

Status of foraminiferal collections from the Tertiary Basin of Vienna, and revision of *Dentalina spinosa* d'Orbigny, 1846 and *Nonionina boueana* d'Orbigny, 1846

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ABSTRACT

D'Orbigny, in 1846, received a collection of material made by Chevalier von Hauer from the Tertiary of the Vienna Basin with the request that he studies the foraminifera. D'Orbigny studied this material in Paris, kept a part of it, and returned the rest to von Hauer, who may have further sorted it into vials of his choosing. Some of the material was also redistributed to other museums and topotypes were also newly collected. Thus the status of four collections of foraminifera from the Vienna Basin are confused. These collections are located in the Muséum national d'Histoire naturelle, Paris, the Geologische Bundesanstalt, Vienna, the Roemer Museum, Hildesheim (Germany), and in the Cushman Collection of the Smithsonian Institution, Washington, DC. The research undertaken for the present work shows that the only collection containing valid syntypes of d'Orbigny's material is in Paris; the remainder are topotype collections. In the revision of the Austrian collection by Papp & Schmid (1985), the specimens referred to *Dentalina spinosa* d'Orbigny, 1846 and *Nonionina boueana* d'Orbigny, 1846, were misidentified. A close examination of the syntypes housed in the French collection allows clarification of their taxonomical assignment and to designate lectotypes of these two species. Moreover, a comparative study led to reexamine the specimens of *Dentalina elegantissima* d'Orbigny, 1846, for which a lectotype is also designated, as well as specimens of *Nonion commune* (d'Orbigny, 1846) held in the same collection, and topotypes of *Nonion fabum* (Fichtel & Moll, 1798).

KEY WORDS

Foraminifera,
Vienna Basin,
Tertiary,
systematic revision,
collection.

RÉSUMÉ

Statut des collections de foraminifères du Tertiaire du Bassin de Vienne, et révision de Dentalina spinosa d'Orbigny, 1846 et Nonionina boueana d'Orbigny, 1846.

En 1846, le Chevalier von Hauer envoya à d'Orbigny du matériel concernant des foraminifères du Tertiaire du Bassin de Vienne en lui demandant de bien vouloir l'étudier. Après en avoir fait l'étude à Paris, d'Orbigny en garda une partie et renvoya le reste à von Hauer qui le tria et le conditionna dans des flacons de son choix. Une partie de ce matériel fut également redistribuée dans d'autres musées, tandis que des topotypes furent ensuite récoltés. C'est la raison pour laquelle le statut des différentes collections concernant les foraminifères du Bassin de Vienne est sujet à débat. Ces collections sont déposées au Muséum national d'Histoire naturelle, Paris, au Geologische Bundesanstalt, Vienne, au Roemer Museum, Hildesheim (Allemagne), et dans la Collection Cushman de la Smithsonian Institution, Washington, DC. Les recherches effectuées dans le cadre du présent travail montrent que seule la collection de d'Orbigny déposée au Muséum national d'Histoire naturelle à Paris contient des syntypes valides, les autres sont des collections topotypiques. Dans la révision de la collection autrichienne (Papp & Schmid 1985), les individus rapportés à *Dentalina spinosa* d'Orbigny, 1846 et *Nonionina boueana* d'Orbigny, 1846, ont été incorrectement identifiés. Un examen approfondi des syntypes déposés dans la collection française permet de préciser leur position taxonomique et de désigner un lectotype pour chacune de ces espèces. Une analyse comparative a conduit à réexaminer l'espèce *Dentalina elegantissima* d'Orbigny, 1846, pour laquelle un lectotype a également été désigné, ainsi que des spécimens de *Nonion commune* (d'Orbigny, 1846) et des topotypes de *Nonion fabum* (Fichtel & Moll, 1798).

MOTS CLÉS
Foraminifera,
Bassin de Vienne,
Tertiaire,
révision systématique,
collection.

INTRODUCTION

Around 1840 Chevalier von Hauer, who was very much interested in geology, collected extensive foraminiferal material from the Tertiary outcrops of the Vienna Basin in Austria. On his request, Alcide d'Orbigny described the foraminiferal fauna and published in 1846, under the auspices of the Emperor of Austria, a monograph entitled "Foraminifères fossiles du Bassin Tertiaire de Vienne découverts par Son Excellence Le Chevalier Joseph de Hauer". According to the literature, four collections are related to the foraminifera of the Vienna Basin in the world, one in the Muséum national d'Histoire naturelle, Paris (MNHN), a second in the Geologische Bundesanstalt in Vienna, a third

in the Roemer Museum at Hildesheim (Germany) and a fourth in the Cushman Collection of the Smithsonian Institution (Washington, DC).

Papp & Schmid (1985) revised the Austrian collection of the Vienna Basin and published their results in a monograph. The reexamination of the Paris collection, housed at the MNHN, revealed that, at least, two species (*Dentalina spinosa* d'Orbigny, 1846 and *Nonionina boueana* d'Orbigny, 1846) were misidentified in the Austrian collection. This observation led us to consider the status of the different collections of the fossil foraminifera of the Tertiary Basin of Vienna, and to propose new descriptions and illustrations of *Dentalina spinosa* and *Nonionina boueana* based on syntypes in Paris.

