

OBSERVATIONS ON *NEOLIOTHYRINA FITTONI* a rare Maastrichtian terebratulid from NW Europe

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After the original description of *N. fittoni* by Hagenow (1842), the species remained almost unnoticed until Steinich's excellent work on limited material from Rügen, Germany in 1965.

31 specimens and valves are now available from Denmark, 98 from Holland and 2 from Belgium, all of Maastrichtian age. This material is discussed in relation to the German material and the lost holotype, and it allows new observations to be made of the cardinalia, brachidium, growth, variation and palaeoecology of the species.

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Since Hagenow (1842) first described and figured this small, rare terebratulid from Rügen and other Lower Maastrichtian localities in Germany, it has remained fairly unnoticed until it was redescribed by Steinich (1965). The synonymy list is therefore a short one:

- | | |
|------|---|
| 1842 | <i>Terebratula Fittoni</i> Hagenow: p. 542, pl. 9, fig. 6a–c |
| 1860 | <i>Terebratula Fittoni</i> . – Bosquet: p. 392 |
| 1894 | <i>Terebratula Fittoni</i> . – Peron: p. 461, pl. 5, figs. 7 and 8 |
| 1894 | <i>Terebratula Fittoni</i> . – Posselt: p. 37 |
| 1895 | <i>Terebratula Fittoni</i> . – Deecke: p. 73 |
| 1909 | <i>Terebratula Fittoni</i> . – Nielsen: p. 163, pl. 2, figs. 96 and 97 |
| 1945 | <i>Ornatothyris fittoni</i> . – Rosenkrantz: p. 450 |
| 1965 | <i>Neoliothyryna fittoni</i> . – Steinich: p. 35, pl. 5, fig. 3a–d and text-fig. 23 |

Hagenow's specimen

The specimen figured by Hagenow (1842, pl. 9, fig. 6) was lost in the Second World War, and we have only Hagenow's description and figure to rely on. The type specimen did not originate from Rügen since all his material from this locality was more or less crushed. He selected a large and

complete specimen from Quitzin near Grimmen (Lower Maastrichtian according to Steinich 1965, p. 37).

In the original description the dimensions of the type specimen are given in inches, $\frac{1}{12}$ and $\frac{1}{144}$ inch. In 1842 Hagenow had five different inches at his disposal (Meldola, 1845) which fall into two groups, "long" inches and "short" inches:

Mecklenburg-Strelitz inch		
Prussian inch	= 26.154 mm	= »long« inches
Rhenish inch		
Mecklenburg-Schwerin inch	= 23.874 mm	
Rostock inch	= 23.975 mm	»short« inches
Lübeck inch	= 23.968 mm	
Hamburg inch	= 23.881 mm	

Comparison with the dimensions of the original figure indicate that Hagenow used the "long" inches (table I).

Table 1. The following abbreviations are used throughout: *lp*, length of pedicle valve; *lb*, length of brachial valve; *w*, width; *t*, thickness; *f*, diameter of foramen. All measurements in mm.

	<i>lp</i>	<i>lb</i>	<i>w</i>	<i>t</i>	<i>lp/w</i>	<i>lb/w</i>	<i>t/w</i>	<i>f</i>	plication of anterior commissure
According to Hagenow	5'''	3'''9'''	3'''8'''	(1.33)			(0.98)		paraplicate, plication began at <i>lp</i> about 3''' 4'''
long inches	11.0		8.2	8.0	1.33		0.98		plication began at <i>lp</i> about 7
short inches	10.0		7.5	7.3	1.33		0.98		
measured on Hagenow's figure	11.5	10.0	8.2	7.0	1.40	1.22	0.85	1.1 long 0.9 wide	paraplicate, plication began at <i>lb</i> about 6.5

Steinich discussed Hagenow's specimen and concluded that although it had a more tapering front and was more strongly plicate and thicker than the two specimens at his disposal, there was no reason to consider Hagenow's specimen as belonging to a separate species.

Hagenow's figure, however, is apparently slightly idealized and it is better, instead, to turn to Hagenow's excellent description. The dimensions given by Hagenow indicate a specimen which is nearly as thick as it is wide. Concerning the plication of the valves, Hagenow wrote of the brachial valve: "... und senkt sich am zweiten Drittel der Länge zu einem zierlichen, scharfbegrenzten Sinus ein." This indicates that the frontal commissure is sulcate to paraplicate and not sulcificate as Hagenow's figure can be taken

to indicate. The wide, shallow sulcus is a characteristic feature in the Danish material (pls. 1, 2 and 3).

