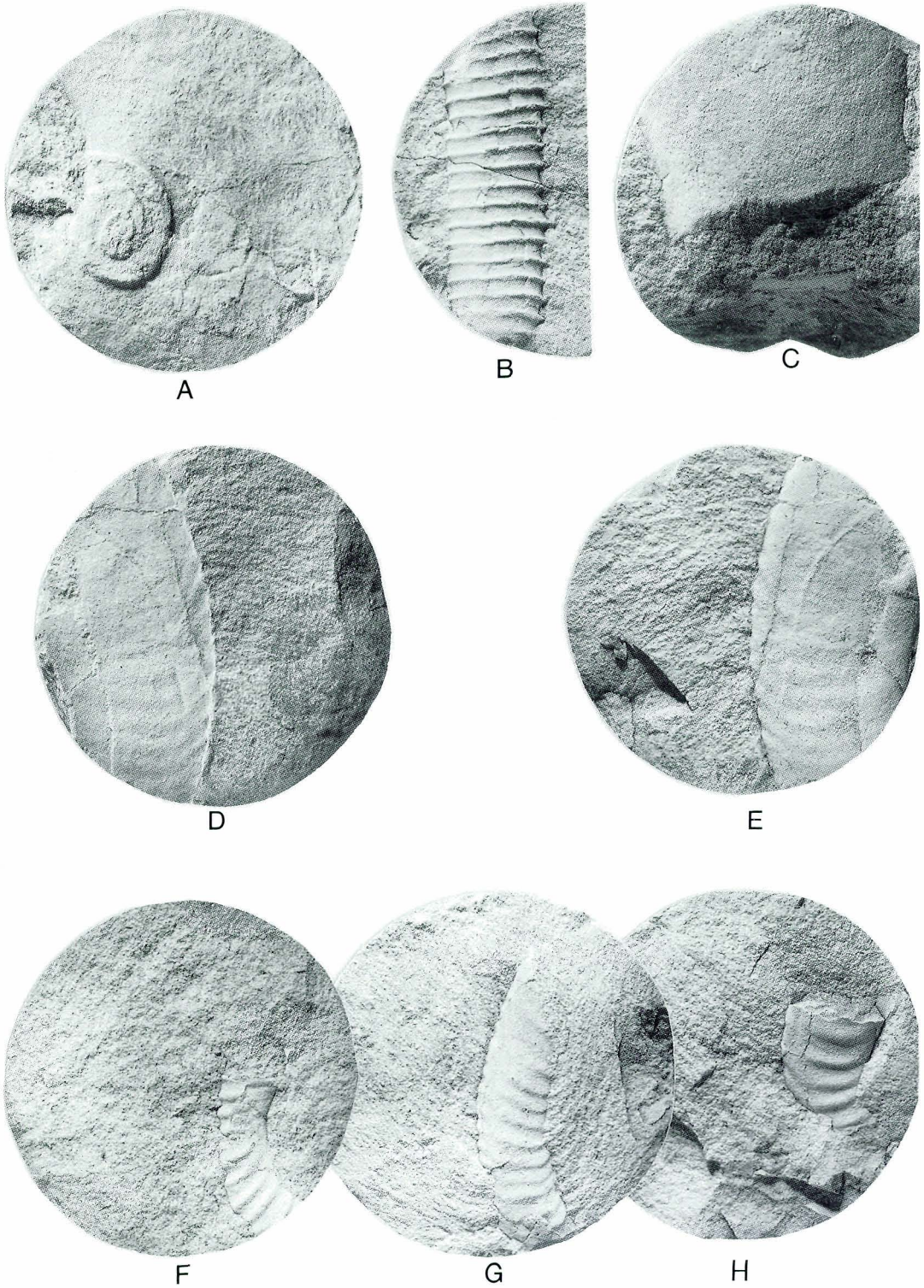


Fig. 2. A, *Hauericeras* cf. *pseudogardeni* (Schlüter, 1872) 433.84–433.86 m. B, *Scalarites* sp. 524.87–525.03 m. C, *Baculites* sp. 1, 338.70–338.74 m. D–H, *Boehmoceras krekekeri* (Wegner, 1905); D, E, 526.58–526.66 mm. F, 524.87–525.03 m. G, 530.11–530.13 m. H, 526.08–526.17 m.