STATUS OF THE COLLECTIONS OF THE VIENNA BASIN FORAMINIFERA

The collection of the Vienna Basin foraminifera, described by d'Orbigny (1846), is part of the d'Orbigny collections housed in the MNHN in Paris. It is composed of small tubes glued on cardboard and labelled with species names and localities. One or several specimens of each species are glued on a thin glass plate that is placed inside each tube. According to the *International Code of Zoological Nomenclature* (ICZN 1999: article 72.4.1.1) the specimens in the French collection are part of the type series. Indeed, in the volume 1 of the "Prodrome de Paléontologie stratigraphique universelle des animaux mollusques et rayonnés", the huge three volumes work (d'Orbigny 1850a, b, 1852), in which he classified 18 000 species stratigraphically, d'Orbigny wrote (1850a: iv): "the asterisk, that we place before the serial number of a species, indicates that we possess it in our collection". Thus, the asterisk which precedes the name of the species described from the Vienna Basin and listed in the volume 3 of this publication (1852), proves that the French Vienna Basin collection was studied by d'Orbigny and therefore that it is a collection of syntypes. Alcide d'Orbigny had a keen sense of the notion of reference, and he would have kept a series of syntypes in his own foraminiferal collection, as he did in his other works concerning not only foraminifera but also many groups of invertebrates (1826, 1839a, b, 1840, 1850a, b, 1852, among others).

No clear evidence exists that the Austrian collection was prepared by or observed by d'Orbigny. In the Austrian collection, the specimens are stored in "small glass vials (so-called 'Biedermeier vials') whose corks were labelled with the numbers 1 to 228 after d'Orbigny's species of 1846. This is equivalent to the number of species described from the Vienna Basin by d'Orbigny in his monograph" (Papp & Schmid 1985: 8). D'Orbigny returned the remaining sediment to von Hauer after the publication of his monograph, and von Hauer himself most probably placed his collection in the "Biedermeier" vials (d'Orbigny did not use this kind of container) following the descriptions and

drawings of d'Orbigny. Papp & Schmid reported that some of these bottles contain a great number of individuals, often hundred and sometimes "more than a thousand specimens". D'Orbigny probably could not take the time to sort such a large number of specimens for the same species because he was very busy with other works. During this period of his life, d'Orbigny published a huge amount of works: the results of the *Voyage dans l'Amérique méridionale* (1835-1847; more than 4000 pages and 500 plates), the *Paléontologie française* (1840-1860), the *Cours élémentaire de paléontologie et de géologie stratigraphiques* (1849-1852) and the *Prodrome de paléontologie stratigraphique* finished in 1847 and published between 1850 and 1852 (d'Orbigny 1850a: lix). The publications of Papp *et al.* (1977) and Papp & Schmid (1985) do not demonstrate the syntypic status of the Austrian collection, and our research in the letters of d'Orbigny or other documents in the archives deposited in the MNHN revealed nothing regarding this problem.

Vespermann (1995) mentioned the presence of another collection related to the Vienna Basin: "In 1989 a chip box with 175 small vials containing foraminifera and a specimen list were discovered in the paleontological collection of the Roemer-Museum in Hildesheim (Germany). It became obvious that the foraminifera were part of collections sampled by Hauer" (1995: 441, abstract). The specimen list, entitled "Verzeichniß der Foraminifères aus dem Wiener Becken bestimmt von Alcide d'Orbigny" is signed by von Hauer. Moreover, Vespermann made reference to possible errors due to von Hauer's own actions: "Außerdem werden Hinweise auf mögliche Probenverwechslungen gegeben, die eventuell ebenfalls Hauer selbst unterlaufen sind" (1995: 459). The kind of vials ("Biedermeier" vials as in the collection at Vienna), as well as Vespermann's information lead us to conclude that this collection was prepared by von Hauer himself from his own material according to the diagnoses and figures published by d'Orbigny in 1846, and was not observed by d'Orbigny. Thus, the syntypic status of the Austrian and German collections and the lectotypes designated from these collections are invalid. Papp *et al.* (1977) and Papp & Schmid (1985) did not recognize the syntypic value of the French col-

