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FURTHER NEW CAMBRIAN BELLEROPHONT GASTROPODS

(With One Plate)

BY

J. BROOKES KNIGHT

Research Associate in Paleontology
U. S. National Museum

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As the result of efforts to probe as deeply as possible into the origins of prosobranch gastropods I published some months ago a paper describing four genera of Cambrian bellerophonts (Knight, 1947). Since that time I have met with specimens of two more Cambrian species of bellerophonts, each seemingly representing still another genus heretofore unknown.

Both of these species and genera are of great interest. One, *Strepsodiscus major,* n. gen., n. sp., appears to be the earliest bellerophont yet known except the questionable bellerophont *Coreospira* Saito. Its discuslike form and deep V-shaped sinus without a slit reminds one somewhat of the Ordovician genus *Cyrtodiscus* Perner but the final half-whorl is out of contact with the others and the coil is slightly asymmetrical. Oriented as a bellerophont, the right side of some specimens protrudes slightly; oriented with this right side as "upward," the coiling would be called sinistral, a feature that may have interesting implications that will be discussed elsewhere.

Chalarostrepsis praecursor, n. gen., n. sp., resembles *Strepsodiscus major* superficially in its discuslike shape and its free final half-whorl, but it is entirely symmetrical and has a deep slit, the earliest known appearance of a slit on any gastropod. It resembles even more significantly *Tropidodiscus* Meek and Worthen (Ordovician—Devonian) since both have the discuslike shape and the deep slit, but in *Tropidodiscus* the shell is closely coiled and even involute. I regard *Chalarostrepsis* as probably the immediate forerunner of *Tropidodiscus.*

With these two, we now know six genera of quite certain Cambrian bellerophonts and two more that are probably primitive bellerophonts. *Coreospira* occurs just above or below the boundary of the Lower and Middle Cambrian. *Strepsodiscus,* new, and *Cycloholcus* Knight seem to be of Dresbachian age. *Sinuella* Knight appears to be of

late Dresbachian or early Franconian age. *Anconochilus* Knight is Franconian, and *Chalarostrepsis* new, *Owenella* Ulrich and Scofield, and *Cloudia* Knight are of Trempealeauian, seemingly in that relative order. These stages are Upper Cambrian.

That each of these six genera, except *Coreospira,* is represented by only a single known species makes it highly probable that other species will be found that will extend the recorded ranges. It is probable too that other genera are still below the horizon. Nevertheless our gradually clearing vision of Cambrian prosobranch gastropods and their occurrence in the time-stratigraphic sequence gives some basis for phyletic studies even though the results of such studies are naturally tentative.

It is to be emphasized that all but *Coreospira,* which is to be regarded as extremely primitive if indeed it is a true bellerophont, have been found only in the Upper Cambrian. The Middle and Lower divisions of the Cambrian so far as we know are destitute of definite prosobranchs and, of course, opistobranchs and other derived groups. The asymmetrical prosobranchs, as distinct from the basically symmetrical bellerophonts, do not appear in the record until Trempealeauian time, the latest division of the Late Cambrian. There they are represented by genera that are pleurotomarians in the broadest sense such as *Dirhachopea* Ulrich and Bridge, *Taeniospira* Ulrich and Bridge, and *Sinuopea* Ulrich, and by two peculiarly sinistral non-pleurotomarian genera, *Scaevogyra* Whitfield and *Matherella* Walcott, of which I shall write again in another place. The Lower and Middle Cambrian share with later beds caplike genera, such as *Scenella* Billings, *Helcionella* Grabau and Shimer, and others, which are thought not to have arrived at the prosobranch stage, and the anomalous group of gastropodlike forms, *Pelagiella* Matthew and its allies, that may not be gastropods at all.

Although all specimens of *Strepsodiscus major* seem to show some asymmetry and always in the same sense, the species appears to be quite variable in the degree that it is developed. The holotype probably shows more pronounced asymmetry than any other specimen in the collection. Many smaller specimens are very nearly symmetrical. The other characters are so very much those of a bellerophont and more particularly of the Cyrtolitidae that the slight lateral asymmetry must be accepted, as it is in two or three other bellerophont genera. However, the asymmetry in the sinistral sense occurring so early in the record may be highly significant.

