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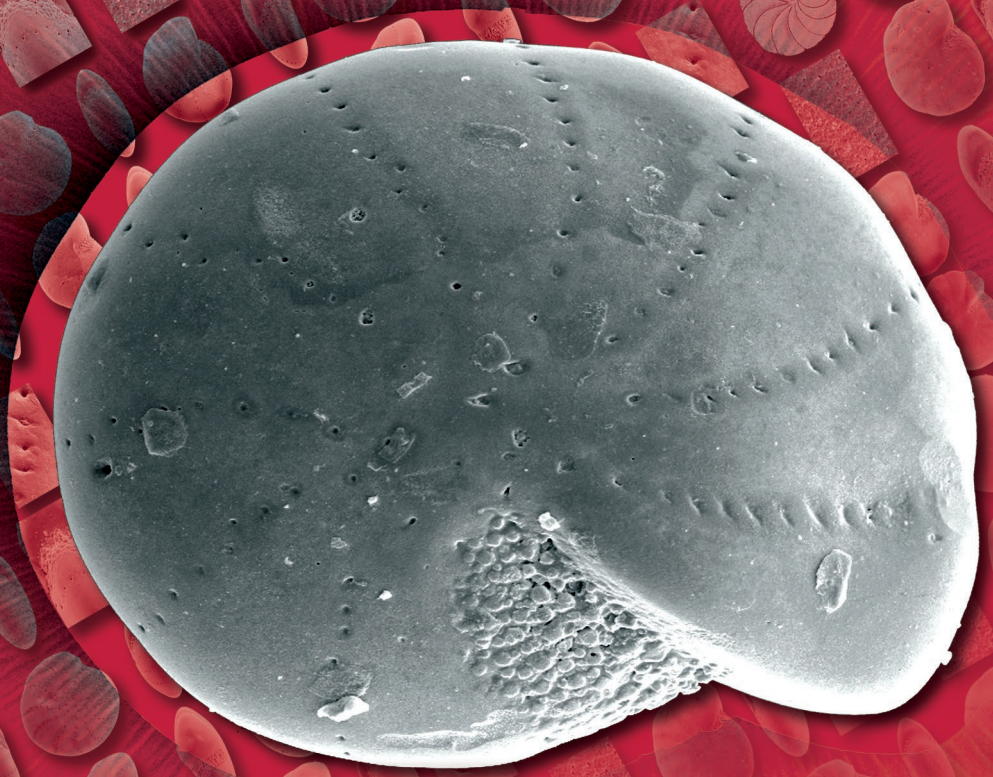
Two poorly known species of Foraminifera: *Polystomella minuta* Reuss, 1865 from the Oligocene of Germany (Bavaria) and *P. falunica* Allix, 1913 from the Miocene of western France (Touraine). Designation of a neotype for *P. falunica*

Jean-Pierre MARGEREL & Armelle POIGNANT



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Couverture / *Cover* :
Elphidiella falunica (Allix, 1913), Thenay (les Gandes) (Fig. 2B).

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Two poorly known species of Foraminifera: *Polystomella minuta* Reuss, 1865 from the Oligocene of Germany (Bavaria) and *P. falunica* Allix, 1913 from the Miocene of western France (Touraine). Designation of a neotype for *P. falunica*

Jean-Pierre MARGEREL
Centre de recherche et d'enseignement de Géosciences de l'environnement (CEREGE), Aix-Marseille Université-CNRS-IRD, Technopôle Environnement Arbois Méditerranée, boîte postale 80, F-13145 Aix-en-Provence cedex 4 (France)

Armelle POIGNANT
5 rue Léon Bloy, F-92260 Fontenay-aux-Roses (France)

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ABSTRACT
The type specimens of *Polystomella minuta* Reuss, 1865, have not been found in the Reuss collection of the Museum of Vienna. No topotypic specimen is known and all the subsequent designations of this species in the Oligocene and Miocene are misidentifications. *Polystomella falunica* Allix, 1913, was discovered again in 1968, and cited in 1980, 1989, 1997, 2009 by one of the authors of this study (JPM) and also a few others (see furthers). It is present in the upper Oligocene of the Paratethys and frequent in the Miocene of France and Paratethys, rare in the Pliocene of France. A neotype is here selected and described.

KEY WORDS
Foraminifers, Germany, France, Paratethys, neotypification.

