Addendum.

9. *Spiraxis Cingalensis*, B., n. sp.

S. testa subrimata, subulato-turrita, gracili, solida, polita, striatula, striis minutis confertissimis undulatis spiralibus decussata; spira elongata, superne sensim attenuata, apice ——? sutura vix impressa, irregulari; anfractibus superstitibus 11 (apicalibus deficientibus), planulatis, ultimo ad basin rotundato; apertura subobliqua, emarginato-elliptica; peristomate recto, intus ad angulum superiorem calloso; margine dextro superne arcuato, basali incrassato, columellari calloso, expansiusculo, subreflexo, superne plica obliqua spirali solida munito.

Long. 14, diam. 3 mill.; apert. long. 3, diam. $1\frac{1}{2}$ mill.
Habitat ad Weelgamoowe, Matelle, Ceylon.

A single specimen of this peculiar form is in Mr. F. Layard's collection. It is a dead shell, and is deficient in the superior whorls. I had not seen it before the previous part of this paper was in type.

January 8.

XIII.—*On the Nomenclature of the* Foraminifera.

By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

Part VIII.—*Textularia.*

As the typical *Buliminæ* have a strong resemblance externally to a *Bulimus*, so the large *Textularia trochus*, D'Orb., insensibly losing itself in *T. turris*, D'Orb., brings to mind the shape of the *Trochus* among *Mollusca*. The mimetic *T. trochus*, however, can scarcely be considered as the type of this very variable species; for the circularity of the transverse section or of the base of the cone is rather to be regarded as an extreme condition,—the conical forms of *Textularia* being homomorphous with the short forms of *Bulimina variabilis* and the broadly conical polystomous *Valvulina*.

Textularia agglutinans, D'Orb., oval in its transverse section, and with more or less irregular gibbosity of its chambers, gives, in its ordinary and moderately developed condition, a fuller idea of the species than any other variety. The *T. sagittula* of Defrance was the first to receive the generic name. It is smaller than the foregoing, and more compressed, and leads down to the most delicate variety, *T. pygmæa*, D'Orb. It does not present the mean of the specific characters, however, and thus does not supply a fair type of the species.

Among the very minute organisms to be seen in marine deposits, recent and fossil (such as chalk-dust and the mud of the Clam-beds of the East Indies), are tiny, delicate, translucent

Foraminifers, consisting of symmetrically arranged globose cells, alternately placed along the axis of the shell, and rapidly increasing in size. These may be grouped in two sorts,—one biserial (*Textularia; T. globulosa*, Ehrenberg), and the other triserial (*Verneuilina; V. pygmæa*, Egger, sp.): the former prevails in the Chalk; and both kinds are abundant in deep seas (Red Sea, &c.). These present conditions very analogous to what obtains in other allied forms, and, like the small and delicate varieties of *Bulimina, Uvigerina, Globigerina*, and *Rotalia* (especially *R. Beccarii* in shallow water), appear to owe their origin to one or other of the following conditions:—an excessive abundance of individuals, local brackishness of shallow water, or extreme and abyssal depth. Such very simply constructed forms, arrested at an early stage of growth, require great care in the observer who would arrange them specifically; and unless the little, almost transparent shell under the microscope be turned in all directions, and compared with its homomorphs in other groups, no certainty can be attained to: seen in Canada-balsam or other liquids, or in transparent sections of rock-specimens, its nature can only be guessed at.

Referring to Dr. Carpenter's 'Introduction to the Study of Foraminifera' (Ray Society), 1862, p. 190, &c., for an account of the structure and relations of *Textularia*, we may state that it is one of the most polymorphic and protean species of Foraminifera. Its morphology is more complex than that of *Nodosarina*. The first four or five chambers are often arranged in a flat Nautiloid spire (like that of *Rotalia* or *Operculina*); but this direction of the coil is soon changed, and the long and more or less compressed spire, with its biserial alternating chambers, is formed. With an almost tendril-like freedom of growth, the spire varies widely in its proportions in different varieties. The nautiloid coil occurs in the flattened "Bigenerine" condition of *Textularia*; but here further licence is taken, the shell finishing with a *single* series of chambers, and thus presenting a *Trigenerine* state. This trimorphism has been observed in certain individuals allied to *T. prælonga*, from the Gault; for in some Gault-clays, probably of deep-sea origin, this variety commences with a flat spiral coil, then becomes biserial with an alternation of chambers (Textularian), and ends uniserially. This Trigenerine variety occurs fossil also in the Oolite-clays. As a useful varietal form, it deserves a distinguishing name, and may be termed *Textularia annectens* (fig. 1).

