

TWO NEW NORTH AMERICAN GIVETIAN RHYNCHONELLID (BRACHIOPOD) ZONES

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(1 figure, 1 table & 2 plates)

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ABSTRACT. The bringing up to date of the taxonomic position of *Leiorhynchus* Hall, 1860 restricts the stratigraphical range of the genus, and leads to the establishment of two North American range zones: the late Givetian *Leiorhynchus* Zone and the early to middle Givetian *Eliorhynchus* Zone. A new rhynchonellid genus, *Mononusphaericorhynchus*, with type species *Leiorhynchus* (L.) *sartenaeri* Johnson, 1974, is described from the latest Eifelian-early Givetian (*ensensis* Zone) of central Nevada, USA.

KEYWORDS: Rhynchonellids, *Leiorhynchus*, *Eliorhynchus*, *Mononusphaericorhynchus* n. gen., Givetian, Canada, USA.

RESUME. Deux nouvelles zones à Rhynchonellides (Brachiopodes) du Givetien d'Amérique du Nord. La position taxonomique de *Leiorhynchus* Hall, 1860 fait l'objet d'une mise au point. Il en résulte une réduction de l'extension stratigraphique du genre. Deux zones d'extension nord-américaines sont proposées: une Zone à *Leiorhynchus* d'âge givetien supérieur et une Zone à *Eliorhynchus* d'âge givetien inférieur et moyen. L'auteur décrit un nouveau genre rhynchonellide de l'Eifélien terminal-Givetien inférieur (Zone à *ensensis*), *Mononusphaericorhynchus*, dont l'espèce-type est *Leiorhynchus* (L.) *sartenaeri* Johnson, 1974 de la partie centrale de l'Etat du Nevada aux Etats-Unis d'Amérique.

MOTS-CLES: Rhynchonellides, *Leiorhynchus*, *Eliorhynchus*, *Mononusphaericorhynchus* n. gen., Givetien, Canada, Etats-Unis d'Amérique.

1. INTRODUCTION

1.1. SYSTEMATICAL POSITION OF THE GENUS *LEIORHYNCHUS* HALL, 1860

Redescription by Sartenaer (1961) of *Leiorhynchus* Hall, 1860 and the reillustration of its type species, *L. quadracostatus* (Vanuxem, 1842), made it possible to reinvestigate the various taxa unduly assigned to the genus.

With the exceptions of the Frasnian genus *Caryorhynchus* Crickmay, 1952 and the Famennian genus *Basilicorhynchus* Crickmay, 1952, of which the type species, *Leiorhynchus carya* Crickmay, 1952 and *L. basilicus* Crickmay, 1952, respectively, were inadvertently assigned to *Leiorhynchus* two

months before, it is from 1961 on that new genera were introduced with, as type species, species previously attributed to *Leiorhynchus*. Such are (type species are indicated in parentheses): the Eifelian genera *Praeleiorhynchus* Rzhonsnitskaya, 1968 = *nomen nudum* [*Leiorhynchus* (?) *kuznetzianus* Rzhonsnitskaya, 1968], *Salairotoechia* Rzhonsnitskaya, 1968 (*Nudirostra*? *pseudocarens* Kulkov, 1960) (*Nudirostra* has been an erroneous substitute for *Leiorhynchus* for a few years from 1951 on; see Sartenaer, 1959), *Ypsilorhynchus* Sartenaer, 1970 (*Leiorhynchus manetoe* McLaren, 1962), and *Properotundirostrum* Sartenaer, 1986 (*Leiorhynchus miriam* Johnson, 1971); the Givetian genera *Stenoglossariorhynchus* Sartenaer, 1970 (*Leiorhynchus awokanak* McLaren, 1962) and *Hadrotatorhynchus* Sartenaer, 1986 (*Leiorhynchus Halli* Flamand, 1911);

the Givetian-Frasnian genus *Platyterorhynchus* Sartenaer, 1970 (*Leiorhynchus russelli* McLaren, 1962); the Frasnian genera *Lateralatirostrum* Sartenaer, 1979 (*Leiorhynchus athabascense* Kindle, 1924), *Stenometeorhynchus* Sartenaer, 1987a (*Liorhynchus Pavlovi* Nalivkin, 1930), *Tomestenoporhynchus* Sartenaer, 1993 (*Liorhynchus rudkini* Lyashenko, 1959), and *Yocrarhynchus* Sartenaer, 1995 (*Leiorhynchus orientalis* Chen, 1978); the Famennian genera *Rugaltarostrum* Sartenaer, 1961 (*Leiorhynchus madisonense* Haynes, 1916), *Trifidorostellum* Sartenaer, 1961 (*Leiorhynchus dunbarensense* Haynes, 1916), *Pseudo-leiorhynchus* Rozman, 1962 (falls into synonymy with *Trifidorostellum*) (*Liorhynchus uralicus* Nalivkin, 1947), *Evanescirostrum* Sartenaer, 1965 (*Nudirostra gibbosa seversoni* McLaren, 1954), *Gastrodetoechia* Sartenaer, 1965 (*Leiorhynchus utahensis* Kindle, 1908), *Planovatiostrum* Sartenaer, 1970 (*Liorhynchus plano-ovalis* Nalivkin, 1937), *Rozmanaria* Weyer, 1972 (*Liorhynchus? equitans* Schmidt, 1924), *Araratella* Abramian, Plodowski & Sartenaer, 1975 (*Liorhynchus dichotomians* Abramian, 1954), and *Orbiculatisinurostrum*, Sartenaer, 1984 (*Leiorhynchus laevis* Gürich, 1903; the Carboniferous genus *Ovlatchania* Abramov & Grigor'yeva, 1986 (*Leiorhynchus ovlatchanensis* Abramov, 1970).

