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ORIGINAL ARTICLE

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Fossil names dedicated to Erik Flügel

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Abstract There are 3 genera and at least 19 species names of fossils, attributed to calcareous algae, sponges, hydrozoans, corals, ammonites, gastropods, foraminifers, and radiolarians that have been dedicated to Erik Flügel. These are listed with their original diagnosis or description and re-illustrations of the holotypes.

Keywords *Eflugelia* · *Fluegelispongites* · *Fluegelium* · *erikfluegeli* · *flügeli* · *fluegeli*

Preface

In biological and geobiological sciences it is usual to name the recent or fossil organisms according to persons to honour them by this way. Three genus (*Eflugelia*, *Fluegelispongites*, and *Fluegelium*) and at least 19 species names of fossil organisms are one of the abundant—if not the most abundant—person names among a variety of fossils, including calcareous algae, sponges, hydrozoans, corals, ammonites, gastropods, foraminifers, and radiolarians that have been dedicated to Erik Flügel. This shows the worldwide popularity of Erik Flügel among geologists and palaeontologists. Following the original diagnosis or the description, the re-illustration of the holotypes of all fossil taxa dedicated to Erik Flügel, are presented here. For the complete description of taxa, mentioned in this paper, see the corresponding publications.

Calcareous algae

Genus: *Epimastopora* Pia, 1922

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Epimastopora flügeli **Kulik, 1978**
(Fig. 1/8)
*1978 *Epimastopora flügeli* sp. nov.-Kulik, p. 198, pl. 5, Figs. 4–6

Original diagnosis: "Bruchstücke mit scheinbar ziemlich kräftigem zylindrischem Thallus, der eine Länge von 2,25 mm und eine Breite von 0,187–0,375 mm erreicht, meist 0,225–0,275. Die Wand des Thallus ist von den breiten Kanälen der Äste durchzogen, die im Schnitt einen fast rechteckigen Umriss haben. Der Durchmesser der Kanäle schwankt von 62–187 m, vorherrschend sind 125–165 μm und einem Verhältnis L/d = 1,5–2,4 und d/i = 1,4–5,1 (oft 1,4–1,3). Auf der äußeren und inneren Wand öffnen sich Kanäle mit einem Durchmesser von 62–75 und 50 μm. Der Abstand zwischen den Kanälen hat die gleiche Breite in all seiner Erstreckung mit zumeist 25 μm und nur in den äußeren Zonen verbreitert er sich, wodurch das Aussehen gleichschenkeliger Dreiecke entsteht mit einer Höhe der Innenwand von 62 μm und einer Breite der Basis (an der Oberfläche der Wand) von 87–150 μm. An der äußeren und inneren Begrenzung der Wand bemerkt man das Zentrum der Zwischenkanal-Fläche in Form von schlecht entwickelten Einkerbungen – "Gräben", die der Wand ein schwach welliges Aussehen verleihen." (Kulik 1978: 198; translated from Russian by Mrs. U. Flügel)

Genus: *Suppiluliumaella* Elliott, 1968
Suppiluliumaella erikfluegeli **Dragastan, 1978**
(Fig. 2/7)
*1978 *Suppiluliumaella erikfluegeli* n. sp. – Dragastan, p. 118, pl. 3, Figs. 4–9

Original description: "Thalle cylindrique, fortement calcifié, ayant un canal axial grand. Les rameaux primaires sont tubulaires-coniques; dans la partie proximale-médiane sont globuleux et subtriangulaires dans la partie distale. Les rameaux secondaires sont courts, finement tubulaires. En section tangentielle on peut observer 4–6 rameaux secondaires à aspect de fleur et à petits pétales. En section longitudinale, les rameaux primaires sont poursuivis de 2 rameaux plus longs, séparés médian d'un rameau plus