Fig. 1.

Textularia annectens, *P. & J.*

Textularia prælonga, Reuss, has very often a coiled commencement (it is figured thus in Eley's 'Geology in the Garden,' pl. 3.

fig. 15, and pl. 9. fig. 15 *c*, p. 196); and Bigenerine *Textulariæ* with a coiled commencement occur in Baffin's Bay. So also *T. carinata*, D'Orb., is often coiled in its early stage, especially the specimens found in the London Clay; and the coiled condition of *Grammostomum capreolus*, D'Orb., is well and boldly illustrated by Soldani in his 'Testaceograph.' vol. i. part 2, pl. 108. *G. capreolus* and its subvarieties may be either coiled and biserial, or coiled, biserial, and uniserial (offering a form equivalent to *Textularia annectens*), or bi- and uniserial without the coil. It is often sandy, and of a large relative size; it occurs in the West Indies, and abounds in the Adriatic.

Some of the shells arranged as *Gaudryina* (for instance, *G. siphonella*, Reuss) have their triple series of chambers so twisted on the axis as to have a Buliminoid aspect. We possess a very beautiful specimen of this kind from the Tertiary beds of San Domingo. A slight approach to this condition occurs in the *Verneuilina polystropha* (*Bulimina polystropha*, Reuss), which we have found to be very common in the living state in Davis's Straits (Baffin's Bay), St. George's Bay (Beyrout), Syra (Greek Archipelago), Abrolhos Bank, &c.

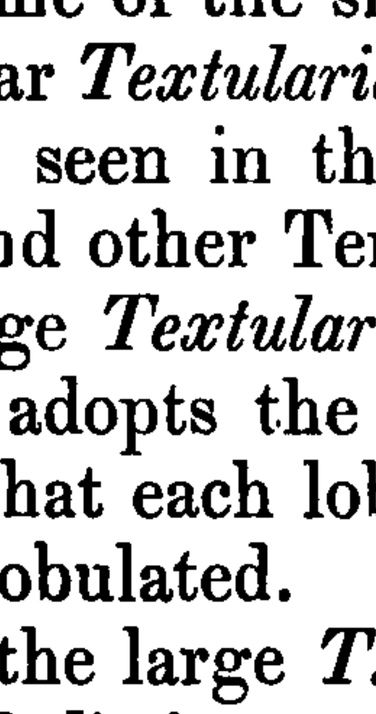
A large proportion of the *Textulariæ* may be clear-shelled and tubuliferous, as the smaller individuals of *Textularia* proper, *Grammostomum*, and *Verneuilina*. Others are opake-shelled, because arenaceous. The calcareous cement of the shell-matter in many (*Verneuilina polystropha* and *Bigenerina digitata*) is of a ferruginous colour in the recent state, the substance of the shell having the rusty-red colour of the recent *Lituola*—a colour which, with other tints, occurs in both opake and clear-shelled Foraminifers*.

All the larger varieties of *Textularia* are arenaceous; but there is a host of small forms (many of which have been honoured by authors with specific appellations) entirely free from foreign matter, the shell being composed of finely perforated clear substance. These are at first sight often undistinguishable from D'Orbigny's *Bolivinæ* (which may be said to be Textulariform *Buliminæ*). The larger forms, *T. trochus*, *T. turris*, *T. agglutinans*, and *T. gibbosa* (essentially hyaline in their shell-structure), strengthen themselves not only with sand-grains, but

* The same species of Foraminifera may be very variable in tint when taken from different habitats. *Orbitolites* may be either rust-coloured, livid, or pink (usually the last). In *Miliola* the aperture is sometimes rusty; and sandy specimens are sometimes altogether rust-coloured, especially *Quinqueloculina agglutinans*. *Peneroplis* is pink when alive. *Alveolina* is sometimes pink, sometimes rusty. *Globigerina* has a beautiful pink colour. *Planorbulina farcta* is livid or purplish in the Mediterranean, *P. vulgaris* of Australia is livid; in the Indian Sea it is rosy pink; and often it is destitute of colour.

