Late Famennian (Devonian) Balviinae (Ammonoidea) from the Holy Cross Mountains, Poland

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ABSTRACT:


Five species of the Late Famennian family Balviinae Korn 2002, Effenbergia lens Korn, 1992, E. minutula Korn, 1992, Kenseyoceras nucleus (Schmidt, 1924), K. biforme (Schindewolf, 1937), and Balvia globularis (Schmidt, 1924), are described from the Holy Cross Mountains, Central Poland. The material comes from the “Wocklumeria Beds” of the Kowala, Ostrówka and Besówka sections, possibly from the Effenbergia lens – Parawocklumeria paradoxa zones and from the upper part of the Wocklumeria sphaeroides Zone – Epiwocklumeria applanata Subzone of the Late Famennian.

Key words: Ammonoidea; Balviinae; Late Devonian; Famennian; Holy Cross Mountains; Poland.

INTRODUCTION

The members of the goniatid subfamily Balviinae, belonging to the Late Devonian–Permian family Prionoceratidae, are known mainly from the Late Devonian Wocklumeria Zone. The appearance of Effenbergia lens (Korn) and other species of Effenbergia without ventrolateral furrows marks the base of the UD VI-B Zone (Becker 1996), whereas the appearance of Kenseyoceras nucleus (Schmidt), possessing ventrolateral furrows, indicates the base of the UD VI-C2 Zone (Becker et al. 2002). So far, representatives of the Balviinae have been reported from Germany (Schmidt 1924; Lange 1929; Schindewolf 1937; Bartsch and Weyer 1982; Korn 1992, 1994; Becker 1996; Becker and House 2000, etc.), England (Selwood 1960), Morocco (Korn 1999; Becker et al. 2002), Algeria (Peter 1959), China (Ruan 1981), the Ural Mountains, Russia (Bogoslovsky 1971; Nikolaeva and Bogoslovsky 2005), and from the Sudetes (Schindewolf 1937; Lewowocki 1959; Dzik 2006). In Poland, besides the Sudetes, a single species of the Balviinae (B. minutula Korn), was reported by Dzik (2006) from the Wocklumeria Genzone of the Holy Cross Mountains. Recent examination of the Jan Czarnocki Collection (housed at the Geological Museum of the Polish Geological Institute; collection number MUZ PIG 284.II.), comprising the material from the “Gonioctylmenia” and “Wocklumeria” beds of the Holy Cross Mountains, revealed, however, the presence of other Balviinae species [Effenbergia lens (Korn, 1992), Kenseyoceras nucleus (Schmidt, 1924), K. biforme (Schindewolf, 1937), Balvia globularis (Schmidt, 1924)], not previously recorded from that area. The taxonomic description and geographical discussion of these forms is the aim of the present paper.

MATERIAL

The Balviinae material in the Czarnocki Collection comes from the Kowala, Ostrówka and Besówka sections of the Gałęzice Syncline, located in the southern region of the Holy Cross Mountains (Text-fig. 1). The
The material comprises 25 well-preserved specimens. Where several specimens are registered under a single number in the collection; particular specimens are indicated herein by a small letter, which follows the main number.

Czarnocki never formally described and/or illustrated this material but, according to the original museum labels, he distinguished four new species: *Prionoceras discoideum* (284.II.385), *Pr. gałęzicensis* (284.II.334), *Pr. globosoideum* (284.II.333 and 728), and *Pr. nasutum* (284.II.727). Consequently, all these taxa are nomina nuda (Pajchlowa 1972 and Zwierz 1974). The specimens from Kowala, referred by Czarnocki to his new species *Pr. nasutum* (284.II.727), should be referred to *Kenseyoceras nucleus* (Schmidt, 1924) and *K. biforme* (Schindewolf, 1937), and those assigned by him to his new species *Pr. globosoideum* (284.II.728, 333), represent *K. biforme* and *Mimimitoceras fuerstenbergi* Korn. The specimens referred by Czarnocki to his new species *Pr. discoideum* (284.II.385) are assigned herein to *Effenbergia lens* (Korn), and his *Pr. gałęzicensis* (284.II.334) to *E. minutula* (Korn).