RÉSUMÉ
Deux espèces mal connues de foraminifères : Polystomella minuta *Reuss, 1865 de l'Oligocène d'Allemagne (Bavière) et* P. falunica *Allix, 1913 du Miocène de l'ouest de la France (Touraine). Désignation d'un néotype pour* P. falunica.
Le type de *Polystomella minuta* Reuss, 1865, n'a pas été trouvé au Muséum de Vienne dans la collection Reuss. Aucun spécimen topotypique n'est connu et les attributions à cette espèce dans l'Oligocène et surtout le Miocène sont toutes erronées. *Polystomella falunica* Allix, 1913, a été redécouverte en 1968, et signalée en 1980, 1989, 1997, 2009 par un des auteurs de ce travail (JPM) et aussi par quelques autres (voir plus loin). L'espèce est présente au sommet de l'Oligocène dans la Paratéthys et fréquente dans le Miocène de France et de la Paratéthys, rare dans le Pliocène de France. Un néotype est choisi et décrit.

MOTS CLÉS
Foraminifères, Allemagne, France, Paratéthys, néotypification.

INTRODUCTION

Polystomella minuta Reuss, 1865, was described in the upper Oligocene of Germany, south of Hannover. It reported from three localities. The species is rare according to its author; this fact is probably the reason for the poor knowledge of the species and of the various generic and specific attributions. One of us (AP) attempted to obtain topotypes writing to various micropaleontologists: Dr Vespermann from Hildesheim, Dr Mutterlose from Bochum and F. W. Luppold from Hannover. These attempts were unsuccessful. However Dr Vespermann (personal communication to AP 2009) provided this interesting answer: "To my knowledge nearly all the material described by August Emmanuel Reuss is housed in the collections of the Natural History Museum in Vienna". After having questioned Drs F. Rögl and Ch. Rupp, from Vienna, Rögl sent us a paper entitled: "The disaster of the Reuss collection" (Rögl 2014) in which he stated: "The collection contained 6765 numbers of foraminifera, ostracoda and bryozoa, including 3212 types described by A.E. Reuss (Anonymous, 1891). Only for the bryozoa, kept in small boxes, labels are present. All other microfossils were kept in small hand-made glass bottles with a cork plug. On the cork a continuous series of numbers are written. But the corresponding catalogues are missing, at least since the thirties of the last century". Consequently, it was impossible to comprehend what is *Polystomella minuta*. Dr Fred Rögl, who knew our interest for this species made a huge effort to search the types. In a message (to AP, September 5th), he wrote: "I have looked through the collection all 4000 numbers of the Tertiary collection, where some vials did not contain specimens anymore… I have found some series of German Oligocene, but it is difficult to order them to a distinct locality. I did not find *minuta* or *discrepans*".

Haphazardly, we found at the "Muséum national d'Histoire naturelle" of Paris (MNHN) in the Le Calvez collection from the Parisian Basin a specimen called *Elphidium minutum* coming from one of the type localities of Reuss: Dickholzen, near Hildesheim. We suppose that Le Calvez used it for her work on the Parisian Basin. Of course, we don't know whether the sender and if his species designation is correct.

Polystomella falunica was described by Allix in 1913 (*in* Lecointre & Allix 1913) from the "faluns" of Touraine (western France) without any indication of the age or the type-locality. The Allix collection is probably lost, but the species is easily recognizable and abundant in all the Miocene deposits of Touraine where it was found again by one of us and rare in Pliocene deposits of Chalonnes (Maine-et-Loire). The authors of this work are the only ones to have cited the species in France since Allix (*in* Lecointre & Allix 1913) and Cushman (1939) afterwards. It was frequently attributed to *Polystomella minuta*, with the generic names: *Elphidium*, *Cribrononion* or *Elphidiella*: (Marks 1951; Drooger *et al.* 1955; Batjes 1958; Julius 1960, 1961, 1963) and *Elphidiellla* (Kristoffersen 1973; Reiser 1987; Rögl 1998; Cicha *et al*. 1998).

TAXONOMIC REVISION

Polystomella minuta Reuss, 1865

Polystomella minuta Reuss, 1865: 478, pl. 4, fig. 6a-b.

Elphidium minutum – Cushman 1939: 40, pl. 10, fig. 22 (Reuss figure), *non* figs 23-25 (the figure of Cushman is the one from Reuss).