Other genera were based on type species not originally placed in the genus *Leiorhynchus*, but later assigned to it by most authors: the early and middle Givetian genus *Eliorhynchus* Sartenaer, 1987b (*Rhynchonella castanea* Meek, 1867; following the latest decision on the position of the Eifelian/Givetian boundary, the species is not present any more in the latest Eifelian); the Givetian genera *Eumetabolotoechia* Sartenaer, 1975 [*Rhynchonella* (?) *Laura* Billings, 1860] and *Ense* Struve, 1992 (*Rhynchonella pumilio* Roemer, 1855); the Frasnian genus *Ryocarhynchus* Sartenaer, 1984 (*Camarophoria tumida* Kayser, 1872); the Famennian genera *Tenuisinurostrum* Sartenaer, 1967 (*Camarophoria crenulata* Gosselet, 1877) and *Brunnirhyncha* Havlíček, 1979 [*Rhynchonella* (*Leiorhynchus*) *rhomboidea* Oppenheimer, 1916 (non *Terebratula rhomboidea* Phillips, 1836)]; and the Carboniferous genus *Corrugatimediostrum* Sartenaer, 1970 (*Terebratula Rocky-Montana* Marcou, 1858).

Outside type species, many species originally assigned to *Leiorhynchus* are now included in other genera: the Givetian species *Leiorhynchus Huronensis* Nicholson, 1874 in *Eumetabolotoechia*; the Frasnian species *Leiorhynchus tuqiaziensis* Chen, 1978 in *Stenometeorhynchus*; the Famennian species *Leiorhynchus cascadenense* Warren, 1927 and *L. walcotti* Merriam, 1940 in, respectively, *Trifidorostellum* and *Eoparaphorhynchus* Sartenaer, 1961; etc...

Many species originally put in other genera than *Leiorhynchus*, but later assigned to it by most authors, are now included in other genera, e.g. the Frasnian species *Gypidula mansuyi* Grabau, 1931, *Terebratula formosa* Schnur, 1851, and *T. (Atrypa) megistana* Le Hon, 1870 in, respectively, *Stenometeorhynchus*, *Phlogoiderhynchus* Sartenaer, 1970, and *Calvinaria* Stainbrook, 1945.

Finally there remains a whole string of species still erroneously tied to *Leiorhynchus*: the Givetian species *Leiorhynchus* (*Leiorhynchoides*) *altaicus* Dovgal, 1953 and *L. iris* Hall, 1867; the Frasnian species *L. mesacostalis* Hall, 1843 and *L. longmenshanensis* Chen, 1978; the Famennian species *L. Lesleyi* Hall & Clarke, 1893 and *L. ohioense* Prosser, 1912; etc...

1.2. STRATIGRAPHICAL RANGE OF THE GENUS *LEIORHYNCHUS* HALL, 1860

Species of *Leiorhynchus* are mentioned in the literature from the late Silurian to the late Permian. Revision of the genus by Sartenaer (1961) implied almost *ipso facto* a considerably reduced stratigraphical range for the genus, and, thus, new generic assignments for many of its 220 or so species, subspecies and varieties, some 150 or so by original designation as Sartenaer (1961: 963; 1987b: 139) has indicated, and 70 or so by subsequent decisions. The exclusion of *Leiorhynchus* from the Silurian, Lower Devonian, Eifelian, Famennian, late Frasnian, Carboniferous, and Permian does not raise any major objection any more. It is enough to entrust time and palaeontologists working in various regions to correct past, and present, errors. The process is under way as demonstrated by the species at both ends of the stratigraphical range of the genus: the Silurian species *Liorhynchus Bodenbenderi* Kayser, 1897 is placed now in the genus *Clarkeia* Kozłowski, 1923, and the Permian species *Leiorhynchus variabilis* Ustritskiy, 1961 in the genus *Leiorhynchoidea* Cloud, 1944. Other examples have been given under 1.1.

Thus, the only remaining problem to consider is the early Givetian to middle Frasnian age of *Leiorhynchus*. Most of the Givetian species of the genus *Leiorhynchus* do not belong to it as exemplified in the classical Devonian region of SW New York [e.g. *L. dubius* Hall, 1867, *L. limitaris* (Vanuxem, 1842), *L. multicosta* Hall, 1860, *L. mysia* Hall, 1867].

As far as early and middle Frasnian species are concerned, Sartenaer (1968: 6; 1983: 43; 1984: 6; 1985: 314; 1987a: 125, 132; 1987b: 139, 146; 1995: 119) has already mentioned their exclusion from the

genus *Leiorhynchus*. Three critical areas of the world are chosen as examples: the Russian Platform (e.g. *L. elegans* Lyashenko, 1959, *L. elevatus* Lyashenko, 1960, *L. jaregae* Lyashenko, 1960, *L. politus* Lyashenko, 1959); South China (e.g. *L. Deprati* Mansuy, 1912, *L. hubaensis* Xian, 1978, *L. longmenshanensis* Chen, 1978, *L. mesoplicata* Fang, 1974, *L. Deprati obesus* Grabau, 1931, *L. tenuiplicatus* Chen, 1978, *Nudirostra sinensis* Fang, 1974, *N. subelliptica* Fang, 1974); SW New York (e.g. *L. mesacostalis* Hall, 1843, *L. robustus* Hall & Clarke, 1893, *L. sinuatus* Hall, 1867).