### STRATIGRAPHIC POSITION OF THE SPECIMENS INVESTIGATED

According to the original labels, the specimens come from the Upper Fammenian “Gonioclymenia Beds” and “Wocklumeria Beds” of the Kowala section, and from the “Gonioclymenia Beds” of the Ostrówka and Besówka sections (Text-fig. 2 and Table 1). With the exception of *B. prima* (Dzik 2006), all the species under discussion are known exclusively from the Wocklumeria Genozone (Table 1; see Becker, 1996; Korn 1992, 1994; Korn and Klug 2002).

There is a problem, however, with specimen 284.II.385, from the Kowala section, and specimen 284.II.334, from the Besówka section. The original labels

<table>
<thead>
<tr>
<th>Sections</th>
<th>Kowala</th>
<th>Ostrówka</th>
<th>Besówka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratigraphic position of samples according to the labels in the collection</td>
<td>“Wocklumeria Beds”</td>
<td>“Gonioclymenia Beds”</td>
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<tr>
<td>Ammonoid Zones (Becker and House 2000; Korn 2002)</td>
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<tr>
<td>Epiwocklumeria</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Conodont Zones: (Becker and House 2000) (Dzik 2006)</td>
<td></td>
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<tr>
<td>L.–M. praesulcata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasbergina trigonica</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>284.II.727</td>
<td>284.II.728</td>
<td>284.II.385</td>
</tr>
<tr>
<td><em>Sporadoceras terminus</em> Dzik</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Effenbergia lens</em> (Korn)</td>
<td></td>
<td>7</td>
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</tr>
<tr>
<td><em>Effenbergia minutula</em> (Korn)</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Kenseyoceras nucleus</em> (Schmidt)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>K. biforme</em> (Schindewolf)</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><em>Balvia globularis</em> (Schmidt)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Mimimitoceras fuerstenbergi</em> Korn</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><em>Epiwocklumeria applanata</em> (Wedekind)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Stratigraphic distribution of the studied species of Balviniae from the collection MUZ PIG 284.II. and their frequencies in samples
with these specimens indicate the “Gonioclymenia Beds” (both are from red nodular limestone). However, the other taxa from these localities [Kalloclymenia pessoides (von Buch), Liroclymenia sp., Kosmoclymenia undulata (Münster) and other clymenids], similarly labelled “Gonioclymenia Beds”, are invariably characteristic of the Wocklumeria and not the Gonioclymenia Genzone. Consequently, a Wocklumeria Beds age is accepted herein for both specimens. The erroneous assignment of fauna from the Wocklumeria Genzone to the “Gonioclymenia Beds” in the notes of Jan Czarnocki has already been mentioned by the editors of the posthumous edition of his clymenid paper (see Makowski and Pawłowska in Czarnocki 1989).

Out of the five specimens with number 284.II.728, preserved in grey nodular limestone, two belong to Kenseyoceras, while the remaining three represent Epiwocklumeria applanata Wedekind (Text-fig. 5M-P). The latter species is one of the most characteristic species of the middle part of the Upper paradoxa Zone or upper part of the Wocklumeria sphaeroides Zone (Korn 1995, 2000; Korn and Klug 2002; Becker and House 2002; Becker et al. 2002). Dzik (2006, fig. 223) located this species in the upper part of the Dasbergina trigonica conodont Zone.

