On Nonion pompilioides (Fichtel & Moll.)

by

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Abstract

A study of the diagnoses of *N. halkyardi* CUSHMAN, *N. planatum* CUSHMAN & THOMAS, *N. affine* (REUSS), *N. soldanii* (D'ORBIGNY) and *N. barbleeanum* (WILLIAMSON) reveals that these diagnoses—apart from differences in phrasing—in reality are identic. The examination of the material at hand, furthermore, shows that a few features, as f. i. thickened rims around the umbilici actually are present in all of the above "species" though mentioned only in the description of a few of them. Thus the proportions between the height of apertural face, thickness and diameter are available for the purpose of identification. Measurements of these properties on a fair number of both fossil and recent specimens have disclosed the following facts: 1) These proportions vary over wide ranges within specimens of same age and from the same locality, 2) the ranges in variation are overlapping between the specimens from various localities. Thus recent specimens from one North Atlantic locality may show greater similarity to fossil forms from a Tertiary locality than to the recent specimens from another North Atlantic locality, 3) no trend of development through geologic time has been observed. It is thus concluded that statistical methods only will allow a subdivision of these forms into different species. Although the examined number of specimens is insufficient for any statistical analysis it seems reasonable to believe that the application of such results might necessitate the definition of a "new" species for nearly every locality. The establishment of several species within this group of highly variable forms is thus of no stratigraphic importance. Our present knowledge of the occurrence of the recent forms is unfortunately insufficient and the possible occurrence of geographic races thus unknown. If the variations in proportions can be correlated with differences in environment of the recent forms a statistical analysis of fossil species may afford valuable paleecologic conclusions.

On the following pages a number of species is described which constitute a group distinctly different from the rest of the species, conventionally referred to the genus *Nonion*. This group consists of *N. halkyardi* CUSHMAN, *N. planatum* CUSHMAN & THOMAS, *N. affine* (REUSS), *N. soldanii* (D'ORBIGNY) and *N. barleeanum* (WILLIAMSON). They are obviously all closely related to *N. pompilioides* (FICHTEL & MOLL) and, furthermore, *N. simplex* (KARRER), *N. novo-zealandicum* CUSHMAN, *N. nicobarense* CUSHMAN, *N. polystoma* (COSTA) and *N. pacificum* (CUSHMAN) seem according to their diagnoses to belong to the same group. All these species are very similar in most respects and mainly differ in certain proportions as thickness compared to the largest diameter and height of the apertural face. A very important character, common to all the examined species,

is the interior-marginal and umbilical aperture. This aperture is a narrow slit at the base of the apertural face and extends from one umbilicus to another. After the addition of a new chamber the interior-marginal part is forming the septal foramen while the umbilical parts are preserved as umbilical apertures, usually only partly covered by thin and narrow lips. The edge of the apertural face is normally thickened along the aperture, but no lips have ever been observed along the interior-marginal part of the aperture.

The reference of these forms to the genus *Nonion* has been questioned by some authors. Thus CUSHMAN (1939, p. 13) writes under his description of *N. soldanii* (D'ORBIGNY): »The generic position of these forms with very deep umbilicus and coarsely perforate test is open to some doubt. They seem to be related to similar larger forms which probably should be included under *Anomalina* and are bilaterally symmetrical in the adult, derived from a trochoid ancestry.« Furthermore VAN VOORTHUYSEN (1950, p. 41) states under the description of *N. barleeanum* (WILLIAMSON) var. *inflatum* (VAN VOORTHUYSEN): »Cushman – – – pointed out that this form shows affinity to *Anomalina*. In our opinion it is indeed not a *Nonion* s. s., because the aperture is not only an arched opening between the base of the apertural face and the preceding coil, but this opening extends to both sides as a slit-like extension.« Personally I do not feel convinced that these species can be related to the genus *Anomalina*. It is true that some specimens are not completely bilaterally symmetrical, but this fact seems caused only by irregularities in growth, and I have failed to observe any distinct indications of a trochoid protoconch. The radiate fibrous type of the wall in the genus *Anomalina* furthermore seems to contradict a close relationship to the genus *Nonion* with granular walls. Moreover, the general lack of knowledge concerning the shape and position of the aperture in the various species of *Nonion* and particularly that of the type species *N. incrassatum* at the present time prevents a discussion of the generic position of the species belonging to the *N. pompilioides* group.