Original diagnosis. — "Klein (0.45-0.5 Millim.), rund, wenig zusammengedrückt, mit sehr stumpfwinkeligem Rücken, ohne Nabel und Nabelscheibe. Zehn schmale, sehr wenig gebogene Kammern mit schwach vertieften linearen Nähten und sehr kleinen, wenig zahlreichen, punktförmigen Nathgrübchen. Die Septalfläche halbmondförmig, breiter als hoch, ohne sichtbare Mündungen".

Age. — Upper Oligocene.

Type locality. — No type locality is given, but three localities are pointed out: Harleshausen, Dieckolzen and Bodenburg, situated south of Hannover.

Occurrence. — Very rare.

Stratigraphical distribution. — *Fide* Reuss (1865), Upper Oligocene.

Remarks

The figures of Le Calvez (1966, 1970) are inspired by the specimen of the collection on the Parisian Basin. Her figure published in 1966, which unfortunately is a drawing, appears to be identical to the picture published in 1970. The main difference with Reuss species is the presence of numerous pustules on the test. These pustules are not mentioned by Reuss in his description of the species.

Dr F. Rögl believes that the Le Calvez species is not the one of Reuss (message to AP 2014).

Elphidiella minuta is quoted by Reiser (1987: 93) in the Oligocene and noteworthy in the Bavarian Chattian where it would be not rare. Unfortunately, it is not figured and the author only gives the Reuss reference. As for Miocene references, they probably always concern *Polystomella falunica*.

Finally, many of all the illustrations since 1974 of the Oligocene "*Polystomella minuta*" correspond to other species, perhaps pro parte to, *Polystomella latidorsata* Reuss, 1864.

Asides from the Ellis & Messina catalogue (1940 and supplements), only two references (Hosius 1895; Beutler 1914) are given with the number of pages but no indication of illustrations.

In 1997, one of us (AP) evoked the problem of mixing both species.

To conclude, we think that now it's impossible to give a description of *Polystomella minuta*, it would be necessary to examine samples from the Reuss localities to obtain topotypic specimens.

Polystomella falunica Allix, 1913

Polystomella falunica Allix *in* Lecointre & Allix, 1913: 45, fig. 9.

