

Yocrarhynchus, new "lower-middle" Frasnian rhynchonellid brachiopod genus from China and Russia

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Abstract

A new genus, *Yocrarhynchus*, including the type species, *Y. orientalis* (CHEN, 1978b), and *Y. adrianovae* n. sp., is described from the "lower-middle" Frasnian of northern Sichuan Province, China, and the western slope of the North Urals, Russia, respectively. The new genus is closely related to the "middle-upper" Frasnian genus *Caryorhynchus* CRICKMAY, 1952.

Key-words: *Yocrarhynchus* - rhynchonellid - "lower-middle" Frasnian - China - Russia.

Résumé

Un nouveau genre, *Yocrarhynchus*, comprenant l'espèce-type, *Y. orientalis* (CHEN, 1978b), et *Y. adrianovae* n. sp., est reconnu dans la partie "inférieure-moyenne" du Frasnien, respectivement, du nord de la Province du Sichuan, en Chine, et du versant occidental de l'Oural du nord, en Russie. Le nouveau genre est étroitement apparenté au genre *Caryorhynchus* CRICKMAY, 1952 de la partie "moyenne-supérieure" du Frasnien.

Mots-clefs: *Yocrarhynchus* - Rhynchonellide - Frasnien "inférieur-moyen" - Chine - Russie.

Introduction

CHEN's (1974, 1978a,b, 1984) pioneer work gave a thorough insight into the Frasnian brachiopod fauna of the important Devonian section at Longmenshan, northern Sichuan Province. The type species of *Yocrarhynchus* n. gen. forms part of a fauna called "*Leiorhynchus* Community" by CHEN and belongs to the so-called "*Leiorhynchus* Zone" of South China.

Yocrarhynchus n. gen. results from the subdivision of *Caryorhynchus* CRICKMAY, 1952, which started with the introduction of *Ryocarhynchus* SARTENAER, 1984 as part of a project refining Devonian rhynchonellid genera (SARTENAER, 1986, pp. 149-150). These three genera are related and their first appearances are successive in time. *Yocrarhynchus* n. gen. is the oldest and occurs in the Middle and Upper *Polygnathus asymmetricus* Zones (= *P. punctata* and Early *P. hassi* Zones in present terminology). *Caryorhynchus* is found in the *Ancyronathus triangularis* and Lower and Upper *Palmatolepis*

gigas Zones (= Late *P. hassi*, *P. jamieae*, and *P. rhenana* Zones in present terminology). *Ryocarhynchus* is present in the Lower, Upper and Uppermost *P. gigas* Zones (= *P. rhenana* and *P. linguiformis* Zones in present terminology).

Yocrarhynchus n. gen.

DERIVATIO NOMINIS

The name is formed by rearrangement of the first five letters of *Caryorhynchus*, to which the new genus bears some resemblance.

DIAGNOSTIC FEATURES

Gibbose; medium-sized; transversely subrounded in ventral and dorsal views; strongly inequivalve; hinge line narrow; well defined shallow to moderately deep sulcus and low fold starting at a short distance from beaks; restricted number of low to moderately high median costae, with divisions and intercalations; few lateral costae, if any; subregular to irregular costation; shell thick in apical region; dental plates convergent; umbonal cavities narrow; thick septum sometimes slightly lenticular or club-shaped posteriorly.

TYPE SPECIES

Leiorhynchus orientalis CHEN, 1978b. The species was abundantly illustrated by CHEN (1978b, pl. 139, figs. 2a-e, 3a-e, 4a-e; 1984, pl. 7, figs. 2a-e, 3a-e, 4a-e, 5a-e, 6a-e, 7a-e, 8a-e, 9a-e, 10a-e, 11a-e, 12a-e, pl. 8, figs. 1a-e, 2a-e, 3a-e, 4a-e, 5a-e), who gave (CHEN, 1984, p. 128) a description in English, almost identical to the original one in Chinese (CHEN, 1978b, p. 326).

The holotype was designated and figured by CHEN (1978b, p. 594, pl. 139, figs. 2a-e), who later (CHEN, 1984, p. 128, p. 165, pl. 7, figs. 6b, 7a,d,c, 6e) duplicated the figures, changed the type number from Sb3563 into CD73146, and, mistakenly, transposed the figures of two specimens.

