Middle Frasnian (Devonian) ostracods from the Frasnes railway section (Dinant Synclinorium, Belgium); taxonomy, biostratigraphy, paleoecology

by Jean-Georges CASIER & Ewa OLEMPSKA

Abstract

Eighty-nine samples have been collected for ostracods, from the stratotypes for the upper part of the Moulin Liénaux Formation and the Grands Breux Formation, in the Frasnes railway section. Forty-seven taxa were recognised, of which 20 have been recorded for the first time in the Middle Frasnian (Devonian) of the Dinant Synclinorium (Belgium). The stratigraphic distributions of a series of already known species are stated more precisely. The investigated part of the section belongs to the Favulella lecomptei Zone. A new species, Bairdiacypris breuxensis nov. sp. is described. The ostracods present in the upper part of the Moulin Liénaux Formation and in the Grands Breux Formation belong exclusively to the Eifelian Mega-Assemblage and their distribution is principally controlled by the energy of the environment, linked to sea level fluctuations.

Keywords: Ostracods, Palaeoecology, Middle Frasnian, Devonian, Dinant Synclinorium, Belgium.

Introduction

A large number of ostracod species are known from the Frasnian of the type region (southern border of the Dinant Synclinorium, Belgium), but their stratigraphical distribution is poorly constrained. In order to define their ranges more precisely, we have begun the study of ostracods present in several classic reference sections, taking advantage of the recently re-examined lithostratigraphy of the Frasnian in the type locality, by the Belgian Subcommission on Devonian Stratigraphy (BOULVAIN et al., 1999). This paper presents the distribution of ostracods in the famous Frasnes railway section, which exposes the stratotypes for the upper boundary of the Moulin Liénaux Formation and the Grands Breux Formation.

The Frasnes railway section

The Frasnes railway section (Fig. 1) is located along the Couvin-Charleroi line (SNCB 134 line) at Frasnes, and on both sides of the bridge holding up the road connecting the N5 (Philippeville-Couvin) to Boussu-en-Fagne (GPS: N50°04'311; E4°30'381).

The Frasnes railway section has been briefly described and schematised in 1963 by LECOMPTÉ, and later studied for conodonts by MOURAVIEFF (1974), VANDELAER et al. (1989) and SANDBERG et al. (1992). In 1994, COEN-AUBERT described and schematised the Frasnes railway section in more detail.

This section was proposed as the stratotype for the Grands Breux Formation by COEN-AUBERT (1994), and has been confirmed as such by the Belgian Subcommission on Devonian Stratigraphy (see BOULVAIN et al., 1999).
The section is also the stratotype for the upper boundary of the underlying Moulin Liénaux Formation, established by BULTYNCK and MOURAVIEFF (in BOULVAIN et al., 1999).

The Frasnes railway section (Fig. 2) exposes the upper 4.4 m of greenish shales belonging to the Ermitage Member of the Moulin Liénaux Formation. Some calcareo-argillaceous nodules are present in the top of the member. The Ermitage Member is overlain by the Grands Breux Formation, which is subdivided into two members: the Bieumont Member and the Boussu-en-Fagne Member. The base of the Bieumont Member is composed of 14.5 m of well-bedded, greyish, massive limestones, becoming more argillaceous upward. The upper part of the Bieumont Member is composed of 24 m of shales, rich in limestone lenses and calcareo-argillaceous nodules. The Boussu-en-Fagne Member is about 80 m thick and consists mainly of greenish shales with calcareo-argillaceous nodules and some thin limestone lenses in the upper part. The overlying Neuville Formation and Matagne Formation are not studied herein.

Previous studies on ostracods in the Frasnes railway section

In 1977, CASIER recorded from the upper part of the Boussu-en-Fagne Member exposed in the Frasnes railway section: Cryptophyllus cf. materni (BASSLER & KELLETT, 1934), Uchtovia materni BECKER, 1971, Asturiella blessi BECKER, 1971, Hollinaeae indet., Favulella lecomptei BECKER, 1971, Polyvities rabiensi BECKER, 1971, Scrobicula capsa BECKER, 1971, Nodella sp., Urythella sp. and Aechminella sp. He also recorded “Kloedenia” dillensis (MATERN, 1929) in the base of the Late Frasnian Matagne Formation (not studied herein).