The material belonging to number 284.II.727, preserved in grey nodular limestone, comprises representatives of the Balviinae and a single specimen of Sporadoceras terminus Dzik (Text-fig. 5K-L). This latter species was described originally from Kowala and Dzikowiec (Dzik 2006) and dated as possibly from the D. trigonica conodont Zone. The Balviinae species, Kenseyoceras nucleus (Schmidt), K. biforme (Schindewolf, 1937), and

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**Table: Kowala section (Czarnocki 1989)**

<table>
<thead>
<tr>
<th>Suite</th>
<th>Genzone</th>
<th>Sub-genzone</th>
<th>Species</th>
<th>Trench I</th>
<th>Linking eocene</th>
<th>Number of samples</th>
<th>Ammonoid assemblages</th>
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<tr>
<td>Cymaclymenia nigra</td>
<td>Wocklumeria</td>
<td>Upper</td>
<td>Wocklumeria sphaeroides, Wocklumeria plana, Epiwocklumeria applanata</td>
<td>2</td>
<td></td>
<td>284.II.727, 728</td>
<td>Cymaclymenia</td>
</tr>
<tr>
<td>Wocklumeria sphaeroides</td>
<td>Wocklumeria</td>
<td>Upper</td>
<td>Dimerclymenia semicostata Kielcensis bohdanowiczi bohdanowiczi</td>
<td>3</td>
<td></td>
<td></td>
<td>Parawocklumeria distorta (Tietze), P. distributa Czarnocki, Liroclymenia fundifera Czarnocki</td>
</tr>
<tr>
<td>Parawocklumeria paradoxa</td>
<td>Wocklumeria</td>
<td>Lower</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Kamtoclymenia endogona</td>
<td>Wocklumeria</td>
<td>Lower</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Effenbergia lens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Text-fig. 2. Stratigraphic position of the studied species in the Upper Famennian of the Kowala section (Trench I; after Czarnocki 1989, table 2, pp. 28–30)**
**Balvia globularis** (Schmidt), are known from the Para-
wocklumeria paradoxa and Wocklumeria sphaerooides
zones of Germany (Korn 1994, 2002; Becker 1996;
Becker and House 2000; Korn and Klug 2002) and from
the nucleus Zone of Morocco (Becker et al. 2002). They
are also known from the Kiya Section of the South Urals,
Russia (Nikolaeva and Bogoslovsky 2005).

**TAXONOMIC DESCRIPTION**

In the descriptions the following shell parameters
(given in millimetres) are used: dm – shell diameter;
wh – whorl height; ah – aperture height; ww – whorl
width; uw – umbilicus width.

*Mimimitoceras fuerstenbergi* Korn, 1992, which
represents the adult form from the Ostrówka section is
described to supplement the description of the embry-
onic form (see Dzik 2006, fig. 178).

Oder Goniatitida Hyatt, 1884
Suboder Tornoceratina Wedekind, 1914
Superfamily Prionocerataceae Hyatt, 1884
Family Prionoceratidae Hyatt, 1884
Subfamily Balviinae Korn in Korn and Klug, 2002

REMARKS: The subfamily Balviinae Korn (in Korn
and Klug, 2002) includes three genera: *Effenber gia*
Korn, 2002, *Kenseyoceras* Selwood, 1960 and *Balvia*
Lange, 1929 and at least eight species. The Balviinae
are characterized by small shells not exceeding
20 mm in diameter. The shells vary from discoid to at-
least globose, and the whorl sides bear distinct radial
constrictions, which are bent towards the aperture just
below the ventrolateral margin and on the venter.

Schmidt (1924) figured two new species, *Glatziella*
nucleus and *Gattendorfia globularis* from the Upper
Devonian of the Sauerland in Germany, without des-
ignating the holotypes of either species. Lange (1929)
discovered that *G. globularis* was quite distinct from
other *Gattendorfia* species and assigned it to a new sub-
genus, *Gattendorfia* (*Balvia*), whereas *Glatziella nu-
cleus* was placed by Schindewolf (1937) in the genus
*Prionoceras*, as with his new species *Prionoceras bi-
forme* Schindewolf, 1937. The species *G. globu-
laris* Schindewolf (1937) interpreted as a characteris-
tic member of the genus *Gattendorfia*. In 1960, two
species, *K. (Kenseyoceras) rostrata* Selwood (junior
synonym of *Prionoceras biforme* Schindewolf) and *K.
(Mayneoceras) nucleus* (Schmidt), which were earlier
referred by Schindewolf (1937) to the genus *Priono-
ceras*, were both placed by Selwood in the genus
*Kenseyoceras*. Selwood (1960), like Schindewolf
(1937), believed that *G. globularis* represented a true
*Gattendorfia*, and consequently regarded the subgenus
*Balvia* as a subjective synonym of *Gattendorfia*.