A scrutiny of the diagnoses of the various species—belonging to the *N. pompilioides* group—offers little assistance towards their separation and makes the preparation of differential diagnoses almost impossible. Thus they are all umbilicate, have a rounded periphery, the number of chambers is normally about 10, varying from 9 to 12, the sutures are flush with the surface. In the diagnoses of *N. planatum* and *N. barleeanum* it is mentioned that the sutures may be slightly depressed; nevertheless, in my material—referred to the other species—some specimens with slightly deepened sutures are normally found, and this feature thus seems to be a case of normal variation, hardly of any value as a character, even if it should be somewhat more pronounced in parts of the material. The thickened rims around the umbilici are mentioned in the diagnosis of *N. planatum*. In his description of topotypical material of *N. affine* CUSHMAN (1936), furthermore, mentions the presence of slightly thickened rims. More or less thickened rims around the umbilici are present in all specimens of my material, irrespective of geologic age and locality. Thus the only difference between the species seems to be whether they are "much

"Species" and Locality	No. of Specimens	D	H	h	Thickness H:D	Height of apert. face h:H
N. "halkyardi"						
Holotype[1])	—	0.36	0.26	0.10	0.7	0.4
Røgle Cliff	1	0.31	0.17	0.12	0.6	0.7
N. "planatum"						
Holotype[1])	—	0.35	0.11	0.09	0.4	0.8
Jackson, Miss.	1	0.35	0.15	0.12	0.6	0.8
N. "affine"						
Holotype[1])	—	—	—	—	0.4	0.8
Offenbach	8	0.23–0.35	0.10–0.15	0.08–0.11	0.4–0.5	0.6–0.8
Sophienlund	24	0.34–0.49	0.14–0.22	0.10–0.19	0.4–0.5	0.7–0.10
N. "soldanii"						
Holotype[1])	—	0.25?	0.17?	0.07?	0.7	0.4
Topotypes[2])	—	0.51–0.55	0.35–0.36	0.09–0.11	0.7	0.3
Soos	15	0.23–0.53	0.13–0.33	0.08–0.15	0.4–0.8	0.4–0.9
Kattowitz	10	0.51–0.65	0.34–0.40	0.16–0.19	0.5–0.8	0.4–0.5
Gram	32	0.23–0.46	0.09–0.19	0.09–0.14	0.3–0.5	0.6–1.0
Maade	20	0.25–0.44	0.11–0.19	0.09–0.15	0.3–0.5	0.6–1.0
N. "barleeanum"						
Holotype[1])	—	—	—	—	0.4	1.0
Godthaabsfjord	18	0.32–0.57	0.17–0.27	0.13–0.20	0.4–0.6	0.6–0.9
Myrabugur	25	0.49–0.66	0.24–0.35	0.14–0.21	0.4–0.6	0.5–0.7
Herdla	16	0.38–0.53	0.16–0.30	0.13–0.17	0.4–0.5	0.5–0.8
N. "pompilioides"	—	—	—	—		
Holotype[1])	—	—	—	—	0.7	0.4
D'ORB. Modèle 86	—	—	—	—	0.8	0.4

[1]) measured on figures of holotype.
[2]) measured on topotypes described and figured by CUSHMAN (1939).

compressed" og "in the adult becoming rapidly broader" and as to size, the diameter ranges from a minimum of 0.22 mm. in *N. planatum* to 0.6 mm. in *N. barleeanum* according to the diagnoses. Large numbers of each species, however, reveal a wide variation in size both in respect of the diameter as well as in thickness (or height) of the specimens. As the final chamber always is the thickest one the difference between "in the adult becoming rapidly broader" and "very inflated" on one side and "compressed" and "flattened" on the other side is very simply expressed by the proportion of maximum thickness to maximum diameter in each individual specimen. In the hope of getting more exact information about these properties in the various species the diameter and the thickness were measured on as many undamaged specimens as could be extracted from the samples. Furthermore, the maximum height of the apertural face was measured. The proportion and maximum height of apertural face and maximum thickness of the specimen gives a numerical value for the shape of the apertural face. The results are abstracted below.