In 1982, CASIER recorded from the base of the Late Frasnian Matagne Formation Member exposed in the Frasnes railway section (not studied herein): Entomoprimitia (Entomoprimitia) concentrica (MATERN, 1929), E. (E.) sartenaeri CASIER, 1975, E. (E.) cf. nitida (ROEMER, 1850), E. (E.) aff. kayseri WALDSCHMIDT, 1885, Entomozoe (Nehdentomis) tenera GÜRICH, 1896, and Richterina (Volkmannii) zimmermanni VOLK, 1939.

Previous studies on Middle Frasnian ostracods in the type region

In the Boussu-en-Fagne Member, MATERN (1929) recorded from “Les Abannets” close to Nismes: Tetrasulcata fluens MATERN, 1929 (= ? Polyzygia neodevonica), Drepanellina laqueus MATERN, 1929 [reported by BECKER (1971) to the genus Plagionephrides], Dizygopleura neodevonica MATERN, 1929 (now ascribed to the genus Polyzygia), Eridoconcha rugosa ULRICH & BASSLER, 1923 [= Cryptophyllus materni (BASSLER & KELLETT, 1934)], Beyrichia n. sp. A (an indeterminable ostracod) and Bolilia belgica MATERN, 1929.


Finally, CASIER (1977) recorded from the Boussu-en-Fagne Member exposed formerly in the Ermitage path at Boussu-en-Fagne: Healdianella? sp. B, Plagionephrides
Fig. 2 — Lithological column of the upper part of the Moulin Liénaux Formation (Ermitage Member) and of the Grands Breux Formation (Bieumont Member and Boussu-en-Fagne Member). For the position of samples, see tables where their height from the bases of members is indicated.

Material and methods

Seven samples of approximately 500 g each and numbered CFF-1 to 7 were collected in the upper part of the Moulin Liénaux Formation exposed on the western flank of the trench. Eighty-two samples of the same weight and numbered CFF-8 to 80 and CFF-100 to 110 were collected in the Grands Breux Formation. Samples CFF-1 to 80 have been collected on the western flank of the trench, and samples CFF-100 to 109 on the eastern flank of the trench because the view of a part of the section is blocked by a wall. Carbonate rocks have been selected except in the top of the Moulin Liénaux Formation which is principally argillaceous. All the samples were crushed by a hydraulic press, and samples CFF-1 to 4 and CFF-7 collected from shales were directly sieved on 100 μm, 250 μm and 1600 μm mesh screens. About 100 g of each of the other samples collected from limestone or from argillaceous limestone were attacked with 99.8% glacial acetic, at nearly 90°C, generally for four days at a rate of eight hours a day. This mode of extraction called hot acetolysis method has been described by LETHIERS & CRASQUIN-SOLEAU (1988). The residue was sieved on 100 μm, 250 μm and 1600 μm mesh screens. For samples containing ostracods after this first process, that part of the sample retained by the 1600 μm mesh screen was again attacked by acid and sieved on 250 μm and 1600 μm mesh screens only. About 1400 carapaces, valves and fragments of ostracods identifiable at any taxonomic level were thus extracted, 230 in the Ermitage Member of the Moulin Liénaux Formation, 950 in the Bieumont Member and 220 in the Boussu-en-Fagne Member of the Grands Breux Formation.

In the Bieumont Member ostracods are absent in samples CFF-33 (10.6 m from the base of the member), 34 (11 m), 42 (13.9 m), 43 (14.3 m), 44 (14.7 m), 45 (15.4 m), 46 (16.1 m), 47 (16.5 m) and 100 (36 m). Ostracods are rare and unidentifiable in samples CFF-16 (4.4 m), 31 (10 m), 52 (20.7 m), 53 (22.3 m), 58 (29.4 m), and 59 (30.2 m). In the Boussu-en-Fagne Member ostracods are absent in samples CFF-101 (2.0 m from the base of the member), 104 (11.5 m), 105 (14.5 m), 106 (17.2 m), 62 (35.2 m), 64 (38.2 m), 66 (42.0 m), 69 (47.9 m) and 80 (78.1 m). Ostracods are rare and unidentifiable in samples 109 (28.0 m), 71 (53.9 m), and 79 (76.1 m). Ostracods are abundant only in six samples collected in the Ermitage Member (CFF-6) and in the Bieumont Member (CFF-10, 22, 24, 25, 27).