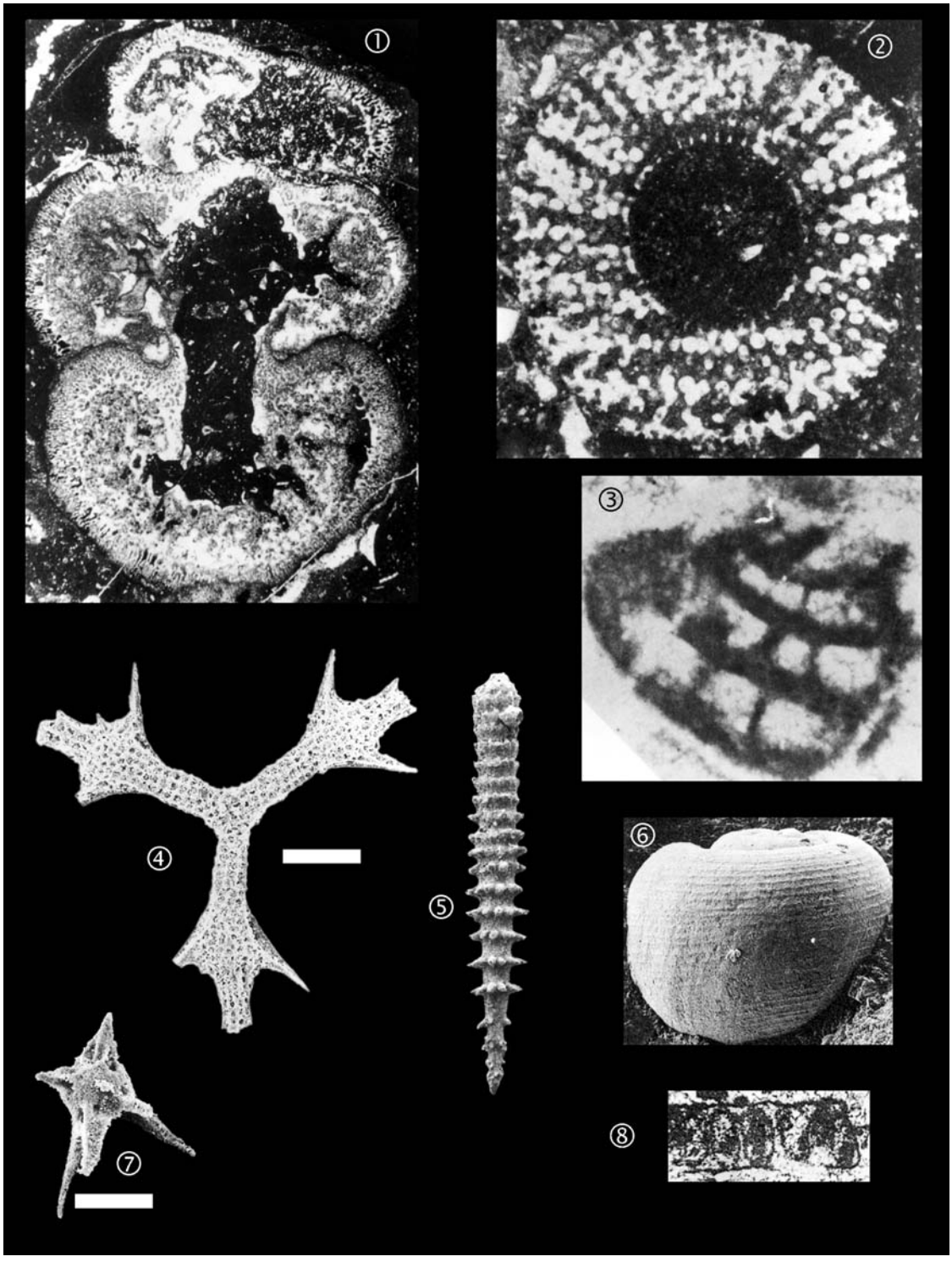

Fig. 1 The explanations and the magnifications of all figures have been taken from the original description of the species by the corresponding authors. **1** *Welteria fluegeli* Senowbari-Daryan. "Längsschnitt durch drei Segmente. Das vierte Segment (unten im Bild) ist nur randlich angeschnitten. Der ambisiphonate Kanal ist zwischen dem unteren und mittleren Segment gut zu erkennen. Die Segmente stehen durch eine größere Öffnung (ringförmig?) mit dem Spongocoel in Verbindung. Die Segmenthöhlungen werden durch reticuläres Füllskelett gefüllt." ×4. (Senowbari-Daryan 1990: 262). **2** *Zitellina fluegeli* Parente. "Subtransversal section; the calcareous skeleton consists of coalescing calcified fertile ampulae connected to a thin proximal wall enveloping the proximal portion of branches." ×30. (Parente 1997: 102). **3** *Kaeveria fluegeli* (Zaninetti, Altiner, Dager and Ducret). "Coupes tangentielles montrant les cloisons varticales à paroi micritique dense, et en bordure la paroi agglutinée diffuse des septes primaries." (No magnification). (Zaninetti, Altiner, Dager and Ducret 1982: 132). **4** *Fluegelium symmetricum* Steiger and Steiger. Scale bar 100 μm. **5** *Ropalospongia fluegeli* Mostler. ×150. **6** *Coelodiscus fluegeli* Bandel and Hemleben. "Lateral view of a larval shell of *C. fluegeli* n. sp. showing the low spiral." ×60. (Bandel and Hemleben 1987). **7** *Cyrtisphaeractinium* (?) *fluegeli* Kiessling and Tragelehn. "Lateral view" (Kießling and Tragelehin 1994: 246). Scale bar 45 μm. **8** *Epimastopora flügeli* Kulik. ×60