SPECIES ATTRIBUTED TO THE GENUS

Besides the type species, one other is assigned to the

genus: *Yocrarhynchus adrianovae* n. gen., n. sp., described as *Liorhynchus pavlovi* var. *taimyrica* NALIVKIN by ADRIANOVA (1955, p. 352, p. 356, pp. 357-358, p. 359, table 1, p. 384, table 2, p. 386, p. 388, pl. V, figs. 1a,b,v,g, 2a,b,v,g, 3a,b,v,g, 4a,b,v,g; the specimen figured on pl. V, figs. 1a,b,v,g is here designated as the holotype). Five points need to be made: [1] the synonymy proposed by ADRIANOVA is rejected; [2] no internal characters were mentioned by ADRIANOVA and serial sections of one specimen were made in order to confirm the generic assignment; [3] specimens identified as *L. pavlovi* var. *taimyrica* (e.g. CHERNOV, 1961, p. 181; 1962, p. 47, table 10; 1973, p. 286) but not figured have not been examined, and cannot yet be considered as synonyms; [4] the view of ADRIANOVA, and of MARKOVSKIY *vide* ADRIANOVA (1955, p. 358), SOKOLSKAYA (1970, p. 81) and other authors that *taimyrica* is a regional variety of *L. pavlovi* is not shared. As I stated earlier (SARTENAER, 1987a, p. 128), "*Leiorhynchus pavlovi* var. *taimyrica* NALIVKIN, 1936 (in EMEL'YANTSEV & NALIVKIN, 1936) (established as a species) and *L. pavlovi* var. *rotunda* ADRIANOVA, 1955 are varieties that belong neither to the species [*Stenometoporphynchus pavlovi* (NALIVKIN, 1930)] nor to the genus [*Stenometoporphynchus* SARTENAER, 1987a]"; [5] more important, *L. pavlovi* var. *taimyrica* belongs to *Yocrarhynchus* n. gen. while *Liorhynchus taimyricus* NALIVKIN, 1936 (in EMEL'YANTSEV & NALIVKIN, 1936) is, for me, a representative of *Caryorhynchus* although, in 1961 (p. 973), I still accepted it as a species of *Leiorhynchus* HALL, 1860.

DESCRIPTION

Uniplicate, gibbose, medium-sized, and transversely subrounded in ventral and dorsal views. Strongly inequivalve, with brachial valve considerably more convex than pedicle valve. Commissure sharp; frontal commissure slightly, exceptionally more sharply, crenulated by irregular zigzag median costae; when lateral costae are present, lateral commissures are only slightly crenulated by the internal lateral costae. Valves join at commissure at an angle fluctuating around 90°. Hinge line narrow, considerably less than maximum width of shell. Postero-lateral margins concave near commissure.

Contour of pedicle valve low, semi-elliptical in longitudinal and transverse median sections, with the semi-ellipse sulcate in transverse median sections. From inflated umbonal region flanks slope gently towards lateral commissures, and rather sharply towards postero-lateral commissures. Well defined sulcus starting at a short distance from beak, and widening rapidly. Sulcus is shallow to moderately deep, and wide. Bottom of sulcus flat to slightly convex and passes progressively to a moderately high to high tongue with sharp borders. Tongue is generally trapezoidal, sometimes rectangular, and rarely slightly arched. Upper part of tongue never vertical or recurved posteriorly. Top of tongue corresponds to most anterior part of shell. Beak erect to slightly incurved and does not overhang hinge line, but comes close to brachial valve because of inflated dorsal umbonal region.

Minute foramen developed at point of beak by resorption. Partly covered interarea, short and poorly delimited by feeble ridges. Relatively strong deltidial plates have been observed in transverse serial sections.

Contour of brachial valve a high half-ellipse or half-circle in cardinal profile. Umbonal region strongly inflated, extending beyond pedicle umbonal region. Flanks slope steeply towards commissure. Well defined, low fold starting at a short distance from beak; top of fold flat to slightly convex. Dorsal beak incurved and hidden by pedicle valve.

Moderate number of costae: 1 to 6 median costae, 0 to 6 lateral costae. Well marked median costae generally low, sometimes moderately high, exceptionally high, angular — usually obtuse — with rounded top, wide at front. Generally two, sometimes three primary costae on fold; generally one, two or all divide a short distance from beak into costae commonly of different width and height, but sometimes none divide, and a costa may undergo a division near front. In sulcus either one or two primary costae, divided or not, and one to three intercalated costae, or costae of similar width of which one or two may divide. Primary costae begin close to beaks and are higher than those resulting from their division and than the intercalated ones. Sometimes a low inconspicuous costa develops in middle part of fold — not necessarily in the middle — without affecting the frontal commissure. All this results in either an irregular or a more regular pattern. Parietal costae rarely present, and result mostly from a median costa being lower than the others or from an internal lateral costa being higher than the others. When present, lateral costae are low, wide, and obtuse with rounded top; they may extend to the umbonal regions. Number of costae may be different on each flank.

Greatest thickness of brachial valve, and thus of the shell, located considerably posterior to frontal commissure. From there, valve curves more or less gently towards this commissure; thus, the highest part of tongue is not the highest part of shell. Width is largest dimension, but width and length are similar, exceptionally identical. Maximum width of shell occurs at a point around mid-length. Apical angle wide: from 115° to 130°.