Type species: *Ammonites gardeni* Baily, 1855, p.450, pl.11, fig. 3, by original designation.

Hauericeras cf. *pseudogardeni* (Schlüter, 1872)

Fig. 2A

compare:

1872 *Ammonites pseudogardeni* Schlüter, p.54, pl.16, figs. 3–6.

Description: The specimen is the composite mould of the umbilicus and part of a septate whorl, occupying the whole of the surface of the core, 55 mm in diameter. Coiling is very involute, the umbilicus very shallow, with a low, flattened wall and sharp umbilical shoulder. The flanks, so far as preserved, are flat, smooth, with traces of a deeply incised suture line of desmoceratacean type.

Discussion: Although rather unpromising, the Upper Santonian age of this specimen, suture, coiling, very shallow umbilicus and smooth shell surface suggest it to be a part of a *Hauericeras*, probably *H. pseudogardeni*. A faint radial ridge (corresponding to a groove on the surface of the internal mould) can be felt at one point on the surface, and this is a typical feature of the genus. We have been unable to trace the original of Schlüter's figure of the shell of this species (1872, pl.16, figs. 3, 4), but the specimen upon which he



Fig. 3. The lectotype of *Boehmoceras arculus* (Morton, 1834), in the collections of the Academy of Natural Sciences of Philadelphia, and from the 'older Cretaceous strata of Greene County, Alabama', that is to say, the Tombigbee Sand Member of the Eutaw Formation. All figures are $\times 1$.

based his illustrations of the suture (1972, pl.16, figs. 5, 6), from Dülmen, Westphalia, is in the collection of Geologisches und Paläontologisches Institut, Bonn (GAB48), and compares closely with the present fragment.

Occurrence: Köpingsberg borehole, 433.84–433.86 m. *H. pseudogardeni* has been recorded from both Upper Santonian and Lower Campanian, with records from northern England, Germany, European Russia, and the Crimea. *Hauericeras* cf. *pseudogardeni* is recorded from Ignaberga and Eriksdal by Birkelund & Bromley (1979), and from the Höllviken-2 borehole by Ødum (1953).

Suborder Ancyloceratina Wiedmann, 1966

Superfamily Turrilitaceae Gill, 1871

Family Diplomoceratidae Spath, 1926

Subfamily Diplomoceratinae Spath, 1926

Genus *Scalarites* Wright & Matsumoto, 1954

Type species: *Helicoceras scalare* Yabe, 1904, p.9, pl.3, fig. 2, by original designation

Scalarites sp.

Fig. 2B

Description: The single specimen shows all of the flank of one side of the shell, 55 mm long, with a maximum preserved whorl height of 18 mm. Ornament is of sharp, distant feebly prorsiradiate ribs that are weakened on the dorsum, but strengthen markedly on the venter, where some appear to be accentuated and flared; the rib index is 6.

Discussion: The present specimen compares closely in ribbing style with one of the specimens of *Crioceras sarta* Müller and Wolleemann, 1906 (pl.10, fig. 4), differing only in being straight rather than curved.

Occurrence: Köpingsberg borehole, 524.87–523.03 m.

Family Baculitidae Gill, 1871

Genus *Baculites* Lamarck, 1799

Type species: *Baculites vertebralis* Lamarck, 1801, p.80, by subsequent designation by Meek, 1876, p.391.

