Early Famennian bryozoan fauna from the Baqer-abad section, northeast Isfahan, central Iran

Andrej Ernst¹ · Ali Bahrami² · Ayesheh Parast²

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Abstract
A bryozoan fauna from the Upper Devonian (lower Famennian) of the Bahram Formation of the Baqer-abad section in central Iran contains four species: three trepostomes and one rhabdomesine cryptostome. Two trepostome species and one genus are new: Anomalotoechus parvus sp. nov. and Zefrehopora asynithis gen. nov. et sp. nov. The trepostome Coeloclemis zefrehensis Ernst et al., 2017 and the rhabdomesine cryptostome Euthyrhombopora tenuis Ernst et al., 2017 were recorded previously from the Upper Devonian (Frasnian) of the Bahram Formation at the Zefreh section. The fauna is dominated by the erect ramose Euthyrhombopora tenuis, accompanied by relatively frequent Zefrehopora asynithis, which developed both the erect and encrusting colonies. The bryozoans indicate low to moderate water energy environment in a middle to outer ramp position. Low diversity and high abundance of one species indicate an environmental stress apparently caused by strong sediment deposition. No significant differences in the composition of the bryozoan assemblages of the Frasnian and lower Famennian of the Bahram Formation were observed mirroring global patterns.

Keywords Bryozoa · Taxonomy · Early Famennian · Northeast Isfahan · Central Iran

Introduction
The late Middle and Late Devonian represents a relatively warm period with an acme in diversity, size and latitudinal distribution of reefs and associated shallow-water sediments in the Middle Devonian (Flügel and Kiessling 2002; Joachimski et al. 2009). On the other hand, the mid-Palaeozoic underwent dramatic change in Earth’s climate systems which resulted in changes in ocean chemistry and sea level. As a consequence of this, palaeoecosystems were impacted by several mass extinctions and ecological perturbations spanning millions of years (e.g. Talent et al. 1993). Fluctuations in physical palaeoenvironments and resultant mass extinctions were recorded in the sedimentological record by lithological changes and geochemical excursions which are also dependent on the depositional setting (Mottequin et al. 2017). Middle to Late Devonian strata are mainly composed of shallow-water facies and occur in isolated units in central Iran (e.g. Zahedi 1973; Soffel and Förster 1984; Wendt et al. 2005). The distribution of the upper Palaeozoic sediments around Isfahan (Fig. 1) is mostly limited to the northern Isfahan basin (Soh and Natanz regions Najhj, Negheleh, Varkamar, Northern Tar and Western Kesheh sections; Zahedi 1973; Adhamian 2003; Gholadipour et al. 2013; Bahrami et al. 2015), northeastern Isfahan basin (Zefreh, Chahriseh and Dizlu sections; Brice et al. 2006; Gholamalian 2003; Habibi et al. 2013; Königshof et al. 2017; Ernst et al. 2017; Bahrami et al. 2018) and southern Isfahan basin (Darchaleh and Ramsheh (in Shahreza region) sections; Boncheva et al. 2007; Leven and Gorgij 2008, 2011; Bahrami et al. 2014). The main objectives of this paper are to describe and interpret the bryozoan fauna from bryozoan-
bearing horizons at the lower part of the Bahram Formation in the study area (Baqer-abad section, NE Isfahan).

**Geological setting and material**

The Baqer-abad section is located 46 km to the northeast of Isfahan (N 33° 2′ 38″, E 51° 57′ 91″ WGS coordinates; Fig. 2) in the area where most Devonian outcrops of Iran are exposed; the sequence includes some hiatuses due to erosion and/or tectonic activity. The entire section has a thickness of approximately 1000 m, ranging stratigraphically from the Devonian (Bahram Formation) to the Cretaceous (Aptian-Albian), whereas the studied section of the Bahram Formation has a thickness of 220 m representing mainly shallow-water palaeoenvironments. The section has been grouped in 13 units which include fossiliferous carbonate units with brachiopods, tentaculitids, corals, gastropods, crinoid remains and bryozoans, with a few shale (grey to black) and sandstone interbeddings. Bryozoans occur in distinct layers mainly in the lower part (triangularis to crepida conodont zones) of the section in unit 1 (samples P1–P6; Figs. 3, 4). Twenty-seven rock samples were taken from this part of the section from which 54 thin sections of different size were made.