There is a possibility that *Strepsodiscus* may prove to be congeneric with *Protoscaevogyra* Kobayashi (1939, p. 286), in which case the

name would be submerged in synonymy. However, the genotype of *Protoscaevogyra* is known from a single specimen so poorly preserved that it is impossible to discover significant characters. It seems likely that *Protoscaevogyra* was applied to a sinistral example of some species of *Pelagiella*. Sinistrality seems to be a common variation in some species of that genus. I place it, along with *Proeccyliopterus* Kobayashi and *Parapelagiella* Kobayashi, as a subjective junior synonym of *Pelagiella*. It is my opinion that Kobayashi did not have opportunities to investigate thoroughly the shell morphology of *Pelagiella* and that his supposed genera are not distinct from it.

Both of the two genera erected here have a superficial resemblance to *Pelagiella*. In fact, some unknown worker had labelled the types of *Chalarostrepsis praecursor* in the National Museum as *"Pelagiella."* But although *Pelagiella* seems to have a shallow and broad peripheral emargination, it does not have a deep, V-shaped sinus as in *Strepsodiscus* nor a deep slit as in *Chalarostrepsis*. Furthermore, *Pelagiella* has only two whorls or less that expand more rapidly than in those of either. It is, of course, quite asymmetrical and, in the types of the genotype species at least, in a dextral sense.

Suborder BELLEROPHONTACEA Ulrich and Scofield, 1897

Family CYRTOLITIDAE Ulrich and Scofield, 1897

Genus STREPSODISCUS Knight, new genus

Genotype, *Strepsodiscus major* Knight, new species.

Diagnosis.—Discuslike bellerophontiform gastropods with a deep, V-shaped sinus in the anterior lip culminating sharply at the sharp dorsal crest but without a slit. The final whorl is out of contact with the coil and, at least in the only known species, there is a slight, varying degree of asymmetry in the sinistral sense.

I am placing *Strepsodiscus* in the Cyrtolitidae because of the sinus culminating at a dorsal carina or "notch keel." The light contacts of the whorls and the rather steep umbilical slopes speak likewise for that assignment. That it is a bellerophont in spite of its slightly sinistral coiling is attested by the essential bilateral symmetry of its coiling, by its anterior V-shaped sinus, and by the traillike posterior margin of the aperture.

STREPSODISCUS MAJOR Knight, new species

PLATE 1, FIGURES 1a-m

Description.—A moderately large species, all observed specimens of which are to a greater or less degree asymmetrical in a sinistral

sense; the umbilical slopes commonly set off from the lateral slopes by angulations and the umbilical slope on the right side being very slightly deeper than that on the left, but in some specimens, such as the holotype, the sinistral twist is greater and the circumumbilical angulation less pronounced; whorls three in number and the final ⅓ whorl free; surface features including probable pseudo-selenizone not well known but seemingly smooth except for lines of growth.

Measurements

	Diameter	Thickness
The holotype (U.S.N.M. 114277).....	24.3 mm.	12.8 mm.
A figured paratype (U.S.N.M. 114278).....	13.7 mm.	6.4 mm.
An unfigured paratype (U.S.N.M. 114281 a)..	18.5 mm.	6.1 mm.

Hypodigm.—Approximately 150 specimens.

Remarks.—All specimens are in a light-brown calcareous sandstone with rather coarse angular sand grains. The preservation is remarkably good for so coarse a matrix. Many specimens are broken free. Great variation in relative thickness suggests that some specimens may be compressed laterally; however the matrix seems to be one that should resist compaction. The individual variation in other respects such as skewness and the angularity of the circumumbilical ridges suggests that individuals may vary in ratio of diameter to thickness too. Individuals are very abundant, as many as 15 showing on the surface of an oblong block approximately 6 cm. by 9 cm. Few individuals (only 2 out of 150) reach the size of the holotype, most of them being much smaller, narrower, and showing less skewness.