More recently, *Balvia* was treated by Korn (1992,
1994) as a separate genus, to which he referred
*Glatziella nucleus*, *Gattendorfia globularis* and *Priono-
ceras biforme*, as well as a number of his new
species. Subsequently, Becker (1996) placed Sel-
wood’s (1960) subgenera within the genus *Balvia*,
recognising: *Balvia (Kenseyoceras)*, *Balvia (Mayneo-
ceras)* and *Balvia (Balvia)*. Becker (1996) referred *P.
biforme* Schindewolf to *Balvia (Kenseyoceras)* and
the majority of known species of Balviinae to *Balvia*
(Mayneoceras); in *Balvia (Balvia)* only a single
species, *B. (B.) globularis* Lange, was recognised.
Later, Becker (2000, 2002) raised particular subgenera
to independent genera and, at the same time, Korn (in
Korn and Klug 2002) established a new subfamily
Balviinae Korn, to include: *Effenbergia* Korn, 2002,
*Kenseyoceras* Selwood, 1960 and *Balvia* Lange, 1929.
The Korn concept (in Korn and Klug 2002) is followed
herein.

The genus *Kenseyoceras* Selwood is used herein ac-
ording to its original definition by Selwood (1960). In
contrast to *Balvia Lange*, both *Effenber gia* Korn and
*Kenseyoceras* Selwood are in-volute. *Effenber gia*
differs from *Kenseyoceras* and *Balvia* in the absence of ven-
trolateral grooves, which in the latter two genera are
very conspicuous. Some of the species of *Effenber gia*
(e.g. *E. lens* and *E. obesa*), may have a slight keel,
bounded by poorly marked grooves, in the adult stage.

Genus *Effenber gia* Korn in Korn and Klug, 2002

**TYPE SPECIES:** *Balvia lens* Korn, 1992, p. 35, fig. 2A.

REMARKS: *Effenber gia* is separated from *Kenseyoceras*
and *Balvia* by the absence of ventrolateral grooves, which
in the latter two genera are very conspicuous.

*Effenber gia lens* (Korn, 1992)
(Text-figs 3A–E, I)

1992. *Balvia lens* sp. nov.; D. Korn, p. 35, fig. 2A.
33–34, pl. 1: 6–9
MATERIAL: MUZ PIG 284.II.385(a–g); 7 specimens (labelled as Prionoceras discoideum sp. n. Czarnocki, 1936).

DESCRIPTION: Shell discoid, with venter becoming sharper with ontogeny, resulting in a lenticular cross-section; typically, shells wider in diameter are flatter (see shell parameters). Umbilicus closed. Three constrictions per whorl, distinct on shell flanks and disappearing on the venter, bending forwards. Ventral keel indistinct, bounded by poorly marked grooves. Suture with deep and rounded ventral lobe. First lateral saddle rounded, passing into v-shaped first lateral lobe; second lateral saddle wide, of the same height as first lateral saddle.

OCCURRENCE: Holy Cross Mountains, Poland; uppermost Fammenian, *Effenbergia lens–Parawocklumeria paradoxa* zones.

*Effenbergia minutula* (Korn, 1992) (Text-figs 3F–H)

1992. *Balvia minutula* sp. nov.; D. Korn, p. 34, fig. 2C.