Shell thick in apical region. Thick and short convergent dental plates, sometimes forming a Y-shaped structure with ventral septum, and delimiting narrow umbonal cavities. In transverse serial sections two or three very small chambers, separated by lamellar outgrowths of shell, are present in the extreme apical region; they follow one another in the slender part of pedicle valve bordering delthyrium. Simple short, thick, narrow teeth. Septum thick, sometimes somewhat lenticular or club-shaped posteriorly, high, thinning anteriorly in becoming lamellar, and persisting for about one-third to one-half length of valve. Hinge plates faintly developed, breaking up early into ridges and crural bases. Narrow and moderately deep crural trough. Simple, narrow, shallow dental sockets. Thin, short crura, close to each other, with Phrygian cap to subtriangular shape in section posteriorly, becoming dorsally grooved forward.

COMPARISONS

The "middle-upper" Frasnian genus *Caryorhynchus* and the new genus have much in common, including: size; gibbosity; strongly inequivalve; sharp commissure; frontal commissure crenulated by irregular zigzag median costae; lateral commissures only slightly crenulated by internal lateral costae, when latter are present; hinge line narrow, considerably shorter than maximum width of shell; greatest thickness of shell around mid-length (highest part of tongue is never highest part of shell); apical angle wide; inflated ventral umbonal region; well defined sulcus and fold, wide at front, begin a short distance from beaks; shallow to moderately deep sulcus with slightly convex to flat bottom; moderately high to high tongue, with top corresponding almost always to most anterior part of shell; tongue generally trapezoidal; ventral beak erect to slightly incurved, not overhanging hinge line, and coming close to brachial valve; ventral interarea poorly delimited by feeble ridges; developmental pattern of costation; some internal characters (teeth, dental sockets, hinge plates, crural trough, crura). Other internal characters and external shape easily permit separation of the two genera. *Yocrarhynchus* is transversely subrounded in ventral and dorsal views (*Caryorhynchus* is transversely subelliptical to subpentagonal), has different l/w (0.87 to 1 for *Yocrarhynchus*, 0.77 to 0.98 for *Caryorhynchus*) and t/w (0.76 to 0.84 for *Yocrarhynchus*, 0.64 to 0.88 for *Caryorhynchus*) ratios, and does not show the invariably alate aspect of *Caryorhynchus*; the new genus possesses dental plates, sometimes forming a Y-shaped structure with a ventral septum, and umbonal cavities. *Yocrarhynchus* has a septum which is either not lenticular (generally) or less lenticular or less club-shaped posteriorly, and although the developmental pattern of costation is similar in both genera, subregular and irregular patterns may coexist in the new genus; the frontal commissure in *Yocrarhynchus* is generally only slightly crenulated by the median costae, which are also generally lower.

I have indicated (SARTENAER, 1984, p. 6; 1985, p. 314; 1987a, p. 125; 1987b, p. 139, p. 146) that *Leiorhynchus* has to be excluded from the Frasnian, and this applies, of course, to *Yocrarhynchus orientalis*, originally attributed to *Leiorhynchus*. The "lower-middle" Frasnian *Yocrarhynchus* n. gen. and the Givetian genus *Leiorhynchus* — in a forthcoming paper I shall demonstrate that it is restricted to the upper Givetian — share many characters, such as shape (both are gibbose, strongly inequivalve), a narrow hinge line, inflated ventral and dorsal umbonal regions, and the greatest thickness located at the same place. They also have: similar apical angles and similar contour in ventral, dorsal, and lateral views; sharp commissure; lateral commissures located high; wide sulcus with flat to slightly convex bottom; fold with flat to slightly convex top; shape of tongue; short, small teeth; high, long septum; faintly developed hinge plates; narrow, short, moderately deep crural trough; and crura close to each other. On the other hand the developmental pattern of costation is basically different in the two genera; in *Leiorhynchus* costae are rounded and weaker,

frontal and lateral commissures are more gently undulated by median and internal lateral costae, lateral costae may be more numerous, and the general aspect of median costation is more regular. The shell is thinner in *Leiorhynchus*; dental plates are more widely separated, less convergent and thinner; umbonal cavities are better developed, and crura are more slender with different shape, notably the inverted L section in their proximal part. Other differences in *Leiorhynchus* are the more weakly developed sulcus and fold, usually starting further from the beaks, and a less inflated dorsal umbonal region, and, thus, not usually extending beyond the ventral umbonal region.