Baculites sp. group of *capensis* Woods, 1906

Fig. 4A

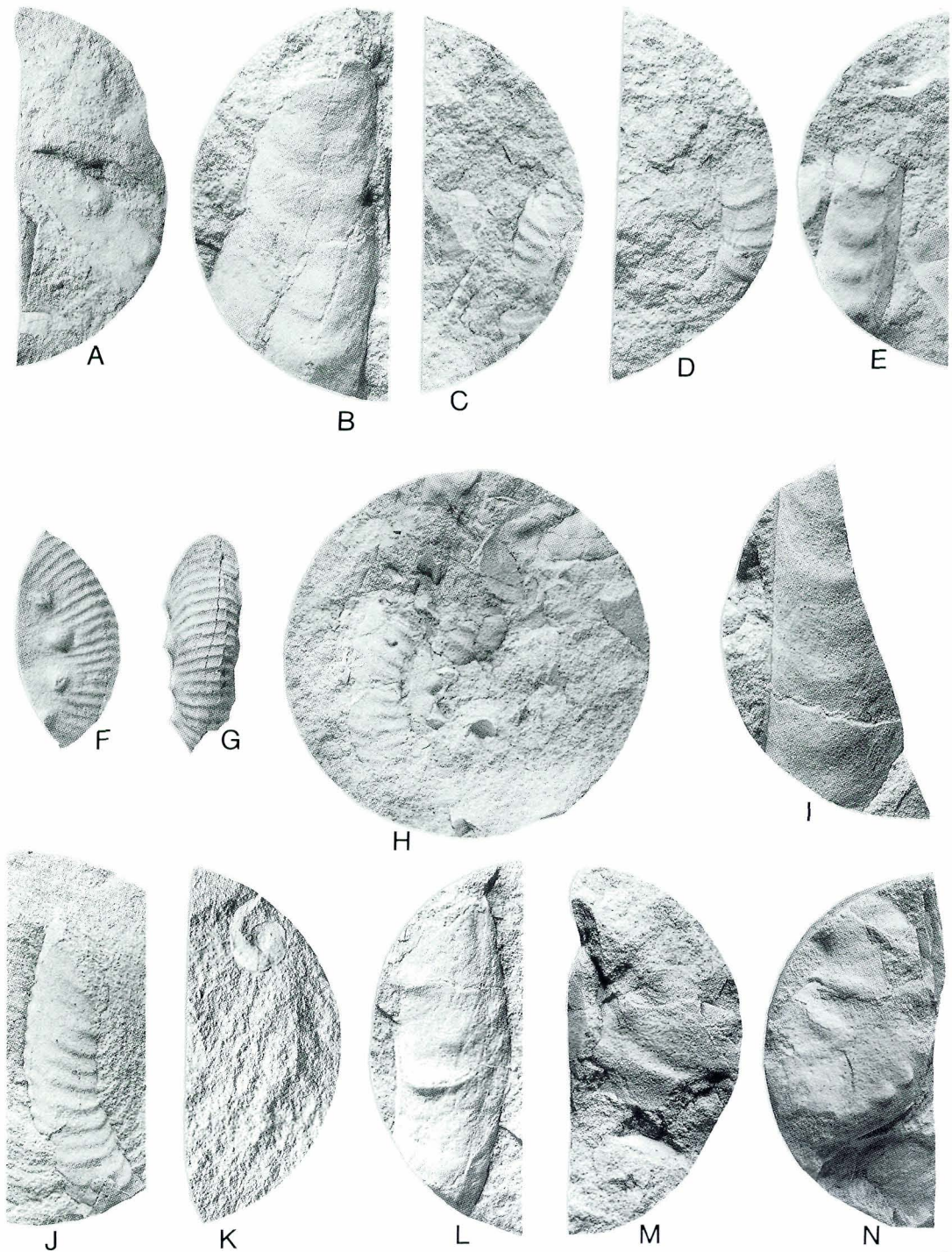


Fig. 4. A, *Baculites* sp., group of *capensis* Woods, 1906, 491.91–491.96 m. B, E, I, *Baculites* sp. 1; B, 341.68–341.71 m. E, 251.70–251.75 m. I, 251.70–251.75 m. C, D, H, J, *Boehmoceras krekeleeri* (Wegner, 1905); C, 525.18–525.29 m. D, 527.12–527.23 m. E, 251.70–251.75 m. H, 524.87–525.08 m. J, 530.11–530.13 m. F, G, M, N, *Scaphites* (*Scaphites*) *kieslingswaldensis fischeri* Riedel, 1931; F, G, 397 m. M, 561.13–561.16 m. N, 624.87–624.95 m. K, indeterminate juvenile ammonite. L, *Boehmoceras arculus* (Morton, 1834), 481.26–481.35 m. All figures are $\times 1$.

Discussion: Although *Baculites* are the commonest ammonites in the Köpingsberg borehole, the material is all poorly preserved, with only limited diagnostic features. Small specimens with conical dorsolateral nodes that give rise to feeble, rapidly effacing concave ribs on the middle and ventral parts of the flank most closely resemble the widely occurring Upper Coniacian to Lower Santonian *Baculites capensis* group (see discussion in Klinger & Kennedy, 1977, and Kennedy & Cobban, 1991).

Occurrence: Köpingsberg borehole, 251.70–251.75 m, 491.91–491.96 m, 524.87–525.03 m.