So we come to the conclusion that only a few Givetian species belong to the genus *Leiorhynchus*. This includes of course the type species *L. quadracostatus*; as a matter of fact, Sartenaer (1983: 43; 1984: 6; 1985: 314; 1987a: 125, 128; in Norris *et al.*, 1992: 48) has already drawn attention to a formal problem connected with accepted international language: following the latest decision on the position of the Givetian/Frasnian boundary, *L. quadracostatus* has acquired a late Givetian age instead of its previous early Frasnian age. Some species have already found their place in appropriate genera [e.g. *L. kelloggi* Hall, 1867 in *Eumetabolotoechia*, *L. Huronensis* (see 1.1.)]. Others are brushed aside, because they have no similarity whatever to *Leiorhynchus* (e.g. *L. iris* Hall, 1867, *L. lucasi* Stewart, 1927, other examples in 1.2.). The only ones worth considering are the early Givetian species *L. castanea* (Meek, 1867), the latest Eifelian-early Givetian species *L. (L.) sartenaeri* Johnson, 1974, and the middle Givetian [erroneously considered as early Frasnian by Chen (1978a: 114; 1978b: 327; 1984: 99, table 2, 100, 136-138)] species *L. sichuanensis* Chen, 1978, because they show some or close similarity to *Leiorhynchus*. The first one has become the type species of *Eliorhynchus* Sartenaer, 1987b; its redefinition by Sartenaer (1987b) has resulted in the exclusion of middle and late Givetian forms erroneously incorporated with it. The second species was already separated from *E. castanea* by Johnson (1974) (see synonymy in 2.2.); the author goes one step further in choosing it as the type species of a new genus described in 2.1. The third one belongs to the genus *Stenoglossariorhynchus*, and not to the genus *Platyterorhynchus* Sartenaer, 1970 as proposed by Chen (1984).

This leaves us with no early and middle Givetian species in the genus *Leiorhynchus*. The only species and subspecies included up to the present in it are of late Givetian age: *L. quadracostatus* from SW New York, *L. quadracostatus alces* Sartenaer, 1992 from northern Ontario, *L. hippocastanea* (Crickmay, 1960) from the District of Mackenzie, Northwest Territories, and *L. sphaericum* Cooper & Dutro, 1982 from SW

New Mexico. The author proposes therefore to found a late Givetian North American *Leiorhynchus* Zone. The introduction of this zone allows indirectly to establish a second North American one, the early to middle Givetian *Eliorhynchus* Zone. This latter zone includes the early Givetian *E. castanea* Zone of the Lower Mackenzie River Valley, District of Mackenzie, Northwest Territories, as well as the following new species mentioned by Sartenaer (1987b: 145): a new middle Givetian species from the SW part of the District of Mackenzie to be described in a forthcoming paper, by Norris, Uyeno and Sartenaer, on the brachiopods and conodonts of the Bituminous limestone member (upper part of *ensensis* Zone, Early and Middle *varcus* Subzones) of the Pine Point Formation, on the south bank of Great Slave Lake; and new lower and middle Givetian forms from both central Nevada and the SW part of the District of Mackenzie mentioned in the literature as *Leiorhynchus castanea* and *L. (Ypsilorhynchus) castanea*. Both these zones are range zones.

2. SYSTEMATIC PALAEONTOLOGY

Order Rhynchonellida Kuhn, 1949
 Superfamily Rhynchonellacea Gray, 1848
 Family Camarotoechiidae Schuchert & LeVene,
 1929
 Subfamily Leiorhynchinae Stainbrook, 1945

2.1. GENUS *MONONUSPHAERICORHYNCHUS* n. gen.

2.1.1. Type species

Leiorhynchus (Leiorhynchus) sartenaeri Johnson, 1974. The species is abundant, and represented by about 425 specimens in the available collections: about 300 specimens in Johnson's collection at Oregon State University in Corvallis; the three primary types housed in the National Museum of Natural History in Washington; about 100 specimens in Merriam's collection deposited in the same institution; and, 24 specimens presented to the author by Merriam and Johnson. All this material was examined, and 77 specimens were measured: the three primary types; the 24 specimens received as a gift; and, 50 specimens from Johnson's collection.

2.1.2. Derivatio nominis

ΜΟΝΟΝΟΥ (Greek, adverb) = almost; σφαιρικός, η, ον (Greek, adjective) = sphaerical; το ρυγχός (Greek, neutral) = beak. the name has been chosen to draw attention to the subsphaerical shape of the shell.

2.1.3. Diagnostic features

Small sized. Subcircular (generally). Strongly inequivalve (deeply dorsi-biconvex). Subsphaerical, because length, width, and thickness have similar values. Dorsal umbonal region not or slightly projected posteriorly beyond the pedicle valve. Frontal commissure slightly crenulated by the low costae. Sulcus weakly developed and wide, starting at a relatively great distance from the beak. Tongue subrectangular and strongly deflected. Curve of brachial valve, in longitudinal median sections, is one quarter of a circumference. Greatest thickness of brachial valve never at front, but posterior (sometimes very posterior) to it. Width is generally the largest dimension. Low well marked median costae begin near to the beaks. Lateral costae commonly present. Dental plates converging strongly and meeting on the floor of the pedicle valve. Septum blade- to lens(thin)-shaped.

