SILURIAN AND DEVONIAN FORAMINIFERS AND OTHER ACID-RESISTANT MICROFOSSILS FROM THE BARRANDIAN AREA

KATARÍNA HOLCOVÁ
Institute of Geology and Palaeontology, Charles University, Albertov 6, CZ-128 43 Prague 2, Czech Republic

Abstract. The first systematic study of the Silurian and Devonian foraminifers from acid-insoluble residues from the Barrandian area was based on 14 Silurian and 24 Devonian sections including stratotypes and auxiliary stratotypes. Eighty morphotypes of agglutinated foraminifers from families Psammosphaeridae, Hemisphaeramminidae, Saccamminidae, Hippocrepinidae, Ammodiscidae and Lithoidae and 6 morphotypes of calcareous foraminifers were distinguished. Foraminifers are rare in the Silurian (with the exception of the Ludfordian). In the Devonian, foraminifers are common to abundant. They are the most abundant in the Dalejan Třebotov and Pragian Dvore-Prokop Limestones. The stratigraphical ranges of the Barrandian Silurian and Devonian foraminifers were summarized and the species of biostatigraphical value were selected. As the occurrence of foraminifers was influenced by palaeoecological conditions, the stratigraphical ranges represent only ecocratigraphical data for the Barrandian area. The highest abundance and diversity of foraminifers in the Třebotov and Dvore-Prokop Limestones reflect the fact that nodular limestones were deposited under the environmental conditions favoured by the Devonian foraminifers: low-energy, deeper-water environment (below the wave base). The clastic components necessary for building agglutinated tests were present. Foraminifers are a good palaeoecographical indicator. They mainly indicate broad migration of foraminiferal fauna between the Barrandian Dalejan and the Saxothuringian Upper Devonian. Close affinities of foraminiferal assemblages between the Dalejan of the Barrandian, Upper Devonian of the Saxothuringicum and Upper Devonian of the Rhehohercynicum and the Holy Cross Mountains confirm the hypothesis of the closure of the Rheic Ocean in the Late Devonian. Foraminifers migrated to the Rhehohercynicum from the Saxothuringicum in the Late Devonian. In the time interval from the Upper Devonian to the Lower Mississippian, the assemblages penetrated to the North American basins through an unknown passageway.

Introduction

Foraminifers from the Barrandian were first mentioned at the beginning of the 20th century (Schubert and Liebus, 1902; Liebus and Wähner, 1904). These authors described foraminifers from the Eifelian of Hlubočepy near Prague. These studies were revised by Pokorný (1959) who found foraminifers of the genera Psammosphaera, Thurammina and sessile hemispherical saccamminids in the Eifelian from Hlubočepy. A new species Psammastephus remesi was described by Prantl (1947). Nowadays, this genus is classified among Polychaeta (Loeblich and Tappan, 1987). Agglutinated foraminifers from a slide from the Eifelian of Hlupočepy were mentioned by Petráněk (1950). Recently, a find of foraminifers in the Ordovician was reported by Bubík (1995, 1996). Foraminifers from the micropalaeontological collection of the Department of Paleontology, Charles University, Prague were revised by Holcová (1999). A systematic study of the Barrandian foraminifers has not been done yet.

A limited number of studies focused on Silurian and Devonian foraminifers appeared also in the world literature. Numerous papers with the highest number of newly described taxa deal with the North American Palaeozoic: from Silurian (Moreman, 1930; Grubbs, 1939; Stewart and Priddy, 1941; Dunn, 1942; Browne and Schott, 1963; Miller, 1956; Mound, 1961; Ireland, 1966; Mound, 1968; Watkins et al., 1999), Silurian and Devonian (Moreman, 1933; Ireland, 1939; McClellan, 1966) and Devonian (Cushman and Stainbrook, 1943; Stewart and Lampe, 1947; Summerson, 1958, 1959; Conkin and Conkin, 1964, 1967; Gutschick and Wueellner, 1983). A synthesis of stratigraphical ranges of North American Palaeozoic foraminifers was given by Conkin and Conkin (1982). In Europe, Silurian and Devonian foraminifers were studied in the following regions: Thuringian Slate Mountains (Blumenstegel, 1961, 1963), Eifel synclinorium (Bartenstein, 1937; Pichler, 1971; Langer, 1991), Rheinisches Schiefergebirge (Beckmann, 1952; Eickhoff, 1970, 1971), Sauerland (Flügel and Hotzl, 1971), Holy Cross Mountains (Duszynska, 1956, 1959; Olempska, 1983; Malec, 1992), Carnic Alps (Kristan-Tollmann, 1971), Baltic region (Eisennack, 1932, 1937, 1954, 1959, 1967, 1969, 1971; Bykova, 1956, 1964), Moravia (Pokorný, 1951) and Bulgaria (Trifonova, 1964). Foraminifers from the Russian Platform and Volga-Ural Area (Bykova, 1952, 1953; Bykova and Polenova, 1955; Reytinger, 1957), Ural region (Tschernych, 1965, 1969; Pronina, 1963, 1968a, b) and Siberia (Lipina, 1959) were described from Russia. Russian authors predominantly described foraminifers from slides, which complicates their comparison with isolated specimens. Silurian and Devonian foraminifers were mentioned also from Australia (Crespin, 1961; Simpson et al., 1993; Winchester-Seeto and Bell, 1995).
Material and methods

The Barrandian is a classical Lower Palaeozoic area with numerous thoroughly documented sections. These sections were chosen for a pioneer study of the Barrandian foraminifers because the existing biostratigraphical and palaeoecological data can be used for the assessment of biostratigraphical and palaeoecological value of foraminiferal assemblages.

The aim of this paper is to present the results of the first systematic study of the Silurian and Devonian foraminifers from the thoroughly documented Barrandian sections.

1994; Bell, 1996; Bell, 1999). For the determination of foraminiferal taxa, an analysis of Upper Palaeozoic foraminifers is important (e.g., Ireland, 1956; Gutschick and Treckman, 1959; Gutschick et al., 1961; Conkin, 1961; Gutschick, 1962; Conkin et al., 1965, 1968).

The aim of this paper is to present the results of the first systematic study of the Silurian and Devonian foraminifers from the thoroughly documented Barrandian sections.
solved washing residue. In the next step, dissolution of rock samples in acetic acid was tested using acids of different concentrations for the same sample. The sample was broken into small pieces (about 1 cm³) and dissolved in the 5%, 10% and 30% acetic acid for 3–4 weeks. The acid was completely changed every week. Foraminiferal tests were the most abundant when 10% acetic acid was used for test dissolution (Text-fig. 4). Therefore, 10 % acetic acid was chosen for the dissolution of the analysed samples.

Foraminifers and other microfossils were separated using a stereomicroscope. SEM was used for a detailed study of test morphology, internal tests structures were studied in transmitted light. Test parameters were measured using a video system.

Abundances of foraminiferal tests were roughly evaluated using a semiquantitative scale (abundant-common-rare-very rare) because the dissolution of samples did not allow an accurate recalculation of the foraminiferal abundances in washing residua into the abundances in rock samples. The relative abundances of taxa in samples were established where absolute abundances ranged between common and abundant. Relative and absolute abundances of foraminifers in samples are given in Text-figs 5, 7–9, 12, 13, 16–19, 23–28, 31–41, 44, 46, 48, 50, 51.

Taxonomical study of the Barrandian foraminifers was based on the determination of morphotypes (Text-figs 6, 11, 14, 15, 20–22). The weak points of this classification were the low numbers of foraminiferal tests in many samples. Therefore, the variability of test morphology could be studied on rare occasions only.

These morphotypes can be: (1) well-correlated with the described taxa; (2) corrollable with the described taxa but showing some differences between the holotype of the described species and the Barrandian specimens; (3) fragments of tests which are indeterminable; (4) new taxa. The taxa could not be described because sufficient material for the study of variability and a well-preserved specimen for the designation of a holotype were missing. Collection of plentiful material from the samples with probably new taxa is proposed as the next step in the study of the Barrandian foraminifers.

Systematic part

The suprageneric classification follows Loeblich and Tappan (1987).

Order Foraminiferida EICHWALD, 1830
Suborder Textulariina DELAGE et HÉRUARD, 1896
Family Bathysiphonidae AVNIMELECH, 1952

Genus Bathysiphon SARS, 1872

Bathysiphon sp.

Description: Test free, represented by a straight undivided and unbranched tube, postmortem-flattened, open at both ends. Wall agglutinated, composed of fine material. Only three broken specimens were found, which cannot be determined in more detail.
Material: 3 specimens

Distribution in the Barrandian area: Pragian (Stydlé vody), Zlichovian (section below Barrandov)

Family Astrorhizidae BRADY, 1881

Genus Psammosiphon VINE, 1882

Psammosiphon remesi PRANTL, 1947

Pl. 22, fig. 11

1947 Psammosiphon remesi PRANTL, Prantl, Výskyt rodu Psammomosiphon..., pp. 227–228, Pl. I, figs 1–4

Description: Test attached, approximately hemitubular and irregularly branched. Numerous apertures at ends of conical projections irregularly arranged in convex part of test. Wall agglutinated, composed of fine-grained material, thick.

Remarks: Genus Psammosiphon VINE, 1882 described from the Wenlock of England was classified within Annelida. Prantl (1947) reclassified the genus within Foraminifera. Leoblich and Tappan (1987) treated Psammosiphon as Polychaeta. Based on the character of numerous irregularly arranged apertures at the end of projections, I agree with the opinion of Prantl (1947) and attribute the genus Psammosiphon to Foraminifera.

Material: 2 specimens

Distribution in the Barrandian area: Rhudanian (Hlásná Třebaň section), Prantl (1947): Pragian (Dvorce-Prokop Lst., U kapličky Quarry), Dalejan (Třebotov Lst., Prastav Quarry)

Family Rhabdamminidae BRADY, 1884

Genus Rhabdammina SARS, 1869

Rhabdammina (?) sp. – fragments

Description: Test free, tubular, branching dichotomously. Wall agglutinated, composed of medium- to fine-grained material, surface rough.

Remarks: Distinguishing of morphotypes among di-
chotomously branching fragments was impossible, but it is probable that these fragments represent two or more taxa.

Material: about 10 specimens

Distribution in the Barrandian area: Gorsián (surroundings of Lochkov), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry), Dalejan (Třebotov Lst.: Prastav Quarry)

Family Psammospheridae HAECKEL, 1894

Genus Psammophaera

Moreman (1930), Eisenack (1932), Ireland (1939), Dunn (1942), Parr (1942), Stewart and Lampe (1947) and Summerson (1958) described 17 species of psammosphaeras from the Palaeozoic rocks. The following criteria were used for the description of new species: shape of test, size of test, thickness of test wall, size of grain material. Mound (1961), Browne and Schott (1963) and Mac Clellan (1966) discussed intraspecific variability of psammosphaeras and proposed that these criteria were not adequate for the speciation. Based on this concept, Kristan-Tollmann (1971) revised the Early Palaeozoic Psammophaera and 14 species were put in synonymy with P. cava. To accept this intraspecific variability, all specimens occurring in the Barrandian material can be determined as P. cava.

To document the variability of psammosphaeras in the Barrandian material, four morphotypes were distinguished. These morphotypes are clearly defined and no transitions between them were observed. The morphotypes are well

<table>
<thead>
<tr>
<th>Concentration of acetic acid</th>
<th>0 %*</th>
<th>5 %</th>
<th>10 %</th>
<th>30 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locality</td>
<td>Number of species/number of specimens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opatříka - Červený lom Quarry, Dvorce-Prokop Lst. Sample 1</td>
<td>0</td>
<td>2/6</td>
<td>4/10</td>
<td>1/1</td>
</tr>
<tr>
<td>Opatříka - Červený lom Quarry, Dvorce-Prokop Lst. Sample 2</td>
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<td>5/12</td>
<td>8/21</td>
<td>3/7</td>
</tr>
<tr>
<td>&quot;Údolí Hlučky&quot; Valley near Karštajn, Dalej Shales</td>
<td>0</td>
<td>2/13</td>
<td>2/38</td>
<td>1/3</td>
</tr>
<tr>
<td>Road <em>Ke Štítů</em> Dalej Shales</td>
<td>0</td>
<td>1/1</td>
<td>2/4</td>
<td>0</td>
</tr>
<tr>
<td>Original stratotype of Pragian/Zlíchovian boundary, Praha-Barrandov</td>
<td>0</td>
<td>4/9</td>
<td>4/18</td>
<td>2/8</td>
</tr>
</tbody>
</table>

* only freezing of rock sample

Text-fig. 4. Results of the testing of the best concentration of acetic acid for the dissolution of rock samples.

Text-fig. 5. Hlásná Třebaň section, lithology and ranges of selected fossils from Kříž 1992.

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comparable with species synonymized with *Psammosphaera cava* and names of these species were used for their designation. Although the morphotypes could represent ecophenotypes, their occurrence in the same samples testifies against this hypothesis.

Among the morphotypes, the group of *P. cava* – *P. devonica* – *P. minuta* can be distinguished. Test size (text-fig. 10) and wall thickness allow to distinguish the morphotypes within this group, while the size of grain material changes gradually. *P. gracilis* is clearly different.

*Psammosphaera cava* MOREMAN, 1930
Text-fig. 6a, Pl. 10, figs 6, 8; Pl. 11, fig. 13; Pl. 13, fig. 4; Pl. 15, figs 1, 4, 12
1930 *Psammosphaera cava* MOREMAN; Moreman, Arenaceous Foraminifera from Ordovician, p. 48, Pl. 6, fig. 12

**Description:** Test free, spherical, compressed or not. Wall thin, composed of fine to medium material, gradual changes in the size of grains were observed. Aperture indefinite. Diameters of tests larger than 145 μm (Text-fig. 10).

**Material:** about 200 specimens

**Distribution in the Barrandian area:** Aeronian (Hlásná Třebáň section), Shinwoodian (section Bubovice-Loděnice), Homerian (Kační Quarry), Ludfordian (Požáry section, Smoking Quarry, Kolendník Quarry), Lochkovian (Hmolka near Velká Chuchle), Pragian (Dvorce-Prokop Lst.; Hmolka near Velká Chuchle, Opatřilka Quarry, Braník Quarry, Karlík Valley, Stydlé vody Quarry; Slivenec Lst.; Cikánka Quarry), Zíchovian (section below Praha-Barrandov), Dalejan (Daleje Sh.; Ke lžiště section; Třebotov Lst.; Chýnice – old quarry, Udolí Hluboké Valley, Grassat Quarry, Nad trati Quarry; Suchomasty Lst.; Červený lom Quarry)

**Other distribution:** Common at numerous localities of Ordovician sediments (Conkin and Conkin, 1982)

*Psammosphaera devonica* STEWART et LAMPE, 1947
Text-fig. 6b, Pl. 2, fig. 7; Pl. 6, figs 7–9; Pl. 10, figs 1, 9, 10; Pl. 13, figs 1, 2; Pl. 15, figs 2, 3, 9–11
1947 *Psammosphaera devonica* STEWART et LAMPE, Stewart and Lampe, Foraminifera from the Middle Devonian Bone beds of Ohio, p. 533, Pl. 78, fig. 2

**Description:** Test free, spherical. Wall thick, composed of fine to coarse grains, grain size gradually changing with a discrete difference between the thin wall of *P. cava* morphotype and the thick wall of *P. devonica* morphotype. This variability was studied at the localities of Karlík Valley and Prastav Quarry where plentiful material (about 50 specimens) was collected (see also Holcová, 1999). Aperture not apparent. Diameters of tests larger than 145 μm (Text-fig. 10).

**Material:** about 25 specimens

**Distribution in the Barrandian area:** Silurian/Devonian boundary (Klonk), Pragian (Dvorce-Prokop Lst.: Karlík Valley), Dalejan (Třebotov Lst.; Chýnice – old quarry, Udolí Hluboké Valley, Prastav Quarry, U jezírka Quarry)

**Other distribution:** Middle Devonian of Ohio (Stewart and Lampe, 1947; Summerson, 1958)

*Psammosphaera minuta* DUNN, 1942
Text-fig. 6c, Pl. 13, fig. 3; Pl. 15, figs 5 – 8
1942 *Psammosphaera minuta* DUNN, Dunn, Silurian Foraminifera of the Mississippi Basin, p. 323, Pl. 42, figs 10–12

**Description:** Test free, spherical, small-sized. Wall agglutinated with fine to medium-grained material. No aperture observable. Test diameters ranging between 105 to
121 µm (Text-fig. 10), differing from those of ‘P. cava’ in their smaller size in agreement with the diagnosis of ‘P. minuta’. In the studied material, this morphotype occurs either with larger psammosphaeras (Dalejan, Údolí Hluboké Valley, Prastav) or separately (Zlichovian, section below Barrandov).

Material: about 40 specimens
Distribution in the Barrandian area: Ludfordian (Požáry section, Smokvna Quarry), Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley, Opatřilka Quarry, Stydlé vody Quarry), Zlichovian (section below Praha-Barrandov, Stydlé vody Quarry), Dalejan (Daleje Sh.: Ke hřbitovu section; Třebotov Lst.: Údolí Hluboké Valley, Prastav Quarry)

Other distribution: Silurian of the Mississippi Basin (Dunn, 1942)

Psammosphaera gracilis IRELAND, 1939

Text-fig. 6d, Pl. 2, fig. 12; Pl. 12, fig. 2; Pl. 14, fig. 2

1939 Psammosphaera gracilis IRELAND, Ireland, Devonian and Silurian Foraminifera from Oklahoma, p. 194, figs A-10, 11

Description: Test free, spherical. Wall agglutinated, very thin, composed of very fine material. Aperture not apparent.

Remarks: This morphotype is clearly different from the morphotypes of ‘P.cava-P. devonica- P. minuta’ – group and may represent a separate species.

Material: about 35 specimens
Distribution in the Barrandian area: Telychian (Litohlavy section), Dalejan (Nad tratí Quarry, Chýnice – old quarry, Prastav Quarry), Eifelian (Kačák Creek Valley)

Other distribution: Silurian of the Mississippi Basin (Dunn, 1942)

Psammosphaera sp. IRELAND, 1939

Text-fig. 6e, Pl. 1, fig. 9; Pl. 2, fig. 15; Pl. 7, fig. 13

1939 Psammosphaera gracilis IRELAND, Ireland, Devonian and Silurian Foraminifera from Oklahoma, p. 194, figs A-10, 11

Description: Test attached, subglobular, with rests of objects of attachment often preserved on the test. Aperture not visible. Wall agglutinated of fine particles.

