

[PROC. ROY. SOC. VICTORIA, 55 (N.S.), Pt. II., 1943.]

ART. XI.—*Eocene Nautiloids from Victoria.*

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(Communicated by G. Baker, M.Sc.)

[Read 10th December, 1942; issued separately 1st October, 1943.]

Abstract.

Nautilus victorianus, n.sp., and *Aturoidea distans*, n.sp., are described from Tertiary beds on the south coast of Victoria. It is concluded that the occurrence of *Aturoidea*, which has not been previously reported from Australia, indicates an Eocene age of the strata in which the nautiloids were found. This is the first suggestion of the occurrence of Eocene strata anywhere in the eastern half of the Australian continent.

At the request of Associate-Professor E. S. Hills and Mr. George Baker, of Melbourne University, I have examined the remains of a few nautiloid cephalopods, collected by Mr. Baker early in 1942 from $\frac{1}{2}$ mile north-west of Pebble Point, south-east of Princetown, on the south coast of Victoria, about 20 miles north-west of Cape Otway. According to information supplied by Mr. Baker, Jurassic sandstones are in this locality overlain by a series of fossiliferous marine sediments of Tertiary age, which begins with ferruginous grits and ironstones at the base. These strata contain a small mollusc fauna which includes *Cucullaea*, *Lahillia*, *Limopsis*, *Turritella*, and *Dentalium*. The nautiloid fragments were found in a grit band in this basal series (the Pebble Point Beds) 30-40 feet above the unconformity with the Jurassic. Mr. Baker has called my attention to an early report of the occurrence of nautiloids in this place which was published by Wilkinson in 1865 and was quoted almost *verbatim* by Duncan in 1870. Wilkinson lists "*Nautilus*," together with "*Cucullaea*," and "*Cytherea*," in the uppermost beds of a series of 50 feet of thin ferruginous sandy beds which lie on top of 45 feet of greyish-brown carbonaceous sandstone showing false bedding and containing hard nodules and fragments of carbonized wood (Jurassic). The locality where fragments of carbonized wood described as " $2\frac{1}{2}$ miles south-east of the mouth of the Gellibrand River" and is the same as that from which Mr. Baker obtained his specimens.

Also, it must be mentioned that Chapman (1915, p. 353) listed *Aturia australis* from the "Gellibrand River (low down in the series)" and it seems possible that this determination might have

been based on fragments of *Aturoidea distans*, as described in the present paper, rather than on the true *Aturia australis* which seems to be a younger fossil.

It was found that the fragments collected by Mr. Baker belonged to four, perhaps five, different specimens of which one is here described as *Nautilus victorianus*, n. sp., whereas the other specimens belong to a new species of *Aturoidea* which is here described as *Aturoidea distans*.

The occurrence of *Aturoidea* in Victoria is of considerable interest as it seems to indicate the occurrence in that State of Tertiary strata of a greater age than any that have previously been reported from the eastern half of the Australian continent. It is one of the rarer nautiloid genera and the few species that have been assigned to it are all from strata of either Late Cretaceous or Eocene age. Apparently the genus developed out of *Hercoglossa* near the end of Cretaceous time and became extinct before the end of the Eocene, after *Aturia* had developed from it in the beginning of that period.

From the evidence furnished by this nautiloid it can be concluded, therefore, that the strata in which it was found are probably not younger than Eocene. They might even be as old as Upper Cretaceous, but since we are apparently concerned with the basal part of a continuous sequence which passes upwards into sediments of Miocene age, and since the genus *Nautilus* is not known from strata of pre-Tertiary age, an Eocene age of the nautiloid beds seems to be the most likely assumption.

Considering the fact that certain molluscs survive in Australian waters to-day which are closely related to forms that were more widespread in earlier periods, it might be argued that *Aturoidea* could have been something in the nature of an "Australian living fossil" of some period later than the Eocene. *Nautilus* itself with its present restricted range from the Java Sea to the Fiji Islands may be such a "living fossil." However, it should be borne in mind that the living species of *Nautilus* are the last descendants of a once vigorous strain which as late as the Miocene was widely distributed in various parts of the world. *Aturoidea* on the other hand was an unstable transition stage in an evolutionary lineage. Its few species are found widely apart and were never prolific in numbers of individuals.

Palaeontological Descriptions.

Family HERCOGLOSSIDAE.

Genus **Aturoidea** Vredenburg.

