

X.—On some Foraminifera from the North Sea, etc., dredged by the Fisheries Cruiser 'Goldseeker' (International North Sea Investigations — Scotland). III. On *Cornuspira diffusa*, a new type from the North Sea.

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and ARTHUR EARLAND, F.R.M.S.

(Read May 21, 1913.)

PLATE XII.

*Cornuspira foliacea* Philippi sp. ("monstrous specimen"). Brady, 1884, Foram. 'Challenger,' pl. xi. fig. 7 (no reference in the text).  
Ditto. Rhumbler, 1903, System. Zusamm. d. recent. Rhizopoden, Arch. Protistenk., iii. p. 287, fig. 141b.

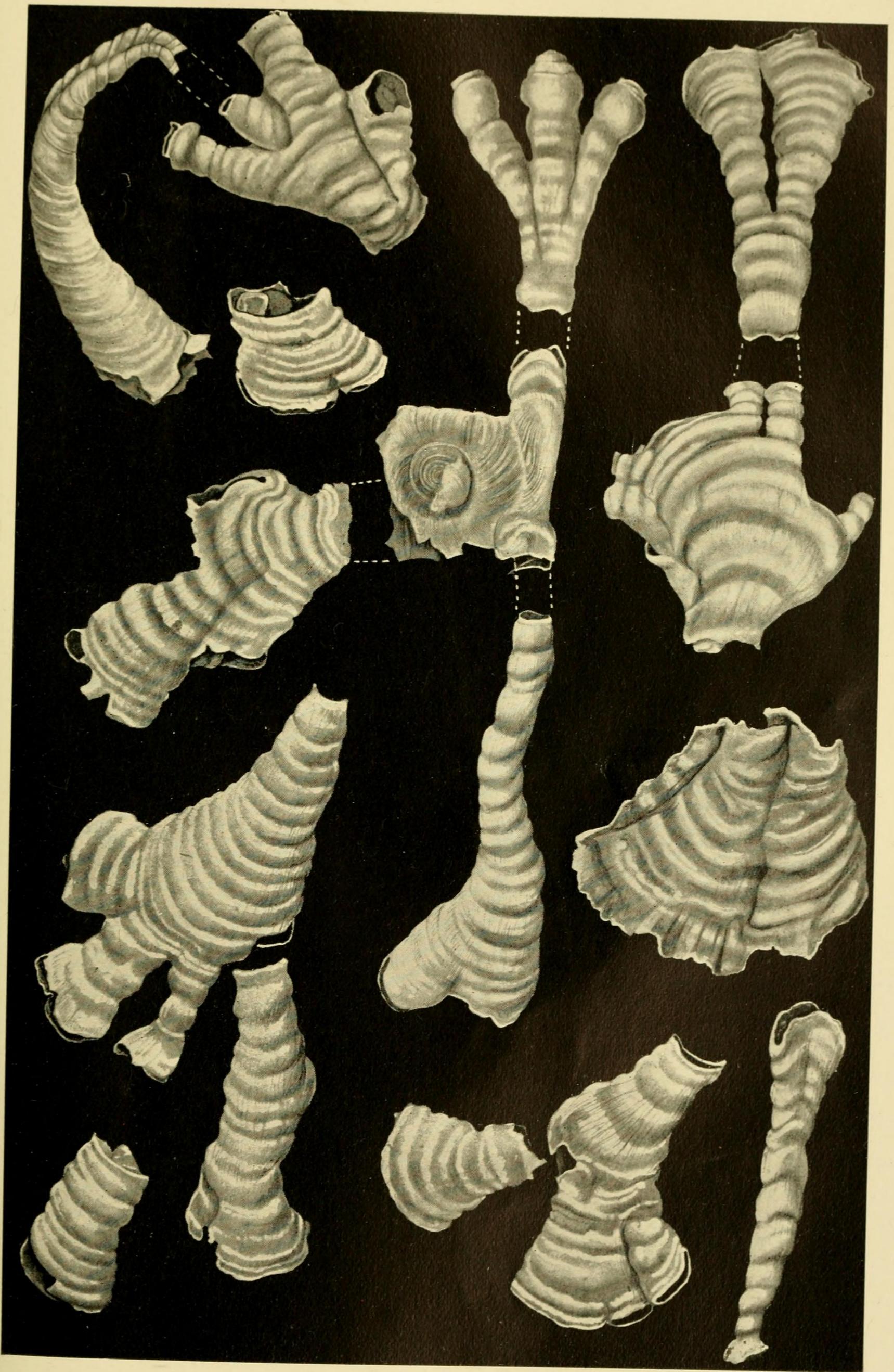
*Description of Species.*—Test free, porcellanous, of extremely variable form and size, constructed of a non-septate calcareous tube which apparently is at first coiled in a plane compressed spiral of rapidly increasing width (type of *C. foliacea* Philippi sp.), and subsequently abandons the spiral mode of growth, becoming protean. It may then adopt one or other of two different plans of increase.