Indeed, if the larger individuals did not show the skewness to so much higher degree than the more abundant smaller ones, it might have been missed. The specimens shown on plate 1 as figures 1e-g, 1h-j, 1k-l, illustrate smaller specimens.

Occurrence.—Sawatch formation, north side of Taylor Peak, 4 miles south of Ashcraft, Colo. Collected about 100 feet above Archaean rocks in 1891 by S. Ward Loper. Associated with the numerous specimens of *S. major* were specimens of *Kingstonia loperi* Resser, *Maryvillia loperi* Resser (in both cases the types) and a specimen identified by Dr. Christina Lochman Balk as "cf. *Louchocephalus*." All of these indicate a Dresbachian fauna, early Upper Cambrian, probably low in the *Crepicephalus* zone.[1]

[1] Oral communication by Dr. C. L. Balk.

Family BELLEROPHONTIDAE McCoy, 1851

Genus CHALAROSTREPSIS Knight, new genus

Genotype, *Chalarostrepsis praecursor* Knight, new species.

Diagnosis.—Discuslike bellerophontiform gastropods with a shallow, narrow sinus in the anterior lip culminating in a deep, narrow slit that generates a selenizone. The final whorl is out of contact with the coil. The shell is entirely symmetrical.

I am placing *Chalarostrepsis* in the Bellerophontidae close to *Tropidodiscus* (=*Oxydiscus* Koken) which may well be derived directly from it. *Tropidodiscus* differs principally in that it is closely coiled throughout or even moderately involute.

CHALAROSTREPSIS PRAECURSOR Knight, new species

PLATE 1, FIGURES 2a-c

Description.—A moderately large species of 3 or 4 whorls with sharply rounded but not angular dorsum, with the whorls of the coil barely in contact, and the last ¾ whorl free. The umbilici are, of course, widely open. The slit is almost ½ whorl deep, narrow, and generates a convex selenizone bordered by faint striae. The aperture projects slightly behind in a skirtlike trail, then passes forward on the sides at an angle about 40° above the radius until it approaches to about one-sixth of the distance to the dorsum where it turns roundly to form the margins of the slit. The ornamentation consists of growth lines alone.

Measurements

	Diameter	Thickness
The holotype (U.S.N.M. 114282)	11.0 mm.	4.3 mm.
A small paratype (U.S.N.M. 114283)	5.5 mm.	?
A large imperfect paratype (U.S.N.M. 114283)	20 mm.*	9 mm.*

* With estimates to allow for imperfections, especially in thickness.

Hypodigm.—Three specimens.

Remarks.—The only three specimens of this species known are preserved in a gray, crystalline limestone. The holotype has been largely removed from the matrix and is exquisitely preserved. It shows shape and surface features with remarkable fidelity. The slit can be seen as that adapertural portion of the dorsal crest through which the matrix within the shell was continuous before preparation, a roughened portion without a selenizone. The largest specimen is too poorly preserved for effective preparation and the smallest is too small to justify the labor. On the largest specimen the rear end of

the final whorl is separated something like $3\frac{1}{2}$ mm. from the crest of the nearest part of the previous whorl. The homologous distance on the smaller holotype is less than 1 mm. This indicates continued divergence of the final whorl.

Occurrence.—The three specimens were collected in 1889 by the late C. D. Walcott from boulders in the Lévis conglomerate near the cemetery at Point Lévis, Quebec (Walcott's locality number 115a). Species recorded as being associated are *Loganellus logani* (Devine), *Agnostus americanus* Billings, *Palaeostrophia elax* (Clark) and *Levisella* sp. These are said to indicate the *Hungaia* zone of the Upper Cambrian. The *Hungaia* zone however has not yet been placed accurately in the standard Upper Cambrian sequence of the Mississippi Valley (Rasetti, 1944, p. 231). However, it is not older than the upper third of the Franconian stage or later than the Trempealeauian. In the opinion of Dr. Christina Lochman Balk [2] the *Hungaia* zone is close to the upper *Dikelocephalus* zone in the Trempealeauian.