**Systematic palaeontology**

Bryozoans were studied in thin sections using a binocular microscope. Morphological character terminology is partly adopted from Anstey and Perry (1970) for trepostomes and from Hageman (1993) for cryptostomes. The spacing of structures is measured as the distance between their centres. Statistics are
summarised using number of measurements (N), arithmetic mean (X), sample standard deviation (SD), coefficient of variation (CV) and minimum (MIN) and maximum (MAX) values.

All the studied material is housed at Senckenberg Research Institute and Natural History Museum, Frankfurt am Main, Germany (prefix SMF).

Phylum Bryozoa Ehrenberg, 1831
Class Stenolaemata Borg, 1926

Superorder Palaeostomata Ma, Buttler and Taylor, 2014
Order Trepostomata Ulrich, 1882
Suborder Amplexoporina Astrova, 1965
Family Stenoporidae Waagen and Wentzel, 1886
Genus Coeloclemis Girty, 1911

Type species: Coeloclemis tumida Girty, 1911. Fayetteville Shales (Upper Mississippian, Carboniferous); Westville, Oklahoma, USA.
Fig. 3 Lithological characteristics and stratigraphy of the Baqer-abad section based on conodont fauna
Occurrence: Upper Devonian to Lower Carboniferous; Iran; USA.

Diagnosis: Colonies encrusting, maculae unknown. Autozooecia usually cylindrical or prismatic, with short recumbent parts, growing from exterior basal colony walls. Autozooecial apertures circular to oval, becoming polygonal in deeper sections. Hemiphragm, in type species, located at transition of exozone to endozone, on proximal side deflected towards base. Exilazoecia rare or absent. Exozonal styles present, usually located at autozooecial corners. Diaphragms absent. Walls thick and laminated in exozone, in tangential-section autozooecial boundary cross-sectional shape four to six sided in inner exozones becoming sub-polygonal to sub-circular in outer exozones, with disordered pattern on outer colony surface. Cortex thickness regular, no cingulum; weakly beaded in some species. Autozooecial cortex microstructure laminated, boundaries serrated. Cortex spherules and tubules common, generally located at zooecial boundaries in rows and occasionally in groups. Some tubulae project as spines into zooecial chambers (modified after Caroline Buttler, pers. comm., 2016).

Remarks: Coeloclemis is unique because of the presence of a single hemiseptum in the autozooecia. It differs from Stenophragmidium Bassler, 1952 in the presence of this single hemiseptum instead of hemiphragms in autozooecia. Records of Coeloclemis from the Upper Carboniferous and Permian do

Fig. 4  a-b Field photographs of the Baqer-abad section.  a Medium to thick-bedded sandy limestone just above the bryozoan bearing horizons (package 2).  b Grey thick-bedded limestone with scattered bryozoan fauna (part of package 1).  c-d Thin sections parallel (c) and across (d) bedding plane showing lithological characteristic of limestones at the Zefreh section.  a SMF 23.899,  b SMF 23.914.  Scale bars 5 mm (c-d)
Coeloclemis zefrehensis Ernst et al., 2017
(Fig. 5a–e; Table 1)

2017 Coeloclemis zefrehensis Ernst et al., p. 543, fig. 3a–f

Material: SMF 23.840–SMF 23.863.

Description: Thin encrusting colonies, 0.20–0.36 mm thick. Autozooecia growing from a thin epitheca, bending gently in their deeper portion and intersecting the colony surface at angles of 80°–90°. Epitheca 0.008–0.010 mm thick. Typically single long hemisepht in each autozooecium on its proximal wall, curved proximally. Autozooecial diaphragms rare, straight. Autozooecial apertures polygonal. Exilazooecia few to absent. Acanthostyles large, abundant, 3–5 surrounding each autozooecial aperture. Microacanthostyles abundant, arranged irregularly in the exozonal wall between autozooecia, 0.010–0.025 mm in diameter. Autozooecial walls granular, 0.005–0.010 mm thick in endozone; laminated, 0.030–0.055 mm thick in exozone.

Remarks: Coeloclemis zefrehensis Ernst et al., 2017 differs from C. tumida in the smaller distances between autozooecial apertures (0.13–0.23 mm vs. 0.29–0.40 mm in C. tumida). The species Eostenopora unica Yang, Hu and Xia, 1988 described from the Frasnian of China may belong to the genus Coeloclemis. Singular hemisepht typical for Coeloclemis are visible in longitudinal sections of this species (Yang, Hu and Xia, 1988, p. 155, pl. 19, Figs. 4–5). This species has larger autozooecial apertures (aperture width 0.15–0.21 mm vs. 0.09–0.19 mm in Coeloclemis zefrehensis).