The genus *Aturoidea* has recently been discussed in detail by Miller and Thompson (1935) to whose descriptions the reader is referred. Its species have long been confused with those of other

genera, especially *Aturia*, from which, however, they differ in important features. Miller and Thompson have drawn up the following exhaustive definition of the genus (1935, p. 566):—

“Conch sublenticular in shape, nautiliconic in its mode of growth; all known forms large. Whorls compressed, flattened laterally, rounded ventrally, impressed dorsally. Umbilicus closed; umbilical shoulders rounded. Septa asymmetrically sigmoidal; each mature suture forms a very broad, deep, blunt ventral saddle: on either side of it a long, narrow, asymmetrical, narrowly-rounded lateral lobe; a broad, deep, broadly rounded, asymmetrical lateral saddle; a long, broad, rounded lobe with its centre near the umbilical seam; a broad, deep, broadly-rounded saddle located on the sides of the impressed zone and extending to the dorsal lobe; the dorsal lobe apparently large, more or less V-shaped, but rounded. Siphuncle subdorsal in position (that is, much nearer the dorsum than the venter, but not in contact with the dorsum); orthochoanitic in structure—segments not expanded nor contracted within the camerae but essentially cylindrical in shape; septal necks relatively long (only slightly shorter than the connecting rings).”

Aturoidea differs from *Aturia*, first of all in the position of the siphuncle which is not marginal as in the latter genus, but somewhat removed from the dorsum; equally important is the fact that in *Aturoidea* the septal funnels extend only half-way to the preceding septum. Finally, the septa in *Aturoidea* are farther apart than in *Aturia*; in the former genus the lateral lobe reaches approximately to the level of the crest of the lateral saddle of the preceding suture; whereas in *Aturia* the lateral lobe invariably reaches below that level.

Miller and Thompson are undoubtedly right in regarding *Aturoidea* as a connecting link between *Hercoglossa* and *Aturia*. It is a rare genus, for as Miller and Thompson have pointed out, only six or eight species have been described from North America, from England, and from India, and each species is known by one or two specimens only. Most of the species of *Aturoidea* are from Eocene strata; two species (*Nautilus serpentinus* Blanford, *N. schweinfurthi* Zittel) from the Cretaceous of India and Africa have been referred to the same genus, but these are intermediate between *Hercoglossa* and *Aturoidea* and may perhaps not be typical representatives of the latter genus.

Whether *Aturoidea* should be included in the family Hercoglossidae as Spath proposed, or rather in the Aturiidae, is an arguable, though unimportant point. The former classification suggests itself on the basis of the characteristics of the siphuncle, the latter if the state of development of the sutures is considered more important.

ATUROIDEA DISTANS, n.sp.

[Plate XI., figs. 1-4.]

This species is known from fragments of three, perhaps four, specimens which were found close together. Although it is not possible from the available material to give an exhaustive description of the species, enough of it is known to describe all its important features and to justify its description as a new species which will, it is hoped, be easily recognizable if additional specimens should be found at some future date.

The species is of fairly large dimensions. It can be estimated that the largest fragments belonged to a specimen which had a diameter of about 185 mm. at some stage before it reached maturity. Complete with living chamber the diameter of that specimen might have been anything between 250 and 300 mm.

The shell is involute; its whorls have almost straight, diverging sides and an evenly, though not very strongly rounded venter. In one rather small fragment the height of the whorl is 29 mm., its width about 24 mm., and the height of the whorl above the impressed zone is 19.5 mm. The outside of the shell is marked by weak growth-lines which are convex laterally, forming a very shallow lateral sinus, and are very strongly curved backward as they cross the venter, indicating the existence of a deep hyponomic sinus.

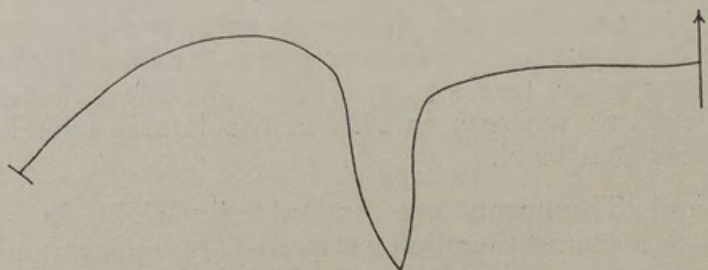


FIG. 1.—External suture of *Aturoidea distans*, n.sp. No. 1860, Department of Geology, Melbourne University.