Some comparison may be made with the upper Eifelian genus *Ypsilorhynchus* SARTENAER, 1970, to which *Yocrarhynchus orientalis* has previously been assigned. Characters common to *Yocrarhynchus* n. gen. and *Ypsilorhynchus* include, *inter al.*: shape; depth and width of sulcus; height of fold; and shape of tongue. *Ypsilorhynchus* is distinguished by: large size; subpentagonal contour in ventral and dorsal views; form usually transversely elongated; surface uniformly costate; lateral costae always present, well marked, and more numerous; reduced umbonal cavities delimited by thin dental plates forming a Y-shaped structure with a ventral septum; and shape of crura.

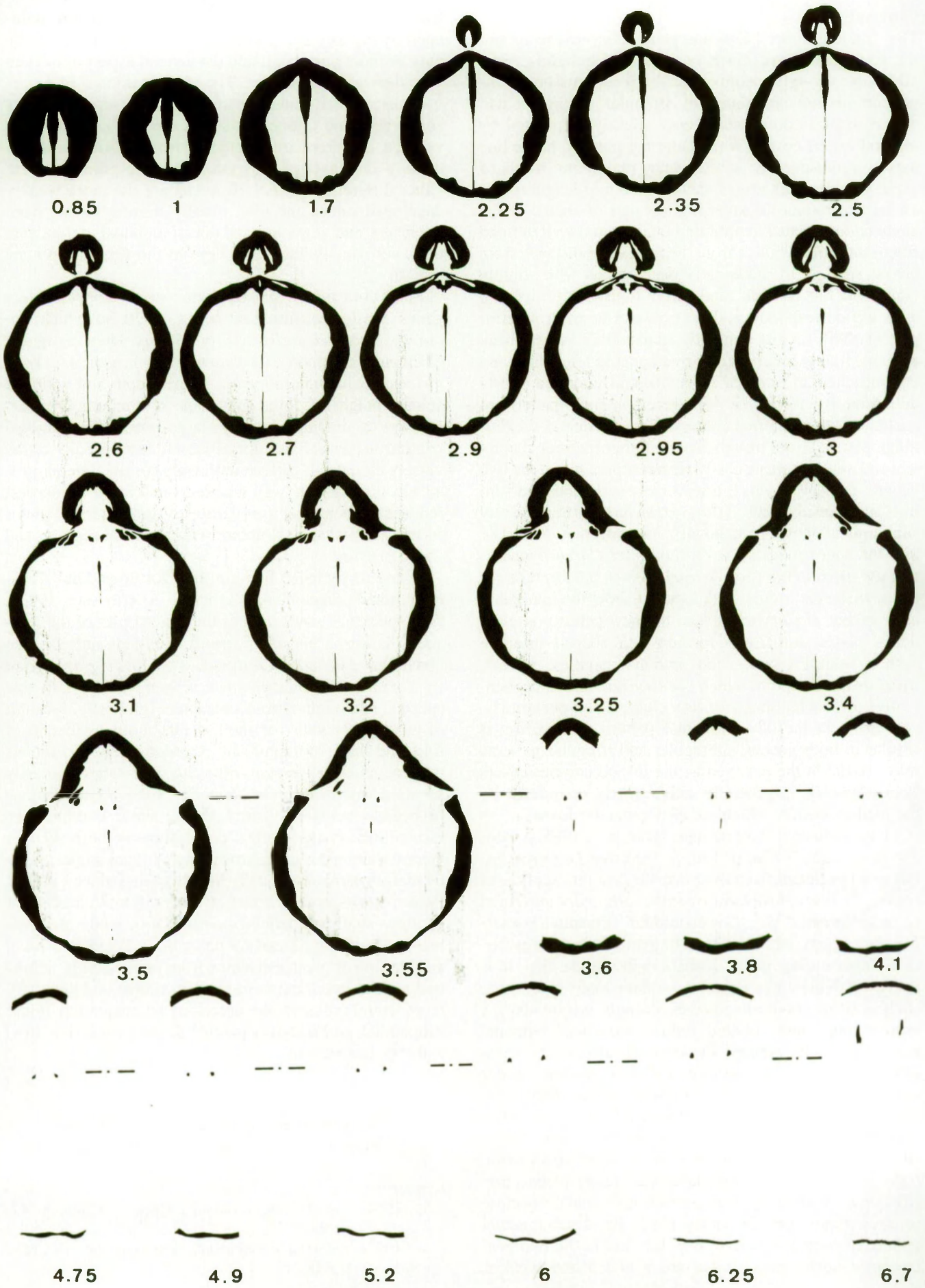
A note is included here on the "lower-middle" Frasnian genus *Stenometoporhynchus* SARTENAER, 1987a, type species *S. pavlovi* from the central part of the Russian Platform, because various Russian authors (see above) have included *Liorhynchus pavlovi* var. *taimyrica* (= *Yocrarhynchus adrianaevae* n. gen., n. sp.) in this species. Although various characters (gibbosity, location of greatest thickness of shell, depth of sulcus, height of fold, and shape of tongue) are common to *Yocrarhynchus* n. gen. and *Stenometoporhynchus*, the latter is easily separated by: medium to large size; subquadrate contour of pedicle valve in ventral view; lateral commissures located low; postero-lateral depressions on both sides of ventral umbonal region; protruding cardinal angles; frontal margin narrower than cardinal margin; reduced ventral flanks; sulcus usually wider at front (58 to 76 percent of width of shell for *Stenometoporhynchus*, while most values are between 58 and 69 percent for *Yocrarhynchus*), and starting at greater distance from beak; clearly delimited ventral interarea; more median costae and generally more lateral costae; wider apical angle; moderately thick, subparallel, and widely separated dental plates; thin, low, and lamellar septum.

