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LOWER CARBONIFEROUS OSTRACODES OF THE HOLY CROSS
MOUNTAINS, POLAND

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Forty four Tournaisian and Lower Viséan ostracode species from the SW Holy Cross Mts (Góry Świętokrzyskie) have been identified, including two new ones: *Graphiactylloideas slowikensis* sp.n. and *Microchettinella bushminae* sp.n. Their stratigraphic importance to the Upper Devonian and Lower Carboniferous, as well as their geographical distribution have been discussed.

Key words: Ostracoda, Lower Carboniferous, Poland.

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INTRODUCTION

The Carboniferous ostracodes of Poland have so far been little known, except for the ostracodes described from the deposits referred to the Tournaisian, Viséan and Namurian of NW Poland (Błaszyk and Natusiewicz 1973). As shown, however, by studies on the conodonts and spores (Matyja 1976; Turnau 1978), a part of these deposits belongs to the Devonian, whereas the Carboniferous strata are not later than the Viséan. A description of ostracodes from the Viséan deposits of SE Poland has been just published (Woszczyńska 1981).

The presence of ostracodes in the Carboniferous deposits of the Holy Cross Mts (Góry Świętokrzyskie) was mentioned several times in papers dealing with another fauna. The present writer found Lower Carboniferous ostracodes in a trench situated near the village of Kowala and in the Jabłonna IG-1 borehole in the SW Holy Cross Mts. This assemblage includes forty four species (Table 1). Some Upper Devonian and Lower Carboniferous species from the outcrops mentioned above have been described by the present writer in an earlier paper (Olempska 1979) including also remarks on their paleoecology. Thus, the present paper is limited only to a description of twenty-one species, including two new ones, whose occurrence in the Holy Cross Mts is restricted to the Carboniferous only (Table 1).

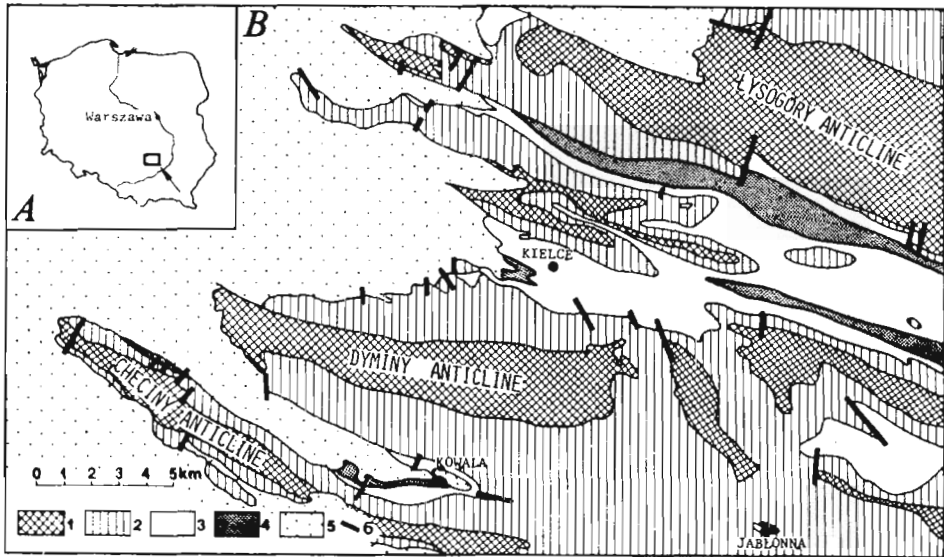


Fig. 1. A general map of Poland, B geological map of the Holy Cross Mts (after Czarnocki 1953, Szulczewski 1971, simplified); 1 Cambrian, Ordovician and Silurian, 2 Lower and Middle Devonian, 3 Upper Devonian, 4 Lower Carboniferous, 5 post-Variscan cover, 6 faults.

The collections of ostracodes here studied is housed at the Institute of Paleobiology, Polish Academy of Sciences (ZPAL), Warsaw.

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GEOLOGICAL REMARKS

Kowala. — The ostracodes of this locality come from a condensed profile of the Upper Devonian and Lower Carboniferous deposits whose stratigraphic-lithological characteristics were given first by Czarnocki (1928, 1933) and later by Żakowa (1967, 1970) who found, mostly on the basis of lithology, a gradual transition of the Devonian deposits into the Lower Carboniferous deposits. So far, only the trilobites (Osmólska 1962) were paleontologically elaborated and they determined the *Gattendorfia* Stage in this profile. Judging from the lithological characteristics of the strata containing the ostracodes here described and the trilobites (Osmólska 1962), it is most probable that they represent the same horizon.

Table 1

Ostracode stratigraphical ranges in the Upper Devonian and Lower Carboniferous of the Holy Cross Mts (Upper Devonian ostracodes after Olempska 1979)