The septa are moderately convex in the median region. The siphuncle is situated a short distance from the dorsal side. In the specimen in which the height of the whorl above the impressed zone was measured as 19.5 mm., the distance of the siphuncle from the dorsal side is 1 mm. The diameter of the siphuncle at this place is 1.5 mm. In a larger fragment in which the height of the whorl above the impressed zone is 58 mm., the distance of the siphuncle from the dorsal side is 6 mm. and the diameter of the siphuncle in this place is between 5.5 and 6 mm. It seems, therefore, that the distance between the siphuncle and the dorsal side is at any stage of growth roughly equal to or only very slightly smaller than the diameter of the siphuncle at the same place. The septal necks are orthochoanitic and extend for about

half the distance between the septa. In one place where a measurement could be made the distance between two successive septa was 24 mm. and the septal necks were 12 mm. long.

The sutures are aturoid (fig. 1). The external suture consists of a strongly curved lateral saddle followed by a rather narrow, long, acute lobe which is situated well on the side of the whorl, about halfway between the umbilicus and the venter. The rest of the suture is straight as it crosses the ventrolateral and ventral parts of the conch. This part of suture remains slightly below the level of the lateral saddle. The sutures are set well apart and the lateral lobe terminates at or only very slightly below the level of the lateral saddle of the preceding suture. The internal suture forms a pair of saddles and a blunt dorsal lobe.

Occurrence.—Grit band, 30-40 feet above the unconformity between the Jurassic and the Tertiary. Second point north-west of Pebble Point, south-east of Princetown, Victoria.

Holotype.—No. 1860, Department of Geology, University of Melbourne.

Paratypes.—Nos. 1861-1862, Department of Geology, University of Melbourne.

Remarks.—*Aturoidea distans* is easily distinguished from the few other species of the genus by the position of its lateral lobe which is unusually far away from the ventral side. From *Aturoidea spathi* Vredenburg from the Eocene Ranikot series of India it also differs conspicuously in its more broadly rounded ventral outline. *A. pilsbryi* Miller and Thompson from the Eocene of New Jersey, U.S.A., is similar in the position of the lateral lobe of the suture, but the lateral lobe is short, broad, and blunt instead of long, narrow, and acute as in *A. distans*.

Family NAUTILIDAE.

Genus **Nautilus** Linné.

Although many nautiloids of Palaeozoic and Mesozoic age have in the past been referred to the genus *Nautilus*, species that are sufficiently similar to the genotype, the living *Nautilus pompilius*, to be included in the same genus do not make their appearance before the Cainozoic. Hyatt (1897, p. 560) even hesitated to include Tertiary species into the genus and it may well be that up to the present day many species of Tertiary nautiloids are classified with *Nautilus* only because they have never been studied in sufficient detail. Although Spath has in recent years removed numerous species to a more satisfactory taxonomic position, the affinities of many others seem to require further elucidation.

While I am not in a position to be able to attempt a revision of the Tertiary species that are now commonly assigned to *Nautilus*, it is with some diffidence that I place the new species to be

described here into that genus. Its affinities will be discussed below.

NAUTILUS VICTORIANUS, n.sp.

[Plate XI., figs. 5-7.]

Only one rather fragmentary specimen is at present available which, however, permits of the observation of most of the important specific characters.

The shell which this fragment represents had a diameter of at least 47 mm., but since only part of the living chamber is preserved the actual size must have exceeded this figure. The shell is broadly discoidal, almost involute, with an umbilicus about 4 mm. wide. The whorls are strongly and evenly rounded, with a deeply impressed dorsal zone. At the base of the living chamber the whorl is about 22 mm. high, 25.5 mm. wide, and the impressed zone is about 7 mm. deep.

The surface of the shell is marked with very faint growth-lines which are slightly sinuous; they indicate the existence of a rather shallow hyponomic sinus. The septa are rather strongly convex, rising rather steeply near the ventral side. The sutures (fig. 2) form a shallow umbilical saddle, followed by a shallow lobe which