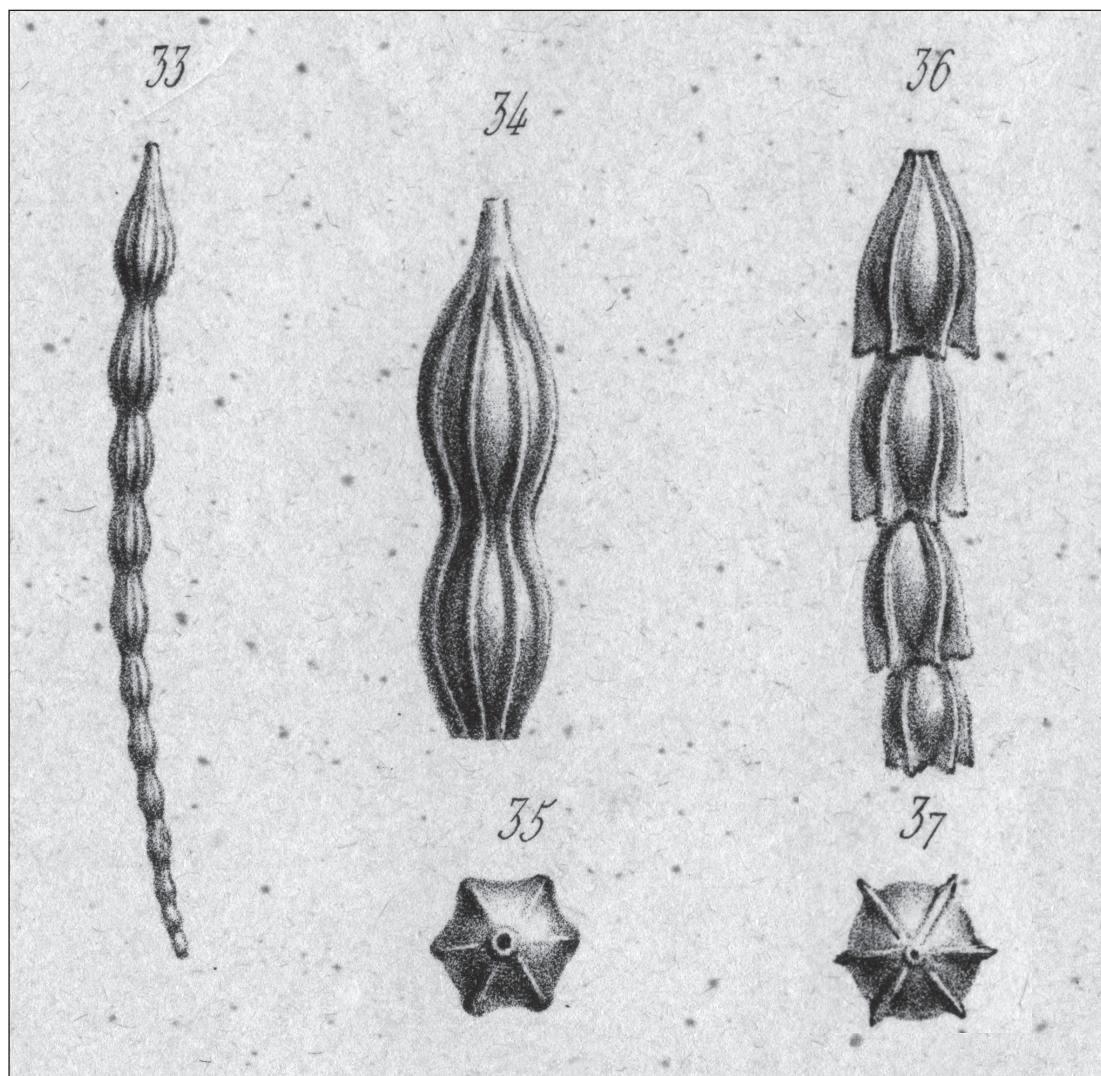


FIG. 1. — *Dentalina elegantissima* d'Orbigny, 1846, figs 33-35 from Plate II in d'Orbigny 1846. *Dentalina spinosa* d'Orbigny, 1846, figs 36, 37 from Plate II in d'Orbigny 1846.

lection, but Vespermann did not agree with them, recognizing the validity of the French syntypical collections, and he wrote that it must be regarded as “Illustration der von d'Orbigny beschriebenen Arten” (1995: 442). In his paper, Vespermann pointed out the necessity of designating lectotypes for 10 taxa, among which *Dentalina spinosa*.

Vespermann also indicated the presence of a Vienna Basin collection housed in the Cushman Collection

in the Smithsonian Institution (Washington, DC). Cushman (1939) wrote in his monograph of the family Nonionidae Schultze, 1854: “At that time the late Dr Yoshiaki Ozawa had returned to my laboratory from a year spent in Europe, bringing with him a large collection which he made particularly in the Miocene of the Vienna Basin. As a result, excellent series of the species of that area which had been compared with d'Orbigny's material so far as

it was preserved in Europe were made available by Dr Ozawa. This series has been of immense value in this work." Then, Cushman stated that the nonionids of the Vienna Basin that he figured in 1939 are topotypes. These assertions prove that the Vienna basin collection of the Smithsonian Institution is only topotypic not syntypic.

REVISION OF *DENTALINA SPINOSA* D'ORBIGNY, 1846 AND *NONIONINA* *BOUEANA* D'ORBIGNY, 1846

Papp & Schmid (1985) indicated that the specimens in vials 37 and 76 of the Austrian collection did not correspond neither to *Dentalina spinosa*, nor to *Nonionina boueana*, as formerly listed under these numbers and names, and figured in d'Orbigny's work (1846: 55, 108; pl. 2, figs 36, 37 and pl. 5, figs 11, 12, respectively). Therefore Papp & Schmid (1985: 34) concluded that: "Vial 37 contains 26 specimens which correspond to *N. [Nodosaria] elegantissima*. Plate 2, fig. 36 in d'Orbigny (1846) corresponds to none of these. We therefore unite this species with *N. elegantissima*". This means that they synonymized both names *D. spinosa* and *N. elegantissima* (d'Orbigny, 1846) (Fig. 1), and, consequently, we think that it is a misidentification of *D. spinosa*.