| Species | SYSTEMS | DEVONIAN | CARBONIFEROUS | |
|--|-------------------|-------------------------|----------------------|-------------------|
| | Stages | Upper Famennian | Lower Tournaisian | Lower ? Viséan |
| | Conodont zones | Bispathodus costatus | Siphonodella | no data |
| <i>Coryellina tenuisulcata</i> OLEMPSKA | | | | |
| <i>Coryellina</i> sp. | | | | |
| <i>Amphissites</i> sp. | | | | |
| <i>Relicostus</i> sp. | | | | |
| <i>Knoxella</i> ? sp. | | | | |
| <i>Healdia antecodepressa</i> BLUMENSTENGEL | | | | |
| <i>Marginohealdia sobolevi</i> OLEMPSKA | | | | |
| <i>Bairdia</i> (<i>Rectobairdia</i>) sp. | | | | |
| <i>Processobairdia spinomarginata</i> BLUMENSTENGEL | | | | |
| <i>Processobairdia beckeri</i> OLEMPSKA | | | | |
| <i>Acrata</i> (<i>Acrata</i>) <i>clinata</i> BLUMENSTENGEL | | | | |
| <i>Coratacratia cerata</i> BLUMENSTENGEL | | | | |
| <i>Newsomites blessi</i> OLEMPSKA | | | | |
| <i>Microcheilinella</i> sp. | | | | |
| <i>Triconaria</i> (<i>Bohemina</i>) sp. | | | | |
| <i>Orthonaria crundeli</i> OLEMPSKA | | | | |
| <i>Coryellina sanctacrucensis</i> OLEMPSKA | | | | |
| <i>Marginohealdia</i> sp. | | | | |
| <i>Bairdia</i> (<i>Bairdia</i>) <i>nidensis</i> OLEMPSKA | | | | |
| <i>Acratia</i> (<i>Cooperina</i>) <i>rostrataformis</i> SCHEVTSOV | | | | |
| <i>Healdianella kieloesensis</i> OLEMPSKA | | | | |
| <i>Healdianella</i> aff. <i>hispidosa</i> GRÜNDEL | | | | |
| <i>Healdianella</i> sp. | | | | |
| <i>Proepilatina adamzaki</i> OLEMPSKA | | | | |
| <i>Ampuloides pumilus</i> OLEMPSKA | | | | |
| <i>Banckiria microspina</i> OLEMPSKA | | | | |
| <i>Rectonaria kowalensis</i> OLEMPSKA | | | | |
| <i>Rectoplicera cinnamomea</i> BLUMENSTENGEL | | | | |
| <i>Rectoplicera elliptica</i> BLUMENSTENGEL | | | | |
| <i>Rectoplicera</i> aff. <i>robusta</i> BLUMENSTENGEL | | | | |
| <i>Orthonaria rectagona</i> (GRÜNDEL) | | | | |
| <i>Triplacera triquetra</i> GRÜNDEL | | | | |
| <i>Aurigerites</i> aff. <i>texanus</i> SONNBY | | | | |
| <i>Aurigerites blumenstonaei</i> OLEMPSKA | | | | |
| <i>Pellerites</i> sp. 1 | | | | |
| <i>Amphissites blumenstongeli</i> GRÜNDEL | | | | |
| <i>Graphiactylloides slowikensis</i> sp. n. | | | | |
| <i>Bairdia</i> (<i>Rectobairdia</i>) <i>venteris</i> GRÜNDEL | | | | |
| <i>Bohlenatia banffensis</i> (GREEN) | | | | |
| <i>Acratia</i> (<i>Cooperina</i>) <i>cropei</i> GRÜNDEL | | | | |
| <i>Microcheilinella aculeata</i> BUSHMAN | | | | |
| <i>Microcheilinella bushmanae</i> sp. n. | | | | |
| <i>Necrateria trapezoidalis</i> GRÜNDEL | | | | |
| <i>Aurigerites</i> ? sp. 1 | | | | |
| <i>Zhivueila</i> sp. 1 | | | | |
| Ostracode indet. | | | | |
| <i>Healdia ratra</i> GRÜNDEL | | | | |
| <i>Bairdia</i> (<i>Bairdia</i>) <i>hypselae</i> ROMK | | | | |
| <i>Bairdia</i> (<i>Bairdia</i>) aff. <i>guliniae</i> ROMKOV | | | | |
| <i>Cerodis weyeri</i> GRÜNDEL | | | | |
| <i>Rectonaria inclinata</i> GRÜNDEL | | | | |
| <i>Rectonaria muelleri</i> GRÜNDEL | | | | |
| <i>Aurigerites obernitzensis</i> GRÜNDEL | | | | |
| <i>Healdiopsis thuringensis</i> GRÜNDEL | | | | |
| <i>Acratia</i> (<i>Cooperina</i>) aff. <i>rostrata</i> LANANA | | | | |
| <i>Necrateria</i> sp., 1 | | | | |
| Ostracode 2 GRÜNDEL | | | | |
| <i>Richterina</i> (<i>Richterina</i>) <i>unispinosa</i> OLEMPSKA | | | | |
| <i>Richterina</i> (<i>Richterina</i>) cf. <i>lenuistriata</i> (KUMMEROW) | | | | |
| <i>Maternella dichotoma</i> (PÄCKELMAN) | | | | |
| <i>Maternella hemisphaerica</i> (RICHTER) | | | | |
| <i>Richterina</i> (<i>Richterina</i>) <i>striatula</i> (RICHTER) | | | | |
| <i>Richterina</i> (<i>Richterina</i>) <i>latior</i> RABTEN | | | | |
| <i>Maternella stenachensis</i> GRÜNDEL | | | | |
| <i>Richterina</i> (<i>Richterina</i>) cf. <i> ampla</i> GRÜNDEL | | | | |
| Entomozoidae | | | | 7-? |

At Kowala, the Lower Carboniferous ostracodes were founds in a trench (trench II; cf. Olempska 1979) in two samples of light-green shales marked No. 113 and No. 114. They overlay deposits of limestones intercalated by shales which represent the upper part of the ostracode *Maternella dichotoma* — *Maternella hemisphaerica* Zone (samples 100 to

133, cf. Olempska 1979: Table 2) corresponding to the uppermost part of the Famennian. Conodonts of the *Siphonodella* Zone were identified by Dr. H. Matyja (oral communication) in samples 113 and 114. Unfortunately, a small number of specimens and a poor state of preservation of the conodonts precluded a possibility of determining precisely the age of the samples under study, as well as finding whether or not a complete stratigraphic continuity occurred in this profile. According to a Belgian zonation, the *Siphonodella* Zone corresponds to the Lower and Middle Tournaisian, from Tn 1b to Tn 2c (Groossens 1974).

The assemblage of ostracodes from the Tournaisian deposits of Kowala consists of thirty-six species, including fifteen which do not occur in samples from older deposits. The stratigraphic range of the remaining species also includes part of the Famennian (cf. Olempska 1979: Table 2).