Material: about 15 specimens
Distribution in the Barrandian area: Aerrian (Hlásná Třebaň section), Ludfordian (Smoking Quarry), Pragian (Stydlé vody Quarry)

Other distribution: Common from the Ordovician (Conkin and Conkin,1982)

Genus Sorosphaera BRADY, 1879

Sorosphaera tricella MOREMAN, 1930

Text-fig. 6h, Pl. 9, fig. 6

1930 Sorosphaera tricella MOREMAN, Moreman, Arenaceous Foraminifera from the Ordovician..., p. 49, Pl. 5, figs 12, 14

Description: Test free, consisting of three spherical chambers arranged in V-turn. Aperture not apparent. Wall agglutinated, composed of fine-grained material.

Material: 2 specimens
Distribution in the Barrandian area: Pragian (Opatřilka Quarry)

Other distribution: Common from the Ordovician (Conkin and Conkin,1982)

Genus Thuraminoides PLUMMER, 1945

Thuraminoides sphaeroidalis PLUMMER, 1945

Pl. 1, figs 1, 2, 4, 6; Pl. 2, figs 6, 8, 14; Pl. 3, fig. 14; Pl. 7, fig. 1; Pl. 8, figs 12–15; Pl. 9, figs 1, 15–16; ? Pl. 10, fig. 7; Pl. 12, fig. 3; Pl. 13, fig. 5; Pl. 14, figs 8–11

1945 Thuraminoides sphaeroidalis PLUMMER; Plummer, Smaller foraminifera in the Marble Falls ..., p. 218, Pl. 15, figs 4–10
1961 Thuraminoides sphaeroidalis PLUMMER, Conkin, Mississippian smaller foraminifera from Kentucky..., p. 243

Description: Test free, compressed, discoidal with broadly rounded periphery. Aperture not visible. Wall agglutinated, thick, composed of fine material.
Remarks: Loeblich and Tappan’s (1987) revision of the holotype of *Thuramminoides sphaeroidalis* was accepted. The genus *Thuramminoides* differs from the psammospherans in the thick wall agglutinated by fine grains.

Material: about 100 specimens

Distribution in the Barrandian area: Rhudanian (Hlásná Třebaň section), Telychian (Litohlavy reservoir), Homerian (Kační Quarry), Ludfordian (Smoking Quarry, Koledník Quarry, Cephalopod Quarry), Přídolí (Na bříči section), Silurian/Devonian boundary (Klonk), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry, Opatřilka Quarry, Udoli Hluboké Valley, U kapličky Quarry, Pod terasami 90

Text-fig. 7. Litohlavy section, lithology and ranges of selected fossils from Kříž 1992.

Text-fig. 8. Section Bubovice-Loděnice section from Bouček 1939.
Quarry, Old Quarry; Řeporyje Lst.: Srbsko section), Zlicho-
vian (Chapel Coral Horizon, section below Barrandov, Stydlé vody), Dalejan (Daleje Sh.: Ke hřbitovu section; Třebotov Lst.: Prastav Quarry, Chýnice Quarry; Suchomasty Lst.: Her-
getův lom Quarry), Eifelian (Kačák Creek Valley)

Other distribution: Common at numerous locali-
ties, from the Cambrian (Alexandrowicz, 1969) to Permian
(Plummer, 1945)

Family Hemisphaeramminidae LOEBLICH et
TAPPAN, 1961

In this family, many genera were erected for Palaeozoic foraminifers: Hemisphaerammina LOEBLICH et TAPPAN, Fairliella SUMMERSON, Metamorphina BROWNE, Sorosphaarella CONKIN, CONKIN et THURMAN, Webinella RHUMBER, Webinelloidea STEWART et LAMPE, and Sorosphaeroidea STEWART et LAMPE. The concept of these genera differs among different authors (e.g., Loeblich and Tappan, 1957; Browne and Schott, 1963; McClellan, 1966). The herein used concept follows Loeb-

Some authors (Adegoke et al., 1969; Bell and Burn, 1979) noted that egg-capsules of different species of gas-
tropods may be of similar shape, size and morphology as those of the forms placed into Hemisphaeramminidae,

Genus Hemisphaerammina LOEBLICH et
TAPPAN, 1957

Hemisphaerammina bradyi LOEBLICH et
TAPPAN, 1957

Text-fig. 11a, Pl. 1, figs 11, 13, 15; Pl. 3, figs. 1, 2, 7; Pl. 6, fig. 1; Pl. 13, fig. 14; Pl. 18, fig. 3

1957 Hemisphaerammina bradyi LOEBLICH et TAPPAN, Loe-
litch and Tappan, Eleven new genera of foraminifera, p. 224, Pl. 72, fig. 3

1966 Hemisphaerammina bradyi LOEBLICH et TAPPAN,
McClellan, Arenaceous foraminifera from the Waldron Shales..., p. 485, Pl. 37, figs 20a, b – 22; Pl. 41, figs 20a, b – 22

Description: Test attached, hemispherical, highly convex with sharp margin between attached area and convex part of test. Diameter of attached area smaller than maximum test diameter (Text-fig. 11). Tests compressed or not (Pl. 1, figs. 13, 15). Wall agglutinated, composed of fine to medium-grained material. Aperture not apparent.

Material: about 20 specimens

Distribution in the Barrandian area: Gors-
tian (Na břekvici section), Homerian (Kační Quarry, U Drdů section), Ludfordian (Smoking Quarry, Koledník Quarry, Kosov Quarry, Mušlovka Quarry), Přídolí (Požáry

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Hemisphaerammina carmani (SUMMERSON, 1958)

Text-fig. 11b, Pl. 1, fig. 5; Pl. 3, figs. 9, 11, 12; Pl. 4, figs 4–5, 7; Pl. 5, figs 1, 12; Pl. 6, figs 10, 11; Pl. 10, figs 2, 3; Pl. 12, fig. 1; Pl. 15, figs 15, 16

1958 Fairliella carmani SUMMERSON, Summerson, Arenaceous Foraminifera from the Middle Devonian... p. 556, Pl. 82, figs 15, 16; text-figs 4a,b
1996 Hemisphaerammina sp. BELL, Early Devonian (Emsian) agglutinated foraminifers, p. 97, fig. 8N

Description: Test attached, composed of a single hemispherical chamber with a flange at the base. Diameter of attached area larger than that of hemispherical part of test (fig.6). Wall thin, agglutinated, composed of medium- to fine-grained particles. Attached area having thinner wall, in some specimens often missing (e.g., Pl. 1, fig. 5). No apparent aperture. Interstitial pores visible in some specimens (Pl. 4, fig. 5).

Remarks: Genus Fairliella is put into synonymy with Hemisphaerammina by Loeblich and Tappan, 1987. Some authors (e.g., Bell and Burn, 1979) consider this species to represent egg-capsules of gastropods.

Material: about 15 specimens

Distribution in the Barrandian area: Ludfordian (Smoking Quarry, Koledník Quarry), Pragian (Ho-molka near Velká Chuchle, Old Quarry, Pod terasami Quarry, Braník Quarry), Zlíchovian (section below Bar-
Hemmisphaerammina aff. casteri McCLELLAN, 1966

Description: Tests attached, pyramidal, highly convex. Side wall forming an acute angle at junction with basal wall. Aperture not visible. Wall agglutinated, composed of medium-sized grains.

Material: 8 specimens

Distribution in the Barrandian area: Dalejan (Při trati Quarry), Eifelian (Prastav Quarry)

Genus Tholosina RHUMBLER, 1895

Tholosina sp. 1

Description: Test attached, globular, with rounded periphery, furrow crossing the area of attachment (?line of attachment to (?) an alga). Two apertures situated at ends of short tubes arranged on test periphery. Wall agglutinat-ed, thin, composed of fine material.

Material: about 20 specimens

Distribution in the Barrandian area: Dalejan (Prastav Quarry)
Tholosina (?) sp. 2

Text-fig. 11f, Pl. 3, fig. 10; Pl. 11, fig. 4; Pl. 13, figs 15, 16; Pl. 18, figs 1, 2

Description: Test attached to another one (Pl. 3, fig. 10) or to sponge spicules (Pl. 11, fig. 4), hemispherical, irregular in outline, small-sized. Aperture representing a narrow opening on the base of convex part of test. Wall agglutinated, composed of fine to medium-sized grains.

Remarks: Determination of these specimens as Tholosina is questionable. Tholosina is characterized by two or more apertures, while these specimens possess one aperture only.

Material: about 25 specimens

Distribution in the Barrandian area: Ludfordian (Koledník Quarry), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry), Dalejan (Třebotov Lst.: Chýnice – old quarry, Údolí Hluboké Valley, Prastav Quarry)

Genus Webbinelloidea STEWART et LAMPE, 1947

Webbinelloidea hattini McCLELLAN, 1966

Text-fig. 11g, Pl. 3, fig. 5; Pl. 7, figs 14, 16; Pl. 10, figs 4, 5

1966 Webbinelloidea hattini McCLELLAN, McClellan, Arenaceous foraminifera from the Waldron Shale, p. 495, Pl. 38, figs 10, 11; Pl. 42, figs 10, 11

Description: Test attached, composed of 3–5 hemispherical chambers in approximately circular arrangement. Chambers highly convex, with sharp basal edge. Sutures between chambers prominent, linear or slightly curved. Aperture not visible. Wall agglutinated, composed of medium-sized grains.

Remarks: The species is classified among Webbinelloidea due to the presence of more than one chamber.

Material: 2 specimens

Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Údolí Hluboké Valley, Prastav Quarry)

Other distribution: Ordovician of Oklahoma (Moreman, 1933), Lower Silurian of Indiana (Browne and Schott, 1963; McClellan, 1966), Mississippian of Montana (Gutschick et al., 1961)

Webbinelloidea sp.

Text-fig. 11i, Pl. 2, figs 9–11

Description: Test attached, numerous irregular, approximately hemispherical chambers arranged into ring structures (Pl. 2, fig. 11) sometimes having irregular
branches (Pl.2, fig. 10). Aperture not observed. Wall agglutinated, composed of medium-sized grains.

Material: 4 specimens
Distribution in the Barrandian area: Přídolí (Na bříči section)

Genus *Sorosphaerella* CONKIN, CONKIN et THURMAN, 1979

*Sorosphaerella* sp.
Text-fig. 11j, Pl. 3, fig. 6; Pl. 5, fig. 4

Description: Test attached to various objects: sponge spicules or echinoid spines (Pl.3, fig.6). Tests approximately hemispherical and irregular in outline. All specimens small (about 100 µm in size). Aperture not visible. Wall agglutinated, composed of poorly sorted and poorly cemented grains.

Material: 3 specimens

Distribution in the Barrandian area: Ludlow (Požáry section), Pragian (Dvorce-Prokop Lst.: Old Quarry)

Genus *Colonammina* MOREMAN, 1930

*Colonammina* sp.
Text-fig. 11k, Pl. 3, fig. 3

Description: Test small in size, attached, globular, periphery of attachment area rounded. Aperture rounded, on small elevation situated in the centre of ventral part of test. Wall agglutinated, composed of very fine material, well cemented.

Material: 2 specimens

Distribution in the Barrandian area: Ludfordian (Požáry section)

Family *Saccamminidae* BRADY, 1884

Genus *Amphitremoida* EISENACK, 1938

*Amphitremoida* sp.
Text-fig. 14a, Pl. 3, figs 8, 13

Description: Test free, elongate, flattened, two apertures situated at opposite ends of test. Wall agglutinated, with fine particles.

Remarks: Only broken specimens were studied; it cannot be determined more precisely.

Material: 4 specimens

Distribution in the Barrandian area: Ludfordian (Koledník Quarry)

Genus *Thurammina* BRADY, 1879

*Thurammina arcuata* MOREMAN, 1930

Text-fig. 15a, Pl. 16, fig. 6

1930 *Thurammina arcuata* MOREMAN, Moreman, Arenaceous Foraminifera from the Ordovician and Silurian, p. 54, Pl. 6, figs 2, 3

Description: Test free, irregularly polygonal in outline, with broad and low projections situated at corners
along polygonal outline of test. Circular apertures situated at ends of the projections. Wall agglutinated, composed of medium to coarse grains.

**Distribution in the Barrandian area:** Dalejan (Třebotov Lst.: Prastav Quarry)

**Other distribution:** Silurian of Oklahoma (Moreman, 1930)

**Thurammina aff. diforamens** IRELAND, 1956

1956 *Thurammina diforamens* IRELAND, Ireland, Upper Pennsylvanian Arenaceous Foraminifera..., p. 841, figs 3–7

**Description:** Test free, spherical, with two neck-like tapering projections at opposite sides, meeting at an angle of 120°. Apertures situated in these projections. Wall agglutinated, composed of fine, well cemented material.

**Remarks:** Specimens from the Barrandian area have shorter projections than the other described specimens.

**Material:** About 40 specimens

**Distribution in the Barrandian area:** Telychian (Litohlavy reservoir), Sheinwoodian (Bubovice-Loděnice section), Gorstian (Na břekvici Quarry, Ludfordian (Smoking Quarry, Kosov Quarry), Pragian (Dvorce-Prokop Lst.: Braník Quarry, Stydlé vody Quarry, Opatřilka Quarry, Old Quarry), Zlíchovian (Stydlé vody Quarry), Dalejan (Třebotov Lst.: Prastav)

**Other distribution:** Upper Silurian of the Mississippi Basin (Dunn, 1942); Llanvirnian of NW Germany (Riegraph and Niemeyer, 1996)

**Thurammina papillata** BRADY, 1879

1879 *Thurammina papillata* BRADY; Brady, Notes on some reticularian Rhizipoda, etc., p. 45, Pl. 6: 4–8

1930 *Thurammina papillata* BRADY; Moreman, Arenaceous Foraminifera from Ordovician, etc., p. 51, Pl. 5: 13

1942 *Thurammina papillata* BRADY; Dunn, Silurian Foraminifera of the Mississippi Basin, p. 334, Pl. 43: 30

**Description:** Test free, spherical, large, with many large protuberances irregularly arranged around the test. Apertures situated at summits of each protuberance. Wall agglutinated, composed of fine quartz grains.

**Material:** About 25 specimens

**Distribution in the Barrandian area:** Ludfordian (Smoking Quarry), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry), Dalejan (Daleje Sh.: Ke hřbitovu section; Třebotov Lst.: Prastav Quarry, Údolí Hluboké Valley, U jezírka Quarry, Při trati Quarry)
Thurammina aff. quadritubulata DUNN, 1942
Text-fig. 15e, Pl. 7, fig. 10; Pl. 10, fig. 13; Pl. 16, fig. 8

1942 Thurammina quadritubulata DUNN; Dunn, Silurian Foraminifera of Mississippi Basin, p. 334, Pl. 43: 22

Description: Test free, spherical. Four long, slightly tapering tube-like projections situated in the “corners” of test. Apertures situated at ends of the projections. Wall thin, often broken, agglutinated, with medium- to coarse-grained material.

Remarks: Barrandian specimens differ from the holotype in more massive projections.

Material: about 35 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry), Dalejan (Třebotov Lst.: Chýnice – old quarry, Prastav Quarry)

Other distribution: Silurian of the Mississippi Basin (Dunn, 1942); Upper Devonian of the East Thuringian Slate Mountains (Blumenstengel, 1961)

Thurammina sphaerica IRELAND, 1939
Text-fig. 15f, Pl. 16, fig. 5

1939 Thurammina sphaerica IRELAND, Ireland, Foraminifera from Oklahoma, p. 197, figs A-33, 34

Description: Test free, spherical. Numerous large protuberances arranged irregularly around the tests similarly to T. papillata. Apertures situated at ends of protuberances. Wall agglutinated, composed of medium-sized grains.

Remarks: This species differs from T. papillata in its wall being composed of coarser grains, in agreement with the original diagnosis.

Material: 3 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Old Quarry), Dalejan (Třebotov Lst.: Prastav Quarry, Chýnice – old quarry)

Other distribution: Silurian of Oklahoma (Ireland, 1939); Upper Devonian of the East Thuringian Slate Mountains (Blumenstengel, 1961)

Thurammina triradiata GUTSCHICK et TRECKMAN, 1959
Text-fig. 15g, Pl. 4, fig. 3; Pl. 16, fig. 4

1959 Thurammina triradiata GUTSCHICK et TRECKMAN, Gutschick and Treckman, Arenaceous Foraminifera from the Rockford..., p. 233, Pl. 33, figs 16, 17

Description: Test free, triangular in outline, with three long and relatively broad tapering neck-like projections situated in the corners of the triangle. Apertures circular at ends of projections. Wall agglutinated, composed with medium-grained grains.

Material: 10 specimens

Distribution in the Barrandian area: (?) Ludfordian (Smoking Quarry, Koledník Quarry) Lochkovian + Pragian (Homolka Quarry), Dalejan (Třebotov Lst.: Prastav Quarry, Chýnice – old quarry)

Other distribution: Upper Devonian of the East Thuringian Slate Mountains (Blumenstengel, 1961); Mississippian of Indiana (Gutschick and Treckman, 1959)

Thurammina aff. tubulata MOREMAN, 1933
Text-fig. 15h, Pl. 7, figs 10, 11; Pl. 16, fig. 8

1933 Thurammina tubulata MOREMAN, Moreman, Arenaceous Foraminifera from Ordovician, etc., p. 52, Pl. 5 : 8

Description: Test free, spherical. Numerous circular apertures situated at the end of tube-like projections irregularly arranged around the test. Wall agglutinated, composed of fine to medium-grained material.
Remarks: In comparison with Oklahoma specimens, foraminifers from the Barrandian area have more massive tube-like projections.

Material: 6 specimens

Distribution in the Barrandian area: Ludfordian (Kosov Quarry), Dalejan (Třebotov Lst.: Prastav Quarry)

Other distribution: Silurian of Oklahoma (Moreman, 1933; Ireland, 1939)

Thurammina sp. 1
Text-fig. 15i, Pl. 10, fig. 11, 12; Pl. 13, fig. 7

Description: Test free, spherical, with 3 to 5 tapering, short neck-like projections irregularly arranged around the test. Rounded apertures situated at ends of projections. Test agglutinated, with medium grains.

Material: about 15 specimens

Distribution in the Barrandian area: Praagian (Dvorce-Prokop Lst.: Stydlé vody Quarry), Dalejan (Třebotov Lst.: Chýnice – old quarry, Údolí Hluboké Valley, Prastav Quarry), Eifelian (Kačák Creek Valley)

Other distribution: common from the Lower Silurian

Genus Lagenammina RHUMBLER, 1911

Lagenammina ovata BELL, 1996
Text-fig. 14b, Pl. 1, fig. 7

1996 Lagenammina ovata BELL, Bell, Early Devonian (Emsian) agglutinated foraminiferans, p. 92, fig. 7 O P

Description: Test free, monothalmous, ovate, aperture terminal, present on a short neck, in thinner part of test. Wall is agglutinated, composed of medium-grained material.