Systematic list of identified ostracod taxa

Suborder Palaeocopina HENNINGSMOEN, 1953
Superfamily Kirkbyoidea ULRICH & BASSLER, 1906
Family Amphissitidae KNIGHT, 1928
Amphissites cf. parvulus (PAECKELMANN, 1913)
   Pl. 1, Fig. 1

Hollinella (Keslingella) lonica BECKER & BLESS, 1971
   Pl. 1, Fig. 2a-b

Family Scrobiiculidae POSNER, 1951
Scrobicula capsa BECKER, 1971
   Pl. 1, Fig. 4a-b

Family unknown
Hollinoidea indet.
   Pl. 1, Fig. 5

Superfamily Youngielloidea KELLETT, 1933
Family Youngiellidae KELLETT, 1933
Youngiella sp. F5 in MAGNE (1964),
   Pl. 1, Fig. 6a-b

Superfamily Primitiopsoidea SWARTZ, 1936
Family Urfiellidae BECKER, 1970
Urfiella? sp. B
   Pl. 1, Fig. 7

Superfamily unknown
Family Aechminellidae SOHN, 1961
Balantoides cf. minima (LEHTIERS, 1970).
   Pl. 1, Fig. 8

PI. 1, Fig. 1
PI. 1, Fig. 2a-b
PI. 1, Fig. 3
PI. 1, Fig. 4a-b
PI. 1, Fig. 5
PI. 1, Fig. 6a-b
PI. 1, Fig. 7
PI. 1, Fig. 8
Family Kirkbyellidae SOHN, 1961

Refrathella sp. A
Pl. 1, Fig. 9a-b

Suborder Paraparchiticopina GRAMM in GRAMM & IVANOV (1975)
Superfamily Paraparchitoidea SCOTT, 1959
Family Paraparchitidae SCOTT, 1959
Paraparchites sp. A
Pl. 1, Fig. 10a-b

Samarella sp. B
Pl. 1, Fig. 11

Suborder Platycopina SARS, 1866
Superfamily Kloedenelloidea ULRICH & BASSLER, 1908
Family Kloedenellidae ULRICH & BASSLER, 1908
Uchtovia materni BECKER, 1971
Pl. 1, Figs 12a-b, 13

Family Cavellinidae EGOROV, 1950
Cavellina? sp. indet.
Pl. 1, Fig. 14

Suborder Platycopina SARS, 1866?
Superfamily unknown
Famille Geisinidæ SOHN, 1961
Hypotetragona tremula BECKER, 1971
Pl. 1, Fig. 15a-b

Suborder Metacopina SYLVESTER-BRADLEY, 1961
Superfamily Healdioidea HARLTON, 1933
Family Healdidæ HARLTON, 1933
Cytherellina sp. A
Pl. 1, Fig. 16a-b

Cytherellina? sp. B
Pl. 1, Fig. 17

Superfamily Thlipsuroidea ULRICH, 1894
Family Thlipsuridæ ULRICH, 1894
Polyzygia neodevonica (MATERN, 1929)
Pl. 1, Figs 18, 19

Polyzygia neodevonica aragonensis GOZALO & SANCHEZ DE POSADA, 1986
Pl. 1, Fig. 20

Favulella lecomptei BECKER, 1971
Pl. 2, Figs 1a-b, 2

Favulella lecomptei spissa ŻBIKOWSKA, 1983
Pl. 2, Fig. 3

Family Bufinidae SOHN & STOVER, 1961
Punctomosea weyanti BECKER, 1971
Pl. 2, Figs 6a-b, 7a-b