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EXPLANATION OF PLATE 1

1a-m. *Strepsodiscus major* Knight, new species.

1a-d, 1m, the holotype (U.S.N.M. No. 114277). 1a, left side view. 1b, posterior view to show skewness. 1c, anterior view showing V-shaped sinus. 1d, right side view, all × 1. 1m, right side view, × 2.

1e-g, a paratype (U.S.N.M. No. 114278). 1e, posterior view, × 2. 1f, g, left and right side views, respectively, × 1.

1h-j, a paratype (U.S.N.M. No. 114279). 1h, posterior view, × 2. 1i, j, left and right side views respectively, × 1.

1k-l, a paratype (U.S.N.M. No. 114280). Left and right side views, respectively, × 1.

2a-c. *Chalarostrepsis praecursor* Knight, new species.

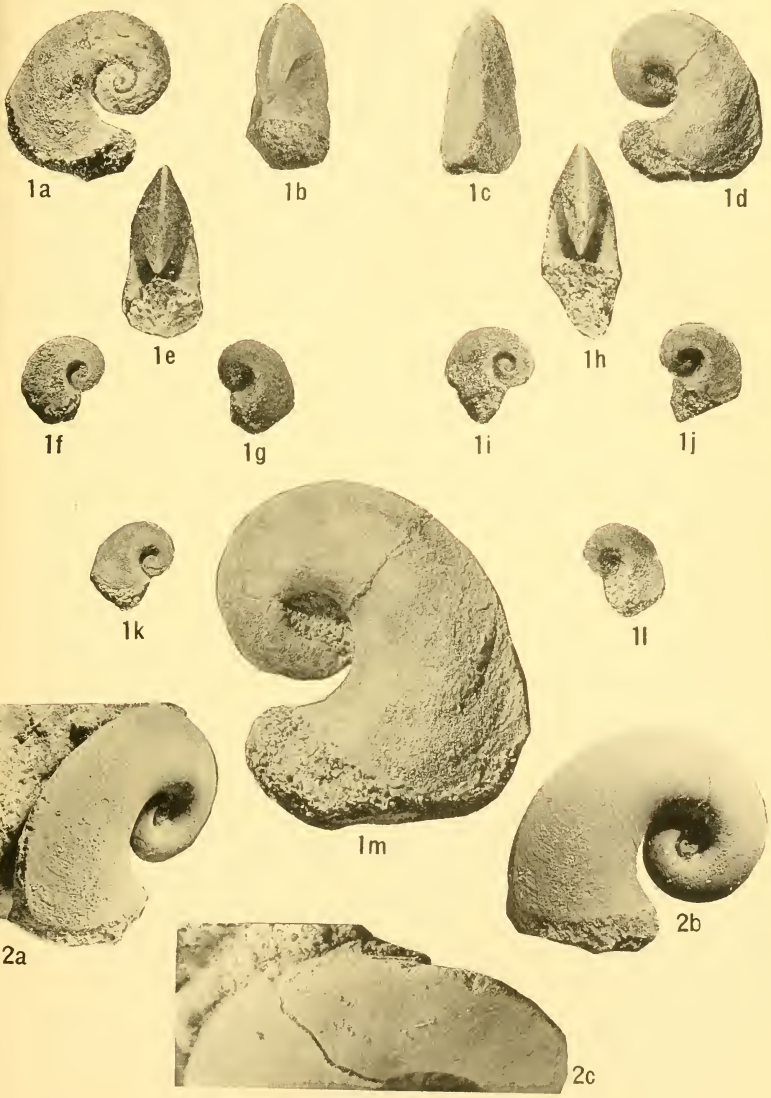
The holotype (U.S.N.M. No. 114282).

2a, oblique anterior view to show slit, × 4.

2b, left side view, × 4.

2c, a portion of the carina (just to right of break shown right of center on 2b) showing selenizone with lunulae, × 8.

[2] Oral communication.



CAMBRIAN BELLEROPHONT GASTROPODS

(See explanation of plate.)