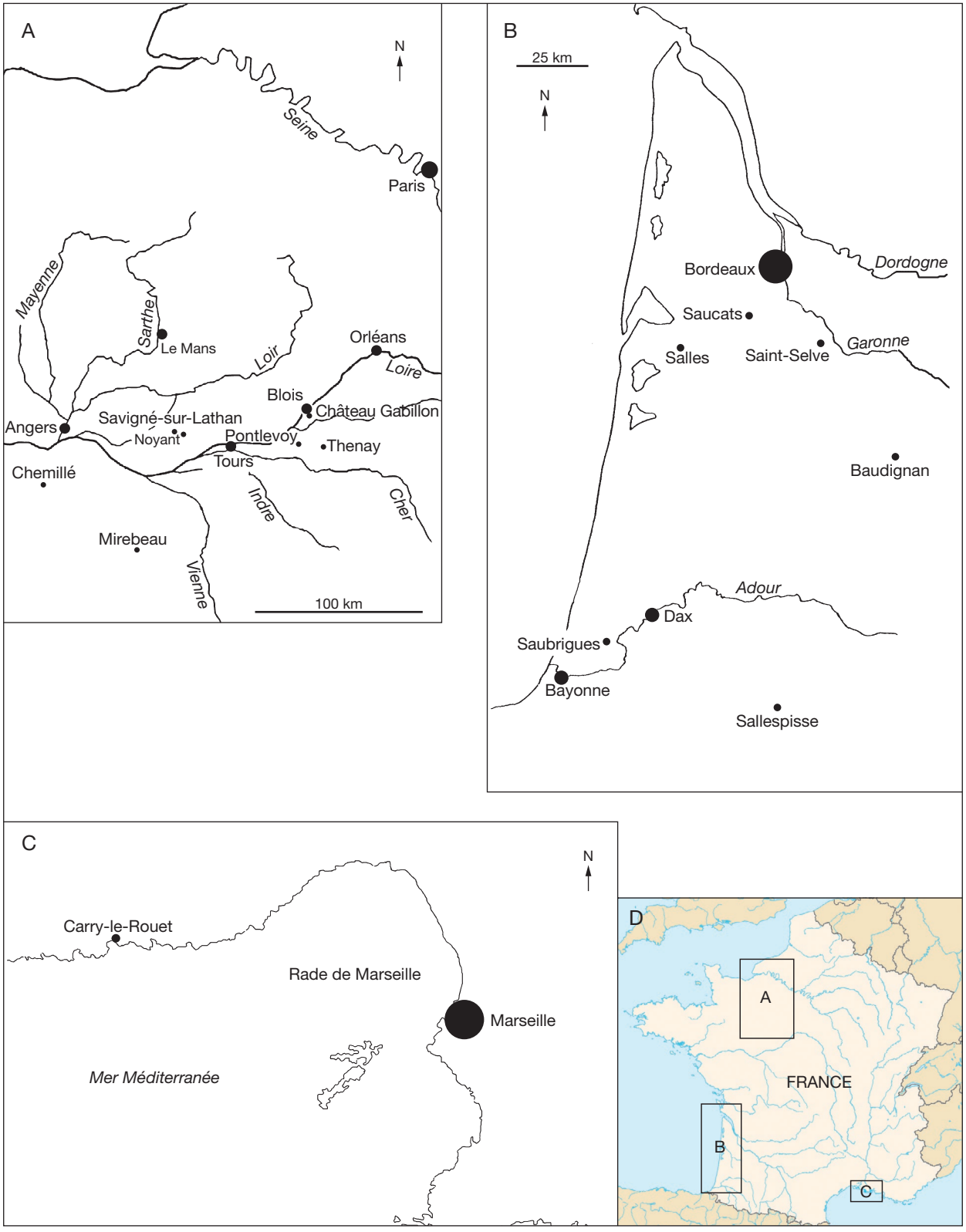

FIG. 1. — Geographical areas: **A**, Touraine: Pontlevoy, le Piziou, le Mincé, les Gandes, la Rangère, Château Gabillon, Savigné-sur-Lathan – Anjou (Chemillé) – Poitou: Mirebeau; **B**, Aquitaine: Saucats, Saint-Selve, Étang des Charmes at southern Saint-Selve, Saubrigues, Sallepisse, Baudignan, Lafaurie; **C**, Provence: Carry-le-Rouet; **D**, France, general map with the localization of the geographical zones **A**-**C**.

Elphidium falunicum – Cushman 1939: 46, pl. 12, fig. 5 (non fig. 6). — Margerel 1968: 135, 136, pl. 27, figs 13-14; 1997: figs 4, 9.

Elphidium minutum – Marks 1951: 53, pl. 6, fig. 6. — Kaasschieter *in* Drooger *et al.* 1955: 72, pl. 7, fig. 3a, b. — Batjes 1958: 164, pl. 12, fig. 1.

Elphidiella minuta – Kristoffersen 1973: 29, 30, pl. 2, figs 2-5, pl. 4, fig. 3. — Wenger 1987: 295, 296, pl. 13, figs 1, 6. — Cicha *et al.* 1998: 94, pl. 75, figs 7-8 (pictures of Wenger).

Cribrononion falunicum – Poignant & Pujol 1976: pl. 11, fig. 9. — Sztrákos 1979: pl. 23, fig. 4. — Margerel 1989: pl. 2, fig. 1.

Elphidiella falunica – Cahuzac & Poignant 1996: pl. 2, fig. 6; 2000: figs 8, 17. — Poignant 1997: 88, 89, pl. 4, figs 15, 19. — Rögl 1998: 142, pl. 8, figs 6-7. — Margerel 2009: fig. 20K, L.

ORIGINAL DIAGNOSIS. — "Coquille lisse et brillante montrant extérieurement bien moins de loges que la précédente (*P. crispa* (Linné). Celles-ci visibles au nombre de neuf généralement, sont un peu arquées et triangulaires. Les fossettes septales sont tellement petites qu'on ne peut guère les voir qu'en les colorant au carmin. Elles sont situées le long et très près des sutures. Le contour de la coquille est en carène obtuse. Il n'est pas toujours régulièrement circulaire et forme quelquefois des angles mousses au niveau des sutures. Elle n'est pas ombiliquée comme la *P. umbilicata* qui a des fossettes bien visibles. Je ne vois aucune espèce décrite qui corresponde à ces caractères. Très commune partout. Diamètre 0,7 mm" (Lecointre & Allix 1913: 45).

TYPE FORMATION. — Les Faluns de Touraine (France).