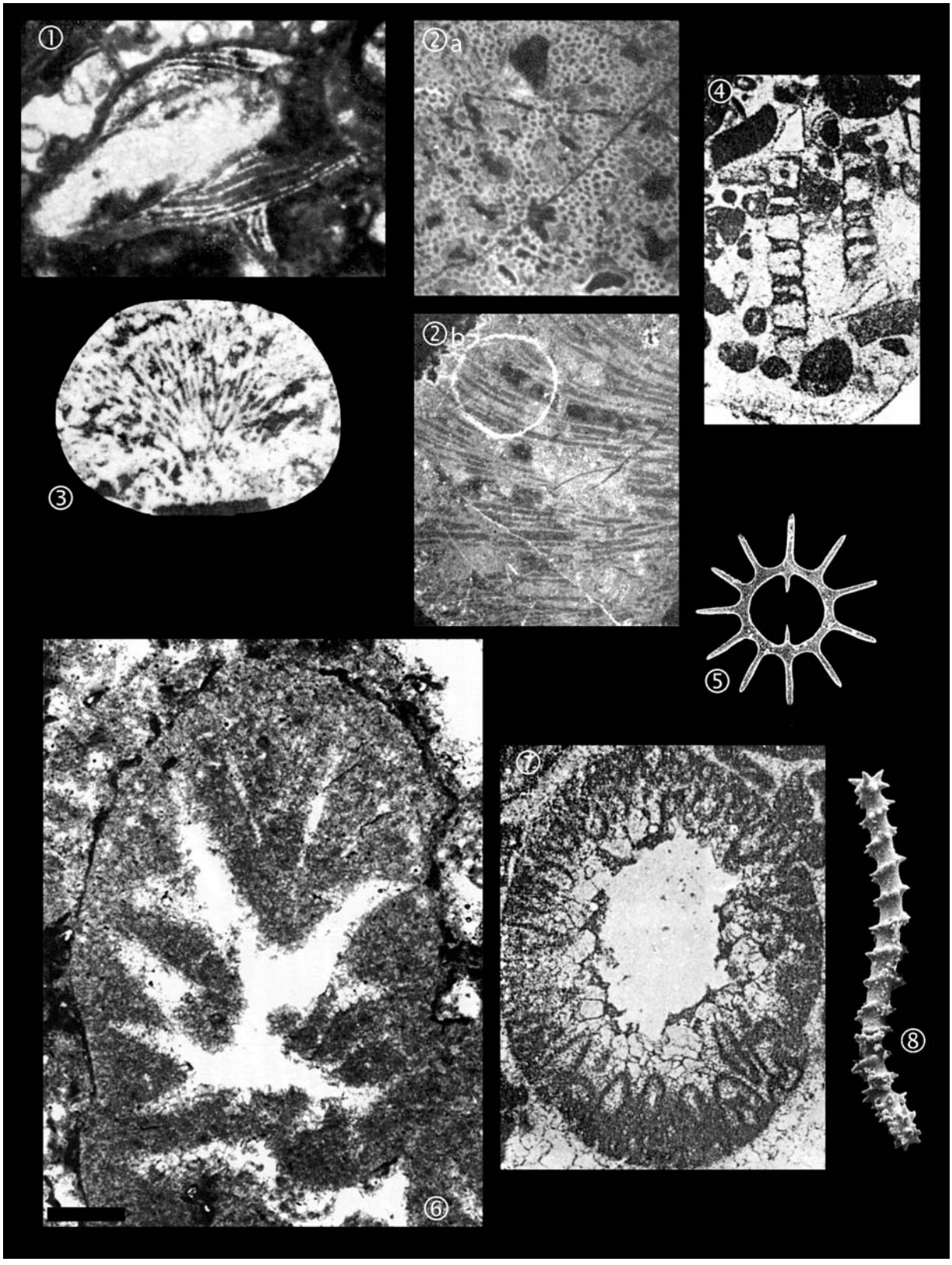

Fig. 2 The explanations and the magnifications of all figures have been taken from the original description of the species by the corresponding authors. **1** *Eflugelia johnsoni* (E. Flügel). "Die Algen umwachsen ein Schalenbruchstück." ×34.4. (Flügel 1966: 17). **2a** *Tubuliella fluegeli* Turnsek. "Transverse thin section." ×4. **2b** "Longitudinal thin section." ×4. (Turnsek 1966: pl. 9). **3** *Garwoodia fluegeli* Dragastan. ×8. **4** *Megaporella fluegeli* (Dragastan). ×30. **5** *Spongosaturnalis fluegeli* Kozur and Mostler. ×80. **6** *Solenopora fluegeli* Ernst. "Longitudinal section of older thallus with an asteroid structure. Thin section. Scale bar 1 mm." (Ernst 2002: 684). **7** *Suppiluliumaella erikfluegeli* Dragastan. ×50. **8** *Fluegelispongites trettoensis* Mostler. ×300

court. Ce caractère est typique au genre *Suppiluliumaella* Elliott." (Dragastan 1978: 118; for correction of description and designation of holotype see Dragastan 1989: 18; Dragastan and Richter 2003: 79)