Material: 3 specimens

Distribution in the Barrandian area: Ludfordian (Smoking Quarry)

Other distribution: Early Devonian of Australia (Bell, 1996)

Lagenammina sphaerica MOREMAN, 1930
Text-fig. 14c, Pl. 4, fig. 2; Pl. 6, fig. 2; Pl. 7, figs 2, 3, 4, 6; Pl. 11, figs 1–3, 12; Pl. 13, fig. 6; Pl. 14, fig. 1; Pl. 16, figs 1–3

1930 Lagenammina sphaerica MOREMAN, Moreman, Arenaceous foraminifera from the Ordovician, p. 51, Pl. 5, fig. 15

Description: Test free, spherical to oval. Aperture rounded, situated on an elongate neck in thicker part of test. Neck usually broken, representing about 1/3 – 1/2 of test diameter if well preserved. Wall agglutinated, thin (often with small breaks; Pl. 7, fig. 2) with unsorted grain material dominated by fine grains.

Material: 70 specimens

Distribution in the Barrandian area: Ludfordian (Kosov Quarry), Pragian (Dvorce-Prokop Lst.: Homolka Quarry, Údolí Hluboké Valley, Stydlé vody Quarry, Old Quarry, Opatřilka Quarry), Dalejan (Třebotov Lst.: Chýnice – old quarry, Nad tratí Quarry, Údolí Hluboké Valley, U jezírka Quarry, Prastav Quarry); Suchomasty Lst.: Červený lom Quarry), Efelfian (Kačák Quarry)

Genus Saccammina CARPENTER, 1869

Species S. pseudospiralis and S. cumberlandiae were originally designated to Proteonina WILLIAMSON. This genus was revised by Loeblich and Tappan (1955). Based on this revision, Proteonina is treated as a junior synonym of Reophax MONFORT. McClellan (1966) recommended Palaeozoic “proteoninas” to be ranked within Saccammina (absence of neck) or Lagenammina (pyriform outline, presence of neck). In this paper, only very thin-walled (often broken) specimens were placed among Lagenammina, and the other to Saccammina.

Generic classification of Saccammina petinensis is questionable.

Saccammina cumberlandiae (CONKIN, 1961)
Text-fig. 14d, Pl. 6, fig. 6

1961 Proteonina cumberlandiae CONKIN, Conkin, Mississippian smaller foraminifera of Kentucky, p. 248, figs 2, 3; Pl. 19, figs 1–3; Pl. 26, figs 4, 5

Description: Test free, compressed, originally probably with ovoid part gradually continuing to long, rounded neck. Aperture rounded at end of the neck. Wall agglutinated, composed of very fine particles.

Material: 1 specimen

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley)

Other distribution: Llandovery of Indiana (Browne and Schott, 1963); Wenlock of Indiana (McClellan, 1966); Mississippian of Kentucky (Conkin, 1961)

Saccammina aff. ligula GUTSCHICK, WEINER et YOUNG, 1961
Text-fig. 14e, Pl. 6, figs 14, 15

1961 Saccammina ligula GUTSCHICK, WEINER et YOUNG, Lower Mississippian arenaceous Foraminifera..., p. 1207, Pl. 150, figs 3, 6, 8, 11; text-figs 3–14, 18–22

Description: Test attached, hemispherical. Surface of attachment reflects the substrate morphology. Aperture
Saccammina pseudospiralis (CUSHMAN et STAINBROOK, 1943)

Text-fig. 14f, Pl. 4, fig. 6; Pl. 5, fig. 17; Pl. 9, fig. 11; Pl. 11, fig. 14; Pl. 12, figs 5, 6; Pl. 18, figs 4–6

Description: Test free, monothalmous, rounded, aperture situated on relatively short (1/2 of test diameter) and thick neck situated at one side of rounded test. Position of the neck gives a spiral appearance of test. Test including neck compressed. Wall agglutinated, composed of medium-to fine-grained material.

Material: about 40 specimens

Distribution in the Barrandian area: Ludfordian (z. with A. laceunda) 1, Ludfordian (z. with A. laceunda) 2, Ludfordian (z. with E. beaumontii) 1, Ludfordian (z. with E. beaumontii) 2, Ludfordian (z. with E. beaumontii) section 780/1 platy limestones

Homerian (z. T. testis)

Gorstian (shales)

Homerian (shales)

Saccammina sp. 1

Text-fig. 14g, Pl. 4, fig. 8; Pl. 5, fig. 3

Description: Test flattened, originally probably globular. Aperture situated on long (about 2 test diameters) and thick neck. Wall agglutinated, composed of medium to fine-grained material. Interstitial pores present in globular part of test.

Material: 1 specimen

Distribution in the Barrandian area: Praagian (Dvorce-Prokop Lst.: Homolka near velká Chuchle; Řeporyje Lst: Srbsko section)

Saccammina (?) petinensis BYKOVA, 1955

Text-fig. 14h, Pl. 14, fig. 3; (?)Pl. 16, fig. 12

1955 Saccammina petinensis BYKOVA, Bykova and Polenova, Foraminifery, radiolarii i ostrakody..., p. 14, Pl. I, fig. 1; Pl. IV, figs 1, 2

Description: Test free, hemispherical with a rounded border. Aperture large, rounded, situated in the middle of flat area. Wall agglutinated, rough, composed of medium-sized grains.

Material: 4 specimens
Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Nad tratí Quarry, (?)Prastav Quarry)
Other distribution: Frasnian of the Voronez region (Bykova and Polenova, 1955)

Family Hippocrepinidae RHUMBLER, 1895

Genus Hyperammina BRADY, 1878

Hyperammina gracilenta GUTSCHICK et TRECKMAN, 1959
Text-fig. 20a, (?) Pl. 2, fig. 5; Pl. 13, fig. 12; Pl. 17, figs 1, 5, 6
1959 Hyperammina gracilenta GUTSCHICK et TRECKMAN, Gutschick and Treckman, Arenaceous Foraminifera from the Rockford limestone,..., pp. 237–238, Pl. 34, figs 10, 11, text-fig. 1-G-I

Description: Test free, small, with elongate or bulbous proloculus followed by a slender tubular second chamber. Diameter of proloculus markedly broader than second chamber. Second chamber straight or slightly curved. Wall agglutinated, thin, composed of medium-grained material.
Remarks: Accurate determination of Silurian specimens is impossible as only two fragments of proloculus were found.
Material: about 45 specimens

Other distribution: Mississipian of Missouri, Illinois and Indiana (Gutschick and Treckman, 1959; Conkin et al., 1968)
Hyperammina kahlleinwensis BLUMENSTENGEL, 1961
Text-fig. 20b, Pl. 13, fig. 13

1961 Hyperammina kahlleinwensis BLUMENSTENGEL, BLUMENSTENGEL, Foraminiferen aus dem Thuringer Oberdevon, p. 322, Pl. II, figs 1–6, 11, 13; Pl. III, fig. 4

Description: Test free, small spherical proloculus followed by tubular second broader chamber, in the final part maybe slightly tapered. Diameter of tubular chamber higher than that of proloculus, max. 2 times higher. It is the largest Hyperammina in the Barrandian material. Rounded aperture at end of second chamber. Wall agglutinated, thick, composed of fine material.

Material: 4 specimens

Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Údolí Hluboké Valley, Při trati Quarry, U jezírka Quarry)

Other distribution: Upper Devonian of the East Thuringian Slate Mountains (BLUMENSTENGEL, 1961); Mississippian of Missouri, Illinois, Montana (Gutschick, 1962; Conkin et al., 1968)

Hyperammina rockfordensis GUTSCHICK et TRECKMAN, 1959
Text-fig. 20c, Pl. 6, fig. 3; Pl. 8, figs 2–5; Pl. 9, fig. 4, 8; Pl. 11, fig. 7, 8

1959 Hyperammina rockfordensis GUTSCHICK et TRECKMAN, Gutschick and Treckman, Arenaceous Foraminifera from the Rockford Limestone..., pp. 238, pl. 34, figs 1–5, text-fig. 1-a-c
Description: Test free, robust. Ellipsoidal proloculus followed by tubular straight second chamber. Only gently tapering between proloculus and second chamber. In some specimens, second chamber having poorly visible constrictions (Pl. 8, figs. 2-5) or slightly enlarged (Pl. 11, fig. 7, 8). Diameter of proloculus similar to that of the second chamber. Aperture not preserved in any broken test (only broken specimens studied). Wall agglutinated, composed of fine material.

Material: about 150 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley, Stydle vody Quarry, Opatřilka Quarry, Homolka near Velká Chuchle, section below Barrandov); Dalejan (Třebotov Lst.: Chýnice – old quarry, Údolí Hluboké Valley, Prastav Quarry, U jezírka Quarry), Eifelian (Kačák Creek Valley)

Other distribution: Upper Devonian of the East Thuringian Slate Mountains (Blumenstengel, 1961) and Kentucky (Conkin, 1961); uppermost Devonian of the Holy Cross Mts. (Olempska 1983); Mississippian of Indiana (Gutschich and Treckman, 1959), Missouri (Conkin et al. 1968).

Hyperammina ( ?) sp. 2
Text-fig. 20e, Pl. 1, fig. 14

Description: Test free, proloculus triangular in outline, separated from second tubular chamber by a tapering. Wall agglutinated, composed of fine-grained material. With only a small part of the second chamber being known, the specimens cannot be safely attributed to genus Hyperammina.

Material: 1 specimen

Distribution in the Barrandian area: Homerian (Kační Quarry)

Genus Saccorhiza EIMER et FICKERT, 1899

Saccorhiza aff. proboscis (BELL, 1996)
Text-fig. 20f, Pl. 17, fig. 2

1996 Hyperammina proboscis BELL, Bell, Early Devonian (Emsian) agglutinated foraminiferans..., p. 86, 88, figs 7A, B

Description: Test free. Ellipsoidal proloculus gradually followed by tubular second chamber without any constriction. Second chamber slightly tapered and then slightly enlarged, sinusoidally curved after the first straight interval. Aperture rounded at the end of second chamber. Wall agglutinated, composed of very fine, well cemented material.

Remarks: Specimens from the Barrandian area differ from the original material in their fine and well cemented material of tests in comparison with poorly cemented angular grains. They have two turns while the Australian specimens possess one turn only.

Material: 3 specimens

Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Prastav Quarry)

Other distribution: Emsian of Victoria, Australia (Bell, 1996)
Family **Ammodiscidae** REUSS, 1862

Genus **Glomospira** RZEHAK, 1885

*Glomospira* (?) sp.

Text-fig. 21a, Pl. 1, fig. 10

**Description:** Test free, secondarily compressed. Proloculus followed by undivided tubular second chamber trochospirally coiled about its axis, with a sharp change in direction of coiling observed in the final stages. Wall agglutinated, composed of fine material. Aperture circular, situated at open end of the second chamber.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Ludfordian (Smoking Quarry)

Genus **Ammovolummina** CHERNYKH, 1967

*Ammovolummina* sp.

Text-fig. 21b, Pl. 5, fig. 8

**Description:** Test free, with large ovoid proloculus followed by tubular second chamber, and separated from the second chamber by hourglass tapering. Second chamber curved, rapidly enlarged in initial stage, later with constant diameter. Wall agglutinated, thick, composed of medium-grained material.

**Remarks:** In contrast to the described Siberian specimens, the second chamber does not enlarge continuously from the proloculus to the apertural end. Only the figured, partly broken specimen was found, which is not sufficient for the establishment of a new species.

**Distribution in the Barrandian area:** Ludfordian (Kosov Quarry)

Genus **Serpenulina** TSCHERNICH, 1967

*Serpenulina uralica* TSCHERNICH, 1967

Text-fig. 21c, Pl. 3, figs 8–11

1967 *Serpenulina uralica* TSCHERNICH, Tschernich, Novyje pozdnesilurskie foraminifery Urala, p. 43, Pl. 3, figs 8–11

**Description:** Test attached, oval proloculus poorly recognizable, followed by hemitubular enlarged second chamber. Second chamber making a weak U-turn. Aperture situated at open end of the second chamber. Wall agglutinated, composed of fine to medium-sized, well cemented grains.

**Distribution in the Barrandian area:** Ludfordian (Kosov Quarry)

**Other distribution:** Ludlow of Siberia (Tschernich, 1965); Lochkovian of Australia (Bell, 1999)

Genus **Ammodiscella** IRELAND, 1956

*Ammodiscella* sp.

Text-fig. 21d, Pl. 9, fig. 12

**Description:** Test attached, small proloculus followed by tubular, planispirally coiled second chamber. 3–4 whors regular, the last one becoming irregular, overlapping the previous whors. Aperture rounded, situated at open end of tube. Wall agglutinated, with small-sized grains.
Remarks: Rare occurrence (2 specimens) does not permit to study variability of ammodiscellas. Therefore, a more detailed classification was not proposed.

Distribution in the Barrandian area: Dalejan (Suchomasty Lst.: Hergetův lom Quarry)

Other distribution: Pennsylvanian of Kansas (Ireland, 1956)

Genus Tolypammina RHUMBLER, 1895 versus Ammovertella CUSHMAN, 1928

Separation of genera Tolypammina and Ammovertella resulted in an equivocal interpretation of their concept in the literature (Ireland, 1956; Barnard, 1958; Gutschick and Treckman, 1959; Conkin, 1961; Conkin and Conkin, 1964; Loeblich and Tappan, 1987; Bell, 1996). Ireland (1956) proposed the following criteria for distinguishing the genera: cross-sections of second chamber (circular in Tolypammina, hemicircular in Ammovertella), coiling of the initial part of second chamber (possibly coiled in Tolypammina, sinuous in Ammovertella), and the presence/absence of agglutinated floor of attached part of second chamber (agglutinated floor present in Tolypammina but not found in Ammovertella). Gutschick and Treckmann (1959) followed these criteria but described forms which combined features of both genera. This observation was also confirmed by the study of Barrandian foraminifers (forms with hemicircular second tube with coiled initial part). Also Conkin (1961) used the same criteria for distinguishing different genera. Barnard (1958) proposed a simple separation of these genera: Tolypammina has no initial coiling of second chamber, Ammovertella has this initial coiling. This concept was also applied by Bell (1996). As it has been shown by the observations of Ireland (1956), the presence/absence of initial coiling may represent intraspecific variability (T. polyvorta IRELAND, A. inclusa CUSHMAN et WATERS, A. primaparva IRELAND).

Text-fig. 22. A sketch of morphotypes from family Ammodiscidae (genus Tolypammina RHUMBLER, 1895). a – Tolypammina irregularis BLUMENSTENGEL; b – Tolypammina polyvorta IRELAND; c – Tolypammina sperma GUTSCHICK, WIENER et YOUNG; d – Tolypammina aff. tornella (IRELAND); e – Tolypammina tortuosa DUNN; f – Tolypammina sp. 1; g – Tolypammina sp. 2; h – Tolypammina sp. (? T. nodosa IRELAND); i – Tolypammina sp. 3; j – Tolypammina sp. 4; k – Tolypammina bulbosa (GUTSCHICK et TRECKMAN); l – Tolypammina sp. 5; m – Tolypammina sp. 6; n – Tolypammina sp. 7; o – Tolypammina sp. 8.
which contradicts the concept of Barnard (1958). Loeblich and Tappan (1987) characterized genus Ammovertella by the second chamber grown in zigzag fashion only. Tolypammina has an irregular second chamber. Forms with coiled second chamber can be attributed to Ammodiscella.

Description: Proloculus small, followed by tubular, second chamber. Diameter may change irregularly. Wall agglutinated, composed of fine material. Bottom wall of attachment absent.

Material: about 15 specimens

Other distribution: Upper Devonian of the East Thuringian Slate Mountains (Blenustengel, 1961) and Holy Cross Mountains (Olempska, 1983)

Tolypammina irregularis BLUMENSTENGEL, 1961

Description: Test attached, with hemispherical proloculus followed by hemitubular second chamber. After straight stage, chamber is planispirally coiled. Its diameter may change irregularly. Wall agglutinated, composed of fine material. Bottom wall of attachment absent.

Material: about 15 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Opatřilka Quarry), Dalejan (Třebotov Lst.: Údolí Hluboké Valley) Other distribution: Upper Devonian of the East Thuringian Slate Mountains (Blenustengel, 1961) and Holy Cross Mountains (Olempska, 1983)

Tolypammina polyverta IRELAND, 1956

Description: Proloculus small, followed by tubular, slightly enlarged second chamber. Initial stage of tube coiled (about 1 whorl), with growth becoming irregular lat-

er: prevalently sinuous growth, with U-turns (Pl. 8, figs 10, 11). Irregular structures arranged in space. Wall agglutinated, with very fine material, surface smooth.

Material: 3 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry) Other distribution: Mississippian of Kansas (Ireland, 1956)

Tolypammina sperma GUTSCHICK, WIENER et YOUNG, 1961

Description: Proloculus small, followed by tubular, second chamber. The second chamber is sinuous. Constriction present between proloculus and second chamber. Wall agglutinated, composed of medium-grained material.

Material: 5 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley), Dalejan (Třebotov Lst.: Údolí Hluboké Valley) Other distribution: Mississippian of Oklahoma, Texas and Montana (Gutschick et al., 1961)

Tolypammina aff. tornella (IRELAND, 1956)

Description: Proloculus small, followed by tubular, second chamber. Tube gradually enlarged and irregularly coiled around a spine-like object. Initial stage of tube straight and parallel to this object, with the straight part partly covered by coils. Wall agglutinated, composed of medium- to fine-grained material, surface rough.

Remarks: Barrandian specimens differ from Ireland’s specimens in their rough surface and gaps between coils.

Material: 2 specimens

Distribution in the Barrandian area: Pragian (Homolka Quarry) Other distribution: Mississippian of Kansas (Ireland, 1956)

Tolypammina tortuosa DUNN, 1942

Description: Test attached, proloculus followed in initial stage by planispiral coiled and hemitubular second chamber (one and a half whorl). The second chamber later becomes

Other distribution: Mississippian of Kansas (Dunn, 1942)
irregular in growth and ellipsoidal in cross-section. Wall agglutinated, composed of medium-sized grain material.