They figured (Papp & Schmid 1985: pl. 17, figs 1, 2) a specimen from vial 37 with the following caption: "*Nodosaria elegantissima* (d'Orbigny) (= *Dentalina spinosa* d'Orbigny)", but no typical reference material was presented. Moreover, Vespermann (1995) points out, as noted above, that this species needed to be revised. For *Nonionina boueana* (Fig. 2), the second species under reconsideration in the present study, Papp & Schmid (1985: 46) remarked: "Vial 76 contains 51 well-sorted specimens; contrary to the illustration in d'Orbigny they are asymmetrical. Based on the illustration in d'Orbigny, this species was often interpreted as a broad form of *N. [Nonion] scaphum*; due to the test shape and aperture, we assign it to *Hanzawaia*". Thus, they retain *Hanzawaia boueana* (d'Orbigny, 1846) as the valid name of this taxon, and designated a lectotype (GBA 1981/03/138) in the Austrian

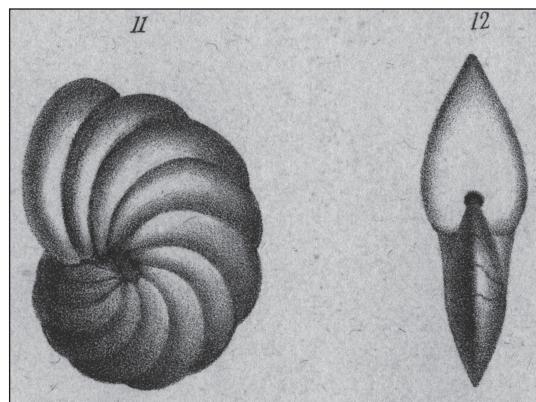


FIG. 2. — *Nonionina boueana* d'Orbigny, 1846, figs 11, 12 from Plate V in d'Orbigny 1846.

collection, which is figured in their paper. This misinterpretation of the species *Nonionina boueana* was first pointed out by Revets (1996).

TAXONOMIC REVISION OF *DENTALINA SPINOSA* D'ORBIGNY, 1846

Strictocostella? spinosa (d'Orbigny, 1846) (Fig. 3A-H)

Dentalina spinosa d'Orbigny, 1846: 55, pl. 2, figs 36, 37. — Cushman 1929: 86, pl. 13, figs 7, 8. — Amato 1974: 84, pl. 1, figs 9, 23.

Dentalina spinosa — Papp & Schmid 1985: 34, pl. 17, figs 1, 2. Non d'Orbigny, 1846.

TYPE MATERIAL. — The lectotype here designated and 4 paralectotypes (MNHN FO 45, d'Orbigny collection).

TYPE LOCALITY. — Baden (Austria).

OTHER MATERIAL EXAMINED. — Several topotypes, among them topotypes MNHN F62163 and MNHN F62164. — 5 specimens from Saubrigues (Aquitaine Basin, France).

DIAGNOSIS

"Coquille allongée, mince, fragile, peu arquée, ornée en long de six côtes non interrompues, saillantes, très élargies et mucronées en arrière, formée de loges ovales séparées les unes des autres par un très fort

étranglement, dont la dernière est un peu acuminée en avant. Cette charmante espèce, l'une des plus remarquables du genre, se distingue de toutes les autres par ses côtes peu nombreuses, qu'une pointe termine en arrière" (d'Orbigny 1846).

FIXATION AND DESCRIPTION OF THE LECTOTYPE

This species was described from the locality of Baden. The d'Orbigny Vienna Basin collection at the MNHN includes a mount (MNHN FO 45) containing five specimens labelled "*Dentalina spinosa*, Baden". These specimens correspond well with d'Orbigny's original description of *Dentalina spinosa*. Four of the specimens possess three chambers, one has four chambers which are highly fissured. The last chamber in all the specimens is broken. We designate the best preserved specimen, third from the left (marked with a black dot), as lectotype of *Dentalina spinosa* d'Orbigny (Fig. 3C).

Description

Test elongate (774 µm in length), straight, uniserial, composed of 3 chambers equal in size, the first ones missing; sutures horizontal; intercameral foramen at the end of a small neck and bordered by a small lip; surface with prominent and translucent costae (6 or 8 by chamber) which seem to be discontinuous and ended in a spine.

ADDITIONAL OBSERVATIONS

The topotypes, selected by M. Lys when he revised the d'Orbigny collection (Lys & Sigal 1947), were examined with SEM (Fig. 3A, B). The proloculus possesses elongate, protruding basal spines (Fig. 3F). Several different (6 or 8) longitudinal plate-like costae form a thin peripheral flange. Some of these costae run from a part of a chamber to another part of either the next or the previous one, crossing the sutures (Fig. 3G, H). They are more or less alternating around the same chamber. Other costae do not cross the sutural area and end in short spines at the chamber base. A few spines, independent from the costae, are also observed at the base of the chambers (Fig. 3E). A round aperture, with a bordering lip, is placed on a small, slightly flaring neck (Fig. 3D). The

neck is set in a small depression. No tooth or tooth-like projections are visible.

In their revision of the Austrian collection, Papp & Schmid synonymized *Dentalina spinosa* with *Dentalina elegantissima* under the current valid name *Nodosaria elegantissima*. They incorrectly fixed the lectotype of *Dentalina elegantissima* in vial 36; it is registered under the number GBA 1981/03/64. The d'Orbigny collection of the MNHN also includes 3 syntypes of *Dentalina elegantissima* mounted in MNHN FO 38. A comparison of these specimens with the *Dentalina spinosa* material and the original illustrations by d'Orbigny shows that the two species clearly differ. *Dentalina elegantissima* has a slender test, more chambers, and a sutural area that is less constricted. Its costae are less prominent, fewer in number and extend the entire length of the test. In addition, *Dentalina elegantissima* has no spines at the base of chambers and a longer neck. The aperture is difficult to observe. We designate here the best preserved specimen, underlined by a dot on the slide, as the lectotype of *Dentalina elegantissima*.