2.1.4. Species attributed to the genus

Only the type species is attributed to the genus.

2.1.5. Description

Small sized. In cardinal view the contour is generally helmet-shaped (brachial valve) with check-trap (pedicle valve) still attached. Subcircular (generally) to longitudinally subelliptical contour in ventral and dorsal views, slightly modified in a subpentagonal contour in ventral view. Strongly inequivalve (deeply dorsi-biconvex). Subsphaerical. Dorsal umbonal region not or slightly projected posteriorly beyond the pedicle valve. Hinge line short. Postero-lateral margins concave near the commissure. Commissure sharp. Top of pedicle valve located posteriorly between 24 and 48 per cent of length of shell forward of the beak or between 20 and 32 per cent of the unrolled length of the valve. Greatest thickness of brachial valve never at the front, but posterior (sometimes very posterior) to it at a point between 38 and 46 per cent of length of shell posterior to the frontal commissure, and, from this point, the valve curves gently toward the commissure. With few exceptions, width is the largest dimension. Maximum width located at a point between 50 and 63 per cent of length of shell anterior to the ventral beak. Length, width and thickness have similar values. Apical angle wide. Frontal commissure slightly crenulated by the low costae. When lateral costae are present, they slightly undulate the lateral commissures.

Contour of pedicle valve is a more or less regular half-ellipse in longitudinal median sections, a very flattened half-ellipse in transverse median sections. From a postero-median protuberance, the slope of

the ventral flanks (toward the lateral commissures) increases progressively from slightly anteriorly to steeply posteriorly. Weakly developed and low sulcus, clearly separated from the flanks, and reaching its greatest width at the junction of the frontal and lateral commissures: 62 to 77 per cent of the width of shell. Sulcus with a flat to slightly convex bottom, starting at a relatively great distance from the beak: between 42 and 57 per cent (generally between 42 and 51 per cent) of the length of shell or between 35 and 40 per cent of the unrolled length of the valve. Tongue high with sharp borders, standing out clearly, strongly deflected (sometimes at right angle), generally subrectangular (i.e. borders of the tongue are subparallel to parallel), sometimes trapezoidal. Upper part of tongue usually vertical. The top of tongue never coincides with the top of the shell; it is located between 8.5 and 21 per cent of the thickness of the shell from its top. Beak small, erect to slightly incurved, not overhanging the hinge line, but nevertheless almost in contact with the inflated dorsal umbonal region. Foramen small, subcircular. Ventral interarea short and poorly delimited. Deltoidal plates observed in transverse serial sections.

Curve of brachial valve, in longitudinal median sections, is one quarter of a circumference. Contour helmet-shaped in cardinal view. Dorsal flanks steep, vertical or almost vertical near the lateral commissures. Fold low with flat top, beginning at a relatively short distance from the beak.

Costae low, well marked, moderately wide, regular, angular with rounded top, and beginning near to the beaks, usually posterior to the beginning of sulcus and fold. Divisions (one, exceptionally two) have been observed in a few specimens. Furrows regular. Very low, and weakly-marked lateral costae are present in about 70 per cent of specimens; they are simple, regular, and extend posteriorly to mid-length. Parietal costae sometimes present. The general costal formula is:

$$\begin{array}{ccc} 4 \text{ to } 6 & & 2 \text{ to } 3 \\ \text{-----}; & 0; & \text{-----} \\ 3 \text{ to } 5 & & 3 \text{ to } 4 \end{array}$$

the general costal formula gives a grouping of at least 75 per cent of the specimens in the categories: median, parietal, and lateral.

Shell material thick. Dental plates moderately stout, developed only in the extreme posterior part of the pedicle valve; they strongly converge and meet on the floor of the valve. Ventral umbonal cavities well developed. Teeth small, stout, outwardly directed. Denticula well developed. Septum thin to moderately thick, blade- to lens(thin)-shaped with a

length that may extend as far as mid-length of the shell, but usually shorter. Hinge plate virtually non existing, marked in the middle by a low and narrow crural trough. Dental sockets narrow, low, short. Crural bases slender, passing progressively forward into relatively long and slender crura that curve ventrally at their distal ends; they are very near to each other in their proximal parts, and diverge progressively and slightly. Dorsal muscle field well marked, spindle-shaped, may extend forward as far as mid-length of the shell. They are strongly impressed on each side of the septum, bounded by strong ridges.