1. The tube may spread out in a flattened irregular sheet, the aperture extending the full width of the test, round the marginal edge, as in *C. striolata* Brady; or

2. The tube may divide into from two to five separate and divergent tubes, each of which may in turn subdivide again. Very rarely after division the tubes may rejoin and become fused into a single tube again.

3. In rare instances the shell proceeds in its growth by a combination of the first and second scheme, i.e. after growing in a flattened sheet it proceeds to constrict itself along the apertural edge, and to ramify from these points.

The walls of the test are very thin and extremely fragile; the surface is irregular, and constricted at frequent intervals with curving furrows or depressions of varying depth and breadth, resembling in external appearance sutural lines. These constrictions apparently mark stages of growth in the life-history of the shell. They are not mere surface markings, being as clearly indicated inside the tube as on the surface. They may be com-



CORNUSPIRA DIFFUSA. SP.N. X20.

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pared with the transverse furrows of growth frequently seen in such Miliolids as *Miliolina subrotunda* Mont. sp. and *Massilina secans* d'Orbigny sp.

The surface of the shell is white and polished, covered either partly or entirely with irregularly disposed and variable striæ or faint costæ, often radially arranged; the striæ are generally most strongly marked in the proximity of the constrictions.

The aperture is simple and extends over the entire extremity of the test, whether this is wide and flattened, or branching and tubular. The edges of the test are generally somewhat constricted in the neighbourhood of the aperture.

The size of the test varies enormously, according to locality and degree of development; among the hundreds of specimens seen both in the living and in the dry condition, there have been none which could be definitely regarded as complete. The largest fragments observed have exceeded 3 mm. in length or breadth, according to the scheme of growth adopted, whether compressed or ramifying, but 1 mm. would probably more nearly represent the average size of the fragments on which our knowledge of the species is largely based.

We have been familiar for very many years with the curious species described in this paper. It was first seen in the shape of occasional fragments of small size and obscure character in some of Mr. Joseph Wright's dredgings from the south-west of Ireland. The specimens were, however, insufficient in number and character to determine the nature and affinities of the organism. Subsequently, when dredging in the North Sea and other Scottish areas, Earland found the species in much greater profusion; but even then, owing to its anomalous character, it was some time before its true position could be ascertained.

For a long time no specimen was found showing any trace of an initial portion, and although on other grounds little hesitation was felt in assigning the specimens to the genus *Cornuspira*, it was not until the specimen figured in the centre of the plate was discovered that we were able to determine its position with certainty. Since then one or two similar individuals showing the initial spiral portion have been observed, but they are extremely rare even in localities where fragments of the protean shell are frequent. This would seem to point to the conclusion that the formation of the normal spiral coil of *Cornuspira* is not an essential part of the life-history of the species, and that the animal is able to reproduce itself by the growth of any portion of the protean shell, which becomes separated by fracture from the parent—the essential nuclear conditions being favourable.

In the absence of the initial portion of the shell, it was at first thought that the organism was sessile in its early stages, but in spite of careful search, no sessile individuals were ever found, and

we now see no reason for supposing that *C. diffusa* is ever other than a free-growing organism.

*Cornuspira diffusa* is probably widely distributed in moderately deep water, on muddy bottoms, to which it appears to be everywhere confined. In addition to the few specimens first seen in Mr. Joseph Wright's dredging from Kenmare River, Co. Kerry, (40 fathoms), we have met with occasional fragments of small size in dredgings from the area of the Clare Island (Co. Mayo) Survey, and in a shore sand from Llanfihangel-y-Traethau, in Wales.