**Material:** 10 specimens

**Distribution in the Barrandian area:** Lochkovian (Homolka near Velká Chuchle), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry, Homolka Quarry), Zlíchovian (Stydlé vody Quarry)

**Other distribution:** Silurian of the Mississippi Basin (Dunn, 1942)

**Tolypammina** sp. 1

**Text-fig. 22f, Pl. 4, figs 9, 10**

**Description:** Test attached, proloculus small and hemioval, followed by hemitubular second chamber of constant diameter. Initial part of second chamber narrow, with tubes making U-turns later. Distances between bends approximately equal. Test generally rectangular in shape. Walls between bends partly doubled, partly single. Final part of tube probably irregular. Wall agglutinated, composed of fine material, with smooth surface on convex side and rough surface on attached side. Floor of attached side missing in some specimens.

**Remarks:** Zigzag growth characterizes initial stage of species *A. inclusa* CUSHMAN et WATERS, *A. primaparva* IRELAND, *A. prodigalis* IRELAND. None of these species can be compared with specimens from the Barrandian area. Well preserved specimens with preserved irregular final stage of second chamber for the establishment of a new species are missing.

**Material:** 3 specimens

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop Lst.: Homolka Quarry, Pod terasami Quarry)

**Tolypammina** sp. 2

**Text-fig. 22g, Pl. 17, fig. 13**

**Description:** Test attached. Proloculus small, followed by hemispherical second chamber. Chamber making a U-turn after 1 1/2 coil and then a U-turn after another 1 1/2 of coil. Wall agglutinated, composed of fine material. Attached wall absent.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Dalejan (Třebotov Lst.: Prastav Quarry)

**Tolypammina** sp. (2) Fragments of proloculus and coiled second chamber

**Tolypammina** sp. (2) *T. nodosa* IRELAND, 1956

**Text-fig. 22h, Pl. 17, fig. 15**

1956 *Tolypammina nodosa* IRELAND, Ireland, Upper Pennsylvanian arenaceous Foraminifera... p. 850, Text-fig. 4-25-29

**Description:** Test apparently free, with inflated spots probably representing areas of attachment. Proloculus large, spherical, separated from tubular second chamber by constrictions. Initial stage of second chamber planispirally coiled (1 whorl), later stage uncoiled. Second chamber possessing characteristic constrictions and only slightly enlarged. Wall thin, composed of fine material.

**Remarks:** Fragments of proloculus and initial stage in the Barrandian material agree with the diagnosis of *T. nodosa*. No complete specimens have been found; as a result, these fragments cannot be safely determined.

**Material:** about 100 specimens

**Distribution in the Barrandian area:** (?) Ludlow (Požáry section), Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry, Homolka Quarry, Opatřilka Quarry, V rokli Quarry), Dalejan (Daleje Sh.: Ke hřbitovu section; Třebotov Lst.: Prastav Quarry, Chýnice – old quarry, U jezírka Quarry, Údolí Hluboké Valley)

**Other distribution:** Pennsylvanian of Kansas (Ireland, 1956)

**Tolypammina** sp. 3

**Text-fig. 22i, Pl. 5, fig. 5**

**Description:** Test attached, secondarily compressed. Proloculus large, originally globular to hemiglobular, followed by slightly enlarging second chamber: its initial stage planispirally coiled, than uncoiled. Diameter of second chamber very probably hemitubular. Wall agglutinated, composed of fine to medium-grained material.

**Remarks:** These fragments may represents initial stage of *T. botonuncus* GUTSCHICK et TRECKMAN or *T. cyclops* GUTSCHICK et TRECKMAN described from the Carboniferous of several regions of the U.S.A.

**Material:** 3 specimens

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop. Lst.: Old Quarry)

**Tolypammina** sp. 4

**Text-fig. 22j, Pl. 11, figs 10, 11; Pl. 14, fig. 4 ; Pl. 17, figs 7, 8, 10**

**Description:** Test attached. Proloculus small, hemiovoid followed by sinuous, hemitubular, later tubular second chamber. Second chamber possessing characteristic constrictions, with irregularly changing diameter. Wall agglutinated, composed of medium-grained material.

**Material:** about 10 specimens

**Distribution in the Barrandian area:** Dalejan (Třebotov Lst.: Chýnice – old Quarry, Údolí Hluboké Valley, Nad tratí Quarry, Prastav Quarry)

**Tolypammina bulbosa** (GUTSCHICK et TRECKMAN, 1959)

**Text-fig. 22k, Pl. 17, figs 11, 12**

1959 *Ammovertella bulbosa* GUTSCHICK et TRECKMAN, Gutschick and Treckman, Arenaceous Foraminifera from the Rockford limestone ... p. 247, Pl. 37, figs 4–5, 8–9
1964 *Tolypammina bulbosa* (GUTSCHICK et TRECKMAN), Conkin and Conkin, Devonian Foraminifera..., pp. 92–95, Pl. 13, figs 12–17

**Description:** Test attached. Proloculus large, ovoid, followed by hemitubular second chamber. Initial stage of tubular chamber turning, then straight. Further continuation of the chamber not observed. Wall agglutinated, composed of fine- to medium-grained material.

**Material:** about 100 specimens

**Distribution in the Barrandian area:** Dalejan (Třebotov Lst.: Prastav Quarry, Údolí Hluboké Valley, Chýnice – old quarry), Eifelian (Choteč Lst.: Kačák Creek Valley)

**Other distribution:** Devonian of Missouri and Illinois (Conkin and Conkin, 1964); Mississippian of Indiana (Gutschick and Treckman, 1959)

*Tolypammina* sp. 5

Text-fig. 22l, Pl. 9, fig. 7; Pl. 12, fig. 7

**Description:** Test attached. Hemispherical proloculus is followed by hemitubular straight second chamber. Its diameter is constant. Wall is agglutinated, composed of fine to medium material.

**Material:** 4 specimens

**Distribution in the Barrandian area:** Dalejan (Třebotov Lst.: Opatřilka Quarry), Eifelian (Choteč Lst.: Kačák Creek Valley)

*Tolypammina* sp. 6

Text-fig. 22m, Pl. 4, fig. 1

**Description:** Test attached. Proloculus large, hemispherical, followed by probably straight hemitubular narrow second chamber. Constriction present between proloculus and second chamber in convex part of test. Shape of second chamber questionable due to preservation of only very small part. Test agglutinated, composed of medium-grained material.

**Material:** 4 specimens

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop Lst.: Homolka Quarry, Stydlé vody Quarry, Braník Quarry); Zlichovian (Stydlé vody Quarry)
**Tolypammina sp. 7**

Text-fig. 22n, Pl. 5, fig. 13

**Description:** Test attached, proloculus hemispherical, followed by gradually narrowing hemitubular straight second chamber. Diameter of initial part of second chamber nearly equal to proloculus diameter. Second chamber possessing constrictions. Wall agglutinated, composed of medium-sized material.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Pra
gian (Dvorce-Prokop Lst.: Pod terasami Quarry)

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**Tolypammina sp. 8**

Text-fig. 22o, Pl. 5, fig. 7

**Description:** Test attached, proloculus large, hemispherical, followed by a narrow hemitubular second chamber. Floor of attached side absent in some specimens, especially in the proloculus. Second chamber inclined towards proloculus. Wall agglutinated, composed of fine-grained material.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Pra
gian (Dvorce-Prokop Lst.: Old Quarry)
**Tolypammina** sp. – fragment of tubular second chamber

*Description:* Among numerous tubular rests, only hemitubular ones were classified as *Tolypammina* sp. The others cannot be classified into genera and are described below. Hemitubular fragments slightly curved, composed of medium-grained material.

*Material:* about 80 specimens

*Distribution in the Barrandian area:* Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley), Zlichowian (Kačák Creek Valley), Dalejan (Suchomasty Lst: Červený lom Quarry)

**Genus Ammodiscus** REUSS, 1862

**Ammodiscus ex gr. incertus** (D’ORBIGNY, 1838)

*Description:* T est free, planispirally coiled, with tubular second chamber having 4–6 coils. Last whorls (the 5th and 6th) partly enclosed by the successive whorl. Aperture situated at open end of tube. Wall agglutinated, composed of fine to medium-sized grains.

*Material:* about 300 specimens

*Distribution in the Barrandian area:* Dalejan (Třebotov Lst.: Chýnice – old quarry, Údolí Hluboké Valley, Prastav Quarry, Pří trati Quarry), Eifelian (Choteč Lst.: Kačák Creek Valley)

*Other distribution:* common from the Lower Silurian (Conkin and Conkin, 1982)

**Ammodiscus exsertus** CUSHMAN, 1910

*Description:* T est free, proloculus followed by tubular second chamber planispirally coiled with 3–4 coils. Final part of second chamber uncoiled, extending perpendicular from the plane of coiling. Aperture situated at end of second chamber. Wall agglutinated, composed of medium to coarse grains.

*Material:* 2 specimens

*Distribution in the Barrandian area:* Dalejan (Údolí Hluboké Valley)

*Other distribution:* common from the Lower Silurian (Conkin and Conkin, 1982)
Ammodiscus sp.

Description: Proloculus small, followed by planispirally coiled second chamber. Central part of test with proloculus often missing. 3–4 whorls observable. Aperture representing open end of the second chamber. Wall agglutinated, composed of medium-sized grains, poorly cemented.

Remarks: Ammodiscus sp. described from the Pragian differs from A. incertus from the Dalejan in its poorly cemented wall, abundant damages of test and smaller size of test with lower number of coils.

Material: 5 specimens

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry, Old Quarry, V rokli Quarry, section below Barrandov).

Ammodiscidae gen. et sp. indet.

Description: Test attached, proloculus ovoid to hemiovoid, followed by undivided hemitubular second chamber that may be dichotomously branched. Attached wall markedly plane. Diameter of second chamber irregularly changing, with characteristic constrictions. Aperture not observed. Wall agglutinated with very fine-grained material.

Remarks: Dichotomous branching has not been described among attached Ammodiscidae. Barrandian morphotype probably represents a new genus. No complete specimen acceptable as a holotype was found in the studied material. Therefore, the new taxa have not been described yet.

Material: about 20 specimens

Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Údolí Hluboké Valley, Prastav Quarry)

Tube-like rests

Tube-like rests are common in many samples. They lack characteristics diagnostic for the classification into specific genera. Therefore, the different types of the tube-like rests are described separately.

Tube-like rests, type 1

Pl. 17, fig. 3, 4

Description: Irregularly curved tubular fragments, agglutinated with fine-grained material, probably represent rests of Saccorhiza proboscis which occur in the same sample.

Material: 4 specimens

Distribution in the Barrandian area: Dalejan (Třebotov Lst.: Údolí Hluboké Valley, Prastav Quarry)

Tube-like rests, type 2

Pl. 3, fig. 4

Description: Fragments with a circular cross-section. Straight or slightly arcuate segments are interrupted by acute turns which may represent fractures of test. Tubes are agglutinated, composed of fine-grained material. No complete specimens with tubular chambers were found in samples with these fragments.

Material: about 10 specimens

Distribution in the Barrandian area: Aeronian (Hlásná Třebáň), Telychian (Litohlavy section), Homerian (Bubovice-Loděnice section), Ludfordian (Smoking Quarry, Koledník Quarry), Přídolí (Požáry section, Na bříči section)

Tube-like rests, type 3

Pl. 5, fig. 10

Description: Tubular fragments are slightly arcuate. They are agglutinated with fine grains. They occur together with hyparamminas as well as tolypamminas.
Material: 3 specimens

**Distribution in the Barrandian area:** Pra-
gian (Old Quarry, Údolí Hluboké Valley)

**Tube-like rests, type 4**

**Description:** Tubular fragments possess U-shape
turns. They represent probable fragments of tolypamminas.
The tubes are agglutinated with fine grains.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Pra-
gian (Old Quarry)

Family **Hormosinidae** HAECKEL, 1894

**Hormosinidae** gen. et sp. indet.

**Description:** Test multilocular, with irregular cham-
bers arranged in a rectilinear series. Test postmortem-flat-
tened. Aperture not preserved. Wall agglutinated, composed
of medium-sized material.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Chapel
Coral Horizon (section below Barrandov)


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<tr>
<td>Material</td>
<td>3 specimens</td>
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<td><strong>Ammonobaculites aff. leptos</strong> GUTSCHICK et TRECKMAN, 1959</td>
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<td><strong>Family Litulidae</strong> DE BLAINVILLE, 1827</td>
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<td><strong>Genus Ammobaculites</strong> CUSHMAN, 1910</td>
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<td>Text-fig. 29a, Pl. 17, fig. 17</td>
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<td><strong>Description:</strong> Test free, small-sized, multilocular, with its early portion coiled with 5 spherical chambers in outer whorl. Later portion monoserial. Monoserial part with max. 5 chambers observed, however, with no complete specimens studied. Aperture not preserved. Wall agglutinated, with fine-grained material, surface rough.</td>
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<td>Remarks: Barrandian specimens differ from the original material in their small size.</td>
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<td><strong>Material:</strong> 3 specimens</td>
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</table>
| **Distribution in the Barrandian area:** Dale-
jan (Trebotov Lst.: Prastav Quarry) |
| **Other distribution:** Mississippian of Oklahoma, Texas and Montana (Gutschick and Treckman, 1959; Gutschick et al., 1961) |

1959 **Ammobaculites aff. leptos** GUTSCHICK et TRECKMAN, Gutschick and Treckman, Arenaceous foraminifera from the Rockford limestone ..., pp. 247–248, Pl. 37, figs 12, 13
Ammobaculites minutus WATERS, 1927

Description: Test free, multilocular, planispiral in early stage, later monoserial. Planispiral stage formed by 1 whorl consisting of 5–6 chambers. Sutures very slightly inflated. Periphery of planispiral stage rounded. Monoserial stage consisting of 3–4 chambers with more inflated sutures. Aperture rounded, terminal, situated at end of small neck. Wall agglutinated, composed of fine-grained material.

Material: 1 specimen

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley)

Ammobaculites (?) sp.

Pl. 9, fig. 17

Description: A poorly preserved specimen, maybe partly dissolved in an acid. Test free, multilocular, consisting of coiled early portion and monoserial portion. Planispiral stage possessing a higher number of whorls. Shape of chambers difficult to distinguish, aperture not preserved. Definite classification of these specimens is hindered by their poor preservation. They may be correlated with A. chappelensis GUTSCHICK, WEINER et YOUNG.

Material: 1 specimen

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley)

Fragments of monoserially arranged tests

Pl. 6, fig. 13

Fragments of multilocular tests are composed of elongate, monoserially arranged chambers. Fragments with 2–3 chambers were found. Wall is agglutinated, composed of fine-grained material. They may represent fragments of Ammobaculites or Reophax.

Material: 1 specimen

Distribution in the Barrandian area: Pragian (Dvorce-Prokop Lst.: Braník Quarry)

Suborder Fusulinina WEDEKIND, 1896

Calcereous tests were preserved only very rarely in dissolution residua. Specimens are fragmentary, partly dissolved, and morphotypes are often represented only by a single specimen. Therefore, their determination is only approximate.
Family **Archaesphaeridae** MALAKHOVA, 1956

*Archaesphaeridae* gen. et sp. indet.

**Description:** Test free, central sphere with two or three hemispherical protrusions. No aperture observed. Wall calcareous, very thin.

**Material:** 2 specimens

**Distribution in the Barrandian area:** Dalejan (Daleje Sh.: “Ke hřbitovu” section)

Family **Usloniidae** MIKLUKHO-MAKLAY, 1963

**Genus** *Bisphaera* BIRINA, 1948

*Bisphaera* (?) sp.

**Description:** Test free. Large globular chamber connected with a smaller elongate chamber via constriction, with no septum developed between them. Aperture not visible. Wall calcareous, perforate.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop Lst.: Pod terasami Quarry)

Other distribution: Middle and Upper Devonian, Lower Carboniferous of Russia (Bykova, 1955; Birina, 1948)

Family **Moravamminidae** POKORNÝ, 1951

**Moravamminidae** gen. et sp. indet.

**Description:** Test attached. Tubular nonseptate chamber coiled, forming ring structure, probably around slender tubular object of attachment. Continuation of test probably uncoiled. Wall calcareous.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop Lst.: Old Quarry)

Family **Paratikhinellidae** LOEBLICH et TAPPAN, 1984

**Paratikhinellidae** gen. et sp. 1

**Description:** Test free. Proloculus drop-like, connected via constriction with slightly curved tube partly subdivided to cylindrical chambers. Aperture not preserved. Wall calcareous.

**Material:** 4 specimens

**Distribution in the Barrandian area:** Pragian (Dvorce-Prokop Lst.: Pod terasami Quarry, Homolka Quarry)

**Paratikhinellidae** (?) gen. et sp. 2

**Description:** Test free. Proloculus large, elongate, followed by second elongate curved chamber. Following chambers cylindrical, flattened in their middle parts, with restrictions between chambers. Apertural end of test not preserved. Wall calcareous.

**Material:** 1 specimen

**Distribution in the Barrandian area:** Ludfordian (Koledník Quarry)

Family **Nodosinellidae** RHUMBLER, 1895

**Nodosinellidae** (?) gen. et sp. indet.

**Description:** Chambers of sack type, narrower towards open end (? aperture), with calcareous wall. They may represent fragments of tests of family Nodosinellidae.

**Material:** 3 specimens

**Distribution in the Barrandian area:** Wenlock (Vyskočilka section), Pragian (V rokli Quarry)

### Microfossils of other groups

These organic rests were not studied and classified in much detail. The following data are intended as information about the occurrence of other organic groups.

**Radiolaria**

Pl. 20, figs 1–6

Only spumellarsids were found in the analysed samples. With the exception of the Choteč Lst., poorly preserved specimens were found. Abraded specimens may be mistaken for psammosphraeras. Study of walls in transmitted light enables a clear discrimination between radiolarians and psammospheraeras (psammospheraeras have thicker wall composed of grains).

**Distribution:** Homerian (Kační Quarry), Sheinwoodian (Loděnice-Bubovice section), Ludfordian (Smoking Quarry, Kosov Quarry), Lochkovian (Srbsko section), Pragian (Dvorce-Prokop Lst.: Opatřilka Quarry, V rokli Quarry, section below Barrandov), Zlichovian (Kačák Creek Valley, section below Barrandov), Dalejan (Trebotov Lst.: Nad trati Quarry, U jezírka Quarry, Prastav Quarry), Eifelian (Choteč Lst.: U jezírka Quarry, Prastav Quarry)
Sponge spicules

Pl. 20, figs 16–20; Pl. 21, figs 11–13, Pl. 22, fig. 10

The most common types are small-sized smooth spheara, often broken with clearly visible internal structure (Pl. 20, figs 16–18, 20; Pl. 21, figs 11–13). Another common type is desma. Tetrapods (Pl. 20, fig. 19) and oxyasters (Pl. 20, fig. 22) occur rarely.