REMARKS

About the synonymy of *Elphidium falunicum*. "The types came from the Miocene of southern France. I have material from the Miocene, Helvetien, Pontlevoy Touraine; and Salles, Moulin du Minoy; Burdigalien inférieur, Moulin de l'Église, Saucats, Gironde; Le Coquillat, Léognan; Aquitanien supérieur, La Brède, Larriey [sic]; and St. Arit [sic], near Mont de Marsan, France. It is a very distinct species in this region" (Cushman 1939: 46).

Allix (*in* Lecointre & Allix 1913) makes an error since the type does not come from southern France but from western France.

Margerel (1968) identified Allix species and this new specific name will only be used by the French authors. The foreign authors will keep the designations *minuta* or *minutum*.

About the synonymy of *Elphidium minutum*. Marks appears to be the person responsible for confusing the two species. Indeed, in his paper entitled: "A revision of the smaller foraminifera from the Miocene of Vienna Basin" (Marks 1951), he figures *Polystomella falunica* under the name *Polystomella minuta* and calls it *Elphidium.* He does not speak of *P. falunica* because we suppose he did not recognise it.

Kaasschieter (*in* Drooger *et al.* 1955), working on the Miocene of southwestern France, puts *P. minuta* and *falunica* into synonymy and explains his opinion: "Cushman recorded this species (*falunicum*) from some Aquitanian, Burdigalian and Helvetian localities in the Aquitaine basin. Cushman suggested that *minutum* differs from *falunicum* in the number of retral processes, but the figures do not show this differences. In our material, this feature shows a variation from 9 to 14. As regards the number of chambers the variation (9 to 15) does not exceed that of Cushman's figures".

Batjes (1958) makes an interesting remark: "The few Boom clay specimens have very probably derived from the overlying sand of Antwerp and younger strata". And, as a matter of fact, the sand of Antwerp is of a Miocene age, and *E. falunica* seems to be present in Western Europe only from the Miocene.

About the synonymy of *Elphidium minuta.* To our knowledge, Kristoffersen (1973) is the first to place *Polystomella falunica* in the genus *Elphidiella*. He puts into synonymy: Marks, Batjes. He does not recognise Allix species.

About the synonymy of *Elphidiella falunica.* Poignant (1997), mentions the confusion between *Polystomella minuta* and *P. falunica*.

There are also numerous citations from the Miocene without figures and with various specific and generic attributions which concern without any doubt the Allix species. No mention, besides the Allix one, made in Ellis & Messina (1940 and supplements).

DESIGNATION AND DESCRIPTION OF THE NEOTYPE

Elphidiella falunica (Allix, 1913)
(Fig. 2B-F)

DIMENSIONS. — Length = 0.560 mm; width = 0.420 mm; thickness = 0.250 mm.

TYPE LEVEL. — Langhian-Early Serravallian.

TYPE LOCALITY. — **France**. Loir-et-Cher, Thenay, Quarry les Gandes, 46.629°N, 1.431°E (shore sands rich in remains of shells).

EXAMINED MATERIAL. — Sample Thenay (quarry les Gandes) (reference MNHN.F.763117).

DESCRIPTION

Test round, inflated, hyaline, very smooth, bright, very finely perforated, periphery not lobate, or very little on the last chambers, not carinate, 10 chambers, flat umbilicus, sutures forming sometimes a small depression between the last chambers, underlined by small pores in one line open into subsutural canals; apertural side oval; aperture and foramina interiomarginal, multiple, masked by conical to rounded pustules.

The internal structure of the genus *Elphidiella* has been described by Kristoffersen (1973) and Hansen & Lykke-Andersen (1976). The description of *Elphidiella minuta*, i.e., *falunica*, given by Kristoffersenis as follows: "One row of sutural pores communicate with subsutural canal. Spiral canal forming a simple and rather regular spiral without complicated anastomoses. Retral processes not present".

Our own observations reveal that in a majority of specimens the spire consists of two and half to three whorls and that the septal wall is bilamellar. We easily observe the sutural pores communicating with the sutural canal (Fig. 3M, N).

MORPHOLOGICAL VARIABILITY

Examined material

Touraine (Pontlevoy, le Piziou, le Mincé, les Gandes, la Rangère, Château Gabillon, Savigné-sur-Lathan); Anjou (Chemillé); Poitou (Mirebeau); Aquitaine (Saucats), Saint-Selve, Étang des Charmes (southern Saint-Selve), Saubrigues, Sallespisse, Baudignan, Lafaurie); Provence (Carry-le-Rouet).