STRATIGRAPHICAL DISTRIBUTION

D'Orbigny pointed out that *Dentalina spinosa* is rare, whereas *D. elegantissima* is frequent at Baden. *Dentalina spinosa* has been little mentioned in the literature. Cushman (1929) reported it from the late Tertiary of Venezuela, Amato (1974) indicated that this species is abundant in the Upper Oligocene of SW France (Chattian of Saint-Étienne-d'Orthe, Aquitaine Basin) and Cahuzac & Poignant (2004) mentioned that it is very rare in the upper Burdigalian of the SW France (Saubrigues, Aquitaine Basin).

GENERIC ATTRIBUTION OF *DENTALINA SPINOSA*

Since d'Orbigny's initial description, the genera *Dentalina* and *Nodosaria* have been divided into several different taxa (Loeblich & Tappan 1987). The assignment of d'Orbigny's species to one of these taxa is difficult because the apertural characters are not obvious on the type specimens. Due to the rarity of this species, we only examined a few specimens by SEM. Based on the general morphology and ornamentation, this species could be related to *Strictocostella* Patterson, 1987.

Due to the absence of the last chamber, the SEM photographs are not conclusive regarding the presence or absence of the tooth which is diagnostic of *Strictocostella*.

TAXONOMIC REVISION OF *NONIONINA BOUEANA*

HISTORICAL BACKGROUND

The case of *Nonionina boueana* is even more complicated. Even though well known in the literature (Ellis & Messina [1940] had listed 62 references between 1856 and 1930), this species is not well understood. Its misinterpretation often came from a confusion of the genera *Florilus* de Montfort, 1808, *Nonionina* d'Orbigny, 1826, *Nonion* de Montfort, 1808 and *Hanzawaia* Asano, 1944, resulting in a very complicated history over the last three decades. It was documented by numerous authors (Banner & Culver 1978; Hansen & Rögl 1980; Rögl & Hansen 1984; Revets 1996) and is briefly summarized below.

De Montfort (1808) proposed the generic name *Florilus* and designated *Florilus stellatus* de Montfort, 1808 as type species; this taxon was later considered as a junior synonym of *Nautilus asterizans* Fichtel & Moll, 1798. He also erected the genus *Nonion* and designated *Nautilus incrassatus* Fichtel & Moll, 1798 as type species. Later, Parker & Jones (1863) designated *Nautilus asterizans* Fichtel & Moll, 1798 as type species of *Nonionina* d'Orbigny, 1826. Cushman (1930) finally considered *Nonionina* as a junior synonym of *Nonion*.

Although the genus *Florilus* had not been used since de Montfort (1808), Voloshinova reerected it in 1958. After the loss of the de Montfort collection, Banner & Culver (1978) proposed the specimen figured by Brady (1884: 729, pl. 109, figs 12, 13), under the name *Nonionina boueana*, as neotype for *Florilus stellatus*. This specimen, registered in the Natural History Museum, London (no. BMNH ZF 1991), was referred later to *Nonion* cf. *N. asterizans* in Barker (1960). Ever since Jones (1994), revising the *Challenger* collection, considered the Brady specimen to be *Nonion fabum* (Fichtel & Moll, 1798).

In their revision of the species *Nautilus asterizans* based on the Fichtel & Moll collection, Rögl & Hansen (1984) assigned this species to the genus *Hanzawaia*, due to the trochospiral morphology of the lectotype. In their paper they synonymized, nevertheless with caution, the names *Nonionina boueana* d'Orbigny, 1846 and *Hanzawaia asterizans* (Fichtel & Moll, 1798) on the basis of the Austrian collection and the findings of Papp & Schmid who prepared a revision of the Vienna material. In 1985, Papp & Schmid designated a specimen belonging to the Austrian collection as "lectotype" of *Nonionina boueana*. Taking into account its trochospiral morphology, Papp & Schmid (1985: 45) assigned this specimen to the genus *Hanzawaia*.

This complex history resulted in confusion and incorrect usage of some of these names which led Hansen & Rögl to submit two applications (1988a, b, cases 225/1 and 225/2) to the International Commission on Zoological Nomenclature. Using its plenary powers, the Commission stated (ICZN 1990a, b, opinions 1567 and 1568): 1) all previous designations of type species for *Nonion* de Montfort, 1808 are set aside and *Nautilus faba* Fichtel & Moll, 1798 is designated as type species; 2) the names *Florilus* de Montfort, 1808 and *Nonionina* d'Orbigny, 1826 are placed on the Official Index of Rejected and Invalid Generic Names in Zoology, and 3) the name *Hanzawaia* is placed on the Official List of Generic Names in Zoology, with type species by original designation *Hanzawaia nipponica* Asano, 1944. Since this date, Revets (1996) has shown that the concept of *Florilus* was different from that of *Hanzawaia* (type species *H. nipponica*), and has proposed a new name, *Riminopsis* (with type species *Nautilus asterizans*) to replace the name *Florilus*.