Occurrence: Zefreh section, central Iran; Bahram Formation, Upper Devonian (Frasnian). Baqer-abad section, central Iran; Bahram Formation, Upper Devonian (lower Famennian).

Family Atactotoechidae Duncan, 1939
Genus Anomalotoechus Duncan, 1939
(= Stereotoechus Duncan, 1939; see Boardman 1960; Astrova 1978)

Type species: Anomalotoechus typicus Duncan, 1939. Traverse Group (Middle Devonian); Michigan, USA.

Diagnosis: Encrusting, massive, less commonly branched colonies. Autozooecia with polygonal to rounded-polygonal apertures. Diaphragms abundant in exozones, straight or inclined. Exilazooecia rare, short. Acanthostyles abundant. Autozooecial walls thin in the endozone; merged, without visible zooecial boundaries, strongly and irregularly thickened in the exozone, often with monilae-shaped thickenings.

Remarks: Anomalotoechus Duncan, 1939 differs from Leptotrypa Ulrich, 1883 in having massive and branched colonies, thickened walls and abundant diaphragms, and from Atactotoechus Duncan, 1939 in having abundant acanthostyles.

Occurrence: Upper Silurian–Upper Devonian; North America, Eurasia.

Anomalotoechus parvus sp. nov. (Figs. 5f–i and 6a–b; Table 2)

Derivation of name: The species name refers to the small colony (from Latin parvus—small)

Holotype: SMF 23.864.

Paratypes: SMF 23.865–SMF 23.870.

Type level: Bahram Formation, Upper Devonian (lower Famennian).

Measurements: See Table 2.

Diagnosis: Thin-branched colonies with distinct exozones; diaphragms rare; autozooecial walls thick, monilae-shaped in early exozone; exilazooecia few, small; acanthostyles abundant, 3–5 surrounding each autozooecial aperture; maculae absent.

Description: Branched colonies, 0.94–2.10 mm in diameter, with 0.19–0.65 mm wide exozones and 0.43–1.15 mm wide endozones. Autozooecia long in endozones, bending abruptly in exozones. Autozooecial

| Table 1 Summary of descriptive statistics for Coeloclemis zefrehensis Ernst et al., 2017. Abbreviations: N, number of measurements; X, mean; SD, sample standard deviation; CV, coefficient of variation; MIN, minimal value; MAX, maximal value |
|------------------|--------|-------|------|-----|-----|------|
|                  | N      | X     | SD   | CV  | MIN | MAX  |
| Autozooecial aperture width, mm | 50     | 0.14  | 0.021 | 15.38 | 0.09 | 0.19 |
| Autozooecial aperture spacing, mm | 50     | 0.18  | 0.020 | 11.40 | 0.13 | 0.23 |
| Acanthostyle diameter, mm        | 40     | 0.036 | 0.007 | 19.45 | 0.025 | 0.050 |
| Acanthostyles per aperture       | 22     | 3.6   | 0.727 | 19.99 | 3.0  | 5.0  |
| Autozooecial wall thickness, mm  | 10     | 0.040 | 0.007 | 16.97 | 0.030 | 0.055 |
apertures rounded-polygonal. Autozooecial diaphragms rare in exozone, straight, thin; absent in endozone. Autozooecial walls laminated, 0.005–0.008 mm thick in endozone; merged without visible zooecial boundaries, locally monilae-shaped in early exozone, 0.05–0.12 mm thick in exozone. Exilazooecia few, polygonal in shape, 0.03–0.05 mm in diameter. Acanthostyles abundant, 3–5 surrounding each autozooecial aperture. Maculae absent.

Remarks: Anomalotoechus parvus sp. nov. differs from A. insuetus (Morozova, 1959) from the Frasnian of Kuznets Basin in having rare autozooecial diaphragms, and from A. ramosus (Morozova, 1959) from the same locality in having rare autozooecial diaphragms and abundant acanthostyles. Anomalotoechus parvus differs from A. pervulgatus Lavrentjeva, 2001 from the lower Famennian of Transcaucasia in having branched colony and in smaller autozooecial apertures (aperture width 0.09–0.16 mm vs. 0.12–0.22 mm in A. pervulgatus).

Occurrence: Anomalotoechus parvus sp. nov. is currently only known from the Bahram Formation, Upper Devonian (Frasnian) at the Baqer-abad section, central Iran.

Family Eridotrypellidae Morozova, 1960
Genus Zefrehopora gen. nov.
Type species: Zefrehopora asynithis gen. nov. et sp. nov., by monotype.