In addition to benthic ostracodes of the orders Palaeocopida, Metacopida and Podocopida, samples 113 and 114 include pelagic entomozoids, *Richterina* (*Richterina*) *striatula*, *R. (R.) latior* and *Maternella steinachensis*, of which only *R. (R.) striatula* occurs also in the Devonian deposits. The stratigraphic range of the species *Richterina* (*Richterina*) *latior* in the areas of the Rhenish Slate Mts, Thuringia, and the Kama-Kinel Depression in the USSR is limited to the deposits of the *Gattendorfia* Stage, while *R. (R.) striatula* is also known from the deposits of both the *Wocklumeria* and *Gattendorfia* Stages (Rabien and Rabitz 1958; Blumenstengel 1959; Rabien 1960; Gründel 1961; Groos-Uffenorde and Uffenorde 1974; Tschigova 1977; Tschigova and Bouckaert 1977). *Maternella steinachensis* was found by Gründel (1961, 1963) in the deposits of the *Gattendorfia* and *Pericyclus* (cu I and II β/γ) in Thuringia and the southern margin of the Ruhr Region.

The benthic ostracode species occurring in this locality (Table 1), that is, *Amphissites blumenstengeli*, *Healdia ratra*, *Bairdia* (*Rectobairdia*) *venterba*, *Bohlenatia banffensis*, *Acratia* (*Cooperuna*) *cooperi*, *Necrateria trapezoidalis* and *Aurigerites obernitzensis* occur in Thuringia, East-European Platform and Canada also only in the deposits of the *Gattendorfia* Stage (Gründel 1961, 1962; Green 1963; Bushmina 1975). The occurrence of the benthic species mentioned above and the pelagic species *Richterina* (*Richterina*) *latior* seems to document the presence of the *Richterina* (*Richterina*) *latior* Zone, corresponding approximately to the range of the *Gattendorfia* Stage (Rabien 1960; Becker and Bless 1974), in the deposits examined.

Jabłonna. — In the Jabłonna IG-1 borehole, the Lower Carboniferous (Tournaisian and Lower Viséan) deposits, in which ostracodes have been found, occur at a depth of 59 to 22.30 m (Table 2). A detailed lithological and stratigraphic elaboration based on macrofauna and, partly, on conodonts is now being prepared (Chlebowski and Żakowa, in preparation; Szulczewski and Żakowa, in preparation).

Table 2
Ostracode distribution in the borehole Jabłonna IG-1

| Stratigraphy | | Tournaisian | | ?Lower Viséan | | | |
|--|---------|---------------|---------------|---------------|---------------|----------------------------|---------------|
| | | Lower | Upper | | | | |
| Species | Samples | 58,80 - 59,00 | 54,40 - 54,70 | 31,70 - 32,50 | 27,60 - 28,30 | 27,50 - 27,60 ^c | 22,30 - 23,80 |
| <i>Coryellina sanctacrucensis</i> | | + | | | | | |
| <i>Healdia ratra</i> | | | | + | + | | |
| <i>Healdiopsis thuringensis</i> | | | | + | + | | |
| <i>Bairdia (Bairdia) hypsela</i> | | + | | + | + | | + |
| <i>Bairdia (Bairdia) aff. galinae</i> | | | | | + | | + |
| <i>Bairdia (Rectobairdia) venterba</i> | | + | | | | | |
| <i>Acratia (Cooperuna) cooperi</i> | | + | | | | | |
| <i>Acratia (Cooperuna) aff. rostrata</i> | | | | | + | | |
| <i>Healdianella</i> sp. | | + | | | | | |
| <i>Gercodia weyeri</i> | | | | | + | | |
| <i>Bashkirina microspina</i> | | + | | | | | |
| <i>Rectonaria inclinata</i> | | + | | + | + | + | |
| <i>Rectonaria muelleri</i> | | | | | | + | |
| <i>Rectonaria kowalensis</i> | | + | | | | | |
| <i>Rectoplacera elongata</i> | | + | | | | | |
| <i>Necrateria</i> sp. | | | | | + | | |
| <i>Aurigerites obernitzensis</i> | | + | | | + | | |
| <i>Shivaeella</i> sp. | | + | | | | | |
| Ostracode 2 | | | | | + | + | + |
| <i>Richterina (Richterina) cf. ampla</i> | | | + | | | | |

The Lower Carboniferous deposits from Jabłonna IG-1 borehole are developed in the clayey-siliceous facies (radiolarites, claystones) with intercalations of micritic and organodetrital, marly limestones. The admixtures of tuff and tuffite intercalations in these deposits shows that they were accompanied by the volcanic activity (Chlebowski and Żakowa, in preparation). In Dr. Chlebowski's opinion (oral communication), the lithological data indicate here a sedimentary continuity of the highermost Famennian and lowermost Tournaisian. The assemblage of ostracodes described in the present paper comes mostly from calcareous intercalations. The Upper Devonian ostracodes from Jabłonna IG-1 borehole were formerly described by the present writer (Olempska 1979).

An assemblage of eleven species of ostracodes (Table 2) representing benthic forms only was found in the sample from the depth of 58.8—59 m of the deposits of the *Gattendorfia* Stage (Żakowa, oral communication). Four of them: *Bairdia* (*Rectobairdia*) *venterba*, *Acratia* (*Cooperuna*) *cooperi*, *Aurigerites* *obernitzensis* and *Shivaella* sp.1 do not occur in older deposits of the Jablonna profile. The four species mentioned above, together with the species occurring at Kowala, are also known in Thuringia only from the deposits of the *Gattendorfia* Stage (Gründel 1961, 1962). A single specimen of *Richterina* (*Richterina*) cf. *ampla*, a species described by Gründel (1963) from the cu II β/γ Zone (Upper Tournaisian) of the southern margin of the Ruhr Region was found in a sample from the depth of 34.40—34.70 m closely underlying the Upper Tournaisian deposits containing conodonts of the *Scalignathus anchoralis* Zone (Żakowa, oral communication). The stratigraphic range of this species has not so far been studied accurately. In the Rhenish Slate Mts, it was found in the deposits of the *Richterina* (*Richterina*) aff. *latior* Zone suggested by Becker and Bless (1974) as an equivalent of the Middle and Upper Tournaisian and part of the Viséan. Since *R. (R.) ampla* occurs in the deposits of Jablonna IG-1 borehole under those of the conodont *S. anchoralis* Zone, starting, according to the Belgian stratigraphic division, in the upper part of Tn 3 (the uppermost Tournaisian), we can presume that the samples from the depth of 34.40—34.70 m belong to the Upper Tournaisian.