Punctomosea weyanti spiny subsp.
Pl. 2, Fig. 8a-b

Family Quasillitidae CORYELL & MALKIN, 1936
Jenningsina lethiersi BECKER, 1971
Pl. 2, Fig. 9

Svantovites magnei BECKER, 1971
Pl. 2, Figs 10, 11a-b

Family Ropolonellidae CORYELL & MALKIN, 1936
Plagionephrodes laqueus (MATERN, 1929)
Pl. 2, Figs 12, 13a-b

Superfamily Thlipsuroidea ULRICH, 1894?
Family unknown
Asturiella blessi BECKER, 1971
Pl. 2, Fig. 4a-b

Asturiella blessi spiny subsp.
Pl. 2, Fig. 5

Suborder Podocopina SARS, 1866
Superfamily Bairdiocypridoidea SHAVER, 1961
Family Bairdiocypridæ SHAVER, 1961
Healdianella sp. A in BECKER (1971)
Pl. 2, Fig. 14a-b

Healdianella? sp. indet.
Pl. 2, Fig. 15a-b

Bairdiocypris sp. 5 in MAGNE (1964)
Pl. 2, Fig. 16a-b

Bairdiocypris sp. A
Pl. 2, Fig. 17

Bairdiocypris sp. B
Pl. 2, Fig. 18a-b, Pl. 3, Figs 1, 2

Family Bairdiocypridæ SHAVER, 1961?
Orthocypris sp. A in BECKER (1971)
Pl. 3, Fig. 3a-b
Description of a new Bairdiacypris Bradfield, 1935

Bairdiacypris breuxensis nov. sp.

Pl. 3, Figs 14a-b, 15, 16

Derivatio nominis
From the Grands Breux Formation.

Types
Holotype: Carapace (Pl. 3, Fig. 14a-b), CFF-10, Bieumont Mbr., IRScNB n° b4918, L = 0.81 mm; H = 0.47 mm; W = 0.29 mm. Paratype A: Carapace (Pl. 3, Fig. 15), CFF-76, Boussu-en-Fagne Mbr., IRScNB n° b4919, L = 0.67 mm; H = 0.41 mm; W = 0.27 mm. Paratype B: Carapace (Pl. 3, Fig. 16), CFF-68, Boussu-en-Fagne Mbr., IRScNB n° b4920, L = 0.78 mm; H = 0.46 mm; W = 0.31 mm.

Locus typicus
Frasnes railway section, Belgium.

Stratum trypicum
Middle Frasnian. Devonian. Grands Breux Formation.

Material
12 carapaces and several valves.

Diagnosis
Species of Bairdiacypris with strongly asymmetrical valves. Dorsal border of the right valve long and straight forming a 145° angle with the straight antero-dorsal border. In right lateral view, left valve of adult highly prominent in the postero-ventral sector.

Description
Middle sized, preplete Bairdiacypris with very asymmetrical valves. Dorsal and anterior borders of the carapace regularly rounded. Posterior border of juveniles regularly rounded becoming slightly angular in adults. Ventral border of juveniles straight becoming slightly concave in adults. Great length at mid-height and great height generally before the mid-length. Right valve smaller comparatively to the left, with the dorsal and the antero-dorsal borders straight and forming a 145° angle. Anterior border of the right valve well rounded in the anterior and antero-ventral sectors. Posterior border of right valve well rounded, and ventral border slightly concave. In right lateral view, left valve of adult highly prominent in the postero-ventral sector. In dorsal view, elliptic with the great width at mid-length, and contact of valves sinuous. Carapace smooth.
Remarks
Bairdiacypris breuxensis nov. sp. is not so elongate compared to the majority of species belonging to this genera. B. breuxensis is distinguishable from all other species belonging to the genus by the character of the diagnosis.

Occurrence
Bairdiacypris breuxensis nov. sp. is known from the Franses railway section, in the upper part of the Moulin Liénaux Formation and in the Grands Breux Formation. The new species is also present in the Chalón Member of the Moulin Liénaux Formation in the Arche quarry located close to the Franses railway section. The study of ostracods present in the Arche quarry is in progress.