Shell parameters in *Effenbergia lens* (Korn, 1992)

<table>
<thead>
<tr>
<th>Specimen no.</th>
<th>dm</th>
<th>wh</th>
<th>ah</th>
<th>ww</th>
<th>uw</th>
<th>wh/dm</th>
<th>ah/dm</th>
<th>ww/dm</th>
<th>uw/dm</th>
</tr>
</thead>
<tbody>
<tr>
<td>284.II.385h</td>
<td>9.5</td>
<td>6.1</td>
<td>–</td>
<td>5.0</td>
<td>–</td>
<td>0.64</td>
<td>–</td>
<td>0.53</td>
<td>–</td>
</tr>
<tr>
<td>284.II.385c</td>
<td>11.4</td>
<td>7.0</td>
<td>2.2</td>
<td>5.3</td>
<td>–</td>
<td>0.61</td>
<td>0.19</td>
<td>0.46</td>
<td>–</td>
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<tr>
<td>284.II.385b</td>
<td>11.7</td>
<td>6.8</td>
<td>2.0</td>
<td>4.0</td>
<td>–</td>
<td>0.58</td>
<td>0.17</td>
<td>0.34</td>
<td>–</td>
</tr>
<tr>
<td>284.II.385a</td>
<td>12.8</td>
<td>7.6</td>
<td>–</td>
<td>5.0</td>
<td>–</td>
<td>0.59</td>
<td>–</td>
<td>0.39</td>
<td>–</td>
</tr>
<tr>
<td>284.II.727e</td>
<td>8.5</td>
<td>5.3</td>
<td>–</td>
<td>4.5</td>
<td>–</td>
<td>0.62</td>
<td>–</td>
<td>0.53</td>
<td>–</td>
</tr>
</tbody>
</table>

MATERIAL: MUZ PIG 284.II.334; 1 specimen (section between Besówka and Stokówka hills, labelled Prionoceras gałęzicensis sp. n. Czarnocki, 1936). MUZ 284.II.727k; 1 specimen (Kowala section, labelled Prionoceras nasutum sp. n. Czarnocki, 1936).

REMARKS: The specimen 284.II.334 was described and illustrated by Dzik (2006). It is supplemented by the 284.II.727k specimen, from Kowala.

OCCURRENCE: Holy Cross Mountains, Poland; uppermost Fammenian, Effenbergia lens–Parawocklumeria paradoxa zones.

Genus Kenseyoceras Selwood, 1960

TYPE SPECIES: Kenseyoceras (Kenseyoceras) rostrata Selwood, 1960, pp. 171–172, pl. 28, figs 4–10, text-fig. 5A (= Prionoceras biforme Schindewolf, 1937).

DIAGNOSIS: “Shell discoidal to subglobose, completely involute. Flanks marked by deep radial constrictions which swing forwards at the venter to form grooves bounding a median keel. Suture-line consists of a ventral saddle divided by a deep parallel-sided lobe, lateral lobe bell-shaped, passing into a gently arched lateral saddle.”

Shell parameters in Effenbergia minutula (Korn, 1992)

<table>
<thead>
<tr>
<th>Specimen no.</th>
<th>dm</th>
<th>wh</th>
<th>ah</th>
<th>ww</th>
<th>uw</th>
<th>wh/dm</th>
<th>ah/dm</th>
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<tbody>
<tr>
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<td>–</td>
<td>0.58</td>
<td>0.19</td>
<td>0.65</td>
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</table>

Text-fig. 4. Specimens of Kenseyoceras from Kowala and Besówka. A-C - Kenseyoceras nucleus (Schmidt, 1924), specimen MUZ PIG 284.II.727b, × 3.5; D-L – Kenseyoceras biforme (Schindewolf, 1937): D, H – specimen MUZ PIG 284.II.727a, × 2.8; E, I, J – specimen MUZ PIG 284.II.728b, × 2.8; F, G - specimen MUZ PIG 284.II.728a, × 3.8; K, L - specimen MUZ PIG 284.II.727g, × 4.5
**Kenceyoceras nucleus** (Schmidt, 1924)
(Text-figs 4A–C)

1924. *Glatziella nucleus* Schmidt; H. Schmidt, p. 119, pl. 6, figs 10, 10a.