Steinich's specimens

Steinich's material comprised only two somewhat crushed specimens. One of these originated from Hagenow's collection and was dissected by Steinich and figured in his text-fig. 23a–b. The other, more complete specimen was figured in pl. 5, fig. 3a–d, and had the following dimensions:

lp	lb	w	t	lp/w	lb/w	t/w	f	plication of anterior commissure
16.5	(13.5)	12.2	(?)8.5	1.35	(1.11)	(?)0.70	outer 1.7 inner 1.1	slightly paraplicate plication began at $w = 8$

It can be seen in Steinich's pl. 5 that the specimen is somewhat dorso-ventrally compressed. The true width must accordingly have been slightly smaller than stated and the true thickness considerably larger than 8.5 mm.

The specimen figured by Steinich in text-fig. 23 had a width of about 12 mm. Both specimens are larger than any of those from Denmark.

The brachidium is missing in Steinich's specimen but the cardinalia are well preserved and show features which Steinich considered to be specific, i. e. the cardinal process is semiglobular and there are articulation-platforms on the posterior part of the inner socket ridges which receive the swollen part of the teeth bases. The inner divided hinge plates are only weakly developed; in fact only the right one is present as a thin ledge on the median side of the right crura base.

Danish material

So far *Neoliothyryna fittoni* has been found in Danish white chalk localities belonging to both Lower and Upper Maastrichtian. It is extremely rare, and nearly always crushed owing to the thinness of its shell. (MMH numbers are housed in the Mineralogisk Museum, København).

Lower Maastrichtian

Møns Klint. 1 complete specimen MMH no. 11392. 2 crushed specimens, 1 incomplete pedicle valve.

Zone 4 (Surlyk, 1970)

Hundefangs Klint about 2 m below the hardground: 1 crushed specimen and 1 crushed pedicle valve.

Hvidskud about 2 m below the hardground: 1 crushed pedicle valve.

Upper Maastrichtian

Stevens Klint. Grey Chalk (zone 10 of Surlyk, 1970). 1 specimen MMH no. 411 (collected at Mandehoved, Nielsen 1909, pl. 2, figs. 96 and 97). 8 crushed specimens, 1 complete pedicle valve, 6 crushed pedicle valves and 2 crushed brachial valves.

North of Kulsti Rende: 1 complete specimen MMH no. 11391 from the topmost (hardened) Grey Chalk. 1 pedicle valve from lower Grey Chalk.

Other Upper Maastrichtian localities

Zone 9 (Surlyk 1970)

Nørre Flødal about 5 m above the clay layer: 1 crushed specimen.

Zone 10 (Surlyk 1970)

E of Bjerge, Hanstholmen: 1 crushed specimen.

SW of Udbyovre: 1 pedicle valve.

Vive: 1 pedicle valve (13.4 mm long being the largest so far found in Denmark).

Dimensions of complete specimens (see also text-fig. 1):

	lp	lb	w	t	lp/w	lb/w	t/w	f	plication of anterior commissure
MMH no. 411	8.9	7.9	c.7.2	5.4	c.1.24	c.1.10	c.0.75	0.6	incipiently sulcate plication began at lb= 6.5
MMH no. 11391	11.0	9.7	9.3	7.9	1.18	1.04	0.85	0.9	asymmetrical plication began at lb= 7
MMH no. 11392	13.0	11.2	c.10.0	10.2	c.1.30	c.1.12	c.1.02	1.2	paraplicate, sulcate at lb= 8.5 paraplicate at lb= 10

MMH no. 11391 pl. 1, figs. 1–3 and pl. 2. This complete specimen with brachidium was described by Rosenkrantz (1945) and tentatively referred to the genus *Ornatothyris* Sahni, 1929. In its obesity and plication this mature specimen shows no gerontic features. The cardinal process is feeble and transverse as in *N. obesa* Sahni, 1925. The inner socket ridges are not furnished with articulation platforms to receive swollen teeth bases. The teeth bases are not swollen. Hardly any traces of inner divided hinge plates are developed in this specimen, though there is a slight swelling on the median side of the right crura base similar to the development in the specimen figured by Steinich.