Discussion concerning the distribution of ostracods

The stratigraphic distribution of a series of species described by BECKER (1971) from a sample collected in the access path to the Lion quarry is stated more precisely within the Boussu-en-Fagne Member. In particular, the extension of the stratigraphic range of Favulella lecomptei (BECKER, 1971) and of Plagionephrodes laqueus (MATERN, 1929) to the top of the member, and consequently to the top of the Grands Breux Formation is of great interest because species belonging to the Thlipsuroidea are good biostratigraphic markers.

The stratigraphic distributions of Scrobicula capsa BECKER, 1971, Bairdia (Rectobairdia) sp. A in BECKER (1971), and of Orthocypris sp. A in BECKER (1971) are extended to the Bieumont Member of the Grands Breux Formation, and the stratigraphic distributions of Plagionephrodes laqueus (MATERN, 1929) and of Healdianella sp. A in BECKER (1971) are extended to the Ermitage Member of the Grands Breux Formation.


Favulella lecomptei is relatively abundant and regularly present in samples collected in the Ermitage, Bieumont and Boussu-en-Fagne Members. This species characterises a sub-zone established by LETHIERS (1974), but later elevated by CASIER (1979) to the rank of a zone in a biostratigraphic zonation established exclusively on Metacopina.

Discussion concerning the palaeoecology

Three mega-assemblages are recognised in the Devonian (CASIER, 2004): 1. The Myodocopida Mega-Assemblage characterised by entomozoid and (or) cyprinoid ostracods is indicative of poorly oxygenated marine environments; 2. The Thuringe Mega-Assemblage characterised by spiny ostracods is indicative of deep and (or) cold marine environments; 3. The Eifel Mega-Assemblage generally characterised by a rich and diversified ostracod fauna is indicative of shallow marine (neritic), semi-restricted or lagoonal environments. The Thuringe and Eifel Mega-Assemblages correspond to the Thuringe and Eifel ecotypes defined by Becker (in BANDEL & BECKER, 1975). In reality “ecotype” is improperly used in this case since the word indicates specimens belonging to one species but genetically adapted to a particular environment (CASIER, 2004; CASIER et al., 2005).

The Thuringe Mega-Assemblage is absent in the Franses railway section. The sea was probably too warm during the Lower and Middle Frasnian in the Dinant Synclinorium, and the water conditions too poorly oxygenated during the late Frasnian for the spiny-ostracods belonging to the Thuringe Mega-Assemblage.

The Myodocopid Mega-Assemblage, which is indicative of poorly oxygenated water conditions (CASIER, 2004), is on the contrary well represented in the Late Frasnian Matagne Formation exposed in the Franses railway section (see CASIER, 1982).

The ostracods present in the upper part of the Moulin Liénaux Formation and in the Grands Breux Formation belong exclusively to the Eifelian Mega-Assemblage. Their abundance, diversity, and particularly the abundance of Podocopina, generally indicate a shallow marine environment.

In the Ermitage Member (Table 1), belonging to the Moulin Liénaux Formation, the ostracod fauna is indicative of a regressive trend: samples CF-1, CF-2 and CF-4 contain quasi exclusively ostracods belonging to the Metacopina. The environment was calm, poorly oxygenated, and below storm wave base. In sample CF-3, the ostracod fauna is more diverse: 4 species
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<th>Ostracod Species</th>
<th>CF-1</th>
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<td><em>Punctomosea weyanti</em></td>
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<td>Polyzygia neodovonica</td>
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<td>Favulella lecomptei</td>
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<td>Youngiella sp.</td>
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<td><em>Bairdia</em> (R.) sp. B, aff. B (R.) pafrathensis</td>
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<td>Hollinoidea indet.</td>
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<td>Uchtonia materni</td>
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Table 1 — Distribution of ostracods in the Ermitage Member. In bold: sample numbers; in regular: location of samples, in meter above the base of the member.

belong to the Metacopina, 2 to the Palaeocopina, and 3 to the Podocopina. This composition is indicative of better oxygenated conditions, but the abnormally large number of instars in sample CF-3 indicates storm deposition. The greater number of species belonging to the Podocopina in samples CF-5 to CF-7, the entry of Platycopina in sample CF-6 and even of a Cryptophyllidae in sample CF-7 indicate better oxygenated water conditions, probably between fair weather and storm wave bases.