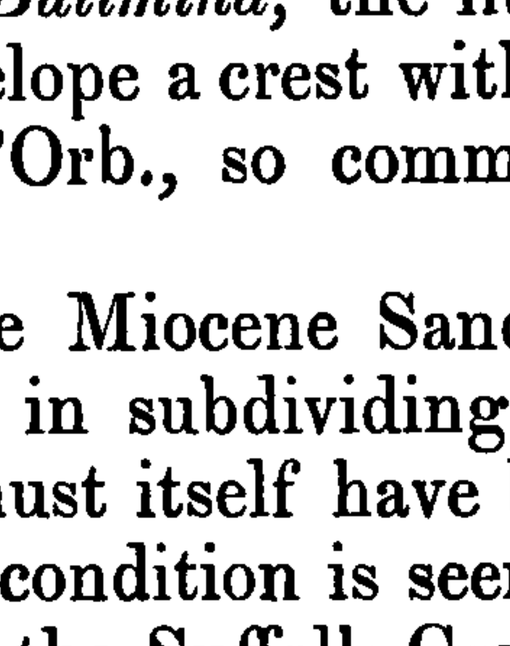
(as is also the habit of *Valvulina*) acquire some degree of rude ornament from the accretion of smaller Foraminifers, sponge-spicules, and prismatic fragments of molluscan shells. The clear and porous shell, in small and medium-sized specimens, occasionally has the pores projected as short tubes; this is well shown in a little Bigenerine *Textularia* in the Eocene deposits of Grignon, which is closely related to *T. pectinata*, Reuss (Denkschr. k. Akad. Wiss. Wien, 1850, i. pl. 49. f. 2, 3), from the Vienna Basin, but is characterized by its relatively few pseudopodian passages being elongated as short tubes all over the surface (fig. 2). *Planorbulina farcta* has very small deep-sea varieties with similar structure—for instance, *Rotalia reticulata*, Czjzek, Haid. Nat. Abhandl. ii. 1848, pl. 13. f. 7–9 (= *Siphonia fimbriata*, Reuss, Denks. k. Akad. Wiss. Wien, i. 1850, pl. 47. f. 6) (fig. 3): these tubuliferous *Planorbulinæ* are not uncommon in the Red Sea and elsewhere, and both recent and fossil in the Mediterranean area.

Fig. 2.



Textularia (Bigenerina) tubulifera, *P. & J.*

Fig. 3.



Planorbulina farcta, var. reticulata, *Czjzek*.

Like some of the small varieties of *Bulimina*, the little, particularly clear *Textulariæ* frequently develope a crest with prickles, as is well seen in the *T. carinata*, D'Orb., so common in the London and other Tertiary clays.

The large *Textularia trochus* of the Miocene Sands of San Domingo adopts the habit of *Lituola* in subdividing its chambers; so that each lobule of sarcode must itself have been most minutely lobulated. This labyrinthic condition is seen in a less degree in the large *T. agglutinans** of the Suffolk Crag.

As in *Bulimina*, so in *Textularia* proper, the aperture is the diagnostic mark. It is merely a low transverse arch having for its base the middle of the septal plane of the penultimate chamber: generally the aperture has not a thickened margin; but sometimes it is slightly lipped. In many of the Textularian varieties the aperture gets more and more in the substance of the septal plane, passing upwards towards the apex of the con-

* For many splendid specimens of this shell, and also of *T. turris* and *T. gibbosa*, from the same deposit, we are indebted to Searles Wood, Esq., F.G.S.

vexity of the septum, and thus becoming terminal. In this way it takes the form of a vertical slit-like aperture (generally without a margin) in *Grammostomum* (a compressed *Textularia*) both in the monomorphous and dimorphous forms, and especially in the large individuals.

Ehrenberg's *Proroporus* (as illustrated by Reuss, Sitzungsb. Akad. Wiss. Wien, vol. xl. p. 231, pl. 12. fig. 5) is an elongate *Textularia* with its aperture terminal or nearly so.