Genus: *Megaporella* Deloffre and Beun, 1986
***Megaporella fluegeli* Dragastan, 1978**
(Fig. 2/4)
*1978 *Salpingoporella fluegeli* nov. sp. – Dragastan, p. 130, pl. 8, Figs. 1–2
1989 *Megaporella fluegeli* (Dragastan). – Dragastan, p. 10, pl. 7, Figs. 1–4

Original description: "Thalle cylindrique à parois épais et canal axial grand. Les rameaux sont de type phloiphore, ayant la zone proximale très courte tubulaire, qui agrandissent en diamètre beaucoup à l'extérieur, étant ouverts et à aspect d'entonnoir. En sections transversales, les rameaux ont les mêmes formes tout comme dans les sections axiales, mais etant un peu plus étroites. En sections tangentielles, les rameaux sont faiblement pressés verticalement. Les verticilles sont disposées régulièrement euspondyle. On ne connaît pas de sporanges." (Dragastan 1978: 130)

Genus: *Garwoodia* Wood, 1941
***Garwoodia fluegeli* Dragastan, 1985**
(Fig. 2/3)
*1985 *Garwoodia fluegeli* n. sp. – Dragastan, p. 119–120, text-Fig. 3, pl. 19, Figs. 1–8

Original diagnosis: "Thallus hemispherical 2.7–4.0 mm wide and 1.7–4.5 mm high. Semi-lax inner structure of the thallus, crossed by dichotomous filaments and polychotomous with three filaments. In dichotomous filaments the angle of divergence is about 45–50°, and in the polychotomous filaments the angle is 90°. The diameter of filaments is 50–75 μm, and they are always dextrally branched." (Dragastan 1985: 120)

Genus: *Zitellina* (Morellet and Morellet, 1913) emend. Barattollo, 1985
***Zitellina fluegeli* Parente, 1997**
(Fig. 1/2)
*1997 *Zittelina fluegeli* n. sp. – Parente, p. 93–100, pl. 28, Figs. 1–7

Original description: "Thallus ovoid. Calcareous skeleton markedly tapering and open at the lower end. Primary branches subcylindrical or slightly phloiophorous, arranged in close whorls and alternating in subsequent whorls. Lenticular fertile ampullae arranged all around the median and distal part of the branches. Calcification made by a calcareous wall enveloping only the proximal part of the branches (except in basal whorls) and by closely packed, and partly coalescent, calcified fertile ampullae. Basal whorls devoid of ampullae and with calcareous wall enveloping also the median and distal part of the branches." (Parente 1997: 94)

Genus: *Principia* Brenckle (in Brenckle et al.), 1982
***Principia fluegeli* Vachard (in Krainer and Vachard), 2002**
(Fig. 3/1)
*2002 *Principia fluegeli* n. sp. – Vachard (in Krainer and Vachard), p. 12, pl. 1, Figs. 3–5, pl. 2, Figs. 2–4, 8, 14, pl. 3, Fig. 6

Original diagnosis: "*Principia fluegeli* is characterized by its large, elongate articles, showing a rather narrow hypothallus with elongate cells." (Vachard in Krainer and Vachard 2002: 12)

Genus: *Halimeda* Lamouroux, 1812
***Halimeda fluegeli* Bucur, 1994**
(Fig. 3/3)
*1994 *Halimeda fluegeli* n. sp. – Bucur, p. 15, pl. 3, Figs. 1–5

Original diagnosis: "Thallus consisting of cylindrical, sometime waved segments. Medullary zone represents about 1/3 from the thallus diameter and is often uncalcified. When preserved, medullary filaments have a subparallel arrangement. Cortical filaments are perpendicular to the medullar zone and are dichotomically ramified. They are characterized by constrictions and swellings specific to this genus." (Bucur 1994: 15–16)

Genus: *Solenopora* Dybowsky, 1877
***Solenopora fluegeli* Ernst, 2002**
(Fig. 2/6)
*2002 *Solenopora fluegeli* n. sp. – Ernst, p. 688, Figs. 2b, 3a, b, 4b

Original description: "Nodular thalli, consisting of densely arranged, unbranching, parallelly proceeding filaments. The thalli reach 0.69–4.73 mm in the diameter. Filaments radiate from a centre. The filaments are hexagonal in cross-section, without cross partitions, 33–46.2 μm in diameter, and possess about 10 μm thick wall. Wall thickenings absent. The younger thalli are compact in their construction while the older ones show a centrally positioned void. The voids are asteroid in the cross-section. Some of them show remnants of thicker tubes radially diverging from the base of the node (conceptacles?). The tubes possess own walls." (Ernst 2002: 688–689)

Genus: *Alpinocodium* Senowbari-Daryan and Zamparelli, 2005
***Alpinocodium fluegeli* Senowbari-Daryan and Zamparelli, 2005**
(Fig. 3/4)
*2005 *Alpinocodium fluegeli* n. sp. – Senowbari-Daryan and Zamparelli, pl. 11, Figs. 1–7, text-Fig. 8