In the two first meters of the Bieumont Member (Table 2) belonging to the Grands Breux Formation (samples CF-8 to CF-11), and also between 5 and 8 m, the Podocopina dominate largely the ostracod fauna. Thick shelled *Tubulibaidia* and *Microcheilinella* are the most abundant species in this level. Moreover, in sample CF-9, dissociated and broken carapaces are very abundant. The environment was certainly well oxygenated, very shallow and sometimes strongly agitated, probably close to, and sometimes just above, fair weather wave base. Between 2 and 5 meters, several Metacopina are also present, indicating a slight deepening. Above 8 m, the Metacopina are as much or more abundant than the Podocopina proving that the environment was below fair weather wave base. The rarity or even the absence of ostracods above 10 m is indicative of deep water conditions below storm wave base, especially between 12 m and 19 m.

In the Boussu-en-Fagne Member (Table 3), and particularly in the upper part of that member, ostracods are more abundant and diverse than in the upper part of the underlying member. The Podocopina and Metacopina are present together and the environment was presumably between fair weather and storm wave-base.

The Neuville Formation and the Matagne Formation have not been studied herein. In reality due probably to an increase in deepening, and (or?) to the increase in sedimentation rate, ostracods are extremely rare in the Neuville Formation. In the Matagne Formation, the environment became poorly oxygenated, as indicated by the entry of the Entomozoidea (CASIER, 1982). They belong to the Myodocopid Mega-Assemblage.
Table 2 — Distribution of ostracods in the Bieumont Member. In bold: sample numbers; in regular: location of samples, in meter above the base of the member.
Table 3 — Distribution of ostracods in the Boussu-en-Fagne Member. In bold: sample numbers; in regular: location of samples, in meter above the base of the member.

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Explanation of plates

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PLATE 1

Fig. 1 — **Amphissites cf. parvulus** (Paeckelmann, 1913), CFF-35, Bieumont Mbr., IRScNB n° b4867, right valve, x60.

Fig. 2 — **Adelphobolbina europaea** Becker & Bress, 1971, CFF-2, Ermitage Mbr., IRScNB n° b4868, carapace, a. left lateral view, b. dorsal view, x50.

Fig. 3 — **Hollinella (Keslingella) ionica** Becker & Bress, 1971?, CFF-13, Bieumont Mbr., IRScNB n° b4869, broken left valve, x70.

Fig. 4 — **Scrobicula capsas** Becker, 1971, CFF-22, Bieumont Mbr., IRScNB n° b4870, carapace, a. right lateral view, b. dorsal view, x105.

Fig. 5 — **Hollinoidea indet.**, CFF-3, Ermitage Mbr., IRScNB n° b4871, right valve, x95.

Fig. 6 — **Youngiella** sp. F5 in Magne (1964), CFF-76, Boussu-en-Fagne Mbr., IRScNB n° b4872, carapace, a. right lateral view, b. dorsal view, x95.

Fig. 7 — **Urftellia** sp. B, CFF-65, Boussu-en-Fagne Mbr., IRScNB n° b4873, right lateral view of a carapace, x110.

Fig. 8 — **Balantoides cf. minima** Lethiers, 1970, CFF-21, Bieumont Mbr., IRScNB n° b4874, left valve, x135.

Fig. 9 — **Referathella** sp. A, CFF-51, Bieumont Mbr., IRScNB n° b4875, carapace, a. left lateral view, b. dorsal view, x65.

Fig. 10 — **Paraparchites** sp. A, CFF-6, Ermitage Mbr., IRScNB n° b4876, carapace, a. right lateral view, b. dorsal view, x80.

Fig. 11 — **Samarella** sp. B, CFF-25, Bieumont Mbr., IRScNB n° b4877, right lateral view of a carapace, x45.

Fig. 12 — **Uchtovia materni** Becker, 1971, CFF-6, Ermitage Mbr., IRScNB n° b4878, carapace of a tecnomorph, a. left lateral view, b. dorsal view, x55.