Distribution: Sheinwoodian (Loděnice-Bubovice section), Gorstian (Arethusina Gorge, Na břekvici section), Ludfordian (Mušlovka Quarry, Cephalopod Quarry, Koledník Quarry, Smoking Quarry, Kosov Quarry, Požáry section), Přídolí (Koledník Quarry, Kosov Quarry, Požáry section, Podolí section), Lochkovian (Barrandova skála section, Srbško section, Holomlka Quarry), Pragian (Dvorce-Prokop Lst.: Holomlka Quarry, V rokli Quarry, Stýdlé vody Quarry, Braník Quarry, Slivenec Lst.: Srbško section), Zlichovian (Kačák Creek Valley, Údolí Hluboké Valley, Stydlé vody Quarry, section below Barrandov), Daleján (Daleje Sh.: Údolí Hluboké Valley, Třebotov Lst.: Nad tratí Quarry, Chýnice – old quarry, Údolí Hluboké Val-
Star-shaped microfossils are composed of a central body and very regularly arranged six arms in a single plane. The arms are approximately twice as long as the diameter of central body and may be predominantly slender (Pl. 21, figs 5, 7–10), rarely thick (Pl. 21, fig. 6). Two morphotypes can be distinguished on the basis of these differences in thickness of arms. They may be correlated with sponge spicules. Similar forms were described by Grubbs (1939) from the Niagarian of the Chicago area. Grubbs’s forms are pentagonally symmetrical (with 5 arms) but all other characteristics are fully identical. Grubbs's forms described the correlation of these fragments with polychaetous (pentagonal symmetry) or bryozoans similar to the genus *Evactinopora*.

Distribution: Ludfordian (Koledník Quarry, Kosov Quarry, Stochomasty Lst.: Červený Lom Quarry, Eifelian (Choteč Lst.: Chýnice – old quarry, Kačák Creek Valley), Lochkovian (Kotýs Lst.: Údolí Hluboké Valley), Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley, Homolka, Opatřilka Quarry, Stydlé vody Quarry, Old Quarry; Řeporyje Lst.: Srbsko section, V rokli Quarry; Koněprusy Lst.: Houbův lom Quarry), Zlichovian (Stydlé vody Quarry), Dalejan (Třebotov Lst.: Nad tratí Quarry, Chýnice – old quarry, Údolí Hluboké Valley; Suchomasty Lst.: Červený Lom Quarry), Eifelian (Choteč Lst.: Kačák Creek Valley)
Distribution: Pragian (Dvorce-Prokop Lst.: Stydlé vody Quarry)

**Ostracods**

Pl. 22, figs 1–4

In the studied acid-resistant residua, only recrystallized small-sized podocopids were found with no preserved taxonomically significant characteristics.

Distribution: Aeronian (Hlásná Třebáň section), Sheinwoodian (Loděnice-Bubovice section), Ludfordian (Koledník Quarry, Smoking Quarry), Lochkovian (Homolka Quarry), Pragian (Dvorce-Prokop Lst.: Údolí Hluboké Valley, Opatřilka Quarry, Homolka Quarry, Stydlé vody Quarry, Starý lom Quarry, Řeporyje Lst.: Srbsko section), Zlichovian (Stydlé vody Quarry), Dalejan (Daleje Sh.: Údolí Hluboké Valley; Suchomasty Lst.: Koněprusy area), Eifelian (Choteč Lst.: Prastav Quarry, Kačák Creek Valley)

Sclerites of **Holothuroidea**

Pl. 21, fig. 8

Mostly fragments of sclerites with pentalateral symmetry were found.

Distribution: Sheinwoodian (Loděnice-Bubovice section), Pragian (Dvorce-Prokop Lst.: Homolka Quarry, Stydlé vody Quarry; Řeporyje Lst.: Srbsko section), Dalejan (Troškov Lst.: Chýnice – old quarry, Prastav Quarry; Suchomasty Lst.: Červený lom Quarry), Eifelian (Choteč Lst.: Prastav Quarry, Kačák Creek Valley)

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<tr>
<th>Sample</th>
<th>Distribution</th>
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<tr>
<td>A</td>
<td>Hergetův lom Quarry 1, Suchomasty Lst.</td>
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<tr>
<td>B</td>
<td>Hergetův lom Quarry 2, Suchomasty Lst.</td>
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<tr>
<td>C</td>
<td>Zlatý kůň Hill, Acanthopyge Lst.</td>
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<tr>
<td>D</td>
<td>Houbův lom Quarry, Koněprusy Lst., lower part</td>
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<td>E</td>
<td>Houbův lom Quarry, Koněprusy Lst., middle part</td>
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<td>F</td>
<td>Houbův lom Quarry, Koněprusy Lst., upper part</td>
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<td>G</td>
<td>Houbův lom Quarry, Suchomasty Lst.</td>
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<td>Kobyla Quarry, lower part of Silvenec Lst.</td>
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<tr>
<td></td>
<td>Kobyla Quarry, upper part of Silvenec Lst.</td>
</tr>
<tr>
<td></td>
<td>Jiráskův lom Quarry, Acanthopyge Lst.</td>
</tr>
</tbody>
</table>

† + species present in sample (rare foraminiferal abundance in sample)  
□ less than 5 specimens in 1 kg rock sample

Text-fig. 34. Koněprusy area, section from Chlupáč 1999.

Text-fig. 35. Branik Quarry.
Text-fig. 36. Section Srbisko, from Chlupáč 1999.

Text-fig. 37. “Opatřilka – Červený lom” Quarry, lithology and ranges of selected fossils from Chlupáč et al. 1986.
Text-fig. 38. "Stydlé vody" Quarry, lithology and ranges of selected fossils from Chlupáč and Lukeš 1999.

<table>
<thead>
<tr>
<th>Relative abundance of species</th>
<th>More than 50%</th>
<th>5-10%</th>
<th>1-5%</th>
<th>less than 1%</th>
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</thead>
<tbody>
<tr>
<td>Bathysiphon sp.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rhabdammina (?) sp. – fragments</td>
<td></td>
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<tr>
<td>Praammosphaera cava MOREMAN</td>
<td></td>
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<tr>
<td>Praammosphaera minuta DUNN</td>
<td></td>
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<tr>
<td>Pseudastrominina aff. irregularis DUNN</td>
<td></td>
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<tr>
<td>Pseudastrominina sp.</td>
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<tr>
<td>Thurammina sphaerolithica PLUMMER</td>
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</tr>
<tr>
<td>Hemmisphaerammina cf. casteri McCLELLAN</td>
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<td>Hemmisphaerammina sp. 1</td>
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<td>Tholosina (1) sp. 2</td>
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<tr>
<td>Webbinelloidea hattini McCLELLAN</td>
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<tr>
<td>Thurammina aff. echinata DUNN</td>
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<td></td>
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<tr>
<td>Thurammina papillata BRADY</td>
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<tr>
<td>Thurammina quadrilobulata DUNN</td>
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<tr>
<td>Lagenammina sphaerica MOREMAN</td>
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</tr>
<tr>
<td>Saccammina pseudospiralis (CUSH. et STAINB.)</td>
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<tr>
<td>Hyperammina gracilenta GUTSCH. et TRECK</td>
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<tr>
<td>Hyperammina rockfordensis GUTSCH. et TRECK</td>
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<tr>
<td>Tolypammina polyvreta IRELAND</td>
<td></td>
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<tr>
<td>Tolypammina tortuosa DUNN</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tolypammina sp. (? T. nodosa IRELAND)</td>
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<tr>
<td>Tolypammina sp. 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolypammina sp. – fragm. of tubular sec. chamber</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammodiscus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foraminiferal abundance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Incertae sedis

Sphaeras

Pl. 21, figs 1–4

Regularly globular or elongate sphaeras were found rarely. The walls of sphaeras are very thin, siliceous, with distinct perforation. Sphaeras may evoke radiolarians with plate walls but they are known only from the Neogene.

Distribution: Pragian (Dvorce-Prokop Lst.: Opatřilka Quarry), Dalejan (Třebotov Lst.: Prastav Quarry)

Sack-like tests

Pl. 19, figs 1–21

Small, sack-like tests with large, rounded openings are very common in the studied samples. Shape of tests is variable: spherical (e.g. fig. 2), ovoid (e.g. fig. 16), cup-like (e.g. fig. 1). Ornamentation appears in younger forms (from the Dalejan) and is represented by rings (e.g. fig. 16). The rings vary from 5 to 10 in number and have different densities and intensities. Borders of openings may bear denticulation (e.g. fig. 15). The openings may be situated on necks: neck diameter may be close to test diameter (figs 9, 19) or narrow and long (fig. 13). Walls of shells are acid-resistant, thick.

This morphogroup may include different organisms. It can be supposed that microfossils with acid resistant tests are morphologically closest to tintinnids. Their occurrences in the Palaeozoic sediments are very rare.

A detailed systematic study of the group may provide very useful data as its representatives are common also at the levels with no microfossils. They can be used as index fossils because they have a sufficient morphological variability.

Distribution: Ludfordian (Koledník Quarry, Kosov Quarry, Požáry Quarry), Lochkovian (Srbsko section), Zlíchovian (Údolí Hluboké Valley, Stydlé vody, section below Barrandov), Pragian (Dvorce-Prokop Lst.: Opatřilka Quarry, Homolka Quarry, Stydlé vody Quarry, section below Barrandov), Dalejan (Třebotov Lst.: Prastav Quarry, Nad trati Quarry, Údolí Hluboké Valley; Suchomasty Lst.: Červený lom, Koněprusy area), Efielian (Choteč Lst.: Kačák Creek Valley, U jezírka Quarry, Prastav Quarry)

Incertae sedis 1

Pl. 20, figs 9–14

Test attached, composed of an ovoid central chamber with two narrow long tubes on the opposite side of test. One tube represents a narrowed central chamber, second
Text-fig. 41. Stratigraphical ranges of Silurian and Devonian foraminifers from the Barrandian. Continued on p. 121.
Text-fig. 41. Continued from p. 120.

<table>
<thead>
<tr>
<th>Silurian</th>
<th>Devonian</th>
<th>Chronostratigraphy</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Glomospira (?) sp.</td>
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<td></td>
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<td>Ammomovulummina sp.</td>
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<tr>
<td></td>
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<td>Serpenuolina uralica TSCHERNICH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammodiscella sp.</td>
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<tr>
<td></td>
<td></td>
<td>Tolypamina irregularis BLUMENSTENGEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina polyvata IRELAND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sperma GUTSCHICK, WIENER et YOUNG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina aff. hollina (IRELAND)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina tortuosa DUNN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. (?) T. nodosa IRELAND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. 4</td>
</tr>
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<td></td>
<td></td>
<td>Tolypamina bulbosa (GUTSCHICK et TRECKMAN)</td>
</tr>
<tr>
<td></td>
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<td>Tolypamina sp. 5</td>
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<td>Tolypamina sp. 7</td>
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<td></td>
<td></td>
<td>Tolypamina sp. 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolypamina sp. – fragment of tubular second chamber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammodiscus exsertus CUSHMAN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammodiscus ex gr. incertus (D’ORBIGNY)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammodiscus sp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammodiscidae gen. et sp. indet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tube-like rests, type 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tube-like rests, type 2</td>
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<tr>
<td></td>
<td></td>
<td>Tube-like rests, type 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tube-like rests, type 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hormosinidae gen. et sp. indet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammobaculites aff. leptoe GUTSCHICK et TRECKMAN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammobaculites minutus WATERS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammobaculites sp. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammobaculites (?) sp. 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fragments of monoserially arranged test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Archaeasphaeridae gen. et sp. indet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bisphaera (?) sp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moravamminidae gen. et sp. indet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paratikhinellidae gen. et sp. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paratikhinellidae (?) gen. et sp. 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nodosinellidae (?) gen. et sp. indet.</td>
</tr>
</tbody>
</table>

- Stratigraphical ranges of species in their occurrences outside the Banradian
- Occurrence in Barradian area: rare, common, abundant
tube comes from the basal part of test and meets the central part of test at various angles. The basal part is represented by a base representing the area of attachment. Wall very thin, siliceous.

Fragments, which may represent central chambers of the described tests were figured by Pichler (1971) and described as internal moulds of foraminifers.

Taxonomical position of this test is questionable. Its pertinence to foraminifers cannot be excluded. Long tubes may indicate an infaunal organism.

Distribution: common in different palaeoenvironments and stratigraphical levels, such as the Gorstian (Na břekvici section), Ludfordian (Mušlovka Quarry, Cephalopod Quarry, Smoking Quarry, Kosov Quarry), Lochkovian (Barrandova skála section, Šrbsko section, V rokli Quarry), Pragian (Dvoře-Prokop Lst.: Údolí Hluboké Valley, Ópatřilka Quarry, Homolka Quarry, V rokli Quarry, Stydlé vody Quarry, Braník Quarry; Loděnice Lst.: Šrbsko section), Zlichovian (Údolí Hluboké Valley, Stydlé vody Quarry, section below Barrandov), Dalejan (Třebotov Lst.: Chýnice – old quarry, Údolí Hluboké Valley, Prastav Quarry, Suchomasty Lst.: Koněprusy area, Červený lom Quarry), Eifelian (Choteč Lst.: Chýnice – old quarry, Kačák Creek Valley)

Incertae sedis 2  
Pl. 21, fig. 14

Incertae sedis 2 is represented by a fragment of U-turned tube with a tube-like protuberance.

Distribution: Aeronian (Hlášná Třebáň)

Probable inorganic pseudofossils represent subsphaeras without floor with an opening in the centre of subsphaera. Subsphaeras are interconnected. Borders can be observed around the whole object and around openings.

Distribution: Ludfordian (Mušlovka Quarry)

Besides the above described organic rests, the following shells occur in washing residua:

– small fragments of Tabulata (Pl. 22, fig. 17) distribution: Aeronian (Hlášná Třebáň) juveniles of molluscs (Pl. 22, figs 5, 6, 9); distribution: Gorstian (Na břekvici section), Homerician (U Drdů section), Ludfordian (Mušlovka Quarry, Koledník Quarry), Pragian (Dvoře-Prokop Lst.: Homolka Quarry, Údolí Hluboké Valley), Dalejan (Suchomasty Lst.: Červený lom Quarry), Eifelian (Choteč Lst.: Chýnice – old quarry, Kačák Creek Valley)

– juveniles of brachiopods (Pl. 22, figs 9, 13); distribution: Gorstian (Na břekvici section), Ludfordian (Cephalopod Quarry, Koledník Quarry, Smoking Quarry), Přidolí (Požáry section), Lochkovian (Na brčí section), Pragian (Dvoře-Prokop Lst.: Old Quarry, Stydlé vody Quarry, Homolka Quarry, section below Barrandov; Reporyje Lst.: Šrbsko section), Dalejan (Daleje Sh.: Údolí Hluboké Valley; Třebotov Lst.: Nad trati Quarry, Prastav Quarry)

– tentaculites; distribution: Pragian (Dvoře-Prokop Lst.: Braník Quarry, Homolka Quarry, V rokli Quarry, Stydlé vody Quarry), Zlichovian (Údolí Hluboké Valley, Stydlé...
<table>
<thead>
<tr>
<th>Lithostratigraphical unit</th>
<th>Lithology</th>
<th>Color</th>
<th>CaCO$_3$ content</th>
<th>Paleoecology</th>
<th>*</th>
<th>**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radotín Lst.</td>
<td>platy limestones with intercalations of calcareous shales</td>
<td>dark grey to black</td>
<td>60–80 %</td>
<td>deeper-water, current influenced environment (assemblages 4 to 5 of Boucot's classification)</td>
<td>27/10/0</td>
<td>4/400</td>
</tr>
<tr>
<td>Kotýs Lst.</td>
<td>crinoid well-bedded limestones</td>
<td>light grey</td>
<td>79–86 %</td>
<td>shallow subtidal environment with variable turbulence (assemblages 2 to 3 of Boucot's classification)</td>
<td>2/3/0</td>
<td>3/120</td>
</tr>
<tr>
<td>Dvorce-Prokop Lst.</td>
<td>micritic or platy limestones</td>
<td>grey</td>
<td>70–90 %</td>
<td>low-energy, deeper-water environment below the wave-base and muddy bottom (assemblages 4 to 5 of Boucot's classification)</td>
<td>4/32/10</td>
<td>34/300</td>
</tr>
<tr>
<td>Reporyje Lst.</td>
<td>micritic or biomicritic distinctly nodular limestones</td>
<td>red and red-brown*</td>
<td>?</td>
<td>? similar to Dvorce-Prokop Lst.</td>
<td>3/3/2</td>
<td>7/?</td>
</tr>
<tr>
<td>Loděnice Lst.</td>
<td>platy biomicritic up to finely - bioclastic limestones</td>
<td>variable (red, violet, rose, grey, greenish)*</td>
<td>67–92 %</td>
<td>similar to Dvorce-Prokop Lst., redeposition of organic remains</td>
<td>3/2/0</td>
<td>2/?</td>
</tr>
<tr>
<td>Slivenec Lst.</td>
<td>coarsely bedded, crinoidal limestones</td>
<td>reddish and rose-coloured</td>
<td>90–98 %</td>
<td>shallow-water, high energy (assemblages 3 of Boucot's classification) – crinoid &quot;forest&quot;</td>
<td>7/1/1</td>
<td>5/?</td>
</tr>
<tr>
<td>Koněprusy Lst.</td>
<td>indistinctly bedded or massive bioclastic limestones</td>
<td>white or light grey</td>
<td>97–98 %</td>
<td>reef complex</td>
<td>5/1/0</td>
<td>1/500</td>
</tr>
<tr>
<td>Chapel Coral Horizon</td>
<td>coarsely bioclastic limestones with slump structures</td>
<td>grey</td>
<td>?</td>
<td>shallow-water sessile benthic forms transported from reef and peri-reef environment</td>
<td>0/0/2</td>
<td>5/200</td>
</tr>
<tr>
<td>Zílchov Lst.</td>
<td>finely bioclastic sparry limestones with irregular bedding surfaces with common cherts and intercalations of calcareous shales</td>
<td>grey and dark grey</td>
<td>72–93 %</td>
<td>deeper-water, medium to low-energy environment (assemblages 4 to 5 of Boucot's classification)*</td>
<td>16/9/0</td>
<td>7/?</td>
</tr>
<tr>
<td>Daleje Shale</td>
<td>calcareous shales</td>
<td>greenish, grey-green, reddish</td>
<td>?</td>
<td>deeper-water (lower part of photic zone), low-energy environment with muddy bottom (assemblages 4 to 5 of Boucot's classification)</td>
<td>4/4/5</td>
<td>2/?</td>
</tr>
<tr>
<td>Trebotov Lst.</td>
<td>micritic to biomicritic, well-bedded, distinctly nodular limestones</td>
<td>red passing upwards to light-grey</td>
<td>1 30 % of insoluble residues</td>
<td>probably deeper-water, low-energy environment, in upper part shallowing (assemblages 4 to 5 of Boucot's classification)</td>
<td>0/7/46</td>
<td>40/?</td>
</tr>
<tr>
<td>Suchomasty Lst.</td>
<td>well-bedded biomicritic and bioclastic limestones</td>
<td>red and grey</td>
<td>87–96 %</td>
<td>shallow-water, high energy environment (assemblages 3 (± 2) of Boucot's classification)</td>
<td>7/9/0</td>
<td>3/?</td>
</tr>
<tr>
<td>Choteč Lst.</td>
<td>well-bedded micritic or biomicritic or bioclastic spartic limestones</td>
<td>grey to dark grey*</td>
<td>83–98 %</td>
<td>deeper-water environment with current activity (? turbidity currents, storm) (assemblages 4 to 5 even 6 of Boucot's classification)</td>
<td>8/11/2</td>
<td>5/?</td>
</tr>
<tr>
<td>Acanthopyge Lst.</td>
<td>platy or thick-bedded bioclastic limestones</td>
<td>light grey</td>
<td>94–97 %</td>
<td>shallow-water, subtidal environment, transport of organic remains in some layers (assemblages 2 to 3 of Boucot's classification)</td>
<td>1/2/0</td>
<td>1/?</td>
</tr>
<tr>
<td>Kačák Mb.</td>
<td>thinly laminated calcareous shales</td>
<td>dark grey to black</td>
<td>?</td>
<td>assemblages 6 of Boucot's classification</td>
<td>4/0/0</td>
<td>0</td>
</tr>
<tr>
<td>Roblin Mb.</td>
<td>flysch-like laminated siltstones, sandstones and clastones</td>
<td>grey-green</td>
<td>?</td>
<td>unfavourable living condition (?low salinity)</td>
<td>2/0/0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Number of samples without foraminifers/number of samples with rare occurrence of foraminifers/number of samples with abundant foraminifers
** Number of foraminiferal morphotypes/total number of available species of all organic groups