1960. *Kenseyoceras* (Mayneoceras) *nucleus* (Schmidt); E.B. Selwood, p. 172, pl. 28, figs 11–17, text-figs 5b, 6.

1992. *Balvia nucleus* (Schmidt); D. Korn, p. 32, fig. 2E.

1994. *Balvia nucleus* (Schmidt); D. Korn, p. 33, pl. 24H–L.

1996. *Balvia* (Mayneoceras) *nucleus* (Schmidt); R.T. Becker, p. 34, pl. 3, figs 4, 5.


**MA TERIAL:** MUZ Pig 284.ii.727(b, e, j); three specimens (Kowala section; labelled *Prionoceras nasutum* sp. n. Czarnocki, 1936); j – incomplete.

**DE S CRI P TIO N:** Discoid shell, with flattened flanks. Umbilicus closed. Three constrictions on flanks; distinct, rounded keel bounded by grooves along entire length of venter of last whorl. Constrictions straight on flanks, bending forwards near venter, forming distinct but shallow grooves.

**OC CURR E NCE:** Holy Cross Mountains, Poland; uppermost Fammenian, *Epiwocklumeria applanata* Sub-zone.

**Kenseyoceras biforme** (Schindewolf, 1937)
(Text-figs 4D–L, 5A–B, E)


1960. *Kenseyoceras* (Kenseyoceras) *rostrata* sp. nov.; E.B. Selwood, p. 171–172, pl. 28, figs 4–10, text-fig. 5A.


**Shell parameters in Kenseyoceras nucleus** (Schmidt, 1924)

<table>
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<th>Specimen no.</th>
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<th>ah</th>
<th>ww</th>
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<td>0.23</td>
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**Shell parameters of Kenseyoceras biforme** (Schindewolf, 1937)

<table>
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<th>ah</th>
<th>ww</th>
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<td>284.II.727a</td>
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<td>2.46</td>
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<td>0.58</td>
<td>0.20</td>
<td>0.65</td>
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<td>6.9</td>
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<td>0.60</td>
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<td>284.II.727g</td>
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<td>4.3</td>
<td>1.7</td>
<td>4.7</td>
<td>–</td>
<td>0.59</td>
<td>0.23</td>
<td>0.64</td>
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<tr>
<td>284.II.727h</td>
<td>10.5</td>
<td>6.2</td>
<td>2.3</td>
<td>6.9</td>
<td>–</td>
<td>0.59</td>
<td>0.22</td>
<td>0.66</td>
<td>–</td>
</tr>
<tr>
<td>284.II.727i</td>
<td>8.6</td>
<td>5.8</td>
<td>1.5</td>
<td>6.2</td>
<td>–</td>
<td>0.67</td>
<td>0.17</td>
<td>0.72</td>
<td>–</td>
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<tr>
<td>284.II.728a</td>
<td>8.9</td>
<td>5.6</td>
<td>1.4</td>
<td>5.6</td>
<td>–</td>
<td>0.63</td>
<td>0.16</td>
<td>0.63</td>
<td>–</td>
</tr>
<tr>
<td>284.II.728b</td>
<td>11.7</td>
<td>7.7</td>
<td>2.4</td>
<td>9.0</td>
<td>–</td>
<td>0.66</td>
<td>0.21</td>
<td>0.77</td>
<td>–</td>
</tr>
</tbody>
</table>

**MATERIAL:** MUZ Pig 284.II.728(a, b); 2 specimens (Kowala section; labelled *Prionoceras globosoideum* sp. n. Czarnocki, 1936); MUZ 284.II.727(a, f, g, h, i) 5 specimens (Kowala section; labelled *Prionoceras nasutum* sp. n. Czarnocki, 1936).