Round the Scottish coast it is of wider distribution, occurring more or less frequently at many 'Goldseeker' stations round the west coast, and in Orkney and Shetland. But the species reaches its greatest development both as regard size and abundance in the fine ooze which covers the bottom in the central area of the Scottish North Sea. At some of these stations fragments of all shapes and sizes are of frequent occurrence, notably at Station xliA (Lat.  $56^{\circ} 48' N.$ , Long.  $1^{\circ} 19' E.$ ), 94 metres, where the specimens were particularly abundant. Remarkably fine specimens were also obtained at the "Huxley" Station 25 ( $56^{\circ} 34' N.$   $3^{\circ} 53' E.$ ), in 37 fathoms to the south of the Inner Shoal and Great Fisher Bank in the North Sea. The organism, however, is so extremely fragile, that Earland did not succeed in obtaining a single perfect specimen, although at various times he has passed several entire dredgings from this station through a fine sieve immediately after they were taken. The shells were often seen in a practically complete condition in the sieve, but invariably separated into fragments similar to those figured, either by their own weight when deprived of the supporting ooze, or as soon as an attempt was made to raise them with a brush.

There can be no doubt that the organism when undisturbed is capable of ramifying and spreading over the surface of the ooze, and that it may attain a very much greater size than any of the separate fragments recovered. The protoplasm is abundant, and of a dark olive tint.

The species is not, in our opinion, a primitive condition of *Cornuspira*, as might at first sight seem probable, but rather a degenerate and pauperate form. Its affinities are with *C. striolata* Brady,\* which itself may be regarded as an abnormally developed and evolute condition of the more abundant *C. foliacea* Philippi sp. *C. striolata* is best known from the deep water of the cold area of the Shetland Faroe channel, where it attains a gigantic size (fig. 36). Many specimens have been taken approaching 25 mm. in length, and some exceeding those dimensions. As the species extends from the deep and very cold ( $-1.04^{\circ} C.$ ) water of this area into the shallower North Sea, it becomes very different in size and appear-

\* Foram. 'Challenger,' 1884, p, 202, pl. cxiii. figs. 18, 19.

ance. Its size diminishes to a maximum of 3 mm., and, while retaining the characteristic shape and striolation of the test, the shell assumes a delicacy and fragility comparable with *C. diffusa*, which possesses the same striolate surface in a less marked degree.

It is not difficult to account for the development of the tubular and ramifying scheme of growth. The object of the wide slit-shaped aperture evolved by *C. foliacea* Philippi sp., and in a more advanced stage by its ally *C. striolata* Brady, is obviously to secure immediate access for the pseudopodial outgrowths to extended feeding grounds in the superficial ooze. In some specimens of *C. striolata* the slit-like aperture extends over more than half of the entire periphery of the shell. This increase of aperture must,