Derivation of name: The genus name refers to the Zefreh section in the vicinity of which it was found.

Occurrence: Central Iran; Bahram Formation, Upper Devonian (Frasnian).

Diagnosis: Branched and encrusting colonies; autozooecial apertures rounded-polygonal; autozooecial diaphragms rare to common, concentrated in the exozone, straight, thin; hemiphragms rare, straight; exilazooecia few; acanthostyles abundant, 2–5 surrounding each autozooecial aperture; tubules between acanthostyles abundant; autozooecial walls laminated, merged without visible zooecial boundaries; indistinct maculae of macrozooecia.

Table 2 Summary of descriptive statistics for Anomalotoechus parvus sp. nov. Abbreviations as for Table 1

|                  | N  |   X  |   SD  |   CV  |  MIN  |  MAX  |
|------------------|----|------|-------|-------|-------|-------|
| Autozooecial aperture width, mm | 20 | 0.09 | 0.027 | 28.46 | 0.06  | 0.16  |
| Autozooecial aperture spacing, mm | 20 | 0.17 | 0.030 | 17.95 | 0.12  | 0.24  |
| Acanthostyle diameter, mm | 20 | 0.05 | 0.008 | 17.72 | 0.03  | 0.06  |
| Acanthostyles per aperture | 10 | 3.7  | 0.823 | 22.25 | 3.0   | 5.0   |
| Branch diameter, mm | 10 | 1.63 | 0.373 | 22.90 | 0.94  | 2.10  |
| Exozone width, mm | 10 | 0.45 | 0.156 | 34.50 | 0.19  | 0.65  |
| Endozone width, mm | 10 | 0.72 | 0.216 | 29.94 | 0.43  | 1.15  |
| Autozooecial wall thickness, mm | 10 | 0.08 | 0.022 | 28.22 | 0.05  | 0.12  |

Table 3 Summary of descriptive statistics for Zefrehopora asynithis gen. nov. et sp. nov. Abbreviations as for Table 1

|                  | N  |   X  |   SD  |   CV  |  MIN  |  MAX  |
|------------------|----|------|-------|-------|-------|-------|
| Autozooecial aperture width, mm | 70 | 0.12 | 0.017 | 14.68 | 0.08  | 0.15  |
| Autozooecial aperture spacing, mm | 70 | 0.17 | 0.023 | 13.32 | 0.13  | 0.22  |
| Acanthostyle diameter, mm | 45 | 0.03 | 0.016 | 48.84 | 0.013 | 0.060 |
| Acanthostyles per aperture | 25 | 3.1  | 0.862 | 27.99 | 2.0   | 5.0   |
| Exilazooecia width, mm | 20 | 0.04 | 0.009 | 24.50 | 0.02  | 0.05  |
| Branch diameter, mm | 5  | 1.59 | 0.410 | 25.79 | 1.08  | 2.10  |
| Exozone width, mm | 5  | 0.36 | 0.108 | 29.71 | 0.25  | 0.50  |
| Endozone width, mm | 5  | 0.87 | 0.224 | 25.84 | 0.58  | 1.20  |
| Autozooecial wall thickness, mm | 45 | 0.05 | 0.010 | 19.92 | 0.028 | 0.070 |
Zefrehopora asynithis gen. nov. et sp. nov. (Fig. 6c–i; Table 3)

Derivation of name: The species name refers to the unusual morphology of this bryozoan expressed in combination of tubules, acanthostyles and hemiphragms (from Greek asynithis—unusual).

Holotype: SMF 23.871.
Paratypes: SMF 23.872–SMF 23.889.
Type locality: Baqer-abad section, central Iran.
Type level: Bahram Formation, Upper Devonian (lower Famennian).
Measurements: See Table 3.
Diagnosis: Colonies branched. Autozoecia radially diverging in a broad endozone and forming more or less distinct bundle. Autozoecial apertures rounded-polygonal. Autozoecial diaphragms rare to common, concentrated in the endozone, straight, thin. Locally 1–2 short straight hemiphragms in autozoecia present. Autozoecial walls laminated, 0.005–0.010 mm thick in endozone; merged without visible zooecial boundaries, 0.028–0.070 mm thick in exozone. Exilazoecia few, rounded-polygonal in shape, 0.02–0.05 mm in diameter. Acanthostyles abundant, 2–5 surrounding each autozoecial aperture, originating in endozone. Tubules between acanthostyles abundant, 0.010–0.015 mm in diameter. Indistinct maculae of macrozoecia present. Macrozoecial apertures 0.16–0.20 mm in width.