Text-fig. 43. Lithological and palaeoecological characteristics of the Devonian lithotypes in the Barrandian area in comparison with the distribution of foraminifers (all data with the exception of numbers of foraminiferal morphotypes according to Chlupáč et al. 1998).

vody Quarry), Dalejean (Daleje Sh.: Údolí Hluboké Valley) fragments of Bryozoa (Pl. 22, figs 7, 16), distribution: Pragian (Homolka Quarry, Stydlé vody Quarry), Zílchovian (section below Barrandov), Eifelian (Choteč Lst.: Kačák Creek Valley) – crinoids; distribution: Sheinwoodian (section Bubovice-Loděnice), Homerian (U Drdů section), Gorstian (Na břekvici section), Ludfordian (Mušlovka Quarry, Požáry section, Koledník Quarry, Kosov Quarry, Smoking Quarry), Přídolí (Na bříči section, Požáry section, Cephalo-
Biostratigraphy

Biostratigraphical significance of Palaeozoic foraminifers was systematically studied in North America. The synthesis of their stratigraphical ranges from the Ordovician to Permian was presented by Conkin and Conkin (1982). Stratigraphical ranges of Australian foraminifers of Wenlock to Frasnian age were summarized by Bell (1999). Russian micropalaeontologists (Bykova, 1952; 1953; Bykova and Polenova, 1955) also summarized stratigraphical ranges of Devonian foraminifers from the Russian Platform and Ordovician and Silurian foraminifers of the Baltic region.

Stratigraphical ranges of the Barrandian foraminifers based on the analysis of Silurian and Devonian sections are given in Text-fig. 41. In the studied time interval, periods with abundant foraminiferal assemblages alternate with periods of rare occurrence of foraminifers (Text-fig. 42). Therefore, the occurrence of foraminifers is influenced by palaeoecological conditions, and Palaeozoic foraminiferal biostratigraphy has merely an ecostratigraphic value in a limited area.

The first diversified foraminiferal assemblages were described from the Ludfordian (Upper Ludlow). In the older samples, only 10 cosmopolitan species of the families Sacamminidae and Psammosphaeridae and Hyperammina sp. were found. All these taxa are known from the Ordovician or Cambrian. Bubík (1996) described foraminifers of families Ammodiscidae and Hormosinidae from the Barrandian Ordovician, which occurred only in the Ludfordian (Upper Ludlow) or Devonian in my material.

Twenty-six foraminiferal taxa were recognized in the Ludfordian (Upper Ludlow). The assemblages are characterized by hemisphaeramminas and thuramminas. First Ammodiscidae were described. Amphitremoida (also Holcová, 1999) and Thurammina tortuosa (also Holcová, 1999) and Thurammina tubulata occur only at this stratigraphical level and do not appear in the Devonian.

Přídolí foraminifers are rare again. The oldest Devonian assemblages (Lochkovian) contain 8 species. The first tolypamminas were found. Based on the studied material, Tolypammina tortuosa, which appeared in this time interval, functions as a good marker of the Lochkovian – Zlichovian interval because it was found in all the lithotypes of this interval. Pragian foraminifers are the most diversified with 54 morphotypes described from
this time interval. The following species firstly appeared: *Thurammina* aff. *quadritubulata*, *Th. sp. 1*, *Th. sp. 2*, *Hyperammina gracilenta* and *H. rockfordensis* (these FADs may serve as good biostratigraphical markers because *H. rockfordensis* is a common species in different facies), *Ammobaculites* sp. and small-sized *Ammodiscus* sp. The assemblages are characterized by common and diversified *tolypamminas* (14 morphotypes were distinguished).

Assemblages from the Zlíchov Limestone and Daleje Shale are a little diversified. The youngest diversified Barrandian foraminiferal assemblages were found in the Daleján Třebotov Lst. The assemblages can be characterized by common occurrence of *Ammodiscus incertus*. The FADs of *Ammodiscus incertus*, *Ammobaculites* aff. *leptos*, *A. minutus*, *Tolypammina bulbosa*, *Thurammina sphaerica* were described.

Eifelian assemblages of the Choteč Formation in the western and central part of the Prague Basin are very poor (Chýnice – old quarry, Prastav Quarry, Nad tratí Quarry, Udolí Hluboké Valley near Karlštejn). No foraminifers were found in the Givetian sediments. Stratigraphical ranges of the Barrandian foraminifers substantially differ from those of North America (Conkin and Conkin, 1982). *Ammodiscidae* and some *tolypamminas*
described in diversified assemblages from the Silurian of North America appear only in the Devonian in the Barrandian area. On the other hand, other Barrandian Lower Devonian species (Ammobaculites, some tolypaminas) appear only in the Mississippian of North America. The North American Devonian assemblages are of low diversity. In comparison with Australian foraminiferal biostratigraphy (Bell, 1996), species composition of Australian foraminifers differs from that of the Barrandian foraminifers, but generic composition is similar. Generally, Silurian assemblages of Australia are little diversified similarly to the Barrandian ones. Diversification of the assemblages started in the Devonian, much like in the Barrandian.

### Palaeoecology

Only few data exist on the palaeoecology of Lower Palaeozoic foraminifers. Occurrences of foraminiferal species in different lithotypes were studied by Gutschick and Treckman (1959) and Bell (1996). The best data on the life habitat of Palaeozoic foraminifers are available for assemblages where the palaeoenvironment is interpreted from another fossil group or from the character of sediment (e.g., Mound, 1968; McClellan, 1973; Olempska, 1983; Watkins et al., 1999). A relation between the composition of foraminiferal assemblages and their life habitat is observable as early as in the Silurian (McClellan, 1973; Watkins et al., 1999).

Out of the 387 samples analysed within this study, foraminifers were present in 198 samples (51.7%). 72 samples (18.6%) contained abundant foraminiferal assemblages. Comparable data were reported from the Australian Devonian: out of 350 analysed samples, 90 samples contained some foraminifers and in only 14 samples foraminifers were frequent (Bell 1996). These numbers evidence higher abundance of foraminifers in the Barrandian area when compared to the Australian Devonian. Abundances in rock samples correspond to data from other areas (10 specimens/kg of rock sample: Bell, 1966; 25/kg: Gutschick, 1986; 85/kg: Ireland, 1956; 100/kg: Browne and Scott, 1963) with the exception of Prastav Quarry (Dalejan, Třebotov Lst.) where hundreds of tests occur in 1 kg of rock sample at some levels.

<table>
<thead>
<tr>
<th>Palaeoenvironment</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>shallow-water, high energy</td>
<td>Ammodiscus sp.</td>
</tr>
<tr>
<td>deep-water with current activity</td>
<td>Horrobacinella gen. sp. indet.</td>
</tr>
<tr>
<td>deep-water, medium to low energy</td>
<td>Webbinolina sp.</td>
</tr>
<tr>
<td>deep-water, low energy</td>
<td>Psammosphaera devonica</td>
</tr>
<tr>
<td></td>
<td>Tholosina (?) sp. 2</td>
</tr>
<tr>
<td></td>
<td>Hemisphariochina carmanii</td>
</tr>
<tr>
<td></td>
<td>Sonosphera sp. papilla</td>
</tr>
<tr>
<td></td>
<td>Tolypaminina sp. fragilis</td>
</tr>
<tr>
<td></td>
<td>Tolypaminina sp. 6</td>
</tr>
<tr>
<td></td>
<td>Tolypaminina sp. (?) raccosa</td>
</tr>
<tr>
<td></td>
<td>Hyperammina riorii</td>
</tr>
<tr>
<td></td>
<td>Psammosphaera gratios</td>
</tr>
<tr>
<td></td>
<td>Lagenammina sp. similica</td>
</tr>
<tr>
<td></td>
<td>Thoreaspira aff. megala</td>
</tr>
<tr>
<td></td>
<td>Psammosphaera bradyi</td>
</tr>
<tr>
<td></td>
<td>Thoreaspira aff. echinata</td>
</tr>
<tr>
<td></td>
<td>Suchomastys lpt.</td>
</tr>
<tr>
<td></td>
<td>Acantopyge lpt.</td>
</tr>
<tr>
<td></td>
<td>Radotin lpt.</td>
</tr>
<tr>
<td></td>
<td>Choteč lpt.</td>
</tr>
<tr>
<td></td>
<td>Zlíchov lpt.</td>
</tr>
<tr>
<td></td>
<td>Reporyje and Lodnitz lpt.</td>
</tr>
<tr>
<td></td>
<td>Dvorce-Prokop lpt.</td>
</tr>
<tr>
<td></td>
<td>Třebotov lpt.</td>
</tr>
<tr>
<td></td>
<td>Daleši Sh.</td>
</tr>
</tbody>
</table>

Text-fig. 45. Distribution of abundant foraminiferal taxa in the Silurian and Devonian lithotypes.
In the Silurian, foraminifers are “randomly” concentrated in thin horizons of sedimentary complexes, often lithologically monotonous; therefore, the explanation of the causes for their occurrence is difficult.

Abundance and composition of foraminiferal assemblages are similar in all lithostratigraphical units in the Devonian (Text-fig. 43). These units can be subdivided into 4 groups according to the abundance and diversity of their assemblages:

(i) Foraminiferal assemblages are the most abundant and diversified in the Třebotov and Dvorce-Prokop Lst. Both members are characterized by micritic to biomicritic, well-bedded nodular limestones. Low-energy, deeper-water environment (below the wave base) was interpreted for both facies (Chlupáč et al., 1998). Kukal (1975) showed that the genesis of nodular limestones is necessitated by the primary content of 15–25% of insoluble residue (practically clay) in calcareous muds and by diagenetic differentiation of carbonate and argillaceous components. High abundance and diversity of foraminifers in the Třebotov and Dvorce-Prokop members reflect the fact that these limestones represent a combination of several optimum environmental conditions for foraminifers: low-energy shelf setting and content of clastic components in bottom sediments necessary for building agglutinated tests. Both these stratigraphical units with abundant foraminifers have an identical position in second-order cycles defined by Chlupáč (2000) in the Barrandian area. This may reflect long-range climatic oscillations.

(ii) The second group is represented by the Zlíchov, Radotín, Řeporyje, Loděnice and Choteč Lst. in the Kačák Creek Valley and by the Daleje Shale with relatively abundant and diversified foraminiferal assemblages (more than 8 taxa). All these lithotypes were deposited in deeper-water environment of low to high energy and contain assemblages from 4 to 5 of Boucot’s classification (Chlupáč et al., 1998).

(iii) Low abundance of foraminiferal tests and the presence of maximum 6 foraminiferal taxa characterize foraminiferal assemblages from the Kotýs, Suchomasty and Acanthopyge Lst. These members are represented by...
text-fig. 47. Correlation between the distribution of foraminifers and the distribution of other organic rests in acid-insoluble residua.

Biomictic to boidetrital limestones deposited in a shallow-water, high or medium-energy environment with assemblages from 2 to 3 of Boucot’s classification (Chlupáč et al., 1998).

(iv) No foraminifers were found in the Koněprusy and Slivenec Lst. and Kačák and Roblín Mb. Reefal environment (Koněprusy Lst.) is not favourable for Palaeozoic foraminifers, as confirmed also by Mound (1968). The absence of foraminifers may be caused by abundant crinoids. Both the Koněprusy and Slivenec Lst. have also very high CaCO₃ content; hence, they are almost devoid of clasts necessary for building agglutinated tests. Unfavourable living conditions (?decrease in O₂ content, salinity) did not allow survival of foraminifers during the sedimentation of the youngest Barrandian Kačák and Roblín Mbs.

The distribution of foraminiferal taxa was summarized for different lithotypes (Text-fig. 45); the taxa were classified to the following groups:

(i) taxa occurring in diversified assemblages only (deeper-water, low-energy environment): Ammodiscus div. sp., Ammobaculites div. sp., Tolypammina irregularis, T. polyverta, Thurammina aff. quadrirubulata, Th. sp. 1, Th. sp. 2, Webbinelloidea hattini;

(ii) taxa from the Devonian deeper-water limestones (low to high energy) such as Hyperammina rockfordensis, Psammosphaera minuta, Tolypammina nodosa, T. sp. 5, T. sp. 6, T. sperma;

(iii) taxa commonly present in most of the types of palaeoenvironments, such as Thuramminoides sphaeroidalis, Psammosphaera cava, Sacammina pseudospiralis, Thurammina aff. echinata, Hemisphaeram-
mina bradyi, Pseudastrorhiza aff. irregularis, Lagenaminna sphaerica;
(iv) taxa rarely present in different palaeoenvironments, such as Tolypammina tortuosa, Thurammina papillata, Sorosphaerella sp., Hemisphaerammina carmani, H. sp. 1, Thurammina triradiata, Tholosina sp. 2, Psammospa-
haera devonica, Bathysiphon sp., Amphitremoidea sp.

Other taxa occur rarely in one of the facies only.

A correlation was evaluated between the occurrence of foraminifers and other microfossils (Text-fig. 47). The best correlation was observed between the occurrences of foraminifers and sclerites of Holothuroidea, sack-like tests and incertae sedis 1. Holothuroidea are benthic, stenohaline, mainly shallow-water organisms. There are no data about palaeoecology of other two groups.

Low correlation was observed between the occurrences of foraminifers and sponge spicules, leiosphaeras, conodonts, bryozoans, radiolarians and molluscs. Among these groups, leiosphaeras are nearshore organisms, conodonts are nektic and radiolarians planktonic organisms. Low correlation between the occurrences of foraminifers and the above mentioned groups also may be caused by the different postmortem transport and accumulation of their tests.

Palaeogeography

Data available for palaeogeographical interpretation are based on a comparison of species compositions of foraminiferal assemblages from different areas. Reliability of such comparisons depends on two factors:

(1) techniques used for the study of microfauna (study of iso-
lated foraminifers from acid-resistant residua, slides ...) and the number of analysed samples. High similarity was observed between areas with similar quality and quantity of micropalaeontological analyses. Literature data enable to compare the Barrandian foraminiferal assemblages with the assemblages from the following areas: North American Palaeozoic, East Thuringian Slate Mts., Rhine Slate Mts., Holy Cross Mts., Carnic Alps, Siberia, Aus-
tralia, Baltic region and the Russian Platform.

(2) Similar species composition of assemblages from different areas may result from the sea connections among these areas as well as similar palaeoenvironments. Poor knowledge of the palaeoecology of Lower Palaeozoic foraminifers sometimes accounts for our problems with understanding the most probable causes of similarity of foraminiferal assemblages.

Only the safely determined species were chosen for the summary of paleogeographic data. Cosmopolitan species were excluded from this analysis. Safely determined and non-cosmopolitan species found in the Barrandian area and in other areas are summarized in Text-fig. 49:

(i) species described from the North American Silurian gradually appear in the Barrandian Ludfordian (Upper Ludlow) (Thurammina papillata, Hemisphaerammina

bradyi, Webbinelloidea hattini), Pragian (Tolypammina
tortuosa) and Dalejan (Ammodiscus incertus, A. exer-
cetus, Thurammina sphaerica);

(ii) Ammodiscidae described from the Siberian Ludlow (Serpenulina uratica, Amnolvummina sp.) were found in the Barrandian Ludlow and Pragian;

(iii) Serpenulina uratica and Lagenammina ovata occurring in the Barrandian Upper Ludlow were described from the Australian Early Devonian;

(iv) Tolypammina bulbosa described from the North American Devonian occurs in the Barrandian Dalejan;

(v) The closest connection was found between the Barran-
dian Dalejan and the Upper Devonian from the Thuringian Slate Mts. and Rhine Slate Mts. The follow-
ing species from the Barrandian Dalejan were also de-
termined (or descibed) in Germany: Hyperammina rocfordensis, H. kahleleinwensis, Thurammina sphaerica, Th. triradiata, Tolypammina irregularis). With the ex-
ception of H. kahleleinwensis, all these species were determined also in the Barrandian Pragian;

(vi) Three of these species (Hyperammina rocfordensis, H. kahleleinwensis, Th. triradiata) are known from the North American Mississippian. Besides these species,
Hyperammina gracilenta and Tolypammina sperma found in the Barrandian Dalejan were described in the North American Mississippian;
(vii) Tolypammina irregularis found in the Barrandian Pragian and Dalejan and described from the Upper Devonian of the East Thuringian Slate Mts. were recorded in the Upper Devonian of the Holy Cross Mts.