In the samples of Viséan deposits (probably the Lower Viséan: Chlebowski and Żakowa, in preparation) coming from the depth of 32.50—22.30, there occurred the benthic ostracodes exclusively (Tables 1 and 2), only one form of which, described by Gründel (1971) from the Harz Mts as Ostracode 2, has so far been known only from the Viséan deposits, while the remaining species occurred in the Viséan and Tournaisian.

SYSTEMATIC PART

The abbreviations used: *C* carapace, *RV* right valve, *LV* left valve, *L* length, *H* height, *W* width.

Order **Palaeocopida** Hennigsmoen, 1953
 Superfamily **Primitiopsacea** Swartz, 1936
 Family **Rozhdestvenskaytidae** McGill, 1966
 Genus *Fellerites* Gründel, 1962

Fellerites sp.1

(pl. 5: 1)

Material. — Three poorly preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/1 | 0.76 | 0.51 | 0.32 |

Description.—Carapace truncate-oval in lateral outline. Dorsal margin long, straight, terminating in small auriculate processes. Ventral margin gently rounded. Maximum length halfway the height. Carapace slightly higher in the anterior than posterior part. Maximum width halfway the length. A thin, poorly visible marginal ridge stretches along the free margin. Surface of valves very finely pitted.

Remarks.—In the lateral outline of their carapaces, the specimens described are most closely related to *Fellerites bohlenensis* Gründel from the Lower Carboniferous of Thuringia (Gründel 1962: pl. 5: 1) from which they differs in smaller auriculate processes at the ends of the dorsal margin and a finely pitted surface. They also differ, in a smaller height and more elongated lateral outline of carapace, from *F. subsutus* Rozhdestvenskaya from the Lower Frasnian of Bashkiria (Rozhdestvenskaya 1972: pl. 13: 1) which is similar to them in the character of its surface.

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone).

Superfamily **Kirkbyacea** Ulrich and Bassler, 1906

Family **Amphissitidae** Knight, 1928

Genus *Amphissites* Girty, 1910

Amphissites blumenstengeli Gründel, 1962

(pl: 5: 2)

1961. *Amphissites* sp.; Gründel: 86, pl. 2: 2.

1962. *Amphissites (Amphissites) blumenstengeli* Gründel: 68, pl. 1: 10—12.

Material.—Twelve variously preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/2 | 1.06 | 0.58 | 0.61 |

Remarks.—*A. blumenstengeli* Gründel belongs to the group of species described by Blumenstengel (1970) which differ from each other only in small details of ornamentation. They occur in Europe and North America from the Middle Devonian through the Viséan.

Occurrence.—Poland (Holy Cross Mts.): Kowala, Tournaisian (*Siphonodella* Zone). GDR: Thuringia (*Wocklumeria* — *Gattendorfia* Stages).

Order **Metacopida** Sylvester-Bradley, 1961

Superfamily **Healdiacea** Harlon, 1933

Family **Healdiidae** Harlon, 1933

Subfamily **Healdiinae** Harlon, 1933

Genus *Healdia* Roundy, 1926

Healdia ratra Gründel, 1961

(pl. 5: 3)

1961. *Healdia ratra* Gründel: 101, pl. 5: 1—2.

1962. *Healdia ratra* Gründel: pl. 2: 1—2.

Material.—Seven variously preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/3 | 0.56 | 0.35 | 0.26 |

Remarks.—In the specimens from the Holy Cross Mts, a spine is mostly not preserved in the anterodorsal part of the right valve.

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone), Jabłonna IG-1 borehole, depths 31.70—32.50 m and 27.60—28.30 m; ?L. Viséan. GDR: Thuringia (*Gattendorfia* Stage).

Subfamily **Healdiopsinae** Gründel, 1962

Genus *Healdiopsis* Gründel, 1962

Healdiopsis thuringensis Gründel, 1962

(pl. 5: 4)

1961. *Healdia thuringensis* Gründel: 99, pl. 4: 3—5; pl. 14: 4.

1962. *Healdiopsis thuringensis* (Gründel); Gründel: 77, pl. 3: 1—5.

1963. *Healdiopsis thuringensis thuringensis* Gründel: 100, pl. 3: 7.

Material.—Three well preserved carapaces and two valves.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/4 | 1.29 | 0.69 | 0.59 |

Remarks.—The specimens of *H. thuringensis* from the Jabłonna IG-1 borehole have carapaces more elongated in lateral outline than those of the holotype of this species, but their dimensions are within limits of its L/H ratio presented by Gründel (1961: pl. 4: 5).

Occurrence.—Poland (Holy Cross Mts): Jabłonna IG-1 borehole, depths 31.70—32.50 m and 27.60—28.30 m. ?Lower Viséan. GDR: Thuringia. L. Carboniferous (*Gattendorfia* Stage). FRG: Rhenish Slate Mts, L. Carboniferous (*Pericyclus* Stage, cu II β — γ).

Superfamily **Quasillitacea** Coryell and Malkin, 1936

Family **Quasillitidae** Coryell and Malkin, 1936 emend. Henningsmoen, 1953

Genus *Graphiadactylloides* Green, 1963

Graphiadactylloides slowikensis sp.n.

(pl. 6: 1)

Holotype: ZPAL O.XVIII/5; pl. 6: 1.

Type horizon: Tournaisian, *Siphonodella* Zone.

Type locality: Kowala, Holy Cross Mountains, Poland.

Derivation of the name: after the name of the locality Slowik in the Holy Cross Mts.

Diagnosis.—A *Graphiadactylloides* with a strongly reticulate lateral surface of carapace, distinctly visible, smooth muscle scar and well developed posteroventral and anterior spines.