Remarks: As for genus.
Occurrence: Zefrehopora asynithis gen. nov. et sp. nov. is currently known only from the Bahram Formation, Upper Devonian (lower Famennian) of the Baqer-abad section, central Iran.

Order Cryptostomata Vine, 1884
Suborder Rhabdomesina Astrova and Morozova, 1956
Family Rhabdomesidae Vine, 1884
Genus Euthyrhombopora Yang, Hu and Xia, 1988

Type species: Euthyrhombopora hunanensis Yang, Hu and Xia, 1988. Mississippian, Tournaisian; China.

Diagnosis: Colonies branched. Autozoecia radially diverging in a broad endozone and forming more or less distinct bundle. Autozoecial apertures oval or circular, regularly spaced. Acanthostyles of two sizes: macroacanthostyles in junctions of autozoecial walls and paurostyles surrounding autozoecial apertures. Diaphragms and hemisepta few or absent in most species (modified after Yang, Hu and Xia. 1988).

Remark: Euthyrhombopora differs from Rhombopora Meek, 1872 in the radial budding pattern of autozoecia in endozone as against the radial or spiral pattern in Rhombopora, as well as in the presence of hemisepta. Euthyrhombopora differs from Nicklesopora in the arrangement of autozoecia in form of the

Table 4 Summary of descriptive statistics for Euthyrhombopora tenuis Ernst et al., 2017.

|                         | N   | X   | SD  | CV  | MIN | MAX |
|-------------------------|-----|-----|-----|-----|-----|-----|
| Autozoecial aperture width, mm | 50  | 0.05| 0.008 | 15.43 | 0.04 | 0.08 |
| Aperture spacing along branch, mm | 50  | 0.30| 0.034 | 11.19 | 0.23 | 0.38 |
| Aperture spacing diagonally, mm | 50  | 0.18| 0.014 | 7.95  | 0.15 | 0.20 |
| Acanthostyle diameter, mm | 50  | 0.041| 0.009 | 21.90 | 0.025| 0.060|
| Paurostyle diameter, mm | 30  | 0.021| 0.005 | 21.72 | 0.015| 0.030|
| Axial zooecia width, mm | 20  | 0.15| 0.024 | 15.64 | 0.11 | 0.20 |
| Branch diameter, mm | 25  | 0.95| 0.217 | 22.84 | 0.62 | 1.63 |
| Exozone width, mm | 25  | 0.26| 0.082 | 31.68 | 0.13 | 0.50 |
| Endozone width, mm | 25  | 0.44| 0.109 | 24.95 | 0.23 | 0.68 |
axial bundle and in arrangement of larger and smaller acanthostyles around autozooecial apertures (only paurostyles in Nicklesopora).

**Occurrence:** Upper Devonian–Lower Carboniferous (Mississippian); China, Iran, Siberia, Caucasus, Malaysia, USA.

**Euthyrhombopora tenuis** Ernst et al., 2017

(Figs. 4a–b, 7a–h; Table 4)

2017 *Euthyrhombopora tenuis* Ernst et al., p. 548, figs. 6a–f

**Material:** SMF 23.890–SMF 23.943.

**Description:** Branched colonies, branch diameter 0.62–1.63 mm, with 0.23–0.68 mm wide endozone and 0.13–0.50 mm wide exozone. Secondary overgrowths and encrusting sheets occurring, 0.2–0.3 mm in thickness. Axial region often formed by few irregular and large axial zoecia; locally axial zoecia are not developed. Autozooecia tubular, bending sharply in exozone. Single massive superior hemiseptum occurring at the base of exozone; inferior hemiseptum is absent. Autozooecial apertures are oval, arranged in regular rhombic pattern on the colony surface. Acanthostyles large, with distinct hyaline cores and laminated sheath, 1–2 regularly arranged between autozooecial apertures. Abundant paurostyles arranged in single row between acanthostyles surrounding apertures, in a regular rhombic to hexagonal pattern. Metazooecia absent.

**Remarks:** *Euthyrhombopora tenuis* Ernst et al., 2017 differs from *E. carnosa* (Trizna, 1958) from the Mississippian (Tourmaisian) of the Kuznets Basin in possessing thinner branches (0.62–1.63 mm vs. 1.90–2.00 mm in *E. carnosa*). It differs from *E. diaphragmata* Yang, Hu and Xia, 1988 from the Mississippian (Tourmaisian) of China in possessing thinner branches and in smaller autozooecia (autozooecial width 0.04–0.08 mm vs. 0.12–0.14 mm in *E. diaphragmata*).