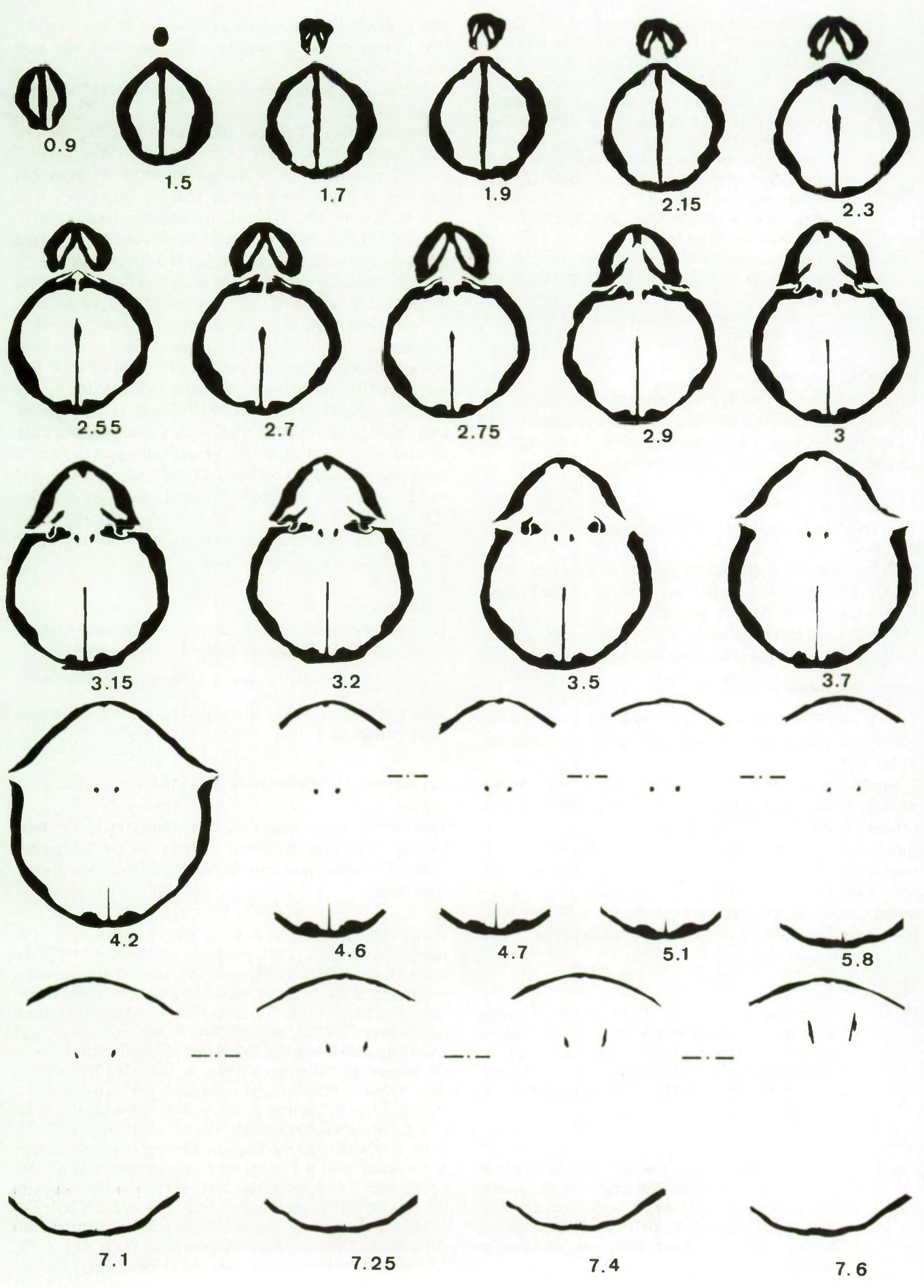
Yocrarhynchus orientalis (CHEN, 1978b)

Plate 1, Figures 1-50; Text-figures 1, 2.