As previously stated, Papp & Schmid (1985) based their conclusion regarding "*Hanzawaia boueana*" on their reexamination of the Austrian collection (51 specimens of vial 76). As the number 76, which is written on the cork of the vial, is also the numeral rank given to *Nonionina boueana* by d'Orbigny in his monograph (1846: 108), they concluded that the specimens found in this vial must be assigned to *Nonionina boueana*, despite the large discrepancy that they observed

between their morphology and the description and illustrations of d'Orbigny (1846). Unfortunately they put more reliance on a part of the collection only labelled by a number written on a cork (which could have been inverted) than in d'Orbigny's original work. This led Papp & Schmid to erroneously designate a lectotype for *Nonionina boueana* d'Orbigny, 1846 (mount GBA 1981/03/138) with the following diagnosis: "test flat, asymmetrically coiled, composed of 10-12 chambers. The last chambers are convex. Externally the chambers have a round margin; the aperture is a slit, extending across 2 chambers ventrally, with the overlapping at the basis of the septa being typical for *Hanzawaia*" (1985: 45). It does not conform neither with the figures of *N. boueana* drawn by d'Orbigny (1846: pl. 5, fig. 12) nor with the specimen in the French collection. Moreover, it does not correspond to the diagnosis of the genus *Nonionina* which indicates (1846: 105): "coquille libre, régulière, équilatérale..." .

Besides, Revets (1996) pointed out the discrepancy between *Nonionina boueana* described by d'Orbigny and its assignment to *Hanzawaia* by Papp & Schmid. In his work, Revets reported and discussed a similar erroneous assignment of *Anomalina rotula* d'Orbigny, 1846. He concluded "d'Orbigny was a naturalist of high repute as the result of his careful observations and his keen eye for detail (Heron-Allen 1917; Revets 1994). It is, therefore, inconceivable that d'Orbigny would have misjudged the morphological characteristics of the taxa *A. rotulata* and *N. boueana* to the extent implied by the reclassification proposed by Papp & Schmid". We agree with his conclusion. Later, Cicha *et al.* (1998), referred the figure of Papp & Schmid (1985: pl. 35, figs 1-5) to *Riminopsis boueanus* (d'Orbigny, 1846).

In order to clarify the current taxonomical problems we herein revise the original material of *Nonion boueanum* (d'Orbigny, 1846). We complete this study with a reexamination of the specimens of *Nonion commune* (d'Orbigny, 1846) held at the MNHN d'Orbigny collection and topotypes of *Nonion fabum*, because confusion had been made previously between the three

species. This includes the specimen erroneously attributed to *Nonionina boueana* by Brady (1884) and now referred to *Nonion fabum* (Fichtel & Moll, 1798) by Jones (1994) and specimens that were confused with *Nonion commune* by other authors (e.g., Butt 1966).

***Nonion boueanum* (d'Orbigny, 1846)**
(Fig. 3K-M)

Nonionina boueana d'Orbigny, 1846: 108, pl. 5, figs 11, 12.

Nonion boueanum — Cushman 1939: 12, pl. 3, figs 7, 8. — Poignant 1997: 82, pl. 3, fig. 5; 1999: 150, pl. 3, fig. 9. — Cahuzac & Poignant 2000: 280, 284, figs 7, 11.

Florilus boueanus — Poignant & Pujol 1978: 680, pl. 9, fig. 2.

?*Florilus boueanum* — AGIP Mineraria 1982: pl. 20, fig. 9.

Hanzawaia boueana — Gebhardt 1994: pl. 13, figs 15, 16.

TYPE MATERIAL. — Lectotype here designated (MNHN FO 94, d'Orbigny collection).

TYPE LOCALITY. — Nussdorf (Austria).

OTHER MATERIAL EXAMINED. — Several specimens from Soos and Baden, collected par Grill, Schlumberger, and Poignant and deposited in the MNHN collections; several specimens from Burdigalian, Langhian and Serravalian localities in Aquitaine (France) also deposited in the MNHN collections.

DIAGNOSIS

"Coquille ovale, comprimée, lisse, anguleuse au pourtour, formée de douze loges étroites, très arquées, convexes, réunies au centre autour d'une dépression ombilicale assez large. La dernière loge, plane en dessus, représente la forme d'un fer de lance en avant. Ouverture très petite" (d'Orbigny 1846).

FIXATION AND DESCRIPTION OF THE LECTOTYPE
This species was described by d'Orbigny on material from Nussdorf. The mount labelled "*Nonionina boueana* d'Orb., Nussdorf, Vienne" bearing the number MNHN FO 94 in the French collection includes one specimen, glued on a thin glass plate, and a glue mark.