As will be seen from the figures in the table above the thickness—computed as the proportion between the height (H) and the diameter (D)—

and the height of the apertural face—numerically expressed as the proportion between the measured height (h) and the thickness (H) varies over wide ranges provided that a reasonable number of sepcimens from each locality is measured. Of course there are differences among the various "species", but such differences seem to be of minor importance compared to the wide range in variation among the specimens even from the same locality. As a matter of fact actual measurements only confirm the general impression obtained by just scanning the specimens in each sample. Thus the time-consuming method of measuring a fair number of specimens fails to provide exact data for the subdivision of the material into well-defined species. So far the conclusion must be that, although small differences exist, these differences are too ill-defined to justify a number of different species within this group of very variable forms. I am even opposed to consider them as subspecies of a single species. They are quite evidently not chronosubspecies as thick forms (*N. "halkyardi"*) are observed as early as the more compressed forms (*N. "planatum"*). Owing to the small results obtained by the measurements of a smaller number of specimens it has been considered futile to procure sufficient material for a real statistic analysis, and it is thus not proved if more than one mode is present in the material. However, in no case definitely thick forms have been observed in company with distinctly compressed forms. It is thus still possible that the differences may be indications of the presence of geographic races. The considerable differences between the recent form from the three North Atlantic localities may suggest this. The present material, however, is insufficient for any decision in this question. It is thus recommended that all these forms are included in one single species irrespective of their geologic age and geographic distribution. An examination of large numbers of specimens from a considerable number of localities in the North Atlantic Ocean might possibly supply valuable information, as the examination of the material and a study of the conditions in each case may reveal whether the differences are caused by the presence of geographic races or are due to differences in environment.

Summarily it may be said that I have failed to find any distinct characters warranting a discrimination of well-defined species within this group of forms. It is true that differences in proportions are present among the forms of different ages and from different localities, but no distinct trend of development can be traced through geologic time, nor is our present knowledge of their recent distribution sufficient for an evalution of the presence of geographic races. According to these facts it seems futile to me to maintain a subdivision of the group into several different species as the present definitions of the various "species" seem highly artificial and evidently of no stratigraphic importance. A close study of the recent forms, however, may supply valuable information for paleecologic conclusions.

Although the figure of *N. pompilioides* by FICHTEL & MOLL (1798) presents an extremely thick form it is, nevertheless, the earliest record of a form, safely referred to this group, and I consequently prefer to include all the previously mentioned species in *N. pompilioides* (FICHTEL & MOLL).

Nonion pompilioides (Fichtel & Moll)

Nautilus pompilioides, Fichtel & Moll, 1798, p. 31, pl. 2, fig. a–c. (Cat. Foram.).

Diagnosis:

Die Schale ist schnirkelförmig in sich selbst gewunden und, den verlängerten Theil, wo die Mündung ist, ausgenommen, beynahe rund und glänzend glatt, dick, mit einem stumpfen Rücken. Überhaupt hat dieser kleine *Nautilus* mit jenem grossen, den Linné *pompilius*, andere den grossen dicken *Nautilus* nennen, dem äussern Bau nach wille Ähnlichkeit, und erhielt daher auch oben angeführten Nahmen. In der Mitte befindet sich auf beyden Seiten ein offener tiefer Nabel. Die Scheidewände, deren an der äussersten Windung gewöhnlich zehn sind und von aussen betrauchtet gerade zu seyn scheinen, sind, wie man aus angeschliffenen Stücken sehen kann, nicht wie es bey dem *Naut. pompilius* Linn. vorwärts concav, sondern vorwärts convex, wie es bey allen folgenen Arten dieses Geschlechts der Fall ist, und scheinen bläulich durch die Schale durch. Die durch die Scheidewände gebildeten Glieder oder Kammern sind kaum bemerkbar erhaben, und eher ganz flach zu nennen. Die Mündungsfläche ist hälbmondförmig, die Mündung ist eine schmale strichförmige nach dem Zug des schmalen Theils des halben Umrisses eines Ovals gekrümmte und mit einem Saume versehene Spalte, welche hart an der nächsten innern Windung anliegt. Durch diesen Bau der Mündung und der Scheidewände unterscheidet er sich auch hinlänglich vom *Nautilus pompilius*, und kann daher keine junge Brut desselben seyn, wofür ihn manche seiner äusseren Form wegen halten könnten. Da Hr. Soldani in seiner Testaceographie von dem oben angeführten Stück ausdrücklich sagte, es sey über die ganze Schale mit sehr kleinen Grübchen versehen, sie auch in der Abbildung andeutete, wir aber dergleichen an unsern mehrfachen Exemplaren nicht bemerken konnten, so macht uns dieser Umstand zweifelhaft, ob seine und unsere Stücke von einerley Art seyn und diese Abbildung hierher gehöre oder nicht. Farbe der natürlichen weiss, der fossilen aschgrau. Grösse, der fünfte Theil einer Linie in Durchmesser.