Occurrences of identical foraminiferal species in different areas indicate the existence of a migration pathway between these areas. These pathways represented “corridors” with suitable palaeoenvironment for the Silurian and Devonian foraminifers: stenohaline, neritic, low-energy. Usually, identical species occur in discrete areas at different stratigraphical levels and migration “history” of these species between these horizons remains unknown.

The above mentioned data (i-vii) suggest a possible existence of the following pathways:

(1) between Siberia and the Barrandian area in the Ludlow;
(2) between the Barrandian area and E Victoria (Australia) a certain time level from Upper Ludlow to Lochkovian.

While Australia and the Bohemian Massif were incorporated in Gondwana (Scotese and McKerrow, 1990), Siberia was situated on the northern hemisphere, although some relations between their faunas were observed (Chlupáč, 1994);

(3) some of the North American Silurian foraminifers penetrated successively to the Barrandian area from the Ludfordian to the Dalejan. Their migration pathways are not clear. Contrastingly, migration of foraminiferal species from the Barrandian area to North America was realized from the Dalejan to the Mississippian (probably across the Rhenohercynicum – see below);

(4) a broad migration of foraminiferal fauna was expected between the Barrandian area and the Saxothuringicum as these units were situated on the northern shelf (Barrandian) and slope (Saxothuringicum) of Gondwana (Chlupáč, 1994). Species which appeared in the Barrandian area in the Pragian and Dalejan were described from the Upper Devonian of the Saxothuringicum. Palaeoenvironment in the Saxothuringicum suitable for these species existed only at this time level. No data exist on the survival of this species from the Dalejan to the Upper Devonian.
Assemblages from the Lower/Middle Devonian boundary from the Holy Cross Mts. (Malec, 1992) are completely different from the Barrandian ones. Rheonohercynian Lower Devonian foraminifers also differ from the Barrandian assemblages (Beckmann, 1952).

Different foraminiferal assemblages were described by Pokorný (1951) from the Givetian of the Moravo-Silesian part of northern Gondwana shelf. Faunal differences were observed also in other organic groups (Ficner and Havlíček, 1978; Chlupáč, 1992; Galle et al. 1993). This assemblage is similar to the Eifelian assemblages from the Holy Cross Mountains (Duszynska, 1956); close affinities of foraminiferal assemblages between the Dalejan of the Barrandian area, Upper Devonian of the Saxothuringicum and Rheonohercynicum (Eickhoff, 1970) confirm the hypothesis about the closure of the Rheic Ocean in the Late Devonian (Chlupáč, 1994). Foraminifers migrated to the Rheonohercynicum probably from the Saxothuringicum during the Late Devonian. Similar assemblages appeared at this time level also in the Holy Cross Mts. (Olempska, 1983), which may indicate the existence of a migration pathway among the Saxothuringicum, Rheonohercynicum and the Holy Cross Mts. in the latest Devonian. In the time interval, from the Upper Devonian to the Lower Mississippian, the assemblages penetrated to North American basins through an unknown way. Affinities of foraminiferal assemblages from the Rheonohercynicum, Saxothuringicum and North America were already noted by Eickhoff (1970).

**Conclusions**

1. The first systematic study of Silurian and Devonian foraminifers of the Barrandian area included the analysis of 387 samples from 14 Silurian and 24 Devonian sections including stratotypes and auxiliary stratotypes of stages: Požáry Quarry, Klonk section, Budňany rock section, Homolka Hill at Velká Chuchle, Prastav Quarry. Foraminifers were studied from acid-insoluble residua. Foraminifers were found in 200 samples (51.7 %), and were abundant in 72 samples (18.6 %).

2. Eighty morphotypes of agglutinated foraminifers from families Psammosphaeridae, Hemisphaeramminidae, Saccamminidae, Hippocrepinidae, Ammodiscidae and Lituolidae and 6 morphotypes of calcareous foraminifers were distinguished. Thirty-two morphotypes can be well correlated with the earlier described species, 10 morphotypes can be partly correlated, other morphotypes belong to new species or are represented by poorly preserved specimens which cannot be determined more accurately.

3. Together with the foraminifers, the following organic remains were found in washing residua: radiolarians, ostracodes, sponge spicules, conodonts, sclerites of Holothuroidea, leiothesphaerias, tentaculites, juveniles of brachiopods and molluscs, bryozoans, columnals of crinoids and Incertae sedis.

4. In the Silurian sediments, foraminifers are rare and concentrate to thin horizons only in the sections. Foraminifers are the most abundant in the Ludfordian.
the Devonian sediments, foraminifers are common to abundant (with the exception of reefal limestones and the youngest Kačák and Roblín Mbs.). They are the most abundant in the Dalejan Třebotov Lst. and Pragian Dvorce-Prokop Lst.

(5) Stratigraphical ranges of the Barrandian Silurian and Devonian foraminifers were summarized with the following species being of biostratigraphical value: (i) Amphitremoida and Thurammina tubulata occur only in the Ludlow; (ii) Tolypammina tortuosa appeared in the Lochkovian and can be a good marker of the Lochkovian–Zlichovian interval; (iii) Thurammina aff. quadritudulata, Th. sp. 1, Th. sp. 2, Hyperammina gracilenta and H. rockfordensis (these FADs may serve as good biostratigraphical markers because H. rockfordensis is a common species in different facies), Ammobaculites sp. and small-sized Ammodiscus sp. first appeared in Pragian; (iv) the Dalejan assemblages can be characterized by the common occurrence of Ammodiscus incertus. FADs of Ammodiscus incertus, Ammobaculites cf. leptos, A. minutus, Tolypammina bulbosa, Thurammina sphaerica were described in the Dalejan.

As the distribution of foraminifers was influenced by palaeoecological conditions, the stratigraphical ranges represent only ecostratigraphical data for the Barrandian area.

(6) High abundance and diversity of foraminifers in the Třebotov and Dvorce-Prokop limestones reflect the fact that nodular limestones were deposited under optimum environmental conditions for foraminifers: low-energy, deeper water environment (below the wave base) with clastic components necessary for building agglutinated tests. Low abundances of foraminiferal tests characterize biomicritic to biodetrital limestones deposited in shallow-water, high or medium-energy conditions. No foraminifers are present in reefal limestones. During the sedimentation of the youngest Barrandian Kačák and Roblín Mbs., unfavourable living conditions (?lowering of O2-content, salinity) did not enable survival of foraminifers.

(7) Foraminifers may pose a good palaeogeographical indicator. The occurrence of identical foraminiferal species (well-determinable, non-cosmopolitan) in different areas indicates the existence of the following migration path-
ways: (i) between Siberia and the Barrandian area in the Ludlow; (ii) between the Barrandian area and E Victoria (Australia) at a certain time level from the Ludfordian to Lochkovian; (iii) some of the North American Silurian foraminifers successively penetrated to the Barrandian area from the Ludfordian to the Dalejan. Their migration pathways are unclear; (iv) the broad migration of foraminiferal fauna between the Dalejan of the Barrandian area and Upper Devonian of the Saxothuringicum; (v) close affinities of foraminiferal assemblages between the Dalejan of the Barrandian area, Upper Devonian of the Saxothuringicum and Rhenohercynicum confirm the hypothesis on the closure of the Rheic Ocean in the Late Devonian. Foraminifers migrated to the Rhenohercynicum (and also to Holy Cross Mts. where similar assemblages also appeared in the Late Devonian) probably from the Saxothuringicum in the Late Devonian. In the period of the Upper Devonian to the Lower Mississippian, the assemblages penetrated to the North American basins through an unknown pathway.

Acknowledgments

The author wishes to acknowledge the extensive helpful information about the Barrandian Devonian provided by Ivo Chlupáč (Charles University Prague) and the discussions about Palaeozoic foraminifers with Miroslav Bubík (Czech Geological Survey Brno). This research was supported by grant project No. MSM 113100006

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Explanation of plates

PLATE 1
1–10. Kozolupy, Smoking Quarry, Ludfordian
1. Thuramminoides sphaeroidalis PLUMMER, Kozolupy 81
2. Thuramminoides sphaeroidalis PLUMMER, Kozolupy 63
3. Webbinelloidea hattini McCLELLAN, Kozolupy 57 (length of scale bar 50 µm)
4. Thuramminoides sphaeroidalis PLUMMER, Kozolupy 63
5. Hemisphaerammina carmani (SUMMERSON) (lenght of scale bar 100, LG 35, SR 33 µm)
6. Thuramminoides sphaeroidalis PLUMMER, Kozolupy 100 (length of scale bar 33 µm)
7. Lagenammina ovata BELL, Kozolupy 63
8. Hemisphaerammina aff. casteri MCCLELLAN, Kozolupy 72
9. Psammospaera sp., Kozolupy 63
10. Glomospira (?) sp., Kozolupy 60
11–16. Kační Quarry, Na břekvici Section, Hommerian-Gorstian
11. Hemisphaerammina bradyi LOEBLICH et TAPPAN., Na břekvici, tuffite, Gorstian
12. Thuramminoides sphaeroidalis PLUMMER, Na břekvici, tuffite, Gorstian
13. Hemisphaerammina bradyi LOEBLICH et TAPPAN, Na břekvici Section 20, Silurian/Devonian
14. Hyperammina (?) sp. 2, fragment of proloculus, Kační Quarry, Hommerian
15. Hemisphaerammina bradyi LOEBLICH et TAPPAN, Kační Quarry, Hommerian
Lenght of scale bar 100 µm, if not given other.

PLATE 2
1. Serpulinalina uralica TSCHERNICH, Kosov Quarry, Ludfordian, zone with A. fecunda
2. 3. Thurammina aff. tubulata MOREMAN, Kosov Quarry, Ludfordian, zone with A. fecunda (two different specimens)
4. Pseudostrophoiza sp., Kosov Quarry, Ludlow, zone with E. beaumontii
5. Hyperammina cf. gracilenta GUTSCHICK et TRECKMAN, fragment of proloculus, Kosov Quarry, Ludlow, zone with A. fecunda
6. Thuramminoides sphaeroidalis PLUMMER, Klonk Section 20, Silurian/Devonian
7. Psammospaera devonica STEWART et LAMPE, Klonk Section 20, Silurian/Devonian
8. Thuramminoides sphaeroidalis PLUMMER, Na bříči Section 2, Pridoli, length of scale bar 200 µm
9. Webbinelloidea sp., Na bříči Section 2, Pridoli, length of scale bar 400 µm
10. Webbinelloidea sp., Na bříči Section 2, Pridoli, length of scale bar 200 µm
11. Webbinelloidea sp., Na bříči Section 2, Pridoli, length of scale bar 200 µm
12. Psammospaera gracilis IRELAND, Litohlavy Reservoir, 2.5 m, Telychian
13. Paraithinellidae (?) gen. et sp. 2, Koledník Quarry 6, Ludfordian
14. Thuramminoides sphaeroidalis PLUMMER, Hlášná Třebaň, 0.5 m, Rhuddanian
15. Psammospaera sp., Hlášná Třebaň, 4.5 m, Aeronian
Lenght of scale bar 100 µm, if not given other.

PLATE 3
Požáry Section, Ludlowian/Pridoli
1. Hemisphaerammina bradyi LOEBLICH et TAPPAN, Požáry 100, Pridoli

2. Hemisphaerammina bradyi LOEBLICH et TAPPAN, Požáry 100, Pridoli
3. Colonammina sp., Požáry 93, Ludfordian, zone with A. fecunda
4. tube-like rest, type 2, Požáry 158, Pridoli, length of scale bar 200 µm
5. Webbinelloidea hattini McCLELLAN, Požáry 28, Ludlow, zone with E. beaumontii
6. Sorosphaerella sp., Požáry 2, Ludlow
7–14. Koledník Quarry, Ludfordian
7. Hemisphaerammina bradyi LOEBLICH et TAPPAN, broken specimen, Koledník 22, length of scale bar 200 µm
8. Amphitreneoidea sp., Koledník 6
9. Hemisphaerammina carmani (SUMMERSON), Koledník 6
10. Tholosina (?) sp. 2, specimen attaching other one, Koledník 8
11. Hemisphaerammina carmani (SUMMERSON), Koledník 7
12. Hemisphaerammina carmani (SUMMERSON), Koledník 6
13. Amphitreneoidea sp., Koledník 21, length of scale bar 75 µm
14. Thuramminoides sphaeroidalis PLUMMER, Koledník 5
15. Nodosinellidae (?) gen. et sp. 1, Vyskočilka near Malá Chuchle, Wenlock
Lenght of scale bar 100 µm, if not given other.

PLATE 4
Homolka near Velká Chuchle, Lochkovian/Pragian
1. Tolypamina sp. 6 (fragment of proloculus), Homolka 18, Pragian, length of scale bar 200 µm
2. Lagenammina sphaerica MOREMAN, Homolka 20, Pragian
3. Thurammina triradiata GUTSCHICK et TRECKMAN, Homolka 20, Pragian
4. Hemisphaerammina carmani (SUMMERSON), attached side, Homolka 20, Pragian
5. Hemisphaerammina carmani (SUMMERSON), convex side, Homolka 20, Pragian
6. Saccammina pseudospiralis (CUSHMAN et STAINBROCK), Homolka 20, Pragian
7. Hemisphaerammina carmani (SUMMERSON), convex side, Homolka 6, Lochkovian
8. Saccammina sp. 1, Homolka 18, Pragian
9. Tolypamina sp. 1, Homolka 18, Pragian, length of scale bar 200 µm
10. Tolypamina sp. 1, Homolka 20, Pragian, length of scale bar 300 µm
11. Tolypamina aff. tornella (IRELAND), Homolka 1, Lochkovian
Lenght of scale bar 100 µm, if not given other.

PLATE 5
1–13 Barrandov, Dvorce-Prokop Lst., Pragian
1. Hemisphaerammina carmani (SUMMERSON), basal part partially missing, Old Quarry (section below Barrandov)
2. Moravaminniidae gen. et sp. indet., Old Quarry (section below Barrandov)
3. Saccammina sp. 1, Old Quarry (section below Barrandov)
4. Sorosphaerella sp., Old Quarry (section below Barrandov)
5. Tolypamina sp. 3, Old Quarry (section below Barrandov), length of scale bar 200 µm
6. Lagenammina aff. sphaerica MOREMAN, Old Quarry (section below Barrandov)
7. Tolypamina sp. 8, Old Quarry (section below Barrandov)
8. Amphitremoidea sp., Old Quarry (section below Barrandov)
9. Tolypamina sp., fragment of tubular second chamber, Old Quarry (section below Barrandov)
10. tube-like rest, type 3, Old Quarry (section below Barrandov)
11. tube-like rest, type 4, Pod terasami Quarry (section bellow Barrandov)
12. Hemisphaerammina carmani (SUMMERSON), Pod terasami Quarry (section bellow Barrandov)
13. Tolypammina sp. 7, Pod terasami Quarry (section bellow Barrandov)
14. Thurammina aff. diforamens IRELAND, V rokli Quarry, Dvorce-Prokop Lst., Pragian
15. Paratikhinellidae gen. et sp. 1, Pod terasami Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian
16. Tolypammina sp., fragment of tubular chamber, V rokli Quarry, Dvorce-Prokop Lst., Pragian
17. Sacconina pseudospiralis (CUSHMAN et STAINBROCK), Srbsko, Reporyje Lst., Pragian
18. ? Paratikhinellidae gen. et sp. 1, Pod terasami Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian
19. isolated chamber of Nodosinellidae, V rokli Quarry, Dvorce-Prokop Lst., Pragian

PLATE 6
1–6. Údolí Hluboké Valley near Karlštejn, house No. 27, Dvorce-Prokop Lst., Pragian

PLATE 7
1–5. Štýdlé vody Quarry, Dvorce-Prokop Lst., Pragian
6. Ammosphaera castelli IRELAND, above iron ore horizon, Dvorce-Prokop Lst., Pragian
7. Psammosphaera devonica IRELAND, Zlichovian 10, two different specimens
8. ? Lagenammina sp., Section 1/2, Řeporyje Lst.
9. Thurammina aff. echinata DUNN, section 1/12, Dvorce-Prokop Lst., length of scale bar 75 µm
10. Thurammina aff. quadrirribulata DUNN, section 2/1, Dvorce-Prokop Lst.
11. Pseudastrorhiza aff. irregularis DUNN, section 2/3, Dvorce-Prokop Lst., length of scale bar 200 µm
12. Pseudastrorhiza aff. irregularis DUNN (broken specimen), section 1/23, Dvorce-Prokop Lst., length of scale bar 50 µm
13. Psammosphaera sp., section 1/32, Dvorce-Prokop Lst.
14. Webbinelloidea hattini McCLELLAN, section 1/21, Dvorce-Prokop Lst.
15. Hemisphaerammina aff. casteri McCLELLAN, section 2/4, Dvorce-Prokop Lst., length of scale bar 200 µm
16. Webbinelloidea hattini McCLELLAN, section 1/2, Řeporyje Lst. Length of scale bar 100 µm, if not given other.

PLATE 8
1–11. Dvorce-Prokop Lst., Pragian
1. Bathysiphon sp., above iron ore horizon, length of scale bar 200 µm
2. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, section 1/14, length of scale bar 200 µm
3. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, section 1/13, length of scale bar 200 µm
4. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, below iron ore horizon
5. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, section 1/12
6. Ammodiscus sp., section 1/14
7. Tolypammina tortuosa DUNN, section 1/33, length of scale bar 200 µm
8. Tolypammina tortuosa DUNN, Section 1/31, length of scale bar 75 µm
9. Tolypammina polyverta IRELAND, above iron ore horizon, length of scale bar 200 µm
10. Tolypammina polyverta IRELAND, above iron ore horizon
11. Tolypammina polyverta IRELAND, section 1/15, length of scale bar 400 µm
12. 13. Thuramminoides sphaeroidalis McCLELLAN, Zlichovian 10 (two different specimens)
14. 15. Thuramminoides sphaeroidalis McCLELLAN, Zlichovian 2, length of scale bar 75 µm (two different specimens)
Length of scale bar 100 µm, if not given other.