Baculites sp. 1
Figs. 2C, 4B, E, I

Discussion: A second, larger *Baculites* has a whorl height of up to 42 mm. The shell varies from smooth (Fig. 2C) to ornamented by widely separated crescentic dorsolateral ribs (Fig. 4I), and parallel growth striae (Fig. 4B).

Occurrence: This is the commonest ammonite in the Köpingsberg borehole and occurs at depths of 316.78–642.69 m.

Genus *Boehmoceras* Riedel, 1931

Type species: By subsequent designation by Wright, 1957, p.L220: *Ancyloceras krekeleri* Wegner, 1905, p.210, pl.8, fig. 2.

Boehmoceras krekeleri (Wegner, 1905)
Figs. 2D-H, 4C, D, H, J

- 1905 *Ancyloceras krekeleri* Wegner, p.210, pl.8, fig. 2
1931 *Boehmoceras krekeleri* (Wegner): Riedel, p.691, pl.77, figs. 3–5; pl.78, figs. 1, 2.
1979 *Boehmoceras krekeleri* (Wegner); Summesberger, p.118, pl.2, fig. 14; text-figs. 7, 8.
1983 *Boehmoceras* Kennedy & Wright, p.866.
1985 *Boehmoceras krekeleri* (Wegner); Schönfeld, pl.2, fig. 4.
1987 *Boehmoceras krekeleri* (Wegner); Kennedy, p.778, text-figs. 3a, b.

Types: These appear to be lost. They were from the Santonian of the Münster Basin, Germany.

Discription: Specimens consist of curved shafts with whorl heights of between 8 and 27 mm. On small specimens (e.g. Figs. 2F-H, 4C, D, J) ornament is of blunt, prorsiradiate concave ribs that are strongest on the dorsolateral flank, sweeping forwards and declining on the ventral flanks and strengthening over the venter, which is markedly crenulate in profile; the rib index is 4. In the largest specimen (Fig. 2D, E) the style of ornament is similar, but the ribs weaken and are much more crowded, with a rib index of 6 and occasional shorter intercalated ribs.

Discussion: The very even ribbing shows these specimens to be *Boehmoceras krekeleri*; *B. arculus* (Morton, 1834) (= *B. loescheri* Riedel, 1931, p.692, pl.78, figs. 3–6; see revision in Kennedy & Cobban, 1991, p.82, figs. 6:2, 8; 8:9-15, 18–22; 9:1, 2, 11–52; 10:20, 21, 24–26; 12:3, and Figs. 3 and 4L herein) differs in having coarse, distant crescentic dorsolateral bullae giving rise to one or more ribs, with the wide interspaces ornamented by numerous weaker intercalated minor ribs that strengthen markedly on the venter.

Occurrence: Upper Santonian, Recklinghäuser Mergel, *Marsupites/granulata* Zone of the Münster Basin, Germany. Upper Santonian 'sandsteinbank' of the Gosau Basin. In the Köpingsberg borehole, we have specimens from 524.74–524.78 m, 524.87–525.03 m, 525.18–525.29 m, 526.08–526.17 m, 526.58–526.66 m, 527.12–527.23 m, and 530.11–530.13 m.

Boehmoceras arculus (Morton, 1834)
Figs. 3, 4L

- 1834 *Hamites arculus* Morton, p.44, pl.15, figs. 1, 2.
1834 *Hamites arculus* var. A, Morton, p.45.
1937 *Boehmoceras löscheri* Riedel, p.692, pl.78, figs. 3–6.
1971 *Boehmoceras löscheri* Riedel; Ulbrich, pl.5, fig. 4.
1979 *Boehmoceras loescheri* Riedel; Summesberger, p.119, pl.2, figs. 15, 16, 18; text-figs. 9–12.
1983 *Boehmoceras* Kennedy & Wright, p.866.
1985 *Boehmoceras* sp., Kennedy, pl.2, fig. 1.
1985 *Boehmoceras loescheri* Riedel; Schönfeld, pl.2, fig. 6.

1987 *Boehmoceras loescheri* Riedel; Kennedy, p.777, pl.82, figs. 4-16; text-fig. 2.

1991 *Boehmoceras arculus* (Morton); Kennedy & Cobban, p. 182, figs. 6:2, 8; 8:9-15. 18-22; 9:1, 2, 11-52; 10:20, 21, 24-26; 12:3.