Original diagnosis: "Nodular colonies of irregulary growing alga of more than 20 cm in diameter, with dichotomously multibranched thallus. The medullar zone is poorly calcified appearing dark in transmitted light. The relatively thick cortical zone is strongly recrystallized, therefore the siphons are not recognizable." (Senowbari-Daryan and Zamparelli 2005: 160)

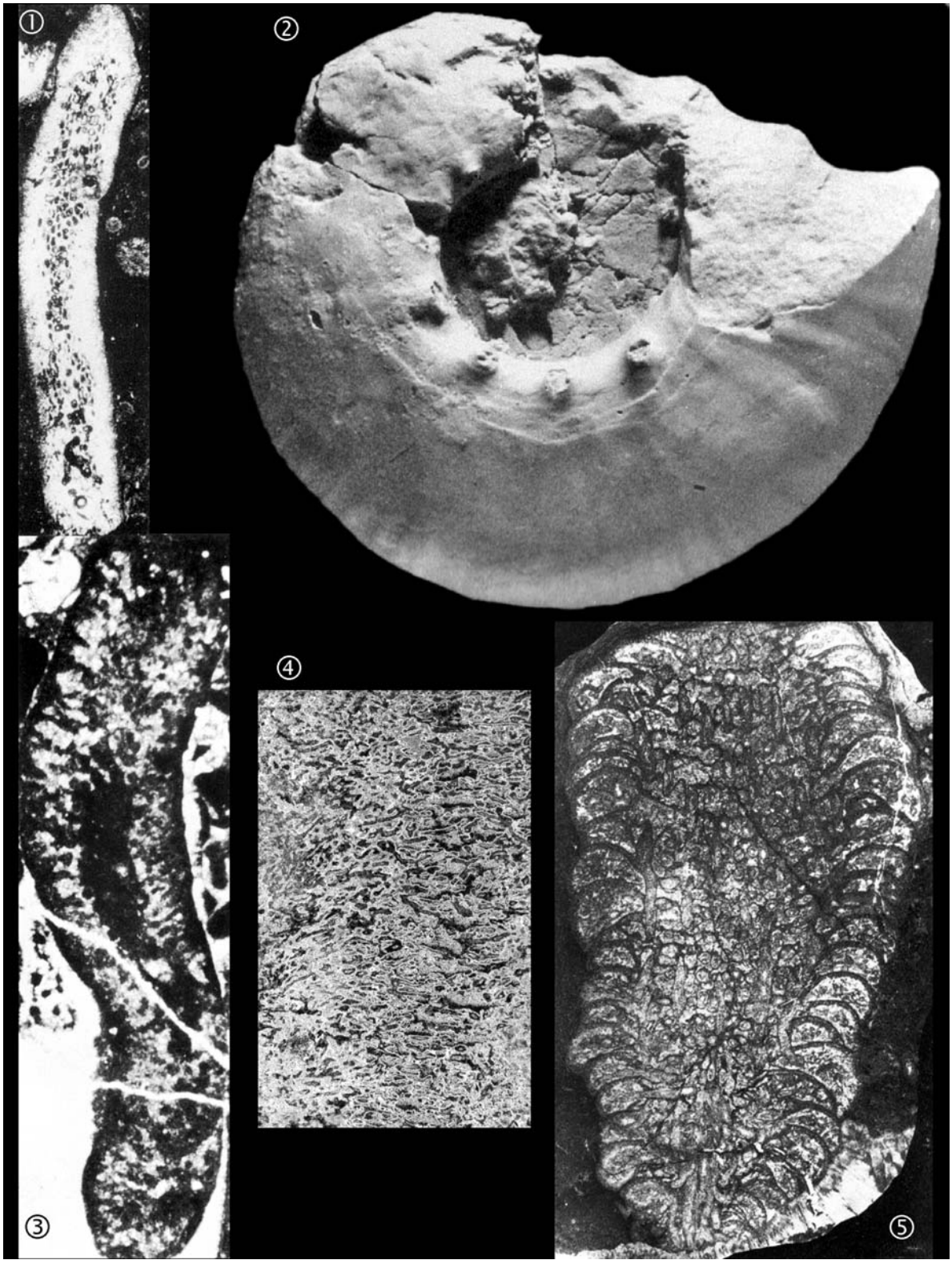

Fig. 3 The explanations and the magnifications of all figures have been taken from the original description of the species by the corresponding authors. **1** *Principia fluegeli* Vachard (in Krainer and Vachard). "Longitudinal section showing the hypothallus and the emplacement of the perithallus, and the elongate not bifurcated section of the thallus." ×36. (Krainer and Vachard 2002: 6). **2** *Schaireria fluegeli* Zeiss, 1994. "Steinkern. Basale Lagen des Bronner Plattendolomits, SW Pegnitz/Oberfranken. Ober-Kimmeridge. Natürliche Größe." (Zeiss 1994: 520). **3** *Halimeda fluegeli* Bucur, 1994. "Longitudinal section." ×50. (Bucur 1994: 28). **4** *Alpinocodium fluegeli* Senowbari-Daryan and Zamparelli. Longitudinal section. View of numerous thalli which are grown one beside others. ×1.7. **5** *Polysiphospongia fluegeli* Senowbari-Daryan and Schäfer. "In den Kammerhöhlungen tubuläres Füllskelett." ×1.7. (Senowbari-Daryan and Schäfer 1986: 264)

Problematic alga (or sponge?)