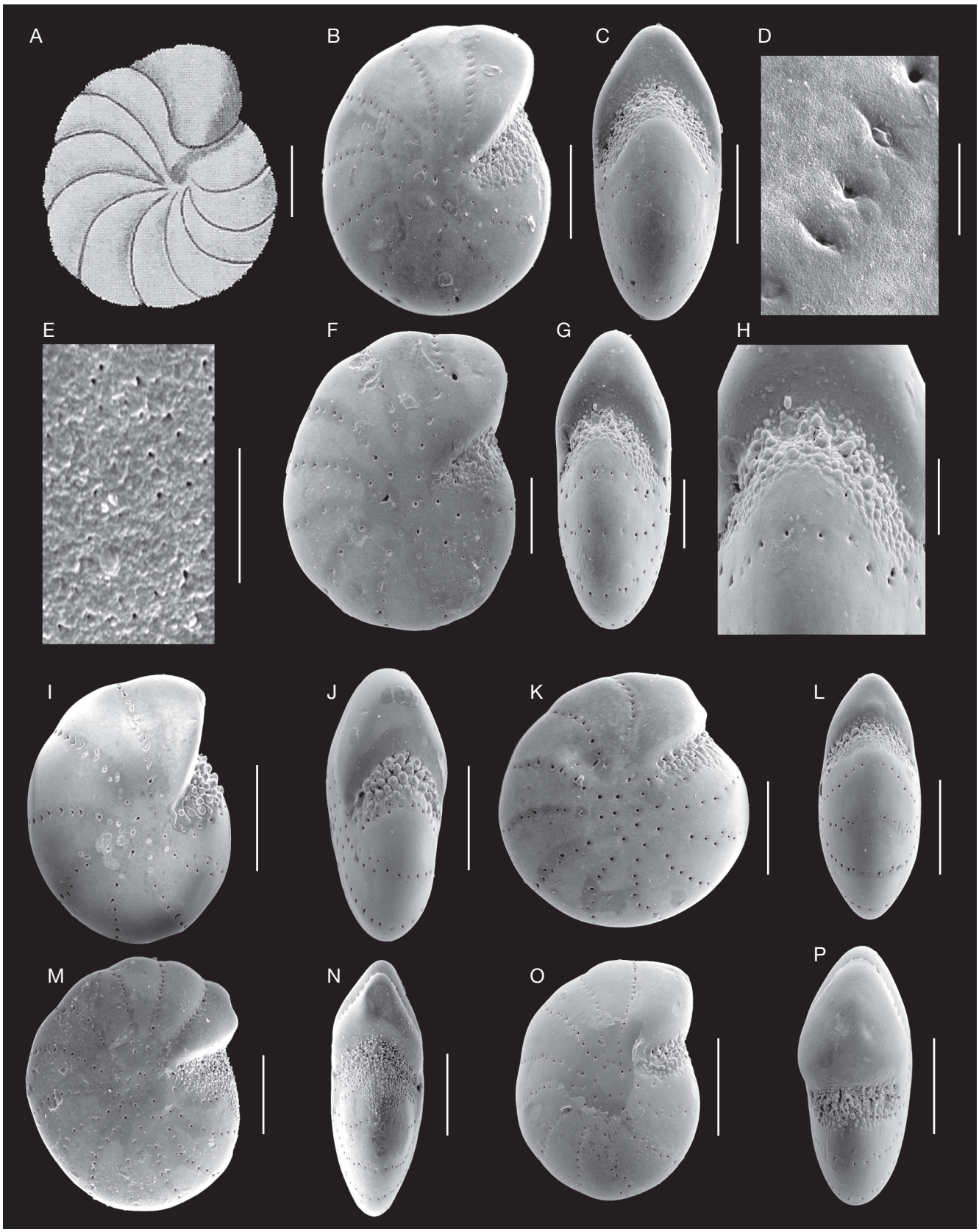

FIG. 2. — **A**, *Polystomella falunica* Allix, 1913; **B**-**P**, *Elphidiella falunica* (Allix, 1913), Thenay (les Gandes); **B**, **C**, lateral and oral views; **D**, sutural pores; **F**-**H**, Thenay (le Piziou); **A**, **B**, lateral and oral views; **C**, enlargement of the oral part; **I**, **J**, Thenay (la Rangère), lateral and oral views; **K**, **L**, Chemillé, lateral and oral views; **M**, **N**, Mirebeau, lateral and oral views; **O**, **P**, Noyant, lateral and oral views. Scale bars: A-C, I-P, 200 mm; F, G, 100 mm; H, 50 mm; D, 20 mm; E, 5 mm.