**Occurrence:** Zefreh section, Central Iran; Bahram Formation, Upper Devonian (Frasnian). Baqer-abad section, central Iran; Bahram Formation, Upper Devonian (lower Famennian).

**Discussion**

The studied fauna contains four species: three trepostomes—*Coeloclemis zefrehensis* Ernst et al., 2017, *Anomalotoechus parvus* sp. nov. and *Zefrehopora asynithis* gen. nov. et sp. nov.—and one rhabdomesine cryptostome *Euthyrhombopora tenuis* Ernst et al., 2017. The trepostome *Coeloclemis zefrehensis* and the rhabdomesine cryptostome *Euthyrhombopora tenuis* were recorded previously from the Upper Devonian (Frasnian) of the Bahram Formation of the Zefreh section (Ernst et al. 2017).

The bryozoan assemblage is represented by encrusting and erect branched growth forms with the latter dominating the fauna numerically (66.7%). Encrusting colonies occur in form of hollow erect tubes, which are apparently cavaiform, i.e. encrusting ephemeral cylindrical objects (*Coeloclemis zefrehensis*) and as secondary overgrowths of erect branched species (*Zefrehopora asynithis, Euthyrhombopora tenuis*). *Anomalotoechus parvus* developed exclusively erect branched colonies. *Euthyrhombopora tenuis* is clearly the dominant species represented by numerous fragments (Fig. 4c–d). *Zefrehopora asynithis* and *Coeloclemis zefrehensis* are less abundant, whereas *Anomalotoechus parvus* occurs in a few thin sections. Fenestrate and cystoporate bryozoans are completely absent in the Bahram Formation.

The studied bryozoan fauna shows low diversity and high abundance of one species (*Euthyrhombopora tenuis*). The same pattern has been observed in the Frasnian of the Bahram Formation (Ernst 2017). Low diversity and high abundance one or few species are usually signs of an environmental stress (e.g. Bone and Wass 1990; Bone 1991; Butler and Cuffey 1996). The position of the studied fauna within the middle to outer ramp setting (Königshof et al. 2017; Ernst et al. 2017) implies a soft and unstable substrate with relatively high rates of fine sedimentation. Erect colonies of the dominant species *Euthyrhombopora tenuis* are relatively immune to such sediment influx, and can tolerate wide range of water energy (e.g. Nelson et al. 1988; Amini et al. 2004). In contrast, encrusting species are strongly affected by strong sediment precipitation.

Bryozoans do not show significant extinctions during the bioevents at the Frasnian-Famennian transition (Bigey 1988; Morozova et al. 2002). During these bioevents, bryozoan faunas experience rather taxonomic shifts rather than reduction in diversity and abundance (Ernst 2013). Bryozoans from the Bahram Formation display a similar pattern. Both the Frasnian (Zefreh section) and lower Famennian (Baqer-abad section) assemblages are represented by four species, but two trepostome species (*Cyphotrypa definita* Morozova, 1960 and *Anomalotoechus ramosus* Morozova, 1960) of the Frasnian were replaced by the trepostomes *Anomalotoechus parvus* sp. nov. and *Zefrehopora asynithis* gen. nov. et sp. nov. in the Famennian assemblage. *Coeloclemis zefrehensis* and *Euthyrhombopora tenuis* occur in both assemblages.

**Conclusions**

The bryozoan fauna from the lower Famennian of the Bahram Formation at the Baqer-abad section, central Iran, contains four species: three trepostomes *Coeloclemis zefrehensis* Ernst et al., 2017, *Anomalotoechus parvus* sp. nov. and *Zefrehopora asynithis* gen. nov. et sp. nov., and one rhabdomesine cryptostome *Euthyrhombopora tenuis* Ernst et al., 2017. The
latter species is numerically dominant. Two species are previously known from the Frasnian of the Bahram Formation at the Zefreh section. The studied assemblage shows lower diversity and high abundance of one species (Euthyrhombopora tenuis) existing apparently in stressful environment. Environmental stress was apparently caused by soft substrate and high sediment precipitation in the middle to outer ramp setting. Dominance of erect branched colonies against encrusting ones is explained as adaptation for an environment with high sediment influx. No difference in the diversity and abundance of bryozoans in the Frasnian and lower Famennian assemblages of the Bahram Formation was observed. The transition between Frasnian and Famennian is marked by a replacement of two trepostome taxa.

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

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