Genus: *Eflugelia* Vachard (in Massa and Vachard), 1979
Type species: *Cuneiphycus johnsoni* E. Flügel, 1966

Original diagnosis: "Auojgaliide Ptychocladiidé fixé. Réseaux régulier à laminae faiblement écartées, à maille carrée ou presque. Les laminae sont assez peu embrassantes. La forme générale est conique, parfois presque biconique. Paroi hyaline, januâtre, granuleuse. Comparaison: Par ses laminae faiblement embrassantes, *Eflugelia* se distingue de tous les autres Ptychocladiidés, en particulier du genere *Fourstonella* qui possède le même type de maille et de r'seaus. Répartition: Carbonifère supérieur-Permien terminal; eurasiatique." (Vachard in Massa and Vachard 1979: 34)

Remarks: *Eflugelia* was attributed to Ischyrosponges by Vachard (in Massa and Vachard 1979). It is listed as sponge "Class and order UNCERTAIN" by Finks and Rigby (in Finks et al. 2004: 762).

***Eflugelia johnsoni* (E. Flügel, 1966)**
(Fig. 2/1)
*1966 *Cuneiphycus johnsoni* n. sp. – Flügel, p. 17–19, pl. 2, figs. 1–5
1979 *Eflugelia johnsoni* (E. Flügel). – Massa and Vachard, p. 34, pl. 9, Fig. 10

Original diagnosis: "Flache, inkrustierende Thalli mit geringer Vertikalerstreckung. Die Thalli bestehen aus Zellen, die deutlich lagenförmig angeordnet sind. Die Vertikalelemente sind dünn, stehen meist eng und treten im Vergleich mit den Horizontalelementen im Erscheinungsbild zurück. Die Zellen-Höhe ist größer als die Zellen-Breite." (Flügel 1966: 18)

Sponges

Genus: *Ropalospongia* Mostler, 1994
***Ropalospongia fluegeli* Mostler, 1994**
(Fig. 1/5)
*1994 *Ropalospongia fluegeli* n. sp. – Mostler, p. 344, pl. 1, Figs. 8, 10, 15

Original diagnosis: "Spongien mit Spathidostylen, deren gerade gestrecktes Rhabd massiv gebaut ist, vom spitzen zum stumpfen Ende allmählich an Dicke zunimmt und mit 17–21 Dornenreihen ausgestattet ist. Der Kopfbereich setzt sich aus 4–6 nach oben gerichteten Dornenreihen zusammen, der eigentliche Kopf selbst besteht aus 3–4 verschmolzenen, sich überlappenden Dornenreihen." (Mostler 1994: 344–345)

Genus: *Fluegelispongites* Mostler, 1994
Type species: *Fluegelispongites trettoensis* Moster, 1994

Original diagnosis: "Spongien mit schlanken C- bis S-förmig gebogenen Acanthostrongylen, deren Dornen spiralförmig angeordnet sind." (Mostler 1994: 345)

***Fluegelispongites trettoensis* Mostler, 1994**
(Fig. 2/8)
*1994 *Fluegelispongites trettoensis* n. sp. – Mostler, p. 345, pl. 2, Figs. 7–10

Genus: *Polysiphospongia* Senowbari-Daryan and Schäfer, 1986
***Polysiphospongia fluegeli* Senowbari-Daryan and Schäfer, 1986**
(Fig. 3/5)
* 1986 *Polysiphospongia fluegeli* n. sp. – Senowbari-Daryan and Schäfer, p. 250, pl. 44, Figs. 1–2

Original diagnosis: "Zylindrisch bis kegelförmiger Schwamm mit sichelförmigen bis halbkugeligen Kammern. Das Kanalbündel besteht aus bis zu 30 Einzelkanälen. Anordnung der Kammern glomerat." (Senowbari-Daryan and Schäfer 1986: 250)

Genus: *Welteria* Vinassa De Regny, 1915
***Welteria fluegeli* Senowbari-Daryan, 1990**
(Fig. 1/1)
*1990 *Welteria fluegeli* n. sp. – Senowbari-Daryan, p. 94, pl. 32, Figs. 1–3, text-Fig. 34

Original diagnosis: "Catenulater Schwamm mit einem Spongocoel von ambisiphonatem Typ. Eine ringförmige Öffnung, welche sich wie ein Blutgefäßsystem in den Nieren verzweigt, verbindet das Spongocoel mit dem Segmentinneren. Labyrinthische Verzweigung der Wandporen. Fein reticuläres Füllskelett im Segmentinneren." (Senowbari-Daryan 1990: 94)