In *Gaudryina* and the sandy *Sagrina* the aperture is generally more or less margined and terminal. In *Verneuilina* the later cells have the aperture more and more axial; the terminal chamber in large specimens having a central aperture, generally unlipped: these form Reuss's genus *Tritaxia**. In the bi-uniserial varieties, also, of *Textularia* the mouth becomes central and pouting.

A most complete confluence of all these Textularian forms, whether varying in the mode of growth, the size and shape of chambers, or position of aperture, is proved by the countless intermediate modifications yielded by most sea-bottoms, fossil and recent.

The chief forms of Textularian growth may be thus enumerated:—

Textularia proper. Biserial, with transverse aperture at the base of the chamber.

Bigenerina. Biserial, becoming uniserial (bi-uniserial); with a terminal, round, pouting aperture.

Grammostomum. Usually biserial, extremely compressed; with simple slit-like aperture at the end of the chamber: occasionally bimorphous or even trimorphous.

Sagrina (in part: *S. rugosa*†, D'Orb., sandy). Biserial and sometimes tri-biserial; and then uniserial as far as one chamber; with a pouting, round terminal aperture.

Gaudryina begins triserially (Verneuiline), and generally ends biserially, the last aperture being Textularian; but it runs insensibly into the foregoing. Some *Gaudryinæ* are twisted and Buliminoid.

Verneuilina. Triserial. *V. dubia* (Reuss) = *Uvigerina tricarinata*, D'Orb., takes in its last chamber a central aperture (*Tritaxia*, Reuss): another single chamber makes it Clavuline. In *V. dubia* the aperture may be seen, in a series of specimens, to creep up from the base of the cell to the top.

Clavulina (part). Those *Verneuilinæ* taking on a uniserial

* Sitzungsberichte Akad. Wiss. Wien, 1860, vol. xl. p. 83.

† The other *Sagrina* (*S. pulchella*, D'Orb. For. Cuba, pl. 1. figs. 23, 24) (biserial, ribbed, and not sandy) is a *Uvigerina*.

chamber, with a round, pouting, central aperture, and no valve *.

Textulariæ are widely distributed: one and the same deposit usually yields many varieties; indeed, it is a world-wide species, and it seems to thrive equally well off the North Cape and in the East Indian Seas. The largest specimens are *T. gibbosa*, *T. agglutinans*, and the conical *T. trochus* and *T. turris*. Shelly sands and shelly clays yield the largest *Textulariæ* at from 30 to 100 fathoms, 60 to 70 fathoms being the best depth (coast of Sicily; English Channel; off Vigo and Ushant; and Southern Australia).

Textularia sagittula generally occurs in company with the large-sized *Textulariæ*, and is very common in all seas at a moderate depth. Remarkably large specimens of *T. carinata* (which usually occurs of small size) are found in the rich Nodosarian clay of the Vienna Basin; also recent in the line of soundings off South Arabia, between Socotra and Kurachee.

The London Clay yields three varieties of *Textularia*—a globose-chambered form, a compressed carinate form, often with a flat spiral commencement (*T. carinata*, D'Orb.), and the triuniserial form (*Clavulina communis*†).

The Chalk and Chalk-marl are very rich in Textularian forms, especially *T. trochus*, *T. turris*, *T. prælonga*, and other true *Textulariæ*, as well as *Verneuilina triquetra*, *V. dubia*, &c. The Gault of Biggleswade, Bedfordshire, appears to have been deposited in a deeper sea than the Gault of Kent was, if we judge by the varieties of *Textularia* and other genera, compared with recent conditions. It yields *Textulariæ* not only having the coiled commencement, but becoming uniserial (*T. annectens*).

Textularia occurs in the Silurian greensand of St. Petersburg; in the Carboniferous and Permian limestones; plentifully (usually small, but large when Verneuiline) in some of the clays of the Oolites; abundantly in the Cretaceous rocks; and plentifully and varied in the Tertiary deposits.

A List of some of the Textulariæ *proper.*

1826. Textularia gibbosa, *D'Orb.* Modèles, No. 28; Ann. Sc. Nat. vii. p. 262. No. 6.
1826. Textularia pygmæa, *D'Orb.* Modèles, No. 7; Ann. Sc. Nat. vii. p. 263. No. 13.
1828. Textularia sagittula, *Defrance*, Dict. Sc. Nat. vol. xxiii. p. 344, pl. 13. f. 5.