Material.—Fourteen well preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/5 | 1.26 | 0.61 | 0.51 |

Description.—Carapace subrhomboidal in lateral outline. Dorsal margin in a narrow depression. Ventral margin subrectilinear, slightly concave in its middle

part. Anterodorsal slope gently inclined, anterior margin uniformly rounded, posterior rounded in the dorsal and strongly truncate in the ventral part. Maximum length halfway the height, maximum height in the posterior part of carapace, maximum width at about two-thirds of length from the anterior end. Left, larger valve slightly overlaps the right along the free margin. A smooth muscle scar is situated in the middle part of valve. Surface most strongly reticulate in the posterior part of valve and in the middle part of the anterior end. The surface adjoining the anterior margin and the ventral part of carapace smooth. Long, posteriorly turned spines occur in the posteroventral part of valves. A narrow marginal flange surrounds the anteroventral margin reaching somewhat higher than halfway the height where it terminates in a small, erect spine present only in well preserved specimens.

Remarks.— *Graphadactylloides slowikensis* sp.n. displays a certain general similarity in its lateral outline and ornamentation of carapace to *Graphadactylloides* sp.B described by Green (1963: pl. 17: 13, not fig. 11), from which it differs, however, in an irregular ornamentation of its carapace. In the character of ornamentation, it is also related to *G.* sp.D (Green 1963: pl. 17: 10) and *G. paucituberculatus* Green (1963: pl. 17: 1—5) from which it differs in a lack of nodes along its posterodorsal and anteroventral margins.

Occurrence.— Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone).

Order **Podocopida** Müller, 1894
 Suborder **Cypridocopina** Jones, 1901
 Superfamily **Bairdiacea** Sars, 1888
 Family **Bairdiidae** Sars, 1888
 Genus *Bairdia* McCoy, 1844
 Subgenus *Bairdia* (*Rectobairdia*) Sohn, 1960
Bairdia (*Rectobairdia*) *venterba* Gründel, 1961
 (pl. 6: 3; pl. 7: 3)

1961. *Bairdia venterba* Gründel: 102, pl. 5: 3—5; pl. 14: 6.

Material.— Thirty-three variously preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/6 | 1.12 | 0.53 | 0.40 |
| ZPAL O.XVIII/7 | 0.90 | 0.48 | 0.32 |

Remarks.— In a general lateral outline of carapace and its flattening along the anterior and posterior margins, this species is related to *B. (R.) dorsoconstricta* Blumenstengel described from the lower and upper *P. gigas* Zone of the Harz Mts (Blumenstengel 1970) from which it differs in a posterodorsal part of carapace. *B. (R.) venterba* also displays a similarity in lateral outline to *B. (R.) calceolae* (Kummerow) from the *Calceola* Schiefer Zone of the Rhenish Slate Mts (Kummerow 1953) from which it differs in a lower situated posterior point. *B. (R.) venterba* is also related in a general outline of its carapace to *B. (R.) canigranulosa* McGill from the Upper Givetian Slave Point Formation of Canada (Province of Alberta) (McGill 1966) and to *Bairdia* sp. illustrated by Lethiers (1972: pl. 23: 20). Its granulose surface and lateral outline of carapace relate it also to *B. (Orthobairdia?) cf. granireticulata* Harlton (*sensu* Bushmina 1970), illustrated by Becker *et al.* (1974) from the Lower Tournaisian (Tn 1b) of the Ardeno-Rhenish Massif from which it differs in a stron-

ger flattening of carapace and a smaller sloping of hinge margin towards the posterior end.

Occurrence. — Poland (Holy Cross Mts): Kowala, Jabłonna IG-1 borehole, depth 58.80—59.00 m, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage).

Genus *Bohlenatia* Gründel, 1961
Bohlenatia banffensis (Green, 1963)
(pl. 6: 4)

1961. *Acratia* cf. *inornata* Cordell; Gründel: 108, pl. 7: 3—4.

1962. *Bohlenatia* cf. *inornata* (Cordell); Gründel: 88.

1963. *Acanthoscapha* ? *banffensis* Green: 152, pl. 12: 6—14.

1975. *Bohlenatia banffensis* (Green); Bushmina: 71, pl. 10: 1—2.

Material. — Three carapaces with their posterior ends broken off.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/8 | 1.06 | 0.40 | 0.32 |

Remarks. — Specimens of *B. banffensis* illustrated by Gründel (1961) have their dorsal margins more strongly sloping towards the posterior end than those of this species from other areas. It seems, however, that this difference may be considered as an intraspecific variability.

Occurrence. — Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage). USSR: Kolyma Massif, L. Tournaisian. Canada: Alberta, L. Carboniferous (Banff Formation).

Subfamily **Acratiinae** Gründel, 1962 emend. Kozur, 1971

Genus *Acratia* Delo, 1930

Subgenus *Acratia* (*Cooperuna*) Gründel, 1962

Acratia (*Cooperuna*) *cooperi* Gründel, 1962

(pl. 7: 4)

1961. *Acratia* aff. *mucronata* Cooper; Gründel: 110, pl. 7: 5—6; pl. 14: 10.

1962. *Acratia* (*Cooperuna*) *cooperi* Gründel: 87.

1963. *Acratia* (*Cooperuna*) *cooperi* Gründel: 102, pl. 1: 6.

Material. — Seventy-five mostly well preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|----------------|------|------|------|
| ZPAL O.XVIII/9 | 0.92 | 0.42 | 0.40 |

Remarks. — Specimens of *A. (C.) cooperi* from the Lower Carboniferous of Kowala differs from the holotype of this species in a smaller height in posterior part of carapace and less distinct sinus of ventral margin. The lateral outline of the carapace of *A. (C.) cooperi* is similar to that of *A. (C.) rostrata* Zanina (1956) from the Viséan of Moscow Basin from which this species differs in a lower situated maximum length of carapace.

Occurrence. — Poland (Holy Cross Mts): Kowala, Jabłonna IG-1 borehole, depth 58.80—59.00 m, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage). FRG: NW Harz (*Wocklumeria* Stage, Rhenish Slate Mts (*Pericyclus* Stage, cu II β — γ).

Acratia (Cooperuna) aff. rostrata Zanina, 1956

(pl. 6: 2)

Material. — One slightly compressed carapace.