Hydrozoa

Genus: *Tubuliella* Turnsek, 1966
***Tubuliella fluegeli* Turnsek, 1966**
(Figs. 2/2a–b)
*1966 *Tubuliella fluegeli* n. sp. – Turnsek, p. 406–407 (72–73), pl. 9, Figs. 1–4, pl. 11, Fig. 5

Original diagnosis: "*Tubuliella* with predominant thin coenosteal tubes and with rare wide tubes." (Turnsek 1966: 406)

Corals

Genus: *Stuoresia* Cuif, 1976
***Stuoresia fluegeli* Turnsek and Senowbari-Daryan, 1994**
(Fig. 4)
*1994 *Stuoresia fluegeli* n. sp. – Turnsek and Senowbari-Daryan, p. 481, pl. 5, Figs. 1–6

Original description: "Cerioid-meandroid colony. Corallites in cross section roundish, oval or meandroid. Budding intracalicinal, in more directions. Septa compact, in 3–4 cycles, the last one as ridges in the wall only. Lateral ?menianes poorly preserved. Wall septothecal. No columella." (Turnsek and Senowbari-Daryan 1994: 481)

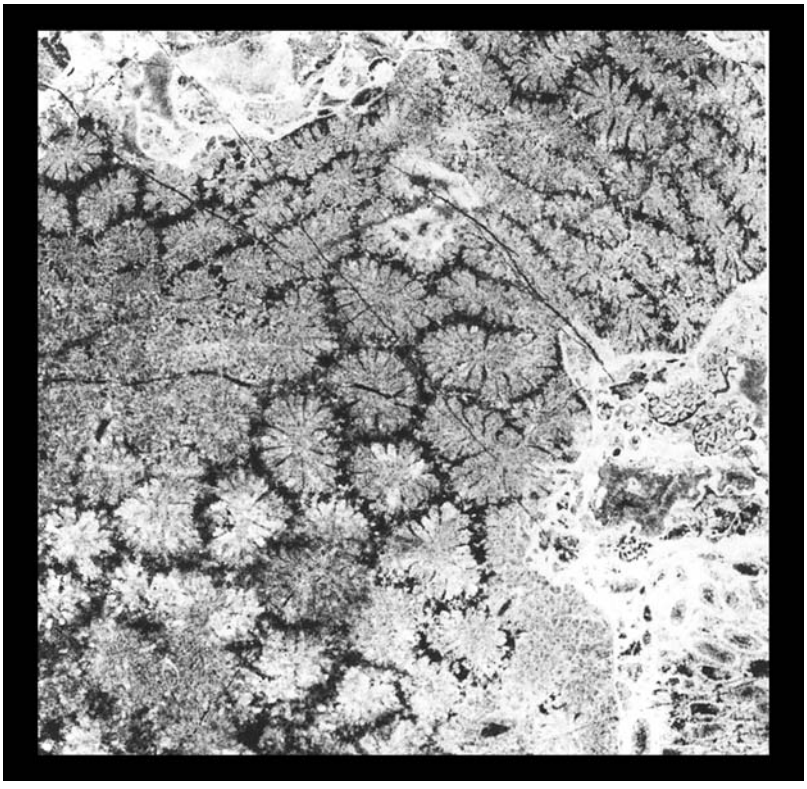

Fig. 4 *Stuoresia fluegeli* Turnsek and Senowbari-Daryan. "Transversal section of colony with roundish, polygonal, and meandroid corallites." ×4. (Turnsek and Senowbari-Daryan 1994: 492)

Ammonites

Genus: *Schaireria* Checa, 1985

***Schaireria fluegeli* Zeiss, 1994**

(Fig. 3/2)

*1994 *Schaireria fluegeli* n. sp. – Zeiss, p. 511, Figs. 1–2, pl. 1, Figs. 1–2

Original diagnosis: "Eine Art der Gattung *Schaireria* mit einem relativ schlanken Windungsquerschnitt, tief abfallendem Nabel und wohlausgebildeten Stachelknoten am Nabelrand." (Zeiss 1994: 511)

Gastropods

Genus: *Coelodiscus* Brösamlen, 1909

***Coelodiscus fluegeli* Bandel and Hemleben, 1987**

(Fig. 1/6)

*1987 *Coelodiscus fluegeli* n. sp. – Bandel and Hemleben, p. 5, Figs. 4–6, 8

Original diagnosis: "Apical portion of conch almost flat. Up to 5 whorls coiled with growth lines and sculptured by up to 30 longitudinal lirae, which are zigzaging to undulating." (Bandel and Hemleben 1987: 5)

Foraminifers

Genus: *Kaeveria* Senowbari-Daryan, 1984

***Kaeveria fluegeli* (Zaninetti, Altiner, Dager and Ducret, 1982)**

(Fig. 1/3)

*1982 *Palaeolituonella fluegeli* n. sp. – Zaninetti, Altiner, Dager and Ducret, p. 107, pl. 8, Figs. 1–2, 4–5