Types: Morton illustrated two specimens, and Richards (1968) refers to 2-5 cotypes (one missing) in the collections of the Academy of Natural Sciences of Philadelphia, and from the "older Cretaceous strata of Greene County, Alabama", that is to say the Tombigbee Sand Member of the Eutaw Formation. We here designate the cotype shown in Fig. 3 lectotype of the species.

Description: The specimen consist of a curved fragment 48 mm long, with a maximum preserved whorl height of 18 mm. Ornament consists of strong, concave, narrow, crescentic, distant dorsolateral bullae that give rise to a narrow rib that effaces across the ventral part of the flanks. The interspaces bear numerous minor ribs that are best developed on the venter, giving it a feebly crenulate appearance when viewed in profile.

Discussion: The present specimen differs in no significant respects from the lectotype (Fig. 3), and falls well within the range of variation documented by Kennedy & Cobban (1991). The very distant umbilicolateral bullae and numerous minor ribs between immediately distinguish it from the evenly ribbed *Boehmoceras krekeleri*, described above.

Occurrence: Upper Santonian *Texanites shiloensis* Zone in Mississippi, Alabama, and the Big Bend area of Texas in the USA, Upper Santonian Recklingshauser Mergel, *Marsupites/granulata* Zone of the Münster Basin, Germany (Schönfeld, 1985), but said to be longer-ranging in the Subhercynian Cretaceous Basin (Ulbrich, 1971). Assizes M² and N² in the Aquitaine Basin. Upper Santonian 'Sandsteinbank' of the Gosau Basin. In the Köpingsberg borehole we have a single specimen from 481.26-481.35 m.

Superfamily Scaphitaceae Gill, 1871

Family Scaphitidae Gill, 1871

Subfamily Scaphitinae Gill, 1871

Genus and Subgenus *Scaphites* Parkinson, 1811

Type species: *Scaphites equalis* J. Sowerby, 1813,

p.53, pl.18, figs. 1-3; by subsequent designation by Meek (1876, p.413).

Scaphites (Scaphites) kieslingswaldensis fischeri Riedel, 1931

Figs. 4F, G, M, N

1931 *Scaphites fischeri* Riedel, p.704, pl.79, figs. 5, 6.

1991 *Scaphites fischeri* Riedel: Kennedy & Christensen, p.222, pl.2, figs. 1, 2; pl.5, fig. 2; pl.6, figs. 2,3,4,7; pl.7, figs. 2,4.

Lectotype: The original of Riedel, 1931, pl.79, fig. 6, designated by Kennedy & Christensen, 1991, p.223.

Discussion: We recently described and discussed this species at length (1991, p.222). The present material consists of one well-preserved fragment of the early body chamber (Figs. 4F, G) and two fragments of the late body chamber (Figs. 4M, N).

Occurrence: Lower Santonian to Lower Campanian of the Münster Basin and elsewhere in Germany. It occurs in the Köpingsberg-1 borehole at 397 m, 561.13-561.6 m and 624.87-624.95 m.

Acknowledgements. We thank Dr. S. Laufeld, formerly at the Swedish Geological Survey, Uppsala, for allowing us to study the material from the Köpingsberg-1 borehole. Kennedy acknowledges the financial support of the Natural Environment Research Council (U.K.), and technical assistance of the staff of the Geological Collections, University Museum, Oxford, and Department of Earth Sciences, Oxford, UK. Christensen acknowledges the financial support of the Carlsberg Foundation.

Dansk sammendrag

Ammonitterne fra et 510 m interval i Köpingsberg-1 boringen i Vomb truget i Skåne beskrives. Faunaen består af følgende taxa: *Hauericeras* cf. *pseudogardeni*, *Scalarites* sp., *Baculites* sp. group of *capensis*, *Baculites* sp. 1, *Boehmoceras krekeleri*, *Boehmoceras arculus* og *Scaphites kieslingswaldensis fischeri*. Denne fauna er af Santonien alder og kendes bedst fra Tyskland. I Skandinavien er Santonien ammonitter sjældne bortset fra forekomsten på Bornholm.

References

- Anderegg H. J., Norling, E. & Skoglund, R. (1968): SGU oljegeologiska arbeten 1967-1968. *Sver. Geol. Unders., Rapport*, 8 pp.