Fig. 13 — **Uchtovia materni** Becker, 1971, CFF-11, Bieumont Mbr., IRScNB n° b4879, dorsal view of a heteromorph, x50.

Fig. 14 — **Cavellinal**? sp. indet., CFF-35, Bieumont Mbr., IRScNB n° b4880, left valve?, x115.

Fig. 15 — **Hypotetragona tremula** Becker, 1971, CFF-50, Bieumont Mbr., IRScNB n° b4881, carapace, a. right lateral view, b. dorsal view, x70.

Fig. 16 — **Cytherellina** sp. A, CFF-2, Ermitage Mbr., IRScNB n° b4882, carapace, a. right lateral view, b. dorsal view, x60.

Fig. 17 — **Cytherellina**? sp. B, CFF-13, Bieumont Mbr., IRScNB n° b4883, right lateral view of a carapace, x65.

Figs 18-19 — **Polyzygia neodevonica** (Matern, 1929), 18 = CFF-27, Bieumont Mbr., IRScNB n° b4884, left valve, x90; 19 = CFF-77, Boussu-en-Fagne Mbr., IRScNB n° b4885, left valve, x60.

Fig. 20 — **Polyzygia neodevonica aragonensis** Gozalo & Sanchez de Posada, 1986, CFF-12, Bieumont Mbr., IRScNB n° b4886, right valve, x70.

PLATE 2

Figs 1-2 — **Favulella lecomptei** Becker, 1971, 1 = CFF-6, Ermitage Mbr., IRScNB n° b4887, carapace. a. left lateral view, b. dorsal view, x45; 2 = CFF-12, Bieumont Mbr., IRScNB n° b4888, right valve, x65.

Fig. 3 — **Favulella lecomptei spissa** Zbikowska, 1983, CFF-3, Ermitage Mbr., IRScNB n° b4889, right lateral view of a carapace, x70.

Fig. 4 — **Asturiella blessi** Becker, 1971, CFF-35, Bieumont Mbr., IRScNB n° b4890, carapace, a. right lateral view, b. dorsal view, x60.

Fig. 5 — **Asturiella blessi** Becker, 1971, spiny subsp., CFF-67, Boussu-en-Fagne Mbr., IRScNB n° b4891, right lateral view of a carapace, x50.

Figs 6-7 — **Punctomosea weyanti** Becker, 1971, 6 = CFF-6, Ermitage Mbr., IRScNB n° b4892, carapace, a. right lateral view, b. dorsal view, x60; 7 = CFF-51, Bieumont Mbr., IRScNB n° b4893, carapace, a. left lateral view, b. dorsal view, x55.

Fig. 8 — **Punctomosea weyanti** Becker, 1971, spiny subsp., CFF-38, Bieumont Mbr., IRScNB n° b4894, carapace, a. right lateral view, b. dorsal view, x55.
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Fig. 9  —  Jenningsina lethiersi BECKER, 1971, CFF-76, Boussu-en-Fagne Mbr., IRScNB n° b4895, left valve, x75.
Figs 10-11  —  Svantovites magnei BECKER, 1971. 10 = CFF-6, Ermitage Mbr., IRScNB n° b4896, left valve, x65; 11 = CFF 7, Bieumont Mbr., IRScNB n° b4897, carapace, a. right lateral view, b. dorsal view, x50.
Figs 12-13  —  Plagiocyprides laqueus (MATERN, 1929). 12 = CFF-19, Bieumont Mbr., IRScNB n° b4898, left valve, x60; 13 = CFF-12, Bieumont Mbr., IRScNB n° b4899, carapace, a. right lateral view, b. dorsal view, x65.
Fig. 14  —  Healdianella sp. A BECKER, 1971, CFF-78, Boussu-en-Fagne Mbr., IRScNB n° b4900, carapace, a. right lateral view, b. dorsal view, x75.
Fig. 15  —  Healdianella? sp. indet., CFF-50, Bieumont Mbr., IRScNB n° b4901, carapace, a. right lateral view, b. dorsal view, x110.
Fig. 16  —  Bairdiocypris sp. 5 MAGNE, 1964, CFF-24, Bieumont Mbr., IRScNB n° b4902, broken carapace, a. right lateral view, b. dorsal view, x40.
Fig. 17  —  Bairdiocypris sp. A, CFF-23, Bieumont Mbr., IRScNB n° b4903, right lateral view of a carapace, x100.
Fig. 18  —  Bairdiocypris sp. B, CFF-23, Bieumont Mbr., IRScNB n° b4904, carapace, a. right lateral view, b. dorsal view, x50.