SYNONYMY

1974 *Leiorhynchus orientalis* Chen* - CHEN, p. 47, p. 50, p. 51;1978a *Leiorhynchus orientalis* Chen (sp. nov.) - CHEN, p. 114;





- 1978b *Leiorhynchus orientalis* Chen (sp. nov.) - CHEN, p. 326, p. 327, pl. 139, figs. 2a-e, 3a-e, 4a-e;
- 1984 *Ypsilorhynchus orientalis* (CHEN) - CHEN, p. 98, table 2, p. 100, p. 103, pp. 127-130, p. 135, pl. 7, figs. 2a-e, 3a-e, 4a-e (= pl. 139, figs. 3b,a,d,c,e in CHEN, 1978b), 5a-e, 6a-e (6b,e = pl. 139, figs. 2a,e in CHEN, 1978b), 7a-e (7a,d,c = pl. 139, figs. 2b,c,d in CHEN, 1978b), 8a-e (8b,e,d = figs. 29a-c in *textu* p. 127), 9a-e, 10a-e (10b,e,c = figs. 30a-c in *textu* p. 127), 11a-e, 12a-e, pl. 8, figs. 1a-e (= pl. 139, figs. 4b,a,c,d,e in CHEN, 1978b), 2a-e, 3a-e, 4a-e, 5a-e;
- 1988 *Leiorhynchus orientalis* Chen - HOU *et al.*, p. 30, p. 80, p. 89, table 7, p. 91, table 11, p. 111, pl. 45, figs. 6a-c;
- non 1988 *Ypsilorhynchus orientalis* (Chen) - JIA *et al.*, pl. 4 (= p. 91), figs. 18a,b.

MATERIAL

Five hundred and twenty-five specimens, including the primary types and two hundred forty-four examples collected by the author, have been studied. More than 80 percent are in good state of preservation.

DESCRIPTION

This refers only to generic characters in need of further detail.

Sulcus starting at around 20 percent of length of shell. Width at front is 58 to 75 percent of width of shell (most values between 58 and 69 percent).

The general costal formula, which is a grouping of at least 75 percent of the specimens in median, parietal, and lateral categories is: $\frac{2-4}{1-3}$; 0; $\frac{0-2}{0-3}$.

The ratios of median and lateral costae (in specimens in which such observations were possible) are given in Table 1.

Median costae 1.5 to 5.5mm (generally 1.5 to 2.5mm) wide at front. In 75 percent of specimens there are two primary costae on fold; generally one is divided, sometimes both, a short distance from beak into two costae commonly of different width and height; in 25 percent of specimens none is divided, and only rarely does an external costa undergo division near the front. Sulcus contains a median primary costa, exceptionally divided, and

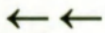


Fig. 1 — *Yocrarhynchus orientalis* (CHEN, 1978b). Camera lucida drawings of serial transverse sections; figures are distances in mm forward of the dorsal umbo. Topotype K, I.R.Sc.N.B. n° a10153. Measurements: length = 17.7 mm; width = 20.1 mm; thickness = 16.3mm.



Fig. 2 — *Yocrarhynchus orientalis* (CHEN, 1978b). Camera lucida drawings of serial transverse sections; figures are distances in mm forward of the dorsal umbo. Topotype L, I.R.Sc.N.B. n° 10154. Measurements: length = 18.6 mm; width = 21 mm; thickness = 16.8 mm.

one or generally two intercalated costae or, more rarely, two to four costae of similar width, of which one may divide.

Lateral costae are present in about 40 percent of specimens.

Measurements of sixteen specimens, including the primary types of 1978b, were given by CHEN (1984, table 17, p. 128); measurements of ten specimens photographed in the present paper are given in Table 2. Topotypes A-D (I.R.Sc.N.B. n° 10143-10146) are adult specimens, topotypes E-I (I.R.Sc.N.B. n° 10147-10151) are ephebic, and topotype J (I.R.Sc.N.B. n° 10152) is a juvenile.

Top of pedicle valve located at a point between 21 and 36 percent of length of shell forward of beak or between 23 and 29 percent of unrolled length of valve. Greatest thickness of brachial valve, and thus of shell, located at a point between 40 and 60 percent of length of shell forward of umbo. Highest part of tongue is situated at a point between 19 and 31 percent of thickness of shell below top. Maximum width of shell occurs at a point between 47 and 60 percent of length of shell anterior to ventral beak (most values are between 47 and 53 percent). Apical angle varies from 112° to 127° (most values are between 120° and 125°).

Transverse serial sections of two specimens (topotypes K, L) are shown in Figures 1, 2.

COMPARISONS

Yocrarhynchus adrianovae is easily separated from *Y. orientalis* by the costation: general costal formula $\frac{4-6}{3-5}$; 0; $\frac{4-5}{5-6}$; usually two or three primary costae on fold, and two in sulcus; divisions more common; subregular pattern as a rule.