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* *Clavulina Parisiensis*, D'Orb., Modèles, No. 66, is certainly a triuniserial *Valvulina* with the loss of the little lip—an accident common to the brittle Grignon fossils. *Clavulina nodosaria*, D'Orb., is a Bigenerine *Textularia*.

† *Nodosaria rustica*, Jones, Morris, Catal. Brit. Foss. 1854, p. 38.

1839. Textularia agglutinans, *D'Orb.* For. Cuba, pl. 1. f. 32–34. [The type.]
1839. Textularia globulosa, *Ehrenberg*, Abhandl. Akad. Berlin (1838), 1839, pl. 4 (several figs.).
1840. Textularia trochus, *D'Orb.* M. S. G. Fr. iv. p. 45, pl. 4. f. 25, 26.
1840. Textularia turris, *D'Orb.* M. S. G. Fr. iv. p. 46, pl. 4. f. 27, 28.
1845. Textularia prælonga, *Reuss*, Böhm. Kreid. i. p. 39, pl. 12. f. 14.
1846. Textularia carinata, *D'Orb.* For. Foss. Vien. p. 247, pl. 14. f. 32–34.

A List of several of the best-known Varieties, Passage-forms, or Polymorphs of Textularia, *with Remarks on their Synonymy.*

1826. Vulvulina* capreolus, *D'Orb.* Modèles, No. 59; Ann. Sc. Nat. vii. p. 264. No. 1, pl. 11. f. 5–7.
„ Vulvulina elegans, *D'Orb.* Ann. Sc. Nat. vii. p. 264. No. 3.
„ Bigenerina nodosaria, *D'Orb.* Modèles, No. 57; Ann. Sc. Nat. vii. p. 261. No. 1, pl. 11. f. 9–12.
„ Bigenerina digitata, *D'Orb.* Modèles, No. 58. [*Gemmulina digitata*, D'Orb. Ann. Sc. Nat. vii. p. 262. No. 4.]
1838. Textularia triquetra, *Münster*, N. Jahrb. 1838, pl. 3. f. 19. [Verneuilina.]
„ Bigenerina pusilla, *Roemer*, N. Jahrb. 1838, pl. 3. f. 20. [B. nodosaria, *D'Orb.*]
1839. Vulvulina gramen, *D'Orb.* For. Cuba, pl. 1. f. 30, 31.
„ Candeina nitida, *D'Orb.* For. Cuba, pl. 2. f. 19, 20. [A small *Verneuilina*, showing a few pseudopodial passages near the junctures of the cells.]
„ Clavulina nodosaria, *D'Orb.* For. Cuba, pl. 2. f. 19, 20. [Bigenerina nodosaria, *D'Orb.*]
1840. Verneuilina tricarinata, *D'Orb.* Mém. Soc. Géol. France, iv. p. 39, pl. 4. f. 3, 4. [V. triquetra, *Münster.*]
„ Uvigerina tricarinata, *D'Orb.* M. S. G. Fr. iv. p. 42, pl. 4. f. 16, 17. [Verneuilina (Tritaxia) dubia, *Reuss.*]
„ Gaudryina rugosa, *D'Orb.* M. S. G. Fr. iv. p. 44, pl. 4. f. 20, 21.
„ Gaudryina pupoides, *D'Orb.* M. S. G. Fr. iv. p. 44, pl. 4. f. 22, 24.
„ Sagrina rugosa, *D'Orb.* M. S. G. Fr. iv. p. 47, pl. 4. f. 31, 32.
1845–1846. Textularia triquetra, *Münst.*, Reuss, Böhm. Kreid. pl. 13. f. 77. [Verneuilina.]
„ Bulimina polystropha, *Reuss*, Böhm. Kreid. ii. p. 109, pl. 24, f. 53. [Verneuilina; sandy, swollen, twisted.]
„ Textularia tricarinata, *Reuss*, Böhm. Kreid. pl. 8. f. 60. [Verneuilina triquetra, *Münst.*]
„ Verneuilina Bronni, *Reuss*, Böhm. Kreid. pl. 12. f. 5. [V. triquetra, *Münster.*]
1846. Clavulina communis, *D'Orb.* For. Foss. Vien. pl. 12. f. 1. [Verneuilina, tri- uniserial; or Clavuline Verneuilina.]
„ Bigenerina agglutinans, *D'Orb.* For. Foss. Vien. pl. 14. f. 8–10. [B. nodosaria, *D'Orb.*, elongate.]
„ Verneuilina tricarinata, *D'Orb.* For. Foss. Vien. pl. 21. f. 26, 27. [V. triquetra, *Münster.*]
„ Gaudryina pupoides, *D'Orb.* For. Foss. Vien. pl. 21. f. 34, 35 [not 36].
„ Vulvulina gramen, *D'Orb.* For. Foss. Vien. pl. 21. f. 46, 47.
1850. Verneuilina spinulosa, *Reuss*, Denkschr. Wien, i. pl. 47. f. 12.
„ Gaudryina Badensis, *Reuss*, Denkschr. Wien, i. pl. 47. f. 14.