MMH no. 11392 (pl. 3), a specimen mentioned by Posselt (1894) but not figured, seems to be gerontic. Thickness exceeds width and it possesses a paraplicate frontal commissure with a strong concentration of crowded growth lines near the front. The foramen is slightly labiate and worn asymmetrically.

Dutch and Belgian material

In 1860 Bosquet mentioned *Terebratula Fittoni* from Limburg, Holland. Bosquet's 98 specimens, which originate from the glauconitic chalk of the localities Slenaken, Pesaken and Galoppe, are housed in the Musée Royal des Sciences Naturelles, Bruxelles, Belgium.

The glauconitic chalk of Bosquet's localities was previously considered to be equivalent to the "craie marneuse glauconifère" above the "smectite de Herve" and thus was assumed to be of Campanian age. However, Calembert & Meyer (1956, p. 417) showed that the glauconitic chalk of Slenaken and vicinity was of Lower Lower Maastrichtian age (*Belemnella lanceolata* Zone).

Bosquet's specimens, kindly placed at the author's disposal, are nearly all somewhat crushed. The largest specimen has a lp of about 14 mm. The dimensions of 4 complete specimens are:

lp	lb	w	t	lp/w	lb/w	t/w	f	plication of anterior commissure
11.2	9.7	8.1	6.3	1.38	1.20	0.78	0.9	incipiently paraplicate
9.4	8.3	7.3	6.2	1.29	1.14	0.85	0.8	incipiently paraplicate plication began at lb= 6.5
9.0	7.8	7.2	5.8	1.25	1.08	0.81	0.8	sulcate plication began at lb= 6.3
9.0	7.8	7.0	6.2	1.29	1.11	0.89	?	incipiently paraplicate

The dissection of one specimen revealed the same development of cardinalia as seen in the Danish and German material. Measurements of growth lines also agree well with those of the Danish Material (text-fig. 1). Most of the specimens have labiate foramina and worn beaks.

In 1894 Peron described and figured *Terebratula Fittoni* from the Maastrichtian "craie phosphatée de Ciply" at La Malogne, Belgium. Dimensions of the figured specimen are:

lp	lb	w	t	lp/w	lb/w	t/w	f	plication of anterior commissure
15.2	13.4	12.0	10.6	1.27	1.12	0.88	1.4	paraplicate plication began at lb= 8.5

Peron mentioned that he had three specimens. An examination of the Peron collection in Musée d'Histoire Naturelles in Paris, France, however, revealed that one of these three specimens is a terebratellid. Of the others, one is a *N. fittoni* 12.5 mm long and slightly crushed. The third specimen, figured by Peron, is here refigured in pl. 1, figs 4-6.

It has been impossible to study the internal characters of the Belgian specimens, but in external features Peron's specimens agree well with the other NW European specimens (text-fig. 1).