GEOGRAPHICAL DISTRIBUTION AND STRATIGRAPHICAL POSITION

Yocrarhynchus orientalis is very abundant at the type locality, Tuqiaozi, Beichuan County, in the Longmenshan Mountains, northern Sichuan Province, south-central China.

Y. orientalis is found in bed 20, one of twenty-three beds recognized by CHEN (1974, pp. 47-50; 1984, pp. 98-99) in the lower Frasnian Tuqiaozi Member, the lower of two members recognized in the Frasnian Shawozi Formation (*stratum typicum*). Bed 20 is a 13.2m (13.2m in 1984, 13.24m in 1974) thick unit between 247.44 and 260.64m (between 247.44 and 260.64m in 1984, between 247.74 and 260.98m in 1974) above the base of the 310.91m (310.91m in 1984, 311.7m in 1974) thick Tuqiaozi Member, and is included (1974, p. 51, p. 52; 1984, p. 95, p. 102, table 4, p. 102, p. 103), with beds 19 and 21, in a *Leiorhynchus* Community. HOU *et al.* (1988, pp. 27-31, p. 89, p. 90) elevated the Tuqiaozi Member to formation rank and reduced it to a 220.4m thick unit by removing CHEN's (1984) beds 2 to 9 at the base and moving the top higher; in this new definition, the Tuqiaozi Formation includes beds 128 to 143 from base to top. *Yocrarhynchus orientalis* is mentioned (HOU *et al.*, 1988, p. 30, p. 89, table 7, p. 91, p. 425) in the 17.17m thick bed between 97.31m and 114.48m above the base

Table 1.
Number of median and lateral costae.

| Median costae | | | | | | | Lateral costae | | | | | | |
|------------------|-----------------|------|-------------------|------|--------|------|------------------|-----------------|------|-------------------|------|--------|------|
| Number of costae | Adult specimens | | Epehbic specimens | | Total | | Number of costae | Adult specimens | | Epehbic specimens | | Total | |
| | Number | % | Number | % | Number | % | | Number | % | Number | % | Number | % |
| 2/1 | 10 | 15.6 | 26 | 28.9 | 36 | 23.4 | 0 | 25 | 48.1 | 55 | 67.9 | 80 | 60.2 |
| 3/2 | 12 | 18.8 | 39 | 43.3 | 51 | 33.1 | 1/2 | 2 | 3.8 | 7 | 8.7 | 9 | 6.7 |
| 4/3 | 35 | 54.7 | 25 | 27.8 | 60 | 39 | 2/3 | 7 | 13.5 | 9 | 11.1 | 16 | 12 |
| 5/4 | 7 | 10.9 | | | 7 | 4.5 | 3/4 | 11 | 21.1 | 7 | 8.7 | 18 | 13.5 |
| | 64 | 100 | 90 | 100 | 154 | 100 | 4/5 | 3 | 5.8 | 2 | 2.4 | 5 | 3.8 |
| | | | | | | | 5/6 | 4 | 7.7 | 1 | 1.2 | 5 | 3.8 |
| | | | | | | | | 52 | 100 | 81 | 100 | 133 | 100 |

Table 2.
Measurements (in mm) based on 10 specimens are tabulated below; figures in parentheses are reasonable estimates on damaged specimens. Abbreviations used: l = length; w = width; t = thickness; pv = pedicle valve; bv = brachial valve.

| in mm | Topotype A | Topotype B | Topotype C | Topotype D | Topotype E | Topotype F | Topotype G | Topotype H | Topotype I | Topotype J |
|--------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | I.R.Sc.N.B. N° a 10143 | I.R.Sc.N.B. N° a 10144 | I.R.Sc.N.B. N° a 10145 | I.R.Sc.N.B. N° a 10146 | I.R.Sc.N.B. N° a 10147 | I.R.Sc.N.B. N° a 10148 | I.R.Sc.N.B. N° a 10149 | I.R.Sc.N.B. N° a 10150 | I.R.Sc.N.B. N° a 10151 | I.R.Sc.N.B. N° a 10152 |
| l | 21.5 | 18.5 | 17.6 | 17.4 | (16.2) | (16.2) | 16.1 | (15.2) | 14.9 | 14.2 |
| w | 21.3 | 20.9 | 20.9 | 19.9 | 18.6 | 18.3 | 17.1 | (17.3) | 15.6 | 14.7 |
| lpv unrolled | 28.5 | 26.5 | 25.0 | (24.0) | (21.5) | (22.0) | 22.5 | (19.5) | 20.0 | 18.0 |
| t | 17.8 | 16.1 | 16.4 | 15.1 | 12.3 | 12.8 | 14.0 | (12.4) | 11.0 | 9.2 |
| tpv | 6.4 | 4.9 | 5.9 | 5.9 | 4.6 | 5.2 | 5.1 | (3.8) | 3.6 | 3.6 |
| tbv | 11.4 | 11.2 | 10.5 | 9.2 | 7.7 | 7.6 | 8.9 | (8.6) | 7.4 | 5.6 |
| l/w | 1.0 | 0.89 | 0.84 | 0.87 | (0.87) | (0.89) | 0.94 | (0.88) | 0.96 | 0.97 |
| t/w | 0.84 | 0.77 | 0.79 | 0.76 | 0.66 | 0.7 | 0.82 | (0.72) | 0.71 | 0.63 |
| t/l | 0.83 | 0.87 | 0.93 | 0.87 | (0.76) | (0.79) | 0.87 | (0.82) | 0.74 | 0.65 |
| apical angle | 112° | 122° | 123° | 124° | 127° | (120°) | 112° | ? | 115° | 114° |