Dimensions (in mm):

| | L | H |
|-----------------|------|------|
| ZPAL O.XVIII/10 | 1.35 | 0.53 |

Remarks. — In its lateral outline and dimensions of carapace, the specimen described is related to the largest extent to *A. (C.) rostrata* Zanina, from which it differs, however, considerably in its width. Due to a compression of the specimen from Jabłonna, its actual width cannot be measured accurately. *A. (C.) aff. rostrata* also displays a certain similarity in the lateral outline and dimensions of its carapace to *A. (C.) cooperi* Gründel, illustrated by Gründel (1963), from the cu II β — γ Zone of the Ruhr Region, from which it differs in a larger height of the anterior part of carapace.

Occurrence. — Poland (Holy Cross Mts): Jabłonna IG-1 borehole, depth 27.60—28.30 m, ? L. Viséan.

Family **Pachydomellidae** Berdan and Sohn, 1961Genus *Microcheilinella* Geis, 1933*Microcheilinella aculeata* Bushmina, 1975

(pl. 7: 2)

1975. *Microcheilinella aculeata* Bushmina: 44, pl. 2: 11.1975. *Microcheilinella* sp. no 3; Kotchetkova: pl. 3: 33.*Material.* — Three well preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/11 | 0.45 | 0.27 | 0.28 |

Remarks. — The presence of a spine in the posteroventral part of the right valve and the lateral outline of carapace relate *M. aculeata* Bushmina to *Microcheilinella* sp. 3, illustrated by Kotchetkova (1975). It is possible that they are conspecific.

Occurrence. — Poland (Holy Cross Mts.): Kowala, Tournaisian (*Siphonodella* Zone). USSR: Kolyma Massif, M. Viséan; S Urals, L. and U. Tournaisian.

Microcheilinella bushminae sp.n.

(pl. 7: 1)

Holotype: ZPAL O.XVIII/12; pl. 7: 1.*Type horizon:* L. Carboniferous, *Gattendorfia* Stage.*Type locality:* Kowala, Holy Cross Mts, Poland.

Derivation of name: In honour of Dr. Ludmila Bushmina, Soviet investigator of the Carboniferous ostracodes.

Diagnosis. — *Microcheilinella* with strongly convex posteroventral part of valves.*Material.* — Eight well preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/12 | 0.48 | 0.27 | 0.27 |

Description.—Carapace suboval in lateral outline. Dorsal and ventral margins straight. Hinge margin in a narrow depression. Anterior margin rounded, posterior slightly truncate in its upper part. Maximum length near the ventral margin. Maximum height halfway the length. Maximum width in the posterior end of carapace. Valves asymmetrical; the left, larger valve overlaps the right along the entire free margin, the largest extent of overlapping in the ventral part. Valves strongly convex in their posteroventral parts, the right valve more convex than left. Surface of valves smooth.

Remarks.—The species described differs from other known species of this genus in the posteroventral convexity of its valves.

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone).

Superfamily **Cytheracea** Baird, 1850
 Family **Rectonariidae** Gründel, 1962
 Genus *Necrateria* Gründel, 1962
Necrateria trapezoidalis Gründel, 1962
 (pl. 7: 5)

1962. *Triplacera (Necrateria) trapezoidalis* Gründel: 82, pl. 2: 13--15.

Material.—Eight variously preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/13 | 0.70 | 0.46 | 0.35 |
| ZPAL O.XVIII/14 | 0.92 | 0.50 | 0.38 |

Remarks.—As compared with specimens from Thuringia, those of *N. trapezoidalis* from the Holy Cross Mts display a smaller width of carapaces in relation to their length.

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage).

Necrateria sp.1
 (pl. 7: 6)

Material.—One carapace.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/15 | 0.79 | 0.58 | 0.38 |

Description.—Carapace subtrapezoidal in lateral outline. Dorsal and ventral margins subrectilinear. Anterior margin uniformly rounded, posterior almost vertically truncate. Hinge margin in a small depression. Maximum length somewhat below the midheight, height somewhat larger in the posterior part of carapace. The left, larger valve gently overlaps the right one along the free margin. A small spine occurs at the posterior end of carapace somewhat below the midheight on each valve. Surface smooth.

Remarks.—The form described differs from *N. trapezoidalis* Gründel, related to it in a similar lateral outline, in a considerably lower situated posterior spine.

Occurrence.—Poland (Holy Cross Mts): Jabłonna IG-1 borehole, depth 27.60—28.30 m, ? L. Viséan.

Family unknown
Genus *Aurigerites* Roundy, 1926
Aurigerites obernitzensis Gründel, 1962
(pl. 8: 7)

1962. *Aurigerites obernitzensis* Gründel: 75, pl. 2: 10—12.

Material. — Five carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/16 | 0.63 | 0.34 | 0.24 |

Remarks. — The specimens of *A. obernitzensis* from Jablonna differ from the holotype of this species in a somewhat more rectangular lateral outline and narrower carapace.

Occurrence. — Poland (Holy Cross Mts): Jablonna IG-1 borehole, depths 58.80—59.00 m and 27.60—28.30 m, Tournaisian — ? L. Viséan. GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage).

Aurigerites ? sp.
(pl. 8: 3)

Material. — Two carapaces, one of them partly damaged.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/17 | 0.62 | 0.42 | 0.32 |
| ZPAL O.XVIII/18 | 0.73 | 0.46 | 0.40 |

Description. — Carapace rectangular-rounded in lateral outline. Dorsal margin straight; hinge margin in a small depression. Ventral margin subrectilinear. Maximum length of carapace halfway the height. Height uniform over the entire length. Maximum width in the posterior part of carapace. Left, larger valve overlaps the right one along the entire free margin. Free margin of the left valve swollen. A ridge which, in the anterodorsal and posteroventral parts of carapace, is strongly swollen and forms a protruding point, occurs on valves almost parallel to the free and dorsal margins. Surface smooth.