Emendation:

Test planispiral, completely involute, compressed to swollen, proportion of thickness (H) and largest diameter (D) varying from $^1/_3$ to $^3/_4$; periphery broadly rounded; number of chambers 8 to 12 in the final coil; sutures distinct, radial, slightly limbate, thickened along the umbilical margin; wall calcitic, granular, not laminated, distinctly perforated by fairly coarse pores; apertural face and septal walls imperforate, often appearing as more hyaline than the test wall; height of apertural face (h) compared to thickness (H) varying from $^1/_1$ to $^1/_3$; aperture interior-marginal and umbilical, long and narrow, an undivided slit extending from the umbilicus on one side to the umbilicus on the other side, the interior-marginal parts of the apertures of the preceding chambers serving as septal foramina while the umbilical parts are preserved as umbilical apertures; thus each of the preceding chambers have an interior-marginal foramen and two umbilical apertures; the last coil is for that reason not directly

fastened to the preceding coils; umbilici deeply excavated and with thin and narrow lips partly covering the umbilical apertures of the various chambers.

Nonion "halkyardi" CUSHMAN

Nonion halkyardi, CUSHMAN 1936, p. 63, pl. 12, figs. 1 a, b.
Nonion halkyardi, CUSHMAN 1939, p. 8, pl. 2, fig. 6.

Diagnosis:

Test small, in the adult becoming rapidly broader than in the early stages, biumbilicate, periphery broadly rounded; chambers 10–12 in the final coil, distinct, little if at all inflated, increasing gradually in size as added, but rapidly expanding in breadth; sutures distinct, radial, limbate, not depressed; wall smooth, distinctly perforate; aperture, a distinctly arched opening at the base of the apertural face. Diameter 0.35–0.40 mm; thickness 0.25 mm. This species differs from *N. soldanii* (D'ORBIGNY) in the larger number of chambers and more rapidly expanding test.

Material:

One fragmentary specimen from the Lower Eocene Røsnæs Clay Røgle Cliff.

Remarks:

The holotype is evidently—according to the figure—a fragmentary specimen missing the last chamber. Measurements on the figure gave the following values for the dimensions of the holotype; D = 0.36 mm.; H = 0.26 mm.; h = 0.10 mm. The fragmentary specimen from the Danish Lower Eocene has the following dimensions: D = 0,31 mm.; H = 0.17 mm.; h = 0.12 mm. My specimen seems to lack at least the two last chambers. Nevertheless, the Danish specimen does not increase as rapidly in thickness as that of the holotype. The thickened rims around the umbilici are hardly as pronounced as in the recent "species" and according to CUSHMAN's figure the holotype is in this respect similar to the Danish specimen. Both the Danish specimen as well as the holotype show 11 chambers in the final whorl.

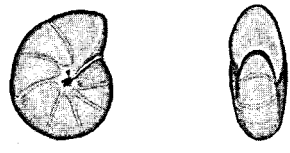

Fig. 1. *Nonion "planatum"* CUSHMAN & THOMAS, Moody's Branch Marl, Jackson Formation, N. of Jackson, Mississippi, 50×.

Nonion "planatum" CUSHMAN & THOMAS

Nonion planatum, CUSHMAN & THOMAS, 1930, p. 37, pl. 3, figs. 5 a, b.

Diagnosis:

Test planispiral, close coiled, compressed, bilaterally symmetrical, biumbilicate, periphery rounded; chambers distinct, but not inflated, about

ten in the last-formed coil, which is almost completely involute, peripheral face of the last chamber convex; sutures distinct, earlier ones flush with the surface, later ones very slightly depressed, ending in a thickened ring about the umbilici; wall smooth, finely perforate; aperture a crescent-like slit at the base of the last-formed chamber. Maximum diameter, 0.25 mm. minimum diameter, 0.22 mm.; thickness, 0.11 mm. This is the same form that has been recorded by WEINZIERL and APPLIN and by other authors as *Nonion umbilicatum* (MONTAGU).

Material:

Five specimens labelled Moody's Branch Marl, Lower Jackson Formation, North af Jackson, Mississippi. One specimen is undamaged. The final chamber is missing in the rest of them.