2.1.6. Comparisons

It is evident that *Mononusphaericorhynchus* n. gen. and the late Givetian genus *Leiorhynchus* exhibit similar features, as *Mononusphaericorhynchus sartenaeri* has been originally assigned to the latter genus. Some of the common characteristics are: inflated and deeply dorsi-biconvex aspect; wide apical angle; weakly developed and low sulcus and fold; tongue with sharp borders, standing out clearly; top of tongue corresponding to the most anterior part of shell at frontal commissure, and never coinciding with top of shell; short hinge line; small and erect to slightly incurved beak, almost in contact with the inflated dorsal umbonal region; helmet-shaped contour of brachial valve in cardinal view; many of the internal structures (short dental plates, well developed umbonal cavities, long septum, crural trough, divided hinge plate, small and short teeth and dental sockets, slender crural bases and crura, spindle-shaped dorsal muscle scars). However many characteristics make *Mononusphaericorhynchus* n. gen. distinct from *Leiorhynchus*: small size; subsphaerical shape on account of length, width and thickness having similar values (l/w , t/w , t/l = 0.90 to 0.95, 0.81 to 0.94, 0.87 to 0.98, respectively, in *Mononusphaericorhynchus*, 0.86 to 0.94, 0.56 to 0.80, 0.65 to 0.85, respectively, in *Leiorhynchus*); maximum thickness often located less posteriorly; median longitudinal curvature of pedicle valve: high half-ellipse to one half a circumference (low to high half-ellipse in *Leiorhynchus*); median longitudinal curvature of brachial valve: one half a circumference; contour rarely transversely elliptical in ventral and dorsal views (commonly in *Leiorhynchus*); frontal commissure slightly crenulated by higher costae; lateral costae, when present, slightly undulating the lateral commissures (lateral commissures are little or not undulated by the lateral costae, which are always present in *Leiorhynchus*); higher and generally subrectangular tongue (tongue is always trapezoidal in *Leiorhynchus*); upper part of tongue usually vertical; due to its strong deflection, tongue is never stretched anteriorly, and its top is only a little,

sometimes not at all, anterior to a line joining the points of junction of the frontal and lateral commissures (top of tongue always clearly, sometimes considerably, anterior to the same line in *Leiorhynchus*); top of fold mostly flat (gently curved and sometimes flat in *Leiorhynchus*); median costae regular, higher, and angular with rounded top; lateral costae fewer and not always present (maximum 4 against about 10 in *Leiorhynchus*); regular median furrows; thicker shell material; strongly convergent dental plates meeting on the floor of the valve; usually thinner blade- to lens(thin)-shaped septum [lens(thick)- to club-shaped posteriorly in *Leiorhynchus*].

It is to *Eliorhynchus* of early and middle Givetian age that the new genus is nearest. Some of the features that *Mononusphaericorhynchus* n. gen. has in common with *Eliorhynchus* are: contour, in cardinal view, generally helmet-shaped (brachial valve) with check-trap (pedicle valve) still attached; strongly inequivalve (deeply dorsi-biconvex) aspect; short hinge line; weakly developed, low, and wide sulcus with a flat to slightly convex bottom starting at a great distance from the beak; high tongue with sharp borders, standing out clearly, with top never coinciding with top of shell; contour of brachial valve helmet-shaped in cardinal view; dorsal flanks steep, vertical or almost vertical near the lateral commissures; greatest thickness of brachial valve never at front, but posterior (sometimes very posterior) to it; maximum width posterior to mid-length; similar values of apical angle; very low lateral costae, weakly marked, simple, regular, commonly present; many internal characters. *Mononusphaericorhynchus* n. gen. is easily distinguishable by: small size (small to medium sized, exceptionally large, in *Eliorhynchus*); generally subcircular contour in ventral and dorsal views (generally longitudinally subelliptical to suboval in *Eliorhynchus*); dorsal umbonal region not or slightly projected posteriorly beyond the pedicle valve (always more or less strongly projected posteriorly beyond the pedicle valve in *Eliorhynchus*, giving an inflated aspect to the shell); frontal commissure slightly (more slightly in *Eliorhynchus*) crenulated (undulated in *Eliorhynchus*) by the low costae; sulcus and fold clearly separated from the flanks (not easy to separate from the flanks, where they start, and only well marked at the junction of the frontal and lateral commissures in *Eliorhynchus*), starting somewhat more posteriorly; tongue strongly deflected, usually subrectangular (usually trapezoidal with top not rarely slightly convex in *Eliorhynchus*); upper part of tongue usually vertical (only exceptionally vertical in *Eliorhynchus*, because the tongue is less deflected and more stretched anteriorly); curve of brachial valve, in longitudinal median sections, is one quarter of a circumference (more often one