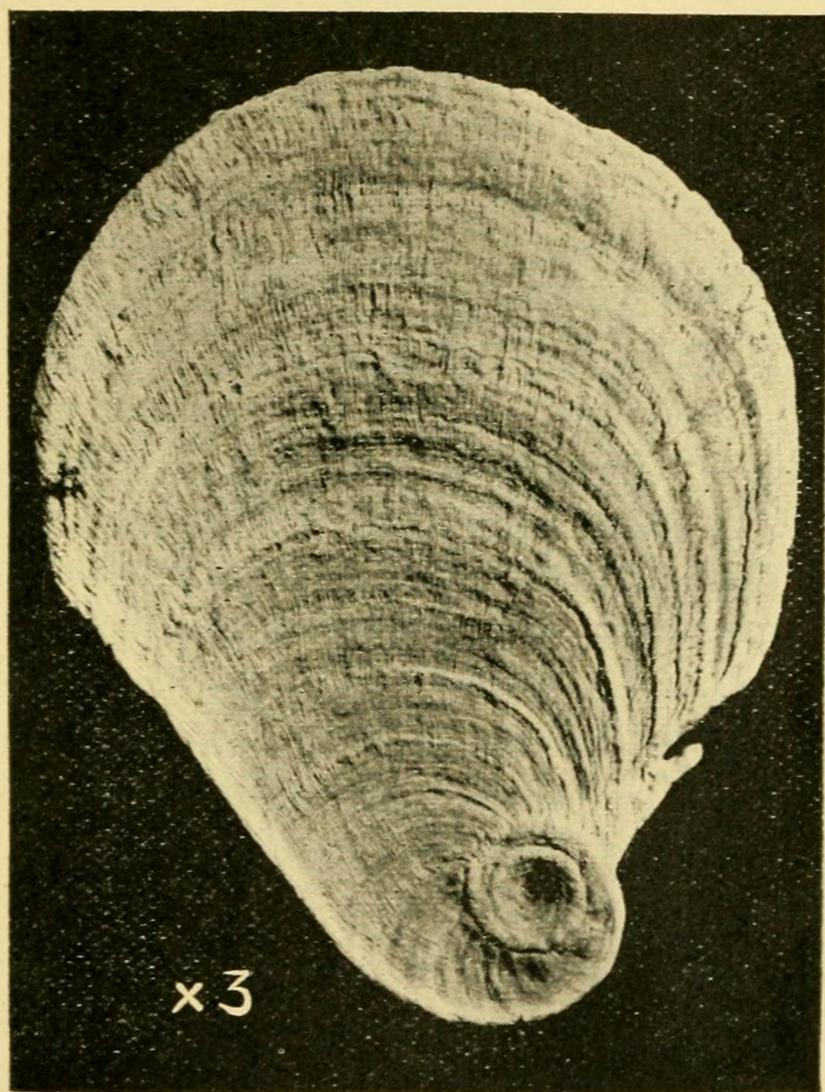


FIG. 36.

however, have its detrimental feature in the increased fragility of the test, there being no internal septa to strengthen and support the two thin parallel walls. It is, therefore, not surprising to find that some of the large deep-water specimens of *C. striolata* show a tendency to variation in the direction of tubular outgrowths, which, while strengthening the general aperture of the shell, allow ready passage of the pseudopodia to the ooze. From this stage to the development of the ramifying protean growths of *C. diffusa*, the transition appears to be slight.

In the plates to the 'Challenger' monograph (*suprà*) Brady figures a "monstrous specimen" of *Cornuspira foliacea* Philippi

sp., with several apertures, which is very possibly an example of the spiral initial portion of our species (fig. 37). No details are furnished in the text, and we are unaware of the locality from which the specimen was obtained. Dr. Rhumbler has reproduced the figure in his *Zusammenstellung* (*suprà*), and refers to it as a

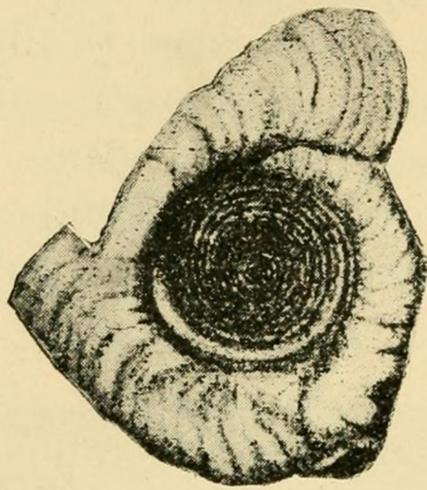


FIG. 37.

frequently observed abnormality in which the later developments of the plan of growth give an impression of polythalamous structure.

On the same plate (figs. 8 and 9) Brady figures two distorted specimens also attributed to *C. foliacea* which Dr. Rhumbler in his *Zusammenstellung* has taken as the types of a new species, *Cornuspira primitiva* Rhumbler. These might at the first glance be considered identical with our species, but a closer inspection shows that they have no feature in common except their irregular appearance. The characteristic constrictions and striolations are lacking, and we think with Brady that the specimens are only abnormal growths such as occur in every species. We have seen similar monstrous forms in some of the 'Goldseeker' dredgings.

*Cornuspira diffusa* may perhaps be regarded as isomorphous with the equally anomalous and variable arenaceous type *Psammonyx vulcanicus* Doderlein \* from Sagami Bay, Japan, 185-370 metres.

\* L. Doderlein, 1892, *Verh. d. Deutsch. Zool.-Gesell.*, p. 145. See also Rhumbler, *Zusammenstellung*, *op. cit.*

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AND

A SUMMARY OF CURRENT RESEARCHES RELATING TO  
ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia)

MICROSCOPY, &c.

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Minimis partibus, per totum Naturæ campum, certitudo omnis innititur  
quas qui fugit pariter Naturam fugit.—*Linnæus*.

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