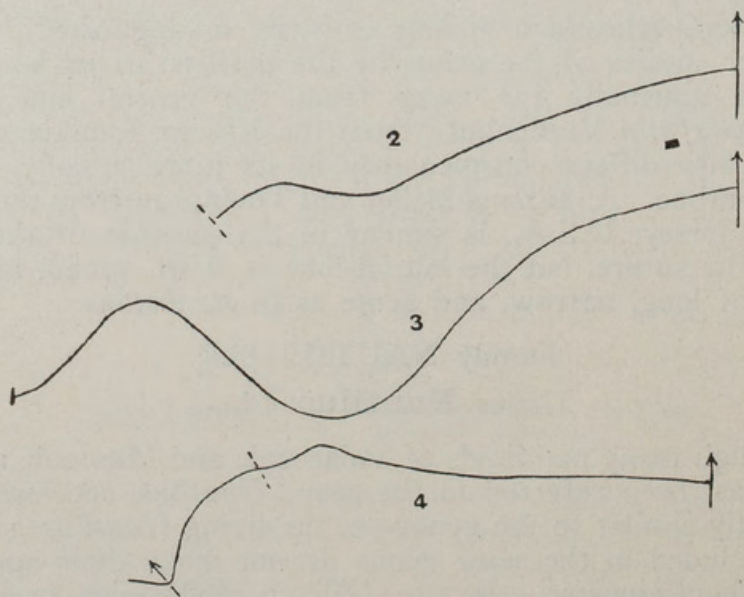


FIG. 2.—External suture of *Nautilus victorianus* n.sp., Holotype.

FIG. 3.—External suture of *Nautilus pompilius* Linné. No. 16248, Dept. of Geology, University of W.A.

FIG. 4.—Suture of *Nautilus geelongensis* Foord. No. 1863, Dept. of Geology, University of Melbourne.

is situated close to the umbilical shoulder; the sutures then rise almost straight across most of the lateral sides to form the ventral saddle. The exact course of the internal suture could not be studied, but it can be seen that a dorsal lobe is present at all stages.

of growth. At a stage where the whorl is 14 mm. wide the annular lobe is about 2 mm. long; at the base of the living chamber the length of that lobe seems to have decreased to about 1 mm. The septa are comparatively closely-spaced; in the whorl preceding the last whorl the distance between them when measured near the umbilicus is between 1 and 1.5 mm. The septal necks are short and orthochoanitic.

Occurrence.—In grit band 30-40 feet above Jurassic-Tertiary unconformity. Second point north-west of Pebble Point, south-east of Princetown, Victoria.

Holotype.—No. 1864, Department of Geology, University of Melbourne.

Remarks.—The only other Victorian nautiloid with which this species can be compared is *Nautilus geelongensis* Foord (1891, p. 332). The two species resemble each other in the degree of involution of the conch; both have a very small umbilicus. Their conchs are also similar in cross-section, but the ventral side of *Nautilus geelongensis* is slightly more broadly rounded than that of *Nautilus victorianus*. The two species can be most easily distinguished by their sutures which are more strongly sinuous in *Nautilus victorianus*. The external suture of *N. geelongensis* (fig. 3) is composed of a narrow, though shallow, lobe on the umbilical wall, followed by a low saddle on the umbilical shoulder which is in turn followed by a broad and shallow lateral lobe; the venter is crossed by a broad, low saddle. The internal suture possesses an annular lobe which is present at all stages of growth. On the other hand, the more pronounced and more asymmetrical lateral lobe whose deepest point is situated closer to the umbilical shoulder are features by which *Nautilus victorianus* can be easily distinguished from *N. geelongensis*.

Nautilus victorianus in some respects resembles species of the genus *Eutrephoceras*. Typical species of that genus have, however, a suture which, as Davies pointed out (1935, p. 351), is situated "entirely above (in front of) the guide-line," the latter being defined as "a straight line drawn from the centre of the shell-spiral at a tangent to the suture-line in the middle of the periphery," in other words, the suture on the whole is somewhat convex. The sutures are very slightly sinuous in the umbilical region and almost straight across most of the lateral sides and across the venter. There are, however, species which are commonly referred to *Eutrephoceras* and which have more sinuous and slightly concave sutures; one of these is *Eutrephoceras bryani* Gabb from the Eocene of New Jersey, a species which has been well illustrated and described by Whitfield in 1892. The suture of this species is entirely behind the "guide-line" and its lateral lobe is more strongly developed than in normal species of *Eutrephoceras*. "*Eutrephoceras*" *bryani* is perhaps the Tertiary nautiloid in North America which resembles *Nautilus victorianus*.

most, but I cannot help feeling doubtful about the systematic position of that species and wonder whether it would not be more correct to include it in the genus *Nautilus*, at least until the remaining Tertiary "Nautili" have been thoroughly revised.

For comparison with these Tertiary nautiloids an original drawing of a suture of *Nautilus pompilius* is here reproduced as fig. 4. It may be noted that this suture agrees well with the one of the same species which was figured by Reeside (1924, fig. 3), but less so with one depicted by Miller and Thompson (1933, p. 309) in which the umbilical saddle is much less prominent.