Remarks:

The figured specimen has the dimensions D = 0.35 mm., H = 0.15 mm.; h = 0.12 mm. CUSHMAN & THOMAS in 1930 give the maximum diameter as 0.25 mm. which is supposed to be a misprint as the dimensions of the holotype according to the figures are D = 0.35 mm.; H = 0.11 mm.; h = 0.09 mm. Thus my specimens seem to be slightly thicker than the holotype.

The thickened rims around the umbilici are in my specimens even less pronounced than in the specimen from the Danish Lower Eocene, referred to *N. "halkyardi"*. This specimen is somewhat thicker than those of *N. "planatum"* in my material, although not quite as thick as the holotype according to CUSHMAN's pictures. The Danish specimen from the Lower Eocene thus seems to be intermediary between *N. "halkyardi"* and *N. "planatum"*.

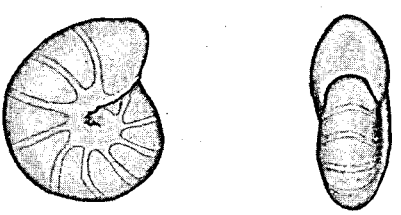

Fig. 2. *Nonion "affine"* (REUSS). Middle Oligocene, Sophienlund Brickyard, Jutland, Denmark. 50×.

Nonion "affine" (REUSS)

Nonionina affinis, REUSS 1851, p. 72, pl. 5, figs. 32 a, b.

Diagnosis:

Das kleine Gehäuse scheibenförmig, stark zusammengedrückt, im Umkreise gerundet, im Centrum enge genabelt, mit sehr feinen Punkten dicht besäet. Zehn schmale flache wenig gebogene Kammern mit linienförmigen Näthen. Die Mundfläche der letzen Kammern wenig höher als breit, mässig gewölbt. Mündung kurz, halbmondförmig.

Material:

8 (undamaged) specimens labelled Offenbach, Germany. Numerous specimens from several localities in the Danish Middle Oligocene Branden Clay.

Remarks:

CUSHMAN (1939) mentions the occurrence of a "slightly thickened rim", observed on topotypical material of this species. Most of my specimens show fairly well developped thickened rims around the umbilici, on well-preserved specimens even with narrow lips, partly covering the umbilical parts of the aperture. These thickened rims seem normally to be better developed in this form than in the Eocene ones. While REUSS (1851) gave the diameter as 0.28–0.3 mm. CUSHMAN (1939) gives it as 0.45 mm. and the thickness as 0.18–0.20 mm., which corresponds very well with my measurements. In this respect attention is drawn to the fact that the measured properties of *N. halkyardi* and *N. planatum* fall within the range of *N. affine*.

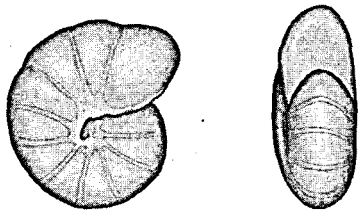

Fig. 3. *Nonion »affine«* (REUSS). Upper Oligocene, Cilleborg, Jutland, Denmark. 50×.

Nonion "soldanii" (D'ORBIGNY)

Nonionina soldanii, D'ORBIGNY 1846, p. 109, pl. 5, figs. 15, 16.

Diagnosis:

Coquille discoïdale, très renflée dans son ensemble, couverte partout de petites dépressions qui la rendent comme pointillée, composée d'une spire embrassante dont les tours sont très convexes au pourtour et formés de onze loges étroites, peu arquées, planes, laissant au centre un ombilic étroit, profond. La dernière loge en dessus est semilunaire, transverse et entièrement plane, percée d'une courte ouverture en croissant.

Très voisine, par sa forme, du *N. ombilicata* cette espèce s'en distingue par son pointillement très marqué et par son ouverture plus étroite.

Material:

18 (10 undamaged) specimens labelled, Miocene Marl, Kattowitz, Silesia.

15 undamaged and numerous more or less incomplete specimens labelled Miocene Badener Tegel, Soos bei Baden, Vienna Basin.

Numerous specimens from the Danish Upper Miocene (32 undamaged specimens from the brickyard at Gram, and 20 from the brickyard at Maade).

Remarks:

The specimens from the Badener Tegel from Soos are most valuable as the Badener Tegel is the stratum typicum of *N. soldanii*. As was to be expected my specimens fit very well into to the description and figures by D'ORBIGNY. The measurements of 15 undamaged specimens, however,

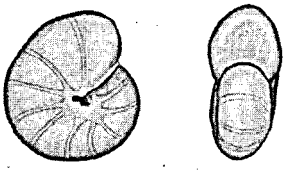

Fig. 4.