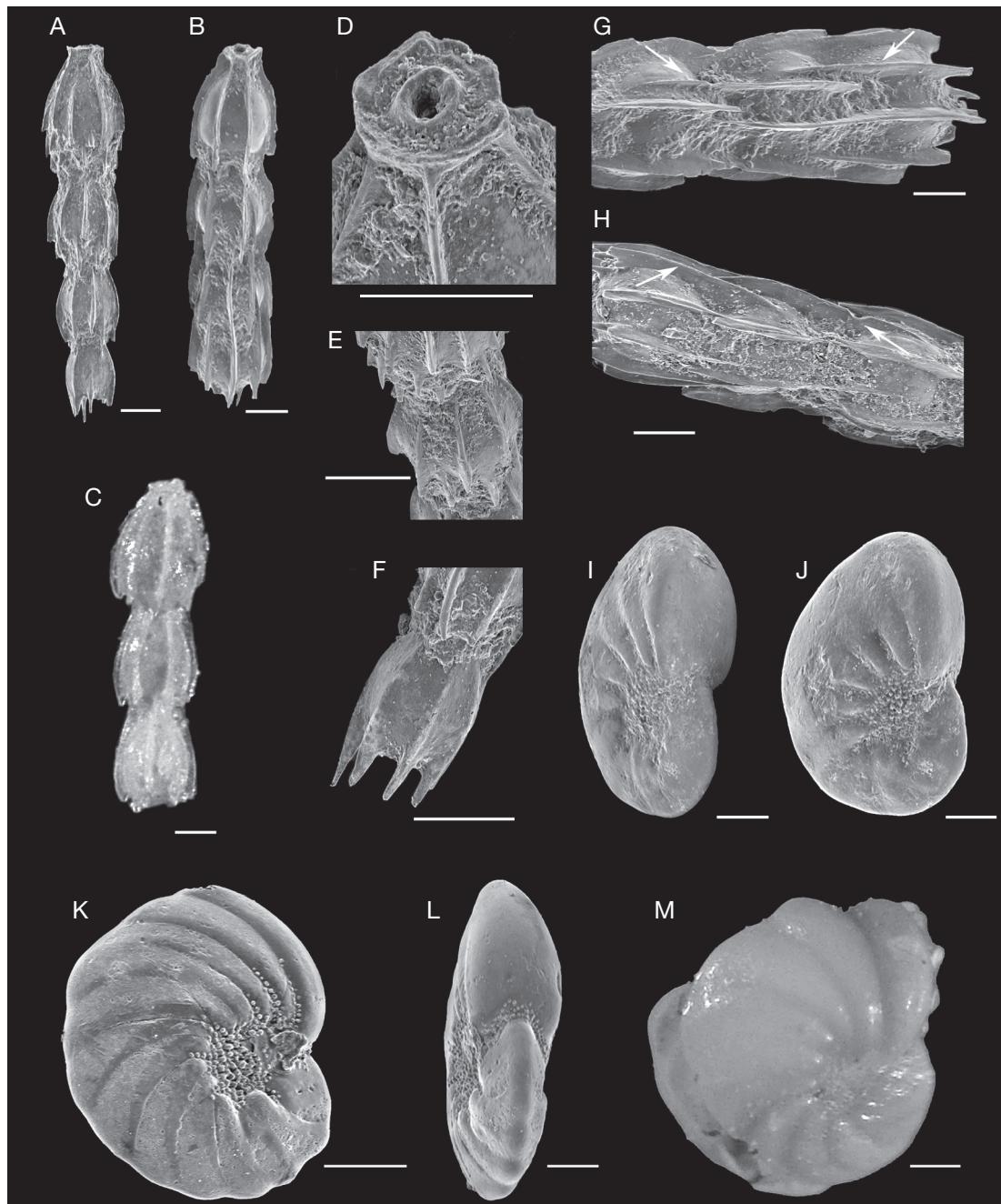


FIG. 3. — **A-H.** *Strictocostella?* *spinosa* (d'Orbigny, 1846); **A**, topotype (Baden) (MNHN F62163); **B**, topotype (Baden) (MNHN F62164); **C**, lectotype (MNHN FO 45); **D, E**, enlargements of A; **F**, enlargement of A showing the chamber basal spines; **G, H**, enlargements of B showing (arrows) the alternating costae running from a part of a chamber to another part of the next chamber; **I, J**, *Nonion com-mune* (d'Orbigny, 1846), specimen from Baden (MNHN F62166); **K-M**, *Nonion boueanum* (d'Orbigny, 1846); **K**, specimen from Baden (MNHN F62165); **M**, lectotype (MNHN FO 94). Scale bars: 100 µm.

This leads us to assume that d'Orbigny's original description was probably based on several specimens. The specimen of mount MNHN FO 94 closely resembles the one figured by d'Orbigny in 1846 (pl. 5, fig. 11) and might be the same specimen. As the specimen chosen by Papp & Schmid as lectotype of *Nonionina boueana* does not belong to the syntypic material, it loses this status (ICZN 1999: article 74.2). Consequently, we designate as lectotype of *N. boueana* the specimen of mount MNHN FO 94 (Fig. 3M) held in the French d'Orbigny collection.

Description

Test subcircular (max. diameter: 596 µm, min. diameter: 564 µm), planispiral, completely involute, bilaterally symmetrical, umbilical area depressed and filled with pustules. Periphery subacute and slightly lobulate in the later portion of the test. Chambers distinct, 12 in the final whorl, increasing gradually in size and more and more elongate from the early part to the later part. Sutures curved, limbate, depressed near the umbilical areas. Aperture small at the base of the apertural area. Some chambers are damaged by a small fracture, which nevertheless does not blind the main characteristics of the species.

ADDITIONNAL OBSERVATIONS

We have observed topotypic material from the Vienna Basin (Nussdorf) selected by Schlumberger in the sands of the d'Orbigny's collection, specimens collected at Soos (Baden) by Grill and deposited in the MNHN collection, as well as other specimens collected by one of us (Poignant) in the outcrops of Baden. All of them agree with the above description. Additional examination by SEM shows that the whole test is perforate except the sutures which are glassy and become deeply incised and filled in the proximal part with some pustules (Fig. 3K).

STRATIGRAPHICAL DISTRIBUTION

Nonion boueanum was reported by d'Orbigny (1846) and Cushman (1939) only in the Badenian. According to Poignant and coauthors (Poignant 1997; Poignant & Pujol 1978; Cahuzac & Poignant 1996, 2000, 2002; Cahuzac *et al.* 1999) this species seems to appear in the early Burdigalian, and is still present in the Serravallian of Aquitaine (SW France).