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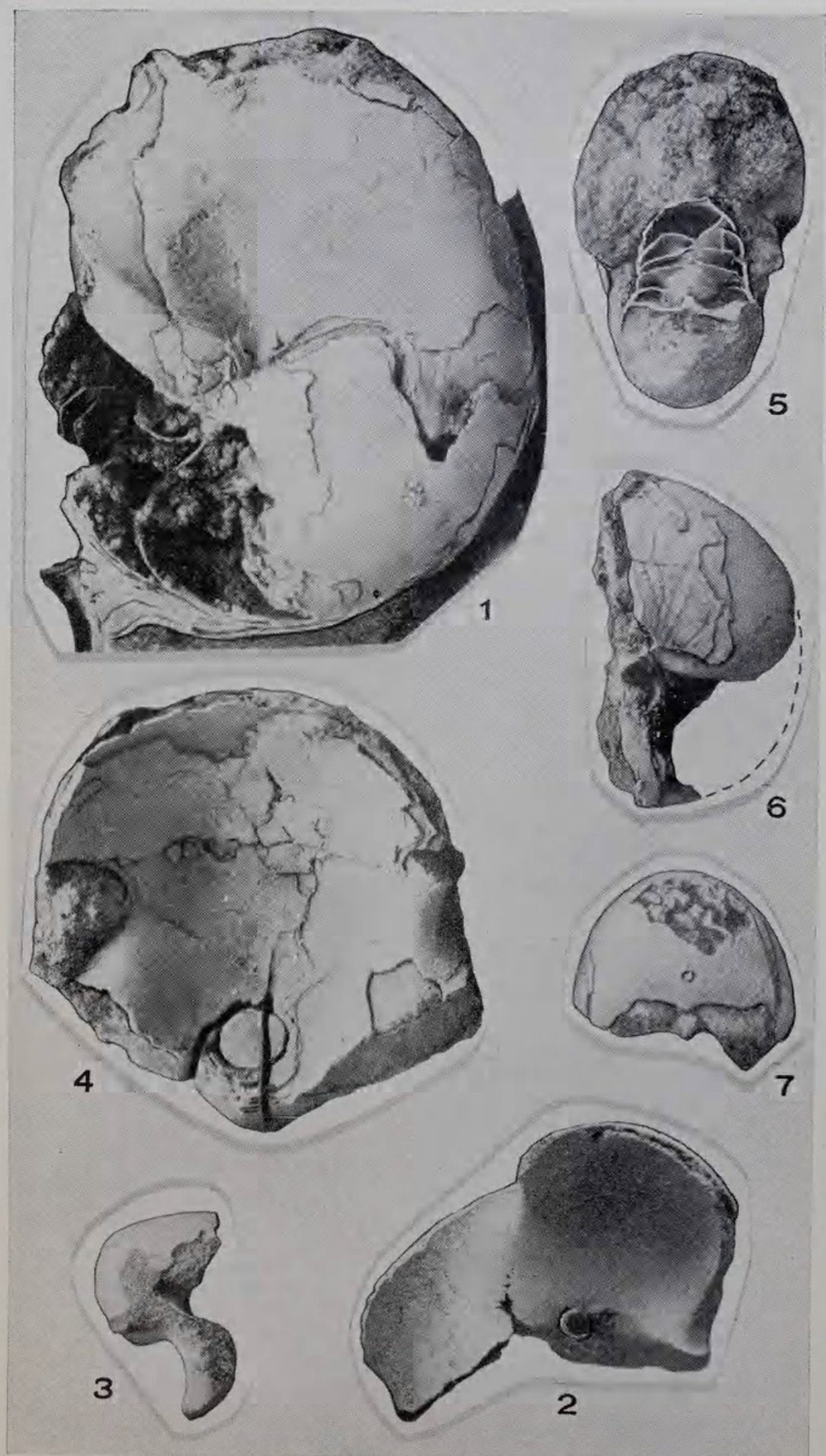
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Explanation of Plate.

PLATE XI.

- FIG. 1.—*Aturoidea distans* Teichert, n. sp. Holotype. Lateral view, Nat. size.
- FIG. 2 and 3.—A chamber of another specimen of the same species (fig. 2 septal aspect, 2 X; fig. 3 side view, nat. size).
- FIG. 4.—*Aturoidea distans* Teichert, n. sp. Septal aspect of a larger fragment, nat. size.
- FIG. 5-7.—*Nautilus victorianus* Teichert, n. sp. Holotype. Nat. size.

All the specimens come from a grit band 30-40 feet above the Jurassic-Tertiary unconformity, from the second point north-west of Pebble Point, south-east of Princetown, Victoria.





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