Remarks. — The form described displays a certain general similarity to *A. blumenstengeli* Olempska, 1979 from which it differs in the presence of points on the concentric ridge, a more rectangular lateral outline of carapace and the lack of spine at the posterior and of the dorsal margin of the left valve.

Occurrence. — Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone).

Superfamily **Paraparchitacea** Scott, 1959
Family **Paraparchitidae** Scott, 1959
Genus *Shivaella* Sohn, 1972
Shivaella sp.1
(pl. 8: 8, 9)

Material. — Four variously preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/19 | 1.20 | 0.87 | 0.56 |
| ZPAL O.XVIII/20 | 1.46 | 1.06 | 0.72 |

Description.—Carapace subamplete in lateral outline. Dorsal margin long, straight; ventral rounded. Anterior margin uniformly rounded, posterior slightly truncate in the lower part. Maximum length halfway the height. Maximum height in the anterior part of carapace, close to midlength. Maximum width somewhat behind the midlength. Left, larger valve overlaps the right one along the free margin, particularly so in the ventral part. Right valve slightly projecting above the hinge margin. Carapace uniformly convex. A small spine occurs in the posterodorsal part of both valves just below the hinge margin. Surface of valves smooth.

Remarks.—In the very small dimensions of its posterodorsal spines, the form described is related to *S. microphthalmia* (Eichwald) from the Tournaisian of the Russian Platform (Eichwald 1860) from which it differs in a smaller carapace and a larger distance of the spines from the posterior than dorsal margin. Its lateral outline and distribution of its spines also relate *Shivaella* sp.1 to *S. niclesi* (Ulrich) from the Carboniferous of the USA from which it differs, however, in the situation of maximum height near the midlength of carapace.

Occurrence.—Poland (Holy Cross Mts): Kowala, Jablonna IG-1 borehole, depth 58.80—59.00 m, Tournaisian (*Siphonodella* zone).

Ostracode indet.

(pl. 8: 4)

Material.—Three poorly preserved carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/21 | 0.73 | 0.37 | 0.33 |

Description.—Carapace rectangular-rounded in lateral outline. Dorsal margin long, straight, ventral very slightly rounded. Maximum length halfway the height which is nearly uniform over the entire length. Maximum width halfway the length. A ridge forming a ringlike structure occurs along the free and dorsal margins. Surface of valves smooth.

Remarks.—The presence of a ridge which surrounds the whole valve makes the specimens described similar to the representatives of the genus *Nezamyslia* Přibyl, from which they differ, however, in a smooth surface of valves and in their ridge situated closer to the free margin.

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone).

Ostracode 2 Gründel, 1971

(pl. 8: 5)

Material.—Three carapaces.

Dimensions (in mm):

| | L | H | W |
|-----------------|------|------|------|
| ZPAL O.XVIII/22 | 0.67 | 0.40 | 0.32 |

Description.—Carapace subtrapezoidal in lateral outline. Dorsal and ventral margins straight. Anterior margin rounded, posterior strongly truncate in the upper part. Maximum length slightly below the midheight, height somewhat larger in the posterior part of carapace. Left, larger valve overlaps the right one along the entire free margin, to the largest extent in the ventral part. A small anterodorsal spine occurs on the margin of the left valve. Also small spines, situated symmetrically

on both valves, occur in the posterior part near the dorsal margin. Surface of valves smooth.

Remarks.—The presence of a ridge which surrounds the whole valve makes dorsal spine occurs only on the left valve which has not been mentioned in Gründel's (1971) description.

Occurrence.—Poland (Holy Cross Mts): Jablonna IG-1 borehole, depths 27.50—27.60 m and 22.30—23.80 m, ? L. Viséan. GDR.: Harz Mts, L. Viséan (cu II γ).

Order **Myodocopida** Sars, 1866
 Suborder **Entomozocopina** Gründel, 1969
 Superfamily **Entomozoacea** Přibyl, 1951
 Family **Entomozoidae** Přibyl, 1951
 Genus *Richterina* Gürich, 1896
 Subgenus *Richterina* (*Richterina*) Gürich, 1896
Richterina (*Richterina*) *latior* Rabien, 1960
 (pl. 8: 1)

1958. *Richterina* (*Richterina*) n.sp., aff. *striatula* Rabien: 178.

1959. *Richterina* (*Richterina*) n.sp., aff. *striatula* Blumenstengel: 68, pl. 1: 11.

1960. *Richterina* (*Richterina*) *latior* Rabien: 69, pl. 1: 1—4; pl. 2: 6—7.

1961. *Richterina* (*Richterina*) *latior* Rabien: Gründel: 123, pl. 11: 6.

1974. *Richterina* (*Richterina*) *latior* Rabien; Groos-Uffenorde und Uffenorde: 80, pl. 4: 5.

1977. *Richterina* (*Richterina*) *latior* Rabien; Tschigova: 105, pl. 14: 3.

Material.—Two valves.

Dimensions (in mm):

| | L | H |
|-----------------|------|------|
| ZPAL O.XVIII/23 | 0.50 | 0.43 |

Occurrence.—Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage). FRG: Rhenish Slate Mts, L. Carboniferous (*Gattendorfia* Stage). USSR: Kamsk-Kinel Depression, L. Carboniferous (*Gattendorfia* Stage).

Richterina (*Richterina*) cf. *ampla* Gründel, 1963
 (pl. 8: 6)

Material.—One partly damaged carapace.

Dimensions (in mm):

| | L | H |
|-----------------|------|------|
| ZPAL O.XVIII/24 | 1.05 | 0.64 |

Remarks.—The deformation of carapace precludes the possibility of its unequivocal identification, but a similarity to *R. (R.) ampla* is suggested by its taxonomic characters.

Occurrence.—Poland (Holy Cross Mts): Jablonna IG-1 borehole, depth 34.40—34.70 m, Tournaisian.

Genus *Maternella* Rabien, 1954
Maternella steinachensis Gründel, 1961
(pl. 8: 2)

1961. *Richterina (Maternella) steinachensis* Gründel: 128, pl. 12: 1
1963. *Maternella steinachensis* Gründel: 106, pl. 2: 7.