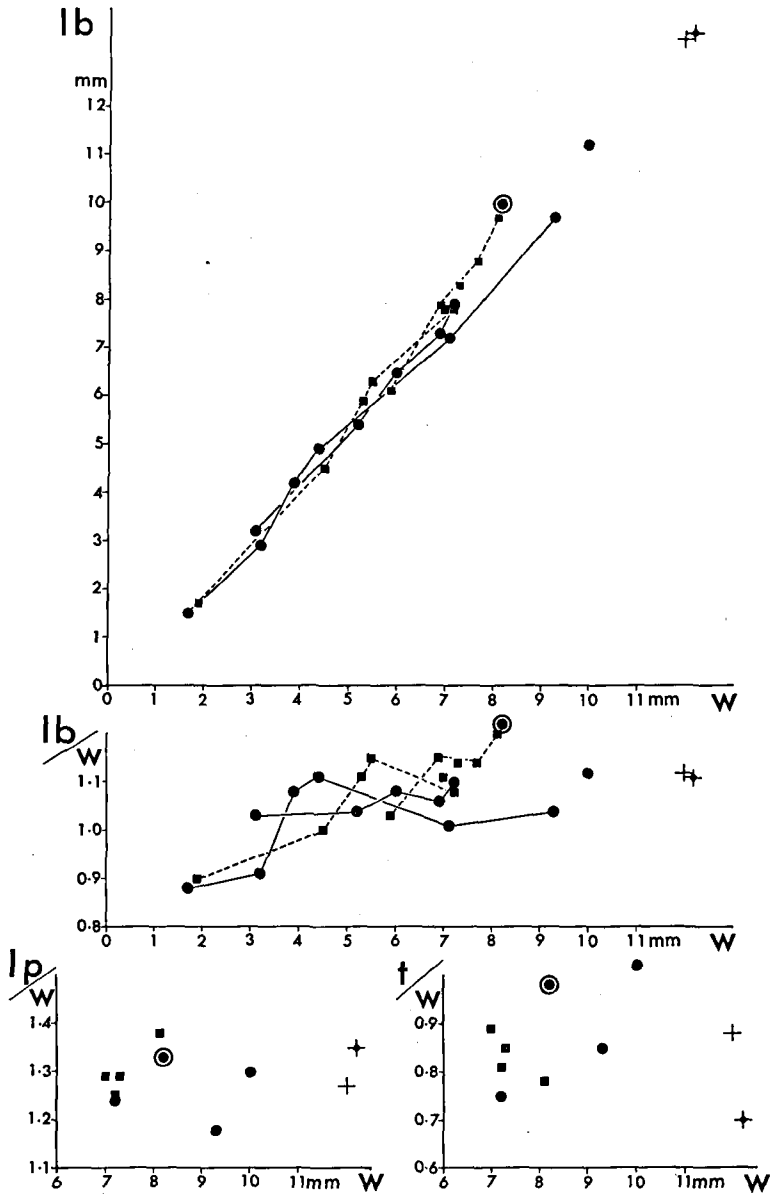


Fig 1. Relative dimensions of Danish (●) and Dutch (■) specimens. Growth lines of two of each have been measured (connected points). Dimensions of the Hagenow (⊙), Peron (+) and Steinich (+) specimens are also shown.

Palaeoecology

With one exception, the Danish specimens of *Neoliothyryna fittoni* from known horizons all originate from zones 4 and 10, which are the horizons with a large benthonic fauna (Surlyk, 1972). At these horizons a varied selection of substrates was present for those brachiopods which, like *N. fittoni* and *N. obesa*, had a stout, functional pedicle throughout life. The pedicle was short, as the well worn beak shows, especially in *N. obesa* but also in the MMH no. 11392 specimen of *N. fittoni*.

However, it is possible that selective collecting through the last hundred years in the benthos-rich horizons of the classical sections of Stevns Klint and the southern part of Møns Klint has exaggerated the distribution pattern.

Discussion

The characters of the species unquestionably fall well within the generic definition of *Neoliothyryna*. However, the extremely weak development of the inner hinge plates is a neotenic feature in contrast to the strong development of the plates in *N. obesa*, which overlap in many mature specimens (see Steinich, text-figs. 17(3) and 20a). The developmental stage of the inner hinge plates is similar to that of the 20 mm wide specimen of *N. obesa* figured in Steinich's text-fig. 19. The neotenic stage of the cardinalia in *N. fittoni* in comparison with the contemporary *N. obesa* has its parallel in the apparent phylogenetic development of *N. obesa*. The Upper Campanian English specimens of *N. obesa* have weakly developed inner hinge plates (see Sahni, 1929; pl. 8, figs. 26–28 and pl. 9, figs. 19–21 and text-fig. 3b) while the Maastrichtian specimens from the white chalk of Denmark and Germany tend to be larger and generally have strongly developed inner hinge plates (cf. Steinich, 1965, text-figs. on p. 31 and 32).

Gerontic specimens of *Neoliothyryna fittoni* tend to reach a greater thickness than width and the anterior commissure reaches a paraplicate stage. Steinich's c. 12 mm wide specimen figured in his text-fig. 23 also seems to be a gerontic specimen having swollen cardinal process and teeth bases, while MMH 11391 seems to represent the normal, mature stage of the species.

Acknowledgments. Mrs. J. Wehding produced the drawings, except pl. 2 which is the work of C. Rasmussen. Miss J. Drot, Musée d'Histoire Naturelles, Paris, kindly placed the photographs of Peron's specimen at the author's disposal. Mr. C. E. Andersen assisted in solving the problem of the Mecklenburgian inch. Dr. R. G. Bromley improved the English of the manuscript.