1984 *Kaeveria fluegeli* (Zaninetti, Altiner, Dager and Ducret). – Senowbari-Daryan, p. 87, pl. 1, Figs. 1–2, 5–7, 9–11, pl. 2, Fig. 9

Original description: "Le test conique de *Palaeolituonella fluegeli*, n. sp., comporte une partie initiale trochospiralée, faite d'un nombre indéterminé de loges dépourvues de subdivisions internes, qui surmonte en crosse un plus long stade déroulé et bisérié dans lequel on compte 5 à 7 rangées de 2 loges. Au niveau de ce second stade, les loges sont subdivisées par des cloisons verticales complètes, en disposition radiaire, dont une alternance régulière de septes plus longs et plus courts peut être observée sur le spécimen en coupe transversale. Aucune cloison horizontale n'est observée dans le test de *Palaeolituonella fluegeli*, n. sp. La paroi apparaît sous deux aspects; la paroi externe du test, celle qui forme les flancs des loges et les septes primaires, montre une trame "spongieuse", faite de matériel agglutiné et apparaissant en gris clair sous le microscope; les septes secondaires sont eux de texture micritique dense, contrastant ainsi en noir et avec des bords nets sur la paroi plus diffuse des loges ellesmêmes. Ce caractère est particulièrement visible sur l'individu, sectionné près du centre et montrant bien la disposition bisériée des loges, mais en revanche peu de septes verticaux, ceux-ci n'atteignant pas le bord interne des loges et apparaissant sur cette section en raison

de la relative obliquité de celle-ci. L'ouverture n'a pas été observée; toutefois, en raison de l'arrangement bisérié des loges dans le stade déroulé, il est probable que l'ouverture soit une simple fente, en position intériomarginale." (Zaninetti et al. 1982: 107)

Radiolarians

Genus: *Spongosaturnalis* Campbell and Clark, 1944

***Spongosaturnalis fluegeli* Kozur and Mostler, 1972**
(Fig. 2/5)

*1972 *Spongosaturnalis fluegeli* n. sp. – Kozur and Mostler, p. 35, pl. 1, Fig. 5

Original diagnosis: "Kreisrunder schmaler Ring, dessen Innenrand bis auf die beiden polaren Stäbe völlig glatt ist. Die 10–12 langen Stacheln (alle sind annähernd gleich lang) sind senkrecht zur Ringebene seitlich komprimiert. Die von unten bis oben fast gleich breiten Randstacheln sind abgerundet (keine Spitzen) und in sich gegliedert. Auch für diese Art ist die Position der Polarstäbe in Verlängerung der Randstacheln sehr typisch." (Kozur and Mostler 1972: 35)

Genus: *Fluegelium* Steiger and Steiger, 1994

Type species: *Fluegelium symmetricum* Steiger and Steiger, 1994

Original diagnosis: "The test is composed of a small central area from which three arms extend. The arms are rectangular in cross section. The cortical shell shows four thick parallel beams running from the central area to the ends of the arms. The beams are interconnected by bars forming a regular pattern of almost square pore frames. The central area has an irregular arrangement of pores. The arm ends are equally developed. They terminate with a thick bracchiopyle. The bracchiopyles are composed of longitudinal beams interconnected by bars. They also form a regular meshwork but mostly of rectangular pore frames. The arm ends are flanked by three-bladed spines at each side. These spines are arranged in the plane of the test. In lateral view the arms show the spongy meshwork of the medullary shell." (Steiger and Steiger 1994: 457)

***Fluegelium symmetricum* Steiger and Steiger, 1994**
(Fig. 1/4)

*1994 *Fluegelium symmetricum* n. sp. – Steiger and Steiger, p. 457, pl. 1, Fig. 6

Genus: *Cyrtisphaeractinium* Deflandre, 1972

***Cyrtisphaeractinium* (?) *fluegeli* Kiessling and Tragelehn, 1994**
(Fig. 1/7)

*1994 *Cyrtisphaeractinium* (?) *fluegeli* n. sp. – Kiessling and Tragelehn, p. 232, pl. 3, Figs. 1–6

Original description: "Seven triradiate spines with the code notation 1//1/2//3 in Cheng's system. One subapical, three-blades massive spine and three unequal cephalic spines. One cephalic spine on the upper hemisphere, three-bladed, nearly as massive as the subapical horn. The second cephalic spine more weakly developed, slightly curved. The location of this spine is strongly variable, ranging from an almost podominal (holotype) to a subapical position. A third cephalic spine is very tiny and only rarely observed. Three almost straight to curved feet. Feet slender or massive. Irregularly perforated cephalis, trapezoidal to subspherical in lateral view. Largest pores where spines are attached on cephalis. Most of the pores covered by microcrystalline quartz, often leaving only the largest pores open. All of the seven spines triradiate. Podome-wall only moderately developed and imperforate." (Kiessling and Tragelehn 1994: 232–233)

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