Material — Fifteen variously preserved valves.
Dimensions (in mm):

| | L | H |
|-----------------|------|------|
| ZPAL O.XVIII/25 | 0.50 | 0.41 |

Remarks. — In the character of the ornamentation of its valves this species is related to *M. rotundata* Tschigova from the Upper Famennian of the Russian Platform (Tschigova 1977). According to Tschigova, *M. rotundata* is marked by a more rounded lateral outline of its carapace. It seems, however, that these differences are very small and, in fact, *M. steinachensis* and *M. rotundata* may belong to the same species.

Occurrence. — Poland (Holy Cross Mts): Kowala, Tournaisian (*Siphonodella* Zone). GDR: Thuringia, L. Carboniferous (*Gattendorfia* Stage). FRG: Rhenish Slate Mts, L. Carboniferous (*Pericyclus* Stage, cu II β – γ).

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EWA OLEMPSKA

MAŁZORACZKI DOLNEGO KARBONU SW GÓR ŚWIĘTOKRZYSKICH

Streszczenie

Oznaczono 44 gatunki małzoraczków z turneju i dolnego wizenu SW Gór Świętokrzyskich. Dwa spośród nich są nowe, *Graphiadactylloides slowikensis* sp.n. i *Microcheilinella bushminae* sp.n. W niniejszym opracowaniu ograniczono się do opisu 21 gatunków, których okres występowania na obszarze Gór Świętokrzyskich ograniczony jest do utworów karbonu, pozostałe były opisane przez autorkę wcześniej (Olempska 1979). Opracowany materiał pochodzi z szurfów z Kowali i wiercenia Jabłonna IG-1.

Obecność szeregu gatunków bentonicznych oraz małzoraczków pelagicznych z rzędziny Entomozoidae dokumentuje (1) w Kowali i Jabłonie małzoraczkowy poziom *Richterina (Richterina) latior*, w przybliżeniu odpowiadający piętru *Gattendorfia*, oraz (2) w utworach karbonu w Jabłonie — poziom *Richterina (Richterina) aff. latior*, odpowiadający środkowemu i górnemu turnejowi oraz części wizenu.

EXPLANATION OF THE PLATES 5—8

Abbreviations used: RV right valve, LV left valve

Plate 5

1. *Fellerites* sp.1: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/1; ×45.
2. *Amphissites blumenstengeli* Gründel: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/2; ×45.

3. *Healdia ratra* Gründel: a RV lateral view, b ventral view; ZPAL O.XVIII/3; $\times 45$.
1—3 Kowala, Tournaisian (*Siphonodella* Zone)
4. *Healdiopsis thuringensis* Gründel: a RV lateral view, b dorsal view; ZPAL O.XVIII/4; $\times 45$, Jabłonna- borehole IG-1, depth 27.60—28.30 m, ? L. Viséan.

Plate 6

1. *Graphiadactylloides slowikensis* sp.n.: a RV lateral view, b LV lateral view, c dorsal view, d ventral view; holotype ZPAL O.XVIII/5; $\times 45$, Kowala, Tournaisian (*Siphonodella* Zone).
2. *Acratia* (*Cooperuna*) aff. *rostrata* Zanina: RV lateral view; ZPAL O.XVIII/10; $\times 45$, Jabłonna- borehole IG-1, depth 27.60—28.30 m, ? L. Viséan.
3. *Bairdia* (*Rectobairdia*) *venterba* Gründel: RV lateral view; ZPAL O.XVIII/6; $\times 45$.
4. *Bohlenatia banffensis* (Green): RV lateral view; ZPAL O.XVIII/8; $\times 45$.
Kowala, Tournaisian (*Siphonodella* Zone)

Plate 7

1. *Microcheilinella bushminae* sp.n.: a LV lateral view, b RV lateral view, c dorsal view, d ventral view; holotype ZPAL O.XVIII/12; $\times 45$.
2. *Microcheilinella aculeata* Bushmina: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/11; $\times 45$.
3. *Bairdia* (*Rectobairdia*) *venterba* Gründel: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/7; $\times 45$.
4. *Acratia* (*Cooperuna*) *cooperi* Gründel: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/9; $\times 45$.
5. *Necrateria trapezoidalis* Gründel: a RV lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/14; $\times 45$.
All from Kowala, Tournaisian (*Siphonodella* Zone)
6. *Necrateria* sp.1: a LV lateral view, b ventral view; ZPAL O.XVIII/15; $\times 45$, Jabłonna — borehole IG-1, depth 27.60—28.30 m, ? L. Viséan.

Plate 8

1. *Richterina* (*Richterina*) *latior* Rabien: lateral view; ZPAL O.XVIII/23; $\times 45$.
2. *Maternella steinachensis* Gründel: lateral view; ZPAL O.XVIII/25; $\times 45$.
3. *Aurigerites?* sp.1: a RV lateral view, b ventral view; ZPAL O.XVIII/17; $\times 45$.
4. Ostracode indet.: a lateral view, b dorsal view, c ventral view; ZPAL O.XVIII/21; $\times 45$.
Kowala, Tournaisian (*Siphonodella* Zone)
5. Ostracode 2 Gründel: a RV lateral view, b dorsal view; ZPAL O.XVIII/22; $\times 45$, Jabłonna — borehole IG-1, depth 27.60—28.30 m, ? L. Viséan.
6. *Richterina* (*Richterina*) cf. *ampla* Gründel: RV lateral view; ZPAL O.XVIII/24; $\times 37.5$, Jabłonna — borehole IG-1, depth 34.40—34.70 m, Tournaisian.
7. *Aurigerites obernitzensis* Gründel: a RV lateral view, b dorsal view; ZPAL O.XVIII/16; $\times 45$, Jabłonna — borehole IG-1, depth 27.60—28.30 m, ? L. Viséan.
8. *Shivaella* sp.1: a RV lateral view, b dorsal view; ZPAL O.XVIII/20; $\times 37.5$.
9. *Shivaella* sp.1: a LV lateral view; ZPAL O.XVIII/19; $\times 37.5$ Kowala, Tournaisian (*Siphonodella* Zone).