PLATE 3

Figs 1-2  —  Bairdiocypris sp. B, CFF-10, Bieumont Mbr., right lateral view of a carapace, 1 = IRScNB n° b4905, x60; 2 = IRScNB n° b4906, x95.
Fig. 3  —  Orthocypris sp. A BECKER, 1971, CFF-78, Boussu-en-Fagne Mbr., IRScNB n° b4907, carapace, a. right lateral view, b. dorsal view, x70.
Figs 4-5  —  Tubulibairdia sp. A, aff. T. clava (KEGEL, 1933), Bieumont Mbr. 4 = CFF-28, IRScNB n° b4908, carapace, a. right lateral view, b. dorsal view, x95; 5 = CFF-23, IRScNB n° b4909, right lateral view of a carapace, x30.
Fig. 6  —  Microcheilinella sp. A, CFF-19, Bieumont Mbr, IRScNB n° b4910, right lateral view of a carapace, x105.
Fig. 7  —  Acratia evlanensis EGOROV, 1953, CFF-10, Bieumont Mbr., IRScNB n° b4911, carapace, a. right lateral view, b. dorsal view, x85.
Fig. 8  —  Bairdia (Rectobairdia) paffrathensis (KUMMEROW, 1953), CFF-24, Bieumont Mbr., IRScNB n° b4912, carapace, a. right lateral view, b. dorsal view, x60.
Fig. 9  —  Bairdia (R.) sp. B, aff. B. (R.) paffrathensis (KUMMEROW, 1953), CFF-3, Ermitage Mbr., IRScNB n° b4913, carapace, a. right lateral view, b. dorsal view, x50.
Fig. 10  —  Bairdia (R.) sp. A in BECKER (1971), CFF-54, Bieumont Mbr., IRScNB n° b4914, carapace, a. right lateral view, b. dorsal view, x80.
Fig. 11  —  Bairdia (R.) sp. C, CFF-10, Bieumont Mbr., IRScNB n° b4915, broken carapace, a. right lateral view, b. dorsal view, x60.
Fig. 12  —  Bairdia (Orthobairdia) sp. B, CFF-23, Bieumont Mbr., IRScNB n° b4916, broken carapace, a. right lateral view, b. dorsal view, x60.
Fig. 13  —  Bairdia (O.) sp. A, CFF-25, Bieumont Mbr., IRScNB n° b4917, carapace, a. right lateral view, b. dorsal view, x60.
Figs 14-16  —  Bairdiacypris breuxensis nov. sp. 14 = Holotype, CFF-10, Bieumont Mbr., IRScNB n° b4918, carapace, a. right lateral view, b. dorsal view, x50; 15 = Paratype A, CFF-76, Boussu-en-Fagne Mbr., IRScNB n° b4919, right lateral view of a carapace, x60; 16 = Paratype B, CFF-68, Boussu-en-Fagne Mbr., IRScNB n° b4920, right lateral view of a carapace, x55.
Fig. 17  —  Bairdiacypris sp. B, aff. B. martinae CASIER & LETHIERS, 1997, CFF-24, Bieumont Mbr., IRScNB n° b4921, carapace, a. right lateral view, b. dorsal view, x55.
Fig. 18  —  Schneideria groosae BECKER, 1971, CFF-72, Boussu-en-Fagne Mbr., IRScNB n° b4922, right valve, x105.
Fig. 19  —  Cryptophyllus sp. indet., CFF-7, Ermitage Mbr., IRScNB n° b4923, right valve?, x70.