Dansk sammendrag

Efter Hagenows originalbeskrivelse af *Terebratula fittoni* i 1842 forblev denne sjældne Maastrichtien terebratulid ret upåagtet til Steinich genbeskrev arten i 1965. Uheldigvis var Hagenows holotype gået tabt under anden verdenskrig, og Steinich havde kun 2 ufuldstændige eksemplarer til sin rådighed.

Her behandles det danske materiale af *Neoliothyryna fittoni* (31 eksemplarer og enkeltskaller) og sammenlignes med Steinichs 2 eksemplarer samt Hagenows originalbeskrivelse. 98 eksemplarer fra Hollands og 2 fra Belgiens Maastrichtien inddrages også i diskussionen.

Det konkluderes, at Steinichs Nedre Maastrichtien eksemplar afbildet 1965, text-fig. 23a-b er et atypisk, gerontisk eksemplar med opsvulmet cardinalprocess og fortykkede tandbaser, medens MMH no. 11391, her afbildet pl. 1, fig. 1-3 og pl. 2, repræsenterer et normalt, modent eksemplar.

N. fittoni har sammenlignet med *N. obesa* Sahni, 1925 bevaret neoteniske træk i cardinalia.

Det danske materiale fra kendte horisonter stammer på een undtagelse nær fra zonerne 4 og 10 (Surlyk, 1970), som begge har en rig bentonisk fauna (Surlyk, 1972). I disse zoner har en stor mængde forskellige substrater været til rådighed for den lille terebratulid, der gennem hele livet havde en kraftig, funktionsdygtig stilk.

Note added in proof

English material

3 specimens of *N. fittoni* from the Lower Maastrichtian of Trimmingham, Norfolk have recently been discovered in the Brydone Collection at the Institute of Geological Sciences, London. None are measurable. One slightly crushed specimen (GSM 114379) and the posterior end of a pedicle valve (114380) derive from the »Sponge Beds«. A further crushed specimen (114381) is from the »Grey Beds«.

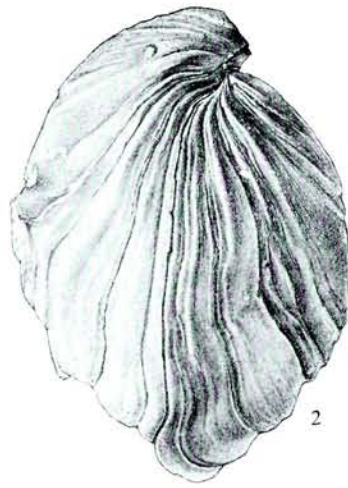
Plate 1. *Neoliothyryna fittoni* (Hagenow, 1842)

Figs. 1-3. Dorsal, lateral and antero-ventral views of MMH no. 11391. $\times 6$. In fig. 3 the cardinalia and brachidium can be seen. Repaired damage near the median part of the pedicle valve is responsible for the asymmetry of the anterior commissure, but has not otherwise affected the shape of the valves.

Figs. 4-6. Dorsal, lateral and anterior views of the specimen figured by Peron (1894, pl. 5, figs. 7 and 8). $\times 2$. Note the paraplicate anterior commissure and the crowded growth lines.



1



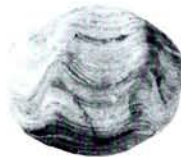
2



3



4



6



5

Plate 2. *Neoliothyryna fittoni* (Hagenow, 1842)

Figs. 1-2. Anterio-ventral and anterior views of MMH no. 11391. $\times 10$. In fig. 1 the repaired damage and the extremely weak development of the inner divided hinge plates can clearly be seen. Fig. 2 shows the asymmetrical anterior commissure.