- Baily, W. H. (1855): Description of some Cretaceous fossils from South Africa. *Q. Jl. geol. Soc. Lond.* 11, 454–465, pls. 11–13.
- Birkelund, T. & Bromley, R. G. (1979): *Hauericeras* cf. *pseudogardani* in the Upper Cretaceous of Ignaberga, Sweden. *Geol. Fören. Stockholm Förh.*, 101, 173–176.
- Chatzjemmaouil, J. P. (1982): The Upper Cretaceous of the Vomb Trough southern Sweden. Part I. Structure geology and sedimentology. Part II. Foraminiferal palaeoecology of the Coniacian and Santonian sequences and its application. *Stockh. Contr. Geol.* 38, 57–161.
- Christensen, W. K. (1986): Upper Cretaceous belemnites from the Vomb Trough in Scania. *Sver. Geol. Unders.* Ca 57, 57 pp.
- Fritsch, A. & Kafka, J. (1987): *Die Crustaceen der böhmischen Kreideformationen*. Selbstverlag, Prague, 53 pp.
- Gill, T. (1871): Arrangement of the Families of Mollusks. *Smithson. Misc. Collns.* 227, xvi + 49 pp.
- Grossouvre, A. de (1984): Recherches sur la craie supérieure, 2. Paléontologie. Les ammonites de la craie supérieure. *Mém. Serv. Carte géol. dét. Fr.*, 264 p., 39 pls. (misdated 1893).
- Hyatt, A. (1889): Genesis of the Arictidae. *Smithson. Contrib. Knowl.*, 673, xi + 239 pp. 14 pls.
- Kennedy, W. J. (1985): Ammonite faunas of the Coniacian, Santonian and Campanian stages in the Aquitaine Basin. *Géol. Méditerranéenne*, 10, 103–113.
- Kennedy, W. J. (1987): Ammonites from the type Santonian and adjacent parts of northern Aquitaine (western France). *Palaeontology*, 30, 765–782, pls 80–82.
- Kennedy, W. J. & Christensen, W. K. (1991): Coniacian and Santonian ammonites from Bornholm. *Bull. geol. Soc. Denmark*, 38, 203–226.
- Kennedy, W. J. & Cobban, W. A. (1991): Upper Cretaceous (upper Santonian) *Boehmoceras* fauna from the Gulf Coast region of the United States. *Geol. Mag.*, 128, 167–198.
- Klinger, H. C. & Kennedy, W. J. (1877): Upper Cretaceous ammonites from a borehole near Richards Bay, South Africa. *Ann. S. Afr. Mus.*, 72, 69–107.
- Kennedy, W. J. & Wright, C. W. (1983): Ammonites *polyopsis* Dujardin, 1837 and the Cretaceous ammonite family Placenticeratidae Hyatt, 1900. *Palaeontology*, 26, 855–873, pls. 85–87.
- Lamarck, J. P. B. A. de M. de (1799): Prodrôme d'une nouvelle classification des coquilles. *Mém. Soc. Hist. Nat. Paris*, (1799), 63–90.
- Lamarck, J. P. B. A. de M. de (1801): *Système des Animaux sans vertèbres*. The author; Deterville, Paris, vii + 432 pp.
- Matsumoto, T. (1938): A biostratigraphic study on the Cretaceous deposits of the Naibuchi Valley, South Karahuto. *Proc. Imp. Acad.* 14, 190–194.
- Matsumoto, T. & Obata, I. (1955): Some Upper Cretaceous Desmoceratids from Hokkaido and Saghalien. *Mem. Fac. Sci. Kyushu Univ.*, Series D, Geology, 5, 119–151, pls. 24–30.
- Meek, F. B. (1876): A report on the invertebrate Cretaceous and Tertiary fossils of the upper Missouri country. In Hayden, F. V. *Report of the United States Geological Survey of the Territories*, 9, 1xiv + 629 pp., 45 pls.
- Morton, S. G. (1834): *Synopsis of the organic remains of the Cretaceous groups of the United States. Illustrated by nineteen plates, to which is added an appendix containing a tabular view of the Tertiary fossils discovered in America*. Key and Biddle, Philadelphia, 88 pp., 18 pls.