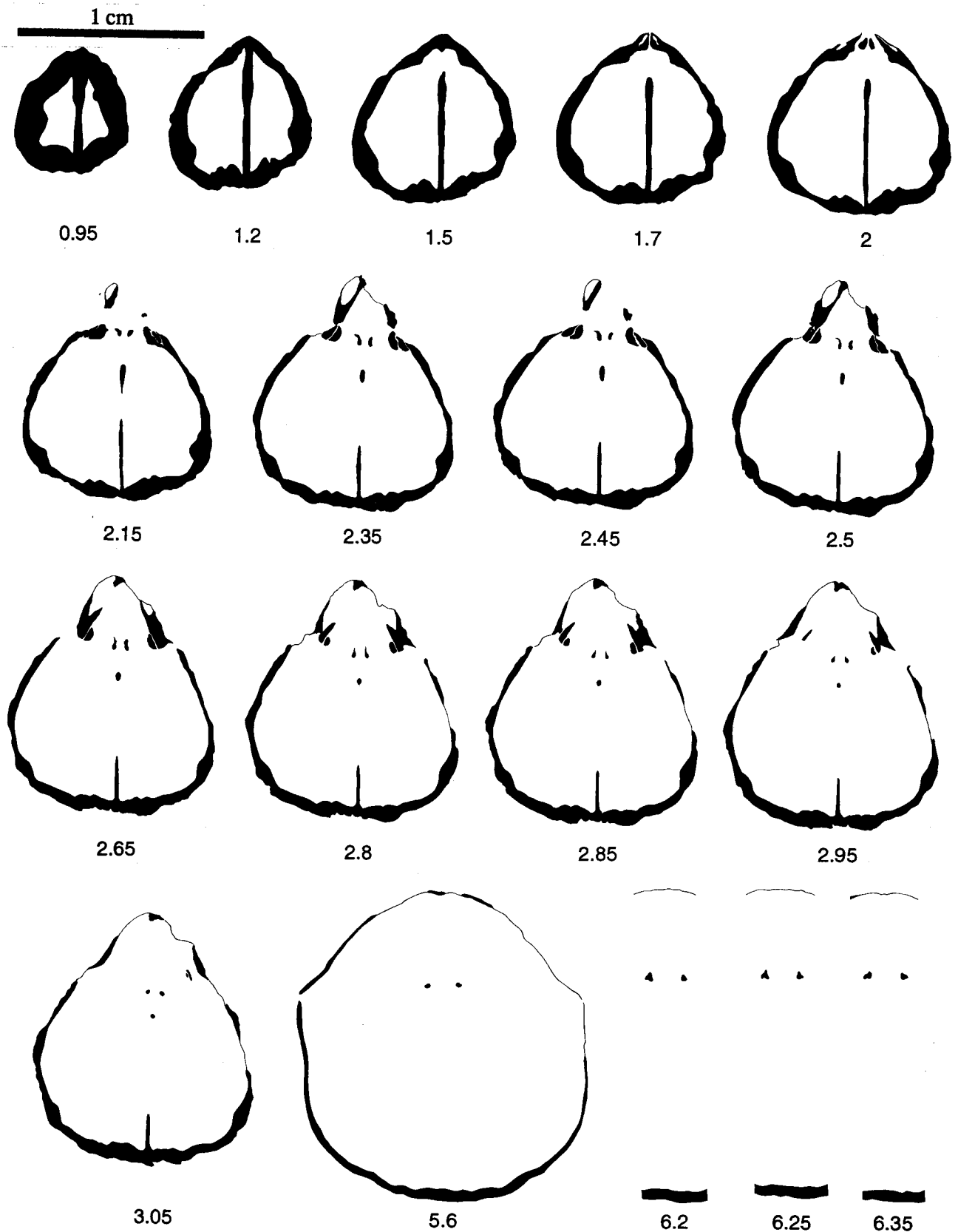


Figure 1. - Camera lucida drawings of transverse serial sections of *Mononusphaericorhynchus sartenaeri* (Johnson, 1974). Distances are in mm forward from the crest of the dorsal umbo. USNM 484520. Costal formula: 6/5; 0; 2/3. Measurements: width: 17mm; length: 16.7mm; thickness: 17mm. In saddle ¼ mi NE of hill 6989 on east flank of Sulphur Spring Range, near southern edge of Mineral Hill quadrangle. Woodpecker Limestone. UCR 3482. Collector: Murphy, M.A. This specimen is a topotype, and was presented to the author by Johnson, J.G. in June 1979. UCR = University of California in Riverside.

quarter of an ellipse slightly deformed by the inflation of the umbonal region in *Eliorhynchus*); fold with flat top (often slightly convex in *Eliorhynchus*) starting nearer to the beak; top of pedicle valve often located less posteriorly (on account of this, the contour of the pedicle valve, in longitudinal median sections, is often subsigmoid); width is generally the largest dimension (length is the largest dimension in *Eliorhynchus*); length, width and thickness have similar values (thickness and width may exceptionally be subequal in *Eliorhynchus*); median costae higher, although still low, well marked (weakly marked, although clearly visible in *Eliorhynchus*), angular with rounded top (rounded in *Eliorhynchus*), regular (in *Eliorhynchus* median costae vary in width and height), and beginning nearer to the beaks; divisions of median costae less common; furrows regular; parietal costae sometimes present; different general costal formulae :

4 to 6	2 to 3
-----;	0; -----
3 to 5	3 to 4

for *Mononusphaericorhynchus*;

4 to 5	2 to 6
-----;	0; -----
3 to 4	3 to 7

for *Eliorhynchus*); dental plates meeting on the floor of the pedicle valve (in *Eliorhynchus* they join either before reaching the floor of the valve or, and only sometimes, when they reach it); septum never lens(thick)- to club-shaped posteriorly.

2.2. MONONUSPHAERICORHYNCHUS SARTENAERI (JOHNSON, 1974)

Synonymy:

1884 *Rhynchonella castanea* Meek; Walcott: 153-155 *pro parte*, pl.15, figs.1, 1a, *cet. excl.*

e.p. 1970 *Eliorhynchus castanea*; Johnson: 2077, 2085, 2086, table 1, 2087, 2090, 2091, 2092.

1970 *Eliorhynchus castanea* (Meek, 1868)(small form); Johnson: 2097 *pro parte*, 2099 *pro parte*, 2102, pl.2 (=2096), figs.12-17, *cet. excl.*

1971 *Eliorhynchus castanea* (Meek, 1878); Johnson: 303 *pro parte*, 305 *pro parte*, 316 *pro parte*, 317 *pro parte*, pl.43, figs.27-31 (= pl.2, figs.14-17 in Johnson, 1970).