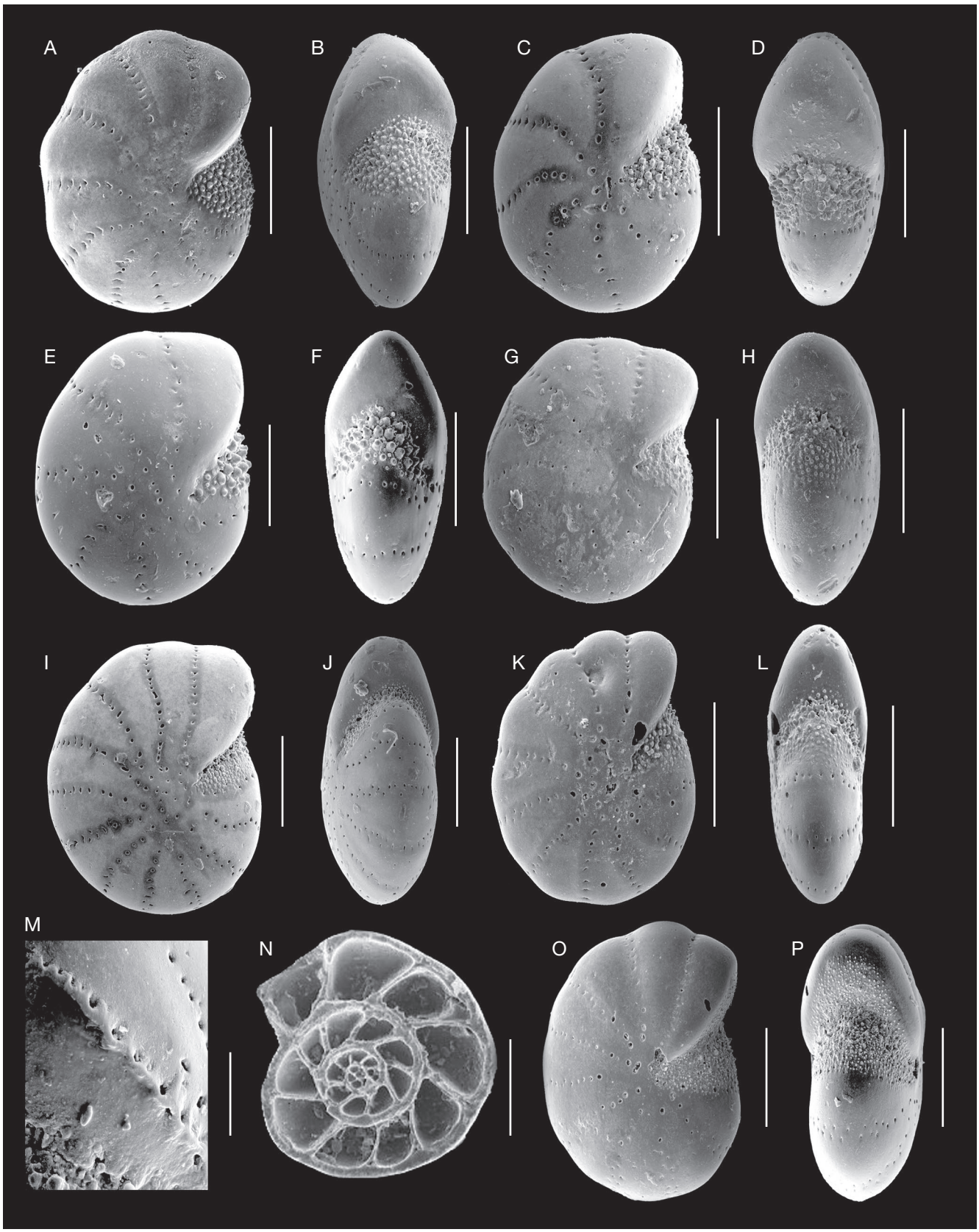

FIG. 3. — **A**-**N**, *Elphidiella falunica* (Allix, 1913); **A**, **B**, Saucats; **C**, **D**, Sallespisse; **E**, **F**, Saint-Selve; **G**, **H**, Étang des Charmes; **I**-**L**, Carry-le-Rouet, lateral and oral views; **M**, sutural canal; **N**, section; **O**, **P**, *Elphidiella hannai* (Cushman & Grant, 1927), lateral and oral views. Scale bars: A-L, N-P, 200 mm; M, 50 mm.