- Müller, G. & Wolleemann, A. (1906): Die Molluskenfauna des Untersenon von Braunschweig und Ilse. II. Die Cephalopoden. *Abh. preuss. geol. Landesanst.*, 47, 1–30, pls. 1–11.
- Norling, E. (1982): Eriksdal (and adjacent Kullemölla valley). In Bergström, J. Holland, B., Larsson, K., Norling, E. & Sivhed, U. (eds): Guide to excursions in Scania. *Sver. Geol. Unders.* Ca. 54, 75–81.
- Ødum, H. (1953): De geologiska resultaten från boringarna vid Höllviken. V. The macro-fossils of the Upper Cretaceous. *Sver. Geol. Unders.* C 527, 37 pp.
- Parkinson, J. (1811): *Organic remains of a former world*, 3: J. Robson, London, 479 p.
- Riedel, L. (1931): Zur Stratigraphie und Faciesbildung im Oberemscher und Untersenon im Südrande des Beckens von Münster. *Jb. preuss. geol. Landesanst.* 51: 605–713, pls. 72–79.
- Rollier, L. (1922): Phylogenie des ammonites. *Ecol. geol. Helv.*, 17, 358–360, pls. 20–22.
- 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, 1–144 (121–264) + x, pls. 36–55 (1876).
- Schönfeld, J. (1985): Zur Lithologie, Biostratigraphie und Fossilführung des Ober-Santon Mergels von Westerwich (Östwestfalen). *Geol. Paläont. Westf.*, 5, 7–20, 2pls.
- Sowerby, J. (1812–1822): *The mineral conchology of Great Britain*. 1, pls. 1–9 (1812), pls. 10–44 (1813), pls. 45–78 (1814), pls. 79–102 (1815); 2, pls. 103–114 (1815), pls. 115–150 (1816), pls. 151–186 (1917), pls. 187–203 (1818), 3, pls. 204–221 (1818), pls. 222–253 (1819), pls. 254–271 (1820), pls. 272–306 (1821); 4, pls. 307–318 (1821), pls. 319–383 (1822). The author, London.
- Spath, L. F. (1926): On new ammonites from the English Chalk. *Geol. Mag.*, 63, 77–83, table.
- Summesberger, H. (1979): Eine obersanton Ammoniten fauna aus dem Becken von Gosau (Oberösterreich). *Ann. Naturhist. Mus. Wien*, 83, 275–283, 3 pls.
- Tomlin, J. R. U. B. (1930): Some preoccupied generic names – II. *Proc. malac. Soc. Lond.*, 19, 22–24.
- Ulbrich, H. (1971): Mitteilungen zur Biostratigraphie des Santon und Campan des mittleren Teils der Subherzynen Kreidemulde. *Freib. ForschHft.*, 267, 47–60, 5 pls.
- Wegner, T. (1905): Die Granulatenkride des westlichen Münsterlandes. *Z. dt. Geol. Ges.*, 57, 112–232, pls. 7–10.
- Wiedmann, J. (1966): Stammesgeschichte und system den post-triadischen ammonoideen; ein überblick. *Neues Jb. geol. Paläont. Abh.*, 125, 49–79, pls. 1–2; 127, 13–81, pls. 3–6.
- Woods, H. (1906): The Cretaceous fauna of Pondoland. *Ann. S. Afr. Mus.*, 4, 275–350, pls. 33–44.
- Wright, C. W. (1957): [Cretaceous Ammonoidea]. In Moore, R. C. (ed). *Treatise on Invertebrate Paleontology*. Part L, Mollusca 4, Cephalopoda Ammonoidea. xxii + 490 pp., New York and Lawrence, Geological Society of America and University of Kansas Press.
- Wright, C. W. & Matsumoto, T. (1954): Some doubtful Cretaceous ammonite genera from Japan and Saghalien. *Mem. Fac. Sci. Kyushu Univ. (D). Geol.*, 4, 107–134, pls. 7–8.
- Yabe, H. (1904): Cretaceous Cephalopoda from Hokkaido. Part II. *J. Coll. Sci. imp. Univ. Tokyo*, 20, 1–45, pls. 1–6.
- Zittel, K. A. von (1884): *Handbuch der Palaeontologie*. 1, Abt. 2; Lief 3, Cephalopoda, pp. 329–522. R. Oldenbourg, Munich & Leipzig.
- Zittel, K. A. von (1895): *Grundzüge der Palaeontologie (Palaeozoologie)*. R. Oldenbourg, Munich & Leipzig, vii + 972 pp.