**DE S CRI P TIO N:** Shells small, subglobose, 7 to 15 mm in diameter with very low, sub-rounded whorls, with slow height increase. Whorls slightly flattened on flanks, venter rounded and wide. Umbilicus slightly concave, punctose, closed in adult forms. Two to three distinct constrictions on the last third of the body chamber, curved backwards on the ventrolateral side, and forwards on the venter; contractions connected in longitudinal grooves bounding a raised keel. On flanks of last whorl the constrictions limited only to the keel area. In two specimens (284.II.728a and f), distinct constrictions are seen on the preceding whorl, underneath the last whorl with keel, with the same pattern as those on the body chamber, but disappearing on the venter (Text-fig. 6A).

**RE M AR KS:** Two distinct groups of morphotypes can be distinguished in *Kenseyoceras biforme*: a group with globose shells (ww/dm: 0.70–0.77), and a group with laterally compressed shells (ww/dm: 0.63–0.66). In most forms the keel length does not exceed one-third the length of the last whorl. Only in a few cases does the keel encompass half of the last whorl (284.II.728a, Text-fig. 4F, G), which may be linked with completeness of specimens. Due to this fact, *Kenseyoceras* (Mayneoceras) *sinuconstricta* Selwood with compressed shells, represent-
ing the second morphotype group, has been included in the synonymy of *Kenseyoceras biforme* (Schindewolf).

**OCCURRENCE:** Holy Cross Mountains; uppermost Fammenian, *Epiwocklumeria applanata* Sub-zone.

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**Text-fig. 5.** Specimens of *Kenseyoceras, Balvia, Sporadoceras* and *Epiwocklumeria* from Kowala and of *Mimimitoceras* from Ostrówka.  
Genus *Balvia* Lange, 1929

**TYPE SPECIES:** *Gattendorfia globularis* Schmidt, 1924, p. 120, pl. 6, figs 13, 13a.

**DIAGNOSIS:** Balviinae with acute lobes. Shell almost globose, evolute. Flanks marked by constrictions, which swing forwards at the venter to form grooves bounding a median keel.

*Balvia globularis* (Schmidt, 1924)  
(Text-fig. 5C, D)

1924. *Gattendorfia globularis* Schmidt; H. Schmidt, p. 120, pl. 6, figs 13, 13a  
1992. *Balvia globularis* (Schmidt); D. Korn, p. 32, fig. 2D.  
1996. *Balvia (Balvia) globularis* (Schmidt); R.T. Becker, p. 33.  
2006. *Balvia globularis* (Schmidt); J. Dzik, p. 245, figs 179M, 181.

**MATERIAL:** MUZ PIG 284.II.727c; 1 specimen (Kowala section; labelled *Prionoceras nasutum* sp. n. Czarnocki, 1936).

**DESCRIPTION:** Shell almost globose, with convex flanks and rounded venter. Umbilicus punctose, concave. Two constrictions visible, connected into longitudinal grooves bounding low and flattened keel on venter. Third constriction present on whorl beyond keel area.

**REMARKS:** From the morphologically similar *Kenseyoceras biforme* this species differs in the flattened low keel and the presence of constrictions beyond the keel area.

**OCCURRENCE:** Holy Cross Mountains, Poland; uppermost Fammenian, *Epiwocklumeria applanata* Subzone.

<table>
<thead>
<tr>
<th>Specimen no.</th>
<th>dm</th>
<th>wh</th>
<th>ah</th>
<th>ww</th>
<th>uw</th>
<th>wh/dm</th>
<th>ah/dm</th>
<th>ww/dm</th>
<th>uw/dm</th>
</tr>
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<tbody>
<tr>
<td>284.II.727c</td>
<td>12.2</td>
<td>7.5</td>
<td>2.4</td>
<td>8.7</td>
<td>–</td>
<td>0.61</td>
<td>0.20</td>
<td>0.71</td>
<td>–</td>
</tr>
</tbody>
</table>