The variability concerns the general shape, the number of chambers and the type of pustules situated at the base of the aperture. It is illustrated in the following figures whose specimens are deposited in the MNHN collection:

Thenay quarry les Gandes (MNHN.F.763117) (Fig. 2B-E);
Thenay quarry le-Piziou (MNHN.F.763118) (Fig. 2F-H);
Thenay quarry la Rangère (MNHN.F.763119) (Fig. 2I, J);
Chemillé (MNHN.F.763120) (Fig. 2K, L);
Mirebeau (MNHN.F. 763121) (Fig. 2M, N);
Noyant (MNHN.F.763122) (Fig. 2O, P);
Saucats (MNHN.F.763123) (Fig. 3A, B);
Sallespisse (MNHN.F.763124) (Fig. 3C, D);
Saint-Selve (MNHN.F.763125) (Fig. 3E, F);
Étang des Charmes (MNHN.F.763126) (Fig. 3G, H);
and Carry-le-Rouet (MNHN.F.763127) (Fig. 3I-L).

A lot of 120 specimens (MNHN.F.763128 and MNHN.F.763129) from "Bassin de Thenay" in Loir-et-Cher have been measured and the number of chambers counted. The results of the measures areas follows:

Vertical diameter: 400 to 600 µm;
Horizontal diameter: 310 to 580 µm;
Thickness: 150 to 220 µm;
Number of chambers: 9 to 11.

Stratigraphical distribution

Miocene of middlewestern (Touraine) and southwestern France (Aquitaine); south France: Miocene of the Carry-le-Rouet section (Provence); *Elphidium minutum* is mentioned in the paper (Anglada 1972) and said to be abundant in the "Formation récifale du Cap des Nautes (Provence)"; one specimen was deposited in the MNHN collection; Pliocene of Anjou.

Sztrakos (1979) observed it in the Oligocene of Hungary, he only gave a drawing, but it seems to belong to the Allix species. In the same way, Cicha *et al.* (1998) believed it begins in the upper Kiscellian (Rupelian) but their illustration concerns the Eggenburgian. This species appears earlier in the Paratethys than in western Europe.

Geographical distribution

Western and Central Europe (see former text): France, Belgique, Denmark, Germany, Austria, Hungary; Asia: Eastern Turkey (Poisson *et al.* 1997, 2014).

Generic attribution

It is neither an *Elphidium*, which generally shows ponticuli across the sutures nor a *Cribrononion* which possesses a chamberlet at the base covered by granulations and disappearing when the following chamber appears.

Kristoffersen (1973) is hesitating as far as the generic attribution is concerned, he writes: "[…] the reference of the species to *Elphidiella* is debatable. Thus the double row of sutural pores which should characterize this genus are not present. When the species nevertheless is placed in the genus *Elphidiella* it is due to a superficial resemblance with the type species *Elphidiella arctica* (Parker and Jones 1864) and especially to the striking resemblance with E. hannai (Cushman and Grant 1927) and to the fact that it does not fit into any of the remaining genera available". The specimen of *Elphidiella hannai* from Plio-Pleistocene deposits from Cotentin (France) observed by Margerel possesses on the last chambers single rows of sutural pores (Fig. 3O, P).

We note that Loeblich & Tappan (1987) admit one row of sutural pores in *Elphidiella*.

CONCLUSION

Even though we have no knowledge of the Reuss type of *Polystomella. minuta*, we are convinced that *P. minuta* and *P. falunica* are two different species; indeed the description and figure of Reuss species are quite different from those of *P. falunica*. Therefore, the problem remains, what is really *Polystomella minuta*? We conclude that the now well known *Polystomella falunica*, needs to be used instead of *P. minuta* specially in the Miocene where it is frequent.

Acknowledgements

We are very deeply indebted at first to Fred Rögl who insuccessfully examined Reuss collection in the Museum of Vienna in order to find *Polystomella minuta*. Specials thanks are due to Dr Vespermann, Dr Mutterlose, Dr Rupp, F. W. Luppold, who helped us for the research of Reuss collection and of *Polystomella minuta*. We also thank Alain Tonetto (Fédération de Recherche des Sciences de Marseille, Plate-forme Pratim) who realized the illustration of our work, Mike Kaminski and an anonymous reviser for their critical reading of our manuscript and H. Salles-Astier for her linguistic improvements.

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