1974 *Eliorhynchus (Eliorhynchus) sartenaeri* n. sp.; Johnson: 49, table 1, 52, 56-58, pl.2, figs.28-42 (figs.33-37 = pl.2, figs.14-17 in Johnson, 1970 = pl.43, figs.27-31 in Johnson, 1971). Figs.38-42 = holotype.

1977 *Eliorhynchus (L.) sartenaeri* J; Johnson: table 4, 26.

1980 *Eliorhynchus (L.) sartenaeri* J; Johnson in Johnson *et al.*: table 12, 91.

1987b *Eliorhynchus (Eliorhynchus) sartenaeri* Johnson, 1974; Sartenaer: 140.

1990 *Eliorhynchus (L.) sartenaeri* J; Johnson: fig.27, 917, 919, 934, fig.49, 938.

e.p. indicates that *Mononusphaericorhynchus sartenaeri* was included in *Eliorhynchus castanea* before it was separated from it by Johnson (1974). It is plain that the *Eliorhynchus castanea* Zone (Johnson, 1970: table 1, 2087, table 2, 2089, 2097; 1971: text-fig.2, 304, 305-306, 309) and the *Eliorhynchus castanea* fauna (Johnson, 1970: 2092) include *Mononusphaericorhynchus sartenaeri* in their definition.

The description of the genus applies of course to its type species. The short original description by Johnson (1974: 56-58, pl.2, figs.28-42) is completed with the full synonymy just given, and with the first transverse serial sections (Fig.1) made in a specimen of the species. Six specimens have been photographed at natural size (Pl.2, figs.46-75) in order to submit a clear representation of the species. The stratigraphical position and the geographical distribution are recalled, because they are also those of the genus.

2.2.1. Stratigraphical position and geographical distribution

According to Johnson (1970: 2096, pl.2, figs.12-17, 2097 as *Eliorhynchus castanea* (small form); 1971: 316, pl.43, figs.27-31 as *L. castanea*; 1974: 49, 52, table 1, 56-58, pl.2, figs.28-42; 1977: 18, fig.2, 24, 25, 26, table 4, 29; 1990, 917, fig.27, 919, 934, appendix 1, 938, fig.49), and Johnson *et al.* (1980: 84, fig.5, 85-86, 91, table 12), *Mononusphaericorhynchus sartenaeri* has been collected in the *Eliorhynchus castanea* Zone or fauna of the Woodpecker Limestone and its equivalents in central Nevada (Sulphur Spring Range, Oxyoke Canyon, Blackrock Canyon); 90 per cent of specimens (including the primary types) are from Sulphur Spring Range. In terms of time-stratigraphic or faunal intervals, *Mononusphaericorhynchus sartenaeri* is part of a *Eliorhynchus* non-diverse Community (later *Eliorhynchus - Emanuella* Community) of the *Eliorhynchus castanea* Zone, which corresponds, in 1977, to Interval 19, that includes conodonts of the Lower *varcus* Subzone (Early *varcus* Subzone in recent terminology), i.e. early Givetian. In 1980, the *L. castanea* Zone becomes equivalent to Intervals 19 and 20 (Sulphur Spring Range) or to the upper part of Interval 19, and to Interval 20 (Simpson Park Range, northern Roberts Mountains, Antelope Range), Intervals 19 and 20 corresponding, respectively, to the *ensensis* Zone and the Lower *varcus* Subzone (Early *varcus* Subzone in recent

terminology), i.e. late Eifelian (latest Eifelian in recent terminology)-early Givetian, but *Mononusphaericorhynchus sartenari* remains confined to Interval 19, and, most probably, to the upper part of this interval as in Sulphur Spring Range, where 90 per cent of the material was collected. The situation remained unchanged in 1990.

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A similar generosity was encountered with Drs. Charles W. Merriam and J. Granville Johnson, who presented the author, respectively, in 1953 and 1979, with specimens of *Mononusphaericorhynchus sartenari*.

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PLATE 1

Ventral, dorsal, frontal, apical, and lateral views of *Eliorhynchus castanea* (Meek, 1867).

Figs.1-35. 1- 5, GSC 111172;
6-10, GSC 111173;
11-15, GSC 111174;
16-20, GSC 111175;
21-25, GSC 111176;
26-30, GSC 111177;
30-35, GSC 111178.

All specimens from the type area. GSC loc.41327. East bank of Andrew River, 4 miles south of junction with Carnwath River, Lower Mackenzie River Valley, District of Mackenzie, Northwest Territories. Lower beds of Middle Ramparts Formation (Middle Ramparts Formation = Hare Indian Formation nowadays). Collector: Lloyd, G.V. (Sproule, J.C. & Associates), 1959.
GSC = Geological Survey of Canada.