Subfamily Prionoceratinae Hyatt, 1884

Genus *Mimimitoceras* Korn, 1988

**TYPE SPECIES:** *Mimimitoceras trizonatum* Korn, 1988, p. 607, text-figs 1a–d, 2.

*Mimimitoceras fuerstenbergi* Korn, 1992  
(Text-fig. 5F–J)

1992. *Mimimitoceras fuerstenbergi* sp. nov.; D. Korn, p. 32, fig. 1G.  
1994. *Mimimitoceras fuerstenbergi* Korn; D. Korn, p. 16, pl. 15C–E; 16A, B; 21B; 30C.  
2006. *Prionoceras fuerstenbergi* (Korn); J. Dzik, p. 243, fig. 178.

**MATERIAL:** MUZ PIG 284.II.333(a, b); 2 specimens (Ostrówka section; labelled *Prionoceras globosoideum* sp.n. Czarnocki, 1936).

**DESCRIPTION:** Shell almost globose, with wide and rounded venter and slightly flattened flanks; ww/dm: 0.78–0.80. Umbilicus concave and closed. Growth lines thin, slightly convex on flanks and venter; constrictions distinct only on flanks of whorls.

**REMARKS:** Dzik (2006) presented only a “larval (or embryonic)” form of this species from the Kowala section (his fig. 178I), whereas the species description (Dzik 2006, p. 243) does not fit the other specimens illustrated from the Dzikowiec section (his fig. 178C–G). This might have resulted from an erroneous caption to his fig. 178: the species illustrated as fig. 178C–G fits the description of *Prionoceras lentum* (Korn).

**OCCURRENCE:** Holy Cross Mountains, Poland; uppermost Fammenian, *Effenbergia lens–Parawocklumeria paradoxa* Zones.

**Jeanet Dzik**

Shell parameters of *Balvia globularis* (Schmidt, 1924)

<table>
<thead>
<tr>
<th>Specimen no.</th>
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<th>wh</th>
<th>ah</th>
<th>ww</th>
<th>uw</th>
<th>wh/dm</th>
<th>ah/dm</th>
<th>ww/dm</th>
<th>uw/dm</th>
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<tbody>
<tr>
<td>284.II.727c</td>
<td>12.2</td>
<td>7.5</td>
<td>2.4</td>
<td>8.7</td>
<td>–</td>
<td>0.61</td>
<td>0.20</td>
<td>0.71</td>
<td>–</td>
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</tbody>
</table>

Shell parameters of *Mimimitoceras fuerstenbergi* Korn, 1992

<table>
<thead>
<tr>
<th>Specimen no.</th>
<th>dm</th>
<th>wh</th>
<th>ah</th>
<th>ww</th>
<th>uw</th>
<th>wh/dm</th>
<th>ah/dm</th>
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<tbody>
<tr>
<td>284.II.333a</td>
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<td>2.4</td>
<td>9.5</td>
<td>–</td>
<td>0.65</td>
<td>0.20</td>
<td>0.79</td>
<td>–</td>
</tr>
<tr>
<td>284.II.333b</td>
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<td>6.7</td>
<td>2.7</td>
<td>8.6</td>
<td>–</td>
<td>0.61</td>
<td>0.25</td>
<td>0.78</td>
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</table>
Acknowledgements

I wish to thank Prof. Jerzy Dzik for his kind remarks and literature support. Dr. Dieter Korn and Dr. Svetlana N. Nikolaeva, the journal referees, are thanked for their constructive comments on the earlier version of the manuscript. Many thanks are due to B. Giblewska, for computer drawings, and to B. Ruszkiewicz, for photographs of fauna (both from the Polish Geological Institute). Anna Żylińska is also warmly thanked for linguistic corrections.

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