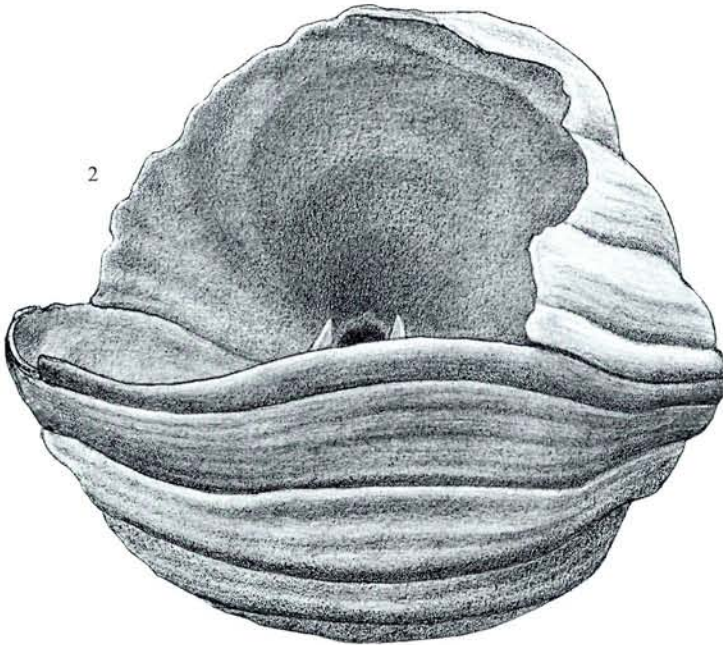
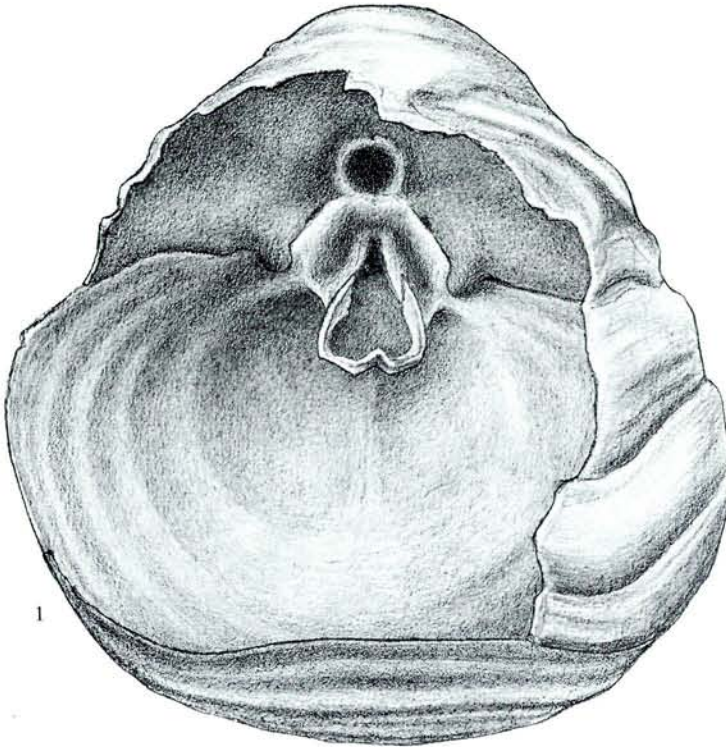
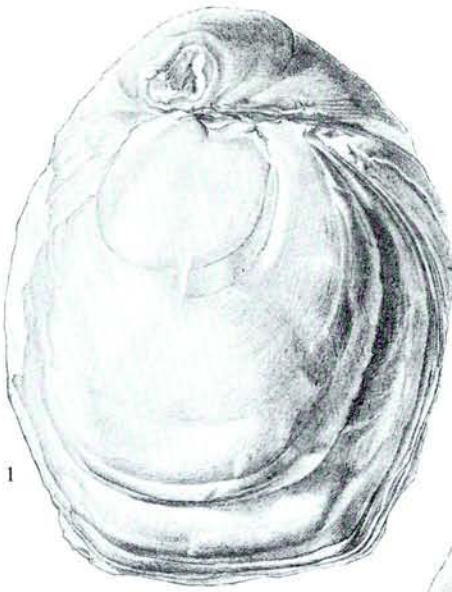


Plate 3. *Neoliothyra fittoni* (Hagenow, 1842)

Figs. 1–3. Dorsal, lateral and anterior views of MMH no. 11392. $\times 6$.
Fig. 1 shows the asymmetrically worn foramen. Figs. 2 and 3 demonstrate the great obesity, the paraplicate anterior commissure and the concentration of growth lines near the anterior commissure in this gerontic specimen.



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