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* This term, disused by D'Orbigny, is well replaced by *Grammostomum*, Ehrenberg.

1851. Verneuilina Bronni, *Reuss*. Nat. Abhandl. iv. pl. 5. f. 2. [V. triquetra, *Münst.*]
„ Verneuilina dubia, *Reuss*, Nat. Abhandl. iv. pl. 5. f. 3. [Tritaxia, *Reuss.*]
„ Gaudryina Ruthenica, *Reuss*, Nat. Abhandl. iv. pl. 5. f. 4. [Sagrina, *D'Orb.*]
„ Gaudryina siphonella, *Reuss*, Zeitsch. Deutsch. Geol. Ges. iii. pl. 5. f. 40–42. [Sagrina, *D'Orb.*]
„ Grammostomum dilatatum, *Reuss*, Zeitsch. Deutsch. Geol. Ges. iii. pl. 8. f. 8. [G. capreolus, *D'Orb.*]
1854. Nodosaria rustica, *Jones*, Morris's Cat. Brit. Foss. 2nd. edit. p. 38. [Clavulina communis, *D'Orb.*; a Clavuline Verneuilina.]
„ Verneuilina Muensteri, *Reuss*, Denks. Wien, vii. pl. 26. f. 5. [V. triquetra, *Münst.*]
„ Polymorphina silicea, *Schultze*, Org. Polyth. pl. 6. f. 10, 11. [Verneuilina polystropha, *Reuss.*]
1857. Bulimina arenacea, *Williamson*, Brit. Foram. pl. 5. f. 136, 137. [Verneuilina polystropha, *Reuss.*]
„ Bulimina tuberculata, *Egger*, N. Jahrb. 1857, p. 284, pl. 12. f. 4–7. [Verneuilina polystropha, *Reuss.*]
„ Bulimina pygmæa, *Egger*, N. Jahrb. 1857, p. 284, pl. 12. f. 10, 11. [Verneuilina; smooth, inflated, twisted.]
1860. Tritaxia tricarinata, *Reuss*, Sitz. Akad. Wien, 1860, vol. xl. p. 83, pl. 12. f. 1, 2. [Verneuilina, with central aperture.]

XIV.—*On the Genera and Species of Recent Brachiopods found in the Seas of Japan.* By Arthur Adams, F.L.S. &c.

The result of my investigations into the geographical distribution of the Terebratulidæ in Japanese waters shows that the North-European, the North-Asiatic, and the Indo-Pacific provinces require to be united as regards these Mollusks. Besides *Waldheimia Grayi*, *Terebratulina Japonica*, and *Terebratella Coreanica*, the North-Asiatic province yielded me *Waldheimia cranium*, *W. septigera*, and *Terebratulina caput-serpentis*. I likewise obtained *Waldheimia picta*, *Terebratulina Cumingii*, and *Ismenia sanguinea*, which were supposed to be confined to the Indo-Pacific province.

Fam. **Terebratulidæ.**

Subfam. Terebratulinæ.

Genus Terebratulina, D'Orb.

1. *Terebratulina Japonica*, Sow.

Hab. Gotto; 48 fathoms. Tsusaki; 55 fathoms.

2. *Terebratulina caput-serpentis*, Linn.

Hab. Tsusaki; 55 fathoms. Tsu-Sima; 26 fathoms. Mino-Sima; 63 fathoms.

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