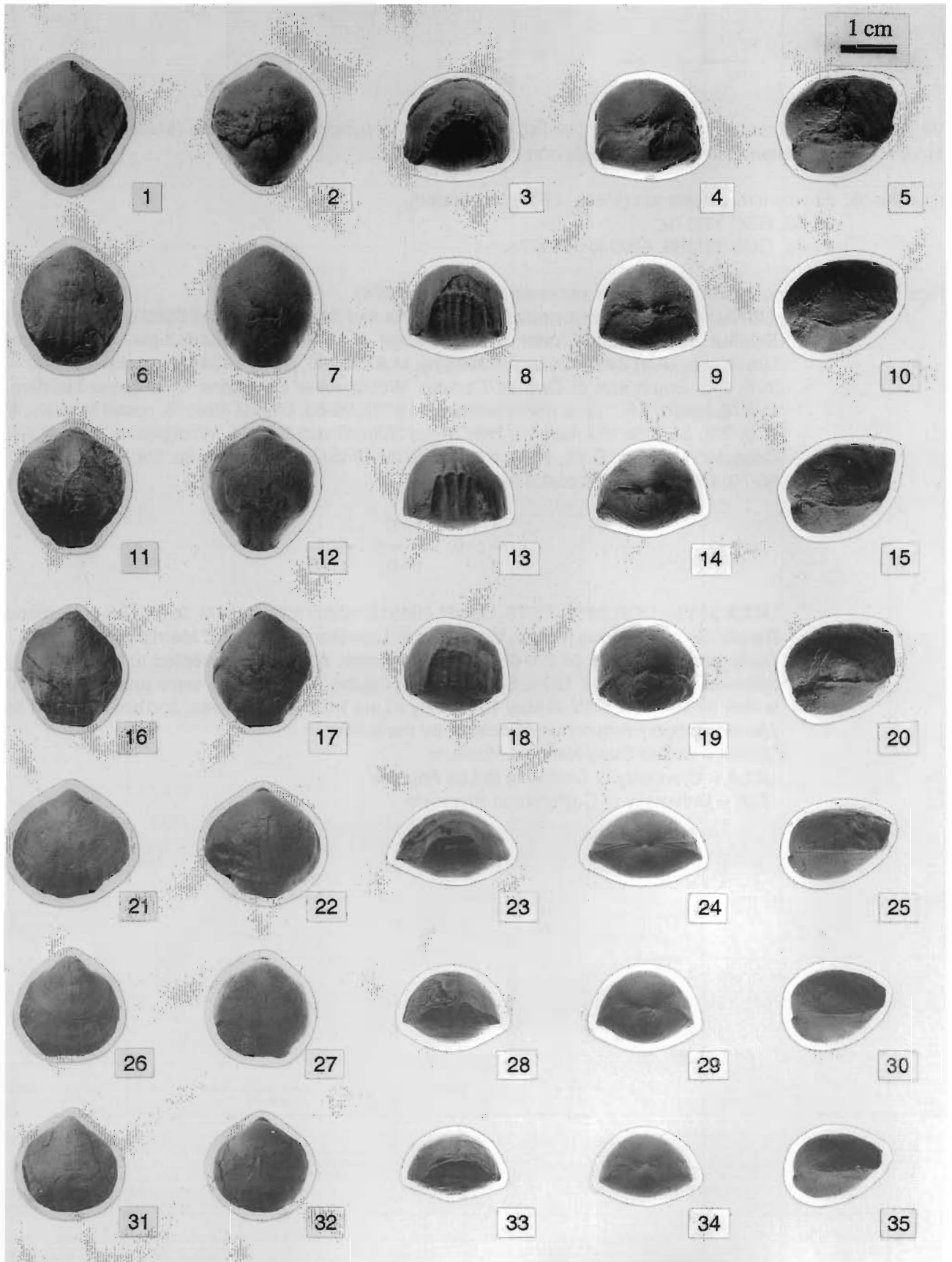


PLATE 2

Ventral, dorsal, frontal, apical, and lateral views of *Eliorhynchus castanea* (Meek, 1867) and *Mononusphaericorhynchus sartenaeri* (Johnson, 1974).

Figs.36-45. *Eliorhynchus castanea* (Meek, 1867) (continued).

36-40, GSC 111179;

41-45, GSC 111180. GSC loc.41327.

Figs. 46-75. *Mononusphaericorhynchus sartenaeri* (Johnson, 1974).

46-50, USNM 484514, costal formula: 5/4; 0; 3/4. In saddle ¼ mi NE of hill 6989 on east flank of Sulphur Spring Range, near southern edge of Mineral Hill quadrangle. Woodpecker Limestone, UCR 3482. Collector: Murphy, M.A.; 51-55, USNM 484515, costal formula: 4/3; 0; 2/3. South end of Oxyoke Canyon. Woodpecker Limestone. Collectors: Merriam, C.W. & Nolan, T.B., 1952 (Field number: M 207); 56-60, USNM 484516, costal formula: 4/3; 0; ?/3. SE side of Alhambra Hills, Pinto Summit quadrangle. Woodpecker Limestone. Collector: Merriam, C.W., 1949; 61-65, USNM 484517, costal formula: 5/4; 0; 3/4. M 207; 66-70, USNM 484518, costal formula:

4	1 - 0	2
-- ; 0;	----- ;	--
3	1 - 0	3

UCLA 3493 = UCR 3482; 71-75, USNM 484519, costal formula: 4/3; 0; 0?. NW of Romano Ranch, Sulphur Spring Range. Woodpecker Limestone. Collector: Merriam, C.W., 1951. Specimens of figures 46-50, 66-70 are topotypes, and were presented to the author by Johnson, J.G. in June 1979. Specimens of figures 51-65, 71-75 were presented to the author by Merriam, C.W. in May 1953; they all are from the type area, and are identified as *Mononusphaericorhynchus sartenaeri* by the author.

USNM = United State National Museum

UCLA = University of California in Los Angeles

UCR = University of California in Riverside