of the formation. The same authors also recognized (1988, p. 80, p. 89, table 11, p. 111) a *Leiorhynchus mansuyi* - *L. orientalis* Assemblage Zone in beds 134 to 136, which are 37.04m thick, extend between 86.08 and 123.12m above the base of the Tuqiaozi Formation, and are equivalent (p. 89) to CHEN's (1984) beds 20 and 21; this zone lies in the upper part of a set of strata assigned (HOU *et al.*, 1988, table 11, p. 111) to the Lower to Upper *Polygnathus asymmetricus* Zones (about *Palmatolepis transitans*, *P. punctata* and Early *P. hassi* Zones in present terminology). My collection (SIC-86-7 and SIC-86-8') was obtained between 97.5 and 112.5m above the base of the Tuqiaozi Formation. In short, the species has a restricted stratigraphical range.

Geographical distribution and stratigraphical position of *Yocrarhynchus n. gen.*

Those of *Y. orientalis* are given above.

Y. adrianovae n. gen., n. sp. is abundant at outcrops in the river valleys on the western slope of the North Urals, in the Kolva-Vishera Territory of the Perm (former Molotov) Administrative Region: Niz'va (168 specimens) and Vishera (1 specimen). The species is found in the lower part of the Domanik horizon, the lowest of three recognized in the middle Frasnian of the western slope of the Urals. In terms of conodont zonation the Domanik horizon corresponds to the *Polygnathus timanicus* Zone [approximately equivalent to the Middle and Upper *P. asymmetricus* Zones (*Palmatolepis punctata* and Early *P. hassi* Zones in present terminology)] and the *Ancyrognathus triangularis* Zone (Late *Palmatolepis hassi* and *P. jamieae* Zones in present terminology).

In short, the age of the new genus lies somewhere in the Middle and Upper *Polygnathus asymmetricus* Zones (*Palmatolepis punctata* and Early *P. hassi* Zones in present terminology).

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At Chengdu College of Geology, in 1986, I had the opportunity to examine the types, as well as the large collections of CHEN Yuan-ren, and was shown the Longmenshan section. I am very grateful for all the

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Explanation of Plate 1

Yocrarhynchus orientalis (CHEN, 1978b)

All figures are natural size

- Figs. 1-5 — Topotype A, I.R.Sc.N.B. n° a10143. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{2}{1}$; 0; 0.
- Figs. 6-10 — Topotype B, I.R.Sc.N.B. n° a10144. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{5}{4}$; 0; 0.
- Figs. 11-15 — Topotype C, I.R.Sc.N.B. n° a10145. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{4}{3}$; 0; $\frac{2}{3}$.
- Figs. 16-20 — Topotype D, I.R.Sc.N.B. n° a10146. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{4}{3}$; 0; $\frac{1}{2}$.
- Figs. 21-25 — Topotype E, I.R.Sc.N.B. n° a10147. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{3}{2}$; 0; 0.
- Figs. 26-30 — Topotype F, I.R.Sc.N.B. n° a10148. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{3}{2}$; 0; $\frac{2}{3}$.
- Figs. 31-35 — Topotype G, I.R.Sc.N.B. n° a10149. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{3}{2}$; 0; 0.
- Figs. 36-40 — Topotype H, I.R.Sc.N.B. n° a10150. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{4}{3}$; 0; $\frac{3}{4}$.
- Figs. 41-45 — Topotype I, I.R.Sc.N.B. n° a10151. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{3}{2}$; 0; 0.
- Figs. 46-50 — Topotype J, I.R.Sc.N.B. n° a10152. Ventral, dorsal, frontal, apical, and lateral views. Costal formula:
 $\frac{2}{1}$; 0; $\frac{1}{2}$.

Plate I.