PLATE 9
1–3, 5–9. Opatřilka-Červený lom Quarry, Pragian
1. Thuramminoides sphaeroidalis McCLELLAN, Dvorce-Prokop Lst., length of scale bar 50 µm
2. (?) Thurammina aff. echinata DUNN, Dvorce-Prokop Lst., length of scale bar 33 µm
3. Thurammina aff. echinata DUNN, Řeporyje Lst.
4. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, Štýdlé vody Quarry, above iron ore horizon
5. Tolypammina sp., fragment of tubular chamber, Řeporyje Lst.
7. Tolypammina sp. 5, Dvorce-Prokop Lst., length of scale bar 50 µm
8. Hyperammina rockfordensis GUTSCHICK et TRECKMAN, Dvorce-Prokop Lst.
9. Tolypammina irregularis BLUMENSTENGEL, Dvorce-Prokop Lst., length of scale bar 50 µm
10. *Psammosphaera cava* MOREMAN, Jiráškův lom Quarry, Acantopyyge Lst., Eifelian
11. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), U ježírka Quarry, Třebotov Lst., Dalejan
12. *Ammodiscella* sp., Hergetův lom Quarry, Suchomasty Lst., Dalejan
13–16. Dalej Shales, Dalejan
13. Archaesphaeridae gen. et sp. indet., Road “Ke hřbitovu”, Hlubočepy, length of scale bar 50 µm
14. Archaesphaeridae gen. et sp. indet., Road “Ke hřbitovu”, Hlubočepy, length of scale bar 33 µm
15. *Thuramminoides sphaeroidalis* PLUMMER, Údolí Hluboké Valley near Karlštejn, house No. 130, length of scale bar 200 µm
16. *Thuramminoides sphaeroidalis* PLUMMER, Údolí Hluboké Valley near Karlštejn, house No. 130, length of scale bar 50 µm

**PLATE 10**

Chýnice – old quarry, Třebotov Lst. (Dalejan), Choteč Lst. (Eifelian)
1. *Psammosphaera devonica* STEWART et LAMPE, Chýnice 4, Třebotov Lst.
2. *Hemisphaerammina carmani* (SUMMERSON), Chýnice 2, Třebotov Lst., length of scale bar 200 µm
3. *Hemisphaerammina carmani* (SUMMERSON), Chýnice 2, Třebotov Lst.
6. *Psammosphaera cava* MOREMAN, Chýnice 4, Třebotov Lst., length of scale bar 300 µm
7. *Thuramminoides sphaeroidalis* PLUMMER, Chýnice 8, Choteč Lst.
11. *Thurammina* sp. 1, Chýnice 2, Třebotov Lst.
12. *Thurammina* sp. 1, Chýnice 4, Třebotov Lst.
13. *Thurammina* sp. 1., Chýnice 2, Třebotov Lst., length of scale bar 200 µm

Length of scale bar 100 µm, if not given other.

**PLATE 11**

Chýnice – old quarry, Třebotov Lst. (Dalejan), Choteč Lst. (Eifelian)
1. *Lagenammina sphaerica* MOREMAN, Chýnice 5, Třebotov Lst., length of scale bar 33 µm
2. *Lagenammina sphaerica* MOREMAN, Chýnice 5, Třebotov Lst.
3. *Lagenammina sphaerica* MOREMAN, Chýnice 5, Třebotov Lst., length of scale bar 50 µm
4. *Tholosina* (?) sp. 2, Chýnice 6, Třebotov Lst.
5. *Ammodiscus incertus* ORBIGNY, Chýnice 2, Třebotov Lst.
6. *Hyperammina* sp. 1, Chýnice 2, Třebotov Lst.
7. *Hyperammina rockfordensis* GUTSCHICK et TRECKMAN, Chýnice 5, Třebotov Lst.
8. *Hyperammina rockfordensis* GUTSCHICK et TRECKMAN, Chýnice 2, Třebotov Lst.
10. 11. *Tolypamina* sp. 4, Chýnice 2, Třebotov Lst. (two different specimens)
12–14. Červený lom Quarry near Koněprusy, Suchomasty Lst. (Dalejan)
12. *Lagenammina sphaerica* MOREMAN, Červený lom 18, length of scale bar 50 µm
13. *Psammosphaera cava* MOREMAN, Červený lom 18, length of scale bar 33 µm
14. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), Červený lom 18, length of scale bar 50 µm

Length of scale bar 100 µm, if not given other.

**PLATE 12**

1–8. Kačák Valley, Choteč Lst. Eifelian
1. *Hemisphaerammina carmani* (SUMMERSON), length of scale bar 75 µm
2. *Psammosphaera gracilis* IRELAND, length of scale bar 200 µm
3. *Thuramminoides sphaeroidalis* PLUMMER
4. *Ammodiscus ex gr. incertus* ORBIGNY, length of scale bar 200 µm
5. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK)
6. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), optical microscope, length of scale bar 180 µm
7. *Tolypamina* sp. 5, length of scale bar 200 µm
8. *Tolypamina* sp., fragment of tubular second chamber, optical microscope, length of scale bar 180 µm
9–11. Údolí Hluboké Valley near Karlštejn, Třebotov Lst., Dalejan
9. *Ammodiscus excavatus* CUSHMAN, Hluboké e6
10. *Ammodiscus exsertus* CUSHMAN, Hluboké e6, length of scale bar 75 µm
11. *Webbinelloidea tholus* (MOREMAN), Hluboké e2

Length of scale bar 100 µm, if not given other.

**PLATE 13**

Údolí Hluboké Valley near Karlštejn, Třebotov Lst., Dalejan
1. *Psammosphaera devonica* STEWART et LAMPE, Hluboké e5, length of scale bar 50 µm
2. *Psammosphaera devonica* STEWART et LAMPE, Hluboké e5, length of scale bar 33 µm
3. *Psammosphaera minutula DUNN, Hluboké e4, length of scale bar 33 µm
4. *Psammosphaera cava* MOREMAN, Hluboké e4, length of scale bar 33 µm
5. *Thuramminoides sphaeroidalis* PLUMMER, Hluboké e6, length of scale bar 50 µm
6. *Lagenammina sphaerica* MOREMAN, Hluboké e4, length of scale bar 33 µm
7. *Thurammina* sp. 1, Hluboké e2, length of scale bar 50 µm
8. *Ammodiscidae* gen. et sp. indet., Hluboké e4
9. *Ammodiscidae* gen. et sp. indet., Hluboké e1
10. *Tolypamina* sperma GUTSCHICK, WIENER et YOUNG, Hluboké e4
11. (?) *Tolypamina* sperma GUTSCHICK, WIENER et YOUNG, Hluboké e2
12. *Hyperammina gracilenta* GUTSCHICK et TRECKMAN, Hluboké e6
13. *Hyperammina kahlleinwensis* BLUMENSTENGEL, Hluboké e6, length of scale bar 300 µm
14. *Hemisphaerammina bradyi* LOEBLICH et TAPPAN, Hluboké e2, length of scale bar 33 µm
15. *Tholosina* (?) sp. 2, Hluboké e6
16. *Tholosina* (?) sp. 2, missing attached wall, Hluboké e6

Length of scale bar 100 µm, if not given other.
PLATE 14
1–5. Nad tratí Quarry, Třebotov Lst., Dalejan
1. *Lagenammina sphaerica* MOREMAN, Nad tratí 1
2. *Psammosphaera gracilis* IRELAND, Nad tratí 1
3. *Saccammina (?) petinensis* BYKOVA, Nad tratí 5, length of scale bar 75 µm
4. *Tolypammina* sp. 4, Nad tratí 5, length of scale bar 300 µm
5. *Hyperammina* sp. 1, Nad tratí 1
6–12. original stratotype of Pragian/Zlíchovian boundary – section below Barrandov
6. *Psammosphaera minuta* DUNN, Zlíchovian 1
7. *Psammosphaera minuta* DUNN, Pragian 5
8. *Thuramminoides sphaeroidalis* PLUMMER, Pragian 2
9–11. *Thuramminoides sphaeroidalis* PLUMMER, Chapel Corral Horizon (three different specimens)
12. Bathysiphon sp., Pragian 5, length of scale bar 200 µm
13. *Paratikhinellidae* gen. et sp. 1, Homolka 18, Pragian, length of scale bar 75 µm
14. Hormosinidae gen. et sp. indet., Chapel Corral Horizon, length of scale bar 200 µm
15. *Tholosina* sp. 1, Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan, Pokorný’s sample
16. *Tholosina* sp. 1, Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan, Pokorný’s sample
17. *Bisphera (?)* sp., Pod terasami Quarry (section below Barrandov), Dvorce-Prokop Lst., Pragian
Lenght of scale bar 100 µm, if not given other.

PLATE 15
Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan
1. *Psammosphaera cava* MOREMAN, Prastav 3
2. *Psammosphaera devonica* STEWART et LAMPE, Prastav 1
3. *Psammosphaera devonica* STEWART et LAMPE, Prastav 5, length of scale bar 75 µm
4. *Psammosphaera cava* MOREMAN, Prastav 5
5. *Psammosphaera minuta* DUNN, Prastav 1
6. *Psammosphaera minuta* DUNN, Prastav 2
7. *Psammosphaera minuta* DUNN, Prastav 12, Choteč Lst.
8. *Psammosphaera minuta* DUNN, Prastav 5, length of scale bar 75 µm
9. *Psammosphaera devonica* STEWART et LAMPE, Prastav 5, length of scale bar 60 µm, light microscope
10. *Psammosphaera devonica* STEWART et LAMPE, Prastav 5, length of scale bar 60 µm, light microscope
11. *Psammosphaera devonica* STEWART et LAMPE, Prastav 5, length of scale bar 60 µm, light microscope
12. *Psammosphaera cava* MOREMAN, Prastav 3, length of scale bar 60 µm, light microscope
13. *Psammosphaera minuta* DUNN, Prastav 1, length of scale bar 60 µm, light microscope
14. *Hemisphaeramminae* sp., Prastav 3
15. *Hemisphaeramminae carmani* (SUMMERSON), Prastav 3
16. *Hemisphaeramminae carmani* (SUMMERSON), Prastav 3, length of scale bar 60 µm, light microscope
Lenght of scale bar 100 µm, if not given other.

PLATE 16
Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan
1. *Lagenammina sphaerica* MOREMAN, Prastav 3
2. *Lagenammina sphaerica* MOREMAN, Prastav 8
3. *Lagenammina sphaerica* MOREMAN, Prastav 3
4. *Thurammina triradiata* GUTSCHICK et TRECKMAN, Prastav 3
5. *Thurammina sphaerica* IRELAND, Prastav 3
6. *Thurammina arcuata* MOREMAN, Prastav 7
7. *Thurammina aff. echinata* DUNN, Prastav 1, length of scale bar 75 µm
8. *Thurammina aff. quadriradiata* DUNN, Prastav 4, length of scale bar 200 µm
9. *Thurammina* sp. 2, Prastav, Pokorný’s sample
10. *Thurammina aff. tubulata* MOREMAN, Prastav 3
11. *Thurammina papillata* BRADY, Prastav, Pokorný’s sample
12. *Saccammina (?) petinensis* BYKOVA, Prastav 3
Lenght of scale bar 100 µm, if not given other.

PLATE 17
Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan
Fig. 1 *Hyperammina gracilenta* GUTSCHICK et TRECKMAN, Prastav 4, length of scale bar 33 µm
Fig. 2 Saccorhiza aff. proboscis (HELL), Prastav 5, length of scale bar 50 µm
Fig. 3 tube-like rest, type 1, Prastav 10
Fig. 4 tube-like rest, type 1, fragments, Prastav 2
Fig. 5 *Hyperammina gracilenta* GUTSCHICK et TRECKMAN, Prastav 10
Fig. 6 *Hyperammina gracilenta* GUTSCHICK et TRECKMAN, Prastav 8
Fig. 7 Tolypammina sp. 4, Prastav 1
Fig. 8 Tolypammina sp. 4, Prastav 8
Fig. 9 Tolypammina sp. 5, Prastav 3, length of scale bar 50 µm
Fig. 10 Tolypammina sp. 4, Prastav 4
Fig. 11 Tolypammina bulbosa (GUTSCHICK et TRECKMAN), Prastav 4
Fig. 12 Tolypammina bulbosa (GUTSCHICK et TRECKMAN), Prastav 3
Fig. 13 Tolypammina sp. 2, Prastav 4
Fig. 14 Ammodiscidae gen. et sp. indet., Prastav 2
Fig. 15 Tolypammina sp. (? T. nodosa IRELAND), Prastav 4
Fig. 16 Tolypammina irregularis BLUMENSTENGEL, Prastav 8
Fig. 17 Ammobaculites aff. leptos GUTSCHICK et TRECKMAN, Prastav 6
Lenght of scale bar 100 µm, if not given other.

PLATE 18
Prastav Quarry, Praha-Holyně, Třebotov Lst., Dalejan
Fig. 1 *Tholosina* (?) sp. 2, Prastav 10, length of scale bar 200 µm
Fig. 2 *Tholosina* (?) sp. 2, Prastav 5, length of scale bar 75 µm
3. *Hemisphaeramminae bradyi* LOEBLICH et TAPPAN, Prastav 5, length of scale bar 75 µm
4. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), Prastav 4
5. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), Prastav 1
6. *Saccammina pseudospiralis* (CUSHMAN et STAINBROOK), Prastav 10
7. *Ammodiscus* ex gr. incertus ORBIGNY, Prastav 8
8. *Ammodiscus* ex gr. incertus ORBIGNY, Prastav, Pokorný’s sample
9. *Ammodiscus* ex gr. incertus ORBIGNY, Prastav, Pokorný’s sample
Lenght of scale bar 100 µm, if not given other.

PLATE 19 Sack-like tests
1. Požáry 63, Ludfordian, zone with *A. fecunda*
2. Kozolupy 72, Ludfordian
3–7. Hergetův lom Quarry, Suchomasty Lst., Dalejan (five different specimens)
8–9. Prastav Quarry 10, Třebotov Lst., Dalejan (two different specimens)
10. Prastav Quarry 10, Třebotov Lst., Dalejan
11. Prastav Quarry 3, Třebotov Lst., Dalejan
12. Prastav Quarry 12, Choteč Lst., Eifelian
13. original stratotype of Pragian/Zlichovian boundary – section below Barrandov, Zlichovian
14. Nad tratí Quarry 5, Třebotov Lst., Dalejan
15. Nad tratí Quarry 7, Choteč Lst., Eifelian
16. Chýnice - old quarry 4, Třebotov Lst., Dalejan
17. Chýnice - old quarry 5, Třebotov Lst., Dalejan
18. Nad tratí Quarry 1, Třebotov Lst., Dalejan
19. Údolí Hluboké Valley near Karlštejn c6, Třebotov Lst., Dalejan
20, 21. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian, (two different specimens)

Lenght of scale bar 100 µm.

PLATE 20

1–6. Radiolaria
1, 2. Nad tratí Quarry 7, Choteč Lst., Eifelian (two different specimens)
3. Kosov Quarry, Ludfordian, zone with A. fecunda
4. Stydlé vody Quarry 10, Dvorce-Prokop Lst., Pragian, lenght of scale bar 75 µm
6. Kačák Valley, Choteč Lst., lenght of scale bar 75 µm
7. 8, 15. Polychaeta
7. Stydlé vody Quarry 10, Dvorce-Prokop Lst., Pragian
8. Stydlé vody Quarry 14, Dvorce-Prokop Lst., Pragian
15. Homolka 18, Pragian
9–14. Incertae sedis 1
9. 10. Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst. (two different specimens)
11. Požáry 26, Ludlow, zone with E. beaumonti
12. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
13. original stratotype of Pragian/Zlichovian boundary – section below Barrandov, Zlichovian
14. Mušlovka Quarry 11, Ludfordian
16-22. spongi spicules
16. Srbsko, Řeporyje Lst., lenght of scale bar 75 µm
17. Prastav Quarry 8, Třebotov Lst., Dalejan
18. Prastav Quarry 3, Třebotov Lst., Dalejan
19. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
20. Prastav Quarry 10, Třebotov Lst., Dalejan, lenght of scale bar 200 µm
21. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
22. Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian

Lenght of scale bar 100 µm, if not given other.

PLATE 21

1–4. Ostracoda
1, 2. Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian, lenght of scale bar 200 µm (two different specimens)
3. 4. Prastav Quarry 10, Třebotov Lst., Dalejan, lenght of scale bar 200 µm (two different specimens)
5. 6. juvenile Gastropoda, Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian, (two different specimens)
7. Bryozoa, Chýnice 7, Třebotov Lst., Dalejan
8. scelerte of Holothuria, Homolka 18, Pragian
9. juvenile Gastropoda, Požáry 26, Ludlow, zone with E. beaumonti, lenght of scale bar 200 µm
10. (?) spongi spicule, Mušlovka Quarry 5, Ludfordian
11. Psammosiphon remesi PRANTL, Hlásná Třebaň, 0.5 m, Rhuddanian
12. juvenile Brachiopoda, Cephalopod Quarry 5, Ludlow, cephalopod limestones
13. juvenile Brachiopoda, Stydlé vody Quarry 26, Dvorce-Prokop Lst., Pragian
15. (?) spongi spicules, Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst.
16. ? Bryozoa, Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
17. Tabulata, Mušlovka Quarry 11, Ludfordian
18. (?) Inorganic pseudofossil Mušlovka Quarry 5, Ludfordian

Lenght of scale bar 100 µm, if not given other.

PLATE 22

1. Incertae sedis – sphaeras, Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian, lenght of scale bar 200 µm
2. Incertae sedis - sphaeras, Prastav Quarry 1, Třebotov Lst., Dalejan, 2a – whole specimen, 2b – detail of wall
3. undeterminable strongly recrystalized test, Cephalopod Quarry 5, Ludlow, cephalopod limestones
4. undeterminable strongly recrystalized test, Kační Quarry, Hommerian, lenght of scale bar 75 µm
5–10. (?) Proastrum div. sp.
5. Kační Quarry, Hommerian
6. V rokli Quarry, Loděnice Lst.
7. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
8. Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian
9. Prastav Quarry 5, Třebotov Lst., Dalejan
10. Prastav Quarry 10, Třebotov Lst., Dalejan, optical microscope, lenght of scale bar 180 µm
11–13. spongi spicules
11. Opatřilka-Červený lom Quarry, Dvorce-Prokop Lst., Pragian
12. Old Quarry (section bellow Barrandov), Dvorce-Prokop Lst., Pragian
13. Stydlé vody Quarry 23, Dvorce-Prokop Lst., Pragian, lenght of scale bar 75 µm
14. Incertae sedis 2, Hlásná Třebaň, 3.5 m, Aeronian, lenght of scale bar 200 µm

Lenght of scale bar 100 µm, if not given other.

Cover: Ammodiscus incertus ORBIGNY, Chýnice 2, Třebotov Lms., (pl. 11, fig. 5), × 100