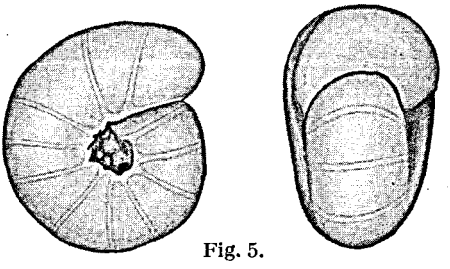

Fig. 5.

Fig. 4. *Nonion »soldanii«* (D'ORBIGNY). Upper Miocene, Gram Brickyard, Jutland, Denmark. 50×.

Fig. 5. *Nonion »soldanii«* (D'ORBIGNY). Miocene, Kattowitz, Silesia. 50×.

reveal the wide range of variation within this species, both in respect of size and proportions. Thus, not only the measurements of the Danish specimens, referred to *N. "soldanii"*, from Gram and Maade fall completely within the ranges of the typical specimens from the Vienna basin, but these ranges are widely overlapping those of *N. "affine"* from the Oligocene, and partly overlapping those of the recent *N. "barleeanum"* as well. It is thus evident that any attempt at using the proportions as characters on the species level is bound to be a failure.

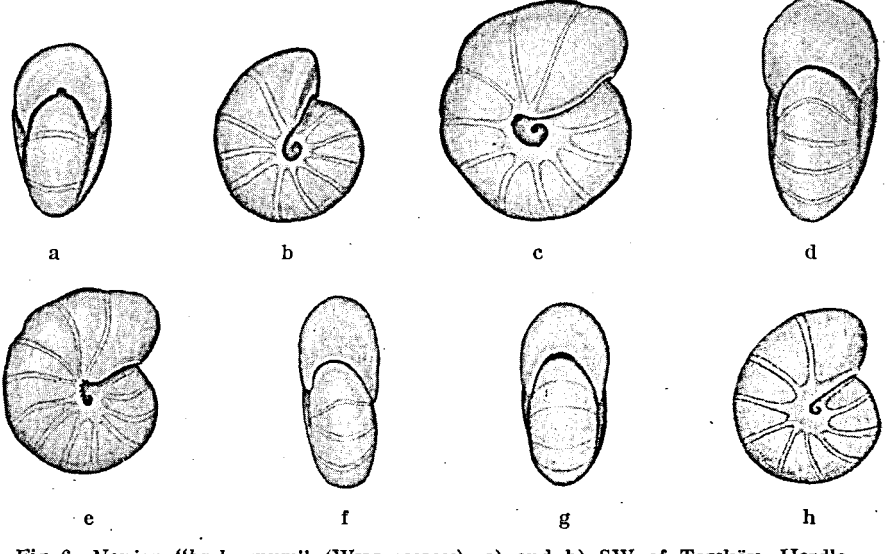

Fig. 6. *Nonion "barleeanum"* (WILLIAMSON). a) and b) SW of Torsköy, Herdla, Norway; c) and d) Myrabugur off Tvisker, Iceland; e) and f) St. 98. Ingolf 1896; g) and h) Godthaabsfjord, Greenland. 50×.

Nonion "barleeanum" (WILLIAMSON)

Nonionina barleeana, WILLIAMSON 1858, p. 32, pl. 3, figs. 68, 69.

Diagnosis:

Shell spiral, equilateral, compressed, smooth, flattened; outermost conclusion consisting of from nine to twelve smooth segments, which become truncated on each side before reaching the umbilicus, leaving a deep, abrupt, umbilical cavity, within which portions of antecedent convolutions are visible. Peripheral margin rounded. Septal plane with rounded margins; septal orifice in the median line, at the junction of the septum with the periphery of the preceding convolution; septal lines slightly curved, somewhat depressed, smooth, and often translucent. The rest of the parieties foraminated, giving the shell a slightly granular aspect; yellowish gray frequently becomming ash-gray or lead-coloured; slightly glistening. Diam.1/40".

Remarks:

According to the figure the holotype is an extremely compressed form; the proportions being $H/D = 0.37$, $h/H = 1.00$. Thus all specimens in my material, referred to this species, are thicker and have a comparatively lower apertural face. Without an examination of WILLIAMSON's material it is impossible to decide whether the holotype is an extremely flattened specimen or whether *N. barleeanum* is a species different from other forms, included in the *N. pompilioides* group.

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