RELATED SPECIES

Nonion commune (d'Orbigny, 1846)

(Fig. 3I, J)

Nonionina communis d'Orbigny, 1826: 294, no. 20 [*nomen nudum*].

Nonionina communis d'Orbigny, 1846: 106, pl. 5, figs 7, 8.

Florilus communis – Poignant & Pujol 1976: 620, pl. 12, figs 9–13.

Nonion commune – Rögl & Hansen 1984: 66, pl. 24, figs 1, 2. — Vénec-Peyré 1984: pl. 9, fig. 2. — Papp & Schmid 1985: 45, pl. 34, figs 1–5. — Poignant 1997: 82, pl. 3, figs 9, 10; 1998: 142, pl. 2, fig. 19, 20. — Cicha *et al.* 1998: pl. 66, figs 1, 2.

TYPE MATERIAL. — Not found.

TYPE LOCALITY. — Nussdorf (Austria); Bordeaux (France); La Coroncina (Siena, Italy); Adriatic; Mediterranean Sea.

OTHER MATERIEL EXAMINED. — 16 fossil specimens from Baden (MNHN FO 95 and FO 96, d'Orbigny collection); 2 specimens from Pliocene of Castel Arquato (MNHN FO 536, d'Orbigny collection); 8 specimens from Falunian of Dax (MNHN FO 572, d'Orbigny collection); 5 fossil specimens from Hungary (MNHN FO 199, d'Orbigny collection); specimens from Rupelian, Chattian, and Miocene localities in Aquitaine (France); living specimens from Banyuls-sur-Mer (Mediterranean Sea); MNHN collections.

DIAGNOSIS

"Coquille ovale, oblongue, comprimée, lisse, anguleuse au pourtour, formée de neuf loges étroites presque droites, triangulaires, non saillantes réunies au centre sans former de dépression ombilicale. La dernière loge, convexe en dessus, forme un triangle assez aigu. L'ouverture est semi-lunaire, très étroite" (d'Orbigny 1846).

Papp & Schmid (1985) reported that vial 74 of the Vienna collection contains *Nonion commune*, described by d'Orbigny in Nussdorf material, and some *Nonionella*. No lectotype of *Nonion commune* was designated.

A mount in the French d'Orbigny collection labelled *Nonionina communis* (MNHN FO 96) contains 11 specimens. These specimens originate from Baden and therefore do not belong to the type series. We described herein the fourth left hand specimen which

is the best preserved. The test, slightly reddish in colour (diagenesis?) is ovate. The final whorl has 12 chambers increasing in size as added, the final one being elongate. The periphery is little angled, the sutures are recessed, and the umbilical area is somewhat depressed and filled with granular material. The apertural face is elongate with some granules above the apertural slit.

This species has been widely cited in the literature (for example 42 references between 1826 and 1929 reported in Ellis & Messina 1940). As suggested by its name, this species has a large geographical and stratigraphical distribution: probably Eocene to Recent according to Cicha *et al.* (1998). This species has also been reported in the Paleocene of Aquitaine: it appears in the upper Selandian (sous-zone P 4a, Sztrákos 2005) and it becomes common from the basal Ypresian (Sztrákos 2000).

In 1846 d'Orbigny had already pointed out the similarities and differences between *Nonionina communis* and *N. boueana*, and wrote about the last one "Cette espèce, par son pourtour anguleux, se rapproche du *N. communis*, mais il s'en distingue par sa forme plus élargie, par ses loges plus arquées et plus convexes, ainsi que par sa dépression omnilicale". SEM observations reveal the existence of a depressed umbilical area with pustules in both species. Thus, we think that they mainly differ by the chamber shapes which are more elongate in *Nonion commune* (Fig. 3J).

Nonion fabum (Fichtel & Moll, 1798)

Nautilus faba Fichtel & Moll, 1798: 103, pl. 19, figs a-c.

Nonion fabum — Rögl & Hansen 1984: 65, pl. 23, figs 5, 6; pl. 24, fig. 3; pl. 25, figs 1-6; text-fig. 26. [figures also in Loeblich & Tappan 1987: pl. 690, figs 1, 2]. — Jones 1994: 108, pl. 109, figs 12, 13.

TYPE LOCALITY. — Not precised by Rögl & Hansen who have selected the lectotype.

TYPE MATERIAL. — Lectotype no. MI-560 (Micropalaeontological Collection of the Natural History Museum in Vienna, Austria).

MATERIAL EXAMINED. — Specimens from the Pliocene of La Coroncina and Ripalta, near Siena (Italy).

REMARKS

In the revision of the original material of Fichtel & Moll deposited in the Vienna Museum (Austria), Rögl & Hansen (1984) redescribed this species. They designated the lectotype from among 7 specimens and published SEM photographs of it (1984: pl. 23, figs 5, 6). This specimen is registered under number no. MI-560 in the Vienna Museum Collection, and the paralectotypes under no. MI-560/1-6. This lectotype resembles *Nonionina boueana* by its general outline, the number and the shape of chambers. It differs in the possession of "a system of furrows branching out from the depressed part of the sutures [...] Fine striations extend from the aperture to the apertural face" (Rögl & Hansen 1984: 65).

D'Orbigny had cited this species in the Adriatic and Mediterranean seas (1826: 295, no. 23). We have also observed specimens of *Nonion fabum* from the Pliocene of La Coroncina on which the furrows appear clearly with binocular lens but the apertural striations must be only visible at a higher magnification.

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